TECHNICAL MEMORANDUM

16th Street Mall Alternatives Analysis and Environmental Clearance: Alternatives Analysis Report

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	February 2019

1. Project Background

The National Environmental Policy Act (NEPA) directs transportation officials to consider balancing engineering and transportation needs with social, economic, and natural environmental factors in making project decisions. A group of partners comprising the Regional Transportation District (RTD), City and County of Denver (CCD), Downtown Denver Partnership (DDP) and Federal Transit Administration (FTA) (the Project Partners), propose to implement improvements to the 16th Street Mall (Mall) to address infrastructure, mobility, safety, and public use needs. The Mall is Denver's busiest transit artery and premier public space, and one of the longest pedestrian and transit malls in the world. The Mall today is a hub for mobility and economic activity in downtown Denver. The Environmental Assessment (EA) documents the NEPA process for the 16th Street Mall Alternative Analysis and Environmental Clearance Project (Project) in accordance with 23 *Code of Federal Regulations* 771. The NEPA process is required for the Project because federal funds constitute a portion of the Project's funding.

2. Purpose of this Report

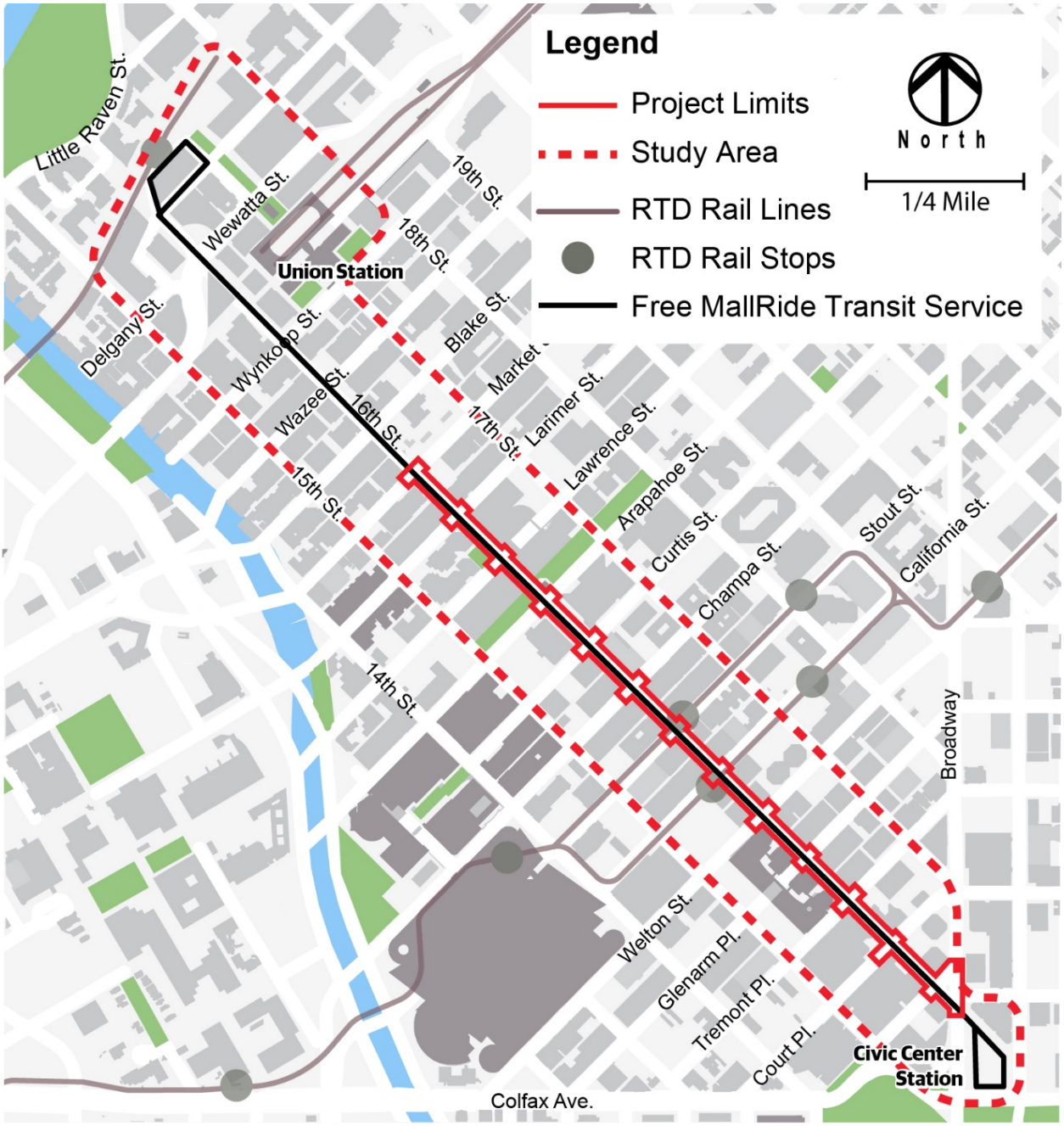
The purpose of this report is to document the development and evaluation of the range of alternatives considered for the Mall and identify a Locally Preferred Alternative (LPA) to best serve the needs of the study area and stakeholders. This report includes a description of the Project limits, study area and prior planning studies, and a review of the alternatives considered, the evaluation process, and the recommended LPA.

3. Project Limits and Study Area

The Project limits are defined as the full 80-foot width of the Mall, building face to building face between Market Street at the western Project limit and Broadway at the eastern Project limit, and including the portion of cross streets that intersect with the Mall's footprint. These Project limits encompass the portion of the Mall constructed in 1982, which connected RTD's Market Street and Civic Center bus stations. In recent years, the Free MallRide service has been

expanded farther west along 16th Street to the renovated and revitalized Denver Union Station (DUS), a hub that connects free MallRide passengers to light rail, commuter rail, and local and regional bus connections. The study area for the EA extends beyond the Project limits to include the area between DUS on the west, Civic Center Station (CCS) on the east, 15th Street on the south, and 17th Street on the north. **Figure 3-1** shows the boundary of the EA study area as well as the Project limits.

Figure 3-1. Project Limits and Study Area



4. Prior Planning and Past Studies

Since 2007, many studies and proposals for rehabilitation have been conducted by RTD and CCD to address the Mall's aging infrastructure and other issues, but none has resulted in a comprehensive rehabilitation of the Mall. **Table 4-1** summarizes past studies that are important to the development of this Project. The *Summary of Previous Studies Relevant to 16th Street Mall Alternatives Analysis and Environmental Clearance* located in **Appendix A** of the EA provides greater detail about each study.

Table 4-1. Summary of Past Studies

Name of Study (Author)	Year	Applicability to Current NEPA Study
The Transitway/Mall: A Transportation Project in the Central Business District of Metropolitan Denver (I.M Pei and Partners, Architects and Planners)	1977	Design concept for the Mall. This concept became the Transitway/Mall Alternative in the 1978 EA.
Denver Central Business District Transitway and Transfer Facilities EA (RTD)	1978	NEPA document detailing alternative selection and environmental impacts for the Transitway/Mall Alternative.
Downtown Multimodal Access Plan (CCD et al.)	2005	Established the Mall shuttle service as the cornerstone of downtown Denver's public transportation system and assumed continued shuttle service as part of the recommendations through 2025.
Denver Downtown Area Plan (CCD et al.)	2007	Comprehensive local planning document that guides downtown development. The plan provides recommendations to strengthen the vitality of the Mall, including enhancing subdistricts, developing a retail strategy, and conducting a study to assess infrastructure and reconstruction of the Mall.
An Advisory Services Panel Report: 16th Street Mall, Denver, Colorado: Building on Success (Urban Land Institute)	2008	As recommended by the *Downtown Area Plan*, an assessment was performed to explore the Mall's audience, recommend retail and nonretail strategies to support the urban environment, evaluate dividing the Mall into subdistricts, advise on infrastructure upgrades, and recommend future land use.

Name of Study (Author)	Year	Applicability to Current NEPA Study
16th Street Technical Assessment and Rehabilitation Study (BID et al.); *16th Street Urban Design Plan: Concept Design Report* (CCD et al.)	2009; 2010	As recommended by the *Downtown Area Plan*, an assessment of the existing physical conditions of the Mall and recommendations for the future. The plan recommended that, based on availability of funding, the proposed action should maintain and renovate the existing asymmetrical and median block configuration; renovate and reconfigure furnishings to support public use, pedestrian circulation, and ADA compliance in pedestrian areas; replant missing trees; upgrade power outlets; renovate or replicate lighting; renovate and repair water features including amenities and irrigation; and construct bulb-outs (curb extensions) at intersections.
16th Street Mall Pilot Repair Project (Atkinson)	2011 (report finished in 2014)	Study to provide feedback on condition of paving system and maintenance records, and conduct pilot project to observe rehabilitation techniques. The study provided operations and maintenance recommendations, such as spreading wheel loads and also using a particular type of mortar to secure pavers that require maintenance.
Categorical Exclusion: 16th Street Mall Transitway Rehabilitation (RTD)	2013	Approved NEPA document for a project to rehabilitate and reconstruct a portion of the Mall from Market to Lawrence Streets, and Court Place to Broadway, using methods tested through the pilot paver program. The project was not constructed because of cost considerations.
Downtown Denver 16th Street Mall: Small Steps Towards Big Change (Gehl)	2014/2015 (report finished in 2016)	Assessment of the existing social conditions of the Mall and recommendations for the future. The study found the spatial configuration and shuttle frequency on median blocks limits public use; pedestrian volumes exceed capacity during peak hours, and pedestrians need more walking space; expanded patios were the most successful generators of (nonwalking) public activity on the Mall, which in turn draws more visitors, creates a greater feeling of safety, and increases retail potential.
Transitway Rehabilitation Study (RTD)	2015	After the 2013 Mall rehabilitation project was not implemented, this 2016 study was started to identify and evaluate surface material alternatives for rehabilitation of the Mall transitway. A preferred alternative was not selected, and the study was stopped. The Section 106 consultation process begun for the Transitway Rehabilitation Study has been reinitiated for the EA.

Note:
ADA = Americans with Disabilities Act of 1990

5. Range of Alternatives Considered

Taking into account prior planning activities and planning studies and public and stakeholder input, the Project Partners developed a range of alternatives for evaluation based on their ability to meet the Project's Purpose and Need and other evaluation criteria, such as costs and community and environmental impacts, while retaining historic design features. The historic design includes three sections of the Mall, often referred to as a beginning, middle, and end:

- Three asymmetrical blocks on the western end of the Mall from Market Street to Arapahoe Street, with the transit ways—separated by a small, 6-foot median with light standards—offset from the center of the Mall, creating a wider public space on one side of the Mall than the other.
- Seven symmetrical median blocks in the middle of the Mall from Arapahoe Street to Tremont Place, with a median in the center between the transit ways.
- Two asymmetrical blocks on the eastern end of the Mall from Tremont Place to Cleveland Place, in the same configuration as described for the western end of the Mall, and a half-block plaza (Gateway Plaza) between Cleveland Place and Broadway where the downtown and city street grids converge.

Five build alternatives, with varied configurations of the transit way, amenity zone (in some cases found in a central median), pedestrian walkway, patio/gathering area, and tree placement, were developed and are illustrated on **Figure 5-3**, along with the existing configuration of the Mall (the No Build Alternative) for comparison. Alternatives that did not meet the Project purpose and need were eliminated. A discussion of why the eliminated alternatives did not meet the purpose and need is found in this section. The Center Running and New Asymmetrical Alternative was selected as the LPA and advanced to the detailed environmental impact analysis in the EA. The following sections describe the alternatives developed and considered for the Project.

A. No Build Alternative

The No Build Alternative cross-section design is the same as the existing cross-section design and has two cross-section designs, Existing Median and Existing Asymmetrical. **Figure 5-1** illustrates the existing cross-section designs and shows to which blocks the cross sections apply.

Figure 5-1. Existing Cross-section Design

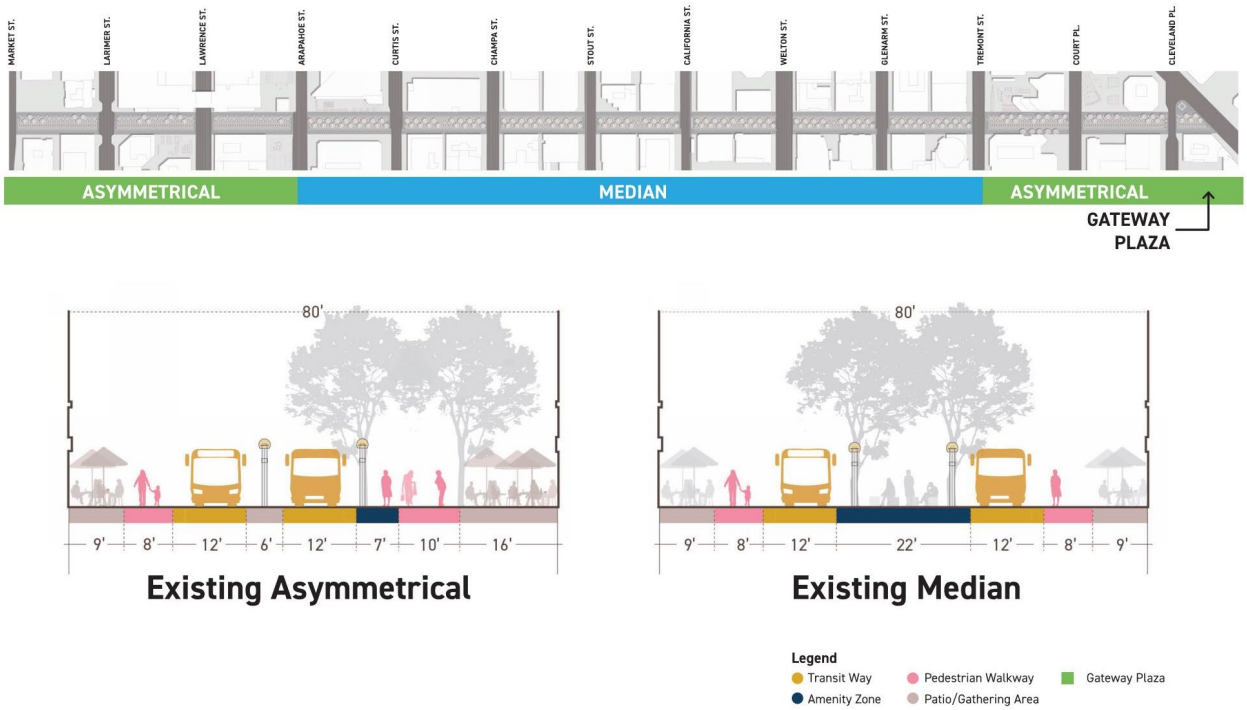
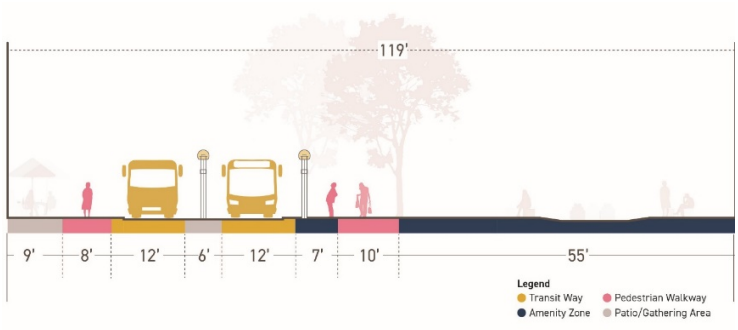


Figure 5-2 is an existing cross section for the Gateway Plaza.

Figure 5-2. Gateway Plaza



In addition to maintaining the existing alignment of the Mall, the No Build Alternative represents future conditions without the construction and operation of the Project. The No Build Alternative includes the current transportation system with all committed transportation improvements in the *2018-2021 Regional Transportation Improvement Program* (TIP) and fiscally constrained *2040 Regional Transportation Plan* (RTP). The 2018-2021 TIP includes funds to maintain the Mall transit way (TIP-ID: 1999-052) from Market Street to Broadway as well as the transfer facilities at Union Station and CCS and State of Good Repair funding for high-intensity bus stock. The 2018-2021 TIP also includes funds for the reconstruction of the Mall from Arapahoe Street to Lawrence Street (TIP-ID: 2016-028); however, these funds will be repurposed for geotechnical and underground surveys as part of a subsequent LPA design phases. The 2040 RTP includes improvements throughout RTD's transit system that are projected to increase transit ridership in downtown Denver. Ridership increases are expected

to be accommodated through continued operation of the Free MallRide on the Mall and the Free MetroRide on 18th and 19th Streets, and continued fare service on bus, light rail, and commuter rail routes.

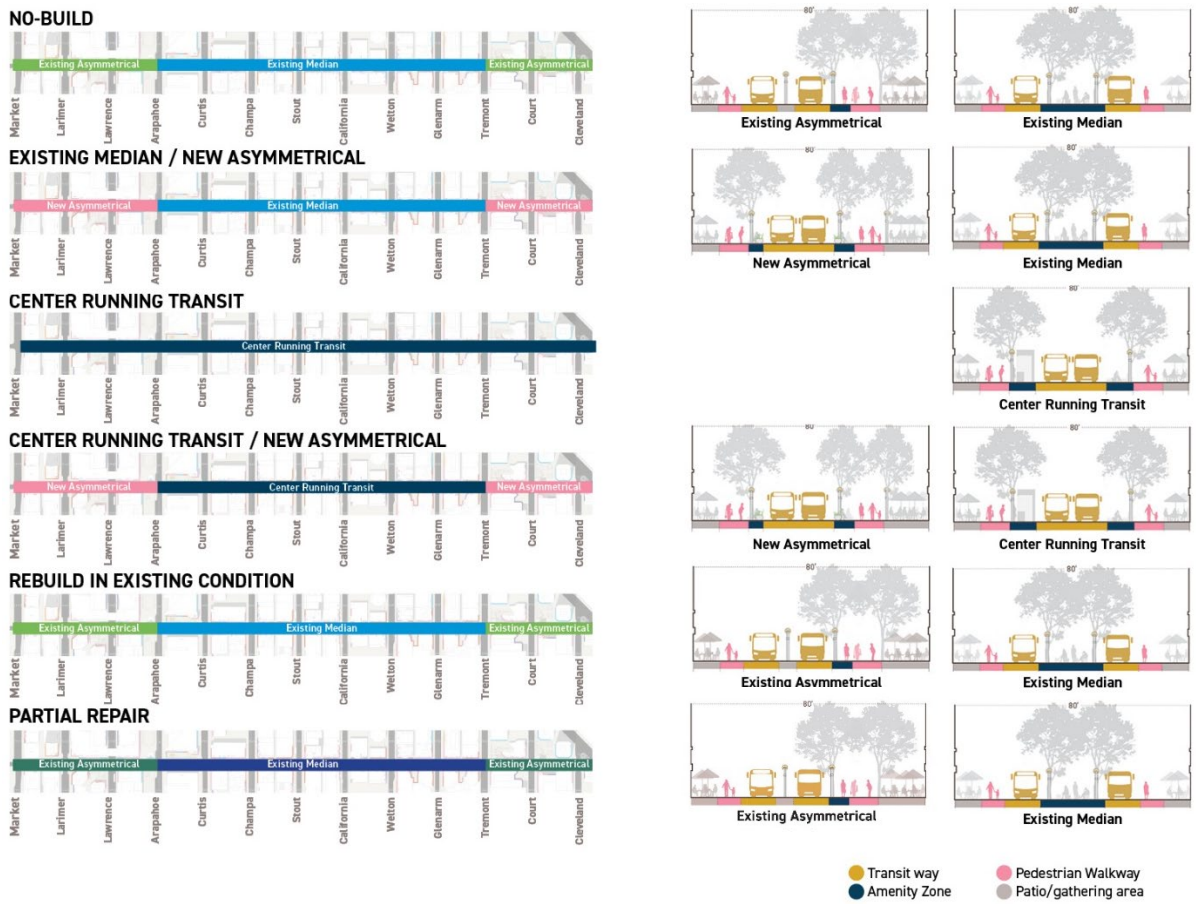
In addition to programmed transit way improvements, the No Build Alternative includes standard maintenance activities (for example, trash pickup, power washing, snow removal, landscaping, and plumbing and electrical maintenance), targeted repairs (for example, granite paver, grout, driveway, and electrical and plumbing repairs), and continued implementation of safety strategies (including DDP's Security Action Plan) along the Mall. Maintenance responsibilities have been determined by intergovernmental agreements (IGA). CCD and RTD have an IGA through 2022 in which RTD provides shared maintenance services for the transit way portion of the Mall. Maintenance activities for areas outside of the transit way are implemented by DDP as part of an ongoing year-to-year IGA with CCD.

The No Build Alternative does not meet the Purpose and Need for the Project, but is retained as a basis for comparison of the environmental impacts of the LPA.

B. Build Alternatives

The Project Partners developed a range of alternatives based on the Project purpose and need, which includes various design elements. These design elements comprise both physical and operational elements and are summarized in **Table 5-1**. Five build alternatives were developed from these design elements; four of the build alternatives were evaluated in the Level 1 evaluation, and one of the build alternatives—Partial Repair—was added after the Level 1 evaluation (**Figure 5-3**).

Figure 5-3. Range of Alternatives Considered



Note: The Gateway Plaza configuration (**Figure 5-2**) could be implemented between Cleveland Place and Broadway under the Existing Median and New Asymmetrical, Center Running, and Center Running and New Asymmetrical alternatives.

With the exception of the Rebuild in Existing Condition Alternative and Partial Repair Alternative, the spatial configuration of each build alternative was developed using the following design standards:

- Transit way – Minimum 12 feet wide or 24 feet wide, when combined into a single transit way (includes a 2-foot-wide edge zone at the back of the curb)
- Pedestrian walkway – Minimum 10 feet wide
- Patio/gathering area – Minimum 9 feet wide
- Trees – Ideal distance between tree and transit way of 5 feet; this distance may be reduced to accommodate other requirements

All build alternatives maintain current and planned Free MallRide service levels on the Mall. RTD's service plans and Denver's *Downtown Multimodal Access Plan* (CCD et al., 2005) establish the Free MallRide service as a critical element in Denver's transit system. Moving the Free MallRide service to parallel streets into either mixed traffic or a dedicated transit way would prevent RTD from providing the needed level of transit service and connectivity, and downtown traffic operations would degrade. The Free MetroRide on 19th and 20th Streets is a parallel

service. but cannot replace the Free MallRide because of its operation in mixed traffic and its location.

Although several design elements were studied that would change transit operations on the Mall, these design elements were not carried forward into the range of build alternatives. Reduced transit service on the Mall could not be implemented as a matter of sound traffic engineering judgement because RTD cannot meet its service requirements and ridership demand through service on parallel city streets. The Free MallRide shuttle was originally designed as a free transit shuttle bus between DUS and CCS, the major transfer stations in metro Denver. Placing the transit service on the Mall decreased the number of buses on downtown streets by funneling express and regional commuter buses to bus terminals. Today, routes along the Mall eliminate approximately 870 daily bus trips on downtown streets (Marsella, 2008, pers. comm.), reducing congestion in the downtown area. Current Free MallRide ridership is approximately 39,000, and is projected to increase to 70,000 in 2035. Reducing service on the Mall would require shifting a portion of the current ridership and all projected ridership to another bus route. Providing bus service on parallel streets, such as the Free MetroRide currently operating on 18th and 19th streets, provides a slower trip and out-of-direction travel, and would not be able to accommodate RTD's current and projected ridership demands.

All build alternatives would comply with federal requirements and meet standards such as ADA requirements and RTD's *Bus Infrastructure Design Guidelines and Criteria* (RTD, 2016a) and *Bus Infrastructure Standard Drawings* (RTD, 2016b), and CCD public works standards for design and streetscapes (CCD, 2017a). Some minor adaptations of the standards may be needed as the Project is designed in more detail.

Table 5-1. Design Elements Considered in Development of Range of Alternatives

Problem	Design Elements	Disposition to Carry Forward into Build Alternatives[a]
Failing and Outdated Infrastructure	Not Applicable	Not Applicable
Failing pavement system in constant need of repair	• Continue existing operations and maintenance program	• Carried forward for No Build
	• New pavement mortar	• Carried forward for Alternatives A through E
	• New sub-base	• Carried forward for Alternatives A through E
	• Clean and reset existing pavers	• Carried forward for Alternative E
	• Replace pavement system	• Carried forward for Alternatives A through D
	• Install new granite pavement system	• Carried forward as pavement option for Alternatives A through D
Failing pavement system in constant	• Install different material pavement system with low maintenance requirements	• Carried forward as pavement option for Alternatives A through D

Problem	Design Elements	Disposition to Carry Forward into Build Alternatives[a]
need of repair (continued)	• Replace buses with smaller, lighter buses to reduce loads	• Not carried forward, does not meet operational requirements
Outdated infrastructure (tree boxes, fountains, lack of water quality treatment and modern fiber optic and communications utilities) leads to poor tree health and doesn't meet modern day needs	• New underground tree infrastructure	• Carried forward for Alternatives A through D
	• Replace failing/missing trees in current infrastructure	• Carried forward for Alternative E
	• Construct water quality treatment features	• Carried forward for Alternatives A through D
	• Install modern fiber optic/communications utilities and additional electric power	• Carried forward for Alternatives A through D
	• New/updated fountains	• Carried forward for Alternatives A through E
	• New furnishing reflecting current practices for safety/security	• To be considered during final design
Poor delineation between pedestrian walks and transit causes collisions and near misses	• Retain existing 4-inch curb	• Carried forward for Alternative E; carried forward as a design option for Alternatives A through D
	• Add higher curb between walks and transit	• Carried forward as a design option for Alternatives A through D
	• Shift walks to storefront area	• Carried forward as a design option for Alternatives B and C
	• Add trees, lights, other furnishings between walks and transit	• Carried forward for Alternatives B and C
	• Visually delineate walks and transit with different materials/colors	• Carried forward as a design option for Alternatives A through D
	• Use technology to delineate walks and transit, such as colored lights	• Carried forward as a design option for Alternatives A through D
	• Add barrier/bollards between walks and transit	• Carried forward as a design option for Alternatives A through D
Slick pavement surface causes pedestrian slips and falls, bus traction problems	• Add grooves to granite in transit way	• To be considered during final design
	• Refinish or replace granite with different finish	• Carried forward as pavement option for Alternatives A through D
	• Use different material with higher friction	• Carried forward as pavement option for Alternatives A through D

Problem	Design Elements	Disposition to Carry Forward into Build Alternatives[a]
Higher crash numbers at cross-street intersections adjacent to median blocks (Arapahoe to Tremont)	• Install physical barrier to prevent crossing between medians and consolidate crossing points to sidewalks	• Carried forward as a design option for Alternatives A, D, and E
	• Install signage to prevent crossing between medians and consolidate crossing points to sidewalks	• Carried forward as a design option for Alternatives A, D, and E
	• Eliminate median and consolidate crossing points to sidewalks	• Carried forward for Alternatives B and C
	• Construct bulb-outs at intersections to reduce cross street width	• Carried forward for Alternatives A through E
Maintain Mall transit operations	• Accommodate bidirectional transit operations to 2035 and beyond	• Carried forward for all alternatives
	• Provide 12-foot-wide bus lanes	• Carried forward for all alternatives
	• Use parallel, center-running lanes to simplify bus operations	• Carried forward for Alternative B
	• Maintain space for two back-to-back buses at each shuttle stop to accommodate increased service needs	• Carried forward for all alternatives
	• Maintain service levels and shift new ridership to Free MetroRide	• Not carried forward, Free MetroRide service is slower than Free MallRide and cannot meet additional Mall ridership demand
Frequent maintenance disrupts transit operations, and would be more disruptive as ridership grows	• New pavement mortar	• Carried Forward for Alternatives A through E
	• New sub-base	• Carried forward for Alternatives A through E
	• Replace pavement system	• Carried forward for Alternatives A through E
	• Install new granite pavement system	• Carried forward as pavement option for Alternatives A through D
	• Install different material pavement system with low maintenance requirements	• Carried forward as pavement option for Alternatives A through D

Problem	Design Elements	Disposition to Carry Forward into Build Alternatives[a]
	• Build third transit way to maintain operations during maintenance	• Not carried forward, will not meet program needs for flexibility
Sidewalks are too small for pedestrian volumes[b] and CCD standards[c] (10-foot sidewalks downtown)	• Widen sidewalks by removing or narrowing patio and gathering areas	• Carried forward for Alternatives A, D, and E; does not meet requirements for patio size[d]
	• Widen sidewalks by moving transit ways	• Carried forward for Alternatives A through C
	• Widen sidewalks by narrowing transit ways	• Not carried forward, does not meet bus operation requirements
Physical separation of median from primary pedestrian walks, along with limited median size and frequent shuttle service on both sides of the median, results in low public use and surveillance, increased negative social behaviors (for example, panhandling[e]), and decreased sense of safety[f].	• Increase size of medians	• Not carried forward, does not provide adequate sidewalk and patio space next to buildings
	• Decrease transit service frequency and shift ridership to Free MetroRide	• Not carried forward, Free MetroRide service is slower than Free MallRide and cannot meet additional Mall ridership demand
	• Remove/reduce medians where possible and consolidate space against buildings	• Carried forward for Alternatives B and C
Limited usability of narrow sides of asymmetrical blocks to accommodate patio/gathering space and pedestrian needs.	• Widen sidewalks by moving transit ways	• Carried forward for Alternatives A through C
	• Widen sidewalks by narrowing transit ways	• Not carried forward, does not meet bus operation requirements
Less than 1 percent of Mall users stop to spend time on the Mall	• Install closed-circuit television (CCTV) and/or other surveillance measures to increase security	• Applicable to Alternatives A through D
	• Maintain/improve security[g] and police presence	• Applicable to all alternatives; current police budget does not allow dedicated officers to Mall
	• Provide more active programming of Mall	• Applicable to all alternatives

Problem	Design Elements	Disposition to Carry Forward into Build Alternatives[a]
	• Install more seating, furniture, interactive installations on blocks without it	• To be considered during final design
	• Redirect pedestrians to storefront areas	• Carried forward for Alternatives B and C

[a] Build Alternatives: A – Median and New Asymmetrical; B –Center Running; C –Center Running and New Asymmetrical; D – Rebuild in Existing Configuration; E – Partial Repair.

[b] Existing (2015) midday peak pedestrian volumes are 3,000 pedestrians per hour Lawrence to Arapahoe (near Denver Union Station neighborhood) and 3,900 pedestrians per hour Welton to Glenarm (Central Business District neighborhood) (Gehl, 2016). Future (2040) minimum midday peak pedestrian volumes are estimated at 4,600 pedestrians per hour in CBD neighborhood and 4,000 pedestrians per hour in DUS neighborhood, based on existing peak hour pedestrian volumes growing at rate of forecasted employment growth from 2015 to 2040 of 0.7 percent annually in the Central Business District (CBD) neighborhood and 1.2 percent annually in the DUS neighborhood (**Table 4** of the *Land Use and Socioeconomic Existing Conditions* technical memorandum located in **Appendix B**).

[c] CCD. 1993. Streetscape Design Manual.

[d] The architectural standard for dining space recommends 300 square inches per diner. Common industry table sizes that meet this standard are 30 inches by 42 inches and 30 inches by 48 inches for four-person tables and 30 inches by 24 inches for two-person tables. The standard aisle width is 36 inches to 42 inches. Using the smallest industry standards of 42-inch-wide four-top table, 36-inch aisle, and 24-inch-wide two-top table results in a patio width of 102 inches, or 8.5 feet, without a barrier railing, and 9 feet with a barrier railing. Additionally, patio permits currently issued by BID require 10 feet of separation from transit ways, resulting in 9-foot patios.

[e] Eighty-eight percent of panhandling occurs on median blocks (Downtown Denver BID Downtown Ambassadors, 16th Street Mall Panhandling Surveys, March 22 – August 29, 2015 as cited in Gehl, 2016).

[f] Activating public space is essential to the perception of safety: when more people gather outside, sense of safety increases and negative social behaviors decrease. Patio seating draws more people to gather on the Mall than any other activity (Gehl, 2016).

[g] Since DDP implemented a security program with private security officers in 2014, crime has decreased 29 percent on the Mall. There are approximately 1,500 crimes on the Mall per year on average for 2014-2016 (Denver Police Department, crime statistics on the 16th Street Mall, January 2017).

BID = Business Improvement District
ROW = right-of-way

1. Median and New Asymmetrical Alternative

The Median and New Asymmetrical Alternative is described using the five following Project elements:

a) Cross-section Design

This alternative uses two primary cross-section designs. The cross-section designs and extent of each cross-section design on the Mall are illustrated on **Figure 5-3**. The median cross-section design would be the same as the existing median cross-section design. The new asymmetrical

cross-section design would be slightly different from the existing asymmetrical cross-section design. The new asymmetrical cross-section design removes the 6-foot median with light fixtures from between the transit ways, pushes the two transit ways together, and increases the size of the sidewalk on the narrow side of the cross section from 17 feet to 19 feet to provide an adequately sized pedestrian walking area. The Gateway Plaza configuration (**Figure 5-2)** could be implemented between Cleveland Place and Broadway to preserve the existing design of that half-block.

b) Infrastructure

This alternative replaces all of the infrastructure on the Mall, including the following:

- Remove and replace existing concrete sub-base slab under transit ways
- Replace existing pavement system
- Install new underground tree infrastructure (tree boxes or continuous trenches, irrigation system, and tree openings/grates)
- Install stormwater quality treatment features
- Replace existing utilities and install new fiber optic/communications utilities, including wifi, and additional electrical power supply
- Update or install new water fountains

c) Intersection Design

This alternative would not change any traffic operations at intersections. Capacity, lane width, and traffic controls and timing would remain the same. Intersections would be reconstructed, and would include safety improvements such as new walkway designs and curb extension bulb-outs.

d) Materials and Pattern

This alternative could be implemented with any of the five pavement options studied:

- Granite pavers with a mortar setting for transit ways and sidewalks, in similar color and pattern as existing conditions or new pattern
- Unit pavers with a sand setting for transit ways, granite pavers for sidewalks, in similar color and pattern as existing conditions or new pattern
- Precast concrete slabs with pattern and color for transit ways, granite pavers for sidewalks, in similar color and pattern as existing conditions or new pattern
- Cast-in-place concrete robust enough to not require replacement over the life of the Project, with no pattern or color for transit ways, granite pavers for sidewalks
- Cast-in-place concrete with less longevity and requiring at least one replacement over the life of the Project, with no pattern or color for transit ways, granite pavers for sidewalks

e) Bus Operations

This alternative would allow for continued Free MallRide service on the Mall in the same manner that it exists today and would not preclude operational changes in transit service along the Mall.

f) Safety and Security

Treatments or design elements to delineate the transit way from sidewalks will be decided during subsequent design phases and could be implemented with any of the previously listed pavement types. This alternative would also allow for continued implementation of DDP's Downtown Security Action Plan (2016). **Section 7** of this technical memorandum describes crime prevention through environmental design (CPTED) principles included in the Project description. The following bullets describe how each cross-section design incorporates CPTED principles:

- Median cross-section design: This cross-section design would maintain the existing median block cross-section design, which restricts natural surveillance, territoriality, and the ability to manage pedestrian use for the entire width of the Mall because the transit ways and buses provide a real and perceived barrier.
- New asymmetrical cross-section design: This cross-section design promotes natural surveillance, territoriality, and provides the ability to manage pedestrian use for the entire width of the Mall because no real or perceived barriers exist.

2. Center Running Alternative

The Center Running Alternative is described using the five Project elements described in this section.

a) Cross-section Design

This alternative uses one cross-section design for the full length of the Project. The center-running cross-section design is illustrated on **Figure 5-3**. The center-running cross-section design places the two, 12-foot-wide transit ways adjacent to each other, without a median separating them. Because the space needed for the medians is relocated, and the alignment is symmetrical, the cross-section design has equal amounts of sidewalk space (28 feet) on each side of the center-running transit lines. The Gateway Plaza configuration (**Figure 5-2**) could be implemented between Cleveland Place and Broadway to preserve the existing design of that half-block.

b) Infrastructure

Refer to description under Median and New Asymmetrical Alternative.

c) Intersection Design

Refer to description under Median and New Asymmetrical Alternative.

d) Materials and Pattern

Refer to description under Median and New Asymmetrical Alternative.

e) Bus Operations

Refer to description under Median and New Asymmetrical Alternative.

f) Safety and Security

Treatments or design elements to delineate the transit way from pedestrian walking areas will be decided during subsequent design phases and could be implemented with any of the pavement types listed in in this technical memorandum This alternative would also allow for

continued implementation of DDP's Downtown Security Action Plan. **Section 7** of this technical memorandum describes CPTED principles included in the Project description. The center-running cross-section design would remove the existing median block cross-section design and utilize CPTED principles. By removing the median blocks and relocating that space outside of the transit way, the design promotes natural surveillance and territoriality, and increases the ability to manage pedestrian use for the entire width of the Mall because no real or perceived barriers exist.

3. Center Running and New Asymmetrical Alternative

The Center-running and New Asymmetrical Alternative is described using the five following Project elements:

a) Cross-section Design

This alternative uses two primary cross-section designs. The center-running cross-section design would be the same as described under the Center Running Alternative. Through the Level 1 and Level 2 evaluations, the new asymmetrical cross-section design was the same as described under the Median and New Asymmetrical Alternative. After the Level 2 screening, the new asymmetrical cross section was refined to better meet the Project needs and goals. The cross-section designs and extent of each cross-section design on the Mall are illustrated on **Figure 5-3**. The Gateway Plaza configuration (**Figure 5-2**) could be implemented between Cleveland Place and Broadway to preserve the existing design of that half-block.

b) Infrastructure

Refer to description under Median and New Asymmetrical Alternative.

c) Intersection Design

Refer to description under Median and New Asymmetrical Alternative.

d) Materials and Pattern

Refer to description under Median and New Asymmetrical Alternative.

e) Bus Operations

Refer to description under Median and New Asymmetrical Alternative.

f) Safety and Security

Refer to description under Center Running Alternative.

4. Rebuild in Existing Configuration

The Rebuild in Existing Configuration Alternative is described using the following five Project elements:

a) Cross-section Design

This alternative maintains the existing cross-section design. Refer to description of the existing cross-section design under No Build Alternative.

b) Infrastructure

Refer to description under Median and New Asymmetrical Alternative.

c) Intersection Design

Refer to description under Median and New Asymmetrical Alternative.

d) Materials and Pattern

Refer to description under Median and New Asymmetrical Alternative.

e) Bus Operations

Refer to description under Median and New Asymmetrical Alternative.

f) Safety and Security

Refer to description under Median and New Asymmetrical Alternative.

5. Partial Repair

The Partial Repair Alternative is based on the recommendation proposed in the *16th Street Urban Design Plan* (CCD et al., 2010) and is described using the five Project elements:

a) Cross-section Design

This alternative maintains the existing cross-section design. Refer to description of the existing cross-section design under No Build Alternative.

b) Infrastructure

This alternative replaces the following infrastructure:

- Renovates existing granite paver system, as described in Materials and Pattern; however, doesn't improve sub-base concrete slab under transit way
- Upgrade surface utilities, including power outlets, where needed
- Replaces failing trees, retains existing tree box infrastructure
- Renovates and reconfigures furnishings to support public use, pedestrian circulation, and ADA compliance in pedestrian areas
- Renovates and repairs water features including fountains and irrigation

c) Intersection Design

Refer to description under Median and New Asymmetrical Alternative.

d) Materials and Pattern

This alternative would be implemented by reusing the existing granite pavers. In the transit ways, the process would include cataloging the existing pattern, removing the existing pavers, cleaning and refinishing the pavers, and then resetting the pavers in their original location. In the pedestrian areas, the pavers would not be removed, but they would be refinished. The result would be a renovation of the existing paver system.

e) Bus Operations

Refer to description under Median and New Asymmetrical Alternative.

f) Safety and Security

Refer to description under Median and New Asymmetrical Alternative.

6. Evaluation Process and Results

A two-step process (referred to as Level 1 and Level 2) evaluated the alternatives. Level 1 evaluated the alternatives on criteria related to Project purpose and need factors, while Level 2 further screened the alternatives on purpose and need factors and on costs, safety, mobility, public use, and community and environmental impacts.

A. Level 1 Evaluation

Four of the five build alternatives were analyzed in the Level 1 evaluation, along with the No Build Alternative. The Partial Repair alternative was added to the range of alternatives, based on stakeholder input, after the Level 1 evaluation was complete. The Level 1 evaluation qualitatively assessed the alternatives against the following criteria related to the Purpose and Need:

- Infrastructure
- Safety
- Mobility
- Public Use
- Social and Environmental Impacts
- Cost
- Construction

Table 6-1 details the performance of each build alternative and the No Build Alternative against the evaluation criteria.

Conclusions. The Level 1 evaluation concluded that the No Build Alternative would not meet the Project purpose and need, and the Median and New Asymmetrical Alternative and the Rebuild in Existing Configuration Alternative would not meet the Project needs for mobility, safety, and public use. However, no alternatives were eliminated from consideration after the Level 1 evaluation. Although the No Build Alternative would not meet the Project purpose and need, it is carried forward as a baseline for comparison of the build alternatives.

Public input received on the Level 1 evaluation included suggestions to include a bike lane in the alternatives, move transit service off of the Mall, and add an alternative similar to the recommendation of the 2010 *16th Street Urban Design Plan* (CCD et al.).

- Bike lanes were not included in the build alternatives for two reasons: RTD operates the transit way as a fixed guideway supported by federal funding, and federal regulations prevent the operation of other transportation modes in a fixed guideway; and CCD has planned and implemented a downtown bicycle network that recognizes the Mall as a dedicated transit way and has bicycle lanes on parallel streets.
- Moving transit off the Mall would have ripple effects through the downtown and regional transit system, as well as the downtown roadway traffic system. **Section 5** in this technical memorandum provides additional discussion as to why moving transit off of the Mall was not carried forward as an alternative.

- A new alternative, named the Partial Repair Alternative (described in **Section 5**), was added to the range of alternatives for study in the Level 2 evaluation.

All four build alternatives and the new Partial Repair Alternative were carried forward to the Level 2 evaluation to analyze costs, safety data, and other criteria.

Table 6-1. Level 1 Alternatives Evaluation

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Infrastructure	Replacement of failing and outdated infrastructure	No replacement of failing and outdated infrastructure. *Does not meet Purpose and Need: does not replace failing and outdated infrastructure.*	Full replacement of failing and outdated infrastructure (for example, pavement system, tree boxes, fountains) and potential addition of needed utilities (fiber, communications, electric). Potential ability to maintain infrastructure with reasonable remaining service life.	Full replacement of failing and outdated infrastructure (for example, pavement system, tree boxes, fountains) and potential addition of needed utilities (fiber, communications, electric). Potential ability to maintain infrastructure with reasonable remaining service life.	Full replacement of failing and outdated infrastructure (for example, pavement system, tree boxes, fountains) and potential addition of needed utilities (fiber, communications, electric). Potential ability to maintain infrastructure with reasonable remaining service life.	Full replacement of failing and outdated infrastructure (for example, pavement system, tree boxes, fountains) and potential addition of needed utilities (fiber, communications, electric). Potential ability to maintain infrastructure with reasonable remaining service life.
	Effect of tree location on tree health	No change to tree location. Trees remain close to transit way and can be damaged by vehicles. Trees remain adequate distance from buildings and other trees.	On asymmetrical blocks, tree location is away from transit way (minimizing vehicle damage) and adequate distance from buildings and other trees. Tree location can be optimized to provide shade and use current best management practices for underground structure for health. On median blocks, trees remain close to transit way, to maintain adequate distance from other trees, resulting in potential damage by vehicles.	Tree location is away from transit way (minimizing vehicle damage) and adequate distance from buildings and other trees. Tree location can be optimized to provide shade and use current best management practices for underground structure for health.	Tree location is away from transit way (minimizing vehicle damage) and adequate distance from buildings and other trees. Tree location can be optimized to provide shade and use current best management practices for underground structure for health.	On asymmetrical blocks, tree location is away from transit way (minimizing vehicle damage) and adequate distance from buildings and other trees. On median blocks, trees remain close to transit way, resulting in potential damage by vehicles.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Safety	Separation/delineation of transit and pedestrians	Constrained pedestrian walking areas (less than 10 feet of clear pedestrian space) remain immediately adjacent to transit ways on median blocks and narrow sides of asymmetrical blocks. *Does not meet Purpose and Need: does not address safety of pedestrians and transit.*	Tree location separates pedestrian walking areas from transit ways on wider sides of asymmetrical blocks. Pedestrian walking areas on narrow sides of asymmetrical blocks remain immediately adjacent to transit ways, but are wider than in No Build and provide 10 feet of clear pedestrian space to accommodate pedestrian volumes. Constrained pedestrian walking areas (less than 10 feet of clear pedestrian space) remain immediately adjacent to transit ways on median blocks. *Does not meet Purpose and Need: does not address safety of pedestrians and transit on median blocks.*	Tree location separates pedestrian walking areas from transit ways on both sides of block.	Tree location separates pedestrian walking areas from transit ways on center-running blocks and on wider sides of asymmetrical blocks. Pedestrian walking areas on narrow sides of asymmetrical blocks remain immediately adjacent to transit ways, but are wider than in No Build and provide 10 feet of clear pedestrian space to accommodate pedestrian volumes.	Tree location separates pedestrian walking areas from transit ways on wider sides of asymmetrical blocks. Constrained pedestrian walking areas (less than 10 feet of clear pedestrian space) remain immediately adjacent to transit ways on both sides of median blocks and narrow sides of asymmetrical blocks. *Does not meet Purpose and Need: does not address safety of pedestrians and transit.*
	Pedestrian/vehicle conflicts	Four conflict points on median blocks. Pedestrians cross single-width one-way transit way. Four conflict points on asymmetrical blocks. Pedestrians cross one-way transit ways with small refuge area in between.	Four conflict points on median blocks. Pedestrians cross single-width one-way transit way. Two conflict points on asymmetrical blocks. Pedestrians cross double-width two-way transit ways.	Two conflict points; pedestrians cross double-width two-way transit ways.	Two conflict points; pedestrians cross double-width two-way transit ways.	Four conflict points on median blocks. Pedestrians cross single-width one-way transit way. Four conflict points on asymmetrical blocks. Pedestrians cross one-way transit ways with small refuge area in between.
	Incorporation of RTD safety criteria, including incorporation of CPTED[a], lighting, and receptacle design.	Does not meet some RTD safety criteria, such as lighting and receptacle design.	Ability to meet RTD safety criteria.	Ability to meet RTD safety criteria.	Ability to meet RTD safety criteria.	Ability to meet RTD safety criteria.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Mobility	Clear space for reliable two-way transit operations	Transit-lane width meets current design requirements.	Transit-lane width meets current design requirements.	Transit-lane width meets current design requirements.	Transit-lane width meets current design requirements.	Transit-lane width meets current design requirements.
	Accommodation of pedestrian volumes[b]	Pedestrian areas on outer edges of median blocks, and narrow sides of asymmetrical blocks, do not provide 10 feet of clear pedestrian space when 9 feet of patio space is provided. *Does not meet Purpose and Need: does not accommodate pedestrian volumes and adequate gathering/patio space.*	Pedestrian areas on outer edges of median blocks do not provide 10 feet of clear pedestrian space when 9 feet of patio space is provided. Both sides of asymmetrical blocks provide at least 10 feet of clear pedestrian space when 9 feet patio space is provided, if narrow sides of blocks are a minimum 19 feet wide. *Does not meet Purpose and Need: does not accommodate pedestrian volumes and adequate gathering/patio space on median blocks.*	Both sides of block can provide 10 feet of clear pedestrian space with a variety of adjacent gathering opportunities.	Both sides of median block can provide 10 feet of clear pedestrian space with a variety of adjacent gathering opportunities. Both sides of asymmetrical blocks provide at least 10 feet of clear pedestrian space when 9 feet of patio space is provided, if narrow sides of blocks are a minimum 19 feet wide.	Pedestrian areas on outer sides of median blocks and narrow side of asymmetrical blocks do not provide 10 feet of clear pedestrian space when 9 feet of patio space is provided. Wide side of asymmetrical block can provide 10 feet of clear pedestrian space with a variety of adjacent gathering opportunities *Does not meet Purpose and Need: does not accommodate pedestrian volumes and adequate gathering/patio space.*
	Ease of transit shuttle operations: number of shifts shuttles make from block to block	Two shifts over length of Mall	Two shifts over length of Mall	No shifts	Two shifts over length of Mall	Two shifts over length of Mall
	Ability to adhere to ADA accessibility requirements	Mall does not fully adhere to ADA requirements. Median block promenades have physical obstructions to ADA accessibility.	Ability to adhere to ADA requirements.	Ability to adhere to ADA requirements.	Ability to adhere to ADA requirements.	Ability to adhere to ADA requirements.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Public Use	Space for both pedestrian use and gathering opportunities for leisure, commerce, and tourism	Outer sides of median blocks and narrow sides of asymmetrical blocks provide limited gathering space and configurations when pedestrian use is accommodated with 10 feet of clear pedestrian circulation. Medians are underutilized because transit ways physically separate median from pedestrian walking areas and because space constraints limit gathering opportunities along with pedestrian access between trees in the medians. Wide sides of asymmetrical blocks allow for a variety of configurations of gathering opportunities, including patios, and 10 feet of clear pedestrian circulation. *Does not meet Purpose and Need: does not provide adequate gathering and patio space and accommodate pedestrian volumes*.	Outer sides of median blocks and narrow sides of asymmetrical blocks provide limited gathering space and configurations when pedestrian use is accommodated with 10 feet of clear pedestrian circulation. Medians are underutilized because transit ways physically separate median from pedestrian walking areas and because space constraints limit gathering opportunities along with pedestrian access between trees in the medians. Narrow sides of asymmetrical blocks do not have room for trees. Wide sides of asymmetrical blocks allow for a variety of configurations of gathering opportunities, including patios, and 10 feet of clear pedestrian circulation. *Does not meet Purpose and Need: does not provide adequate gathering and patio space and accommodate pedestrian volumes on median blocks*.	Provides 28 feet of usable public space on both sides of blocks to allow for a variety of configurations of gathering opportunities, including patios, and 10 feet of clear pedestrian circulation. Offers opportunity for trees along both sides of blocks.	Center-running blocks provide 28 feet of usable public space on both sides of blocks to allow for a variety of configurations of gathering opportunities, including patios, along with 10 feet of clear pedestrian circulation. Narrow sides of asymmetrical blocks provide limited gathering space and configurations when pedestrian use is accommodated with 10 feet of clear pedestrian space. Narrow sides of asymmetrical blocks do not have room for trees. Wide sides of asymmetrical blocks allow for a variety of configurations of gathering opportunities, including patios, and 10 feet of clear pedestrian circulation.	Outer sides of median blocks and narrow sides of asymmetrical blocks provide limited gathering space and configurations when pedestrian use is accommodated with 10 feet of clear pedestrian circulation. Medians are underutilized because transit ways physically separate median from pedestrian walking areas and because space constraints limit gathering opportunities along with pedestrian access between trees in the medians. Narrow sides of asymmetrical blocks do not have room for trees. Wide sides of asymmetrical blocks allow for a variety of configurations of gathering opportunities, including patios, and 10 feet of clear pedestrian circulation. *Does not meet Purpose and Need: does not provide adequate gathering and patio space and accommodate pedestrian volumes*.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Public Use (continued)	Long-term adaptability: ability to allow for spatial reconfiguration for events or other changes, such as building use, over the next 40 years.	Asymmetrical blocks provide consolidated spaces to allow for future changes in space allocation. Ability for spatial reconfiguration is limited in median blocks as a result of space constraints for gathering opportunities along with pedestrian access between trees in the medians. Ability to reconfigure restaurant patios away from buildings and maintain 10 feet of clear pedestrian space along wide side of five asymmetrical blocks. Restaurant patios in medians infeasible because of the need to cross transit ways for service. Lack of modern communications technology infrastructure.	Asymmetrical blocks provide consolidated spaces to allow for future changes in space allocation. Ability for spatial reconfiguration is limited in median blocks as a result of space constraints for gathering opportunities along with pedestrian access between trees in the medians. Ability to reconfigure restaurant patios away from buildings and maintain 10 feet of clear pedestrian space along wide side of asymmetrical blocks. Restaurant patios in medians infeasible because of the need to cross transit ways for service. Ability to incorporate innovative technology and infrastructure to easily adapt to future changes in building use, Mall operations, bus technology and operations, and user expectations.	All blocks provide consolidated spaces to allow for future changes in space allocation. Ability to reconfigure restaurant patios away from buildings and maintain 10 feet of clear pedestrian space along both sides of all blocks. Ability to incorporate innovative technology and infrastructure to easily adapt to future changes in building use, Mall operations, bus technology and operations, and user expectations.	All blocks provide consolidated spaces to allow for future changes in space allocation. Ability to reconfigure restaurant patios away from buildings and maintain 10 feet of clear pedestrian space along both sides of center-running blocks and one side on five asymmetrical blocks. Ability to incorporate innovative technology and infrastructure to easily adapt to future changes in building use, Mall operations, bus technology and operations, and user expectations.	Asymmetrical blocks provide consolidated spaces to allow for future changes in space allocation. Ability for spatial reconfiguration is limited in median blocks as a result of space constraints for gathering opportunities along with pedestrian access between trees in the medians. Ability to reconfigure restaurant patios away from buildings and maintain 10 feet of clear pedestrian space along wide side of asymmetrical blocks. Restaurant patios in medians infeasible because of the need to cross transit ways for service. Ability to incorporate innovative technology and infrastructure to easily adapt to future changes in building use, Mall operations, bus technology and operations, and user expectations.
	Short-term flexibility for gathering opportunities and programming variety.	Requires removal of buses from Mall to reconfigure space on a larger scale on median blocks. No fiber, communications, or widespread electrical utilities.	Requires removal of buses from Mall to reconfigure space on a larger scale on median blocks. Consolidated spaces on asymmetrical blocks provide contiguous space for public use and activities, and changes in amenities and types of use. Opportunity to add utilities (fiber, communications, electric) to allow for changes in amenities and types of use.	Consolidates public gathering space from three areas to two, to provide more contiguous space for public use and activities, and changes in amenities and types of use. Opportunity to combine public use and activities within tree canopy area, maximizing public gathering space. Opportunity to add utilities (fiber, communications, electric) to allow for changes in amenities and types of use.	Consolidates public gathering space from three areas to two, to provide more contiguous space for public use and activities, and changes in amenities and types of use. Opportunity to add utilities (fiber, communications, electric) to allow for changes in amenities and types of use.	Requires removal of buses from Mall to reconfigure space on a larger scale on median blocks. Consolidated spaces on asymmetrical blocks provide contiguous space for public use and activities, and changes in amenities and types of use. Opportunity to add utilities (fiber, communications, electric) to allow for changes in amenities and types of use.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Social and Environmental Impacts	Economic impacts: balance of opportunities and amenities along the Mall to benefit the public, residents, and adjacent property owners.	Asymmetrical blocks do not have similar opportunities for trees, gathering space, pedestrian circulation, or other amenities on both sides of the street.	Asymmetrical blocks do not have similar opportunities for trees, gathering space, pedestrian circulation, or other amenities on both sides of the street. Underutilized medians attract activities like loitering, which can deter patrons from adjacent businesses.	Provides the same opportunities for trees, gathering space, pedestrian circulation, and other amenities on both sides of the street.	Provides the same opportunities for trees, gathering space, pedestrian circulation, and other amenities on both sides of the street on center-running blocks. Asymmetrical blocks do not have similar opportunities for trees, gathering space, pedestrian circulation, or other amenities on both sides of the street.	Asymmetrical blocks do not have similar opportunities for trees, gathering space, pedestrian circulation, or other amenities on both sides of the street. Underutilized medians attract activities like loitering, which can deter patrons from adjacent businesses.
	Construction impacts: effects on businesses, residents, and transit operations.	Continued maintenance activities generate noise and limit transit mobility, and would continue to increase in frequency.	Construction activities generate noise and dust, and limit business access and transit and pedestrian mobility.	Construction activities generate noise and dust, and limit business access and transit and pedestrian mobility.	Construction activities generate noise and dust, and limit business access and transit and pedestrian mobility.	Construction activities generate noise and dust, and limit business access and transit and pedestrian mobility.

Category	Evaluation Criteria	No Build	Median and New Asymmetrical	Center Running	Center Running and New Asymmetrical	Rebuild in Existing Configuration
Social and Environmental Impacts (cont'd)	Land use impacts: consistency with local plans and policies[c]	Inconsistent with recommendations for infrastructure repair and upgrades.	Consistent with recommendations for transit service and infrastructure repair and upgrades.	Consistent with recommendations for transit service and infrastructure repair and upgrades.	Consistent with recommendations for transit service and infrastructure repair and upgrades.	Consistent with recommendations for transit service and infrastructure repair and upgrades.
	Water quality	Does not meet current water quality treatment requirements.	Ability to incorporate water quality treatment features into design.	Ability to incorporate water quality treatment features into design.	Ability to incorporate water quality treatment features into design.	Ability to incorporate water quality treatment features into design.
	Historic resource impacts: ability to honor original Mall design	Mall would retain its original design.	Ability to retain current locations of trees and lights on median blocks. Ability to retain current locations of trees and lights on wider sides of asymmetrical blocks. Small median with lights in between transit ways on asymmetrical blocks would be removed. Ability to accommodate existing paving pattern with some adjustments.	Trees and lights would be moved into rows on each side of transit way in a linear allée. Ability to maintain design element of double rows of alternating trees and lights. Ability to accommodate existing paving pattern with some adjustments.	On center-running blocks, trees and lights would be moved into rows on each side of transit way in a linear allée. Ability to maintain design element of double rows of alternating trees and lights. Ability to retain current locations of trees and lights on wider sides of asymmetrical blocks. Small median with lights in between transit ways on asymmetrical blocks would be removed. Ability to accommodate existing paving pattern with some adjustments.	Current locations of trees and lights would be retained. Ability to retain existing paving pattern.
	Degree of public and agency support for the alternative	Public: Minimal support Agency: Not supported	Public: Minimal support Agency: Not strongly supported	Public: Strong support Agency: Strong support	Public: Moderate support Agency: Moderate support	Public: Moderate support Agency: Not supported
Cost	Capital cost	None	High	High	High	High
	Maintenance cost	High	Low	Low	Low	Low
Construction	Construction duration	None	2 to 4 years	2 to 4 years	2 to 4 years	2 to 4 years

Notes:

[a] Applicable CPTED strategies recommended by RTD include: maximizing visibility of people and patron flow areas; providing adequate lighting minimizing shadows; landscape plantings that maximize visibility; elimination of structural hiding places; open lines of sight; and painting with light (RTD, 2016)

[b] One foot of sidewalk width can comfortably carry four pedestrians/minute and 240 pedestrians/hour (Gehl, 2010). Existing 8-foot walks are too narrow for peak period pedestrian volumes and do not adhere to CCD standards for 10-foot sidewalk widths downtown (CCD, 1993).

[c] Local plans and policies assessed for consistency: 2005 *Downtown Multimodal Access Plan* (CCD et al., 2005), 2007 *Denver Downtown Area Plan* (CCD et al., 2007), 2008 Urban Land Institute 16th Street Mall Study, 2010 *16th Street Urban Design Plan* (CCD et al., 2010), 2011 *Denver Moves: Bicycle and Pedestrian Connections* (CCD, 2011), and 2015 *Downtown Denver 16th Street Mall: Small Steps Towards Big Change* (Gehl, 2016).

B. Level 2 Evaluation

1. Alternatives and Options Evaluated

a) Alignment Alternatives

Five build alternatives and the No Build Alternative were analyzed in the Level 2 evaluation, along with options for pavement materials and curbs. The Level 2 evaluation assessed the No Build and build alternatives against the following criteria:

- Cost and infrastructure
- Safety and security
- Transit and pedestrian mobility
- Public Use functionality
- Community and social/environment impacts

Table 6-2 details the performance of each build alternative and the No Build Alternative against the Level 2 evaluation criteria.

b) Pavement Materials Options

Pavement materials were evaluated using similar criteria to those used for the Level 2 evaluation. The pavement materials evaluated included the following:

- Granite pavers with a mortar setting bed for the full Mall width
  - Pavers would be set on a drainable bedding on top of a concrete slab
  - If technically feasible, size could be matched to existing granite paver size
  - Existing pattern and color could be approximately replicated
- Unit pavers (granite, clay, or concrete) in a sand setting bed for the full Mall width
  - Pavers would be set on a drainable bedding on top of a concrete slab
  - Size would likely be 4 inches by 8 inches
  - Existing pattern and color could be approximately replicated
- Precast concrete slabs in the transit way with granite pavers in the sidewalks
  - Existing pattern in the transit way could be approximately replicated with scoring in the concrete
  - Existing colors in the transit way could be approximately replicated through integral color in the concrete
- Cast-in-place concrete option A in the transit way with granite pavers in the sidewalks
  - Standard cast-in-place concrete in the transit way, which would require approximately two replacements over a 40-year lifespan
  - Replicating the existing pattern in the transit way would be highly difficult to achieve
  - Replicating the existing color in the transit way would not be feasible
- Cast-in-place concrete option B in the transit way and granite pavers in the sidewalks
  - Concrete would be designed for a 40-year lifespan with three 5-inch mill and overlays (this type of concrete construction minimizes the cracking, chipping, spalling, and polishing common with standard concrete)

- Replicating the existing pattern would be highly difficult to achieve
- Replicating the existing color would not be feasible

Table 6-3 details the pavement materials evaluation.

c) Curb Options

Three transit way curb options were considered for the alternatives: a vertical curb that mimics the existing curbs that are on the outer edges of the existing transit lanes, a pan that mimics the existing pan on the inner edges of the existing transit lanes, or a hybrid design with vertical curbs at shuttle stops and cross streets and a pan in other locations (**Figure 6-1**). The vertical curb, illustrated conceptually on **Figure 6-2**, would be 4 to 6 inches tall. The pan, illustrated conceptually on **Figure 6-3**, would slope from the edges to the flowline in the center; the flowline would appear as a shallow longitudinal channel within the pan to direct water as part of the drainage system. In the hybrid option, the vertical curb would be constructed at shuttle stops and cross streets and a pan would be constructed along the transit way in other locations, unless drainage design or ADA compliance requires additional curbs.

Figure 6-1. Existing Vertical Curb and Existing Pan on Median Block

Figure 6-2. Vertical Curb Unit

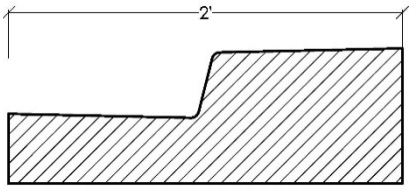


Figure 6-3. Pan Unit

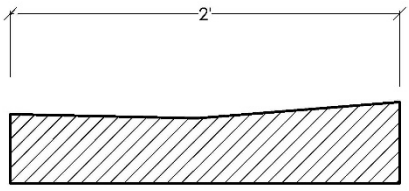


Table 6-4 details the curb options evaluation, and **Section 7.1** describes the design features associated with each curb option in more detail relative to safety, accessibility, and effects to the historic pavement pattern.

2. Initial Conclusions

a) Alignment Alternatives

The Level 2 evaluation concluded that the Median and New Asymmetrical Alternative, the Rebuild in Existing Configuration Alternative, and the Partial Repair Alternative would not meet the Project needs for mobility, safety, and public use; the Partial Repair Alternative additionally would not meet the Project need for infrastructure.

The Level 2 evaluation concluded that of the remaining alternatives that met the Project needs, the Center Running Alternative met the Project needs and goals better than the Center-running and New Asymmetrical Alternative:

- The Center Running Alternative would provide a safer condition because trees would be placed between pedestrian walking areas and transit ways on both sides of the block, better delineating pedestrian and transit areas, consistent with RTD standards (RTD, 2016a) and guidance (NACTO, 2013; NACTO, 2016; FHWA, 2017). In contrast, the narrow side of the asymmetrical blocks in the Center-running and New Asymmetrical Alternative would have the pedestrian walking area immediately adjacent to the transit way, with no tree/amenity zone or other buffer between them.
- The Center Running Alternative would provide better opportunities for public use because trees would be present on both sides of the block, providing shade and zones for public gathering and shuttle stops; in contrast, the narrow side of the asymmetrical blocks in the Center-running and New Asymmetrical Alternative would not have trees or space for shuttle stops that do not obstruct the pedestrian walking area.
- The Center Running Alternative would provide equitable distribution of pedestrian space and public amenities, providing benefits for public use and economic vitality for businesses on both sides of the Mall. The Center-running/New Asymmetrical Alternative would perpetuate inequitable distribution of amenity space and sidewalk capacity fronting businesses, resulting in more public use and a larger customer base adjacent to businesses on wide sides.

The Center Running and New Asymmetrical Alternative would have less impact on the historic design of the Mall than the Center Running Alternative by maintaining an asymmetrical design on the five and a half blocks at the ends of the original Mall and maintaining the existing progression and locations of a beginning, middle, and end of the Mall. The design of the asymmetrical blocks in the Center-running and New Asymmetrical Alternative was refined to better meet the Project's needs and goals, minimize impacts to the Mall's historic design, and respond to stakeholder input; **Section 6.B.3** explains these refinements.

b) Pavement Materials Options

The pavement materials options analysis concluded that although the granite pavers in a mortar bed for the width of the Mall option is more expensive than the other options, and would take longer to construct than the concrete pavement options, granite would most honor the historic design of the Mall and was the most-supported pavement system by CCD, owner of the street. Additionally, each pavement option has various surface treatments to provide appropriate friction for vehicles and pedestrians, which can increase safety. The concrete

options need to be replaced or receive concrete overlays throughout the life of the facility, creating impacts at a later date.

c) Curb Options

The Level 2 evaluation of curb options concluded that the hybrid curb option best met the selection criteria and was supported by CCD and RTD.

3. Identification of the LPA

The Center-running and New Asymmetrical Alternative was refined to better address the Project purpose, needs, and goals, minimize impacts to the Mall's historic design, and respond to stakeholder input. Refinements to the asymmetrical block design comprise shifting the transit way and the pavement pattern on the wide side of the block, including the locations of trees and lights, two feet closer to the buildings (north) to allow for an amenity zone with a third row of trees between pedestrians and transit on the narrow side of the block. These refinements improved the alternative by:

- Providing safer conditions by creating an amenity zone with a row of trees that would physically separate the pedestrian walkway and transit way and provide space for shuttle stops within the amenity zone, so people waiting for the bus do not obstruct the pedestrian walkway.
- Minimizing impacts to the historic design by aligning one row of trees between the asymmetrical and center-running blocks so there is a straight line of trees down the Mall, which is an element of the existing design, and maintaining the existing progression and location of a beginning, middle, and end of the Mall by retaining the design concept of five and a half asymmetrical blocks at the beginning and end of the Mall and seven symmetrical blocks in the middle of the Mall.
- Providing trees and public amenity space on both sides of the asymmetrical blocks, more equitably distributing space and providing more equal benefits to public use and business vitality.

After continued analysis (including continued review of guidance, a Project-specific safety analysis, and continued refinement of edge delineation concepts design to meet the Project purpose and need), the project team determined that the refinements to the New Asymmetrical cross-section design are needed for the Center-running and New Asymmetrical Alternative to meet the Project purpose and need.

Current national guidance and RTD standards recommend visually and physically separating walkways from transit lanes to minimize instances of pedestrians inadvertently walking into transit lanes. Federal Highway Administration's (FHWA) 2013 Pedestrian Safety Guide recommends a buffer zone between 4 and 6 feet wide to separate pedestrians from the street, noting that street furniture or an amenity zone is typically appropriate in downtown or commercial areas (FHWA, 2013). The National Association of City Transportation Officials (NACTO) recommends an amenity zone with street furniture (such as benches, greenery, bollards, street lights, and bicycle parking) be used to delineate between the two areas (NACTO, 2013 and 2016). *RTD Bus Infrastructure Design Guidelines and Criteria* require that pedestrian/transit conflicts be eliminated, or at the least minimized, by separating pedestrian pathways from active bus lanes (RTD, 2016a).

The added space for an amenity zone on the narrow side of the asymmetrical block in the Center Running and New Asymmetrical Alternative allows for a physical and visual delineation between the transit way and the pedestrian walkway, in compliance with RTD standards and national guidance. Further, mobility and public use are part of the purpose and need for the project. The proposed dimensions for the pedestrian walkway and patio/gathering area are needed to meet those factors of the purpose and need.

The refined Center Running and New Asymmetrical Alternative, with granite pavers set in a mortar bed and a hybrid curb design of vertical curbs at designated shuttle stops and cross streets and a pan in other locations, was selected as the LPA because of its ability to meet the Project purpose and need, as well as minimization of impacts to the historic resource.

4. Design Options to the LPA

As part of consultation under Section 106 of the National Historic Preservation Act, Historic Denver requested CCD and RTD explore modifications to the LPA's New Asymmetrical block design on a subset of the original asymmetrical blocks. On asymmetrical blocks, the LPA would shift the pavement pattern, including the locations of trees and lights, two feet closer to the buildings (north) to provide space for an amenity zone on the narrow side of the block. The amenity zone is necessary to provide safe physical and visual delineation between the transit way and the pedestrian walkway.

Historic Denver requested modifications focused on rebuilding in place the pedestrian area on the wide (north) side of the block, from the building faces to the outer (north) edge of the existing transit way, on 3 ½ of the original 5 ½ asymmetrical blocks, from Market Street to Lawrence Street and from Court Place to Broadway. This would eliminate the 2-foot "shift" in the pavement pattern and rows of lights and trees on the wide side of the block, and would reduce space for public use on the narrow side of the block by 2 feet. Historic Denver proposed modifications to these 3 ½ blocks because they felt existing building uses and plazas on adjacent properties create a different context on these blocks.

To maintain the concept of three "rooms" on the Mall, Historic Denver proposed extending the Center Running block design one block farther on each end, into two of the existing asymmetrical blocks, rather than having additional transitions and multiple asymmetrical block designs.

a) Design Options Evaluated

CCD and RTD developed two design options to respond to Historic Denver's request. Both design options would retain the existing pavement pattern location, including locations of trees and lights, on the wide side of the applicable asymmetrical blocks (rather than shift the pattern over 2 feet as proposed in the LPA), and would add 5 feet to the narrow side of the block (rather than add 7 feet as proposed in the LPA). The 2-foot difference would need to be removed from one of the three uses on the narrow side of the block: patio/gathering space, pedestrian walkway, or amenity zone. The pedestrian walkway cannot be smaller than 10 feet, thus the 2-foot width would be removed from the patio/gathering space or amenity zone. The resulting design options vary in where the 2-foot difference on the narrow side of the block would occur. Under both design options, the Center Running blocks would be extended one block farther in each direction, illustrated in **Figure 6-4**.

In comparison to the LPA, Design Option 1 would reduce the amenity zone by 2 feet, and the patio width would remain 9 feet as it is today, illustrated in **Figure 6-5**. The 3-foot amenity zone would not be wide enough to accommodate a row of trees and lights or other street furnishings. In order to safely separate and delineate the pedestrian walkway and the transit way, it would be necessary to add a row of vertical bollards in the amenity zone. A secondary light source would also need to be added to provide adequate nighttime lighting.

In comparison to the LPA, Design Option 2 would reduce the patio width by 2 feet. The 7-foot-wide patio space would reduce seating capacity by one-third from the existing (and proposed LPA) 9-foot width. The 5-foot amenity zone would be wide enough to accommodate a row of trees and lights and other street furnishings, similar to the LPA. Unlike the LPA, the row of trees would not be able to align with the row of trees in the center running blocks.

Both design options would reconstruct the half-block (the triangle plaza block from Cleveland Place to Broadway) with pavers in the same pattern and location as the original design; other elements of the triangle block, including the lights, trees, and fountain, would also be reconstructed in same location.

Table 6-5 details the design options evaluation.

Figure 6-4. Block Design Location – Existing, LPA, and LPA Design Options

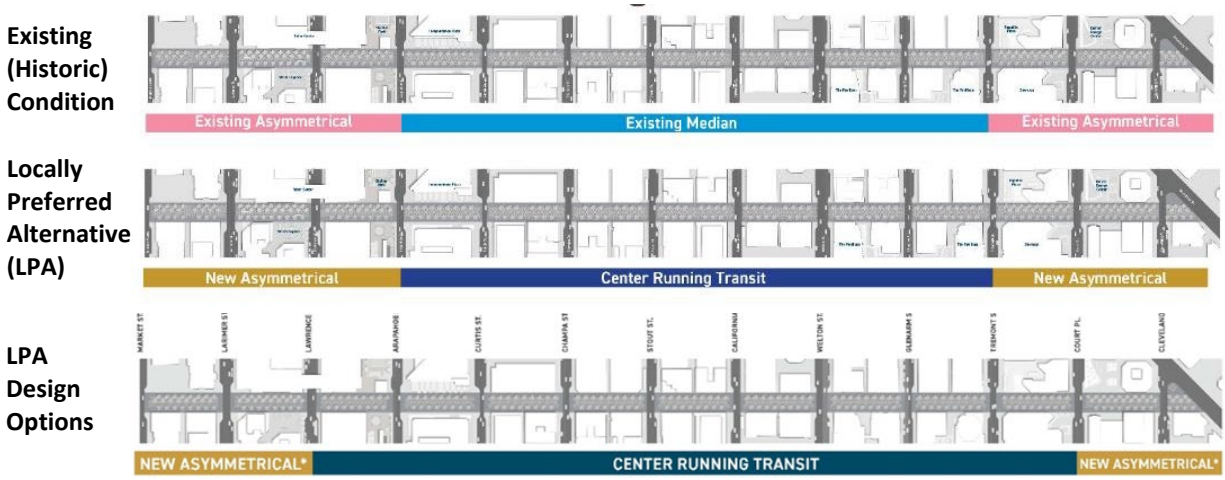
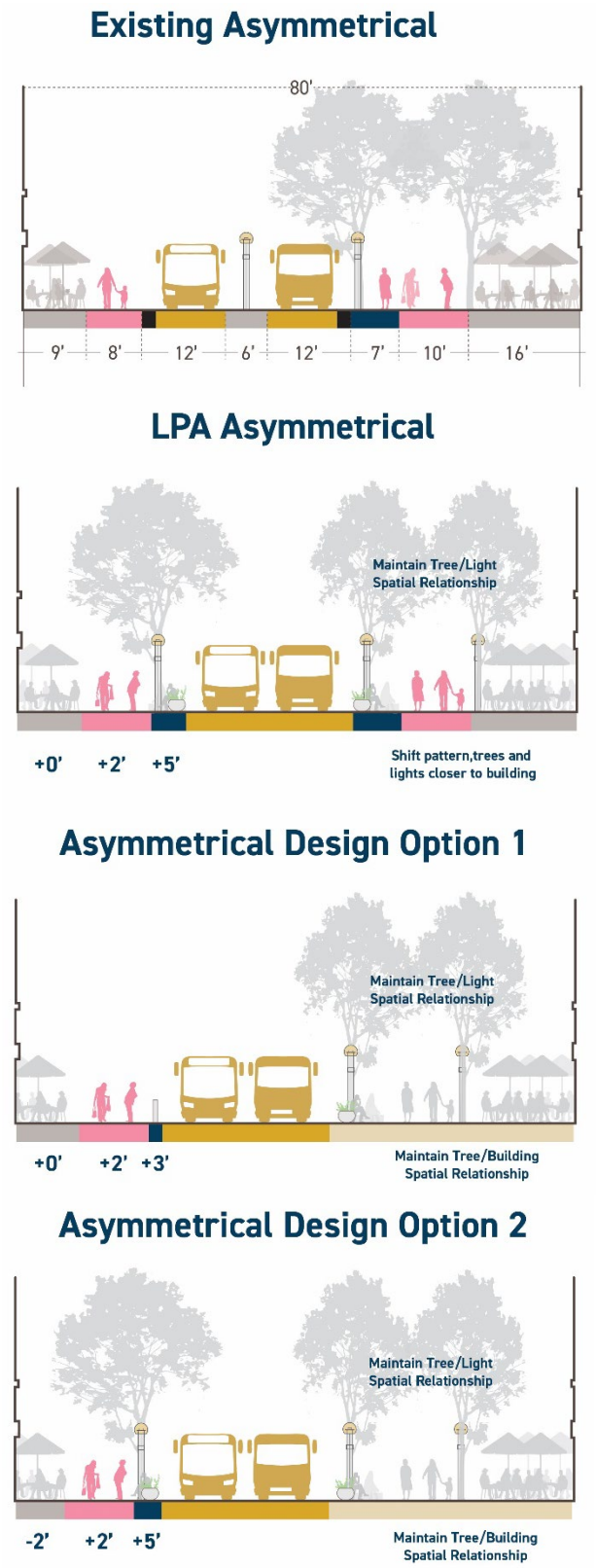


Figure 6-5. Cross Section Design – Existing, LPA, and LPA Design Options



b) Conclusions

The Level 2 analysis of the design options concluded:

- Design Option 1 is eliminated from further consideration
- Design Option 2 is carried forward for further study in the EA
- Reconstruction of the triangle plaza block between Cleveland Place and Broadway in the same pattern and location as the original design is incorporated into the LPA design

Both design options 1 and 2 would accomplish Historic Denver's goals of rebuilding in place the pedestrian area on the wide (north) side of the block. The 3-foot amenity zone in Design Option 1 does not provide space for trees, lights, or street furnishings on the narrow side of the block and requires introducing vertical bollards, which are undesirable new visual elements, to safely separate pedestrians and transit. Design Option 2 would not meet the public use needs of the Project as well as the LPA, but it would better meet the purpose and need and have fewer impacts than Design Option 1. The unique conditions of the half-block triangle plaza between Cleveland Place and Broadway provide the opportunity to incorporate into the LPA reconstruction of this half-block in its original design.

Table 6-2. Level 2 Alternatives Evaluation

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Economics and Cost							
Failing pavement system in constant need of repair	Capital cost	N/A	$76M to $137M depending on pavement material	$76M to $137M depending on pavement material	$76M to $137M depending on pavement material	$76M to $137M depending on pavement material	$62M to $88M
	Annual transit way and sidewalk maintenance cost	$1.2M	$85,000 to $310,000, depending on pavement material	$85,000 to $310,000, depending on pavement material	$85,000 to $310,000, depending on pavement material	$85,000 to $310,000, depending on pavement material	$560,000
	Future transit way replacement cost	N/A	$0 to $20M, depending on pavement material	$0 to $20M, depending on pavement material	$0 to $20M, depending on pavement material	$0 to $20M, depending on pavement material	$54M
	40-year investment	$46.6M	$85M to $152M	$85M to $152M	$85M to $152M	$85M to $152M	$138M to $164M
Outdated infrastructure does not meet current ADA requirements and leads to poor tree health; lack of water quality treatment and modern fiber optic and communications utilities doesn't meet modern-day needs	Ability to address ADA deficiencies[a]	Not possible to address all ADA deficiencies	Not a discriminator: Can address all ADA deficiencies	Not a discriminator: Can address all ADA deficiencies	Not a discriminator: Can address all ADA deficiencies	Not a discriminator: Can address all ADA deficiencies	Not a discriminator: Can address all ADA deficiencies
	Tree infrastructure is updated to modern standards.	Ranks poorly for tree health: No replacement of obsolete tree infrastructure (tree boxes and irrigation)	Ranks well for tree health: Installs modern tree planting infrastructure and new trees; conflicting utilities would be relocated.	Ranks well for tree health: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.	Ranks well for tree health: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.	Ranks well for tree health: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.	Ranks slightly better than No Build Alternative: Replacement of missing and dead trees. No replacement of obsolete tree infrastructure (tree boxes and irrigation).
	Water quality treatment is added to stormwater drainage system.	No water quality improvements: No change in treatment of stormwater runoff beyond maintenance activities and normal Mall janitorial activities.	Improves water quality: Installs stormwater quality treatment facilities, meeting City standards.	Improves water quality: Installs stormwater quality treatment facilities, meeting City standards.	Improves water quality: Installs stormwater quality treatment facilities, meeting City standards.	Improves water quality: Installs stormwater quality treatment facilities, meeting City standards.	No water quality improvements: No change in treatment of stormwater runoff beyond maintenance activities and normal Mall janitorial activities.
	Add fiber optic utility infrastructure and update/increase electric utility capabilities.	No improvement: No fiber optic utilities for modern technology and inadequate electric power supply for programming needs.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Safety and Security							
Poor delineation between undersized[b] pedestrian walks and transit causes near misses between pedestrians and transit vehicles	Pedestrian overflow into transit ways	No change: Median blocks: 8-foot outer pedestrian walks remain undersized, resulting in pedestrian overflow into transit ways. Asymmetrical blocks: 8-foot outer pedestrian walks on narrow side of block remain undersized, resulting in pedestrian overflow into transit ways. 14-foot walkways on wide side of block accommodate pedestrians without overflow into transit ways.	Ranks third: Median blocks: 8-foot outer pedestrian walks remain undersized, resulting in pedestrian overflow into transit ways. New Asymmetrical blocks: 10-foot walkways on asymmetrical blocks accommodate pedestrians without overflow into transit ways.	Ranks best: Center-running blocks: 10-foot-minimum pedestrian walks accommodate pedestrians without overflow into transit ways.	Ranks second best: Center-running blocks: 10-foot-minimum pedestrian walks accommodate pedestrians without overflow into transit ways. New Asymmetrical blocks: 10-foot walkways on asymmetrical blocks accommodate pedestrians without overflow into transit ways.	Same as No Build	Same as No Build
	Delineation between pedestrians and transit	No change: Median blocks: Pedestrian walks remain directly adjacent to transit way and do not meet RTD standards and guidance[c] for physical separation and delineation of pedestrian and vehicular areas. Asymmetrical blocks: Pedestrian walks separated by tree/amenity zones as recommended by guidance[c] on wide side of block. Ability to shift pedestrian walk to storefront on wide side of block to further separate pedestrians from transit.	Ranks third: Median blocks: Pedestrian walks remain directly adjacent to transit way and do not meet RTD standards and guidance[c] for physical separation and delineation of pedestrian and vehicular areas. New Asymmetrical blocks: Pedestrian walks separated by tree/amenity zones as recommended by guidance[c] on wide side of block. Ability to shift pedestrian walk to storefront on wide side of block to further separate pedestrians from transit.	Ranks best: Center-running blocks: Pedestrian walks separated by tree/amenity zones as recommended by guidance[c]. Ability to shift pedestrian walks to storefronts and further separate pedestrians from transit. Additional options for delineation between pedestrian and transit areas: Same options for delineation between pedestrian and transit areas as Median and New Asymmetrical Alternative.	Ranks second best: Center-running blocks: Pedestrian walks separated by tree/amenity zones as recommended by guidance[c]. Ability to shift pedestrian walks to storefronts and further separate pedestrians from transit. New Asymmetrical blocks: Same as Median and New Asymmetrical alternative. Options for delineation between pedestrian and transit areas: Same options for delineation between pedestrian and transit areas as Median and New Asymmetrical Alternative.	Same as No Build	Same as No Build

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Poor delineation between undersized[b] pedestrian walks and transit causes near misses between pedestrians and transit vehicles (continued)	Delineation between pedestrians and transit	Pedestrian walks on narrow side of block remain directly adjacent to transit ways and do not meet RTD standards and guidance[c] for physical separation and delineation of pedestrian and vehicular areas. 4-inch curb of same appearance and material as pedestrian and transit surface is the only delineation between pedestrian and transit areas.	Pedestrian walks on narrow side of block remain directly adjacent to transit way and do not meet RTD standards and guidance[c] for physical separation and delineation of pedestrian and vehicular areas. Additional options for delineation between pedestrian and transit areas: Retain existing 4-inch curb; install higher curb between walks and transit; barrier or bollards between walks and transit; shift pedestrian walks adjacent to storefronts; provide visual and/or tactile difference in materials between walks and transit; use technology to delineate walks and transit, such as colored lights.				
Higher crash numbers adjacent to median blocks (Arapahoe Street to Tremont Place)	Ability to address higher crash locations from Arapahoe Street to Tremont Place	No change: Same street cross section and conflict/crossing points – median and asymmetrical geometrics remain. Same number of conflict points remain at each intersection and block, and same cross-street width remains in place.	Moderate improvement to higher crash locations: Intersection bulb-outs reduce cross-street width at intersections, providing moderate safety benefit from reduced crossing distance and improved visibility/conspicuity for pedestrians. Same number of conflict points remain at each intersection and block.	Greatest improvement to higher crash locations: Intersection bulb-outs reduce cross-street width at intersections, providing moderate safety benefit from reduced crossing distance and improved visibility/conspicuity for pedestrians. Number of conflict points reduced at intersections and within blocks, in former median blocks.	Greatest improvement to higher crash locations: Intersection bulb-outs reduce cross-street width at intersections, providing moderate safety benefit from reduced crossing distance and improved visibility/conspicuity for pedestrians. Number of conflict points reduced at intersections and within blocks, in former median blocks.	Moderate improvement to higher crash locations: Intersection bulb-outs reduce cross-street width at intersections, providing moderate safety benefit from reduced crossing distance and improved visibility/conspicuity for pedestrians. Same number of conflict points remain at each intersection and block.	Moderate improvement to higher crash locations: Intersection bulb-outs reduce cross-street width at intersections, providing moderate safety benefit from reduced crossing distance and improved visibility/conspicuity for pedestrians. Same number of conflict points remain at each intersection and block.

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Slick pavement surface causes pedestrian slips and falls, bus traction problems, compounded by snowy or icy conditions in winter	Pavement surface reduces "slip, trip and fall" risks	No change: Slick granite surface would remain the same assuming no further modifications.	Not a discriminator: Pavement design options comprise granite pavers with a higher friction finish, unit pavers, precast concrete, and cast-in-place concrete.	Not a discriminator: Pavement design options comprise granite pavers with a higher friction finish, unit pavers, precast concrete, and cast-in-place concrete.	Not a discriminator: Pavement design options comprise granite pavers with a higher friction finish, unit pavers, precast concrete, and cast-in-place concrete.	Not a discriminator: Pavement design options comprise granite pavers with a higher friction finish, unit pavers, precast concrete, and cast-in-place concrete.	Ranks below other action alternatives: Granite pavers in transit ways would be cleaned and refinished to improve surface friction.
Safety and security systems should be upgraded to current standards.	Ability to accommodate future technology for security best practices	No improvements: No fiber optic utilities or updated electric power supply to meet future security technology needs.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities.
Transit mobility and operations							
Frequent maintenance disrupts transit operations, and would be more disruptive as ridership increases	Maintenance effects on bus operations efficiency and requirements	No change: Maintenance frequency continues to increase, slowing bus operations.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions, under any pavement design option.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions, under any pavement design option.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions, under any pavement design option.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions, under any pavement design option.	Ranks below other action alternatives: Replacement of sub-base reduces frequency of maintenance impacts on bus operations.
The demand for transit services is projected to increase to 70,000 riders/day in 2035	Provision of connectivity between DUS and CCS, and crossing bus and light rail routes in between	No change: Maintains existing connection. Service expansion options comprise operating buses in tandem or procuring larger buses.	Same as No Build	Same as No Build	Same as No Build	Same as No Build	Same as No Build
	Accommodation of tandem and/or larger buses at shuttle stops	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding along length of block.
Transit operations would become increasingly difficult as the volume of passengers and pedestrian use increases on the Mall	Effect on transit operations	Not endorsed by RTD: Maintains slick surface, high maintenance frequency, and maneuvering between median and asymmetrical blocks.	Agreeable, but less preferred, by RTD: Bus operators need to protect both the curb and median sides of the bus.	Most preferred by RTD: Buses operate on continuous lane assignment throughout Mall and bus operators need to protect only the curb side of the bus. Eliminating the median improves the safety of bus operations.	Most preferred by RTD: Buses operate on more continuous lane assignment throughout Mall and bus operators need to protect only the curb side of the bus. Eliminating the median improves the safety of bus operations.	Agreeable, but less preferred, by RTD: Bus operators need to protect both the curb and median sides of the bus.	Agreeable, but less preferred, by RTD: Bus operators need to protect both the curb and median sides of the bus.

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
During construction the efficiency of transit operations would be dramatically reduced	Minimum disruption during construction	Lowest impact: Limited to maintenance activities which vary by year.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Less impact than the other action alternatives: Construction would occur primarily in the transit ways and would have less disruption in the pedestrian areas than the other action alternatives.
Pedestrian mobility							
Sidewalks are undersized for pedestrian volumes[d] and CCD standards (10-foot sidewalks downtown).	Pedestrian volumes and accessibility guidelines are accommodated	No change: Median blocks: Pedestrian volumes and CCD standards not accommodated - 1,920 pedestrians/hour on 8-foot sidewalks next to patio/gathering space. Asymmetrical blocks: Pedestrian volumes and CCD standards not accommodated on narrow side of block – 1,920 pedestrians/hour on 8-foot sidewalks next to patio/gathering space. Pedestrian volumes and accessibility guidelines are accommodated on wide side of block - 3,360 pedestrians/hour on 14-foot sidewalks, with additional space for pedestrians and/or amenities.	Minimal change from No Build: Median blocks: No change from No Build. New Asymmetrical blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians and/or amenities.	Center-running blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities.	Center-running blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities. New Asymmetrical blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities.	Same as No Build	Same as No Build

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Public Use Functionality							
Limited usability of divided public space on median blocks and narrow sides of asymmetrical blocks to accommodate patio/gathering space[f] and pedestrian needs.	Width for patio and gathering space	No change: Median Blocks: Walkways in outer pedestrian areas of median blocks are not wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian sidewalk. Medians are not conducive to stationary gathering activities because they are too narrow, lack edges, and are surrounded by transit shuttles[g]. Asymmetrical Blocks: Walkways on narrow sides of asymmetrical blocks are not wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk.	Ranks third: Median Blocks: Walkways in outer pedestrian areas of median blocks are not wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk. Medians are not conducive to stationary gathering activities because they are too narrow, lack edges, and are surrounded by transit shuttles[g]. New Asymmetrical Blocks: Walkways on both sides of asymmetrical blocks are wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenities and/or pedestrians on wide side.	Ranks best: Center-running Blocks: Walkways on both sides of blocks are wide enough for 9-foot patio/gathering space and 10-foot pedestrian sidewalk, with additional space for amenities and/or pedestrians.	Ranks second best: Center-running Blocks: Walkways on both sides of blocks are wide enough for 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenities and/or pedestrians. New Asymmetrical Blocks: Walkways on both sides of asymmetrical blocks are wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenities and/or pedestrians on wide side.	Same as No Build	Same as No Build
Negative perception of safety and lack of natural surveillance inhibits positive public use of Mall.	Adherence to best practices for natural surveillance, activation, and positive public use of pedestrian and gathering areas.	No change: Median blocks have low public use and natural surveillance, increased negative behaviors (for example, panhandling[h]), and decreased sense of safety because of size, physical separation from primary walkways, and frequent shuttle service on each side. Asymmetrical blocks can accommodate best practices for natural surveillance and accommodate positive public use and activities.	Same as No Build	Improved over No Build: Replaces public space in medians with consolidated public space adjacent to buildings, increasing natural surveillance and adhering to safety and security best practices.	Improved over No Build: Replaces public space in medians with consolidated public space adjacent to buildings, increasing natural surveillance and adhering to safety and security best practices. New Asymmetrical blocks can accommodate best practices for natural surveillance and accommodate positive public use and activities.	Same as No Build	Same as No Build

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Community and Environment							
Construction impacts	Construction impacts	Lowest impact: Limited to maintenance activities which vary by year.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Comparable to other action alternatives except Partial Repair: Major impact during the construction period; length of construction period varies depending on pavement design.	Less impact than other action alternatives: Construction would occur primarily in the transit ways and would have less disruption in the pedestrian areas than the other action alternatives.
Environmental impacts	Historic resources impacts	Minimal change from existing conditions: The rate at which the Mall deteriorates from use would increase as ridership and pedestrian use increase. Ad hoc replacement of pavers would continue.	Impacts historic properties. More change than Rebuild in Existing Configuration and Partial Repair alternatives: Median blocks maintain historic design. New Asymmetrical blocks modify historic design; can accommodate existing pavement pattern and spatial relationships, with some adjustments.	Impacts historic properties. More change than Rebuild in Existing Configuration and Partial Repair alternatives: Center-running design replaces both median and asymmetrical blocks. Ability to accommodate existing pavement pattern, with minor adjustments.	Impacts historic properties. More change than Rebuild in Existing Configuration and Partial Repair alternatives: Center-running design replaces median blocks. Ability to accommodate existing pavement pattern, with minor adjustments. New Asymmetrical blocks modify historic design; can accommodate existing pavement pattern and spatial relationships, with some adjustments.	Impacts historic properties. Less change than all but the Partial Repair alternative: No change in spatial configuration or pavement pattern, but more change than Partial Repair alternative as a result of reconstruction of entire Mall.	Impacts historic properties. Least change from existing conditions: No change in spatial configuration or pavement pattern.

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
Environmental impacts (continued)	Socioeconomic impacts	Minimal changes from existing conditions.	Minimal changes to social, economic, and land use resources. Asymmetrical blocks perpetuate inequitable distribution of amenity space and sidewalk capacity fronting businesses. Wide sides of block allow more space for walking and gathering than narrow sides, resulting in larger customer base adjacent to businesses on wide sides.	Potential benefits to social, economic, and land use resources because of higher public use, perception of safety, and equitable distribution of space. Center-running blocks provide equitable distribution of pedestrian space and public amenities, including tree canopy and gathering space, providing benefits for economic vitality of businesses on both sides of the Mall.	Potential benefits to social, economic, and land use resources because of higher public use and perception of safety. Center-running blocks provide equitable distribution of pedestrian space and public amenities, including tree canopy and gathering space, providing benefits for economic vitality of businesses on both sides of the Mall. Asymmetrical blocks perpetuate inequitable distribution of amenity space and sidewalk capacity fronting businesses. Wide sides of block allow more space for walking and gathering than narrow sides, resulting in larger customer base adjacent to businesses on wide sides.	Minimal changes to social, economic, and land use resources. Asymmetrical blocks perpetuate inequitable distribution of amenity space and sidewalk capacity fronting businesses. Wide sides of block allow more space for walking and gathering than narrow sides, resulting in larger customer base adjacent to businesses on wide sides.	Minimal changes to social, economic, visual, and land use resources. Asymmetrical blocks perpetuate inequitable distribution of amenity space and sidewalk capacity fronting businesses. Wide sides of block allow more space for walking and gathering than narrow sides, resulting in larger customer base adjacent to businesses on wide sides.
	Natural resources impacts	Minimal changes from existing conditions.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.
Public and agency support	Level of Agency Support	Not supported: Not supported by CCD, RTD, or DDP.	Not strongly supported: Not strongly supported by CCD, RTD, or DDP.	Highest support: Strongly supported by CCD and DDP. Supported by RTD because of improved guideway geometry as compared to the other build alternatives.	Second highest support: Not as strongly supported by CCD or DDP when compared to the Center Running Alternative. Supported by RTD because of improved guideway geometry as compared to the other build alternatives.	Not supported: Not supported by CCD or DDP. Neutral support by RTD.	Not supported: Not supported by CCD, RTD, or DDP.

Category	Criteria	No Build	Alternative Median and New Asymmetrical	Alternative Center Running	Alternative Center Running and New Asymmetrical	Rebuild in Existing Configuration	Partial Repair
	Level of Public Support as demonstrated at public meetings and hearings	Minimal support	Minimal support	Strong support	Moderate support	Moderate support	Not presented during Level 1 screening; recommended alternative in 2010 *16th Street Urban Design Plan* (CCD et al.)
Ability to meet the Project Purpose and Need	Satisfies the Project Purpose and Need	Does not satisfy any Purpose and Need elements.	Ranks third in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility on asymmetrical blocks through wider sidewalks; does not physically separate pedestrian walk from transit way on narrow side of asymmetrical block. Supports future transit mobility. Does not meet requirements for sidewalk and patio/gathering space width. Does not adhere to best practices for natural surveillance and public activation on median blocks. Does not provide flexibility for public use as well as the alternatives with center-running blocks.	Ranks first in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility through wider sidewalks and separation of pedestrian walks from transit ways. Supports future transit mobility. Meets requirements for adequate patio/gathering and sidewalk space. Adheres to best practices for natural surveillance and public activation. Provides flexibility for public use by allowing pedestrian walks to shift against building fronts to consolidate gathering space under trees.	Ranks second in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility through wider sidewalks and separation of pedestrian walks from transit ways on center-running blocks and the wide side of new asymmetrical blocks; does not physically separate pedestrian walk from transit way on narrow side of asymmetrical block. Supports future transit mobility. Meets requirements for adequate patio/gathering and sidewalk space. Adheres to best practices for natural surveillance and public activation. Provides flexibility for public use by allowing pedestrian walks to shift against building fronts to consolidate gathering space under trees on center-running blocks and on wide sides of asymmetrical blocks.	Ranks fourth in fulfillment of the Purpose and Need. Replaces failing infrastructure. Does not improve pedestrian safety and mobility. Supports future transit mobility Does not meet requirements for sidewalk and patio/gathering space width. Does not adhere to best practices for natural surveillance and public activation on median blocks. Does not provide flexibility for public use as well as the alternatives with center-running blocks.	Ranks last in fulfillment of the Purpose and Need. Replaces failing infrastructure in the transit ways, but not in other areas (pedestrian areas, and tree infrastructure) Does not improve pedestrian safety and mobility Supports future transit mobility Does not meet requirements for sidewalk and patio/gathering space width Does not adhere to best practices for natural surveillance and public activation on median blocks. Does not provide flexibility for public use as well as the alternatives with center-running blocks.
Disposition		Carry forward as required by NEPA	Do not carry forward	Carry forward	Carry forward	Do not carry forward	Do not carry forward

[a] ADA deficiencies and recommendations documented in MTC, 2010.

[b] One foot of sidewalk width can comfortably carry four pedestrians/minute and 240 pedestrians/hour (Gehl, 2010). Existing 8-foot walks are too narrow for peak period pedestrian volumes and do not adhere to CCD standards for 10-foot sidewalk widths downtown (CCD, 1993).

[c] RTD, 2016a; NACTO, 2013; NACTO, 2016; FHWA, 2017.

[d] CCD counted hourly pedestrian volumes in 2015 and 2016 in representative locations on the Mall. Pedestrian volumes exceed the carrying capacity of the sidewalks on the median blocks on the east end of the Mall, reaching up to 4,100 pedestrians per hour during the peak weekday lunch hour. The west end of the Mall reaches up to 3,000 pedestrians/hour near the DUS neighborhood (Gehl, 2016). Future (2040) midday peak pedestrian volumes are estimated at 4,800 pedestrians/hour in the CBD and 4,000 pedestrians/hour in the DUS neighborhood, based on existing peak hour pedestrian volumes growing at rate of forecasted employment growth from 2015 to 2040 of 0.7 percent annually in the Central Business District (CBD) neighborhood and 1.2 percent annually in the DUS neighborhood (**Table 4** of the *Land Use and Socioeconomic Existing Conditions* technical memorandum located in **Appendix B**).

[e] CCD, 1993.

[f] The architectural standard for dining space recommends 300 square inches per diner. Common industry table sizes that meet this standard are 30 inches by 42 inches and 30 inches by 48 inches for four-person tables and 30 inches by 24 inches for two-person tables. The standard aisle width is 36 inches to 42 inches. Using the smallest industry standards of 42-inch-wide four-top table, 36-inch-wide aisle, and 24-inch-wide two-top table results in a patio width of 102 inches, or 8.5 feet, without a barrier railing, and 9 feet with a barrier railing. Additionally, patio permits currently issued by BID require 10 feet of separation from transit ways, resulting in 9-foot patios.

[g] People prefer to gather at edges, and people inherently back away from fast-moving objects (Gehl, 2010).

[h] Eighty-eight percent of panhandling occurs on median blocks (Downtown Denver Business Improvement District Downtown Ambassadors, 16th Street Mall Panhandling Surveys, March 22 – August 29, 2015 as cited in Gehl, 2016).

M = million dollars

Table 6-3. Pavement Options Analysis

Category	Criteria	Granite pavers with a mortar setting (full width of Mall)	Unit pavers with a sand setting (full width of Mall)	Precast concrete slabs w/pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option A[a], no pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option B[a], no pattern, color (transit); granite pavers (walks)
Economics and Approximate Cost						
Failing pavement system in constant need of repair	Capital cost (millions)	$114 (range based on market fluctuation: $97 to $137)	$108 (range based on market fluctuation: $92 to $130)	$98 (range based on market fluctuation: $83 to $118)	$88 (range based on market fluctuation: $75 to $106	$92 (range based on market fluctuation: $78 to $110)
	Annual transit way and sidewalk maintenance cost	$309,000	$309,000	$106,000	$85,000	$196,000
	Future transit way replacement cost (millions)	$0	$0	$15.5	$20.0	$0
	40-year investment (millions)	$126.4 (range based on market fluctuation: $107 to $152)	$120.4 (range based on market fluctuation: $102 to $144)	$117.8 (range based on market fluctuation: $100 to $141)	$111.4 (range based on market fluctuation: $95 to $134)	$99.8 (range based on market fluctuation: $85 to $120)
Safety and Security						
Poor delineation between undersized[d] pedestrian walks and transit causes near misses between pedestrians and transit vehicles	Delineation between pedestrians and transit	Options for delineation between pedestrian and transit areas: Retain existing 4-inch curb; Install higher curb between walks and transit; Barrier or bollards between walks and transit; Shift pedestrian walks adjacent to storefronts; Install trees, lights, and other furnishings between walks and transit; Provide visual and/or tactile difference in materials between walks and transit; Use technology to delineate walks and transit, such as colored lights.	Same options for delineation between pedestrian and transit areas as Granite Pavers option.	Different materials visually delineate pedestrian and transit areas. Same options for delineation between pedestrian and transit areas as Granite Pavers option.	Different materials visually delineate pedestrian and transit areas. Same options for delineation between pedestrian and transit areas as Granite Pavers option.	Different materials visually delineate pedestrian and transit areas. Same options for delineation between pedestrian and transit areas as Granite Pavers option.

Category	Criteria	Granite pavers with a mortar setting (full width of Mall)	Unit pavers with a sand setting (full width of Mall)	Precast concrete slabs w/pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option A[a], no pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option B[a], no pattern, color (transit); granite pavers (walks)
Slick pavement surface causes pedestrian slips and falls, and bus traction problems; this is compounded by snowy or icy conditions in winter	Pavement surface reduces "slip, trip and fall" risks	The existing granite pavers have a Thermal finish. Other finishes have a greater coefficient of friction than the existing surface. In addition, grooves and additional texture can be added in key areas to increase traction for buses.	Multiple finishes and textures are available from concrete, clay, or stone pavers, all of which have a greater coefficient of friction than the existing surface. In addition, grooves and additional texture can be added in key areas to increase traction for buses.	In the transit ways, multiple finishes and textures are available with precast concrete, that all have a greater coefficient of friction than the existing surface. In addition, grooves and additional texture can be added in key areas to increase traction for buses. Pavers in the pedestrian areas would use a finish with a greater coefficient of friction than the existing surface.	In the transit ways, concrete finish has a greater coefficient of friction than the existing surface. In addition, grooves and additional texture can be added in key areas while finishing the concrete surface to increase traction for buses. Pavers in the pedestrian areas would use a finish with a greater coefficient of friction than the existing surface.	In the transit ways, concrete finish has a greater coefficient of friction than the existing surface. In addition, grooves and additional texture can be added in key areas while finishing the concrete surface to increase traction for buses. Pavers in the pedestrian areas would use a finish with a greater coefficient of friction than the existing surface.
Transit mobility and operations						
Frequent maintenance disrupts transit operations, and would be more disruptive as ridership increases	Maintenance effects on bus operations efficiency and requirements	Frequency of pavement maintenance substantially reduced from current conditions. Portions of mortar in joints must be replaced as part of routine maintenance.	Frequency of pavement maintenance substantially reduced from current conditions. Small amounts of sand wash out of joints and require additional sand to be added as part of routine maintenance.	Frequency of pavement maintenance substantially reduced from current conditions. Routine maintenance includes repairing and sealing cracks and spalling. Periodic maintenance, for example, concrete panel replacement, required every 5 to 10 years would affect bus operations. Reconstruction of pavement system likely to occur once in 40-year lifespan, substantially disrupting bus operations during construction.	Frequency of pavement maintenance substantially reduced from current conditions. Routine maintenance includes repairing and sealing cracks and spalling. Reconstruction of pavement system likely to occur two times in 40-year lifespan, substantially disrupting bus operations during construction.	Frequency of pavement maintenance substantially reduced from current conditions. Routine maintenance includes repairing and sealing cracks and spalling. Periodic maintenance, for example, concrete removal and overlay, required every 5 to 10 years would affect bus operations. No future reconstruction needed.
During construction the efficiency of transit operations would be dramatically reduced	Minimum disruption during construction	Longer construction disruption on 16th Street than concrete; similar construction duration to unit pavers.	Longer construction disruption on 16th Street than concrete; similar construction duration to granite pavers.	Shortest construction disruption on 16th Street, as concrete panels are poured and formed offsite.	Shorter construction disruption on 16th Street than pavers; slightly longer disruption than precast concrete.	Shorter construction disruption on 16th Street than pavers; slightly longer disruption than precast concrete.

Category	Criteria	Granite pavers with a mortar setting (full width of Mall)	Unit pavers with a sand setting (full width of Mall)	Precast concrete slabs w/pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option A[a], no pattern, color (transit); granite pavers (walks)	Cast-in-place concrete option B[a], no pattern, color (transit); granite pavers (walks)
Community and Environment						
Construction impacts	Construction impacts	Longer construction disruption on 16th Street than concrete; similar construction duration to unit pavers.	Longer construction disruption on 16th Street than concrete; similar construction duration to granite pavers.	Shortest construction disruption on 16th Street, as concrete panels are poured and formed offsite.	Shorter construction disruption on 16th Street than pavers; slightly longer disruption than precast concrete.	Shorter construction disruption on 16th Street than pavers; slightly longer disruption than precast concrete.
Environmental impacts	Historic resources impacts	Most consistent with existing design and pattern. Granite pavers can be installed with similar size, color and pattern, with changes to the finish to reduce slips and falls.	Smaller unit pavers can be similar color and overall pattern as existing. Smaller paver sizes would impact pattern of jointing.	Can be produced to match the overall pattern. Slight color change and texture change may occur with granite pavers at pedestrian areas.	Replicating pattern may be cost prohibitive and technically difficult. This would require multiple separate concrete pours and consistency of coloring that may be difficult. Precision of jointing pattern would be difficult to achieve.	Replicating pattern may be cost prohibitive and technically difficult. This would require multiple separate concrete pours and consistency of coloring that may be difficult. Precision of jointing pattern would be difficult to achieve.
Public and agency support	Level of Agency Support	Granite pavers for the surface treatment are supported to a much higher degree by CCD than concrete.	RTD does not support unit pavers in the transit ways.	RTD supports concrete, especially for the transit guideway.	RTD supports concrete, especially for the transit guideway.	RTD supports concrete, especially for the transit guideway.

[a] Cast-in-place Concrete Option A comprises standard concrete construction, with routine maintenance and two replacements during the 40-year lifespan. Cast-in-place Concrete Option B comprises a thicker concrete slab, and would not need replacement during the 40-year lifespan with routine maintenance.

Table 6-4. Curb Options

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
Infrastructure	Utilities	Impacts to utilities would be the same under all curb options because the level of excavation during construction activities would be the same.		
Infrastructure	Drainage	Design features for drainage would be the same for all curb options. The drainage flowline and inlets would move to the new edge of transit way, and surface runoff would drain into new inlets contained within the 2-foot-wide linear vertical curb or pan strip. Under any of the curb options, some areas of the Mall could be designed with supplemental drainage to remain in its existing location, and surface runoff would drain into or in line with the proposed tree wells.		
Infrastructure	Maintenance	Existing transit way maintenance is most frequent along the drainage flow lines because water gathers along the flow lines and seeps into the sub-base more frequently in these locations, which correspond with the wheel loads of the Free MallRide shuttles. The new pavement system would address this problem in the same manner for all curb options by allowing water to drain into the storm sewer system after it penetrates the surface pavers. Maintenance activities in the transit way would require closure of one lane of transit during the maintenance period. No difference in other maintenance activities (examples: snow removal, drainage inlets, granite maintenance).		

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
Safety	Pedestrians, including ADA Community	Separation of pedestrian walkways from transit way by an amenity zone would increase safety and be consistent with guidance (FHWA, 2013 and 2017; NACTO, 2013 and 2016; RTD, 2016a). Vertical curbs are the traditional means of delineating pedestrian areas from vehicular areas for visually impaired users, although this curb would be undersized and blend in with the surrounding pattern, negating its use as a visual delineation. Additionally, tactile walking surface indicators and detectable edges, consisting of texture changes in the pavement, would delineate the pedestrian walkway from the amenity zone and the amenity zone from the transit way, to assist visually impaired users in wayfinding, consistent with guidance (FHWA, 2017). Vertical curbs create a tripping hazard for pedestrians, particularly during large public events when transit is moved off the Mall to create a pedestrian-only environment. New pavers with increased friction to prevent slips and falls. Fixed furnishings to provide physical barrier against errant vehicles.	Separation of pedestrian walkways from transit way by an amenity zone would increase safety and be consistent with guidance (FHWA, 2013 and 2017; NACTO, 2013 and 2016; RTD, 2016a). No vertical curb to alert visually impaired users to edge of transit way location. Tactile walking surface indicators and detectable edges, consisting of textures changes in the pavement, would delineate the pedestrian walkway from the amenity zone and the amenity zone from the transit way, to assist visually impaired users in wayfinding, consistent with guidance (FHWA, 2017). The pan option reduces tripping hazard for pedestrians. New pavers with increased friction to prevent slips and falls. Fixed furnishings to provide physical barrier against errant vehicles.	Separation of pedestrian walkways from transit way by an amenity zone would increase safety and be consistent with guidance (FHWA, 2013 and 2017; NACTO, 2013 and 2016; RTD, 2016a). Design comprises a vertical curb at designated shuttle stops and cross streets and a pan for the rest of each block (as described in vertical curb and pan columns).

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
Safety (continued)	Transit Shuttle Operation	Vertical curbs provide a small physical barrier to contain Free MallRide shuttles in the transit way if they slip on the pavement during inclement weather. New pavers with increased friction to prevent bus sliding during inclement weather.	The pan design option maintains linear elements of pattern at the edge of transit way. New pavers with increased friction to prevent bus sliding during inclement weather.	Vertical curbs at designated shuttle stops provide a small physical barrier to contain Free MallRide shuttles in the transit way if they slip on the pavement during inclement weather. New pavers with increased friction to prevent bus sliding during inclement weather.
Mobility	Pedestrians, including ADA Community	Wheelchair users can only cross the transit way at the ends of blocks and at alleys. Visually impaired users will have both the curb and tactile walking-surface indicators and detectable edges, consisting of texture changes in the pavement, to guide them.	Wheelchair users can cross the transit way anywhere, not just at the ends of blocks and at alleys. Visually impaired users will have tactile walking-surface indicators and detectable edges, consisting of texture changes in the pavement, to guide them.	Wheelchair users can cross the transit way almost anywhere, not just at the ends of blocks and at alleys. Visually impaired users will have tactile walking-surface indicators and detectable edges, consisting of texture changes in the pavement, to guide them.

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
Mobility (continued)	Transit Shuttle Operation	Vertical curb provides visual and physical guidance for bus drivers. Adjacent furnishings in the amenity zone create another vertical edge to provide visual guidance for bus drivers. Shuttles can use curbs to gain traction during slippery conditions. New pavers with increased friction prevent bus sliding during inclement weather.	The pan option maintains linear elements of pattern at the edge of the transit way to visually delineate the transit way. Adjacent furnishings in the amenity zone create a vertical edge to provide visual guidance for bus drivers. New pavers with increased friction to prevent bus sliding during inclement weather.	Vertical curb provides visual and physical guidance for bus drivers at designated shuttle stops. The pan maintains linear elements of pattern at the edge of the transit way to visually delineate the transit way. Adjacent furnishings in the amenity zone create a vertical edge to provide visual guidance for bus drivers. Shuttles can use curbs to gain traction during slippery conditions at designated shuttle stops where they stop and start. New pavers with increased friction prevent bus sliding during inclement weather.

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
Mobility (continued)	Boarding and Alighting Transit Shuttles	Shuttle boarding and alighting can occur anywhere on the curb on the Mall, but generally occurs at clearly delineated shuttle stops. Same height to step on and off the shuttle as existing conditions.	Shuttle boarding and alighting can occur anywhere on the Mall, but generally occurs at clearly delineated shuttle stops. No curb or platform to step on and off the shuttle. The steps will be 14 inches from the Mall's surface under normal driving height 11.25 inches when the bus is kneeling, compared to 10 inches under current conditions for normal driving height and 7.25 inches when kneeling. If the bus needs to kneel to the special needs of a passenger with a disability, a short delay would occur; the bus requires 3 seconds to kneel and another 3 seconds to come back up to driving height.	Shuttle boarding and alighting can occur anywhere on the Mall, but generally occurs at clearly delineated shuttle stops. Same height to step on and off the shuttle as existing conditions at designated shuttle stops.
Public Use	Flexibility of space for public use	Provides a less flexible space for current and future public use than the other curb options, with a vertical curb separating the spaces within the Mall and preventing the flexibility during special events that a flat surface with no curb would provide.	Provides a more flexible space for current and future public use than the vertical curb option, with a flat surface across the width of the Mall for pedestrian use during public events that temporarily close the Mall to transit service and other vehicles.	Provides a more flexible space for current and future public use than the vertical curb option, with a flat surface across the width of the Mall for pedestrian use during public events that temporarily close the Mall to transit service and other vehicles.

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
	Adaptability of space to future public use/needs	Use of transit way is restricted to transit use between the curbs.	More adaptable space for changed future conditions related to transit technology, entertainment, and public amenities. Corridors without vertical curbs can be viewed by the public as having a unique setting and as a more interesting public space, compared to corridors with a vertical curb, with the potential to attract more people to the space (DVRPC, 2018). Additional users on the Mall can translate to additional revenue from transit service to and from the Mall.	More adaptable space for changed future conditions related to transit technology, entertainment, and public amenities. Corridors without vertical curbs can be viewed by the public as having a unique setting and as a more interesting public space, compared to corridors with a vertical curb, with the potential to attract more people to the space (DVRPC, 2018). Additional users on the Mall can translate to additional revenue from transit service to and from the Mall.
Impact to the 16th Street Historic Property	Pavement pattern	The vertical curb would be located within a linear 2-foot strip of curb that would mimic the existing pavement pattern.	The pan would be located within a linear 2-foot strip of curb that would mimic the existing pavement pattern. This pan would be in the exact same location on the center-running bocks as the current pan between the transit ways and the median.	The vertical curb and pan would be located within a linear 2-foot strip of curb that would mimic the existing pavement pattern. This pan would be in the exact same location on the center-running bocks as the current pan between the transit ways and the median.

Category	Criteria	Vertical Curb	Flat Pan	Hybrid
	Granite Special Units (curbs, cuts, drains)	The vertical curb mimics the existing curbs that are on the outer edges of the existing transit ways. Stormwater collection would occur at the edge of the realigned transit way. Inlet covers would be designed to mimic materials, pattern and color, as applicable.	The pan mimics the existing pan on the inner edges of the existing transit ways by the median. Stormwater collection would occur at the edge of the realigned transit way. Inlet covers would be designed to mimic materials, pattern and color, as applicable.	The vertical curb and pan mimic the existing curbs and pan on the edges of the existing transit way. Stormwater collection would occur at the edge of the realigned transit way. Inlet covers would be designed to mimic materials, pattern and color, as applicable.
	New Edge Delineations	The following are new edge delineations common to all curb option concepts: • Truncated domes at designated crossings • Truncated domes at designated shuttle stops • Optional directional indicator • Amenity zone with fixed furnishings • Textured delineation between the transit way and amenity zone		

Table 6-5. LPA Design Options

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Economics and Cost				
Failing pavement system in constant need of repair	Capital cost (millions)	$114 (range based on market fluctuation: $97 to $137)	Not a discriminator: Comparable to the proposed LPA	Not a discriminator: Comparable to the proposed LPA
	Annual transit way and sidewalk maintenance cost	$309,000	Not a discriminator: Comparable to the proposed LPA	Not a discriminator: Comparable to the proposed LPA

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
	Future transit way replacement cost	$0	Not a discriminator: Comparable to the proposed LPA	Not a discriminator: Comparable to the proposed LPA
	40-year investment	$126.4 (range based on market fluctuation: $107 to $152)	Not a discriminator: Comparable to the proposed LPA	Not a discriminator: Comparable to the proposed LPA
Outdated infrastructure does not meet current ADA requirements and leads to poor tree health; lack of water quality treatment and modern fiber optic and communications utilities doesn't meet modern-day needs	Ability to address ADA deficiencies[a]	Not a discriminator: Can address ADA deficiencies	Not a discriminator: Can address ADA deficiencies	Not a discriminator: Can address ADA deficiencies
	Tree infrastructure is updated to modern standards.	Not a discriminator: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.	Not a discriminator: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.	Not a discriminator: Installs modern tree infrastructure and new trees; conflicting utilities would be relocated.
	Water quality treatment is added to stormwater drainage system.	Not a discriminator: Installs stormwater quality treatment facilities, meeting City standards.	Not a discriminator: Installs stormwater quality treatment facilities, meeting City standards.	Not a discriminator: Installs stormwater quality treatment facilities, meeting City standards.
	Add fiber optic utility infrastructure and update/increase electric utility capabilities.	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.
Safety and Security				
Poor delineation between undersized[b] pedestrian walks and transit causes near misses between	Pedestrian overflow into transit ways	Not a discriminator: Center-running blocks: 10-foot-minimum pedestrian walks accommodate	Not a discriminator: Center-running blocks: 10-foot-minimum pedestrian walks accommodate	Not a discriminator: Center-running blocks: 10-foot-minimum pedestrian walks accommodate

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
pedestrians and transit vehicles		pedestrians without overflow into transit ways. New Asymmetrical blocks: 10-foot walkways on asymmetrical blocks accommodate pedestrians without overflow into transit ways.	pedestrians without overflow into transit ways. New Asymmetrical blocks: 10-foot walkways on asymmetrical blocks accommodate pedestrians without overflow into transit ways.	pedestrians without overflow into transit ways. New Asymmetrical blocks: 10-foot walkways on asymmetrical blocks accommodate pedestrians without overflow into transit ways.
	Delineation between pedestrians and transit	Center-running blocks: Pedestrian walks separated by amenity zones as recommended by guidance[c]. New Asymmetrical blocks: Pedestrian walks separated by amenity zones as recommended by guidance[c].	Center Running Blocks: Pedestrian walks separated and delineated by amenity zones as recommended by guidance[c]. Proposed Asymmetrical: Pedestrian walks on wide side of block are separated by amenity zones as recommended by guidance[c]. Pedestrian walks on narrow side of block physically separated from the transit way by a 3-foot buffer. The buffer is not wide enough to act as an amenity zone for multiuse fixed furnishings, lights, or a row of trees, which could provide delineation between the	Center-running blocks: Pedestrian walks separated by amenity zones as recommended by guidance[c]. New Asymmetrical blocks: Pedestrian walks separated by amenity zones as recommended by guidance[c].

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
			pedestrian walkway and transit way. A row of vertical bollards would provide safe separation and delineation of the pedestrian walkway from transit way.	
Slick pavement surface causes pedestrian slips and falls, bus traction problems, compounded by snowy or icy conditions in winter	Pavement surface reduces “slip, trip and fall” risks	Not a discriminator: Comprised of granite pavers with a higher friction finish.	Not a discriminator: Comprised of granite pavers with a higher friction finish.	Not a discriminator: Comprised of granite pavers with a higher friction finish.
Safety and security systems should be upgraded to current standards.	Ability to accommodate future technology for security best practices	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.	Not a discriminator: Installs new fiber optic and upgraded electric utilities conduit.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Transit mobility and operations				
Frequent maintenance disrupts transit operations, and would be more disruptive as ridership increases	Maintenance effects on bus operations efficiency and requirements	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions.	Not a discriminator: Frequency of pavement maintenance impacts on bus operations substantially reduced from current conditions.
The demand for transit services is projected to increase to 70,000 riders/day in 2035	Provision of connectivity between DUS and CCS, and crossing bus and light rail routes in between	Not a discriminator: Maintains existing connections. Service expansion options comprise operating buses in tandem or procuring larger buses.	Not a discriminator: Maintains existing connections. Service expansion options comprise operating buses in tandem or procuring larger buses.	Not a discriminator: Maintains existing connections. Service expansion options comprise operating buses in tandem or procuring larger buses.
	Accommodation of tandem and/or larger buses at bus stops	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (bollards, trees, lights) prevent bus boarding.	Not a discriminator: Accommodates tandem and/or larger buses; no permanent elements (trees, lights) prevent bus boarding.
Transit operations would become increasingly difficult as the volume of passengers and pedestrian use increases on the Mall	Effect on transit operations	Bus drivers need to protect only the curb side of the bus.	Bus drivers need to protect only the curb side of the bus. The 3-foot amenity zone on narrow side of asymmetrical blocks allows less space for	Bus drivers need to protect only the curb side of the bus.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
			transit users waiting at designated shuttle stops; may force transit users into the pedestrian walkway.	
During construction the efficiency of transit operations would be dramatically reduced	Minimum disruption during construction	Not a discriminator: Major impact during the construction period.	Not a discriminator: Major impact during the construction period.	Not a discriminator: Major impact during the construction period.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Pedestrian mobility				
Sidewalks are undersized for pedestrian volumes[d] and CCD standards (10-foot sidewalks downtown)[e].	Pedestrian volumes and accessibility guidelines are accommodated	Center-running blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities. New Asymmetrical blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for shuttle stops and amenity zone.	Center-running blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities. Proposed New Asymmetrical blocks: Pedestrian volumes and CCD standards are accommodated except at bus stops - 2,400 pedestrians/hour on 10-foot sidewalks. The narrow 3-foot buffer between the pedestrian walkway and transit way does not provide adequate space at bus stops, resulting in more bus passengers standing in the pedestrian walkway at bus stops, reducing sidewalk capacity and	Center-running blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for pedestrians, shuttle stops, and/or amenities. Proposed New Asymmetrical blocks: Pedestrian volumes and CCD standards are accommodated - 2,400 pedestrians/hour on 10-foot sidewalks next to patio/gathering space, with additional space for shuttle stops and amenity zone.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
			hindering pedestrian mobility. The introduction of vertical bollards reduces pedestrian permeability across the Mall.	

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Public Use Functionality				
Limited usability of divided public space on median blocks and narrow sides of asymmetrical blocks to accommodate patio/gathering space[f] and pedestrian needs.	Width for patio and gathering space	Center-running Blocks: Walkways on both sides of blocks are wide enough for 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenity zone. New Asymmetrical Blocks: Walkways on both sides of asymmetrical blocks are wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenity zone.	Center-running Blocks: Walkways on both sides of blocks are wide enough for 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenity zone. Proposed New Asymmetrical Blocks: Walkways on both sides of asymmetrical blocks are wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk, with limited space for an undersized amenity zone.	Center-running Blocks: Walkways on both sides of blocks are wide enough for 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenity zone. Proposed New Asymmetrical Blocks: Walkways on the wide side of asymmetrical blocks are wide enough to accommodate 9-foot patio/gathering space and 10-foot pedestrian walk, with additional space for amenity zone. Walkways on the narrow side asymmetrical blocks not wide enough to accommodate a 10-foot pedestrian walk, a 5-foot amenity zone, and a 9-foot patio/gathering area. Patio/gathering area would be 7 feet. Reducing the patio space by 2 feet

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
				reduces the seating capacity by one-third, resulting in less public activation; patio space has been demonstrated to be the most activating space for public use. Maintains an inequity in the public use of the asymmetrical blocks, with the narrow side continuing to have less capacity for public use and be less desirable.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Negative perception of safety and lack of natural surveillance inhibits positive public use of Mall.	Adherence to best practices for natural surveillance, activation, and positive public use of pedestrian and gathering areas.	Center-running Blocks: Replaces public space in medians with consolidated public space adjacent to buildings, increasing natural surveillance and adhering to safety and security best practices. New Asymmetrical Blocks: Increases opportunities for positive public use and activities on the Mall, increasing natural surveillance and adhering to safety and security best practices.	Center-running Blocks: Replaces public space in medians with consolidated public space adjacent to buildings, increasing natural surveillance and adhering to safety and security best practices. New Asymmetrical Blocks: Does not increase opportunities for positive public use and activities on the Mall. Natural surveillance on the Mall would be approximately the same as under existing conditions.	Center-running Blocks: Replaces public space in medians with consolidated public space adjacent to buildings, increasing natural surveillance and adhering to safety and security best practices. New Asymmetrical Blocks: Reducing patio space reduces the primary generator of public activity on the Mall by one-third, resulting in a small reduction of natural surveillance activity.
Community and Environment				
Construction impacts	Construction impacts	Not a discriminator: Major impact during the construction period.	Not a discriminator: Major impact during the construction period.	Not a discriminator: Major impact during the construction period.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Environmental impacts	Historic resources impacts	Center-running Blocks: Replaces median blocks. Ability to accommodate existing pavement pattern, with minor adjustments. Maintains blocks as symmetrical. New Asymmetrical Blocks: Modify historic design; can accommodate existing pavement pattern and spatial relationships, with some adjustments. Maintains blocks as asymmetrical Relationship of the end “rooms” to the overall design: Maintains three rooms with the same transition locations and linear dimensions of the existing rooms; maintains the setting of the rooms with the historic core in center running/median blocks; maintains the viewshed of the capital and clock tower with the room	Center-running Blocks: Replaces median blocks. Ability to accommodate existing pavement pattern, with minor adjustments. Maintains blocks as symmetrical. New Asymmetrical Blocks: Rebuild wide side of block from edge of right of way to edge of transit way with pattern, trees, and lights in existing locations; modify historic design for remainder of cross section; modifications can accommodate existing pavement pattern and spatial relationships, with some adjustments on the narrow side. Relationship of the end “rooms” to the overall design: Maintains three rooms but changes the transition location and number of blocks (linear proportion) of the rooms; changes the sizes of the rooms and the locations of	Center-running Blocks: Replaces median blocks. Ability to accommodate existing pavement pattern, with minor adjustments. Maintains blocks as symmetrical. New Asymmetrical Blocks: Rebuild wide side of block from edge of right of way to edge of transit way with pattern, trees, and lights in existing locations; modify historic design for remainder of cross section; modifications can accommodate existing pavement pattern and spatial relationships, with some adjustments on the narrow side. Relationship of the end “rooms” to the overall design: Maintains three rooms but changes the transition location and number of blocks (linear proportion) of the rooms; changes the sizes of the rooms and the locations of

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
		transitions in the same locations.	the transitions between the center and end rooms, resulting in change in setting and continuity of the relationship between the median (reconstructed as center running) and asymmetrical blocks; also makes substantial change to the physical aspects of the linear design.	the transitions between the center and end rooms, resulting in change in setting and continuity of the relationship between the median (reconstructed as center running) and asymmetrical blocks; also makes substantial change to the physical aspects of the linear design.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Environmental impacts (continued)	Socioeconomic impacts	Potential benefits to social, economic, and land use resources because of higher public use and perception of safety. Center-running blocks provide equitable distribution of pedestrian space and public amenities, including tree canopy and gathering space, providing benefits for economic vitality of businesses on both sides of the Mall. Asymmetrical blocks provide trees, additional public amenity space, and a 9-foot patio/gathering space on the narrow side of the block, making business locations on the narrow side of the block more desirable than the design options.	Center-running blocks provide equitable distribution of pedestrian space and public amenities, including tree canopy and gathering space, providing benefits for economic vitality of businesses on both sides of the Mall. Does not provide space for trees or lighting to improve the public use conditions on the narrow side of asymmetrical blocks, perpetuating inequitable distribution of public space and resulting in a less desirable business location than the wide side of the blocks and disproportionate impacts to those property owners and businesses. Would require bollards or other vertical separation between transitway and pedestrian walkway, which introduces undesirable visual elements and physical barriers to pedestrian	Center-running blocks provide equitable distribution of pedestrian space and public amenities, including tree canopy and gathering space, providing benefits for economic vitality of businesses on both sides of the Mall. Lesser public use on the narrow side of the asymmetrical blocks impacts businesses and property owners: reduced patio zones remove 30 percent of outdoor table seating and reduce public activation on these blocks, resulting in a less desirable business location than the wide side of the blocks and disproportionate impacts to those property owners and businesses. For visual resources, views to the tower and capital are changed, and the row of trees along the length of the Mall cannot be maintained.

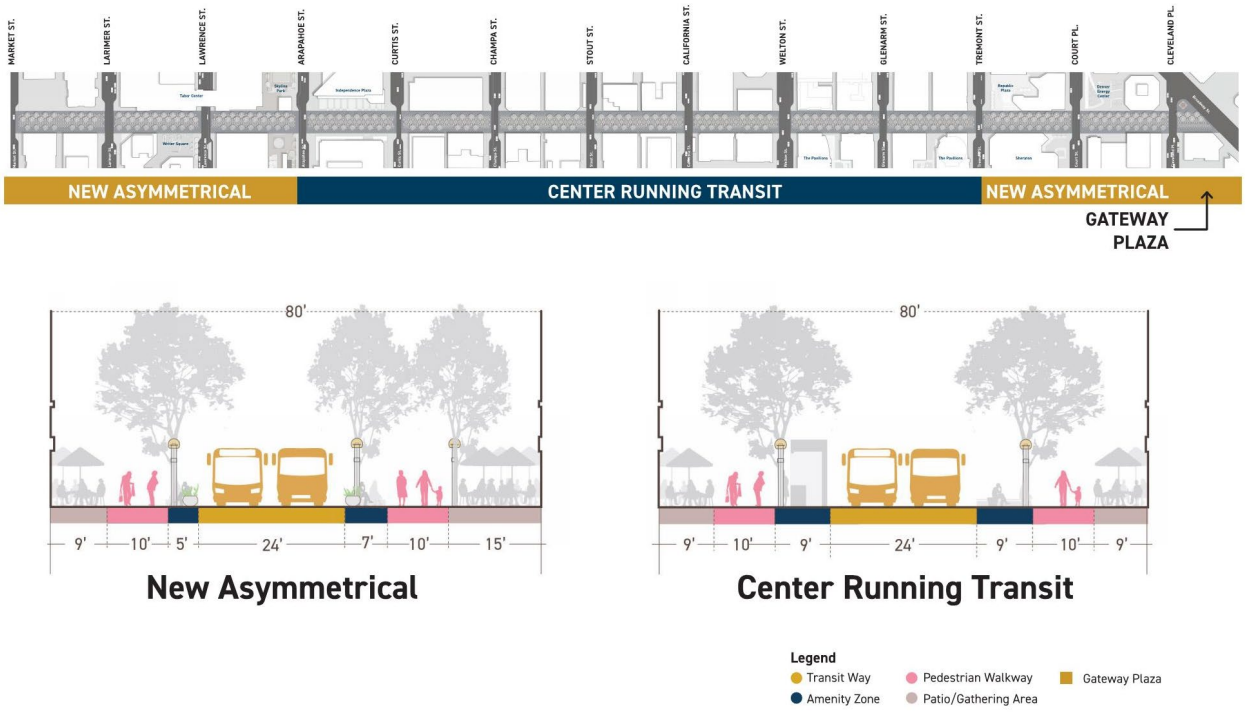
Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
			permeability and flow across the Mall. For visual resources, views to the tower and capital are changed, and the row of trees along the length of the Mall cannot be maintained.	
	Natural resources impacts	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.	Not a discriminator: Replaces 400,000 square feet of hardscape, installs water quality treatment (benefit to water quality). No changes to other resources.

Category	Criteria	LPA: Center Running and New Asymmetrical Alternative	LPA Design Option 1: Reduced narrow side amenity zone	LPA Design Option 2: Reduced narrow side patio space
Ability to meet the Project Purpose and Need	Satisfies the Project Purpose and Need	Ranks first in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility through wider sidewalks and separation of pedestrian walkway from transit way. Supports future transit mobility. Meets requirements for adequate patio/gathering, sidewalk, and amenity space. Adheres to best practices for natural surveillance and public activation.	Ranks third in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility through wider sidewalks and separation of pedestrian walkway from transit way; separation of pedestrian walkway from transit way on narrow side of asymmetrical blocks is narrow and requires vertical bollards for safe delineation. Supports future transit mobility. Does not meet requirements for adequate patio/gathering, sidewalk, and amenity space. Adheres to best practices for natural surveillance and public activation.	Ranks second in fulfillment of the Purpose and Need. Replaces failing infrastructure. Improves pedestrian safety and mobility through wider sidewalks and separation of pedestrian walkway from transit way. Supports future transit mobility. Does not meet requirements for adequate patio/gathering, sidewalk, and amenity space. Adheres to best practices for natural surveillance and public activation.
Disposition		Carry forward	Do not carry forward	Carry forward

7. Locally Preferred Alternative

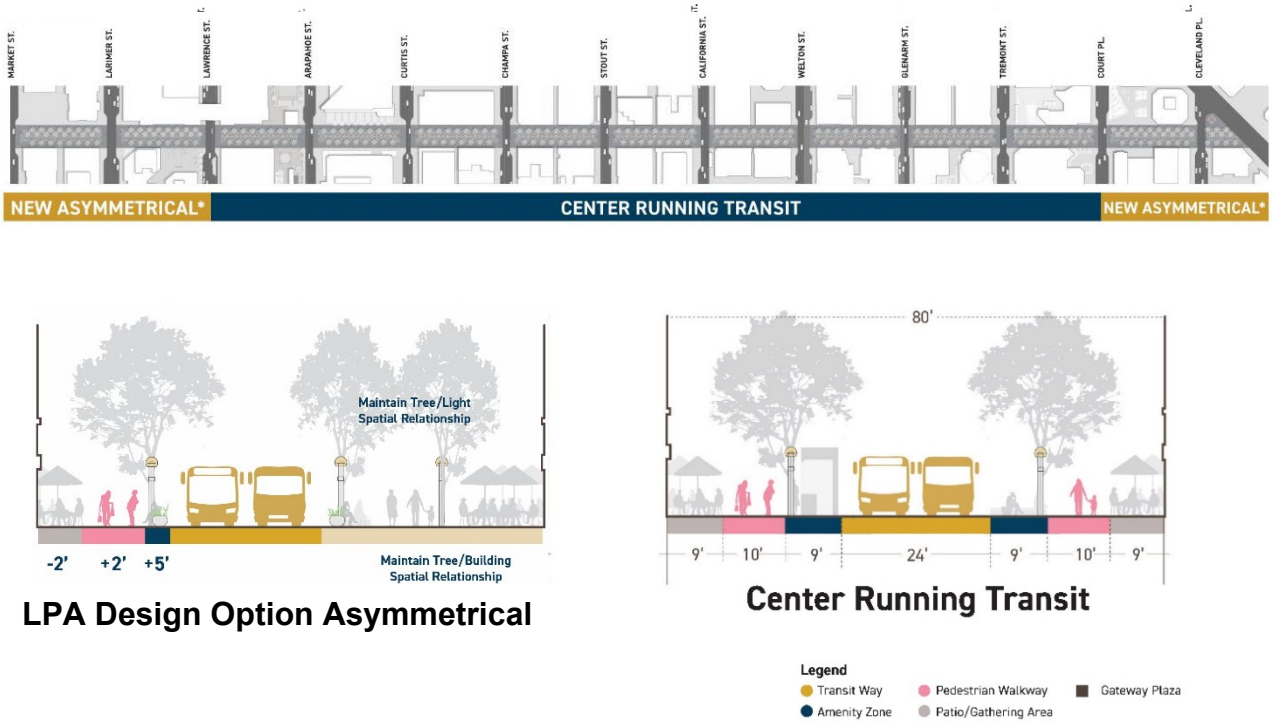
This section describes the LPA, including capital improvements, transit operations, traffic operations, and construction activities. **Figure 7-1** illustrates the proposed alignments and delineates sidewalks and the transit way within the proposed alignments. Figure 7-2 illustrates a LPA Design Option, which extends the center running transit design for two extra blocks and rebuilds the wide side of the remaining asymmetrical blocks in place.

Figure 7-1. Locally Preferred Alternative



*Note: Under the LPA Design Option the Gateway Plaza configuration (**Figure 5-2**) would be implemented between Cleveland Place and Broadway.*

Figure 7-2. Locally Preferred Alternative Design Option



*Note: Under the LPA the Gateway Plaza configuration (**Figure 5-2**) would be implemented between Cleveland Place and Broadway.*

A. Capital Improvements

This section describes the capital improvements that will comprise the LPA and the LPA Design Option. The LPA and LPA Design Option differ only in alignments, transitions, and pattern on the asymmetrical blocks. Accordingly, the LPA Design Option is discussed only in **Sections 7.A.1** and **7.A.2**.

1. Alignments and Transitions

The primary differences between the LPA and the LPA Design Option are the alignments and transitions of the asymmetrical and center running blocks.

a) LPA

The western Project limits would be the eastern edge of the 16th Street and Market Street intersection. From Market Street to Arapahoe Street the alignment would be the new asymmetrical cross-section design (**Figure 7-1**). The new asymmetrical cross-section design removes the existing 6-foot median with light fixtures from between the transit way lanes, pushes the existing two transit way lanes together into a single transit way comprising two adjacent 12-foot transit ways, and increases the size of the pedestrian area on the narrow side of the cross-section from 17 to 24 feet. and reduces the pedestrian area on the wide side of the cross section from 33 feet to 32 feet.

The LPA would shift the location of the pavement pattern, trees, and lights 2 feet north on the wide side of the block, reducing the space between the buildings and first row of trees and lights by 2 feet. The LPA would add 1 foot of usable space to the amenity zone to reduce the amount of bus mirror overhang at the edge of the transit way. This 1-foot addition to the amenity zone would result from adding 1 foot to the inside edge of the transit way, providing the bus more space to travel and reducing the mirror overhang into the amenity zone.

Each pedestrian area would consist of a patio/gathering area, amenity zone with trees, and a minimum 10-foot clear, unobstructed pedestrian walkway free of encroachments from elements such as furnishings, kiosks, and shuttle stops. The patio/gathering area would be 9 feet wide on the narrow side of the block and 15 feet wide on the wide side of the block.

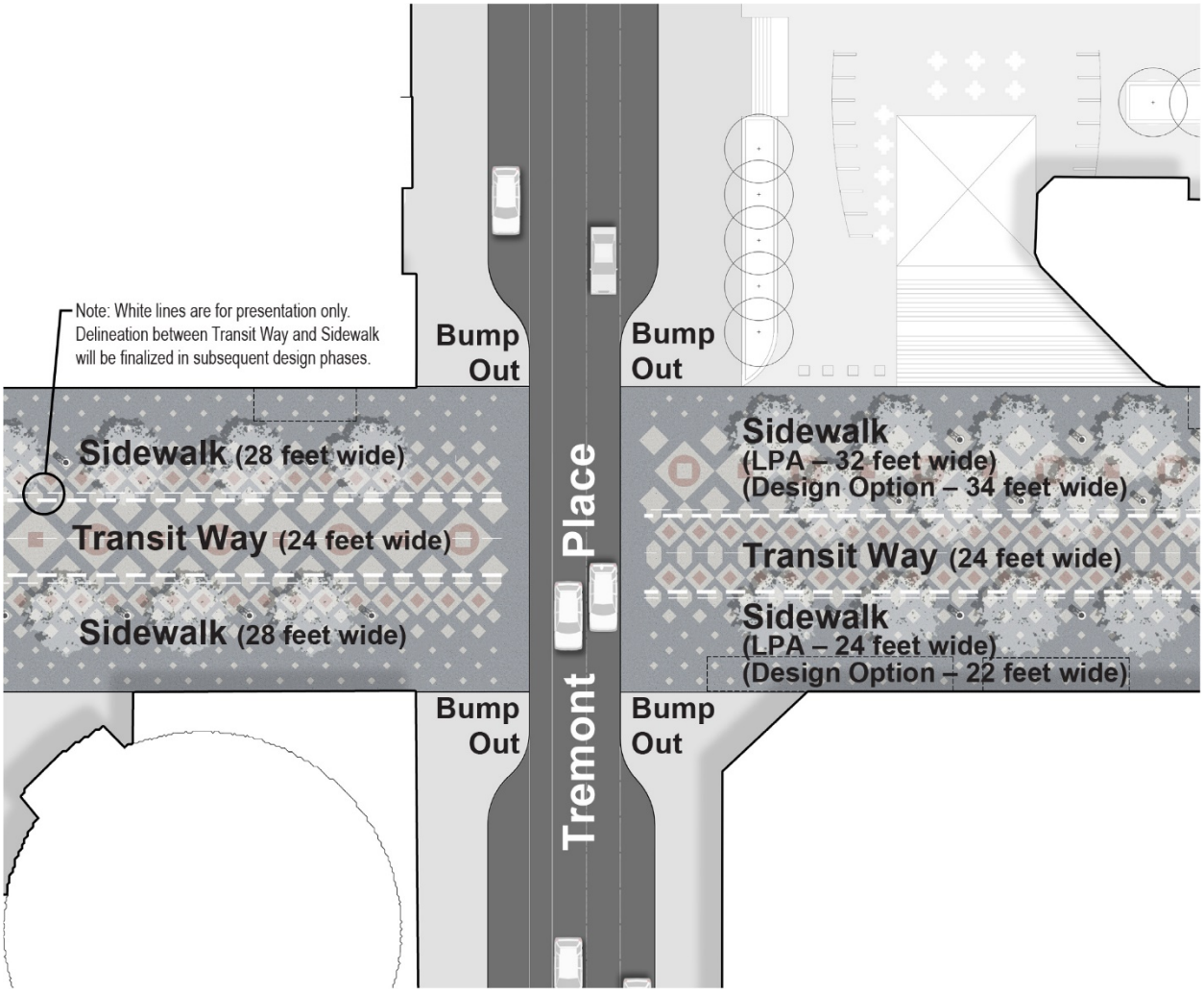
From Arapahoe Street to Tremont Place the alignment would be the center-running cross-section design (**Figure 7-1**). The center-running cross-section design places the two existing transit way lanes together into a single transit way comprising two adjacent 12-foot-wide transit ways, without a median separating them. The cross-section design has equal widths of pedestrian area, 28 feet, on each side of the block, which also allows for additional flexibility in programing the space in a manner that would allow more pedestrians to use it. Each pedestrian area would consist of 9-foot patio/gathering space, a 9-foot tree/amenity zone, and a 10-foot-wide clear, unobstructed pedestrian walkway free of encroachments from elements such as furnishings, kiosks, and shuttle stops.

From Tremont Place to Cleveland Place, the alignment would, again, be the new asymmetrical cross-section design, with a transition to the existing conditions of the half-block gateway plaza between Cleveland Place and Broadway (**Figure 7-1**).

The new transit way alignment would change the locations of the existing vertical curbs between the existing pedestrian walkways and transit ways. Along the edges of the transit way, the LPA would be constructed with vertical curbs, similar to those on the outside edges of the existing transit way lanes, at designated shuttle stops, cross streets, and intersections; the vertical curbs would then transition to a pan, similar to the pan on the inside edges of the existing transit way lanes but with a shallow longitudinal channel within the pan to direct water as part of the drainage system. Constructing the LPA with vertical curbs at shuttle stops and a pan along the remainder of the transit way meets requirements for both transit operations and public use programming flexibility.

The LPA would maintain the progression of a beginning, middle, and end of the Mall through the design of asymmetrical blocks at the beginning and end of the Mall and symmetrical blocks in the middle of the Mall. Transitions between cross-section designs would occur at four locations on the Mall: (1) the western Project limits at Market Street, (2) at Arapahoe Street where the cross-section design changes from new asymmetrical to center running, (3) at Tremont Place where the cross-section design changes back from center running to new asymmetrical, and (4) at Cleveland Place, where the cross-section design transitions to the Gateway Plaza. At the Arapahoe and Tremont Place transitions, the east and westbound transit way lanes would shift 4 feet, while under existing conditions the eastbound transit way lane doesn’t shift and the westbound transit way lane shifts 16 feet. At the Project limit transitions, the LPA will tie into the existing transit ways. **Figure 7-3** illustrates the transition from the center-running cross-section design to the new asymmetrical cross-section design at Tremont Place.

Figure 7-3. Transition at Tremont Place



b) LPA Design Option

From Market Street to Lawrence Street (versus Arapahoe Street in the LPA) the alignment would be a modified asymmetrical cross-section design (**Figure 7-2**) (versus the LPA New Asymmetrical cross-section design [**Figure 7-1**]). The modified asymmetrical cross-section design removes the existing 6-foot median with light fixtures from between the transit way lanes, pushes the two transit way lanes together into a single transit way comprising two adjacent 12-foot transit way lanes, and increases the size of the pedestrian area on the narrow side of the cross-section from 17 to 22 feet (versus 24 feet in the LPA).

The LPA Design Option would maintain the location of the pavement pattern, trees, and lights on the wide side of the block (versus shifting them 2 feet north in the LPA) and would add 1 foot of usable space to the amenity zone to reduce the amount of bus mirror overhang at the edge of the transit way. This 1-foot addition would not change the pavement pattern on the wide side of the block because 1 foot would be added to the inside edge of the transit way,

providing the bus more space to travel and reducing the mirror overhang into the amenity zone.

Each pedestrian area would consist of a patio/gathering area, amenity zone with trees, and a 10-foot clear, unobstructed pedestrian walkway free of encroachments from elements such as furnishings, kiosks, and shuttle stops. The patio/gathering area would be 7 feet wide on the narrow side of the block (versus 9 feet in the LPA) and 15 feet wide on the wide side of the block.

From Lawrence Street to Court Place (versus Arapahoe Street to Tremont Place in the LPA) the alignment would be the center-running cross-section design (**Figure 7-2**). The design option would extend the center-running cross section into two blocks that are currently asymmetrical blocks: the block between Lawrence Street and Arapahoe Street and the block between Tremont Place and Court Place. The center-running cross-section design would be the same as described for the LPA in **Section 7.A.1(a)**.

From Court Place (versus Tremont Place in the LPA) to Cleveland Place, the alignment would, again, be the modified asymmetrical cross-section design (versus the LPA New Asymmetrical cross-section design), with a transition to the existing conditions of the half-block gateway plaza between Cleveland Place and Broadway (**Figure 7-2**).

The design option curbs would be constructed in the same manner as described for the LPA in **Section 7.A.1(a)**, with vertical curbs at designated shuttle stops, cross streets, and intersections and a pan along the remainder of the transit way.

The design option would maintain the progression of beginning, middle, and end “rooms” of the Mall through the design of asymmetrical blocks at the beginning and end of the Mall and symmetrical blocks in the middle of the Mall. However, the design option would change the size and locations of these rooms in comparison to existing conditions and the LPA, reducing the size of the asymmetrical beginning and end rooms by one block each, and increasing the size of the middle room by two blocks. Transitions between cross-section designs would occur at four locations on the Mall: (1) the western Project limits at Market Street, (2) at Lawrence Street (versus Arapahoe Street in the LPA) where the cross-section design changes from asymmetrical to center running, (3) at Court Place (versus Tremont Place in the LPA) where the cross-section design changes back from center running to asymmetrical, and (4) at Cleveland Place, where the cross-section design transitions to the Gateway Plaza. At the Lawrence Street and Court Place transitions, the east and westbound transit way lanes would shift 6 feet (versus 4 feet in the LPA), while under existing conditions the eastbound transit way lane doesn’t shift and the westbound transit way lane shifts 16 feet. At the Project limit transitions, the LPA Design Option will tie into the existing transit ways. **Figure 7-3** illustrates the transition from the center-running cross-section design to the new asymmetrical cross-section design at Tremont Place.

2. Pavement Materials and Pattern

The LPA would be implemented with granite pavers arranged to mimic the Mall's existing color and pattern in the transit way and pedestrian areas. The pavement pattern would honor and complement the existing character of the I.M. Pei- and Hanna/Olin-designed mall by retaining the 45-degree-diagonal grid to resemble the historic Navajo rug-themed pattern and retain the small, medium, and large diamond patterns in the same (or approximately the same) spatial relationship as the original design in the symmetrical blocks. The LPA would also retain the pattern in approximately the same spatial relationship in the asymmetrical blocks, but the overall pattern would be shifted 2 feet to the north (similar to moving a patterned carpet) on the wide side of the block to allow for the wider pedestrian area on the narrow side of the block. The LPA Design Option would not shift the pattern on the wide side of the asymmetrical blocks, and the resulting pedestrian area on the narrow side of the block would be 2 feet narrower than under the LPA. Localized minor adjustments may be required during subsequent design phases to accommodate unforeseen design challenges, infrastructure needs, compliance with federal requirements such as ADA and homeland security standards, safety improvements, and CCD and RTD criteria.

The granite pavers would have improved surface friction and would be arranged and secured on new sub-base. The existing concrete sub-base slabs would be removed and replaced, complete with a new system to drain moisture that penetrates the surface. The surface and sub-base drainage system would discharge water to inlets connected to the local storm sewer; water quality treatment features would be installed to remove pollutants and sediment from the water.

3. Trees and Tree Infrastructure

The LPA would remove the existing trees and replace them with a variety of tree species that fit within the context of the design and thrive in Colorado's climate. Tree placement would honor the existing character of the Mall by retaining geometric and spatial relationships and the colors and aesthetic qualities of the existing tree species. The original monoculture design of red oak trees on the asymmetrical blocks and honey locusts on the symmetrical blocks would be replicated as closely as possible while maintaining current CCD tree diversity standards, which require multiple tree species to be planted in a single block. Tree diversity standards prevent single-species diseases from destroying entire blocks of trees, such as the disease that killed the majority of red oak trees on the Mall. Tree species have been selected using both current CCD forestry requirements and similar criteria to those used to select tree species during design of the original Mall. The LPA would also remove the existing tree boxes with 300-cubic-foot soil capacity and replace them with new suspended tree infrastructure that provides 1,000 cubic feet of soil volume, such as a silva cell or equivalent system. Landscape irrigation would be removed and replaced.

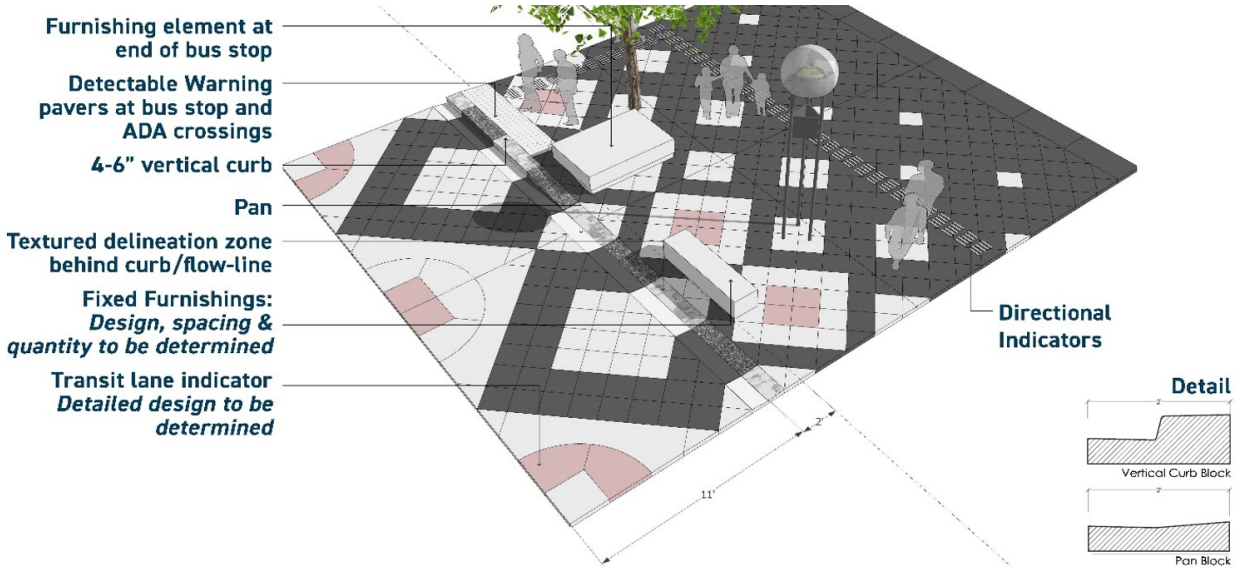
4. Edge Delineation

The LPA would move the edges of the transit lanes, which are currently defined by vertical curbs on their outside edges and pans on their inside edges (**Figure 6-1**), to new locations closer to the center of the block. The edges of the new transit way would be defined by vertical curbs

at designated shuttle stops, cross streets and intersections, and a pan along the remainder of the transit way. The vertical curb and pan units would be constructed of rectangular granite units in the same dimensions and colors as the existing units, designed to blend into the surrounding pavement pattern. On the center-running blocks, the vertical curb and pan units would be in the exact same location as the existing pan between the transit ways and the median.

Design features for safety and ADA compliance include texture on the back of the vertical curb and pan granite units, an amenity zone with fixed furnishings to separate the transit way from the pedestrian walkway, directional indicators within 10-foot pedestrian walkways, truncated domes at designated crossings, and consideration of truncated domes at shuttle stops (**Figure 7-4**). The vertical curb and pan granite units would mimic the existing pattern and colors. Although pedestrians can cross the transit way at any point along the Mall, the designated crossings will be clearly marked and occur at cross streets and at the ends of each block. The separation of pedestrian walkways from the transit way by an amenity zone with fixed furnishings would increase safety and be consistent with guidance (FHWA, 2013 and 2017; NACTO, 2013 and 2016; RTD, 2016a). The textured changes in the pavement, to delineate the pedestrian walkway and the amenity zone from the transit way would assist visually impaired users in wayfinding. Transit lane indicators will guide shuttle operators in immediately adjacent transit lanes without a median separating them. The transit way indicator technique will be decided in subsequent design phases.

Figure 7-4. Transit Way Edge Delineation



Drainage inlets on the Mall currently consist of linear metal grates contained within the 2-foot-wide linear curb strip. Under the LPA, the drainage flowline and inlets would move to the new edge of the transit way and surface runoff would drain into new inlets contained within the 2-foot-wide linear vertical curb or pan strip. Additionally, some areas of the Mall could be designed with supplemental drainage to remain in its existing location, and surface runoff would drain into or in line with the proposed tree wells. The new drainage inlets would not introduce a new linear element into the historic pavement pattern, and inlets would be designed to be context sensitive or resemble the existing inlets.

5. Utilities and Technologies of the Future

The LPA would upsize electrical conduits and wiring to allow for expanded capacity and remove and replace landscape irrigation and drainage infrastructure. The LPA would also provide the opportunity to install fiber optic and/or telecommunications utilities to meet current and future demands. Wifi, Lidar, Infrared, and other communication systems may be installed aboveground to allow for future technologies.

Existing underground utilities (storm sewer, sanitary sewer, water mains, natural gas, and steam) would be evaluated in subsequent design phases and in coordination with utility companies. At that phase, it may be determined that these utilities should be replaced, upgraded, or preserved in place.

6. Safety and Security

The LPA would include a vertical curb at designated shuttle stops and cross streets; a pan at the edge of the transit way in other locations; an amenity zone between the transit way and pedestrian walkway with trees, lights, and furnishings such as benches and chairs, and delineating elements of texture on the back of the vertical curb and pan granite units; directional indicators at the edges of the 10-foot pedestrian walkways; and truncated domes at designated crossings and shuttle stops, consistent with RTD standards (2016a) and national guidance (NACTO, 2013; NACTO, 2016; FHWA, 2017).

The new granite pavers would be less slippery than the existing pavers. The amount of friction on the surface of the transit way and pedestrian areas would be determined by RTD and CCD in a subsequent design phase, to reduce incidents related to slipping and sliding of both pedestrians and vehicles.

CPTED principles promote the design, maintenance, and use of the built environment to enhance quality of life and to reduce both the incidence and fear of crime. The design of the LPA incorporates the following CPTED principles:

- Natural surveillance – The LPA includes clear sight lines such that all spaces in the Mall are visible to others; a person is less likely to commit a crime if they think it will be witnessed
- Territoriality – Placement of pedestrian walkways and gathering spaces adjacent to buildings instead of separated in a center median allows for active “ownership” of all pedestrian areas of the Mall by adjacent properties; potential trespassers perceive this ownership and are discouraged from illicit activities
- Access control – Use of walkways, lighting, and landscape to clearly guide where people walk and spend time on the Mall; the goal with this CPTED principle is to direct the flow of people while decreasing the opportunity for crime
- Management and maintenance – The current maintenance and security programs on the Mall (for example, Downtown Security Action Plan) would continue; well-managed and maintained properties make places safer
- Activity support – The LPA provides appealing gathering spaces that draw people to spend time on the Mall and continues active programming that brings people to the Mall, such as concerts and markets; the presence of pedestrian users engaged in activities on the Mall discourages illicit activities by people who desire anonymity for their actions

The LPA would also comply with federal homeland security requirements and RTD's Safety Design Criteria.

7. Lighting, Signage, and Furnishings

The existing lighting on the Mall was replicated and replaced in 2016. The LPA would reuse the existing lighting as well as provide additional lighting, as needed. New pole-based lighting fixtures would replicate the existing light fixtures. Other types of light fixtures could be incorporated into the design using CPTED principles.

The LPA would incorporate signage and furnishings; their design and locations would be determined during subsequent design phases and would comply with applicable codes, and accommodate people with disabilities, as applicable.

8. Changes to Cross Streets

Bulb-outs would be implemented on cross streets to slow traffic and reduce the crossing distance for pedestrians on those streets, except for instances where space is reserved for existing bicycle or light rail infrastructure. Bicycle and light rail transit (LRT) infrastructure would be maintained through the Project limits. The elimination of the median would consolidate pedestrian crossings to two locations at each cross-street intersection. Changes to pedestrian crossing controls such as crosswalks and crossing signals would be decided during subsequent design phases. New crossing signals will be constructed. Additional intersection improvements to slow traffic and increase pedestrian safety (for example, pavement patterns, pavement color, pavement texture, or raised pavement) would be considered during subsequent design phases.

9. Funding

CCD would use Downtown Urban Renewal Authority (DURA) Tax Incremental Financing (TIF) funds, as well as funds from the recently passed Denver 2017 General Obligation (GO) Bonds. The DURA TIF Board of Commissioners approves the use of DURA TIF funds, and those funds must be used on downtown renewal projects. The DURA TIF funds intended for this project must be spent by 2022. The use of Denver 2017 GO Bonds was recommended in the *2017 GO Bond – Mayor Recommended Package of Investments* (CCD, 2017b). RTD has two federally funded grants to rehabilitate portions of the Mall, which it intends to contribute to the Project if FTA and Denver Regional Council of Governments (DRCOG) approve the transfer of funds and CCD and RTD implement an IGA. The use of FTA grant funds requires FTA approval under NEPA. Ongoing maintenance of the transit way would be funded through an IGA between CCD and RTD. The level of maintenance is expected to be significantly reduced from existing levels. Funding for maintenance of pedestrian areas would continue to be provided through an IGA between CCD and the BID. An IGA between CCD and RTD will ensure that pedestrian walkways maintain the necessary 10-foot clear width for unimpeded pedestrian traffic.

B. Transit Operations

The LPA would accommodate existing and planned Free MallRide transit operations, LRT service operations, and connecting transit service. The transit way would consist of two 12-foot transit way lanes adjacent to each other, with no median or light fixtures between them, except at the half-block triangle plaza between Cleveland Place and Broadway, where the existing area with

light fixtures between transit lanes would be reconstructed in place. A transit lane indicator between transit lanes would be applied in the transit way to aid shuttle operators by clearly defining the inside edge of the transit lanes. The transit lane indicator technique is undecided. Possible techniques include but are not limited to textured pavement, reflective surface treatments and other emerging technologies, with the intent of minimizing visual changes to the pavement pattern. Operations for the Free MallRide and connecting transit services would not change as a result of implementing the LPA and continued Free MallRide operation will be included in an IGA between RTD and CCD.

C. Traffic Operations

Implementation of the LPA would not change long-term operational characteristics of the cross streets or permitted vehicles on the Mall. Incidental uses such as bicycles, horse-drawn carriages, and pedi-cabs (which are allowed on the Mall only during offpeak transit times), would not change under the LPA. Bulb-outs and other intersection improvements to be decided during subsequent design phases would calm traffic in cross streets. Within the cross streets, capacity, lane width, and traffic controls and timing would follow the same concept of operations.

D. Construction Activities

This section describes important aspects of the construction process required to implement the LPA within the proposed construction period.

1. Timeline, Phasing, and Access

Construction of the LPA is anticipated to take 2.5 to 4 years in total. Major construction activities on each block are anticipated to last approximately 8 months to 12 months; however, minor construction activities or unforeseen utility-related construction activities may last longer. Construction will generally occur in two- to six- block segments and multiple segments may be under construction at one time; each segment will require multiple construction phases. Construction will occur within the Project limits illustrated on **Figure 3-1**. Construction phasing will be determined using the following assumptions:

- Maintain reasonable access to businesses during all phases of construction.
- Maintain reasonable access for traffic on cross streets during all phases of construction, except for limited intermittent closures.
- Maintain two-way Free MallRide service for a majority of the distance and Project duration, except for limited intermittent detours. Four scenarios for transit operations during construction have been used to analyze construction impacts in **Section 3**, Environmental Resources, and **Section 4**, Transportation Systems, of the EA; the scenarios are further detailed in those sections.
- Maintain LRT and other connecting transit services on the Mall, except for limited intermittent interruptions as agreed upon by the contractor and RTD, during all phases of construction.
- Maintain reasonable and regulatory compliant access for Free MallRide service, LRT service, and other connecting transit services as agreed upon by the contractor and RTD during all

phases of construction. The regulatory compliance aspects include maintaining access for people with disabilities.

The impact analysis and mitigation recommended in the Project EA are presented to allow the contractor sufficient flexibility to balance cost against schedule, community disruption and mitigation. A Project Management Plan (PMP) and Traffic Management Plan (TMP) will be developed and will include the mitigation measures committed to in **Section 3**, Environmental Resources, and **Section 4**, Transportation Systems, of the EA. The PMP and TMP will be updated as the advancement of design, construction staging, and stakeholder outreach allows for additional decisions to be made regarding impacts and measures to mitigate impacts. The PMP will also include a Public Information Plan (PIP), which will serve to prepare project-area residents, businesses, and commuters for what to expect during construction, listen to their concerns, and develop plans to minimize disruptive effects.

2. Staging

The selection of a construction staging site or sites would be decided in subsequent design phases. The process for deciding a construction staging site or sites would include applicable stakeholders (Project Partners, agencies, and affected landowners and business owners).

3. Construction Activities

Construction activities would generally include, and require equipment for: deconstruction; construction of temporary facilities for maintenance of access and safety; construction of permanent subsurface features; and construction of aboveground surface, traffic control, wayfinding, drainage, communications, lighting, and landscape features. It is anticipated that night work may be performed, and 24-hour construction may be required in some cases to accommodate the construction schedule, maintenance of access, or related stakeholder requirements. Access to the construction site will be controlled through appropriate standards set forth by the Colorado Department of Public Health and Environment, CCD Occupational Safety and Health Administration, CCD Department of Public Works, the Manual on Uniform Traffic Control Devices, the National Fire Protection Association 130 Standard for Fixed Guideway Transit and Passenger Rail Systems, and other applicable regulatory requirements. Haul routes to and from the construction site or staging site(s) will be determined during subsequent design phases. Existing haul routes will be used to the extent practicable.

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ALTERNATIVE ANALYSIS AND ENVIRONMENTAL CLEARANCE

The Future of Denver's 16th Street Mall

Prepared for

Regional Transportation District

August 2018

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Acronyms and Abbreviations

ACS	American Community Survey
BID	Business Improvement District
CAGR	Compound Annual Growth Rate
CBD	Central Business District
CDLE	Colorado Department of Labor and Employment
CSA	Combined Statistical Area
CMSA	Consolidated Metropolitan Statistical Area
DOLA	Department of Local Affairs
DRCOG	Denver Regional Council of Governments
GIS	Geographic Information System
RTD	Regional Transportation District

SECTION 1

Land Use and Socioeconomic Existing Conditions

1.1 Project Description

ArLand Land Use Economics prepared this Existing Conditions memo focusing on socioeconomic and land use conditions for the 16th Street Mall Alternatives Analysis and Environmental Clearance. The general purpose of this project is to develop alternatives for the Mall in order to optimize it for safe and cost-effective transit, pedestrian, and leisure activities. The information developed will be used to aid the City and County of Denver and the Regional Transportation District (RTD) in making an informed decision regarding future design considerations for improvements to the 16th Street Mall.

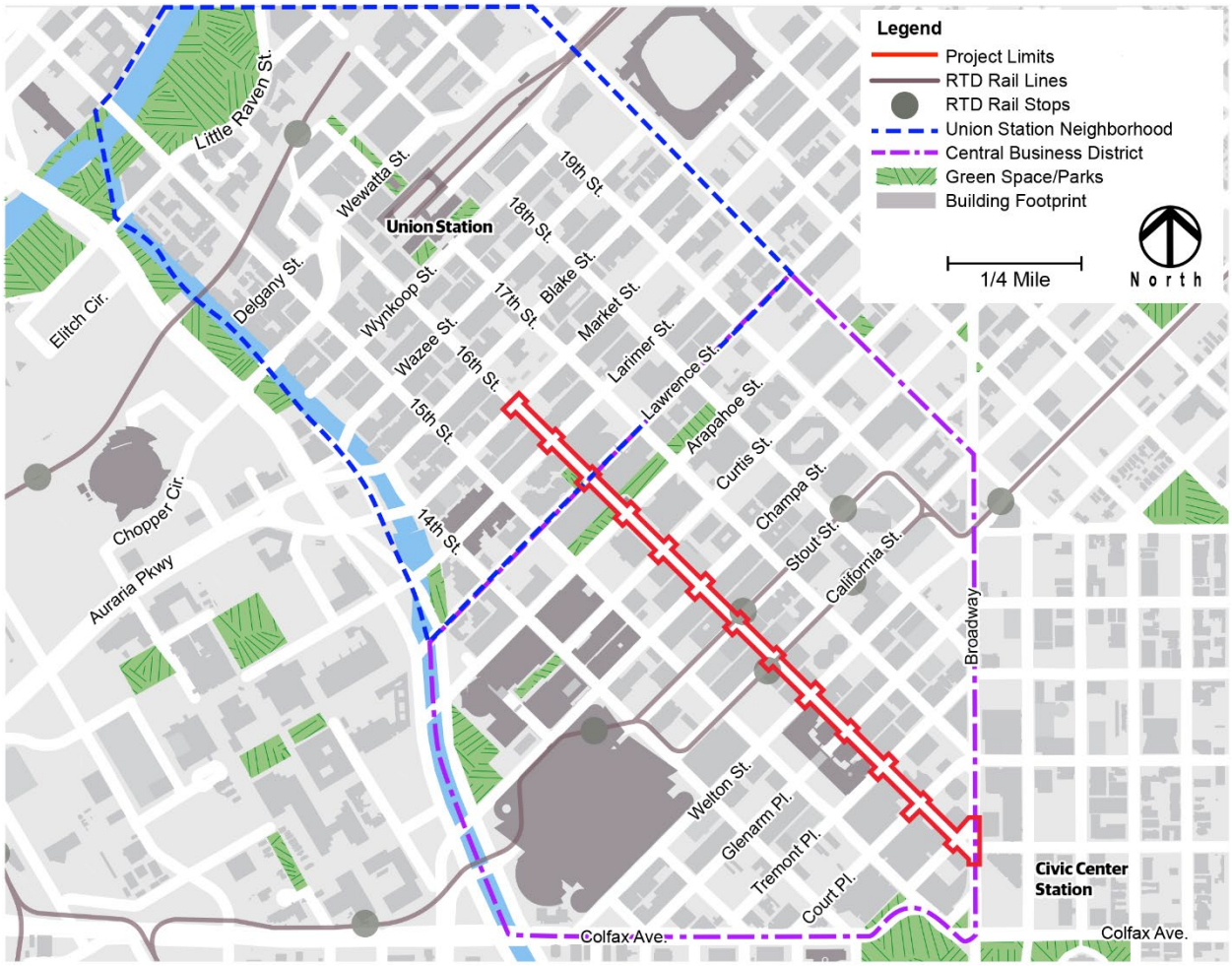
1.1.1 Methodology

The methodology for the socioeconomic and land use sections is based on RTD's Environmental Methodology Manual dated July 2008 which outlines appropriate data and analytical techniques for environmental analysis. The sections in the manual entitled Land Use, Economic Considerations, and Social Impacts are the most applicable to this 16th Street Mall analysis. The manual suggests that the following data be analyzed for these sections.

- **Economic Considerations:** Existing businesses, personal incomes, employment, and fiscal impacts including sales and property tax revenues
- **Social:** Population, household, housing, and neighborhoods
- **Land Use:** Summaries of current land uses, zoning, and land use policies

Planning for the future is an important municipal government responsibility. While the project area is generally focused on the 16th Street Mall from the RTD Civic Center Station to Market Street, different geographies are used in order to provide the most appropriate context for analysis. A discussion of broader economic conditions will focus on Downtown – the Central Business District and the Union Station neighborhoods (**Figure 1-1**) – vis-à-vis the City of Denver.

Figure 1-1. Union Station and Central Business District Neighborhoods



Source: City of Denver

The sales tax analysis is based on the Denver Business Improvement District boundaries which includes the 16th Street Mall, the Central Business District and Union Station neighborhoods, but also includes neighborhoods outside of the immediate downtown area. The map of planned developments also encompasses several downtown neighborhoods. The land use analysis primarily focuses on the Central Business District and the Union Station neighborhoods. An examination of existing businesses will focus on businesses directly on the Mall and adjoining side streets.

The following summary presents:

- Demographic Trends and Forecasts: This section presents population, household, employment, and income trends and forecasts for Downtown Denver (Central Business District and Union Station), the City of Denver, and the Denver Metropolitan Area. Data sources include the Downtown Denver Partnership, the US Census Bureau, the Colorado State Demography Office, the Denver Regional Council of Governments, and the Colorado Department of Labor and Employment.

- Socioeconomic Conditions: Because Downtown Denver is a major employment, cultural, civic, and commercial center for the region, current commercial market conditions will be described. It will be followed by a summary of downtown Denver businesses.
- Current and Future Land Uses: The current and future land use maps and summary are also presented and were created using data from the City of Denver's GIS office, the Denver County Assessors' Office, and visual observations.

1.2 Demographic Trends and Forecasts

Between the year 2000 and 2015, the Central Business District (CBD) and Union Station neighborhoods shown on **Table 1-1** experienced rapid population and household growth. Over the fifteen-year period through 2015, the annual growth rate in these two neighborhoods far outpaced population growth in the City of Denver and the larger Denver Metropolitan Area, as described in Table 1-1. The Union Station neighborhood grew at an average annual rate over 5 percent, followed by the CBD at just under 5 percent. In comparison, the metropolitan area, one of the fastest growing in the country in recent years, grew by about 760,000, or just under 2 percent annually. Combined, these two downtown neighborhoods added almost 5,000 residents from 2000 to 2015.

Table 1-1. Population and Households (2000-2015)

Location	2000	2010	2015 [a]	Growth 2000-2015	CAGR [b] 2000-2015 (percentage)
Population					
CBD	2,005	3,648	4,049	2,044	4.8
Union Station	2,225	4,350	5,062	2,837	5.6
City of Denver	554,636	600,158	649,654	95,018	1.1
Denver Metropolitan Area [c,d]	2,653,295	3,106,113	3,417,077	763,782	1.7
Households					
CBD	1,421	2,363	2,495	1,074	3.8
Union Station (LoDo)	1,588	3,070	3,439	1,851	5.3
City of Denver	239,235	263,107	275,795	36,560	1.0
Denver Metropolitan Area [c,d]	1,031,753	1,219,244	1,333,816	302,063	1.7

Source: U.S. Census, Colorado State Demography Office

[a] U.S. Census Bureau, 2015 ACS 5-year population estimates for all rows except Denver Metropolitan Area

[b] Compound Annual Growth Rate

[c] State of Colorado, DOLA, State Demography Office, County Demographic Profiles

[d] Defined as the U.S. Census Denver-Aurora Combined Statistical Area, which includes the following counties: Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin, Jefferson, Park, Weld

Along with large population changes, the CBD and Union Station neighborhoods also saw large increases in median household incomes between 2000 and 2015 (unadjusted for inflation). The median household income in the Union Station neighborhood increased by the highest rate, over 6 percent annually, amounting to an increase of about $48,000 per year (**Table 1-2**). As of 2015, the median household income in the Union Station neighborhood was almost $82,000 per year, exceeding that of the CBD, the city, and the metropolitan area. Although the median household income in the CBD increased by an annual growth rate of over 4 percent, and actual growth of almost $28,000 per year, it lags the median household income of the metropolitan area, which is just under $66,000 per year.

Table 1-2. Median Household Incomes (2000-2015)

Location	2000	2010	2015	Growth 2000-2015	CAGR[a] 2000-2015 (percentage)
CBD	$30,607	$37,358	$58,242	$27,635	4.4
Union Station (LoDo)	$33,750	$74,289	$81,961	$48,211	6.1
City of Denver	$39,500	$45,501	$53,637	$14,137	2.1
Denver Metropolitan Area[b]	$51,088	$60,174	$65,643	$14,555	1.7

Source: U.S. Census

[a] Compound Annual Growth Rate

[b] 2000 geography is the Denver-Boulder-Greeley CMSA; 2010 is the Denver-Aurora-Boulder CSA; 2015 is the Denver-Aurora CSA. Note: 2000 data does not include Clear Creek, Elbert, Gilpin, or Park Counties.

As Denver's population and household incomes grew over the past decade and a half, the city also experienced employment changes as described in **Table 1-3**. Over the 16-year period through 2016, the city gained almost 26,000 jobs. The city lost almost 50,000 jobs between 2000 and 2010, however, jobs growth over the past 6 years has more than made up for those losses. The city gained just over 74,000 jobs in total over the past 6 years.

Table 1-3. Denver County Average Employment by Industry (2000-2016)

	2000	2010	2015	2016	Change 2000-2016	CAGR[a] 2000-2016 (percentage)
Accommodation and Food Services	34,693	39,069	50,028	52,585	17,892	2.6
Administrative and Waste Services	39,504	31,050	34,869	36,537	-2,967	-0.5
Agriculture, Forestry, Fishing and Hunting	85	145	563	745	660	14.5
Arts, Entertainment, and Recreation	6,083	7,244	9,180	9,691	3,608	3.0
Construction	23,722	14,998	19,408	20,644	-3,078	-0.9
Educational Services	25,088	30,352	30,407	31,980	6,892	1.5
Finance and Insurance	30,844	24,784	26,083	26,030	-4,814	-1.1
Health Care and Social Assistance	46,583	55,155	56,776	59,270	12,687	1.5
Information	30,047	13,792	11,988	12,542	-17,505	-5.3
Management of Companies and Enterprises	5,430	9,440	12,792	13,179	7,749	5.7
Manufacturing	31,233	19,321	21,123	21,211	-10,022	-2.4
Mining	3,372	6,301	8,738	6,947	3,575	4.6
Other Services (for example, Public Administration)	14,961	14,241	16,380	17,105	2,144	0.8
Professional and Technical Services	39,844	37,053	49,773	52,885	13,041	1.8
Public Administration	27,578	27,491	28,265	28,848	1,270	0.3
Real Estate and Rental and Leasing	12,132	10,048	11,675	12,544	412	0.2
Retail Trade	30,109	25,832	29,667	30,112	3	0.0
Transportation and Warehousing	35,364	26,637	30,276	31,169	-4,195	-0.8
Unclassified	5	24	65	66	61	17.5
Utilities	3,224	3,232	3,285	3,336	112	0.2
Wholesale Trade	29,242	24,383	27,030	27,409	-1,833	-0.4
Total	**469,144**	**420,592**	**478,370**	**494,836**	**25,692**	**0.3**

Source: CO Labor Market Information, Quarterly Census of Employment and Wages Program
[a] Compound Annual Growth Rate
Note: sum of all rows may not equal total due to rounding and data suppression

Industries that had the largest change in employment from 2000 to 2016 were Accommodation and Food Services, which gained almost 18,000 jobs (76 percent of them over the past six years), and Information, which lost about 17,500 jobs, mostly between 2000 and 2010. The Professional and Technical Services and Health Care and Social Assistance sectors have also seen large changes in employment, gaining about 13,000 jobs respectively since 2000. The employment gain in the Professional and Technical Services sector is even larger since 2010, given a slight decline in employment from 2000 to 2010.

In percentage terms, excluding unclassified jobs, the Agriculture, Forestry, Fishing and Hunting sector grew at the fastest annual growth rate of 14.5 percent from 2000 to 2016, and over 31 percent over the past six years. It was followed by the Management of Companies and Enterprises, which grew at just under 6 percent over the past 16 years. Employment in the Mining industry (including Oil and Gas) grew by about 4.6 percent over the 16-year period, but only by about 1.6 percent over the past six years. The construction sector saw an overall decline in jobs between 2000 and 2010 tracking changes in the economy, but has grown quickly at an annual growth rate of 5.5 percent since 2010.

Error! Reference source not found. shows population, household and employment forecasts for the CBD, Union Station and the City and County of Denver developed by DRCOG and adjusted for current population and households. Forecasts indicate that while there will be some residential growth in the CBD, it will be relatively modest at approximately 379 households. It also shows that the CBD is forecast to add over 12,000 jobs in the next 25 years. Union Station is forecast to add a significant number of residential units between 2015 and 2040. Some of this growth is already occurring with the large number of residential units recently constructed in the area. Union Station is also forecast to add nearly 7,800 jobs by 2040.

Table 1-4. Population, Household and Employment Forecasts

Category	2015	2040 [a]	Growth 2015-2040	CAGR[a] 2015-2040 (percentage)
Population[b]				
CBD	4,049	4,746	697	0.7
Union Station	5,062	12,007	6,945	3.7
City and County of Denver	649,654	824,674	175,020	1.0
Households[b]				
CBD	2,495	2,874	379	0.6
Union Station	3,439	7,298	3,859	3.2
City and County of Denver	275,795	368,196	88,401	1.2
Employment[c, d]				
CBD	66,385	78,429	12,044	0.7
Union Station	24,187	31,930	7,743	1.2
City and County of Denver	478,370	607,907	129,531	1.0

Source: U.S. Census, DRCOG

[a] Because of the relatively large discrepancy between 2015 ACS/CDLE actual and DRCOG estimates, 2040 forecasts are based on DRCOG growth rates adjusted for actual 2015 figures.

[b] American Community Survey (ACS).

[c] 2015 and 2040 Employment for CBD and Union Station area based on DRCOG. The 2015 City and County of Denver figure based on Colorado Department of Labor and Employment (CDLE).

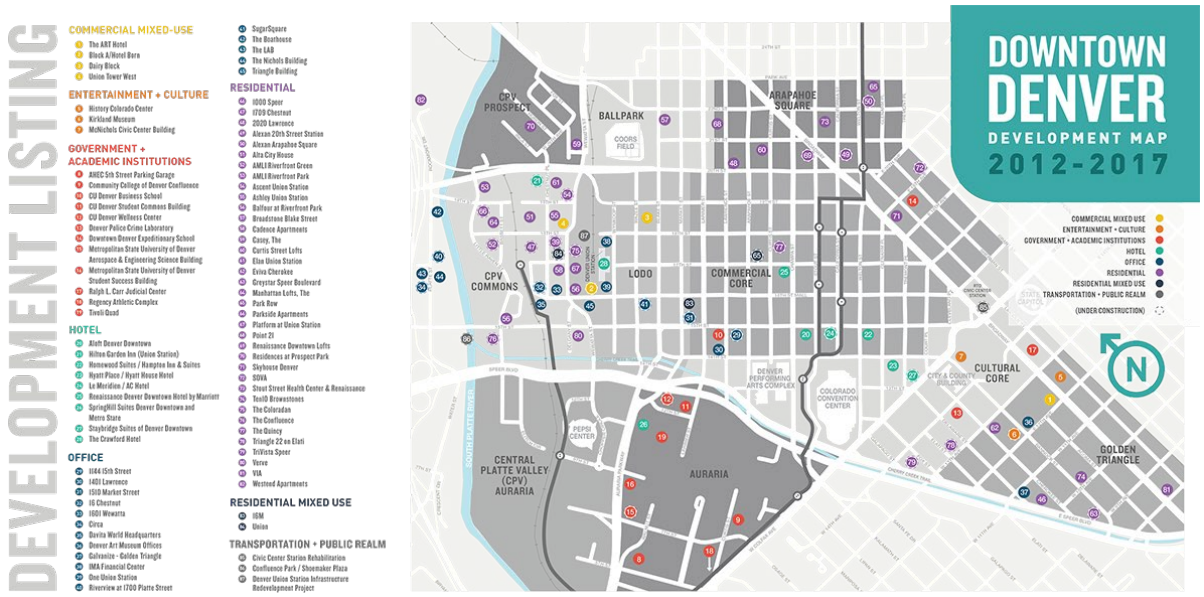
[d] DRCOG forecasts for the Denver Metropolitan Area are not shown because the DRCOG region is significantly different from the Denver Metropolitan Area as defined by the US Census.

1.3 Socioeconomic Conditions

There are numerous reports available from the Downtown Denver Partnership about the state of downtown based on the Downtown Denver Area Plan boundaries, which encompass a much broader geographic area than our area of focus, to include the Golden Triangle neighborhood and Cultural Core district to the south, Auraria to the west, the Ballpark and Arapahoe Square neighborhoods to the north, and the Central Platte Valley. In general, it shows a downtown which has grown by an estimated 9,000 jobs since 2012 with an employment base of 126,029 jobs as of February 2016.

Figure 1-2 from the Downtown Development Partnership illustrates development in Downtown Denver between 2012 and 2017. There are a large number of residential development projects near Union Station (in purple). In contrast, the CBD has seen a number of recent hotel projects but far fewer development projects than the Union Station area. Most of that is attributable to land availability near Union Station.

Figure 1-2. Downtown Denver Development Map (2012-2017)



Source: Downtown Denver Partnership

According to the Downtown Denver Partnership, downtown has seen an increase in retail sales, hotel room rates, and office lease rates in the past five years. While there are positives, there are current challenges including mixed retail market fundamentals, increased vacancies and decreased retail lease rates. The number of for-sale homes has remained flat in the past five years, while the number of apartments in downtown Denver has dramatically increased. Most of the residential development projects are apartments.

Table 1-5 shows commercial market conditions in the CBD and Union Station neighborhoods which are a subset of the Downtown Denver Partnership boundaries. Approximately 7 percent of the City of Denver's retail (including restaurants) is located in the CBD and LoDo. While CBD and Union Station retail lease rates are higher, vacancy rates are also higher than the City as a whole.

Table 1-5. Commercial Market Conditions, Downtown versus City of Denver (2017)

Condition	CBD and Union Station - Retail	City of Denver - Retail	CBD and Union Station - Office	City of Denver - Office
Inventory (Square Feet)	2 million	28 million	28 million	71 million
Under Construction	84,500	480,000	1.1 million	3.2 million
2017 Lease Rates (per square foot)[a]	$26.27	$21.89	$33.18	$29.69
2017 Vacancy Rates	4.5 percent	3.7 percent	15.1 percent	13.0 percent

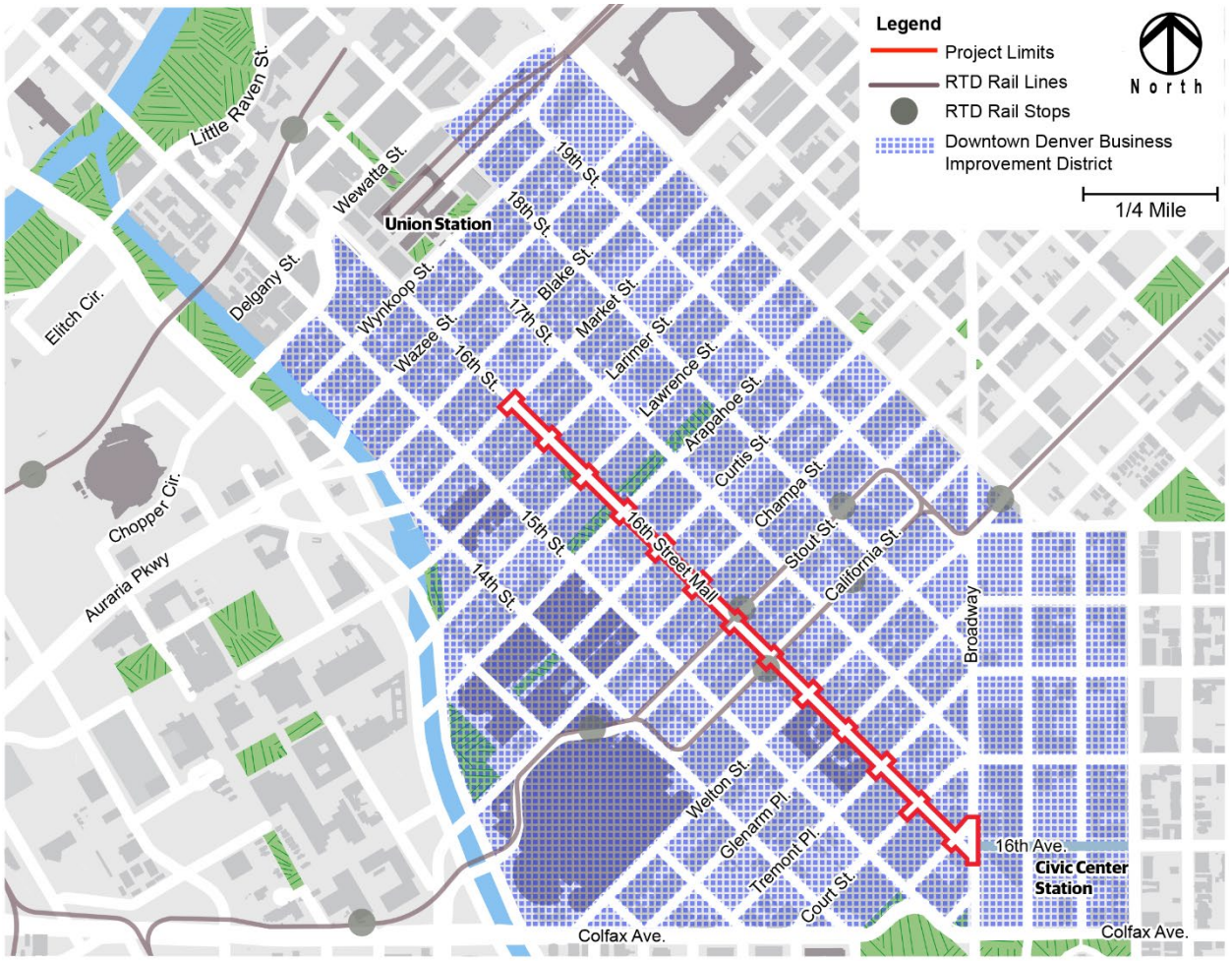
[a] Lease rates for office are reported as Full Service. Retail is reported as Triple Net (Tenants pay for expenses in triple net leases).

Downtown is one of the City's primary office market locations with about 40 percent of the City's office inventory located in the CBD and Union Station. Office rates are also higher in the CBD and Union Station than the City as whole. Vacancy rates are also higher. However, about a third of new Denver office construction is also located in these neighborhoods which may be a reason for current higher vacancy rates as new buildings lease up. The office market at the eastern end of the Mall consists primarily of older building stock and has higher vacancies and lower lease rates than other portions of downtown, which detracts from the downtown office market. The office market at the western end of the Mall near DUS is experiencing much higher investment and performing very well. Other significant Denver office locations include Midtown, south of downtown and the Colorado Boulevard corridor, as well as the Denver portion of the Denver Tech Center.

1.3.1 Sales Tax Analysis

The City of Denver tracks sales tax revenues for downtown using the Downtown Denver Business Improvement District (BID) boundaries shown in Error! Reference source not found.. The 16th Street Mall is shown in orange with Denver Union Station on the top and Broadway at the bottom of the map. It encompasses both the CBD and Union Station neighborhoods. The figures within the blue boxes represent individual zones for assessment calculations.

Figure 1-3. Downtown Denver Business Improvement District Boundaries



Source: Downtown Denver Business Improvement District

Within the Downtown Denver BID, sales tax revenues in 2016 were about $37.6 million. This is about $6.8 million higher than it was in 2012, a 22 percent increase, as detailed in **Table 1-6**. This increase is attributable in large part to four industries - Hotel and Other Accommodation Services, followed by Restaurants, Business Administration, Support and Waste/Remediation, and Clothing/Accessory Stores. Sales tax revenues from these four industries increased by about $7.6 million since 2012, which offset losses in other industries. Since 2012, downtown sales tax revenues have declined in numerous industries, including Manufacturing, Motor Vehicles/Auto Parts, and Information Producers/Distributors, among others.

Table 1-6. Downtown Denver BID, Annual Sales Tax Collections by Industry (2012-2016)

Industry	2012	2013	2014	2015	2016
Manufacturing	$1,920,518	$1,876,172	$1,575,502	$1,227,415	$1,391,293
Motor Vehicles and Auto Parts	$732,834	$976,725	$596,641	$846,858	$196,278
Furniture and Home Furnishings	$138,605	$76,051	$97,898	$73,132	$258,301
Electronics and Appliance Stores	$29,863	$65,342	$91,068	$42,074	$90,050
Building Materials/ Improvement/Nurseries	$39,820	$63,255	$54,051	$106,615	$91,033
Food and Beverage Stores	$368,125	$390,010	$449,571	$487,902	$611,088
Health/Personal Care Stores	$437,918	$419,653	$409,494	$430,232	$413,585
Service Stations	$1,958	$5,061	$45,723	$5,438	$0
Clothing/ Accessory Stores	$2,965,310	$2,886,030	$2,742,101	$2,861,553	$3,714,080
Sporting Goods/ Hobby/Book/Music Stores	$531,340	$513,108	$516,216	$516,405	$753,160
General Merchandise/ Warehouse Stores	$27,835	$16,773	$15,264	$13,887	$19,014
Miscellaneous Stores	$999,384	$1,108,165	$1,353,764	$1,474,076	$807,255
Information Producers/ Distributors	$2,082,863	$1,621,179	$1,583,942	$1,132,768	$1,828,876
Business Admin, Support, Waste/ Remediation	$170,279	$279,180	$501,721	$578,719	$1,577,611
Hotel and Other Accommodation Services	$5,511,377	$5,579,287	$7,131,951	$7,776,264	$8,845,046
Restaurants	$14,823,937	$15,101,611	$15,740,566	$16,566,145	$16,962,632
Other Services	$12,775	$19,599	$26,630	$39,126	$51,082
Total	**$30,794,741**	**$30,997,201**	**$32,932,103**	**$34,178,609**	**$37,610,384**

Source: City of Denver

In 2016, sales tax collections in the BID were 5.6 percent of total city sales tax collections of $676 million. However, Eating and Drinking Establishments and Apparel Stores represent 16 percent and 14 percent of city collections, respectively, as detailed in **Table 1-7**. Sales tax revenues in the BID have decreased in percentage terms relative to the city since 2012, falling from 6.2 percent of total city sales tax collections in 2012 to 5.6 percent in 2016, with a low of 5.3 percent in 2015.

Table 1-7. Downtown Denver BID Sales Tax Collections as a Percentage of City of Denver by Category (2012-2016)

Category	2012	2013	2014	2015	2016
Apparel stores	13.6	12.7	11.4	11.2	14.3
General merchandise	0.2	0.1	0.1	0.1	0.1
Food stores	1.8	1.8	1.9	2.0	2.2
Eating and drinking establishments	19.0	17.7	16.7	16.4	15.9
Home furnishings, electronics and appliances	0.7	0.6	0.7	0.4	0.9
Building materials and farm tools	0.1	0.1	0.1	0.2	0.1
Auto dealers and supplies	1.7	2.0	1.1	1.4	0.3
Service stations	0.0	0.0	0.3	0.0	0.0
Manufacturing	5.3	4.6	3.4	2.7	3.6
Information producers and distributors	5.4	4.3	4.1	3.1	4.5
Other retail	3.8	3.9	3.4	3.4	3.0
All other outlets	5.1	4.6	5.2	5.4	6.7
Total	**6.2**	**5.7**	**5.4**	**5.3**	**5.6**

Source: City and County of Denver, 2016 Comprehensive Annual Financial Report

As detailed in **Table 1-8**, Retail and Eating and Drinking Establishments within the BID and the City of Denver have seen an increase in sales tax collections from 2012 to 2016. Retail sales tax collections rose by about 11 percent within the BID during this time, yet rose by almost 46 percent city-wide. As a result, retail sales tax collections within the BID represented about 2 percent of Denver's collections in 2016. A similar trend occurred in the Eating and Drinking Establishment category. Within the BID, sales tax collections increased by about 14.5 percent, while collections city-wide rose by over 37 percent between 2012 and 2016.

Table 1-8. Retail and Eating/Drinking Establishments Sales Tax Collection Comparison, BID versus Denver (2012-2016)

Year	BID - Retail	Denver - Retail	BID – Eating and Drinking Establishments	Denver – Eating and Drinking Establishments
2012	$6,272,992	$229,630,000	$14,823,937	$77,886,000
2013	$6,520,173	$247,552,000	$15,101,611	$85,211,000
2014	$6,371,791	$281,767,000	$15,740,566	$94,439,000
2015	$6,858,172	$300,416,000	$16,566,145	$101,242,000
2016	$6,953,844	$335,080,000	$16,962,632	$106,903,000

Source: City and County of Denver; 2016 Comprehensive Annual Financial Report

1.3.2 Existing Businesses

There are a number of retail, restaurant, and service businesses directly along the 16th Street Mall as well as on the side streets. There is also office space and some residential space directly fronting the mall. This section focuses primarily on those retail, restaurant, and service businesses on the ground floor, and in some cases, at the basement level, or second floor, which would tend to be oriented to walk-by or convenience traffic. Many tend to be oriented to downtown employees although these businesses also serve the residential population as well as tourists. **Figure 1-4** depicts the general location of the businesses that were identified.

Figure 1-4. 16th Street Mall Businesses

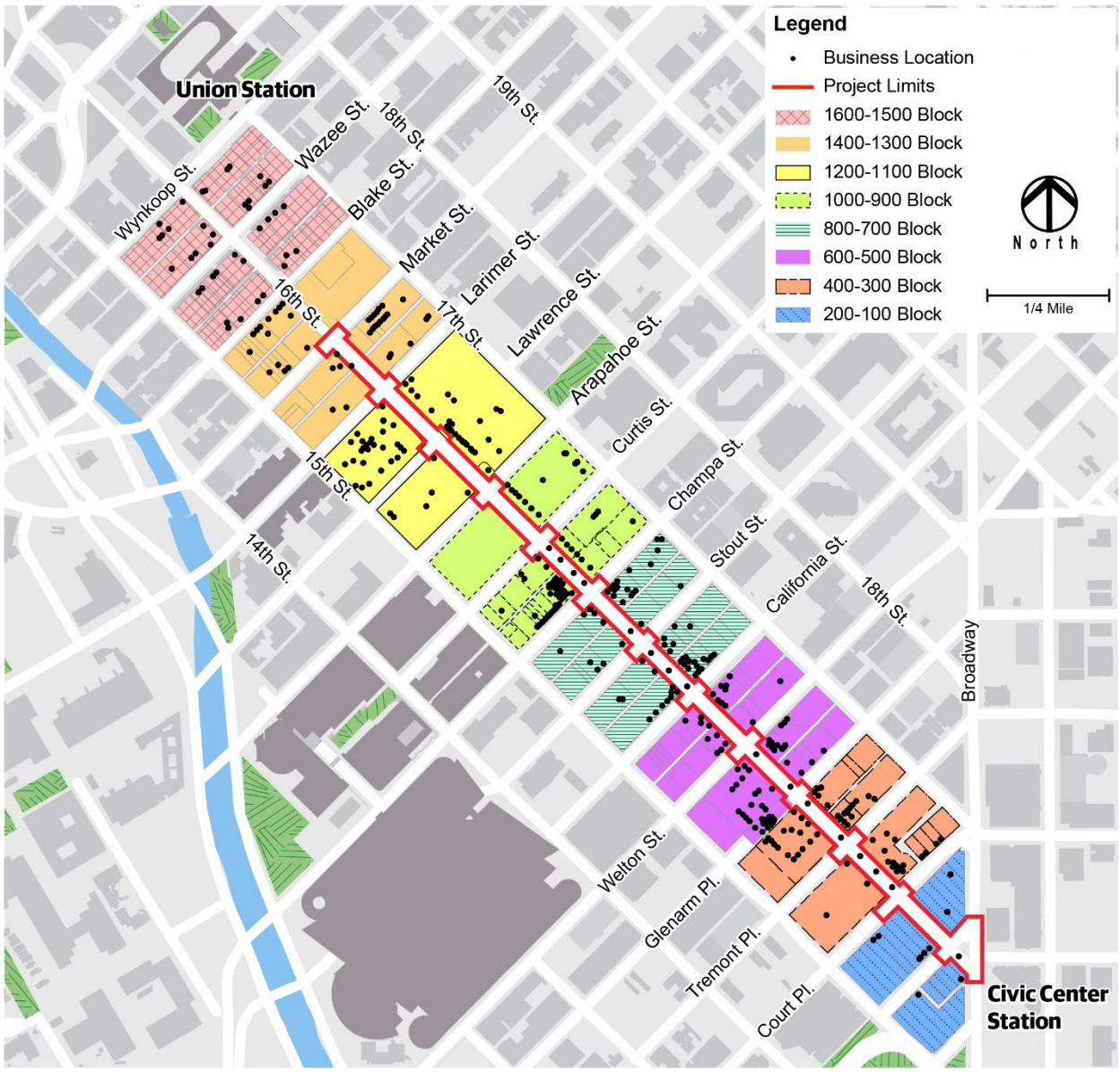


Table 1-9 summarizes the businesses between Broadway and Market Streets on the first floor. In a relatively limited number of cases, subterranean eateries and restaurants grouped together on second floors were also counted, as were the stores at the Pavilions. There are approximately 370 businesses. Restaurant and retail are the dominant businesses along the mall. There are a significant number of national restaurant and retail chains, however in terms of actual count, local establishments outnumber national establishments. While the national establishments tend to be larger, have more employees and revenues, many of the local businesses tend to be relatively small, and located in a multi-tenant setting. The mix of local and national businesses and the key markets served vary along the length of the Mall. Some portions of the Mall are more successful than others, having higher lease rates and fewer retail vacancies.

Table 1-9. Businesses along the 16th Street Mall, July 2017 (Broadway to Market Streets)

Industry	National	Local	Total Number of Businesses	Percent of Total
Restaurants	52	87	139	37.4
Retail and Other	50	74	124	33.3
Services	42	67	109	29.3
Total	**144**	**228**	**372**	**100.0**

Source: InfoUSA

1.4 Land Use

1.4.1 Relevant City Plans/Studies

The City of Denver has jurisdiction over the entire length of the 16th Street Mall and multiple city plans, studies, and reports have informed and guided development along and adjacent to 16th Street for many years. Primary land use plans include the 2000 Comprehensive Plan, Blueprint Denver, and the Downtown Area Plan. There are also others, all of which are summarized in **Table 1-10**.

Table 1-10. City Plans/Studies

Plan/Report	Date	Summary
Central Platte Valley Comprehensive Plan Amendment	1991	The plan was written in response to changed conditions in the valley that necessitated an update from the 1986 Central Platte Valley Comprehensive Plan Amendment, which the 1991 plan superseded. The largest change was the decision to retain passenger-rail operations at Denver Union Station, which the 1986 plan had relocated to an unspecified location to the northeast of the station. The plan encouraged a mix of land uses in the Central Platte Valley, including commercial development, housing, open space, and public facilities to support a dense urban character. Development of a multi-modal transportation center in the center of the valley, which would connect to downtown by extending the 16th Street Mall was one of the primary concepts included in this revised plan amendment.
Denver Comprehensive Plan 2000	2000	Established an overall vision for the City and included four guiding principles to lead toward a shared community commitment to a sustainable future - economic opportunity and security, environmental stewardship, equity, and engagement. The plan called for a Citywide Land Use and Transportation Plan and an updated zoning ordinance. It focused on major new development areas, including the Central Platte Valley.

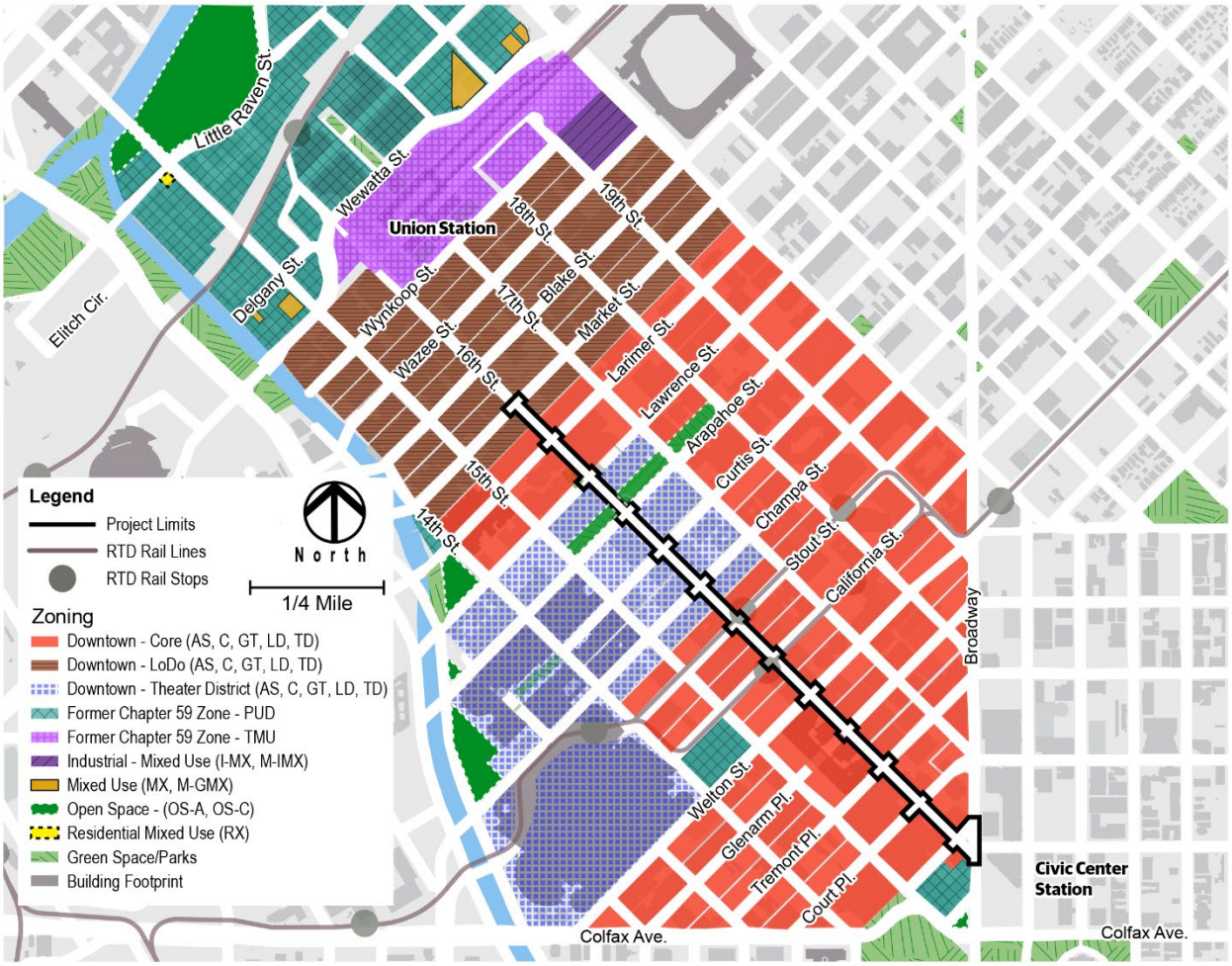
Plan/Report	Date	Summary
Blueprint Denver: An Integrated Land Use and Transportation Plan	2002	Blueprint Denver responded to the call for a land-use and transportation plan in the 2000 Comprehensive Plan. As an integrated land use and transportation plan, it recommended land uses that accommodate future growth and open space, and a balanced, multi-modal transportation system. It divided the City into areas of stability and areas of change. Areas of stability included stable residential neighborhoods where no significant changes in land use was expected. Areas of Change were identified as those areas where future growth should be directed. Downtown Denver and its surrounding neighborhoods were identified as an Area of Change. Land use strategies for downtown included a balanced mix of uses, adequate parks and open space, and housing. Blueprint Denver is currently being updated.
Denver Union Station Master Plan	2004	The 2000 Comprehensive Plan and Blueprint Denver all supported the need for a multimodal transportation center at Denver Union Station. The goal of this plan was to identify and evaluate potential transportation, development, and civic components, along with design character, financing, ownership, and governance structures for the Denver Union Station site. The plan encouraged a mix of land uses on the site with densities compatible with neighborhood plans and concepts. To facilitate transit-oriented development, the plan called for the Denver Union Station site to be rezoned to T-MU-30 with waivers and conditions focused on building envelopes and heights to create active public space, protect views, and frame and honor the historic train station.
Denver Downtown Area Plan	2007	Building on the 1986 Downtown Area Plan, this plan updated the vision, goals and recommendations for Downtown in the form of “1000 small steps” to strengthen Downtown’s fabric, increase its vitality, and make it one of the most livable places in the world. As part of invigorating the Commercial Core, the plan called for specific 16th Street Mall policies, projects, and programs. Among them is the establishment of theatre and visitor districts, and a retail strategy that serves a broad range of users while also breaking up the length of the street with unique identities for the lower, middle, and upper sections.
16th Street Urban Design Plan. Concept Design Report, 16th Street Plan, Phase II	2010	The plan addressed numerous elements, including rehabilitation of the pavement, upgrading and renovation of other design elements, evaluation of the physical design for the next 25-year horizon, economic development and management. The overall urban design concept included two broad recommendations. The first was complementary upgrading of adjacent named and numbered streets to form an attractive pedestrian district within Downtown. The second was the addition of a Downtown Circulator shuttle service on 18th and 19th streets to balance the demand for transit service with goals for pedestrian experience and economic development. The Mall was divided into the Original Mall segment, Lower Downtown segment, and Denver Union Station segment, and the plan includes a variety of design recommendations for each segment (e.g., sidewalks, furnishings, lighting, etc.).

Plan/Report	Date	Summary
Downtown Denver 16th Street Mall: Small Steps Towards Big Change	2016	This report was part of the "Activate Denver's Urban Core: The Mall Experience" project and prepared as a guide to changing 16th Street for the better. The report begins with the premise, informed by research, that despite the potential to be a lively and vibrant heart in Downtown Denver, 16th Street is currently only attracting people to move through the space, not to spend time there. And instead of a traditional planning process, a "Measure-Test-Refine" process focused on inclusivity, transparency, and incremental improvements was used and promoted. For five Sundays in 2015, shuttle traffic was diverted and the blocks between Tremont Place and Arapahoe Street were programmed with special activities for the event titled "Meet in the Street." Pedestrian counts and observations of stationary activities were carried out and compared to "Baseline Sundays" and "Baseline Weekdays." Business sales were better or about the same during the event compared to normal Sundays. Report findings include "8 Guiding Principles" and "Next Steps." The principle of encouraging lively edges included guidelines such as the promotion of business and retail along the edges, and allowance for extensions of outdoor serving by restaurants and cafes. The principle of thinking beyond the boundaries of 16th Street included guidelines such as analyzing policies regarding commercial activities in and around the public realm (e.g., outdoor serving areas in concert with investigations for creating an "Entertainment District," street vending, etc.), creating a diverse environment to attract more residents, and programming adjacent, underused sites.

1.4.2 Current Land Use

Currently, commercial land uses dominate 16th Street from North Broadway to Wynkoop Street, particularly at the ground floor and subterranean level, although other uses including residential, public/institutional, and open space are also present. There are also a few surface parking lots. Over the past 15 years, development along 16th Street has been guided not only by the documents referenced above, but by the zoning code, specifically the Downtown Neighborhood Context zoning, which includes numerous zone districts, shown on **Figure** 1-5.

Figure 1-5. Current Zoning (Land Use)



Source: City of Denver

The Downtown Core District includes the length of 16th Street from North Broadway to midway between Stout Street and Champa Street, and from Lawrence Street to midway between Larimer Street and Market Street. These areas of 16th Street are intended to remain a part of the city's most prominent public environment and the business, entertainment, and urban lifestyle center of the region. The Downtown Theater District includes most of the area from midway between Stout Street and Champa Street to Lawrence and is associated with the Denver Performing Arts Center. A small Open Space Public Parks District is present on the east end of the block abutting Arapahoe Street, and is intended to protect and preserve public parks owned, operated, or leased by the city. The exception is the northwest corner of the 16th Street and Arapahoe Street intersection, which is within the Theater District zone. The Lower Downtown zone district is generally located from midway between Larimer Street and Market Street to Wynkoop Street.

All three downtown zone districts, excluding the open space, allow for some type of all primary land use classifications as follows:

- Residential
- Civic, Public and Institutional
- Commercial Sales, Services, and Repair
- Industrial, manufacturing and wholesale
- Agriculture

Beyond primary land uses, the Downtown Core and Theater Districts generally require Downtown Ground Floor Active Uses in new and existing buildings and outdoor areas. Within the Lower Downtown District, a variety of land uses are permitted to facilitate the reuse of existing structures and new residential development is encouraged. A few specific uses allowed in the other two districts are precluded in the Lower Downtown district, including hospitals and surface and garage parking. Currently, however, a few surface parking lots front 16th Street between Blake Street and Wynkoop Street.

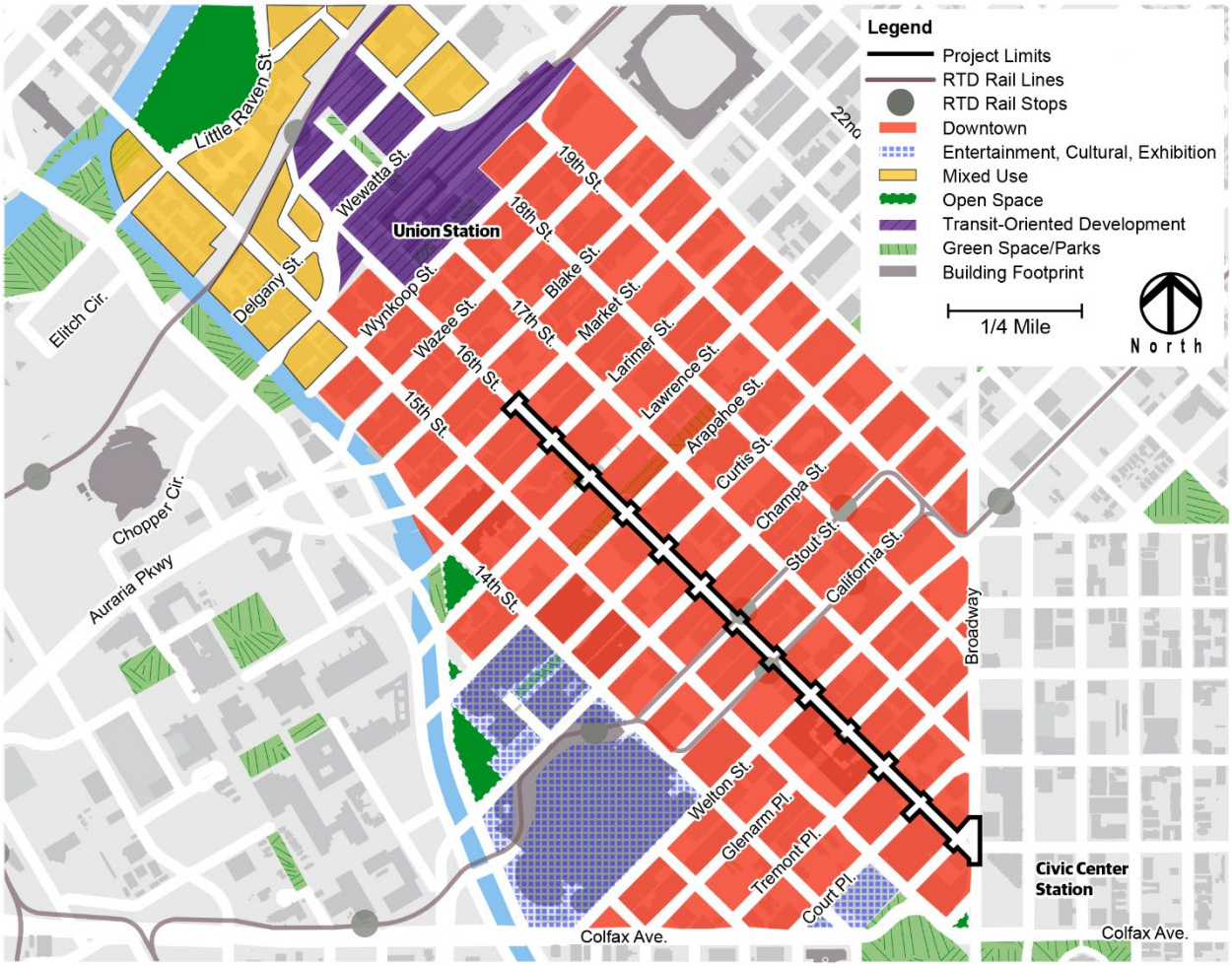
The far western end of 16th Street from Wynkoop Street to the railroad tracks is within the Former Chapter 59 zone, which is from the old zoning code and shown on **Figure 1-5**. The exception to this is the first half of the block west of Wynkoop on the south side of 16th Street, which is within the Lower Downtown zone. Otherwise, the area from Wynkoop Street to Wewatta Street is within the T-MU-30 zone, a transit mixed-use district that permits residential, retail, service, office, institutional, and limited industrial, wholesale, transportation, and utility uses. The area west of Wewatta Street is part of a Planned Unit Development (PUD), which is essentially customized zoning for a specific site. Land uses in this area are mixed to facilitate transit-oriented development around Denver Union Station. Today, office and residential uses are most prevalent. Open space abuts the South Platte River between 15th Street and 20th Street.

1.4.3 Future Land Use

Land uses along the 16th Street Mall will continue to be mixed both horizontally and vertically. There are currently surface parking lots and some buildings which could be candidates for redevelopment.

Beyond the downtown core, the area from Welton Street to Arapahoe Street between 14th Street and Speer Boulevard will continue to be comprised of entertainment and cultural uses with limited open space (this information is detailed on **Figure 1-6**). Pockets of open space will continue to be present along 14th Street between Arapahoe Street and Wynkoop Street. Land uses within the Central Platte Valley, from Wynkoop Street to the South Platte River, will continue to be transit oriented, including retail, office, hotel, and residential uses. Land uses adjacent to the Denver Union Station core area will continue to be mixed, with office and residential uses dominating. Open space will continue to abut the South Platte River between 15th Street and 20th Street.

Figure 1-6. Future Land Use (Blueprint Denver)



Source: City of Denver

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- Table B01003 Total Population -- 2011-2015 ACS 5-year Estimates
- Table B19013 Median Household Income in the Past 12 Months (In 2015 Inflation-Adjusted Dollars) Universe: Households -- 2011-2015 ACS 5-year estimates
- Table B19013 Median Household Income in the Past 12 Months (In 2010 Inflation-Adjusted Dollars) Universe: Households -- 2006-2010 ACS 5-year estimates
- Table DP-1 Profile of General Population and Housing Characteristics: 2010 -- 2010 Census Summary File 1
- Table DP-1 Profile of General Demographic Characteristics: 2000 -- Census 2000 Summary File 1 (SF 1) 100-Percent Data
- Table S0101 Age and Sex. 2011-2015 ACS 5-Year Estimates
- Table S1101 Households and Families -- 2011-2015 ACS 5-year Estimates
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Appendix A
16th Street Mall Cultural Resources Technical Report

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F I N A L

Alternatives Analysis and Environmental Clearance: Cultural Resources Technical Report

Prepared by

Denver Regional Transportation District
City and County of Denver
Downtown Denver Partnership

June 2018
Amended March 2019 with Errata Sheet

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ERRATA SHEET March 2019

The following list represents revisions to the *16th Street Mall Alternatives Analysis and Environmental Clearance: Cultural Resources Technical Report* since it was completed in June 2018.

Page and Section No.	**Correction**
Page 5-6; Section 5.2 Historic Properties	The introductory sentence is corrected from 33 historic properties to 32 historic properties. (Table 5-1 is correct, with 32 properties listed.)
No page number; Section 6 Findings of Effect	An LPA Design Option was developed in response to input received during Section 106 consultation. The LPA Design Option would have the same Section 106 determination of effects as the LPA, with 1 Adverse Effect, 30 No Adverse Effect, and 1 No Historic Properties Affected determinations. The details of the effects of the LPA Design Option on cultural resources are described in the *16th Street Mall Alternatives Analysis and Environmental Assessment (EA)* (Section 3.2, Cultural Resources, pages 3-30—3-33) (FTA, 2019).
Page 6-5; Section 6.2.1.4 Design Options for Transitway Delineation	A hybrid of vertical and pan curbs has been included in the Project curb design. The hybrid curb option is described in Section 2.4.1.4 Edge Delineation of the EA (page 2-12) A description of the effects of this edge delineation on the historic 16th Street Mall property is presented in Section 3.2 Cultural Resources of the EA (pages 3-26 and 3-27).
Page 6-11, Section 6.3 Summary	The Madison Hotel/Harris Hotel is removed from Table 6-2 because it has been demolished.
No page number; Section 7 Avoidance, Minimization, and Mitigation	The discussion of avoidance, minimization, and mitigation measures is updated in the *Draft 16th Street Mall Section 4(f) Evaluation* (Section 4) (FTA, 2019) and Section 3.2.5, Cultural Resources Avoidance, Minimization, and Mitigation Measures, in the EA.
Title page and page 2; Attachment 2 – 16th Street Mall Form 1403	The final 16th Street Mall Architectural Inventory Form 1403 replaces the form in Attachment 2.
Attachment 3 – Section 106 Consultation Record	Attachment 3 contains the Section 106 consultation record through February 2018. The EA Section 5.3, Section 106 Consultation, summarizes the Section 106 consultation through March 2019. EA Appendix C (Agency Coordination and Correspondence) contains the Section 106 consultation record through March 2019.
Attachment 4 – Historic Properties Map Book and Attachment 9 – Map Book Project Limits	Property 5DV.500 (1555 Welton St) is added to the Attachment 4 map book showing historic properties and the Attachment 9 map book showing the project limits in relation to historic properties.

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Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
APE	area of potential effects
CCD	City and County of Denver
CFR	*Code of Federal Regulations*
DDP	Downtown Denver Partnership
EA	environmental assessment
GIS	geographic information system
FTA	Federal Transit Administration
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
OAHP	Office of Archaeology and Historic Preservation
RTD	Regional Transportation District
SHPO	State Historic Preservation Officer
USC	United States Code
UMTA	Urban Mass Transportation Administration

SECTION 1

Introduction

Cultural resources are protected by a number of statutes and regulations at all levels of government and must be taken into consideration during the National Environmental Policy Act (NEPA) process and documented in an environmental assessment (EA). This report examines potential impacts on cultural resources as a result of the 16th Street Mall (Mall) Alternatives Analysis and Environmental Clearance Project (Project). The Project is funded in part by a grant from the Federal Transit Administration (FTA), which makes it a federal undertaking under the National Historic Preservation Act (NHPA). The FTA is the lead federal agency.

Using existing materials and additional research, this report was written and compiled by Sara Orton, an architectural historian with CH2M HILL, Inc. (CH2M), who meets the Secretary of the Interior's Professional Qualifications Standards for architectural history and history.

There are 33 identified historic properties within the project Area of Potential Effects (APE): the Mall and 30 structures adjacent to the Mall, two districts that intersect with the Mall, and one archaeological site. The analysis presented in this report finds that the undertaking would have No Adverse Effect on the 33 properties adjacent to the 16th Street Mall and an Adverse Effect on the 16th Street Mall historic property. This adverse effect will be addressed through consultation in a legally-binding agreement document.

This report takes information from the Project EA and its associated technical reports, and is organized as follows:

- **Section 1, Introduction,** defines the Project purpose and need, as well as its goals.
- **Section 2, Project Alternatives,** describes the Project and its components.
- **Section 3, Regulatory Context,** discusses the regulations pertinent to cultural resources in relation to this undertaking.
- **Section 4, Methodologies,** defines the process used in this evaluation and analysis.
- **Section 5, Identified Historic Properties,** identifies and discusses historic properties in the APE.
- **Section 6, Findings of Effect,** presents the effects analysis and findings.
- **Section 7, Avoidance, Minimization, and Mitigation,** discusses avoidance, minimization, and mitigation measures as they relate to various Project alternatives.
- **Section 8, Conclusions,** provides the effect finding for the undertaking.
- **Section 9, Bibliography**

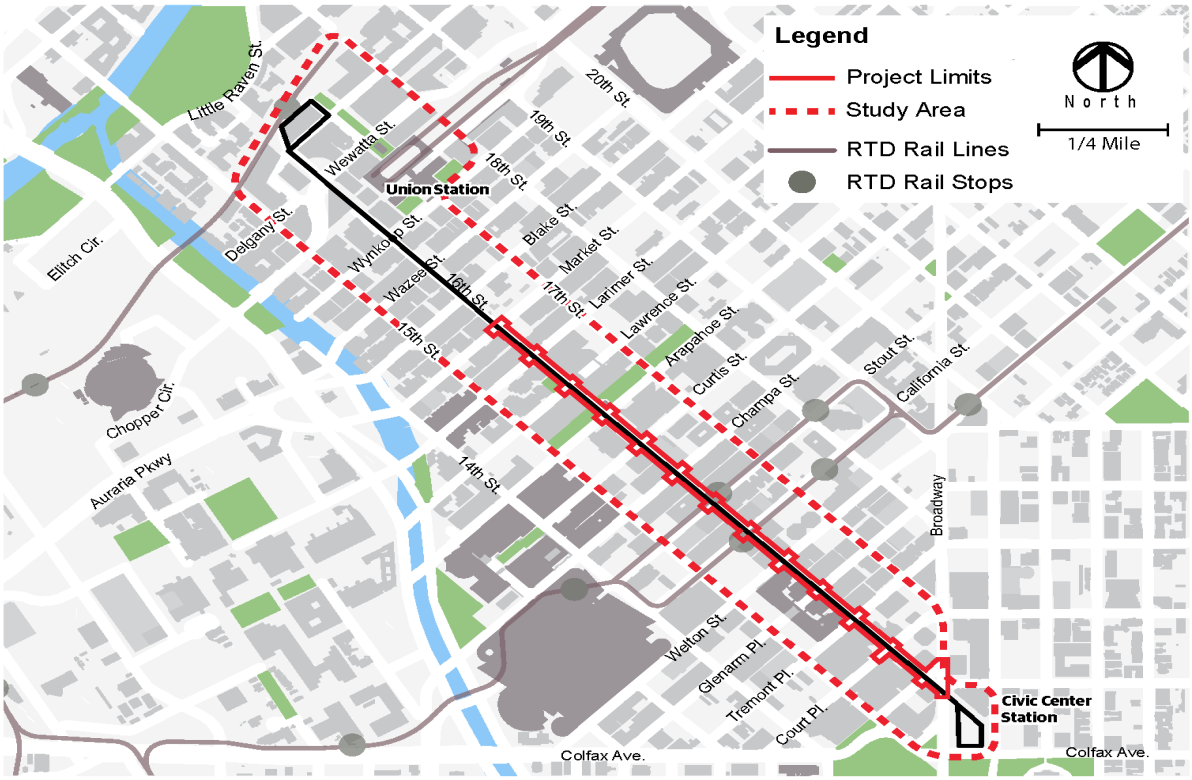
1.1 Project Description

The 16th Street Mall is Denver's busiest transit artery and premier public space; it is one of the longest pedestrian and transit malls in the world and is federally designated as a fixed guideway. The Mall was designed in the late 1970s as a transit and pedestrian mall by the renowned designers I.M. Pei & Partners and Hanna/OLIN. Construction of the Mall was completed in 1982, with an iconic diamond-patterned granite paver surface inspired by the design of a Navajo blanket and resembling a diamondback rattlesnake skin. Through the free bus service on the Mall, known as the Free MallRide, the Mall eliminated hundreds of bus trips from downtown Denver streets, reducing traffic congestion, and helped revitalize the downtown business environment with a unique pedestrian- and transit-oriented public space.

The original 12.5 blocks of the Mall, from Market Street to Broadway, are now over 35 years old and in need of repair and revitalization. Multiple recommendations and studies to address the Mall's infrastructure have been put forth over the past decade by the City and County of Denver (CCD), Regional Transportation District (RTD), Downtown Denver Partnership (DDP), and Downtown Denver Business Improvement District (BID), but none of them have resulted in a comprehensive program of improvements.

RTD, CCD and DDP, with funding support from the FTA, propose to implement, through the Project (undertaking), improvements to the Mall to address infrastructure, mobility, safety, and public use. The Project limits cover the length of the Mall from Market Street to Broadway, the 80-foot width of the Mall from building face to building face, and portions of cross streets intersecting the Mall (**Figure 1-1**).

Figure 1-1. Project Limits and Study Area



1.2 Project Purpose and Need

1.2.1 Purpose of the Undertaking

The purpose of the Project is to develop and implement a flexible and sustainable plan for the Mall to address deteriorating infrastructure, provide equitable and sufficient space for high-quality public gathering opportunities, improve pedestrian and vehicle safety, and continue reliable two-way transit shuttle service on the Mall while honoring the Mall's use and iconic design.

1.2.2 Need for the Undertaking

The Mall has failing and outdated infrastructure and limited space for safe and engaging public gathering activities. The deteriorating infrastructure causes safety hazards for both pedestrians and vehicles, and requires frequent and costly maintenance. The Mall attracts large numbers of people, but a low percentage of people stop to spend time on the Mall. The current configuration of the Mall creates a situation in which pedestrian corridors are constrained, creating frequent pedestrian and shuttle conflicts. The following improvements are needed:

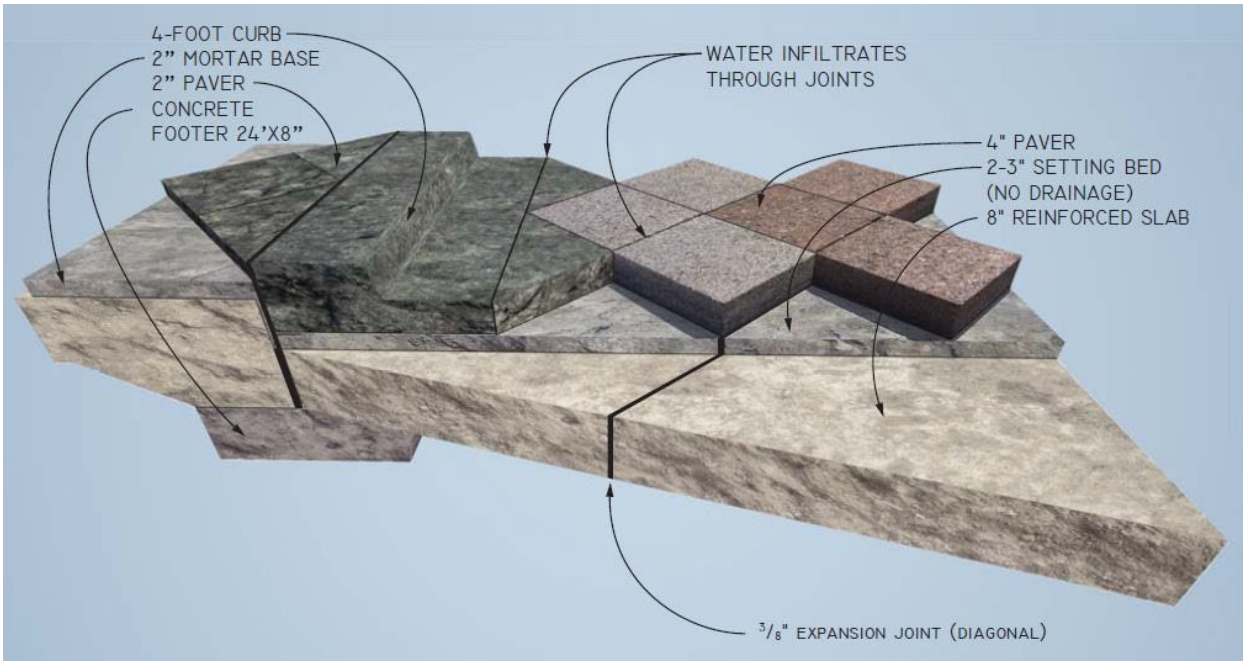
- Address deteriorating infrastructure to allow reasonable maintenance frequency and costs to businesses and taxpayers.
- Improve safety for pedestrians and vehicles.
- Maintain mobility for desired transit operations and for all users.
- Increase opportunities for public use of the Mall as an iconic civic space for leisure, commerce, and tourism.

1.2.2.1 Infrastructure

Most transportation projects are assumed to have a 30-year design life, which was reached in 2012 for the Mall. Improvements are needed to address the original design and construction of the Mall and its deteriorating infrastructure, which causes safety concerns, a high frequency of maintenance activities, and expense.

The transit way was constructed with 4-inch-thick granite pavers that were installed in a mortar setting bed over a series of concrete slabs supported by footers. The Mall's pedestrian area consists of 2-inch granite pavers in a mortar setting bed, which overlays a series of concrete slabs. **Figure 1-2** illustrates the design of the Mall's pavement system.

Figure 1-2. Existing Pavement System



The Mall's pavement system does not provide drainage for water that seeps into the mortar setting bed below the pavers; when moisture infiltrates below the surface of the pavers, it can be trapped there for an extended period of time. The mortar setting bed stays saturated with water for much of the year and is subjected to numerous freeze-thaw cycles. Each time water within the pavement system freezes, it expands and erodes the saturated material, causing severe deterioration over time. The deteriorated mortar setting beds do not provide the necessary support for the pavers, and pavers become dislodged and sometimes damaged, requiring replacement (Atkinson, 2015).

1.2.2.2 Safety

The original granite pavers had a flamed finish to provide traction for pedestrians and vehicles. To create a flamed finish, a high-intensity flame is applied to the surface of the stone, causing the stone crystals to pop and creating a highly textured, rough surface with no shine. Over time, dirt has filled the rough texture of the granite pavers, creating a smooth surface that presents a safety hazard for pedestrians and vehicles. When wet or icy, pedestrians slip on the slick surface, and the transit shuttles have difficulty gaining traction to start and stop.

Pedestrians and transit shuttles use the Mall very close to each other. The walkway, curb, and transit lanes are constructed of the same granite material and do not provide consistent visual indicators or obvious delineation between the pedestrian walkways and transit lanes. Current RTD standards and guidance recommend visually and physically separating walkways from transit lanes to minimize instances of pedestrians inadvertently walking into transit lanes (RTD, 2016a; NACTO, 2013; NACTO, 2016; FHWA, 2017).

The current configuration of the Mall, particularly in the median blocks, creates a condition where space is constrained for pedestrians during peak hours. Pedestrians may walk into the transit lanes or immediately adjacent to transit lanes, where they could be hit by shuttle bus mirrors or cause buses to stop sharply; this creates safety concerns for bus riders as well as

pedestrians. A review of existing pedestrian crash and RTD claims data reveals that five times more pedestrian/bus crashes occur in the existing median blocks than in the asymmetrical blocks (reference the *16th Street Mall – Pedestrian, Bicycle, and Transit Vehicle Crash Analysis* technical memorandum included in **Appendix B** of the EA). Conflicts between pedestrians and shuttles need to be reduced through a design of the Mall that incorporates current best practices for pedestrian and transit way safety.

1.2.2.3 Mobility

In the 1970s, downtown Denver was experiencing high rates of bus congestion, especially on 16th and 17th streets, which limited convenient access to those streets. In addition, the design of pedestrian areas was secondary, which discouraged pedestrian activity. The Mall was a joint solution put forth by the downtown Denver business community and RTD to reinvent 16th Street as a pedestrian destination and relieve bus congestion in downtown Denver (RTD, 1978). The Mall was designed to operate with a free transit shuttle bus service (called the Free MallRide) and transfer stations at each end (BID et al., 2010).

Sidewalks and transit ways provide and accommodate mobility on the Mall. The Free MallRide shuttle ridership is 39,000 riders each weekday, which is anticipated to increase to approximately 70,000 passengers per day by 2035 (RTD, 2017a and 2017b). The current capacity of the two 8-foot pedestrian walking areas on the median blocks is approximately 3,840 pedestrians per hour, while the current capacity of the 8- and 14-foot pedestrian walking areas on the asymmetrical blocks is approximately 5,280 pedestrians per hour (Gehl, 2016). The 8-foot pedestrian walking areas do not meet City and County of Denver (CCD) standards for downtown sidewalk width of 10 feet (CCD, 1993). During peak hours, the capacity is further reduced, as people gathering at Free MallRide bus stops obstruct the pedestrian walkways on the median blocks and narrow sides of the asymmetrical blocks.

Although the design of the Mall preceded the 1990 Americans with Disabilities Act (ADA), the Mall incorporates features of accessibility that are now required. Currently, furnishings and other elements (for example, fountains) in the median and the volume of pedestrian traffic at times makes access by people using wheelchairs difficult (BID et al., 2010). *A Discussion of Accessibility Issues for the 16th Street Mall Project* (MTC, 2010) provides an evaluation of existing conditions and notes, among other observations, that the medians present challenges for accessibility.

1.2.2.4 Public Use

Improvements are needed to provide a flexible configuration that allows for transit use and pedestrian circulation to safely and comfortably continue while providing adequate space for quality public gathering opportunities.

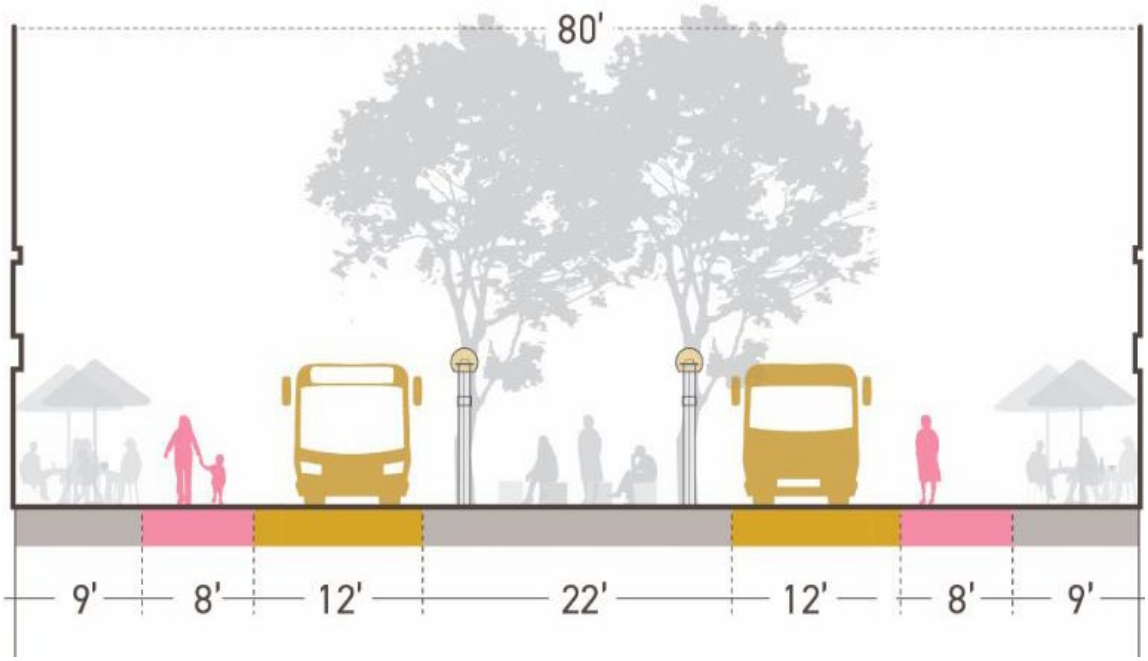
RTD completed an EA in 1978 and selected the Transitway/Mall Alternative based on the following criteria: (1) Provide more efficient bus service to city and suburban neighborhoods, (2) Lessen traffic congestion in downtown, and (3) Create a new pedestrian environment in the downtown, a place for people (RTD, 1978). The Mall opened in 1982. Today, the Mall is a diverse retail destination with a variety of retailers, hybrid retail and entertainment venues, drugstores, tourist-oriented shops, and a variety of restaurants all accessible via the Free MallRide. The Mall has become the spine of downtown Denver.

The CCD study *Downtown Denver 16th St Mall: Small Steps Towards Big Change* (Gehl, 2016) evaluated how people currently use the Mall and recommended steps to increase its use as a destination. The study found that only 1 percent of people moving through the Mall stop to spend time on the Mall on an average weekday; this number increases to 3 percent on weekends. The Mall needs to attract more people engaged in staying and gathering activities such as sitting, eating, and playing.

The study evaluated which conditions within the Mall's existing configuration increased the number of people spending time on the Mall by setting a baseline for Mall use without special programming, then experimenting with selected conditions and observing the results. Patio seating had the largest positive effect on people spending time on the Mall, followed by live music and elements such as interactive water zones and interactive art. Removable seating and other temporary installations provided additional invitations for people to stay on the Mall. The Mall's physical design needs to provide the space and multifunctionality to accommodate a variety of uses and installations for placemaking.

Within the median blocks, where transit lanes separate the public realm and pedestrian space into three separate zones, opportunities for safe and engaging public use and amenities are limited by space constraints. These blocks contain two 8-foot-wide pedestrian walking areas, two 9-foot-wide patio and gathering spaces, two 12-foot-wide transit lanes, and a 22-foot-wide median (**Figure 1-3**). The pedestrian spaces in these blocks are not wide enough or separate enough from the transit lanes to provide a comfortable public gathering experience.

Figure 1-3. Cross Section of Existing Median Blocks



The median is set apart from other pedestrian areas physically and by transit service, which isolates the space, restricts natural surveillance, and results in low ownership of the space by adjacent businesses and users; as a result, the space lacks consistent activation. The median space, while slightly larger than the sidewalks to the sides of the Mall, is too small to provide adequate and comfortable gathering space for pedestrian in between the transit lanes. The

space is underused, as people prefer to gather along the edges, and inherently back away from fast-moving objects like the buses (Gehl, 2016).

The design of the asymmetrical blocks is more conducive to quality public gathering spaces. Public gathering opportunities are greater on the wider side of the block, with its double row of trees and ample space for both walking and staying activities, than on the narrower side, which lacks trees and has less space for both walking and staying. The narrow side lacks the needed visual delineation between transit lanes and pedestrian zones.

Feedback from the public and stakeholders indicates a negative perception of safety on the Mall, with references to loiterers, panhandlers, and criminal activity. The negative perception of safety, lack of natural surveillance in medians, and lack of active edges (for example, building facades with activity and transparency) in some blocks inhibits positive public use of the Mall. Activating public space is essential to the perception of safety; when more people gather outside, the sense of safety increases and negative social behaviors decrease (Gehl, 2016).

1.2.3 Project Goals

Project goals were determined by meeting with agencies and stakeholders during Project scoping activities (including small group interviews, a stakeholder workshop, a meeting with historic preservation organizations, and a set of public open houses) and meetings with the Project Leadership Team. The following goals were developed:

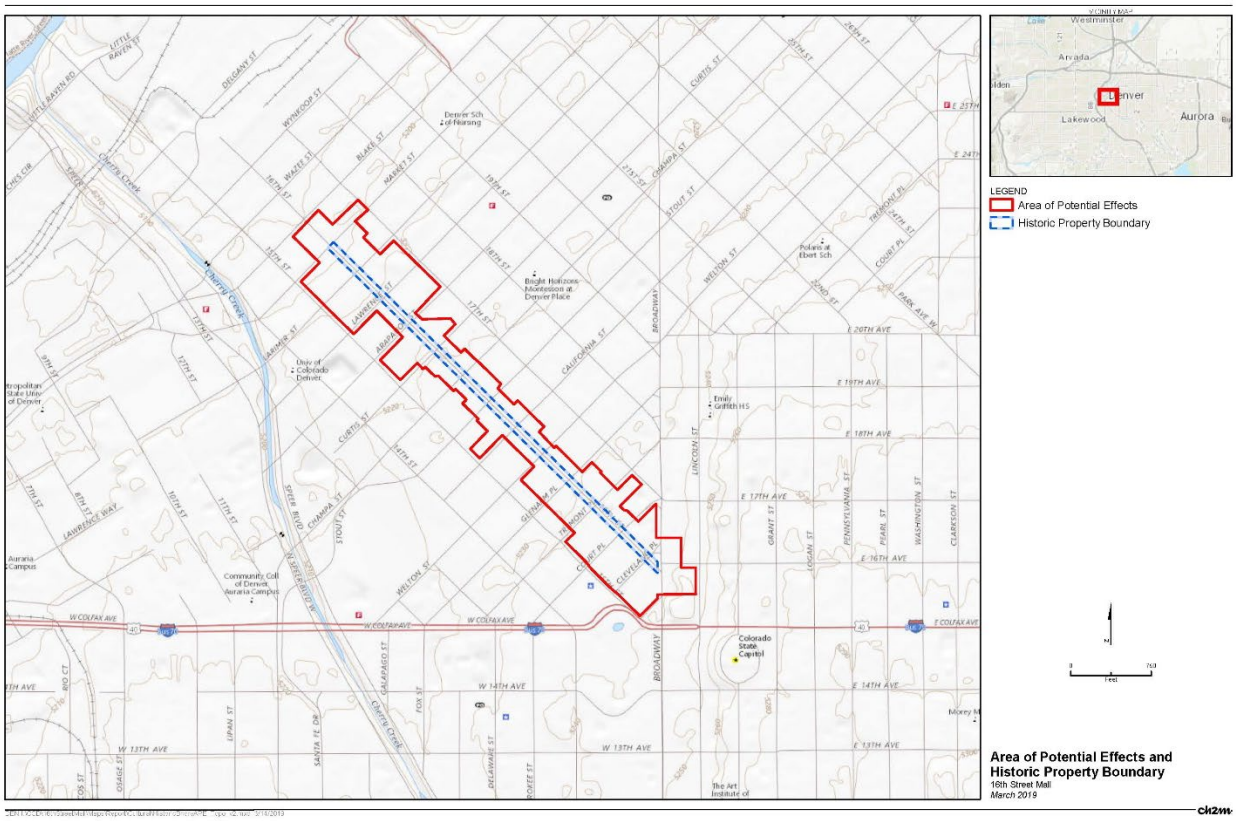
- Maintain and improve transit operations to provide convenient and efficient travel in downtown Denver, including the Free MallRide and Free MetroRide.
- Maintain and improve economic viability of businesses on the Mall and on adjacent streets.
- Provide a balance of amenities fronting properties on both sides of the Mall.
- Maintain and improve a sense of security on the Mall.
- Enhance the public image of the Mall as one of Denver's primary identity elements.
- Provide a flexible, dynamic space over time of day, season, and year.
- Provide a cost-effective solution over the total lifecycle of the Mall.
- Honor the Mall's design, building upon its character-defining features.

1.2.4 Area of Potential Effects

An APE is the area within which the direct and indirect effects of the Project may cause alterations to the character-defining features of historic properties. The Project APE was established in consultation with the State Historic Preservation Office (SHPO) through the Office of Archaeology and Historic Preservation (OAHP); consulting parties were identified starting in June 2017. The Project APE, which includes the 16th Street Mall from Market Street to Broadway and one parcel on each side of the corridor (**Figure 1-4)**, was discussed at the first consultation meeting on July 7, 2017, at the third consultation meeting on September 27, 2017; a revised APE at the meeting on November 11, 2017. The revised APE did not encompass any additional properties; parcels and property lines were updated based on a site visit and additional research. No objections were voiced at any of these meetings regarding the appropriateness of the APE nor the revised APE.

The APE includes 32 properties listed on or eligible for listing on the National Register of Historic Places (NRHP), including the Mall itself. **Section 5.0** discusses these properties in detail.

Figure 1-4. Area of Potential Effects and Boundary of the 16th Street Mall Historic Property



SECTION 2

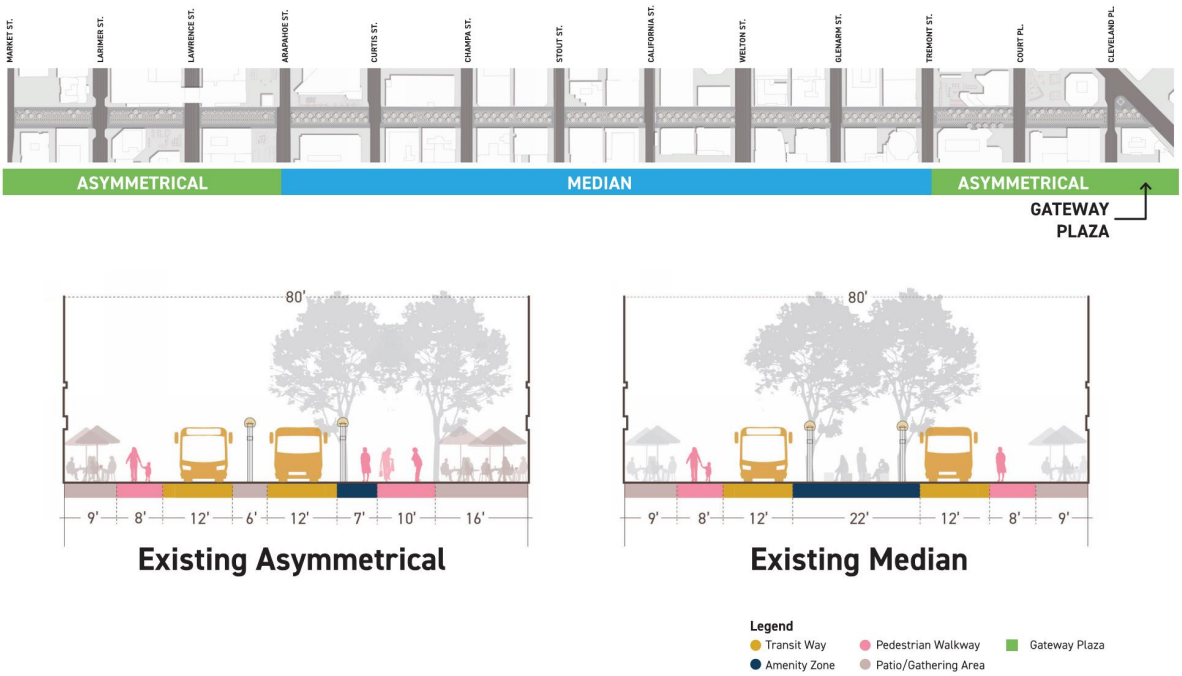
Project Alternatives

2.1 No Build Alternative

The No Build Alternative represents future conditions without the construction and operation of the Project. The No Build Alternative would maintain the existing alignment and configuration of the Mall (**Figure 2-1**), continue standard maintenance activities and targeted repairs (i.e., repairs to the pavement system and other infrastructure), and continue implementation of safety strategies, including the 2016 DDP *Downtown Security Action Plan*. CCD and RTD have an Intergovernmental Agreement (IGA) through 2022 regarding maintenance responsibilities for the Mall.

The No Build Alternative would not repair or upgrade the belowground utilities and infrastructure. The trees and tree boxes would not be replaced, so the condition of the trees would remain the same and there would be no plan for replacing trees that have died or been removed. Under the No Build Alternative, the granite pavers would continue to be replaced in an ad hoc manner as the need arose or replaced with asphalt or other materials. Because the underlying existing deteriorating infrastructure would not be updated, safety hazards for pedestrians and vehicles, and the frequent and costly maintenance would continue.

Figure 2-1. Existing Cross-section



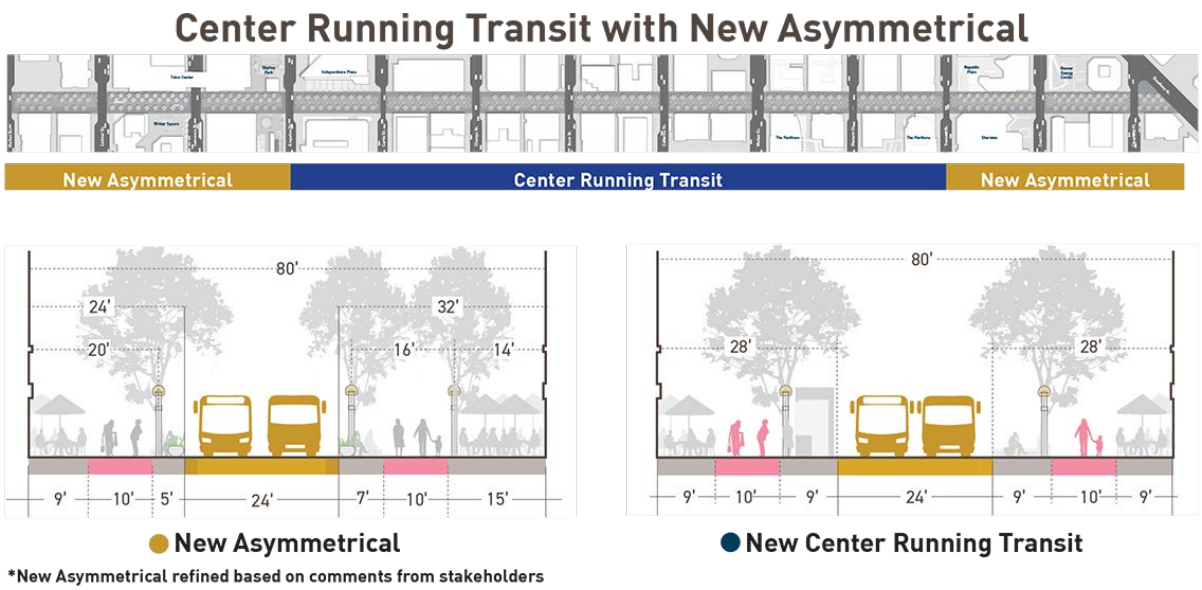
The No Build Alternative includes the current transportation system with the committed transportation improvements in the Denver Regional Council of Governments (DRCOG) *2018-2021 Regional Transportation Improvement Program* and *2040 Fiscally Constrained Regional Transportation Plan*.

The No Build Alternative does not meet the purpose and need for the Project but is retained as a basis for comparison of the environmental impacts of the Locally Preferred Alternative (LPA).

2.2 Locally Preferred Alternative

This section describes the LPA developed by RTD, CCD, and DDP, including capital improvements, transit operations, traffic operations, and construction activities. **Figure 2-2** illustrates the proposed alignments and delineates sidewalks and the transit way within the proposed alignments. **Attachment 1** contains a full corridor plan view of the LPA compared to the existing conditions. The LPA would maintain current and planned Free MallRide service levels on the Mall, per RTD's service plans and Denver's *Downtown Multimodal Access Plan* (CCD et al., 2005).

Figure 2-2. Locally Preferred Alternative Cross Section



2.2.1 Capital Improvements

This section describes the capital improvements that will comprise the LPA.

2.2.1.1 Alignments and Transitions

From Market Street to Arapahoe Street and from Tremont Street to Broadway, the alignment would be the new asymmetrical cross-section design (**Figure 2-2**). The new asymmetrical cross-section design removes the existing small strip with light fixtures from between the transit way lanes, pushes the existing two 12-foot transit way sections together into a single transit way comprising two adjacent 12-foot transit lanes, increases the size of the sidewalk on the narrow side of the cross section from 17 feet to 24 feet, and reduces the sidewalk on the wide side of the cross section from 33 feet to 32 feet. Each sidewalk would consist of

patio/gathering space, tree/amenity zone, and a minimum 10-foot-wide pedestrian walking area free of encroachments from elements such as furnishings, kiosks, and bus stops.

Between Arapahoe and Tremont streets, the alignment would be the center-running design (**Figure 2-2**), which places the two 12-foot transit ways together into a single transit way comprising two adjacent 12-foot transit lanes, without a median separating them. This center section has equal amounts of sidewalk space, 28 feet, on each side of the transit way, which would allow flexibility for programing the space in a manner that will allow more pedestrians to use it. Each sidewalk would consist of patio/gathering space and tree/amenity zone, and between them a minimum 10-foot-wide pedestrian walking area free of encroachments from elements such as furnishings, kiosks, and bus stops.

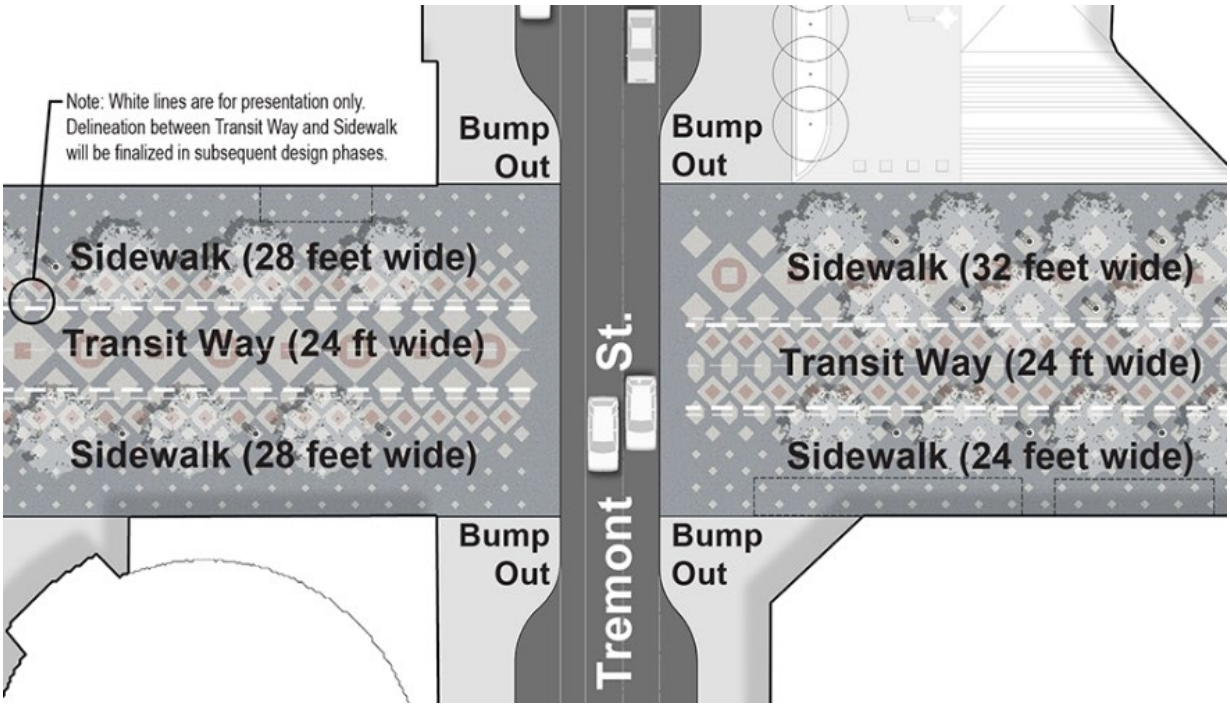
The LPA could be implemented with curbs, as it exists currently, or with a design option that implements the center-running and new asymmetrical cross-section designs without curbs. Constructing the LPA with curbs replicates the existing condition and is preferred for transit operations. Constructing the LPA without curbs provides a more flexible public space and is preferred for programming flexibility. With or without curbs, the paver surfaces and grade changes within pedestrian areas, the transit way, and roadway crossings will be compliant with ADA.

The LPA would maintain a beginning, middle, and end, for the Mall. Transitions between cross-section designs would occur at four locations on the Mall:

1. The western Project limits at Market Street
2. At Arapahoe Street, where the design changes from new asymmetrical to center running
3. At Tremont Street, where it changes back from center running to new asymmetrical
4. At the eastern Project limit at Broadway

At the Arapahoe and Tremont street transitions, the east- and westbound transit lanes would shift 4 feet; under existing conditions the eastbound transit way doesn't shift, and the westbound transit lane shifts 16 feet. At the Project limit transitions, the LPA would tie into the existing transit ways. At Tremont Street, the Project would transition to the existing conditions at Broadway. **Figure 2-3** illustrates the transition from the center-running transit lanes to the new asymmetrical transit lanes at Tremont Street.

Figure 2-3. 16th Street Mall Transit Lane Transition at Tremont Street



2.2.1.2 Pavement Materials and Pattern

The LPA would be implemented with granite pavers arranged to mimic the Mall's existing color and pattern in the transit way and pedestrian areas. The pavement pattern would retain the original I.M. Pei-designed 45-degree diagonal grid and the small, medium, and large diamond patterns in the same (or approximately the same) spatial relationships as the original design. The pattern can be implemented with or without curbs. Localized minor adjustments may be required during subsequent design phases to accommodate unforeseen design challenges, accommodate infrastructure needs, or ADA compliance.

The granite pavers will be arranged and secured on new concrete sub-base slabs. The existing concrete sub-base slabs will be removed and replaced, complete with a new system to drain moisture that penetrates the surface.

2.2.1.3 Trees and Tree Infrastructure

The LPA will remove the existing trees and replace them with a variety of tree species that fit within the context of the design and thrive in Colorado's climate. Tree placement will honor the existing character of the Mall by retaining geometric and spatial relationships. Tree species would be selected using current CCD forestry requirements and similar criteria to those used to select tree species during design of the original Mall.

The LPA would remove the existing tree boxes with 300-cubic-foot soil capacity and replace them with new suspended tree infrastructure that provides 1,000 cubic feet of soil volume, such as a silva cell or equivalent system. Existing landscape irrigation systems would be removed and replaced.

2.2.1.4 Utilities and Technologies of the Future

The LPA will upsize electrical conduits and wiring belowground to allow for expanded capacity and will remove and replace landscape irrigation and drainage infrastructure. The LPA will also provide the opportunity to install fiber optic and/or other underground telecommunications

utilities to meet current and future demands. Wi-fi or other next-generation communication systems may be installed aboveground, to allow for future technologies, but not as a part of this undertaking.

The surface and sub-base drainage system will discharge water to inlets connected to the local storm sewer; water quality treatment features will be installed to remove pollutants and sediment from the water.

Existing underground utilities (e.g., storm sewer, sanitary sewer, water mains, natural gas, and steam) will be evaluated in subsequent design phases and in coordination with utility companies. At that phase, it may be determined that these utilities should be replaced, upgraded, or left in place.

2.2.1.5 Safety and Security

The LPA will include delineating features between the transit way and the pedestrian areas on the Mall, including the placement of trees, lights, and other furnishings (in the tree/amenity zone) between pedestrian walking areas and transit lanes, consistent with RTD standards (RTD, 2016a) and guidance for shared streets (NACTO, 2013; NACTO, 2016; FHWA, 2017). The following additional delineating features may also be considered:

- Curbs
- Visual delineations such as in-pavement lighting or different color materials
- A strip of textured surface, detectable to the visually impaired
- Bollards
- Other delineating features that would not impede movement across the Mall

The new granite pavers would achieve a minimum coefficient of friction—to be determined by RTD in a subsequent design phase—to reduce incidents related to slipping and sliding of both pedestrians and vehicles. Grooved surface material in the transit lanes at bus stops to assist buses with traction in inclement weather would also be considered.

Crime Prevention Through Environmental Design (CPTED) principles promote the design, maintenance, and use of the built environment to enhance quality of life and to reduce both the incidence and fear of crime.

2.2.1.6 Lighting, Signage, and Furnishings

The existing pole lighting on the Mall was replicated and replaced in 2016. The LPA would reuse the existing lighting as well as provide additional lighting, as needed. New pole lighting fixtures would replicate the existing pole light fixtures. Other types of light fixtures could be incorporated into the design using CPTED principles.

The LPA will incorporate signage, furnishings, and water features; the design and location of these features will be ADA-compliant and determined during subsequent design phases.

2.2.1.7 Changes to Cross Streets

Bulb-outs would be implemented on cross streets to calm traffic and reduce the crossing distance for pedestrians on those streets, except for streets with space reserved for bicycle or light rail transit (LRT) infrastructure. The elimination of the median would consolidate pedestrian crossings to two locations at each intersection. Details potential pedestrian crossing

controls, such as crosswalks and crossing signals, would be decided during subsequent design phases.

2.2.1.8 Funding and Intergovernmental Agreements

The LPA would be funded through a cooperation between CCD and RTD. CCD would use Downtown Urban Renewal Authority (DURA) Tax Incremental Financing (TIF) funds, as well as funds from the recently passed Denver 2017 General Obligation (GO) Bonds. The DURA TIF Board of Commissioners approves the use of DURA TIF funds, and those funds must be used on downtown renewal projects. The use of Denver 2017 GO Bonds was recommended in the *2017 GO Bond – Mayor Recommended Package of Investments* (CCD, 2017b). RTD has two federally funded grants to rehabilitate the Mall, which it intends to contribute to the Project. This transfer needs the approval of FTA, DRCOG and the RTD Board, and an IGA between CCD and RTD. The use of FTA grant funds requires FTA and NEPA approval as well as NHPA Section 106 consultation.

Ongoing maintenance of the transit way will be funded through an IGA between CCD and RTD. The level of maintenance is expected to be significantly reduced from existing levels. Funding for maintenance of pedestrian areas will continue to be provided through an IGA between CCD and DDP.

2.2.2 Transit Operations

The LPA would accommodate existing and planned Free MallRide transit operations, LRT operations, and connecting transit services. Visual or textured delineation between transit lanes will be provided during subsequent design phases. Operations for the Free MallRide and connecting transit services would not change as a result of implementing the LPA (reference the *Transit Operations* technical memorandum in **Appendix B** of the EA for additional detail about existing and planned transit operations).

2.2.3 Traffic Operations

Implementation of the LPA would not change long-term operational characteristics of the cross streets or permitted vehicles on the Mall. Bulb-outs would calm traffic in cross streets but would not change traffic operations on the cross streets. Within the cross streets capacity, lane width, and traffic controls and timing would follow the same concept of operations.

2.2.4 Construction Activities

This section describes important aspects of the construction process required to implement the LPA within the proposed construction period.

2.2.4.1 Timeline, Phasing, and Access

The LPA would be built using the Construction Manager/General Contractor (CM/GC) project delivery process. During the CM/GC process, a contractor is selected during design of the project to provide input on project construction. Development of an innovative Construction Mitigation Plan (CMP) would be a critical criterion for judging the selection of the successful constructor.

Construction of the LPA is anticipated to take 2.5 to 4 years. Major construction activities on each block would last approximately 8 to 12 months; however, minor construction activities or

unforeseen utility-related construction activities may last longer. Construction would generally occur in two- to six- block segments and each segment would require multiple construction phases.

2.2.4.2 Staging

The selection of staging sites will be decided in subsequent design phases. The process for deciding a construction staging site or sites will include applicable stakeholders (i.e., Project partners, agencies, and affected landowners and business owners).

2.2.4.3 Construction Activities

Construction activities will generally include, and require equipment for, deconstruction, construction of temporary facilities for maintenance of access and safety, construction of permanent subsurface features, and construction of permanent surface, aboveground communications, lighting, and landscape features. It is anticipated that night work may be performed, and 24-hour construction may be required in some cases to accommodate the construction schedule, maintenance of access, or related stakeholder requirements.

Access to the construction site will be controlled through appropriate standards set forth by the Colorado Department of Public Health and Environment, CCD Occupational Safety and Health Administration, the ADA, the Manual on Uniform Traffic Control Devices (FHWA, 2009), and the National Fire Protection Association Standard 130 for Fixed Guideway Transit and Passenger Rail Systems, and by other applicable regulatory requirements. Haul routes to and from the construction site or staging sites will be determined during subsequent design phases. Existing haul routes will be used to the extent practicable.

SECTION 3

Regulatory Context

The term "cultural resources" encompasses properties of the built environment, archeological sites and artifacts, and Native American sites, artifacts, and cultural properties. Native American cultural resources may include human skeletal remains, funerary items, sacred items, and objects of cultural patrimony. Native American traditional resource procurement areas and culturally important regional landscapes are also considered Native American cultural resources and may be traditional cultural properties if they are places that define tribal identity and meet NRHP eligibility criteria.

Archeological sites are places where past peoples left physical evidence of their occupation. Sites may include ruins and foundations of historic-era buildings and structures. Alternatively, they may be surface ruins or underground deposits of Native American occupation debris such as artifacts, food remains (shells and bones), and former dwelling structures. Important archeological sites can qualify as historic properties.

Other types of cultural resources include cultural institutions, lifeways, culturally valued viewsheds, cultural landscapes, places of cultural association, and other valued places and social institutions. Under the 1992 NHPA amendments, these types of resources can be eligible for listing in the NRHP because of their association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in continuing its cultural identity.

3.1 Federal Regulations

There are various federal laws, regulations, and executive orders that pertain to the identification, treatment, and significance of cultural resources. Federal projects that affect cultural resources are subject to the following primary federal regulations:

National Environmental Policy Act of 1969 (83 Stat 852; 42 United States Code [U.S.C.] 4321). The responsible federal agency for this Project, the FTA, (with support from RTD, CCD, and DDP) is charged with ensuring compliance with the Act. NEPA requires that all major actions sponsored, funded, permitted, or approved by federal agencies (generally referred to as federal undertakings) undergo planning to ensure that environmental considerations, such as effects on cultural resources, are given due weight in decision-making. The federal implementing regulations for NEPA are in 40 *Code of Federal Regulations* [CFR] Parts 1500 through 1508 (*Council on Environmental Quality* [CEQA]); regulations for FTA actions are in 23 CFR 771. The NEPA regulations include sections on urban quality, historic and cultural resources, and the design of the built environment (40 CFR 1502.16(g)).

National Historic Preservation Act of 1966 (80 Stat 915; 16 U.S.C. 470). The NHPA was passed in 1966 as a reflection of the importance of those resources to our national, regional, and local culture. The primary agency for enforcement of this act is SHPO, which implements the regulations (36 CFR 800) issued by the Advisory Council on Historic Preservation (ACHP). When a project receives federal funding or permits, the possible impacts of the project on historic properties must be reviewed. Section 106 of the NHPA requires federal agencies to consider the effects of actions they fund or approve on any district, site, building, structure, or object that is listed in or eligible for listing in the National Register of Historic Places (NRHP).

The regulations implementing Section 106 are codified at 36 CFR 800. The Section 106 review process involves four steps, as follows:

1. Initiate the Section 106 process by establishing the undertaking, developing a plan for public involvement, and identifying other consulting parties.
2. Identify cultural resources within an APE and evaluate their eligibility for inclusion in the NRHP.
3. Assess adverse effects by applying the criteria of adverse effect on historic properties.
4. Resolve adverse effects by consulting with the SHPO and other agencies and consulting parties, including the ACHP, if necessary, to develop an agreement that addresses the treatment of historic properties.

The implementing regulations of the NHPA, 6 CFR 800.16(l)(1), define historic properties as any prehistoric or historic district, site, building, structure, or object included in or eligible for the NRHP (36 CFR 800.16). Under the NHPA, a property is significant if it meets the NRHP criteria listed in 36 CFR 60.4. In addition to significance, a property must retain enough integrity to convey that significance. There are seven aspects of integrity: setting, location, feeling, association, materials, design, and workmanship. Section 106 requires federal agencies and others to consider the effects of proposed projects on historic properties and to provide the ACHP and SHPO with a reasonable opportunity to comment on any undertaking that would adversely affect properties listed in or eligible for listing in the NRHP. Section 106 encourages maximum cooperation with NEPA. This cultural resources report meets the requirements of both NEPA and Section 106 of the NHPA.

Department of Transportation Act of 1966 (49 U.S.C. 303). For transportation-related projects, Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. 303) and its implementing regulations (23 CFR 774) is another federal regulation that protects historic properties. Section 4(f) resources include any significant publicly owned park, recreation area, or wildlife refuge, or any publicly or privately owned historic property listed in, or eligible for listing in, the NRHP. Section 4(f) applies to all projects that require approval by an agency of the U.S. Department of Transportation, including FTA. Under Section 4(f), FTA and other Department of Transportation agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historic properties unless there is no feasible and prudent alternative to the use of land, and the project includes all possible planning to minimize harm to the property. The Section 4(f) evaluation of this Project is a chapter in the EA.

3.2 Section 106 Consultation

The Section 106 consultation process for this undertaking was initiated in June 2017. The FTA and RTD had six consulting party meetings between June 2017 and February 2018 (inclusive) to discuss the definition of the Project APE; historic properties identified within the APE; the alternatives analysis; the design, materials, and trees; OAHP Form 1403, which describes the Mall's NRHP-eligibility, character-defining features and significance (**Attachment 2**); and the effects to the identified historic properties from the LPA. The consultation process is ongoing.

SHPO has not had an opportunity to concur with FTA's finding of effects, but the effects have been discussed with the consulting parties at the consulting party meetings. Upcoming

meetings will discuss appropriate mitigation measures to address the adverse effect on the Mall historic property. Resolution of the adverse effect will be stipulated in an Memorandum of Agreement (MOA) to be developed among the consulting parties and the federal agency. The MOA will be executed prior to completion of the NEPA agreement document.

These are the organizations participating in the Section 106 consultation process as consulting parties.

- Colorado SHPO
- Historic Denver
- National Trust for Historic Preservation
- Federal Transit Administration
- Regional Transportation District
- City and County of Denver
- Downtown Denver Partnership
- Lower Downtown District
- Colorado Preservation, Inc.
- Landmarks Preservation, Community Planning and Development
- The OLIN Studio
- Cheyenne and Arapahoe Tribes

Representatives of the Cheyenne and Arapaho Tribes, Comanche Nation, and Apache Tribe have been invited to participate and receive meeting notifications, materials, and summaries. A representative of the Cheyenne and Arapaho Tribes requested to be copied on all consultation materials, but is not actively participating in the consultation. No responses were received from the other tribes.

Attachment 3 contains a summary of the Section 106 consultation process and correspondence through February 27, 2018.

SECTION 4

Methodology

4.1 Records Search

A review of previous studies and nominations, maps, aerial photographs, and historical photographs provided an understanding of the history of the 16th Street Mall. No additional field investigations were conducted for this Project.

The Project area is covered entirely with structures and roadways. Construction activities would take place in areas previously disturbed during construction of the Mall in 1982.

There is an identified historic archaeological site partially within the APE: Site 5DV.9217.1, a former tramway line, begins at E. 16th Avenue and Broadway and is within the APE from E. 16th Avenue to Cleveland Place, but is outside the limits of construction for this Project. The entire Denver Tramway Trolley system is eligible for listing in the NRHP under Criterion A and B. It played an important role in early public transit in Denver and facilitated the development of more distant neighborhoods by giving residents a way to travel between work, home, and recreational opportunities. The South Broadway line was the first electrified line to operate in Denver. It continued in operation from December 1889 to June 1950 when South Broadway was paved over for vehicular traffic and has been buried under the road since then. There would be no direct or indirect impacts to this resource from the undertaking because it is outside the limits of construction.

The vast majority of the properties within the APE have been previously surveyed. However, some of those surveys were completed in the 1980s and 1990s, which indicates a need to reevaluate their NRHP eligibility because of the passage of time since they were last evaluated. RTD met with the OAHP in January 2018 to discuss how to treat the properties within the APE that will not be directly impacted by the LPA. FTA and RTD proposed treating properties as NRHP-eligible in the following cases:

- Assessment status of Needs Data or No Assessment – Built before 1975
- Assessment status of Not Eligible – Field surveyed before 2015, built before 1975
- Assessment status of Noncontributing – Field surveyed before 2000, built before 1975

For the purposes of this undertaking, the properties that meet these criteria are being considered NRHP-eligible for the effects analysis.

4.2 National Register of Historic Places Eligibility

To qualify for listing in the NRHP, a property must have historic significance and integrity, and generally be at least 50 years old; certain properties are exempt from the 50-year rule if they possess exceptional importance. Historic significance may be present in districts, sites, buildings, structures, and objects that possess integrity, which is defined as the ability of a property to convey its significance. The NRHP recognizes seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. A property must retain sufficient integrity to demonstrate significance in at least one of the following areas:

A. Association with events that have made a significant contribution to the broad patterns of our history;

B. Association with the lives of persons significant in our past;

C. Embodiment of the distinctive characteristics of a type, period, or method of construction or representative of the work of a master, or possessing high artistic value, or representative of a significant and distinguishable entity whose components may lack individual distinction;

D. Yielding, or likely to yield, information important in prehistory or history.

Historic significance is the importance of a property to a community, state, or the nation. In addition to the previously described criteria, significance is defined by the area of history in which the property made important contributions and by the period of time during which these contributions were.

For transportation projects that could impact cultural resources, Section 4(f) of the Department of Transportation Act of 1966 also protects historic resources. Section 4(f) applies to all projects that require approval by an agency of the U.S. Department of Transportation. Section 4(f) resources include any publicly owned park, recreation area, wildlife refuge, or publicly or privately owned historic site. The Section 4(f) evaluation is provided in **Section 5** of the EA.

4.3 Effects Analysis Methods

Section 106 of the NHPA requires federal agencies to take into account the effects a proposed undertaking may have on historic properties. The NHPA's implementing regulations (36 CFR 800) include specific criteria for adverse effects that must be applied to historic properties that may be affected by federal undertakings. When considering the potential for adverse effects, all reasonably foreseeable impacts must be taken into account, including direct, indirect, and cumulative.

The ACHP has developed regulations that guide federal agencies on how to assess effects of their undertakings on historic properties and mitigate those effects, if necessary. Effects to historic properties are defined in the following ways:

- **No Historic Properties Affected:** Either no historic properties are present, or there is no effect of any kind, neither harmful nor beneficial, on the historic properties.
- **No Adverse Effect:** There is an effect, but the effect is not harmful to those characteristics that qualify the property for inclusion in the NRHP.
- **Adverse Effect:** There is an effect, and that effect diminishes the qualities of significance that qualify the property for inclusion in the NRHP.

An adverse effect is found when an undertaking may alter any characteristic of a historic property that qualifies the property for inclusion in the NRHP in a manner that would diminish the integrity of the property. This includes diminishing the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time or be further removed in distance, or effects that may be cumulative.

Examples of adverse effects to historic properties outlined in 36 CFR 800.5 include, but are not limited to, the following:

1. Physical destruction of, or damage to, all or part of the property;
2. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous materials remediation, and provision of handicapped access, that is not consistent with the Secretary of Interior's standards for the treatment of historic properties (36 CFR 68) and applicable guidelines;
3. Removal of the property from its historic location;
4. Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
5. Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
6. Neglect of a property which causes deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to a [Native American] or native Hawaiian organization; and
7. Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

SECTION 5

Identified Historic Properties

Section 5.1 presents a brief historical context of the downtown area, primarily of the 16th Street Mall. **Section 5.2** provides a listing of the historic properties within the APE and a detailed description of the 16th Street Mall, its NRHP eligibility, significance, and character-defining features.

5.1 Historical Context

Properties dating from the early twentieth century were present when the Mall was installed in the 1980s. The downtown commercial area started to decline by the 1960s and 1970s as a result of population shifts to suburban settings, new trends in retail, and the rise of the automobile. Developers started to create large-scale shopping plazas on readily available land near new suburban tracts, reducing the importance and draw of a downtown commercial corridor. By the 1970s, at least 15 different shopping centers existed in the Denver area outside of the downtown core. As Denver-area residents relied more on the automobile, city streets became more congested and polluted, deterring downtown business growth and pedestrian use (Denver Partnership, Inc. and DRCOG, 1982).

In the 1970s, 16th Street was a two-way vehicular public street with busses and vehicular traffic (**Figure 5-1**), similar to the current 17th and 18th streets. The corridor was lined with mostly early twentieth-century, midsize structures (of 2 to 10 stories) with residential and commercial uses. There were also some mid-century modern buildings designed and built the 1960s and early 1970s.

Figure 5-1. 1977 Conditions on 16th Street

Source: RTD, 1977-1979

In the 1970s, city leaders, through federal assistance from the Urban Mass Transportation Administration (UMTA [known after 1991 as the FTA]), sought to disrupt this trend and revitalize the 16th Street corridor through addressing three major concerns: downtown blight, transportation, and noise/air pollution. The 16th Street Mall's distinctive design and unified concept, pedestrian and transit uses, and electric and diesel-powered bus-fleet addressed these issues, providing a resurgence in the area that was celebrated as a success almost immediately following its opening. The 16th Street Mall sparked not only a noticeable economic boom in the area, the transformed corridor fostered a civic spirit previously diminished by post-World War II transportation and development trends (Denver Partnership, Inc. and DRCOG, 1982).

By the early 1970s, cities across the United States initiated similar urban renewal projects like the 16th Street Mall, renovating under-used and decayed urban spaces with new commercial, pedestrian, civic, and transit purposes (McKnight et. al, 2010). Decorative landscaping, hardscape features, and restricted automobile use were often cornerstones of these projects, typically completed in a Modern-style aesthetic (McKnight et. al, 2010). The Fulton Mall in Fresno, California (completed in 1964) is one of the earliest examples, as are the Portland (Oregon) Transit Mall (completed in 1977), Nicollet Mall in Minneapolis (completed in 1968), and the Chestnut Street Transitway in Philadelphia (completed in 1976) (Judge, 2013). These projects also received federal assistance through agencies like UMTA (McKnight et. al, 2010; Judge, 2013).

During the planning of the 16th Street Mall Project, the Project team was admittedly influenced by the eight-block Nicollet Mall, which had a Modern-inspired design and a public bus component and sought to improve a fledging business district (Denver Partnership, Inc. and DRCOG, 1982). To guide the 16th Street Mall project, designers traveled to Minneapolis and cities with similar projects, to meet with business leaders, transportation experts, and elected officials (Denver Partnership, Inc. and DRCOG, 1982).

Denver leaders, downtown merchants, and the RTD considered numerous plans and solutions to the post-World War II decline of downtown business and recreation, loss of longtime streetcar public transportation once centered on 16th Street, and the simultaneous rise of automobile congestion on Denver's city streets. Following popular trends but also lessons of what worked and did not work in other cities with similar challenges in the 1960s and 1970s, CCD, business groups such as the 1970s Sixteenth Street Mall Corporation (1973–1974), RTD, and federal planners decided to convert the city's longtime downtown retail-commercial street to a pedestrian mall with frequent and free transit buses.

By 1977, RTD's review of design proposals resulted in commissioning the New York architectural firm of I.M. Pei & Partners, teamed with Philadelphia landscape architecture consultant Laurie Olin of Hanna/OLIN and ultimately the Denver landscape architecture firm of Phillip E. Flores Associates, Inc. (RTD, 1977-79; I.M. Pei & Partners, 1977). Paving material is called out in the original planning document as the "single element" that would "establish the character of the mall," and is one of the primary character-defining features of the Mall (I.M. Pei & Partners, 1977).

As summarized in *The Transitway/Mall: A Transportation Project in the Central Business District of Metropolitan Denver*, the goals of the project were to "lessen traffic congestion" in downtown Denver, "provide more efficient bus service" to Denver's downtown and suburban neighborhoods, and to "create a new pedestrian environment in the downtown – a place for people" (I.M. Pei & Partners, 1977).

The design concept took into consideration the existing scale of the street, with its variety of visual elements, buildings sizes and uses, and unique interest of the street. The challenge for the designers was to "create a unifying theme and common identity for the street, while protecting its distinctive personality" (I.M. Pei & Partners, 1977). The designers believed that landscaping, in particular, trees, would create the desired unifying theme as well as provide physical protection from the elements: "The location of trees is crucial" (I.M. Pei & Partners, 1977). Thus, the design placed them in the center, diagonally spaced, 32 feet apart so as not to block accessibility or visibility of the structures lining the mall and to maintain the visibility and unique visual qualities of the exiting street. The sidewalks were widened and considered quasi-private spaces that were essentially adjuncts to the shops lining the street. The transit lanes were physically depressed from the sidewalks, but visually cohesive with the pavement pattern. The designers wanted to define the vehicular lanes for safety reasons, but also to make this definition in the least visually obtrusive way.

With its benches, fountains and other amenities, the design intentionally created a framework and a setting for both present planned uses and for the future. "Ample space is provided for sidewalk cafes, kiosks, vending carts, and displays which can evolve into permanent elements or change as different needs emerge" (I.M. Pei & Partners, 1977).

OLIN and Pei's principal designer, Henry Cobb, discussed a design approach of Southwestern geometric patterns including Navajo blankets with polychrome diamond motifs. While still discussing the final design, OLIN visited a souvenir shop along 16th Street Mall and encountered trouser belts decorated with diamondback rattlesnake skins. From those inspirations, the architects and landscape architects crafted the Mall's overall design, precisely interwoven within three shades of granite pavers and unified by the tree plantings, and light standards. Signage, planters, street furniture (e.g., benches and shelters), fountains, banners and other moveable objects (such as mailboxes, phone boxes, and trash receptacles) were part of the overall plan and were given a uniform design and placed along the street in a planned pattern to blend with the rest of the mall's design features.

The tree selection process was extensive and began with the evaluation of 72 species, based on criteria created by the design team; among them, "height and diameter, trunk, branch, leaf and root form, shade characteristics, sun, water and maintenance needs, disease and insect susceptibility, wind and pollution tolerance, availability and cost" (I.M. Pei & Partners, 1977). Based on their evaluation, the team selected the honey locust for the center blocks and red oak for the ends.

Following general plans and public input throughout the 1970s (Sixteenth Street Mall Corporation, 1973–1974; RTD, 1977–1979), construction began in early 1981 (**Figure 5-2**) based on the approved 1980 design from the architects/landscape architects team (Historic Denver, Inc., 2012a). Funding of $76 million came from UMTA and RTD, operator of the Mall buses (Marritz, 2014). The project began on the northwestern end at Market Street and proceeded southeast in increments along the entire 80-foot-wide 16th Street right-of-way. The design cross section specified a transit way concrete base sloping to each curb from an apex centered between the transit lanes (I.M. Pei & Partners, 1980).

Figure 5-2. Overview of Block Design Used on 16th Street Mall, 1981

Source: Photograph courtesy of the Denver Post (2012).

Subsequent maintenance and replacement of the granite pavers indicated the concrete base was ultimately not built with slopes, or with inadequate slopes and disposition of surface water that permeates into the base through deteriorated paver joints (Harvey, 2015).

Because of the narrow roadway, the placement of the trees into the specially designed, irrigated, and drained concrete root chambers under the Mall surfaces presented challenges, especially when completed and paved to match the continuous pavement of the transit lanes and sidewalks (Historic Denver, Inc., 2012b). Construction concluded with a public dedication attended by 200,000 on October 4, 1982.

Following the Mall's completion in October 1982 (**Figure 5-3**), the project won the University of Colorado's 1983 "Honor Award for Excellence in Urban Design," the Associated Landscape Contractors of America's 1984 "Environmental Improvement Award of Distinction" (Historic Denver, Inc., 2012a), and the American Society of Landscape Architects' 1985 "Professional Award, Design Category" (Cultural Landscape Foundation, 2009). The Urban Land Institute (ULI) in 2008 named the Mall "public art of the highest international quality" (ULI, 2008). Henry Cobb is now a Fellow of the American Institute of Architects; Laurie Olin is a Fellow of the American Society of Landscape Architects and recognized as a "Pioneer" by the Cultural Landscape Foundation (2009).

Figure 5-3. The 16th Street Mall, 1987, Facing Southeast

Source: Photograph courtesy of the Denver Post (2012).

Originally, the transit way vehicles crossed Broadway and had a turnaround area in the Civic Center between the Concourse Level (lower level) and the Plaza Level (upper level, which lead to the nearby government offices). This turnaround area has since been removed and is not part of the historic property.

RTD separately contracted designs and construction for its Civic Center Transfer Facility (later named Civic Center Station) as the southeastern Mall bus terminal, and the Northwest Transfer Facility (later named Market Street Station) as the northwestern terminal, including Mall bus drop off and turnaround in the block between Market and Blake streets. The Civic Center Station was a part of the I.M. Pei design, but is no longer extant. Following removal of the 16th Street viaduct across the Union Station railyard, RTD and FTA extended the 16th Street transit way from Blake Street to the northern side of Union Station and the new LRT terminal there. After 2010, that transit way and LRT terminal underwent further reconfiguration to their current services north of the intersection of 16th Street and Chestnut Place in the former Union Station railyard. RTD, with FTA assistance, performs continual maintenance on the transit way, including replacing broken granite pavers and special units.

5.2 Historic Properties

Thirty-three historic properties have been identified within the project APE, one of which is the 16th Street Mall itself (**Attachment 2**, Form 1403). **Table 5-1** lists the historic properties and their NRHP status. **Attachment 4** contains a map book showing the locations of the historic properties within the APE. **Attachment 5** contains an expanded table with additional information on each property.

Table 5-1. Historic Properties within Area of Potential Effects

ID No.	Historic Property Name	Address	NRHP Eligibility
5DV.47	Lower Downtown Historic District	Multiple	NRHP-eligible
5DV.47.15	Waters Building – Market Center	1642 - 1644 Market Street	Contributes to Lower Downtown Historic District
5DV.47.37	Hitchings Block	1620 Market Street	Contributes to Lower Downtown Historic District
5DV.47.7	Liebhardt-Linder Building – Market Center	1624 Market Street	Contributes to Lower Downtown Historic District
5DV.47.96	McCrary Block – Market Center	1628 Market Street	Contributes to Lower Downtown Historic District
5DV.500	Steel Building; Fontius Building; Sage Building	1555 Welton; 600 16th Street	Listed on NRHP
5DV.5297	Liebhardt Building; Cottrell Clothing Company	601 16th Street	Listed on NRHP
5DV.118	Daniels & Fisher Tower	1101 16th Street; 1601 Arapahoe Street	Listed on NRHP
5DV.135	Denver Dry Goods Company Building	702 16th Street; California Street; and 16th Street	Listed on NRHP
5DV.136	Masonic Temple Building	1614 Welton Street, 535 16th Street	Listed on NRHP
5DV.139	Kittredge Building	511 16th Street	Listed on NRHP
5DV.142	A.C. Foster Building; University Building	910-918 16th Street	Listed on NRHP
5DV.1913	Joslin Dry Goods Company Building; Tritch Building	934-938 16th Street	Listed on NRHP
5DV.494	A.T. Lewis and Son Department Store; Holtzman and Appel Block	800-816 16th Street	Listed on NRHP
5DV.496	Neusteter Building	720-726 16th Street	Listed on NRHP

Table 5-1. Historic Properties within Area of Potential Effects

ID No.	Historic Property Name	Address	NRHP Eligibility
5DV.499	McClintock Building	1554 California Street	Listed on NRHP
5DV.1725	Independence Plaza; Prudential Plaza	1001 16th Street 1050 17th St.	NRHP-eligible
5DV.1760	Bridgepoint Plaza; Park Central	1110 16th Street; 1515 Arapahoe Street; 1111 15th Street	NRHP-eligible
5DV.1832	Security Life Building; 1600 Glenarm Place	1616 Glenarm Place	NRHP-eligible
5DV.1854	Hilton Hotel; Radisson Hotel; Adams Mark Hotel	1550 Court Place	NRHP-eligible
5DV.1856	Dome Tower; Great West Plaza; World Trade Center	1625 Broadway	NRHP-eligible
5DV.1877	Zeckendorf Plaza; Hyperbolic Paraboloid	350 16th Street; 1550 Court Place	NRHP-eligible
5DV.1878	Colorado Federal Savings	200 16th Street	NRHP-eligible
5DV.1880	Petroleum Club Building; Petroleum Building; 110 Building	110 16th Street	NRHP-eligible
5DV.1914	Federal Reserve	1020 16th Street	NRHP-eligible
5DV.493	Symes Building; F.W. Woolworth Company	820 16th Street	NRHP-eligible
5DV.497	Hayden, Dickinson & Feldhauser Building; Colorado Building	1609-1615 California Street	NRHP-eligible
5DV.5298	Walgreens	801 16th Street	NRHP-eligible
5DV.7044	16th Street Mall	1-1300 16th Street	NRHP-eligible
5DV.8274	Skyline Park	1500-1800 Arapahoe Street	NRHP-eligible
5DV. 842	16th Street Historic District	Multiple	NRHP-eligible
5.DV.9217.1	Denver Tramway Trolley Lines archaeological site	Broadway	NRHP-eligible

5.2.1 16th Street Mall

5.2.1.1 Property Description

The 16th Street Mall historic property includes 16th Street from Broadway at its western line of intersection with 16th Street, from building face to building face for 12.5 blocks, to Market Street at its eastern line of intersection with 16th Street, plus the small triangular block bounded by Broadway, 16th Street, and Cleveland Place. This boundary encompasses the original design limits of the 1980 Transitway/Mall design by I.M. Pei & Partners and Hanna/OLIN landscape architects (OAHP, 2018).

The property is a transit way and pedestrian corridor (**Figure 5-4**) with three distinct zones: a central zone with a 22-foot-wide median with two parallel rows of trees, and end blocks where the transit lanes are adjacent with two parallel rows of trees on one side. The essential elements of the design, according to the 1977 design concept document, are "paving, planting, and lighting" (I.M. Pei & Partners, 1977).

Figure 5-4. 16th Street Mall

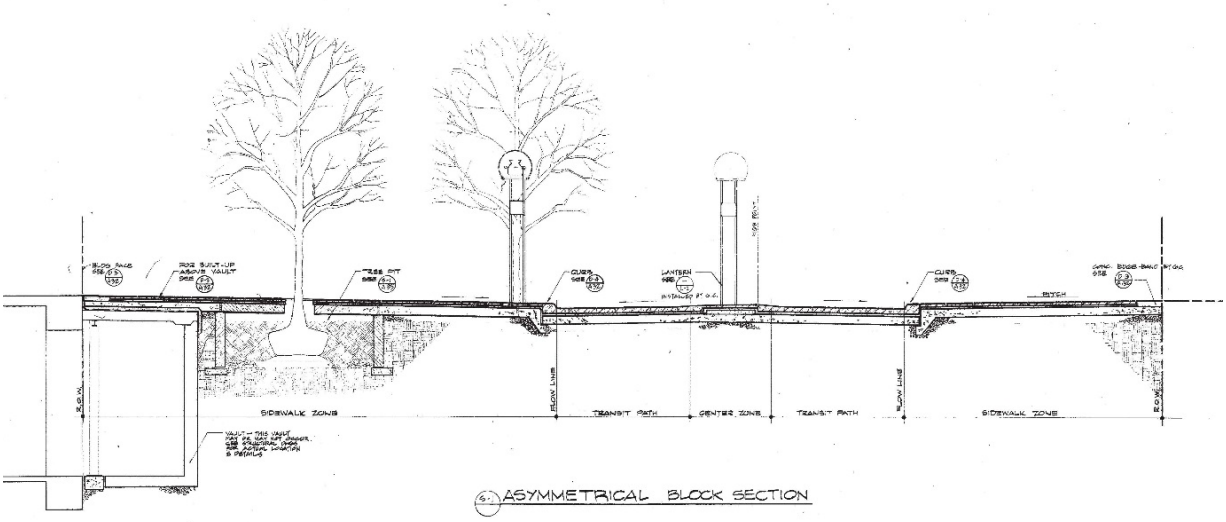
Source: CH2M (Photographed by Sara Orton) February 28, 2018

According to the 1977 design concept (I.M. Pei & Partners, 1977):

> …[the] "basic elements of the 16th Street urban design concept include:
>
> - A double row of mature Honey Locust trees flanking a 22-foot wide promenade in the center of the street.
> - Two 10-foot-wide transitway paths on either side of the central zone.
> - Widened sidewalks along the storefronts.
> - Patterned paving over the entire street surface in varying tones of muted grays and red.
> - A combination light fixture creating a variety of lighting levels at dusk, during the evening, and for late-night security.
> - Shelters, benches, fountains as well as places for displays, sidewalk cafes, and special events.
>
> This basic arrangement is modified on the end blocks of the mall. Here, the transitway paths come together and are flanked by a single row of trees offset to open the street to views of the mountains and the D & F Tower at one end, and the Capitol dome at the other."

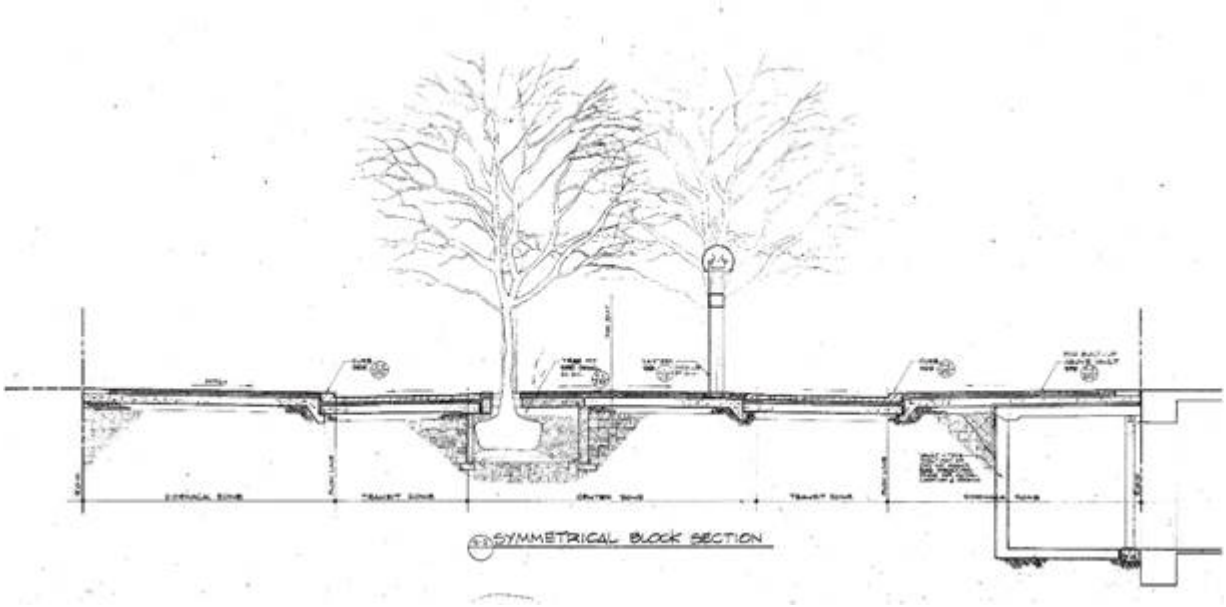
The design, precisely interwoven granite pavers in three colors and unified by the tree plantings and light standards, took into consideration the existing scale of the street. Specifically, designed signage, planters, street furniture (e.g., benches and shelters), fountains, banners and other moveable objects (such as mailboxes, phone boxes, and trash receptacles) were part of the overall plan and were given a uniform design and placed along the street in a planned pattern (OAHP, 2018). **Figures 5-5 and 5-6** show the original cross sections of the end blocks (asymmetrical) and the median blocks (symmetrical), respectively (I. M. Pei & Partners, 1980).

Figure 5-5. Cross Section, Original Asymmetrical End Blocks



Source: I. M. Pei & Partners, 1980

5-6. Cross Section, Original Symmetrical Median Blocks



The design team considered the paving material a critical element of the design in establishing a character of the Mall, consistent for the 12 blocks and ultimately selected granite for the material. As significant to the design as the paving material is the paving pattern; the geometry of the pattern was based on a 45-degree diagonal grid, a reflection of the 45-degree intersection of 16th Street and Broadway and the downtown street system (**Figure 5-7**). This grid is represented in large and small diamond shapes throughout the pattern and the spatial arrangements of the trees and light standards. It also encourages diagonal movement of pedestrians within the Mall (I.M. Pei & Partners, 1977).

Figure 5-7. Overview of Block Design Used on 16th Street Mall, with Colored Planters

Source: SWCA, Inc. (photographed by James Steely), June 6, 2016

The pattern, which visually progresses via the color, shape and size of the pavers, "begins along the street wall as a field of gray paving block which gradually builds in scale as it reaches the center of the mall. The pattern at the edges is deliberately neutral to avoid competition with the varied dimensions of storefronts and doorways. In the center zone the pattern becomes more colorful and dominant. The adjacent transit paths, depressed three inches, are clearly delineated by tone and pattern" (I.M. Pei & Partners, 1977). The depression today measures between 3 and 4 inches along the length of the Mall.

The original design team went to great lengths to find the most appropriate trees for the Mall. A single species, honey locust (**Figures 5-8** and **5-9**), was selected for the median blocks and red oaks for the end blocks, in an intentional monoculture design. In 1977, the design team evaluated 72 species using the following criteria, to select appropriate tree species and arrive at the honey locust and red oak (I.M. Pei & Partners, 1977):

- Height and diameter
- Trunk
- Branch form
- Leaf shape
- Root form
- Shade characteristics
- Sun, water and maintenance requirements
- Disease and insect susceptibility
- Wind tolerance
- Pollution tolerance
- Availability
- Cost

Figure 5-8. Honey Locust Trees in Median Blocks

Source: CH2M (Photographed by Sara Orton) June 30, 2017

Figure 5-9. Honey Locust Trees and Replica Light Standards

Source: CH2M (Photographed by Sara Orton) January 12, 2018

The design document says the honey locust has a "branch and leaf structure that is light and lacy" and "provides shade," but also creates "dappled, flickering light on pavement surfaces" (I.M. Pei & Partners, 1977). It was also selected for its long lifespan. I.M. Pei also designed the system of tree boxes into which the trees would be planted (**Attachment 7**).

The character-defining features of the 16th Street Mall, as identified in the 2018 Form 1403 (OAHP, 2018), are as follows:

- Consistent paving pattern design
- Granite paver units/modules, 1-foot 5-inch by 1-foot 5-inch, in three shades: charcoal gray, light gray, and "Colorado red" (specified as White, Black, and Red on the 1980 plans)
- Granite special units of charcoal and light gray for curbs, cuts, drains, and other applications
- Red oak and honey locust trees planted in specially-designed under-pavement concrete root boxes and ringed at the surface with custom-designed grates
- Custom-designed and -built light standards (**Figures 5-10** and **5-11**)
- Street furniture of custom-designed and -built fiberglass trash and flower receptacles
- Custom metal street signs on traffic signals (**Figure 5-12**) and overhead lights

Figure 5-10. Original 16th Street Mall Light Standard

Source: SWCA, Inc. (photographed by James Steely), June 6, 2016

Figure 5-11. Replica Light Standards

Source: CH2M (Photographed by Sara Orton) February 28, 2018

Figure 5-12. Original Street Sign at 16th Street Mall and Market Street

Source: SWCA, Inc. (photographed by James Steely), June 6, 2016

These features are retained on the Mall today. The light standards have been replicated and returned to their original locations and most of the red oaks have not survived, but the majority of the honey locust trees remain or have been replaced. Other alterations include the removal of the Civic Center Transfer Facility at the Broadway end of the Mall. The original I.M. Pei design included this transfer facility, but it was removed prior to the determination of eligibility for the Mall, so it is not within the boundaries of the historic property. The majority of the drinking fountains and telephone stands have been removed, but a few examples remain. In addition, some features of the design were never implemented, such as runway lighting in the transit lanes, waist-high lighted bollards, transit shelters, and transit stop signs.

The design features of the major fountains at Curtis Street and Tremont Place are extant, but the fountains are not used. The *16th Street Mall Fountain Report* (Waterline Studios, 2010) notes that the water from the fountains, when in use, comes into contact with humans and animal droppings, but lacks proper filtering and sanitation so the fountains have the potential to transmit water-borne illness. The report identified structural and maintenance concerns: nozzle basin leaks, unreliable water level controls and oversized nozzle pumps, as well as being difficult to properly clean.

5.2.1.2 Statement of Significance

This statement of significance comes directly from Form 1403 (OAHP, 2018), prepared by SWCA, Inc and CH2M.

The 16th Street Mall meets NRHP eligibility Criterion Consideration G, as a property that is identifiable as historically significant at less than 50 years old. The property is eligible for listing in the NRHP under Criterion A at a local level and Criterion C at the state and local level of significance. It's period of significance is 1980 through 1982, the period of its final design and construction. In meeting the Criterion Consideration G, the original design and construction

elements from 1982 transformed Denver's downtown streetscape, when the transit way and mall opened, and best represent the exceptional conceptualization of its architects.

NRHP Criterion A. The 16th Street Mall is eligible for listing in the NRHP under Criterion A at the local level in the areas of Transportation and Community Planning and Development. The Mall is significant for transforming Denver's downtown and revitalizing a fledging commercial district affected by post-World War II development outside the city. As Denver-area residents relied more on the automobile, City streets became more congested and polluted, deterring downtown business growth and pedestrian use (Denver Partnership, Inc., et al. 1982). The 16th Street commercial area was in decline by the 1960s and 1970s, caused by population shifts to suburban settings, new trends in retail, and the preeminence of the automobile. Developers started to create large-scale shopping plazas on readily available land near new suburban tracts, reducing the importance and draw of a downtown commercial corridor. By the 1970s, at least 15 shopping centers existed outside downtown Denver. The Public Mall Act was signed into Colorado law in 1970, "allowing municipalities to close off downtown streets" and "in reaction to businesses moving out of downtown areas to suburban indoor malls" (Aspen Historical Society, 2015).

In the 1970s, Denver leaders, through federal financial assistance from the Urban Mass Transportation Administration (UMTA), sought to disrupt this trend and revitalize the 16th Street corridor through addressing three major concerns: downtown blight, transportation, and noise/air pollution (Denver Partnership, Inc., et al. 1982). The 16th Street Mall's distinctive design and unified concept, pedestrian and transit uses, and electric and diesel-powered bus-fleet addressed these issues, providing a resurgence in the area that was celebrated as a success almost immediately following its opening (Denver Partnership, Inc., et al. 1982). On its emergence in 1982, the Mall sparked not only a noticeable economic boom in the area, the transformed corridor fostered a civic spirit diminished by post-World War II transportation and development trends (Denver Partnership, Inc., et al. 1982). Therefore, the 16th Street Mall has made a significant contribution to Denver's recent past and is significant under Criterion A at the local level (OAHP, 2018).

When considering this historic context, the Mall has not definitively achieved significance at a national or state level under Criterion A. Its local significance and contributions are evident, but more historical perspective and time is needed to fully understand if it has state or national significance for a resource using Criteria Consideration G. Per NPS guidance, additional scholarly evaluation and historical perspective over time will help the public understand the role properties from the recent past have played at a national level (NPS 2002; NPS 1998). Other properties determined significant under Criterion A at the national level less than 50 years after they were constructed, tend to have broader implications on the history of the United States, associated with major national themes like the United Farm Workers' movements and Apollo 11 launch. Few pedestrian and/or transit malls developed in the post-World War II context are listed on the NRHP. The notable example is the Lincoln Road Mall, a pedestrian mall constructed in Miami, Florida, ca. 1950 and itself needing revitalization by the late 1960s/early 1970s (Harden 2013), was listed on the NRHP in 2011 (NPS 2011). The Fulton Mall is eligible but not listed on the NRHP. The Nicollet Mall was redeveloped from 2015 to 2017. Although pedestrian and transit malls continue to be developed and redeveloped across the nation, few from that initial era of post-World War II downtown redevelopment remain. A national study found that, by the mid-1980s, "85% of the original 200 U.S. pedestrian malls had been

reopened to traffic" (Judge 2013:3; Harden 2013). South Burdick Street in Kalamazoo, Michigan—credited as being the first pedestrian mall established for downtown redevelopment, in 1959—reopened for vehicle traffic in 1998 (Harden 2013). Comparatively, the *Denver Business Journal* notes that, for Denver, "closing more than a mile of a downtown street to cars has been an unusual—and much-studied—success" (Harden 2013). As presented by the *Denver Business Journal*, many of the less enduring pedestrian malls were not as well planned and designed as the 16th Street example (OAHP, 2018).

NRHP Criterion C. Denver's 16th Street Mall is also significant at the local and state level under NRHP Criterion C in the area of Landscape Architecture, as an award-winning design by master designers, built with granite units in a unique, enduring, western-style pattern consistent along 12.5 blocks. It is also significant under Criterion C in the area of Engineering for its largely hidden but sophisticated matrix of drainage, irrigation, wiring, and "suspended pavement system" that accommodates large and deep root chambers for its 220 shade trees. As noted by Pei's team in their approach for the project, the designers successfully complemented the existing diversity of buildings and uses along the corridor (Pei, 1977; Pei, 1980). They developed a unifying theme and path of travel for pedestrians and buses that created a defined, new experience in the downtown (Pei, 1977). The scope and design of the project was unique at the time in Denver and Colorado, and its master designers received awards almost immediately following its completion (Historic Denver, Inc., 2012a; Denver Partnership, Inc., et al, 1982). Though constructed less than 50 years ago, it is a unique design and surviving example of Denver's late twentieth century Modern style-inspired urban renewal efforts. As a result, it is eligible for listing in the NRHP under Criterion C at the state and local level (OAHP, 2018).

Though significant for its design and engineering at the state and local level, the Mall has not yet achieved significance at the national level under Criterion C. As a less than 50-year old property, the Mall represents one of the exceptional works composed by the design team (NPS, 2002; NPS, 1998). NPS guidance advises that time and perspective are needed to understand how properties fit within with the life work and contributions of masters to their field (NPS, 2002; NPS, 1998). Although each of the principal designers is still living, Pei, Cobb, and Olin have had full careers within which to understand the importance of their projects, including the 16th Street Mall. Pei is about 101 years old, Cobb 92, and Olin 80 years old (as of 2018), and Pei and Cobb have important projects that are now over 50 years old and considered historic on that basis. The Mall remains essential in representing their full body of work and is directly recognized as being among the noteworthy projects of these renowned designers (CLF, 2018). The 16th Street Mall is historically important and exceptional within the history of Colorado at the state level as an enduring example of important works by these recognized masters, even though completed less than 50 years ago (OAHP, 2018).

Colorado was where I. M. Pei and his associates, including Henry Cobb, first conducted and completed a project as a fully independent design firm, after splitting from the firm of Webb and Knapp in 1960—where they had begun their careers (Wiseman 2007). They garnered national recognition with development of the National Center for Atmospheric Research building in Boulder 1961 and 1967. In that Colorado design, Pei incorporated Southwestern elements reflective of Mesa Verde cliff dwellings and natural elements intended to incorporate and display aspects of nature while remaining monumental in a Modern style (Wiseman 2007). Distinctive influences from nature and Native Americans of Colorado and the Southwest would again be reflected in the design of the 16th Street Mall. The natural and cultural accents

employed by the Pei team's architects and landscape architects were in contrast to the starker concrete construction of most Modern design at the time, which has led this unadorned, function-driven construction style to sometimes be called "brutalism" (OAHP, 2018).

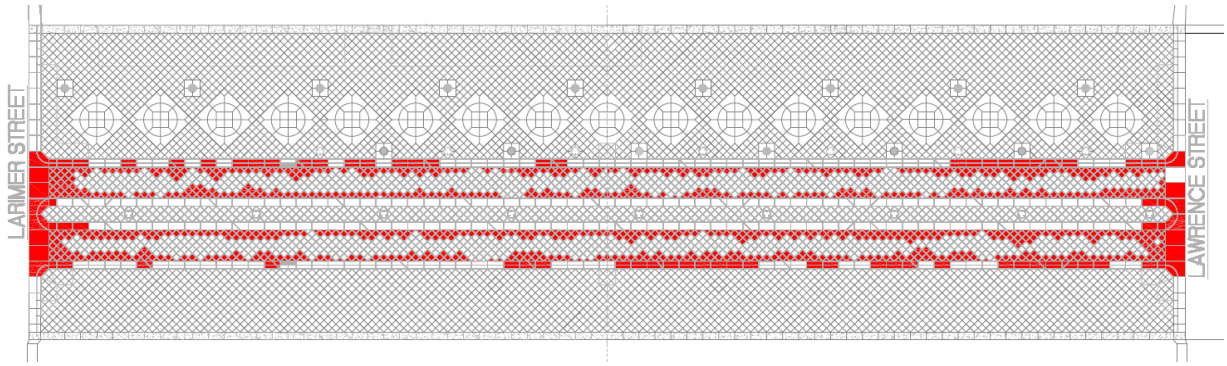
While the 16th Street Mall further demonstrates Post-Modern influences, it's design and concept reflect the earlier Modern examples completed in Philadelphia, Minnesota, and Fresno through federal and local agency involvement. As a Post-Modern structure, the 16th Street Mall incorporates elements of Denver's Old West in a contemporary interpretation; however, while advancing beyond earlier Modern examples, it has not led to a transformation of the property type throughout the country (ULI, 2008). The 16th Street Mall has not achieved significance at a national level under Criterion C at this point in time (OAHP, 2018).

Criteria Consideration G. Although the 16th Street Mall is not yet 50 years old, it meets NRHP Criteria Consideration G as exceptionally important for its enduring design and for its celebrated role in helping to revitalize downtown Denver at a critical time for the city as it struggled with urban flight, insensitive urban renewal, and the decline of its mining and petroleum image and economy. The property is exceptionally significant at the state and local level due to the project's role in shaping downtown Denver and embodying a distinctive design by a team of master designers that is unique in the state (OAHP, 2018).

5.2.1.3 Integrity

Portions of the design have been interrupted with subsequent repaving of cross-street intersections through the omission of scoring—called "sawcut joints"—the concrete pavement to match the granite pavers and general diagonal hash-pattern. This scoring was a part of the original design, intended to bridge the design across the opposite running cross streets, but it was not constructed. Some integrity of materials has been lost with ad hoc replacement of granite pavers as they are damaged by vehicular wear or harsh weather (Harvey, 2015). The replacement granite pavers in the transit way between Larimer and Lawrence streets are an example of the large number of pavers replaced in the transit way since its construction in 1982 (**Figure 5-13**).

Figure 5-13. Paver Replacement in the Mall Transit Way from 2004 to 2014, Larimer to Lawrence Streets



Note: Red areas signify replaced pavers.
Source: RTD, 2015

Some integrity of materials and feeling has been lost through subsequent removal of most of the custom-designed telephone stands and the inactivity of fountains. Some trees have been lost to disease or age, but this has had little overall impact to the setting, feeling, and

association of the Mall. The original turn-around at Civic Center was removed, but the Mall retains integrity of design and workmanship on the remaining 12.5 blocks, even with the loss of that portion of the original design.

The 16th Street Mall retains strong integrity of location, design, materials, workmanship, setting, feeling, and association, and continues to convey its significance under NRHP Criteria A and C, and Criterion Consideration G.

5.2.1.4 Skyline Park

The Skyline Park (5DV.8274) is located along Arapahoe Street from 15th Street to 17th Street, parallel to the Mall (**Figure 5-14**). It was designed by Lawrence Halpern and constructed in 1973 (its period of significance). It includes green spaces, open spaces, planters, sculptural play areas, and water features (**Figure 5-15** contains a photo of the park). Only the portions between 16th Street and 15th Street are currently open to the public. The Daniels and Fisher Tower is within the park boundaries, but was constructed in 1911, prior to the creation of the park.

Figure 5-14. Map of Skyline Park

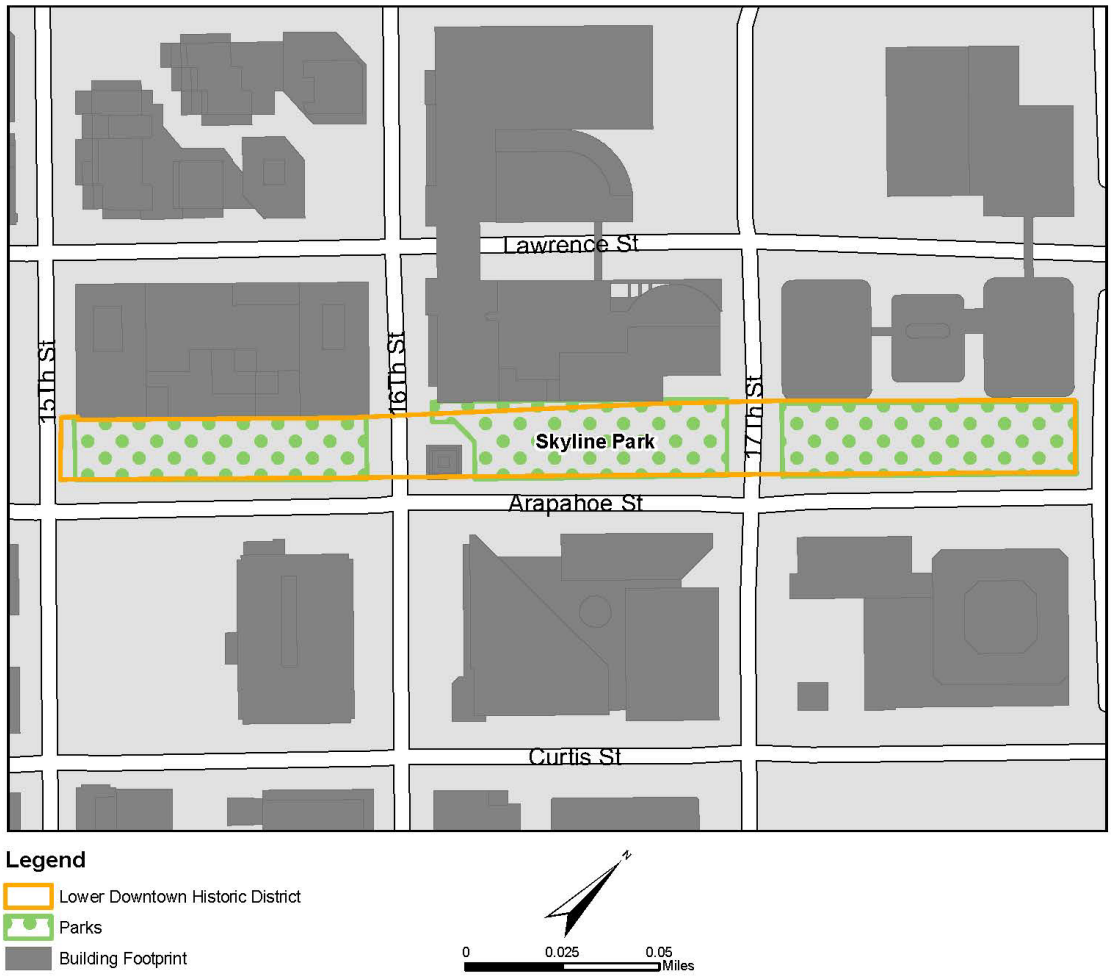


Figure 5-15. Skyline Park, facing 17th Street

Source: CH2M (Photographed by Sara Orton) March 1, 2018

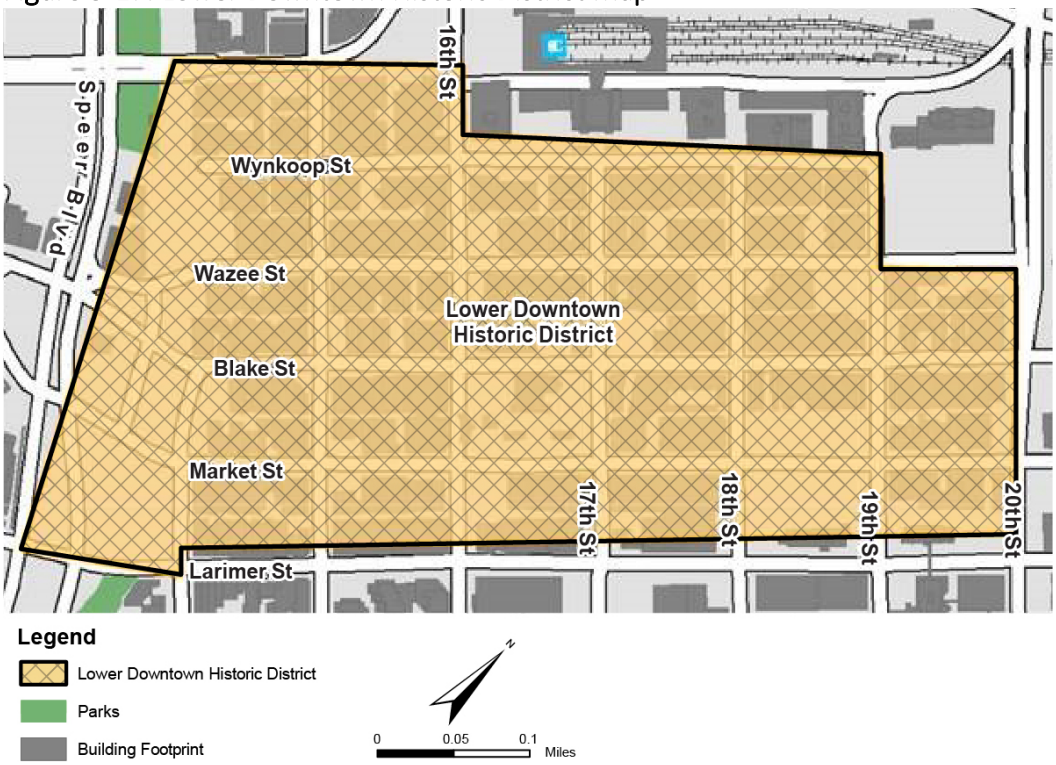
5.2.2 Historic Districts

5.2.2.1 Lower Downtown Historic District

The Lower Downtown Historic District (5DV.47) was formed in 1988 and is significant for its mid- to late-19th century architecture. The period of significance for the district is 1860 through 1941. There are four properties that are contributing elements to the district (5DV.47.7, 5DV.47.15, 5DV.47.37, and 5DV.47.96) that are within the APE (**Figure 5-16**). These contributing properties are along Market Street at the northeastern edge of the APE. The district boundaries are roughly the alley between Larimer and Market streets, 20th Street, Wynkoop Street in front of Union Station, and two blocks of Wewatta Street to Speer Boulevard (Colorado Historical Fund, 2000) (**Figure 5-17** contains a map of boundaries).

Figure 5-16. Market Center in the 1600 Block of Market Street in the Lower Downtown Historic District

Figure 5-17. Lower Downtown Historic District Map



5.2.2.2 16th Street Historic District

The property listed as 5DV.842, the 16th Street Historic District (**Figure 1-4**), is eligible for listing in the NRHP under Criterion C for its unique collection of architectural styles from various eras in retail/wholesale and commerce themes. Surveyed in 1979, the period of significance for the district is 1889 to 1930, which encompasses the build dates of the 25 contributing buildings (Glassman, 1979; Norgren, 1982). The district's significance is based in part on "its role in the economic development of Denver for along the street lie many structures that have played important roles in the city's commerce. …the buildings in the District reflect the historical development of the city and its architectural tradition" (Glassman, 1979).

5.2.2.3 Downtown Denver Historic District

Not listed in **Table 5-1** is the Downtown Denver Historic District (5DV.7989), a locally designated landmark, which is a discontiguous district that does not include the Mall but includes some buildings along the Mall between Arapahoe Street and Glenarm Place. The 43 buildings included in the district date from the 1870s to the early 20th century (Denver Infill, 2018). This property is not further discussed or evaluated in this report because it has not been determined eligible for listing in the NRHP and the Mall is not listed as one of the properties within the Downtown Denver Historic District.

5.2.3 Archaeological Resources

There is an identified historic archaeological site partially within the APE: Site 5DV.9217.1, a former tramway line, begins at E. 16th Avenue and Broadway and is within the APE from E. 16th Avenue to Cleveland Place. The entire Denver Tramway Trolley system is eligible for listing in the NRHP under Criterion A and B. It played an important role in early public transit in Denver and facilitated the development of more distant neighborhoods by giving residents a way to travel between work, home, and recreational opportunities. The South Broadway line was the first electrified line to operate in Denver. It continued in operation from December 1889 to June 1950, when South Broadway was paved over for vehicular traffic, and has been buried under the road since that time. There would be no direct or indirect impacts to this resource from the undertaking because it is outside the limits of construction.

SECTION 6

Findings of Effect

Section 106 of the NHPA creates a process for reviewing the effects of federal undertakings on properties listed in or eligible for the NRHP. A proposed project would have an effect if it changed the characteristics that qualify the property for inclusion in the NRHP. A proposed project would have an adverse effect on historic properties if it diminished the integrity of those characteristics. The Project team applied the Criteria of Effect to determine whether the proposed Project alternatives would affect the historic properties in the APE and whether those effects should be considered adverse.

6.1 No Build Alternative

The No Build Alternative would not change the current alignment of 16th Street Mall and would not repair or upgrade the belowground utilities and infrastructure. The trees and tree boxes would not be replaced, so the condition of the trees would remain the same and there would be no plan for replacing trees that have died or been removed. Under the No Build Alternative, the granite pavers would continue to be replaced in an ad hoc manner as the need arose or replaced with concrete, asphalt or other materials. Because the underlying existing deteriorating infrastructure would not be updated, safety hazards for pedestrians and vehicles, and the frequent and costly maintenance would continue.

There would be No Adverse Effect on the 16th Street Mall under the No Build Alternative; however, there would be impacts including the loss of trees and the loss of granite pavers, as is currently the case, through repair and replacement.

6.2 Locally Preferred Alternative

The following sections discuss the effects of the LPA on the historic 16th Street Mall and the other historic properties within the APE. There would be no property acquisitions and no direct impacts from the LPA to the identified historic properties within the APE that abut the 16th Street Mall.

6.2.1 16th Street Mall Historic Property

There would be an adverse effect on the 16th Street Mall historic property from implementation of the LPA. Impacts to the Mall would include realignment of the asymmetrical ends, relocation of the transit lanes, conversion of the current median to transit lanes, and replacement of the existing granite pavers with new granite pavers. There would also be impacts to the original design through shifts in some of the tree locations, removal of the specifically designed tree boxes, a change in the number and kinds of tree species, and an additional row of trees added on the asymmetrical ends, increasing the overall number of trees on the Mall.

The key elements of the I.M. Pei-designed landscape are paving, planting, and lighting. Implementation of the LPA would affect each of those elements of the 16th Street Mall historic property.

6.2.1.1 Character-defining Features

Paving. Although the LPA would retain granite pavers in three colors as part of the design, as called for in the original I.M. Pei–Hanna/OLIN design, it would not replicate or preserve the original pattern. The existing pavers would not be reused and the new pavers would have a different surface to improve traction.

The LPA design would shift the paving pattern on the asymmetrical blocks roughly 2 feet to accommodate safety, pedestrians, and other elements of the purpose and need (**Attachment 1**). This shift would likely not be perceptible to the casual Mall user, but it means none of the pavers would be in exactly the same location as in the current design. Through the LPA design process, this shift has been reduced to accommodate the original design. The design concept of a carpet covering the space between the existing buildings on an intimate scale would be retained. The LPA design is reverential of the original design and uses the same three colors of pavers with grey tones at the buildings moving to larger pavers with more intense colors and greater scale at the center.

The paver pattern on the current median blocks would be retained. In this area, there would be no shift in the carpet pattern, but there would be a change in programming. In the current design, the paving pattern corresponds to uses; a pattern of large diamonds defines the pedestrian promenade and a distinct pattern of medium diamonds defines the transit lanes. A smaller diamond pattern is used in the pedestrian area. The design team considered reconfiguring the paving pattern to correspond the use (such as transit lanes, pedestrian spaces, or patio spaces) with the paver pattern, as in the current design, but the feedback from consulting parties was a preference for retaining the pattern regardless of the programming. Thus, the paver pattern would be retained in the center-running blocks, and the programming on each pattern would change; the transit lanes would run on the larger diamonds and the trees and amenities would be on the surface with the medium sized diamond pattern. Additional markings on the transit lanes to visually clarify the lane locations could be installed so drivers would know recognize the transit lanes on big pattern. Pedestrian walking areas would continue to use the smaller diamond pattern.

The preliminary LPA paver pattern (**Attachment 1**) retains the 45-degree diagonal grid originally designed as a reflection of the 45-degree intersection of 16th Street and Broadway and the downtown street system. This grid would be retained and would continue to encourage diagonal movement within and across the Mall.

Other changes to the pattern could be required to accommodate federal ADA requirements, local bus loading and unloading requirements, or other unforeseen safety or drainage issues that could arise as the project proceeds. The goal is to retain the pattern geometry, spatial relationships, massing, size, scale, and color where possible, changing these only if it is absolutely necessary to meet functionality, operations, safety, and regulations.

Measures have been taken throughout the design development and consultation process to retain the I.M. Pei–Hanna/OLIN design concepts and philosophies in the proposed paver pattern (**Attachment 6**) contains the Project team's Pattern and Geometry Studies). However, the undertaking would alter the paver pattern, the programming of the paver patterns, and the exact locations of the current pavers, and the pavers themselves.

Planting. The trees selected by the original design team—honey locust for the median blocks and red oaks for the end blocks—were part of the intentional monoculture design. City regulations and best practices regarding tree species have changed since the 1980s to discourage monoculture plantings, to keep the tree canopy healthy and full and to avoid single species die-offs (as happened with the red oaks).

Tree species will be selected using the historic design criteria, while also meeting current Denver Parks and Recreation Forestry Division requirements and diversity regulations. **Table 6-1** provides a comparison of the criteria used in in 1977 for the original design and in 2018 for the current Project. There are tree spacing and diversity requirements that were not in effect in 1982 that need to be accommodated. To protect the overall downtown canopy and the health of the trees, there are maximum numbers of family, genus, and species that can be planted within a certain area.

Table 6-1. Historic and Current Tree Criteria Comparison

Original 1977 Criteria[a]	2018 Criteria
Design Elements	
Height and Diameter: 35 feet tall	Height and Diameter: 35 feet tall • Ability to create straight trunk with first branching at 20-foot height • Crown spread: 20 to 25 feet for promenade trees, 30 to 35 feet minimum for shade trees
Branch and leaf structure: Lacy and Open	Branch and leaf structure: Lacy and Open
Shade characteristics: Dappled Shade	Shade characteristics: Dappled Shade
	Leaf color: • Yellow fall color for shade trees • Contrast for promenade trees
	Leaf texture
Tree Health Elements	
Sun exposure: thrives in partial shade	Sun exposure: thrives in partial shade
Water requirements: moderate	Water requirements: moderate to Xeric
Drought resistant	Drought resistant
Tolerant to wind and air pollution	Tolerant to wind and air pollution
Disease and insect resistance	Disease and insect resistance
	Salt tolerant
	Tolerant of high pH soils
	Growth Rate: fast to moderate preferred

Original 1977 Criteria[a]	2018 Criteria
Other Elements	
Availability	Availability

[a] Source: I.M Pei & Partners, 1977

The design team and the CCD City Forester's office will work closely to meet both the design criteria and the intent of the design criteria, when selecting the tree species (**Attachment 8**). But it will not be possible to have one species along the center-running blocks and one along the new asymmetrical blocks. This alters the original design by disrupting the intentional selection of just two species.

The original design had 199 trees, while today 143 trees can be found on the Mall. The LPA proposes approximately 250 total trees in the new design. Along the asymmetrical blocks, an additional row of trees would be added between the transit lane and the sidewalk where previously there were no trees. In the original design, the narrow sidewalks on the end blocks did not have any trees, but the designers felt that these sidewalks could be landscaped to "augment the mall greenery without diminishing street vistas" (I.M. Pei & Partners, 1977).

The LPA would also remove the existing, character-defining tree boxes that have a 300-cubic-foot soil capacity and replace them with new, suspended, tree infrastructure that provides 1,000 cubic feet of soil volume, such as a silva cell or equivalent technology. The Pei-designed tree root ball containers would not be retained or replicated. Landscape irrigation would be removed and replaced.

The undertaking would alter the number of tree species, the total number of trees, the precise location of the trees, and the specifically designed tree boxes.

Lighting. The existing light standards are replicas of the original design, and the pole light standards under the LPA would replicate this same design. Where the new rows of trees would be added, replica pole light standards would be added, in keeping with the original staggered design of trees and lights.

Alignment. The LPA effects the historic alignment of the Mall by repurposing the medians to transit lanes in center-running blocks, which would move the amenity spaces to the outer sidewalks, shortening the width of the transitions at Tremont Place and Arapahoe Street, and discontinuing a single transit lane that runs the length of the Mall without shifting.

The original design concept of three distinct zones with a sense of beginning, middle, and end would be retained, but the distinction between each zone would be lessened. Currently, one transit lane remains on the same alignment between the median and asymmetrical blocks, and one transit lane shifts 16 feet from its location on the median blocks to its location on the asymmetrical blocks. The LPA would result in both transit lanes shifting 4 feet from their location on the median blocks to their location on the asymmetrical blocks. While the locations of the transitions along the linear feature would be retained, the shifts at each transition would be smaller and less distinct.

Other Features. Other character-defining features would also be affected by the undertaking. Although final decisions have not been made, it is likely that most of the original street

furnishings would be removed and replaced. The trash receptacles do not meet current safety standards and are difficult to use successfully, particularly for the disabled. Most of the specifically designed drinking fountains and telephone stands have already been removed, as have some of the original benches. Examples of each of the original features could be preserved, but that has not been decided. Some of the round planters could be refurbished and reused in some capacity on the Mall, but the majority would be removed. The same is true for other specifically designed movable structures; examples could be preserved, but most would likely not be retained along the Mall.

The major fountains at Curtis Street and Tremont Place are extant, but are not used because of filtration, safety and maintenance problems. The LPA at this stage of design does not include specific locations or specifications for fountains; although water features are planned to be included in the ultimate design, the existing fountains would not be retained or replicated.

The simple street signs on the traffic signals (**Figure 5-12**) would be retained. The pianos are not part of the original design, so the ultimate decision regarding their retention would not affect the historic property.

6.2.1.2 Visual Effects

Visual effects on the historic 16th Street Mall would not be distinct from the long-term effects on the character-defining features of the Mall from the LPA.

6.2.1.3 Construction Effects

There would be no additional effects to the 16th Street Mall historic property from construction that have not already been considered in the implementation of the Project.

6.2.1.4 Design Options for Transitway Delineation

Under either design option, additional delineating features that may be considered include visual delineations such as in-pavement lighting or different color materials; a strip of textured surface, detectable to the visually impaired; bollards; or other delineating features that would not impair movement across the Mall. The effects of these type of features on the historic property would be evaluated as they are further studied and would be included in the Section 106 agreement document developed as a part of this undertaking.

The design option to include a vertical curb along the transit way, delineating the transit way from the pedestrian space, is consistent with the original design separating the transit way from the pedestrian space, with the transit way 3 to 4 inches lower than the walkway. These curbs would not be in the same location in which they are currently located.

The design option to have no curb between the transit way and pedestrian space may not result in noticeable visual change to the Mall's pavement pattern. One of the character-defining features of the Mall is the special units of charcoal and light gray granite pavers for the curbs and curb cuts, so removal of that feature would impact the original design of the historic property. However, charcoal and light gray pavers could be used in the No Curb design option, but they would not vertically separate the transit way from the pedestrian area.

Mitigation Measures

Mitigation measures to address impacts to either design option would not be different; would mitigate the removal or moving of curbs with similar measures; and would mitigate the loss of engineering features in the same way. Measures to mitigate the pattern changes will be the same for each of the design options.

Under either design option, additional delineating features that may be considered include visual delineations such as in-pavement lighting or different color materials; a strip of textured surface, detectable to the visually impaired; bollards; or other delineating features that would not impair movement across the Mall. The effects of these type of features on the historic property would be evaluated as they are further studied and would be included in the Section 106 agreement document developed as a part of this undertaking.

6.2.1.5 Summary

In summary, the undertaking would have an **Adverse Effect** on the historic 16th Street Mall because of alterations to character-defining features of the property, including the granite pavers, pavement pattern, tree species and locations, tree boxes, additional trees, additional lighting, removal of the median in the center-running blocks, and changes to the alignment. The integrity of materials, design, and workmanship would be lost through these changes. Some association could remain, but the final product, while honoring the original design, would no longer be an I.M. Pei-designed property, and thus would lose its association with I.M. Pei. Olin is on the current design team, so the Mall would retain an association with Olin and would continue to be an Olin-designed landscape; however, it would not be the same designed landscape. The Mall would retain its setting, feeling, and location as the footprint would not change, the surrounding buildings would not change, and it would continue to be a 12.5-block pedestrian and transit way mall.

6.2.1.6 Skyline Park

Skyline Park is outside the period of significance of the Mall historic property and is not a contributing element of the Mall. The park was built in 1973, almost 10 years prior to the conversion of 16th Street to a pedestrian and transit corridor. The park was impacted by that construction and conversion. The Project would not change the setting, feeling, association, or location of the park. The materials, design, and workmanship of the park would not be impacted by the Project on 16th Street. Project elements would be within existing transportation right-of-way and would not require any property acquisitions within the park.

There would be No Adverse Effect on the Skyline Park from the undertaking. The park would continue to be a linear, city park intersecting a pedestrian and transit corridor.

6.2.2 Historic Districts

There would be no property acquisitions from the historic districts that intersect the project corridor. Project elements would be carried out only in the existing transportation right-of-way.

6.2.2.1 Lower Downtown Historic District

The Mall is outside the period of significance of the Lower Downtown Historic District and is not a contributing element of the district. Only a half block of the 16th Street Mall historic property is within the boundaries of the historic district. The alley between Larimer and Market streets is the boundary of the district, so the half block between the alley and Market Street would be

the only area affected by the Project and is a very small portion of the larger district. The district as a whole would remain intact and retain the key character-defining features that convey its significance. Project elements would be within existing transportation right-of-way and would not require any property acquisitions within the district.

The district would retain integrity of setting, feeling, location, association, design, workmanship, and materials. There would be No Adverse Effect on the Lower Downtown Historic District from the undertaking.

16th Street Historic District

The Mall is outside the period of significance of the 16th Street Historic District, which was established prior to the construction of the Mall, which is not a contributing element of the district. The significance of the district would be retained, and the collection of distinct architectural styles would not be affected by the Project. The district as a whole would remain intact and would retain the key character-defining features that convey its significance. Project elements would only be within existing transportation right-of-way and would not require any property acquisitions within the district.

The district would retain integrity of setting, feeling, location, association, design, workmanship, and materials. There would be No Adverse Effect on the 16th Street Historic District from the undertaking.

6.2.3 Historic Properties adjacent to the Mall

There would be no property acquisition for this Project. The historic properties adjacent to the Mall are outside the project limits and would not be directly affected by elements of the project. **Attachment 9** comprises a map book showing the historic properties within the APE and the project limits.

Historic properties dating from the early twentieth century were present when the Mall was installed in the 1980s and are not from the period of significance of the Mall. The Mall is not from the period of significance of the majority of the historic properties in the APE. There would be no new effects on historic properties along the Mall from the LPA beyond those that occurred from the original Mall construction in the 1980s.

6.2.3.1 Visual Effects

There would be alterations to the viewshed from the historic properties lining the Mall. The pattern of the granite tiles along the Mall, alignment, tree species, and moveable street features would change under the LPA. The programming along the Mall is not considered a character-defining feature, but would also ultimately change, which could change views from the adjacent historic buildings. The greatest visual effect would be during construction, when the views from the historic buildings would be of construction materials, rather than pedestrians and mature trees. The size of the trees would also be a visual alteration; until the new trees reach maturity, one of the main visual elements of the Mall, the allée of trees, would be altered.

However, the majority of the historic properties within the APE adjacent to the Mall are early to mid-twentieth-century buildings and have an earlier period of significance than the Mall. The visual change to these properties occurred in the 1980s when the Mall was installed, and this would not present a new affect to the buildings adjacent to the Mall.

6.2.3.2 Noise and Vibration Effects

Based on the FTA criteria, the noise study area was defined as a screening distance of 150 feet from the outside edge of the transit way. Existing noise-sensitive uses (resources) in the noise study area were identified by gathering an inventory of existing land uses. Land uses were organized based on the land use categories identified in the *Transit Noise and Vibration Impact Assessment* manual (FTA, 2006). An inventory of the noise-sensitive resources was collected within the 150-foot screening distance. A total of 33 noise-sensitive land uses are within the 150-foot noise screening distance.

Based on the FTA criteria, the vibration study area was defined as a screening distance of 50 feet from the transit travel lanes. Resources were again organized based on the land use categories identified in the *Transit Noise and Vibration Impact Assessment* manual (FTA, 2006). An inventory of the vibration-sensitive resources was collected within the 50-foot screening distance. Three vibration-sensitive land uses are within the 50-foot vibration screening distance. Details of the analysis are presented in the *Noise and Vibration – Sensitive Land Uses* technical memorandum in **Appendix B** of the EA.

Under the new asymmetrical sections of the design, the transit way would shift 5 feet away from the building faces on the southern side of the Mall, and 3 feet closer to the building faces on the northern side. Under the center-running section, the transit way would shift 9 feet further from the building faces on both the northern and southern sides of the Mall. The 16th Street Mall has multiple sources of existing ambient noise, including cross street traffic, pedestrians, and businesses. Because the transit way will be shifting away from the buildings in most cases, there would be no increase in noise levels. In places where the transit way shifts 3 feet closer to sensitive resources, it is unlikely that the short distance would noticeably increase the noise levels of the transit way experienced by those sensitive resources. The Free MallRide shuttle buses are electric, which minimizes the amount of noise they produce. They are so quiet that they use noisemakers to alert pedestrians that buses are coming. The noisemakers would remain under the LPA.

Vibration impacts are unlikely for transportation projects that involve rubber-tired vehicles, except in unusual situations (FTA, 2006). The Free MallRide shuttles have rubber tires, and there are no unusual situations as a part of this project. No substantial roadway surface unevenness (i.e., speed bumps) is proposed, no sensitive manufacturing or research land uses are located within the 50-foot vibration screening distance, and the Free MallRide shuttles do not operate inside or directly underneath any buildings; as a result, no long-term vibration is anticipated. Based on this analysis, there would be no effect on historic properties from noise and vibrations.

6.2.3.3 Construction Effects

Construction impacts identified in the EA would apply to the businesses and residences along the Mall. The setting and feeling of the structures would be temporarily affected during construction of the LPA. Transit service would be shifted or moved off the Mall as described in **Section 4** of the EA, pedestrian activity would be reduced, trees would be removed, and the street would be excavated to repair and replace the infrastructure. These effects would no longer exist following completion of the construction.

The current location, setting, feeling and association of these buildings would not be altered by the LPA, as it will continue to be a transit and pedestrian corridor with two lanes of public transit, parallel rows of trees and pole lighting, and pedestrian walkways directly adjacent to the structures. The conversion of the median to transit lanes would not affect the historic significance of the structures. The basic form, massing, use, and general appearance of the Mall would remain unchanged; therefore, there would be no visual or atmospheric changes to the historic properties. Because there would be no direct impacts, the design, materials, and workmanship of the historic structures would not be affected by the LPA.

In summary, there would be No Adverse Effect on the historic properties within the APE adjacent to the Mall from the LPA because:

- There would be no property acquisitions
- There would be no direct effects
- These historic properties were affected in the 1980s when the Mall was installed
- The project limits do not cross property lines
- Construction would be outside property boundaries
- No visual or atmospheric changes to the historic properties
- Properties would retain integrity of design, materials, workmanship, location, setting, feeling and association

The LPA would also have No Adverse Effect on the Lower Downtown Historic District (Section 6.2.2.1) and the Skyline Park (Section 6.2.2.2), which intersect the Project.

6.2.4 Archaeological Resources

Site 5DV.9217.1, a former tramway line, begins at E. 16th Avenue and Broadway and is within the APE from E. 16th Avenue to Cleveland Place, but is outside the Project limits. In 1950, South Broadway was paved over for vehicular traffic, so the site has been buried under the roadway since that time. There would be no direct or indirect impacts to this resource from the undertaking because it is outside the limits of construction. For archaeological resources, there would be No Historic Property Affected.

No previously recorded significant archaeological resources have been identified within the Project limits. The Project footprint was previously disturbed during the construction of the Mall, making it unlikely that resources would be discovered during construction; however, as with any subsurface construction activities, there is the potential for the discovery of unidentified archaeological resources.

An Unanticipated Discovery Plan will be developed, and if previously unidentified archaeological resources are identified during Project construction, all surface- and subsurface-disturbing activities shall cease in the immediate area of the discovery and the procedures outlined in the project's Unanticipated Discovery Plan will be implemented. If previously unidentified archaeological sites are determined to be eligible for listing in the NRHP, appropriate mitigation measures would be developed in consultation with SHPO, in accordance with the plan. The development of the Unanticipated Discovery Plan will be included as a stipulation in the MOA.

6.2.5 Cumulative Effects

There would be an Adverse Effect on historic properties from this undertaking. Culturally significant structures along the Mall have been demolished or otherwise lost since the 1970s, and there has been some infill along the Mall that complements neither the period of significance of the Mall nor the early and mid-twentieth-century buildings along the Mall. There have also been beneficial effects on historic properties, including the preservation and redevelopment of the Denver Union Station and the implementation of design guidelines for the Lower Downtown Historic District to preserve the historic buildings and the historic character of the district. The effects from this Project would contribute to the cumulative impact to cultural resources in the APE. However, it would not be a significant contribution because 16th Street will remain a pedestrian and transit corridor and because of the minimization measures taken, such as using granite pavers, retaining trees in the design, retaining the beginning, middle, and end alignment and replicating the original pole lighting.

6.3 Summary

Table 6-2 summarizes the findings of effect on each of the historic properties within the APE.

Table 6-2. Findings of Effect on Historic Properties within the Area of Potential Effects
16th Street Mall Alternatives Analysis and Environmental Clearance Project, Denver, Denver County

Historic Property Name	Address	NRHP Eligibility	Finding of Effect
Waters Building – Market Center	1642 - 1644 Market Street	District Contributor	No Adverse Effect[a]
Hitchings Block	1620 Market Street	District Contributor	No Adverse Effect[a]
Liebhardt-Linder Building – Market Center	1624 Market Street	District Contributor	No Adverse Effect[a]
McCrary Block – Market Center	1628 Market Street	District Contributor	No Adverse Effect[a]
Steel Building; Fontius Building; Sage Building	1555 Welton; 600 16th Street	District Contributor	No Adverse Effect[a]
Liebhardt Building; Cottrell Clothing Company	601 16th Street	District Contributor	No Adverse Effect[a]
Daniels & Fisher Tower	1101 16th Street; 1601 Arapahoe Street	Listed on NRHP	No Adverse Effect[a]
Denver Dry Goods Company Building	702 16th Street; California Street; and 16th Street	Listed on NRHP	No Adverse Effect[a]
Masonic Temple Building	1614 Welton Street, 535 16th Street	Listed on NRHP	No Adverse Effect[a]
Kittredge Building	511 16th Street	Listed on NRHP	No Adverse Effect[a]

Historic Property Name	Address	NRHP Eligibility	Finding of Effect
A.C. Foster Building; University Building	910-918 16th Street	Listed on NRHP	No Adverse Effect[a]
Joslin Dry Goods Company Building; Tritch Building; Savoy Grille	934-938 16th Street	Listed on NRHP	No Adverse Effect[a]
A.T. Lewis and Son Department Store; Holtzman and Appel Block	800-816 16th Street	Listed on NRHP	No Adverse Effect[a]
Neusteter Building	720-726 16th Street	Listed on NRHP	No Adverse Effect[a]
McClintock Building	1554 California Street	Listed on NRHP	No Adverse Effect[a]
Independence Plaza; Prudential Plaza	1001 16th Street 1050 17th St.	NRHP-eligible	No Adverse Effect[a]
Bridgepoint Plaza; Park Central	1110 16th Street; 1515 Arapahoe Street	NRHP-eligible	No Adverse Effect[a]
Security Life Building; 1600 Glenarm Place	1616 Glenarm Place	NRHP-eligible	No Adverse Effect[a]
Hilton Hotel; Radisson Hotel; Adams Mark Hotel	1550 Court Place	NRHP-eligible	No Adverse Effect[a]
Dome Tower; Great West Plaza; World Trade Center	1625 Broadway	NRHP-eligible	No Adverse Effect[a]
Zeckendorf Plaza; May D & F Plaza; Hyperbolic Paraboloid	350 16th Street; 1550 Court Place	NRHP-eligible	No Adverse Effect[a]
Colorado Federal Savings	200 16th Street	NRHP-eligible	No Adverse Effect[a]
Petroleum Club Building; Petroleum Building; 110 Building	110 16th Street	NRHP-eligible	No Adverse Effect[a]
Federal Reserve	1020 16th Street	NRHP-eligible	No Adverse Effect[a]
Lower Downtown Denver Historic District	Multiple	NRHP-eligible	No Adverse Effect[a]
Symes Building; F.W. Woolworth Company	820 16th Street	NRHP-eligible	No Adverse Effect[a]
Hayden, Dickinson & Feldhauser Building; Colorado Building	1609-1615 California Street	NRHP-eligible	No Adverse Effect[a]
Madison Hotel; Harris Hotel	1544-1546 Cleveland Place	NRHP-eligible	No Adverse Effect[a]
Walgreens	801 16th Street	NRHP-eligible	No Adverse Effect[a]
16th Street Mall	1-1300 16th Street	NRHP-eligible	Adverse Effect

Historic Property Name	Address	NRHP Eligibility	Finding of Effect
Skyline Park	1500-1800 Arapahoe Street	NRHP-eligible	No Adverse Effect[a]
16th Street Historic District	Multiple	NRHP-eligible	No Adverse Effect
Denver Tramway Trolley Lines archaeological site	Broadway	NRHP-eligible	No Historic Property Affected

[a] No property acquisition; no direct effects; Project limits do not cross property lines; construction would be outside property boundaries; no visual or atmospheric changes to the historic properties; properties would retain integrity of design, materials, workmanship, location, setting, feeling and association.

In summary, the undertaking would have an Adverse Effect on the 16th Street Mall historic property because of alterations to character-defining features of the property, including the granite pavers, pavement pattern, tree species and locations, tree boxes, additional trees, additional lighting, removal of the median in the center-running blocks, and changes to the alignment. The undertaking would have No Adverse Effect on the remaining historic properties in the APE.

Therefore, the undertaking would have an **Adverse Effect** on historic properties under Section 106 of the NHPA.

SECTION 7

Avoidance, Minimization, and Mitigation

7.1 Avoidance

In accordance with 36 CFR 800.1(a) and (c), and from early in Project planning, the Project team and agencies have sought ways to avoid, minimize or mitigate adverse effects on historic properties. No alternative that meets the purpose and need was identified that would avoid an Adverse Effect on the 16th Street Mall historic property. One other build alternative (the Center Running Alternative) would meet purpose and need but, like the LPA, would result in an adverse effect to the 16th Street Mall under Section 106.

The Project evaluated several potential alternatives that would avoid the 16th Street Mall historic property. However, none were feasible or prudent because they either could not be built under sound engineering judgment or did not meet the Project's purpose and need.

7.1.1 No Build Alternative

The No Build Alternative would maintain the existing alignment and configuration of the Mall. Maintenance activities, such as repairs to the pavement system and other infrastructure, would continue as they do now, and there would be continued implementation of safety strategies, including the 2016 DDP *Downtown Security Action Plan*.

The No Build Alternative would not be feasible because there is a construction flaw in the design of the pavement drainage system that causes ongoing maintenance and repair activities that disrupt transit operations and are increasingly costly.

The No Build Alternative would not act to address the Project's stated purpose and need. This alternative would also not include any actions to address the identified safety concerns.

The No Build Alternative would avoid an adverse effect on the 16th Street Mall, but would not address the deteriorating infrastructure, provide equitable and sufficient space for high-quality public gathering opportunities, or improve pedestrian and vehicle safety.

7.1.2 Rebuild in Existing Configuration Alternative

The Rebuild in Existing Configuration Alternative would include the following elements, described further in the *Alternative Screening* technical memorandum in **Appendix B** of the EA:

- Reconstruct the Mall in the exact same design as the existing Mall, replicating the existing spatial configurations of the trees, light fixtures, transit lanes, and pedestrian areas.
- Fully comply with ADA standards, which could result in minor changes to the original Mall design being replicated.
- Replace the Mall's pavement system with a new concrete sub-slab that drains properly
- Replace the existing granite pavers with new granite pavers.
- Replace underground infrastructure and trees.
- Continue operation of the Free MallRide at RTD's current and planned levels of service.

FTA has determined that the Rebuild in Existing Configuration Alternative could be built as a matter of sound engineering judgment and would be feasible from an engineering perspective. The alternative would address the need to improve deteriorating infrastructure and reduce maintenance frequency and costs to businesses and taxpayers. However, it would not meet the following Project needs:

- *Improve safety for pedestrians and vehicles.* The Rebuild in Existing Condition Alternative would reconstruct the Mall in the same physical configuration as its current design, which would not address safety problems related to the physical design of the Mall. The Rebuild in Existing Configuration Alternative would result in continued safety issues related to the need for better delineation between pedestrian walkways and transit lanes.
- The Rebuild in Existing Configuration Alternative would continue to lack consistent visual delineation between pedestrian walking areas and transit lanes, and the attached sidewalk configuration does not conform with national guidance specific to pedestrian safety. This design would perpetuate the existing condition where pedestrians intentionally (because of sidewalk crowding) or accidentally (because of the lack of clear delineation) walk into the transit lanes or close enough to the transit lanes to be hit by bus mirrors.
- *Maintain mobility for desired transit operations and for all users.* The Rebuild in Existing Configuration Alternative would continue the use of undersized sidewalks. The 8-foot pedestrian walking areas do not meet CCD design standards for 10-foot unobstructed sidewalk width downtown (CCD, 1993) and do not accommodate pedestrian volumes, which currently reach up to 4,100 pedestrians per hour at the east end of the Mall between Champa Street and Glenarm Place. At bus stops, the carrying capacity of the 8-foot walking areas is reduced because people gathering at bus stops obstruct the pedestrian walkway as a result of its location immediately adjacent to the transit lanes.
- *Increase opportunities for public use of the Mall as an iconic civic space for leisure, commerce, and tourism*. The Rebuild in Existing Configuration Alternative would continue to have narrow and divided public spaces on the Mall, perpetuating the limited usability of the Mall for safe and engaging public use and amenities. The physical design of the medians would remain too small for comfortable public gathering. The outer sidewalks on the median blocks, and on the narrow sides of the asymmetrical blocks, would remain too small to allow for both a standard 10-foot pedestrian walking area and a 9-foot patio and amenity space.

7.1.3 Partial Repair Alternative

The Partial Repair Alternative is based on the recommendations of the *16th Street Urban Design Plan* (BID et al., 2010). This alternative would retain the existing Mall design and would include the following infrastructure actions:

- Renovate existing granite paver system in some areas, but not replace the existing concrete sub-base slab. This alternative would be implemented by reusing the existing granite pavers. In the transit lanes, the process would include cataloging the existing pattern, removing the existing pavers, cleaning and refinishing the pavers, and then resetting the pavers in their original location. In the pedestrian areas, the pavers would not be removed, but they would be refinished

- Upgrade surface utilities, including power outlets, where needed.
- Replace failing trees.
- Retain existing tree box infrastructure.
- Renovate and reconfigure furnishings to support public use, pedestrian circulation, and ADA compliance in pedestrian areas.
- Renovate and repair water features including fountains and irrigation.

FTA has determined that the Partial Repair Alternative would not address the construction flaw in the design of the pavement drainage system, which causes ongoing maintenance and repair that disrupt transit operations and are increasingly costly.

The Partial Repair Alternative would not address the other Project needs for the same reasons stated for the Rebuild in Existing Configuration Alternative, compromising the Project to a degree that is unreasonable to proceed in light of the Project's stated purpose and need.

7.1.4 Reduce Transit Service on Mall Alternative

This concept would entail the continued operation of the Free MallRide at a reduced service frequency to improve safety and reduce pedestrian conflicts with transit service and reduce the barrier effect of transit service on the medians. To meet transit demand, RTD would need to accommodate the ridership affected by the reduced service on either a new parallel service or on the Free MetroRide on 18th and 19th streets.

The Reduce Transit Service on the Mall Alternative could not be implemented as a matter of sound traffic engineering judgement because RTD cannot meet its service requirements and ridership demand through service in mixed traffic on parallel city streets. The Free MallRide shuttle was originally designed as a free transit shuttle bus between Denver Union Station and Civic Center Station, the major transfer stations in metro Denver. Placing the transit service on the Mall decreased the number of buses on downtown streets by funneling express and regional commuter buses to bus terminals. Today, routes along the Mall eliminate approximately 870 bus trips on downtown streets, reducing congestion in the downtown area. Current Free MallRide ridership is approximately 39,000 and is projected to increase to 70,000 in 2035. Reducing service on the Mall would require shifting a portion of the current ridership and all projected ridership to another bus route. Providing bus service in mixed traffic, such as the Free MetroRide currently operating on 18th and 19th streets, provides a slower trip and out-of-direction travel, and would not be able to accommodate RTD's current and projected ridership demands.

The Reduce Transit Service on Mall Alternative would not address the following Project needs:

- *Address deteriorating infrastructure to allow reasonable maintenance frequency and costs to businesses and taxpayers*. This alternative would not fully address the failing and deteriorating infrastructure on the Mall and would not fix the flawed pavement system that does not drain water, resulting in the need to reconstruct or replace the infrastructure at a future point in time. Existing and ongoing maintenance problems would continue.
- *Improve safety for pedestrians and vehicles*. Fewer buses would travel in the transit way, reducing the potential for pedestrian/transit conflicts from existing conditions. However, this alternative would result in the continued safety issue associated with poor delineation between undersized pedestrian walks immediately adjacent to transit lanes.

- *Maintain mobility for desired transit operations and for all users.* The Reduce Transit Service on Mall Alternative would decrease mobility by reducing transit service on the Mall. Parallel routes do not have the capacity to accommodate the transit demand and do not provide equivalent travel times because of longer routes, buses operating in mixed traffic, and out-of-direction travel for riders to reach bus service on parallel streets. Pedestrian walking areas would remain undersized.
- *Increase opportunities for public use of mall.* The reduced transit service would reduce somewhat the barrier effect of transit service on the medians, but the medians would remain too narrow to provide both adequate and comfortable gathering spaces and pedestrian circulation around the gathering space in between the transit lanes.

The outer sidewalks on the median blocks and the narrow sidewalks on the asymmetrical blocks would remain too narrow for both a standard 10-foot pedestrian walking area and a 9-foot patio.

7.2 Minimization

7.2.1 Measures to Minimize Effects on Archeological Resources

There are no identified significant archaeological resources within the limits of construction. However, an Unanticipated Discovery Plan will be developed, and if previously unidentified archeological resources are identified during Project construction, all surface- and subsurface-disturbing activities shall cease in the immediate area of the discovery and the procedures outlined in the project's Unanticipated Discovery Plan will be implemented. If previously unidentified archeological sites are determined to be eligible for listing in the NRHP, appropriate mitigation measures would be developed in consultation with the SHPO.

7.2.2 Measures to Minimize Effects on Cultural Landscape and Built Environment Resources

Throughout the design process, the design team has recognized the importance of the 16th Street Mall to the historic community and to the city. Efforts have been made to reduce impacts to the historic property while still meeting the purpose and need of the Project. The following are ways in which the LPA had reduced effects to the character-defining features of the 16th Street Mall:

- Retain a granite paver surface in the same three colors as the original design.
- Maintain overall design concept of a carpet covering the Mall surface, by retaining a full 80-foot-wide patterned carpet from building face to building face.
- Retain the 45-degree diagonal grid pattern.
- Retain the existing locations of shifts in transit lane alignment in keeping with the beginning, middle, and end in the original design.
- Maintain spatial relationship between trees and light standards.
- Retain permeability of pedestrians throughout each block.
- Minor changes to the overall pattern of the granite pavers from existing design.

- Retain a single row of aligned trees for 12.5 blocks.
- Replicated historic light fixtures would continue to be used in current and new locations.
- Retain street signs on traffic signals.

Although minimization measures have been included in the design of the LPA, the project would have an Adverse Effect under Section 106 of the NHPA on the 16th Street Mall historic property. The property would retain its integrity of location, setting, and feeling, as it would remain in the same location, the structures around it would not change, and it would continue to serve as a transit and pedestrian corridor. The integrity of materials would be impacted by the replacement of the granite pavers, the removal and replacement of the trees, and the change in tree species. The integrity of design and workmanship would not be retained because of the transit way realignments, conversion of the median to transit lanes, shifts in the carpet pattern, and additional trees on the asymmetrical ends. The I.M Pei-design would not be replicated, but the LPA is reverential to the original design in the geometry of the pattern, Navajo rug influence, tree and light spatial arrangement, granite pavers, and three distinct zones. However, the integrity of association would be lost.

7.3 Mitigation

Mitigation is required when project activities directly or indirectly cause adverse effects to historic properties. Throughout the design process for the proposed project, care has been taken to avoid and minimize effects on historic properties, where possible.

Appropriate mitigation measures to address the adverse effect will be established through the Section 106 consultation process between FTA, RTD, SHPO, and the consulting parties, which is ongoing. Mitigation measures will be stipulated in a binding agreement document signed by the entities with responsibilities under the agreement.

Table 7-1 summarizes the LPA's effects on historic properties, as well as its appropriate mitigation.

Table 7-1. Summary of Effects on Historic Properties and Mitigation

Effects	Mitigation
Adverse Effect to the 16th Street Mall historic property. Effects would include realignment of the asymmetrical blocks, relocation of the transit lanes, conversion of the median to transit lanes, replacement and relocation of trees, introduction of additional tree species, and replacement of the existing granite pavers with new granite pavers. Visual effects on historic properties adjacent to the APE. The setting and feeling of the historic properties would be temporarily affected during construction of the LPA.	Appropriate mitigation measures to address the adverse effect will be established through Section 106 consultation, which is ongoing, between the lead federal agency and consulting parties. Mitigation measures will be stipulated in a binding agreement document signed by the entities with responsibilities under the agreement. An Unanticipated Discovery Plan will be developed for archaeological resources.

SECTION 8

Conclusion

The undertaking would have an adverse effect on the 16th Street Mall historic property because of alternations to the pavement pattern, granite pavers, tree species and locations, tree boxes, as well as additional trees and lighting, removal of the median in the center-running blocks, and changes to the alignment. The undertaking would have No Adverse Effect on the remaining historic properties within the APE.

Therefore, the undertaking would have an **Adverse Effect** on historic properties under Section 106 of the NHPA.

Through Section 106 consultation, which is ongoing, an agreement document will be developed to address the adverse effect on historic properties from the LPA. Appropriate mitigation measures to address the adverse effect will be codified in the agreement document. The legally-binding agreement document will be executed and included with the final NEPA project agreement document.

SECTION 9

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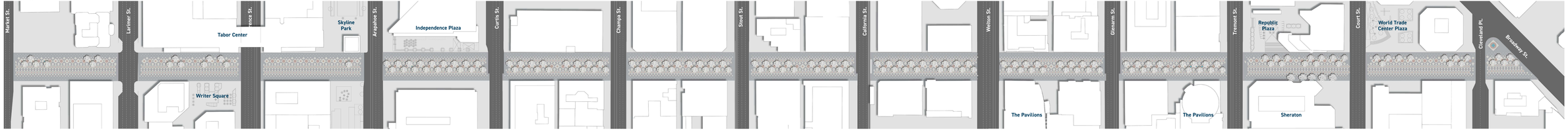
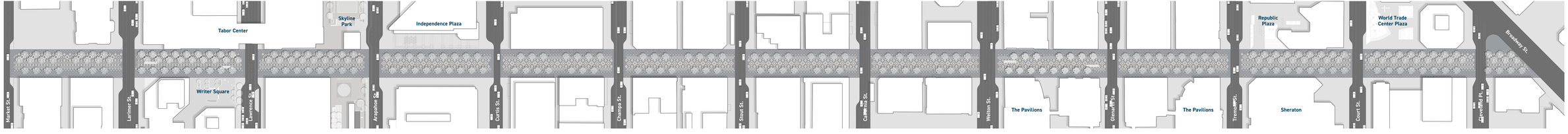
Attachment 1
Locally Preferred Alternative
Preliminary Design

The 16th Street Mall

Existing Conditions



Proposed Alternative: Center Running & New Asymmetrical



Attachment 2
16th Street Mall Form 1403

OAHP1403
Rev. 9/98

COLORADO CULTURAL RESOURCE SURVEY

Architectural Inventory Form

Official eligibility determination
(OAHP use only)
Date _____ Initials _____
_____ Determined Eligible- NR
_____ Determined Not Eligible- NR
_____ Determined Eligible- SR
_____ Determined Not Eligible- SR
_____ Need Data
_____ Contributes to eligible NR District
_____ Noncontributing to eligible NR District

I. IDENTIFICATION

1. Resource number: 5DV7044
2. Temporary resource number: _____
3. County: Denver
4. City: Denver
5. Historic building name: 16th Street Transitway / Mall (Structure - Designed Landscape)
6. Current building name: 16th Street Mall (Structure - Designed Landscape)
7. Building address: Broadway northwest to Market Street, 80202
8. Owner name and address: City/County of Denver: Department of Public Works, 201 West Colfax Avenue, Denver, Colorado 80202

II. GEOGRAPHIC INFORMATION

9. P.M. 6th Township 3S Range 68W

_____ ¼ of NE ¼ of SE ¼ of NE ¼ of Section 33
_____ ¼ of SW ¼ of SW ¼ of NW ¼ of Section 34
_____ ¼ of NE ¼ of NW ¼ of SW ¼ of Section 34
_____ ¼ of SW ¼ of NE ¼ of SW ¼ of Section 34
_____ ¼ of NE ¼ of SE ¼ of SW ¼ of Section 34

10. UTM reference **(center point of structure)**

Zone 1 3 ; 5 0 0 5 4 2 mE 4 3 9 9 5 9 4 mN

11. USGS quad name: Englewood, CO Year: 1980 Map scale: 7.5 feet X 15.0 feet
12. Lot(s): _____ Block: _____

Addition: _____ Year of Addition: _____

13. Boundary Description and Justification:

Description: Full width of 16th Street (from the adjacent building faces lining the northeast side to building faces lining the southwest side, typically 80 feet wide) from Broadway at its west line of intersection with 16th Street, northwest 12 blocks to Market Street at its southeast line of intersection with 16th Street (approximately 4,675 ft or 0.9 miles), plus the small triangular block bounded by Broadway, 16th Street, and Cleveland Place.

Justification: This boundary encompasses the original design limits of the 1980 transitway and mall design by I.M. Pei & Partners, and Hanna/Olin landscape architects, from which mall construction proceeded.

III. Architectural Description (Structural Description)

14. Building plan (footprint, shape): Rectangular (Denver Street Right-of-Way, including sidewalks)
15. Dimensions in feet: Length 4,675 feet x Width 80 feet
16. Number of stories: N/A
17. Primary external wall material(s): Granite paver units in two shades of gray, and one shade of red.
18. Roof configuration: N/A
19. Primary external roof material: N/A
20. Special features: Paver pattern, ornamentation
21. General architectural description: Designed landscape/streetscape and transit mall. This property is a 12-block, 80-foot-wide transitway and pedestrian corridor with three distinct zones, a central zone with a 22-foot-wide median with 2 parallel rows of trees, and end blocks where the transit lanes are adjacent with a single row of parallel trees. The essential elements of the design, according to the 1977 design concept document, are "paving, planting, and lighting" (Pei, 1977) (described in greater detail in Section 35). Key elements were finalized in 1980 design drawings, prior to mall construction in 1981. The intricate patterning of the pavers and the paving material were used by the designers to establish the character of the mall. The geometry of the pattern, based on the city's existing street system and corresponding to 16th Street's 45-degree angle where it meets Broadway, is a 45-degree diagonal grid, which was intended to encourage diagonal pedestrian movement along the mall. The pattern "begins along the street wall as a field of gray paving block which gradually builds in scale as it reaches the center of the mall. The pattern at the edges is deliberately neutral to avoid competition with the varied dimensions of the storefronts and doorways. In the center zone, the pattern becomes more colorful and dominant" (Pei, 1977). The pavement design is carried along the length of the mall by polychrome granite units, generally 1-foot 5-inch by 1-foot 5-inch square granite pavers—charcoal gray, light gray, and "Colorado red" (Cultural Landscape Foundation [CLF] 2009)—with special curb, ramp, drain, circular, and other units from the same granite color palette. The streetscape also features custom-designed and custom-built light fixtures, signage, telephone stands, planter and trash receptacles, drinking fountains, and pavement fountains. Consistent tree plantings of 220 oaks and honey locusts are rooted in special underground structural-concrete chambers, 5 feet 5 inches deep, supported by a "suspended pavement system," with custom tree gratings at the pavement plane (Marritz 2014).

    Architectural style/building type: Modern Movement (See Section 42)
22. Landscaping or special setting features: See Sections 17, 21, 42
23. Associated buildings, features, or objects: The flanking block faces of buildings, and their evolution throughout the function of the transitway and mall after 1980, were accommodated with the landscape/streetscape design, but are not part of the structure. The project incorporated and re-designed the triangular block hosting "United Nations Square" at Cleveland Place and Broadway.

IV. ARCHITECTURAL HISTORY

25. Date of Construction: Estimate:_____ Actual: 1982 (original); 1992 (extension from Blake Street to Union Station, later modified northeast of Wynkoop Street, not part of this evaluation)

    Source of information: 1980 Design Drawings, I.M. Pei & Partners, Architects and Planners

26. Architect: I.M. Pei and Henry Cobb, Architects with I.M. Pei & Partners (Pei Cobb Freed and Partners), New York; Laurie Olin of Hanna/Olin (now OLIN), Landscape Consultants, Philadelphia; Phillip E. Flores Associates, Landscape Architects, Denver

    Source of information: 1980 Design Drawings, I.M. Pei & Partners, Architects and Planners

27. Builder/Contractor: J.A. Walker Company, Denver

    Source of information: 1980 Design Drawings, I.M. Pei & Partners, Architects and Planners

28. Original owner: City/County of Denver; same as existing owner

    Source of information: City/County of Denver

29. Construction history (include description and dates of major additions, alterations, or demolitions):

    Following general plans and public input throughout the 1970s (Sixteenth Street Mall Corporation 1973–1974; Regional Transportation District [RTD] 1977–1979), construction began in early 1981 based on the approved 1980 design from the architects/landscape architects team (Historic Denver, Inc. 2012a). Funding of $76 million came from the Urban Mass Transit Administration (UMTA, after 1991 the Federal Transit Administration [FTA]) and RTD, operator of the mall buses (Marritz 2014). The project began on the northeast end at Market Street and proceeded southeast in increments along the entire 80-foot-wide 16th Street right-of-way. The design cross section specified a transitway concrete base sloping to each curb from an apex centered between the transit lanes (Pei & Partners 1980). Subsequent maintenance and replacement of the granite pavers indicates this concrete base was not originally built with slopes, or was built with inadequate slopes, resulting in surface water run-off permeating into the base as paver joints deteriorate (Harvey 2015).

    Oral histories of workers and designers (Historic Denver, Inc. 2012b) described how pedestrian passage, business access, and as much vehicular traffic as possible continued during construction. The contractor encountered and re-located, or moved deeper, several uncharted steam pipes and water mains as construction progressed. Tree placement in specially designed, irrigated, and drained concrete root chambers under the mall surfaces presented challenges, especially when completed and paved to match the continuous pavement of the transit lanes and sidewalks (Historic Denver, Inc. 2012b). Construction concluded with a public dedication attended by 200,000 on October 4, 1982. Design and construction issues, which resulted in separation of the granite pavers from the joint mortar causing the pavers to sink into the setting bed space, were noted subsequent to opening. A civil suit was filed (RTD, et al v. Weaver, et al, Civil Action No. 83-CV-8819) as a result of paver failure on the transitway. The settlement agreement was filed on September 29, 1986 that released the litigants from future liability and awarded RTD a total amount of $4.07 million to be dispersed over a period of 25 years.

RTD separately contracted designs and construction for its Civic Center Transfer Facility (later named Civic Center Station) as the southeastern mall-bus terminal, and the Northwest Transfer Facility (later named Market Street Station) as the northwestern terminal including mall-bus drop off and turnaround in the block between Market and Blake Streets. In 1992, following removal of the 16th Street viaduct across the Union Station railyard, RTD and FTA extended the 16th Street Transitway and Mall from Blake Street to the north side of Union Station and the new Light-Rail terminal there. After 2010, that Transitway and Mall and Light-Rail terminal underwent further reconfiguration to their current services north of the intersection of 16th Street and Chestnut Place in the former Union Station railyard. RTD performs continual maintenance, including with FTA assistance, on the Transitway, such as replacing broken granite pavers and special units. The City/County of Denver has subsequently rebuilt most cross-streets; however, the scored concrete intersection surfaces between block lengths were never built as planned per the original 1980 Pei/Olin 16th Street Transitway and Mall design. Constructed based on the original designs was a bus turn-around at the Civic Center Station, which has since been removed. Originally, the transitway vehicles crossed Broadway and had a turnaround area in the Civic Center between the Concourse Level (lower level) and the Plaza Level (upper level which lead to the nearby government offices.

30. Original location Yes Moved ____ Date of move(s):

V. HISTORICAL ASSOCIATIONS

31. Original use(s): Government, Public Works; Landscape, Street Furniture/Object; Transportation, Road-Related (vehicular)
32. Intermediate use(s): Same as original.
33. Current use(s): Same as original
34. Site type(s): Structure (Designed Landscape)
35. Historical background: Denver leaders, downtown merchants, and the RTD considered numerous plans and solutions to the post-World War II decline of downtown business and recreation; the loss of longtime streetcar public transportation that once centered on 16th Street; and the simultaneous rise of automobile congestion on Denver's city streets. Following popular trends along with lessons of what worked and did not work in other cities with similar challenges in the 1960s and 1970s, the City/County of Denver, business groups such as the 1970s Sixteenth Street Mall Corporation (1973–1974), and RTD, supported by federal funding, decided to convert the city's longtime downtown retail-commercial street to a pedestrian mall with frequent and free transit buses. By 1977 RTD's review of design proposals resulted in commissioning the New York architectural firm of I. M. Pei & Partners teamed with Philadelphia landscape architecture consultant Laurie Olin of Hanna/Olin, and ultimately the Denver landscape architecture firm of Phillip E. Flores Associates, Inc. (RTD 1977; Pei & Partners 1977).

As summarized in the 1977 *The Transitway Mall* design concept document, the goals of the project were to "lessen traffic congestion" in downtown Denver, "provide more efficient bus service" to Denver's downtown and suburban neighborhoods, and to "create a new pedestrian environment in the downtown

– a place for people" (Pei & Partners 1977). The basic, over-arching design elements on which the design was based were: "a double row of Honey Locust trees flanking a 22-foot wide promenade in the center of the street; two 10-foot wide transitway paths on either side of the central zone; widened sidewalks along the storefronts; patterned paving over the entire street surface in varying tones of muted grays and red; a combination light fixtures creating a variety of lighting levels at dusk, during the evening, and for late-night security; and shelters, benches, fountains, as well as places for displays, sidewalk cafes, and special events" (Pei & Partners 1977). The end blocks are modified so the transitway lanes are together, "and are flanked by a single row of trees, originally red oak, offset to open the street to views of the mountains and the D & F Tower at one end, and the Capitol dome at the other" (Pei & Partners 1977).

The designers believed that landscaping, in particular, trees, would create the desired unifying theme as well as provide physical protection from the elements. "The location of trees is crucial" (Pei & Partners 1977). Thus, the design placed them in the center, diagonally spaced, 32 feet apart so as not to block accessibility or visibility of the structures lining the mall and to maintain the visibility and unique visual qualities of the exiting street. The sidewalks were widened to 19 feet (from 15 feet) and were considered quasi-private spaces that were essentially adjuncts to the shops lining the street. The transit lanes were physically depressed from the sidewalks, but visually cohesive with the pavement pattern. The designers wanted to define the vehicular lanes for safety reasons, but also to make this definition in the least visually obtrusive way.

The design concept took into consideration the existing scale of the street with its variety of visual elements, buildings sizes and uses, and unique interest of the street. The challenge for the designers was to "create a unifying theme and common identity for the street, while protecting its distinctive personality" (Pei & Partners 1977). With its benches, fountains and other amenities, the design intentionally created a framework and a setting for both present planned uses and for the future. "Ample space is provided for sidewalk cafes, kiosks, vending carts, and displays which can evolve into permanent elements or change as different needs emerge" (Pei & Partners 1977).

Laurie Olin and Pei's principal designer, Henry Cobb, discussed a design approach of Southwestern geometric patterns early in their separate processes, then during their collaborative program, discussed including Navajo Chief-style blankets with polychrome diamond motifs. While still discussing the final design, Olin visited a souvenir shop along 16th Street Mall and encountered trouser belts decorated with diamondback rattlesnake skins. From those inspirations, the architects and landscape architects crafted the mall's overall design, precisely interwoven within three shades of granite pavers and unified by the tree plantings (see Section 21), and lighting standards. Signage, planters, street furniture (benches, shelters), fountains, banners and other moveable objects (mailboxes, phone boxes, trash receptacles) were part of the overall plan and were given a uniform design and placed along the street in a planned pattern to blend with the rest of the mall's design features.

The tree selection process was extensive and began with the evaluation of 72 species, based on criteria created by the design team; among them, "height and diameter, trunk, branch, leaf and root form, shade characteristics, sun, water and maintenance needs, disease and insect susceptibility, wind and pollution tolerance, availability and cost" (Pei & Partners 1977). Based on their evaluation, the team selected the honey locust for the center blocks and red oak for the ends.

Following the mall's completion in October 1982, the project won the University of Colorado's 1983 "Honor Award for Excellence in Urban Design," the Associated Landscape Contractors of America's 1984 "Environmental Improvement Award of Distinction" (Historic Denver, Inc. 2012a), and the American Society of Landscape Architects' 1985 "Professional Award, Design Category" (CLF 2009). The Urban Land Institute (ULI) named the mall in 2008 "public art of the highest international quality" (ULI 2008). Henry Cobb is now a Fellow of the American Institute of Architects; Laurie Olin is a Fellow of the American Society of Landscape Architects, and recognized as a "Pioneer" by CLF (2009); the 16th Street Transitway and Mall is designated by that organization as a signature "Landslide" and "At-Risk Landscape."

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VI. SIGNIFICANCE

37. Local landmark designation: Yes ____ No _X_ Date of designation: _____

    Designating authority:

38. Applicable National Register **[of Historic Places, NRHP]** Criteria:

    _X_ A. Associated with events that have made a significant contribution to the broad pattern of our history;

    ____ B. Associated with the lives of persons significant in our past;

    _X_ C. Embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or that possess high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; or

    ____ D. Has yielded, or may be likely to yield, information important in history or prehistory.

    _X_ G. Qualifies under Criteria Considerations A through G (see Manual)

    ____ Does not meet any of the above National Register criteria

39. Area(s) of significance: Criterion A: Transportation, Community Planning and Development; Road-Related (vehicular); Criterion C: Engineering; Landscape Architecture; Criteria Consideration G: Properties That Have Achieved Significance Within the Last Fifty Years.

40. Period of significance: 1980–1982

41. Level of significance: National ____ State _X_ Local _X_

42. Statement of significance: This analysis concludes the 16th Street Mall meets Criterion Consideration G, as a property that is identifiable as historically significant at less than 50 years old. The property is eligible for listing in the NRHP under Criterion A at a local level and Criterion C at the state and local level of significance. It's period of significance is 1980 through 1982, the period of its final design and construction. In meeting the Criterion Consideration G, the original design and construction elements from 1982 transformed Denver's downtown streetscape, when the transitway and mall opened, and best represent the exceptional conceptualization of its architects. The following provides additional information regarding this evaluation.

    Criterion A: The 16th Street Mall is eligible for listing in the NRHP under Criterion A at a local level in the areas of Transportation and Community Planning and Development. The 16th Street Mall is significant for transforming Denver's downtown and revitalizing a fledging commercial district affected by post-World War II development outside of the city. As Denver-area residents relied more on the automobile, City streets became more congested and polluted, deterring downtown business growth and pedestrian use (Denver Partnership, Inc., et al. 1982). The 16th Street commercial area was in decline by the 1960s and 1970s, caused by population shifts to suburban settings, new trends in retail, and the preeminence of the automobile. Developers started to create large-scale shopping plazas on readily available land near new suburban tracts, reducing the importance and draw of a downtown commercial corridor. By the 1970s, at

least 15 different shopping centers existed in the Denver area outside of the downtown. The Public Mall Act was signed into Colorado law in 1970, "allowing municipalities to close off downtown streets" and "in reaction to businesses moving out of downtown areas to suburban indoor malls" (Aspen Historical Society 2015).

Proceeding into the 1970s, Denver leaders, through federal financial assistance from the Urban Mass Transportation Administration, sought to disrupt this trend and revitalize the 16th Street corridor through addressing three major concerns: downtown blight, transportation, and noise/air pollution (Denver Partnership, Inc., et al. 1982). The 16th Street Mall's distinctive design and unified concept, pedestrian and transit uses, and electric and diesel-powered bus-fleet addressed these issues, providing a resurgence in the area that was celebrated as a success almost immediately following its opening (Denver Partnership, Inc., et al. 1982). On its emergence in 1982, the 16th Street Mall sparked not only a noticeable economic boom in the area, the transformed corridor fostered a civic spirit diminished by post-World War II transportation and development trends (Denver Partnership, Inc., et al. 1982). Therefore, the 16th Street Mall has made a significant contribution to Denver and Colorado's recent past and is significant under Criterion A at the local level.

The 16th Street Mall solidly fits within the context of cities across the United States that had initiated similar urban renewal projects in the early 1970s, renovating under-utilized and decayed urban spaces with new commercial, pedestrian, civic, and transit purposes (McKnight, et al. 2010). Decorative landscaping, hardscape features, and restricted automobile use were often cornerstones of these projects, typically completed in a Modern style aesthetic (McKnight, et al. 2010). The Fulton Mall in Fresno, California (completed in 1964) is one of the earliest examples, in addition to the Portland (Oregon) Transit Mall, Nicollet Mall (Minneapolis, completed 1968) and Chestnut Street Transitway (Philadelphia, completed in 1976) (Judge 2013). These projects also received federal assistance through agencies like the U.S. Department of Housing and Urban Development and the Urban Mass Transportation Administration (McKnight, et al. 2010; Judge 2013). During the planning of the 16th Street Mall project, the project team was admittedly influenced by Minneapolis's eight-block Nicollet Mall (by Lawrence Halprin & Associates who also had designed Denver's Skyline Park as a gateway to lower downtown in 1972-1975 [CLF 2016]). These projects tended to have a Modern-inspired design, a public bus component, and sought to improve a fledging business district (Denver Partnership, Inc., et al. 1982). To guide the 16th Street Mall project, designers traveled to cities with similar projects, like Minneapolis, to meet with business leaders, transportation experts, and elected officials (Denver Partnership, Inc., et al. 1982).

When considering the above historic context, the 16th Street Mall has not definitively achieved significance at a national or state level under Criterion A at this point in time. While its clear the significance and contributions made at the local level by the 16th Street Mall, more historical perspective and time is needed to fully understand if it has state or national significance for a resource using Criteria Consideration G.. Per NPS guidance, additional scholarly evaluation and historical perspective over time will help the public

understand the role properties from the recent past have played at a national level (NPS 2002; NPS 1998). Compared to other properties that were determined significant under Criterion A at the national level less than 50 years after they were constructed, these properties tend to have broader implications on the history of the United States, associated with major national themes like the United Farm Workers' movements and Apollo 11 launch. Few pedestrian and/or transit malls developed within the post-World War II context that generated the 16th Street Mall construction are listed on the National Register. The only notable example is the Lincoln Road Mall, a pedestrian mall constructed in Miami, Florida, ca. 1950 and itself needing revitalization by the late 1960s/early 1970s (Harden 2013), was listed on the NRHP in 2011 (NPS 2011). The Fulton Mall, named above, is eligible but not listed on the NRHP. The Nicollet Mall was redeveloped 2015 to 2017. Although pedestrian and transit malls of this sort continue to be developed as well as redeveloped across the nation, few from that initial era of post-World War II downtown redevelopment remain. A national study found that, by the mid-1980s, "85% of the original 200 U.S. pedestrian malls had been reopened to traffic" (Judge 2013:3; Harden 2013). South Burdick Street in Kalamazoo, Michigan—credited as being the first pedestrian mall established for downtown redevelopment, in 1959—reopened for vehicle traffic in 1998 (Harden 2013). Comparatively, the *Denver Business Journal* notes that, for Denver, "closing more than a mile of a downtown street to cars has been an unusual—and much-studied—success" (Harden 2013). As presented by the *Denver Business Journal*, many of the less enduring pedestrian malls were not as well planned and designed that of 16th Street.

Criterion C: As a historic property Denver's 16th Street Mall is also significant at the local and state level under Criterion C in the area of Landscape Architecture, as an award-winning design by master designers, built with granite units in a unique, enduring, western-style pattern consistent along 12 blocks. It is also significant under Criterion C in the area of Engineering for its largely hidden but sophisticated matrix of drainage, irrigation, wiring, and "suspended pavement system" that accommodates large and deep root chambers for its 220 shade trees. (See Section 43 for the correlated review of historic integrity.) As noted by Pei's team in their approach for the project, the designers successfully complemented the existing diversity of buildings and uses along the corridor (Pei, 1977; Pei, 1980). They developed a unifying theme and path of travel for pedestrians and buses that created a defined, new experience in the downtown (Pei, 1977). The scope and design of the project was unique at the time in Denver and Colorado, and its master designers received awards almost immediately following its completion (Historic Denver, Inc., 2012a; Denver Partnership, Inc., et al, 1982). Though constructed less than 50 years ago, it is a unique design and surviving example of Denver's late twentieth century Modern style-inspired urban renewal efforts. As a result, it is eligible for listing in the NRHP under Criterion C at the state and local level.

Though significant for its design and engineering at the state and local level of significance, the 16th Street Mall has not yet achieved significance at the national level under Criterion C. As a less than 50-year old property, the 16th Street Mall represents is one of the exceptional works composed by the design team (NPS, 2002; NPS, 1998). NPS guidance advises that time and perspective are needed to understand how

properties fit within with the life work and contributions of masters to their field (NPS, 2002; NPS, 1998). Although each of the principal designers is still living, Pei, Cobb, and Olin have all had full careers within which to understand the importance of their projects, including the 16th Street Mall. Pei is about 101, Cobb 92, and Olin 80 years old (as of 2018), and Pei and Cobb have important projects that are now over 50 years old and considered historic on that basis. Denver's 16th Street Mall remains essential in representing their full body of work and is directly recognized as being among the noteworthy projects of these renowned designers (cf. CLF: https://tclf.org). The 16th Street Mall is historically important and exceptional within the history of Colorado at the state level for retaining examples of important works by these recognized masters, even though completed less than 50 years ago.

Colorado was where I. M. Pei and his associates, including Henry Cobb, first conducted completed a project as a fully independent design firm, after splitting fully from the firm of Webb and Knapp in 1960—where they had begun their careers (Wiseman 2007). They garnered further national recognition with development of the National Center for Atmospheric Research (NCAR) building in Boulder 1961 and 1967. In that Colorado design, Pei incorporated Southwestern elements reflective of Mesa Verde cliff dwellings and natural elements intended to incorporate and display aspects of nature while remaining monumental in a Modern style (Wiseman 2007). Distinctive influences from nature and Native Americans of Colorado and the Southwest would again be reflected in the design of the 16th Street Mall. The natural and cultural accents employed by the Pei team's architects and landscape architects were in contrast to the starker concrete construction of most Modern design at the time, which has led this unadorned, function-driven construction style to sometimes be called "brutalism."

While the 16th Street Mall further demonstrates Post-Modern influences, it's design and concept reflect the earlier Modern examples completed in Philadelphia, Minnesota, and Fresno through federal and local agency involvement. As a Post-Modern structure, the 16th Street Mall incorporates elements of Denver's Old West past in a contemporary interpretation; however, while advancing beyond earlier Modern examples, it has not led to a transformation of the property type throughout the country (ULI, 2008). The 16th Street Mall has not achieved significance at a national level under Criterion C at this point in time, however—to reiterate—is significant under Criterion C at the state and local level.

Criteria Consideration G: Although the 16th Street Mall is not yet 50 years old, it meets NRHP Criteria Consideration G as exceptionally important for its enduring design and for its celebrated role in helping to revitalize downtown Denver at a critical time for the city as it struggled with urban flight, insensitive urban renewal, and the decline of its mining and petroleum image and economy. Based on the supporting analysis above, the property is exceptionally significant at the state and local level due to the project's role in shaping downtown Denver, and embodying a distinctive design by a team of master designers that is unique in the state.

Character-Defining Features (Pei & Partners, 1980):

- Paving pattern design consistent throughout the Transitway and Mall, between major cross streets, from Broadway northwest 12 blocks to Market Street.
- Granite paver units/modules, 1-foot 5-inch by 1-foot 5-inch, in three shades: charcoal gray, light gray, and "Colorado red" (specified as White, Black, and Red on the 1980 plans).
- Granite special units of charcoal and light gray for curbs, cuts, drains, and other applications.
- Original oak and honey locust trees planted in special under-pavement concrete root boxes and ringed at the surface with custom-designed and -cast iron trunk grates.
- Custom-designed and -built light standards.
- Street furniture of custom-designed and -built fiberglass trash and flower-planter receptacles, metal utility covers.
- Custom metal street signs on traffic signals and overhead lights.

43. Assessment of historic physical integrity related to significance: Portions of the design have been interrupted with subsequent repaving of cross-street intersections through the omission of scoring—called "sawcut joints"—the concrete pavement to match the granite pavers and general diagonal hash-pattern. Some integrity of materials has been lost with ad hoc replacement of granite pavers as they are damaged by vehicular wear or harsh weather (see Harvey 2015). Some integrity of materials and feeling has been lost through subsequent removal of most of the custom-designed telephone stands and the inactivity of below-pavement fountains. Some trees have been lost to disease or age, but this has had little overall impact to the setting, feeling and association of the 16th Street Mall. The original turn-around at Civic Center has been removed, but the mall retains integrity of design and workmanship on the remaining 12 blocks, even with the loss of that portion of the original design.

The 16th Street Transitway and Mall retains strong integrity of location, design, materials, workmanship, setting, feeling, and association and continues to convey its significance under NRHP Criteria A and C, and Criteria Consideration G.

VII. NATIONAL REGISTER ELIGIBILITY ASSESSMENT (See also 42)

44. National Register eligibility field assessment: Eligible X Not Eligible ____ Need Data ____

45. Is there National Register district potential? Yes ___ No X

Discuss: For the evaluated property: Although the transitway and mall comprise a linear resource, which would typically be classified as a site or district, this property is a consistently designed, constructed, and continuous structure, not a district or site. For the encompassing host of downtown Denver a number of commercial districts have been considered for NRHP registration, but never designated in areas that would include the 16th Street Mall between Broadway and Market Street as a contributing resource.

If there is National Register district potential, is this building: Contributing ____ Noncontributing ____

46. If the building is in existing National Register district, is it: Contributing ___ Noncontributing ____

VIII. RECORDING INFORMATION

47. Photograph numbers: N/A

    Negatives filed at: SWCA Environmental Consultants (digital files)

48. Report title: 16th Street Mall National Register of Historic Places Eligibility Evaluation

49. Date(s): June 2016; December 2017

50. Recorder(s): James Steely, Jennifer Moon, and Scott Phillips; Sara Orton and Jeremy Hollins

51. Organization: SWCA Environmental Consultants; CH2M (now Jacobs Engineering)

52. Address: SWCA: 295 Interlocken Boulevard, Suite 300, Broomfield, Colorado 80021
    CH2M: 3330 W. Esplanade Avenue, Suite 612, Metairie, LA 70002

53. Phone number(s): SWCA: 303-487-1183; CH2M: 504-810-0017

NOTE: Please include a sketch map, a photocopy of the USGS quad map indicating resource location, and photographs.

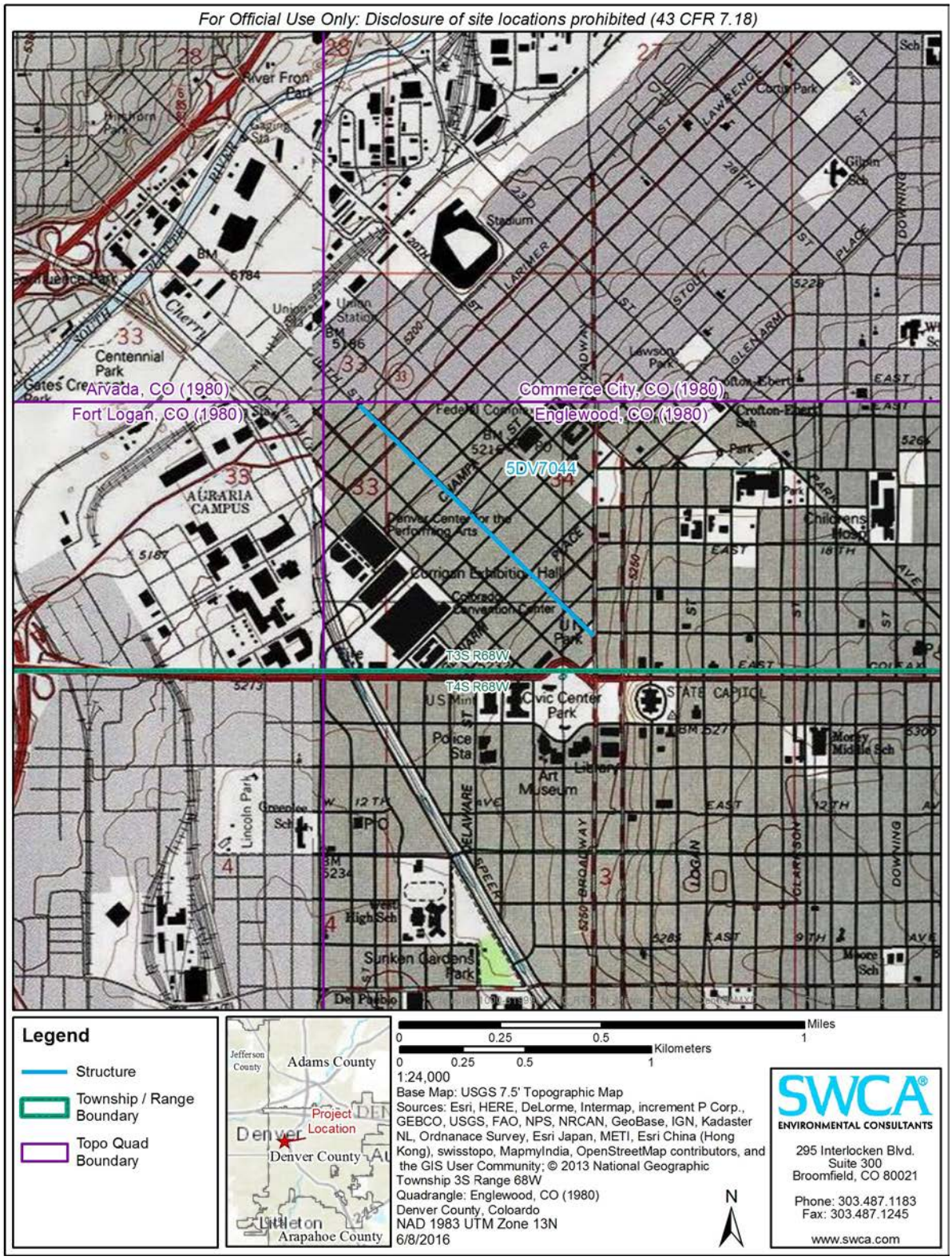


Figure 1. Location map.

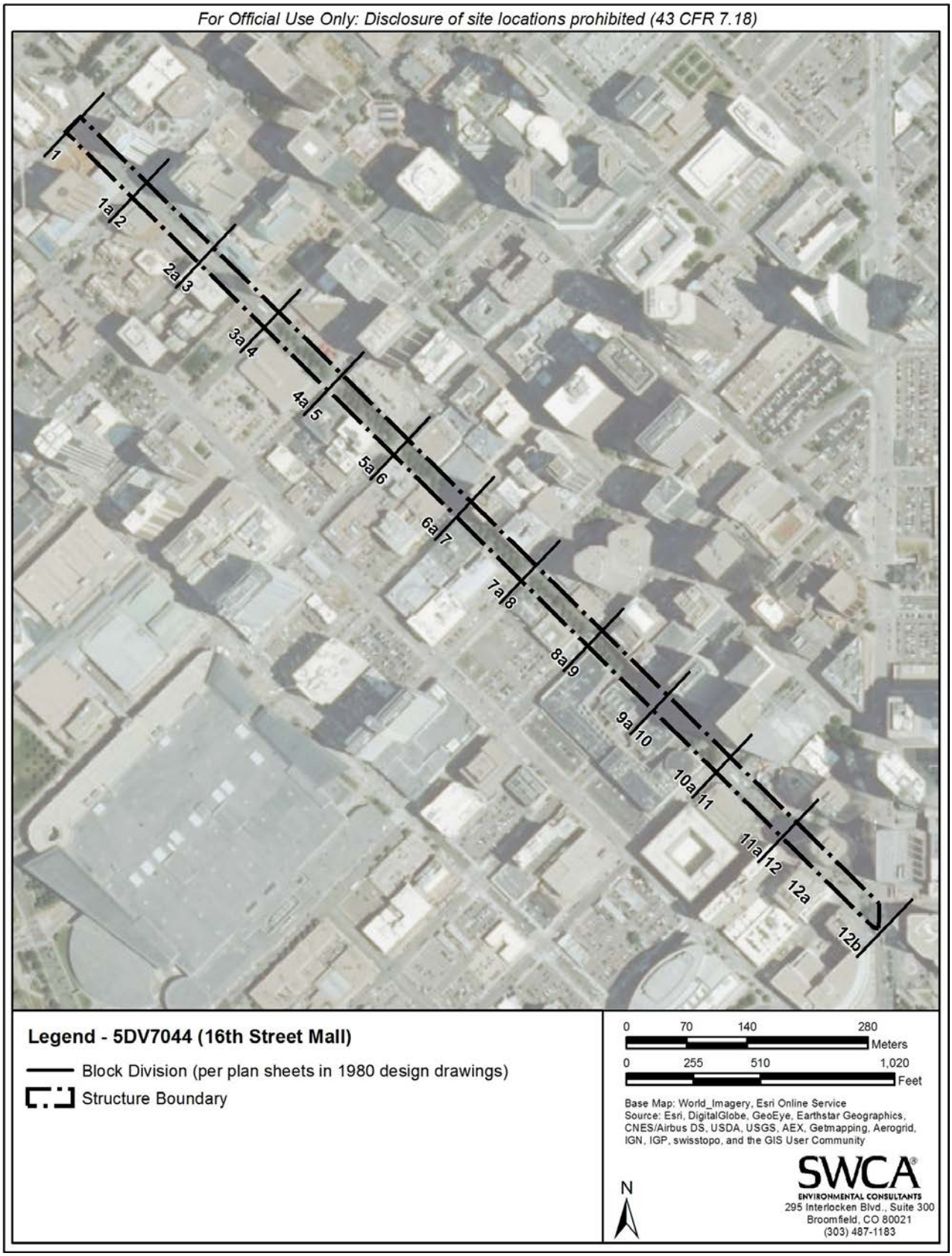


Figure 2. Sketch map, showing resource boundary of 1982–1992 16th Street Transitway | Mall.

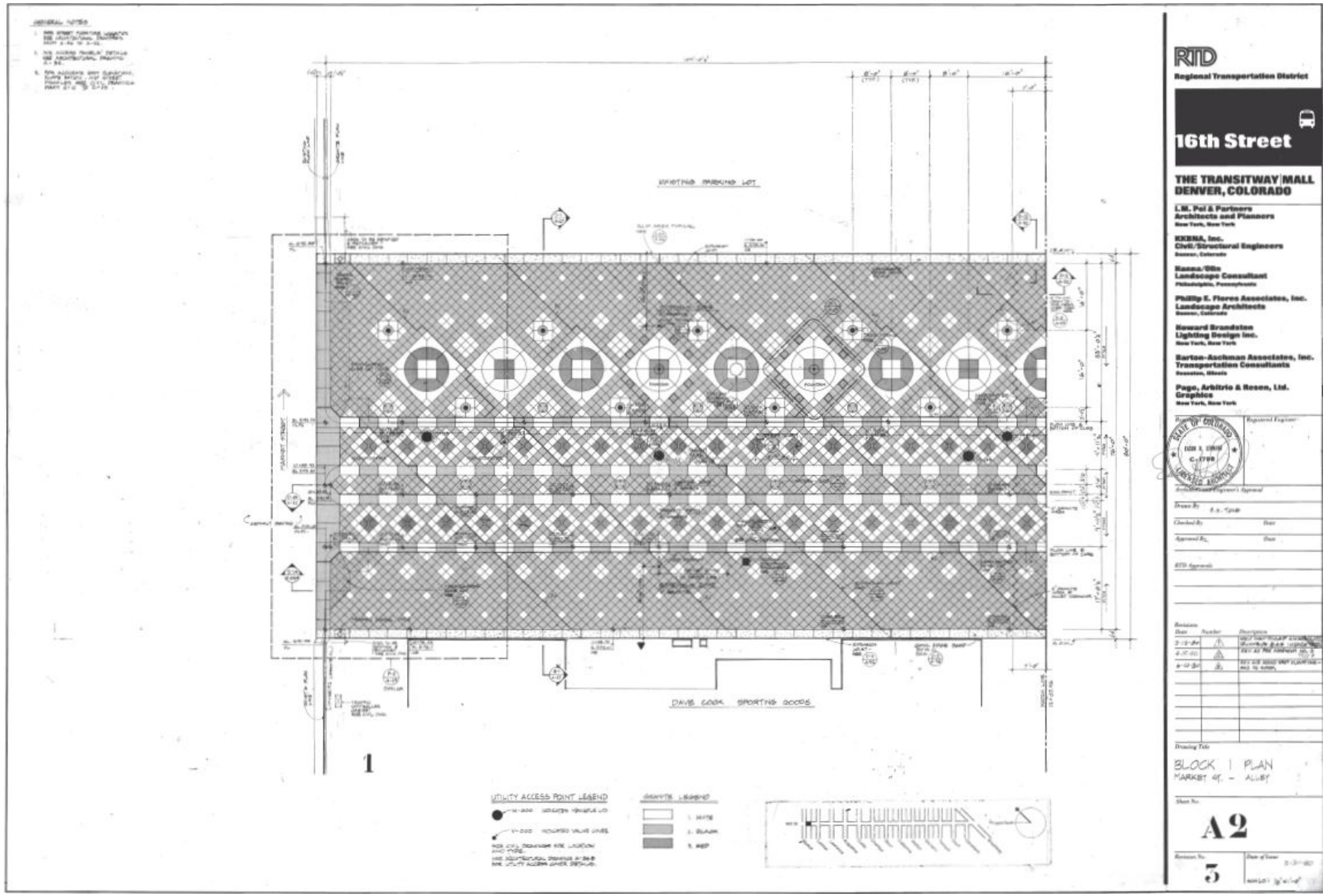


Figure 3. Original I.M. Pei / Hanna/Olin Block Plan as presented in 1980 drawings.

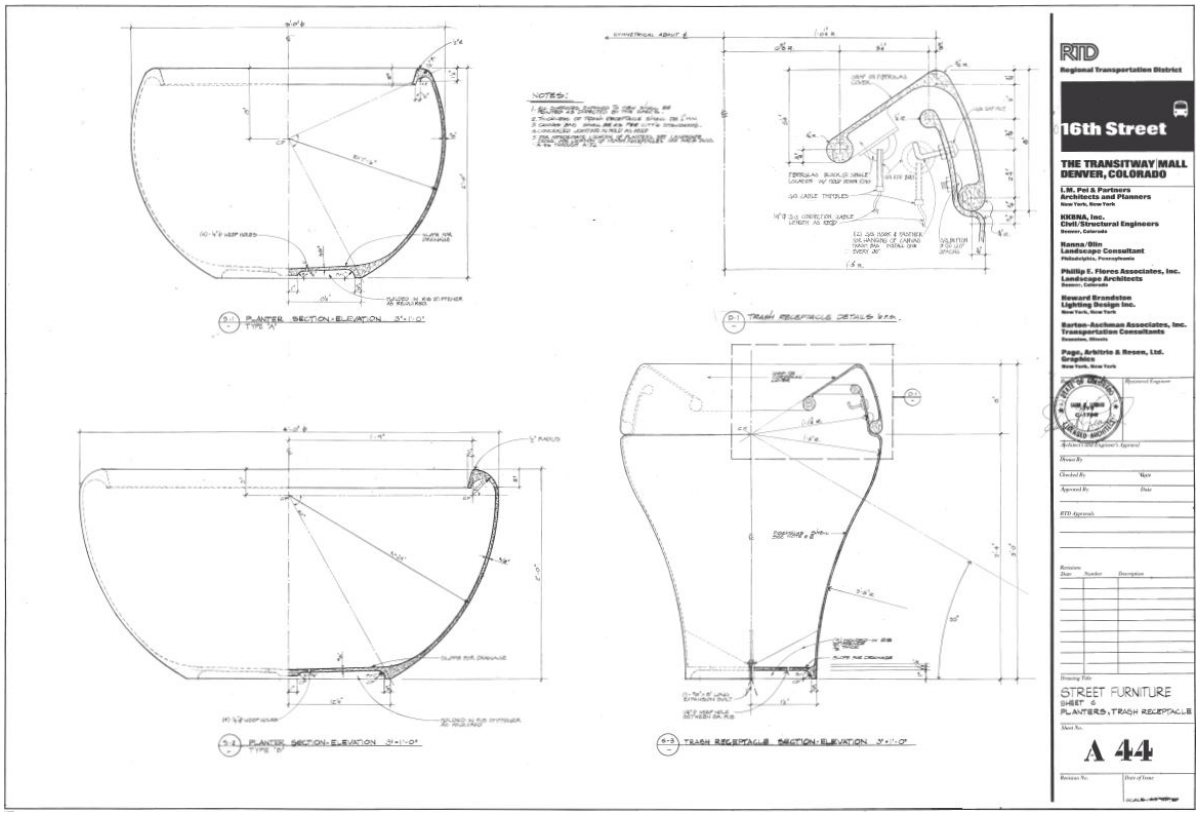


Figure 4. Original I.M. Pei / Hannan/Olin design for Planters and Trash Receptacles in 1980 drawings.

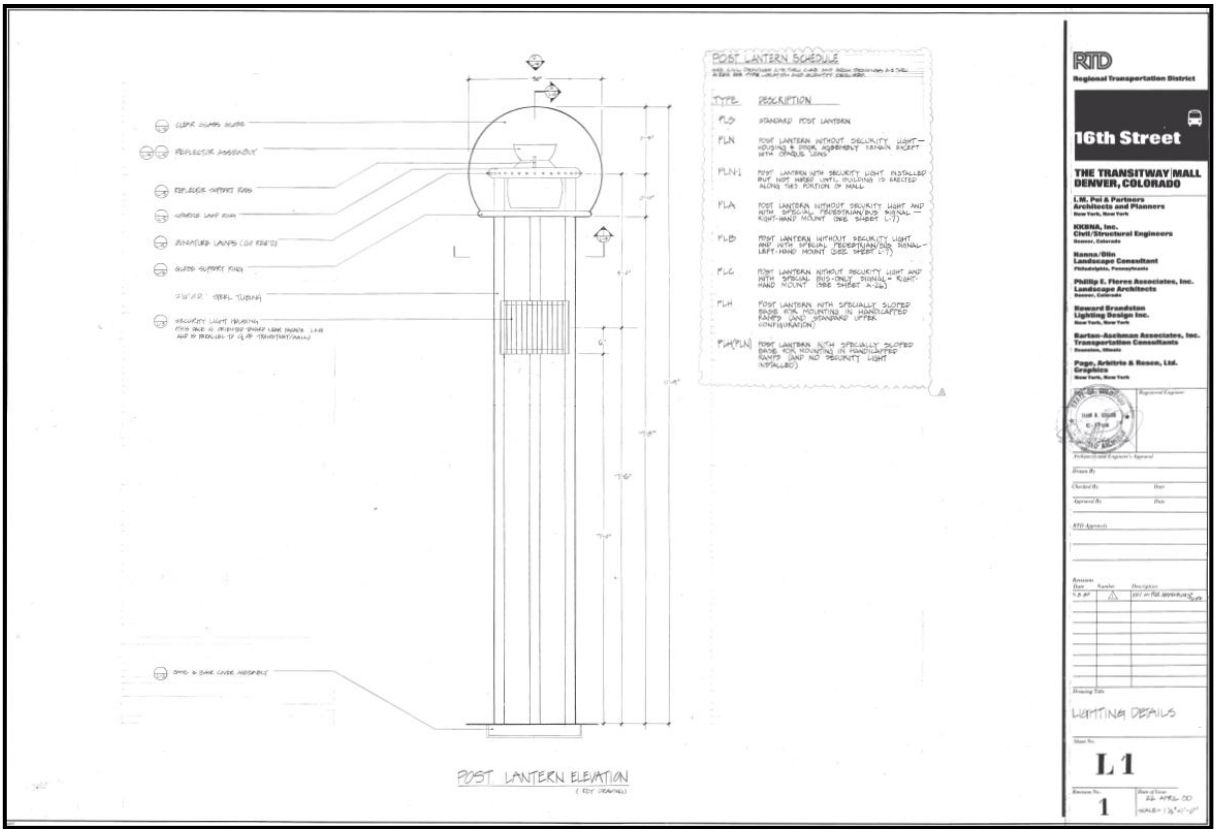


Figure 5. Original I.M. Pei / Hanna/Olin design for Post Lanterns in 1980 drawings.

- Overview of 16th Street Mall from Civic Center Station at Broadway.
- Facing northwest.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Overview of 16th Street Mall from Larimer Street.
- Facing southeast.
- Photograph courtesy of the Denver Post (2012).
- Photo taken in 1987.
- Image has not been altered.

- Overview of 16th Street Mall from Market Street.
- Facing southeast.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Close up of the original street sign at 16th Street Mall and Market Street.
- Facing west.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Overview of block design used on 16th Street Mall flanked by two original colored planters.
- Facing northeast.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Overview of block design used on 16th Street Mall.
- Facing unknown direction.
- Photograph courtesy of the Denver Post (2012).
- Photo taken in 1981.
- Image has not been altered.

- Overview of 16th Street Mall, including original colored planters, post lanterns, tree configuration, and the last remaining telephone booth in the project area (center background).
- Facing northwest.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Overview of a typical 16th Street Mall original post lantern.
- Close up.
- Photographed by James Steely.
- Photo taken 06-06-2016.
- Image has not been altered.

- Example of a Navajo diamond weaving pattern on a Phase III chief blanket from the 1930s.
- Photograph courtesy of the University of Colorado Museum of Natural History.
- Image has been cropped.

- Eastern diamondback rattlesnake.
- Photograph courtesy of Google Images (http://1.bp.blogspot.com/-bDG6zbjosXc/UFGGBKbe5wI/AAAAAAAAMEc/8ra53cOJgxM/s1600/Eastern+Diamondback+Rattlesnake+Crotalus+adamanteus+September+2011+Phillip's+Natural+World+ready+to+strike.jpg).
- Image has not been altered.

Attachment 3
Section 106 Consultation Record Summary

Section 106 Communications Log

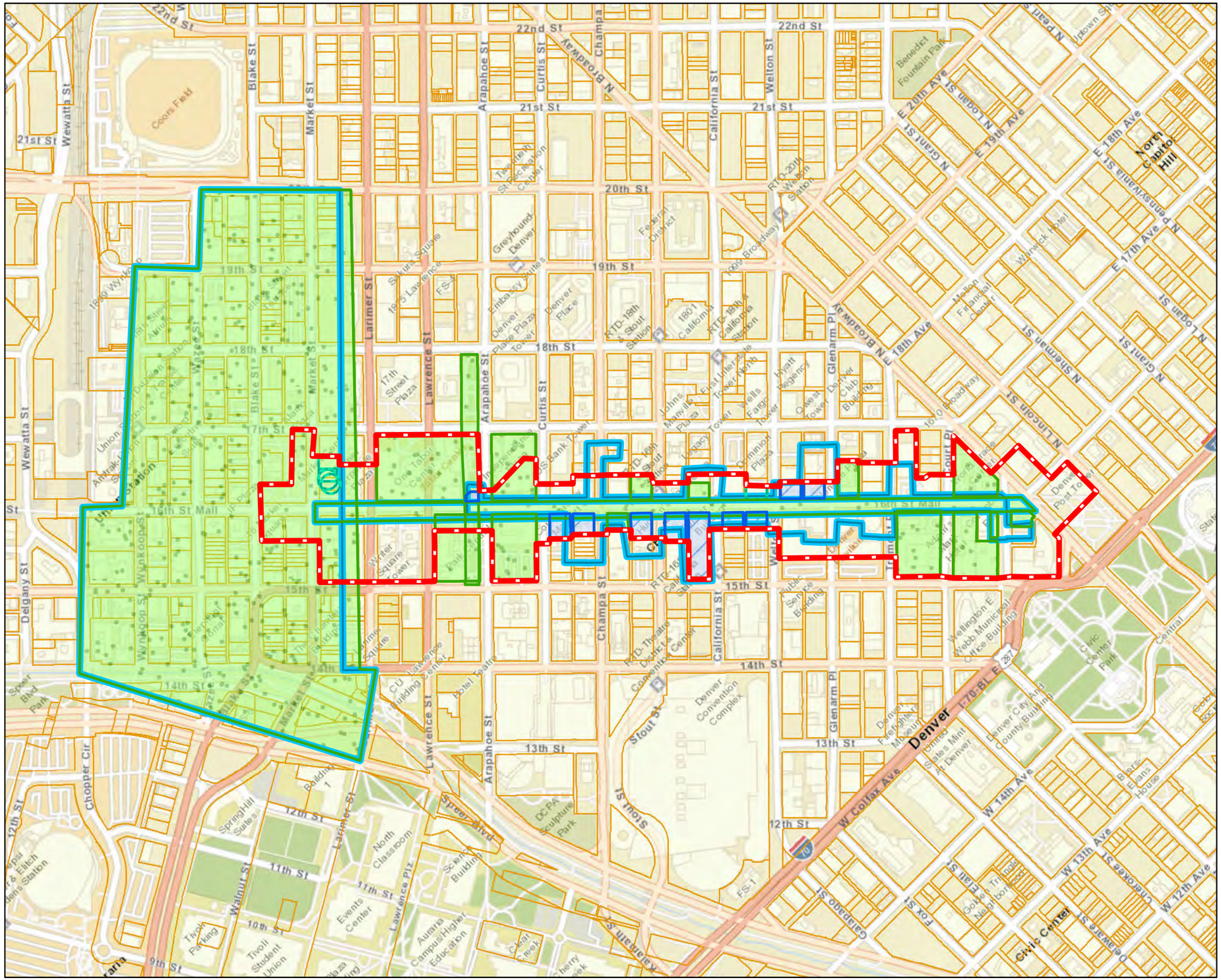
Date	From	To	Subject	Summary
6/2/2015	FTA	SHPO	Initiation of Section 106 Consultation; RTD 16th Street Mall Transit-way Rehabilitation Project	Initiation of Section 106 consultation process and invitation of consultation under 36 CFR 800.3 for the proposed 16th Street Mall transit-way rehabilitation project.
6/2/2015	FTA	Kiowa	Invitation to Consult: FTD 16th Street Mall Transit-way Rehabilitation Project	FTA with RTD invites Kiowa Tribe of Oklahoma to serve as a historic consulting party under Section 106 of the National Historic Preservation Act for the RTD 16th Stree Mall Transit-way Rehabilitation Project.
6/19/2015	SHPO	FTA	RE: Initiation of Section 106 Consultation; RTD 16th Street Mall Transit-way Rehabilitation Project	SHPO received initiation letter and looks forward to working together going forward.
6/22/2017	RTD-FTA	CPs	16th Street Mall Alternatives Analysis and Environmental Clearance - Workshop No. 1	Provides agenda for Workshop No. 1 (6/28-6/30/2017). The 3 planned workshops will be equivalent to 1 year of monthly meetings and allow, if a preferred alternative is selected, for design and construction to proceed and be completed within the next 5 years.
6/23/2017	FTA	SHPO	Re-Initiation of Consultation (HC No. 68388) The Future of Denver's 16th Street Mall: Alternatives Analysis and Environmental Clearance Project	FTA with RTD is preparing an EA for the 16th Street Mall. Provides a description of undertaking. Improvement project has been expanded from 3.5 blocks to a proposed 12 block area. Project area now includes transitway, sidewalks, and pedestrian areas. Area of potential effects (APE) is being reconsidered. Once the APE has been defined, Section 106 process will be updated. Extends an invitation to participate to the consulting parties involved with the previous project.
7/20/2017	RTD-FTA	Consulting Parties	July 25, 2017 Consulting Party Meeting Materials	Provides materials for the 7/25/2017 consulting party meeting.
7/27/2017	HistDen	FTA & RTD	RE: July 25, 2017 Consulting Party Meeting Materials	HistDen and CPI looked at the proposed problem statement, purpose, and need upon request. Offer two options.
8/11/2017	RTD-FTA	Consulting Parties	16th Street Mall Section 106 Consulting Parties Meetings	Invitation for two 16th Street Mall Section 106 consulting parties meetings (9/6/17 and 9/27/17). Provides most current purpose and need. Notification of upcoming send out of agenda and materials.
8/23/2017	RTD-FTA	Consulting Parties	16th Street Mall, Consulting Party Meeting, 09/06/17	Provides materials for the 9/6/2017 meeting. Provides 2 project examples where a project is contained entirely within a historic property.
9/5/2017	HistDen	Consulting Parties	RE: 16th Street Mall, Consulting Party Meeting, 09/06/17 [EXTERNAL]	Request for additional updates/materials prior to meeting.
9/5/2017	RTD-FTA	Consulting Parties	RE: 16th Street Mall, Consulting Party Meeting, 09/06/17 [EXTERNAL]	Provides updated agenda and update on the Olin sketches.
9/15/2017	RTD-FTA	Consulting Parties	16th Street Mall Section 106 Consulting Parties Meeting No. 3	Provides a reminder for the Consulting Parties Meeting No. 3 (9/27/2017) and informs that the agenda and materials will be sent the following week.
9/18/2017	RTD-FTA	Consulting Parties	16th Street Mall Section 106 Consulting Parties documents	Provides meeting notes from the 9/06/2017 meeting and agenda for 9/27/2017 meeting.
9/21/2017	RTD-FTA	Consulting Parties	16th Street Mall Workshop No. 2	Invitation to the workshop on 10/2/2017. Provides drawings, comments, and a draft future statement.
9/22/2017	RTD-FTA	Consulting Parties	RE: 16th Street Mall Section 106 Consulting Parties documents	Provides presentation for meeting (9/27/2017) and Level 1 Alternatives Analysis for Alignment Alternatives.
9/25/2017	RTD-FTA	Consulting Parties	RE: 16th Street Mall Section 106 Consulting Parties follow up	Provides the 2014 16th Street Pilot Repair final report and informs that a comparative cost analysis for various pavement materials has yet to be completed but is scheduled for November.
10/12/2017	HistDen	RTD-FTA	RE: 16th Street Mall Section 106 Consulting Parties Meeting No. 3 Notes [EXTERNAL]	Request for graphics for various paver pattern studies.
10/12/2017	RTD-FTA	Consulting Parties	RE: 16th Street Mall Section 106 Consulting Parties Meeting No. 3	Provides link to the Drop Box containing 5 requested items. Informs that RTD is working on the claims data on pedestrian and transit incidents.

Section 106 Communications Log

Date	From	To	Subject	Summary
10/12/2017	RTD-FTA	Consulting Parties	16th Street Mall Section 106 Consulting Parties Meeting No. 3 Notes	Provides meeting notes from the 9/27/2017 consulting party meeting. Attachment includes agenda and sign-in sheet but not final presentation since it was delivered directly after the meeting. Informs parties about a new Drop Box for delivery of materials.
10/18/2017	FTA	HistDen	RE: Comments on Form 1403 [EXTERNAL]	Confirms receipt of comments from HistDen.
10/18/2017	HistDen	RTD-FTA	Comments on Form 1403 [EXTERNAL]	Provides 7 comments on the 1403 form.
10/25/2017	RTD-FTA	Consulting Parties	FW: Comments on Form 1403 [EXTERNAL]	Provides 7 comments on the 1403 form to the Consulting Parties.
10/25/2017	RTD	RTD-FTA	RE: Comments on Form 1403 [EXTERNAL]	Allows delivery of comments to the consulting parties group.
11/7/2017	HistDen	RTD & FTA	16th Street Mall Letter	Informs the management team that the attached letter was sent to RTD.
11/30/2017	RTD-FTA	Consulting Parties	16th Street Mall Consulting Parties Meeting No. 4	Provides the meeting notes and materials from the 11/14/2017 meeting. Informs that a separate email will be sent with the agenda, materials, and presentation for the 12/14/2017 meeting.
12/15/2017	RTD	HistDen	RE: 16th Street Mall Project; November 7, 2017 Historic Denver Letter	Confirms receipt of 11/7/2017 letter regarding the 16th Street Mall project. Invitation to join the next consulting parties meeting (01/11/18).
1/22/2018	RTD	NTHP	RE: 16th Street Mall Purpose and Need [EXTERNAL]	Provides purpose and need statement for the project to NTHP and provides contact information.
1/26/2018	HistDen	RTD & FTA	Additional Comments on 1403 [EXTERNAL]	Provides additional comments and explanations on the Form 1403.
1/31/2018	RTD	HistDen	RE: Additional Comments on 1403 [EXTERNAL]	Confirms receipt of comments.
2/8/2018	RTD	FTA	RE: Comments on Form 1403 [EXTERNAL]	RTD has not received any comments (beyond HistDen) on the Form 1403.
2/9/2018	NTHP	RTD-FTA	RE: 16th Street Mall Purpose and Need [EXTERNAL]	Requests details and materials for the 2/27/2018 meeting. Informs Betsy will be replacing Jenny as point of contact for the NTHP.
2/12/2018	RTD	FTA	RE: Comments on Form 1403 [EXTERNAL]	Informs RTD did not directly receive any comments on the Form 1403.
2/22/2018	Postmaster	C-A Tribes	Undeliverable: 2/27/18 Consulting Party Meeting	Undeliverable email notification.

Section 106 Consultation Record through 3/8/2014

Attachment 4
Historic Properties Map Book



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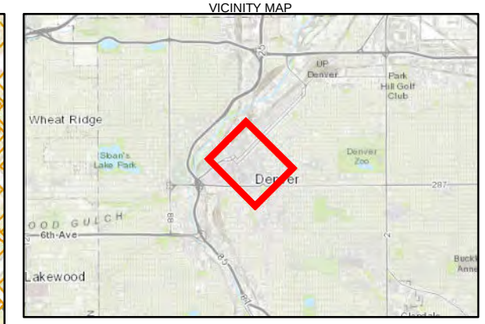


LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

Historic Districts

- Eligible for NRHP
- Contributes to Historic District

N

0 600
Feet

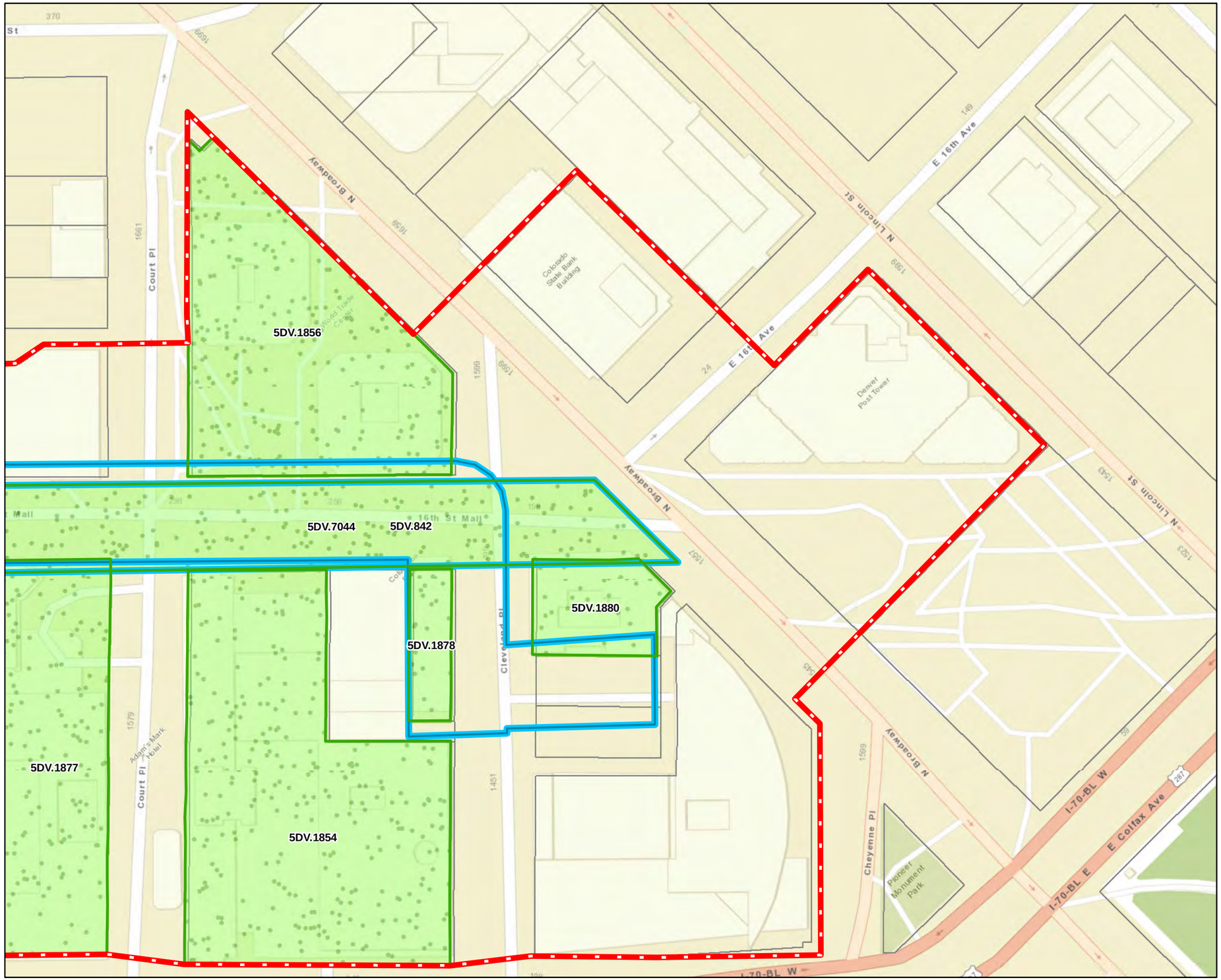
Overview
Identified Historic Properties

16th Street Mall

March 2018

DEN I:\CCD\16thStreetMall\Maps\Report\Cultural\Cultural_Historic_Properties_Overview_b_v7.mxd 3/29/2019

ch2m



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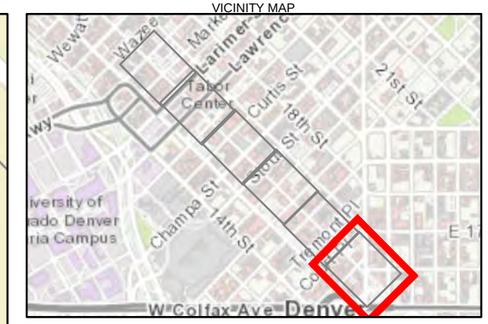


LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

Historic Districts

- Eligible for NRHP
- Contributes to Historic District

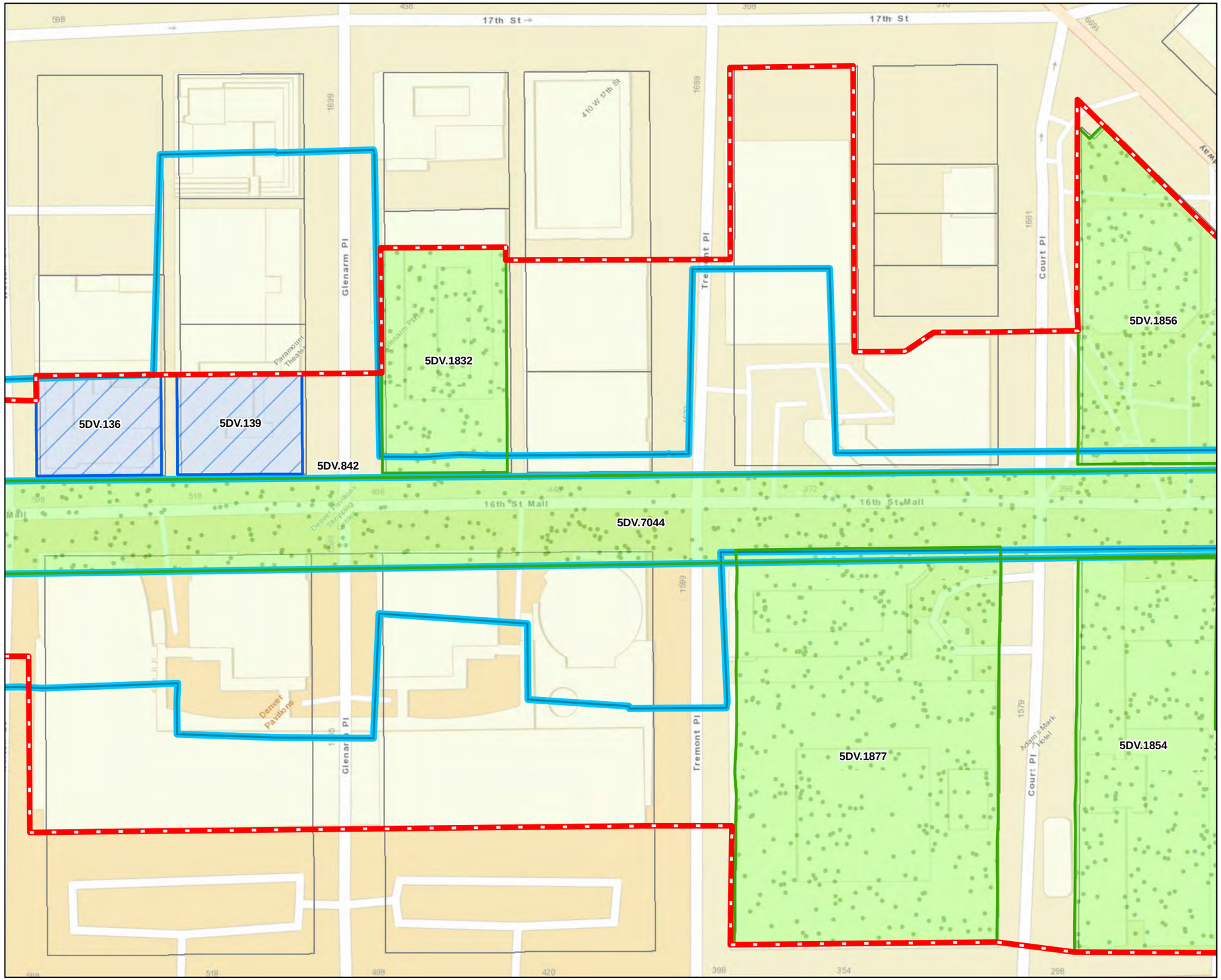
0 100
Feet

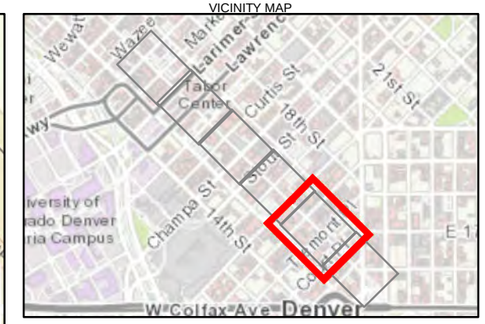
Map Book 1
Identified Historic Properties

16th Street Mall

March 2019

ch2m





LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

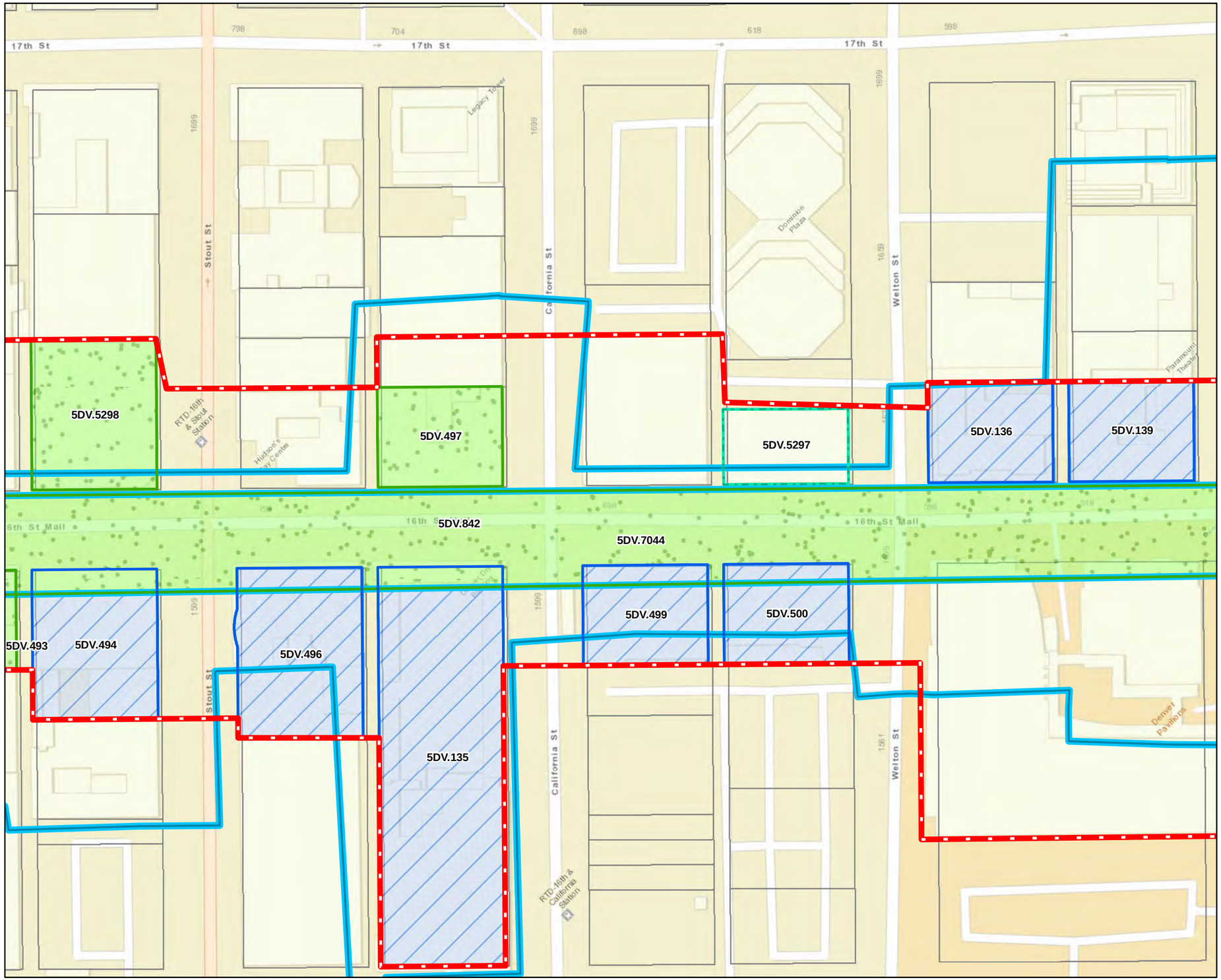
Historic Districts

- Eligible for NRHP
- Contributes to Historic District

0 100
Feet

Map Book 2
Identified Historic Properties
16th Street Mall
March 2019

ch2m



VICINITY MAP

LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

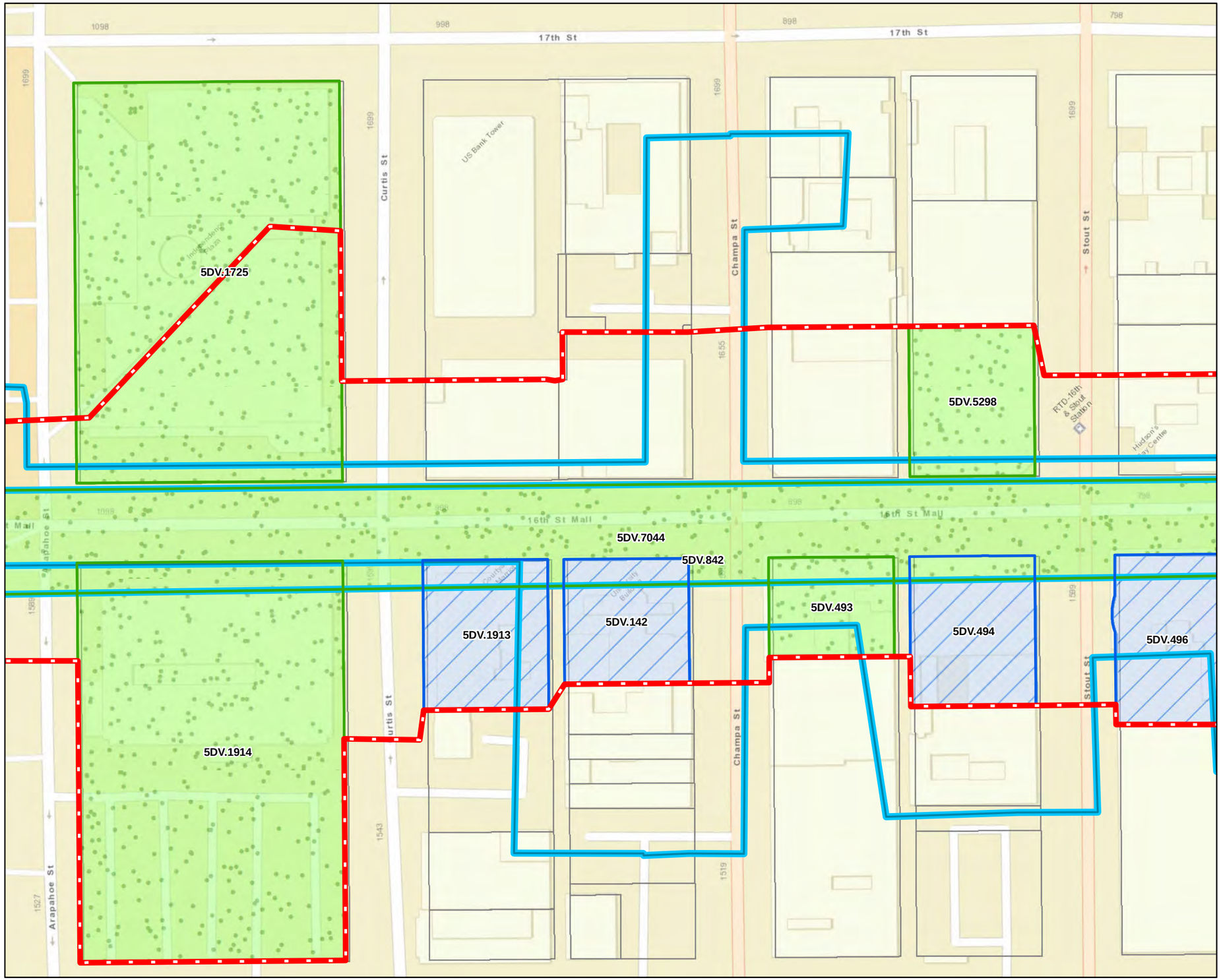
Historic Districts

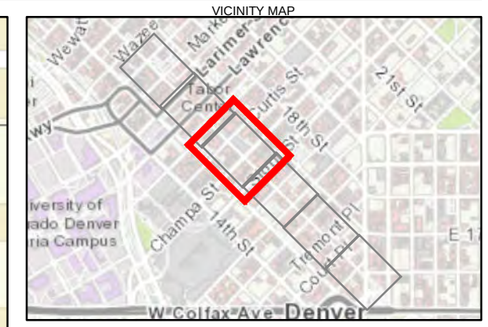
- Eligible for NRHP
- Contributes to Historic District

0 100
Feet

Map Book 3
Identified Historic Properties
16th Street Mall
March 2019

ch2m





LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

Historic Districts

- Eligible for NRHP
- Contributes to Historic District

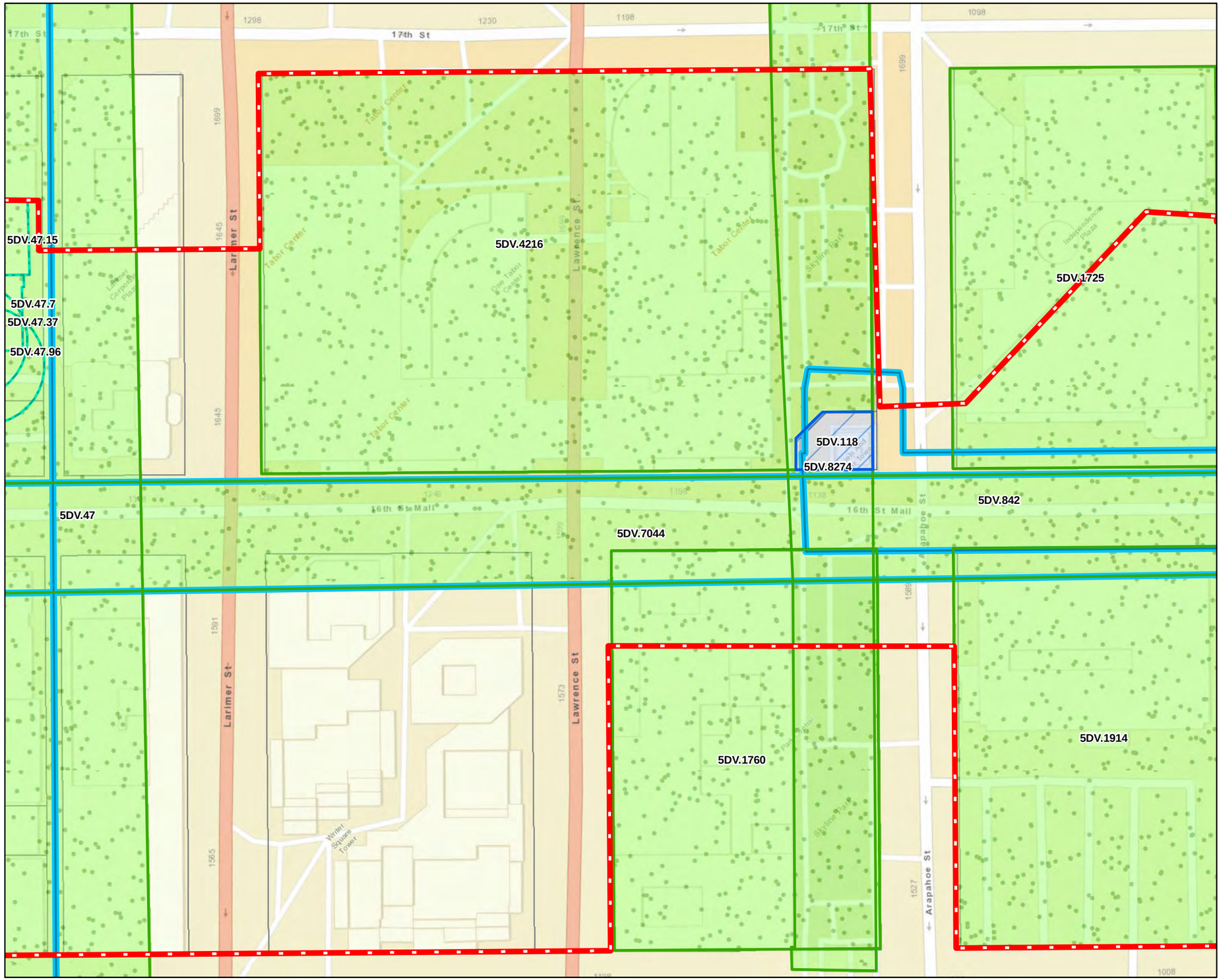
0 100
Feet

Map Book 4
Identified Historic Properties

16th Street Mall

March 2019

ch2m



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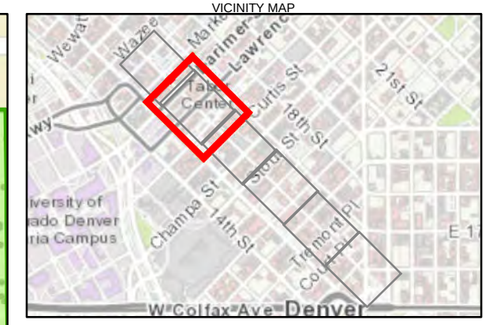

LEGEND

- Area of Potential Effects
- Parcel Boundary

Historic Properties

NRHP Status

- Listed on NRHP
- Eligible for NRHP

Historic Districts

- Eligible for NRHP
- Contributes to Historic District

0 100
Feet

Map Book 5
Identified Historic Properties
16th Street Mall
March 2019

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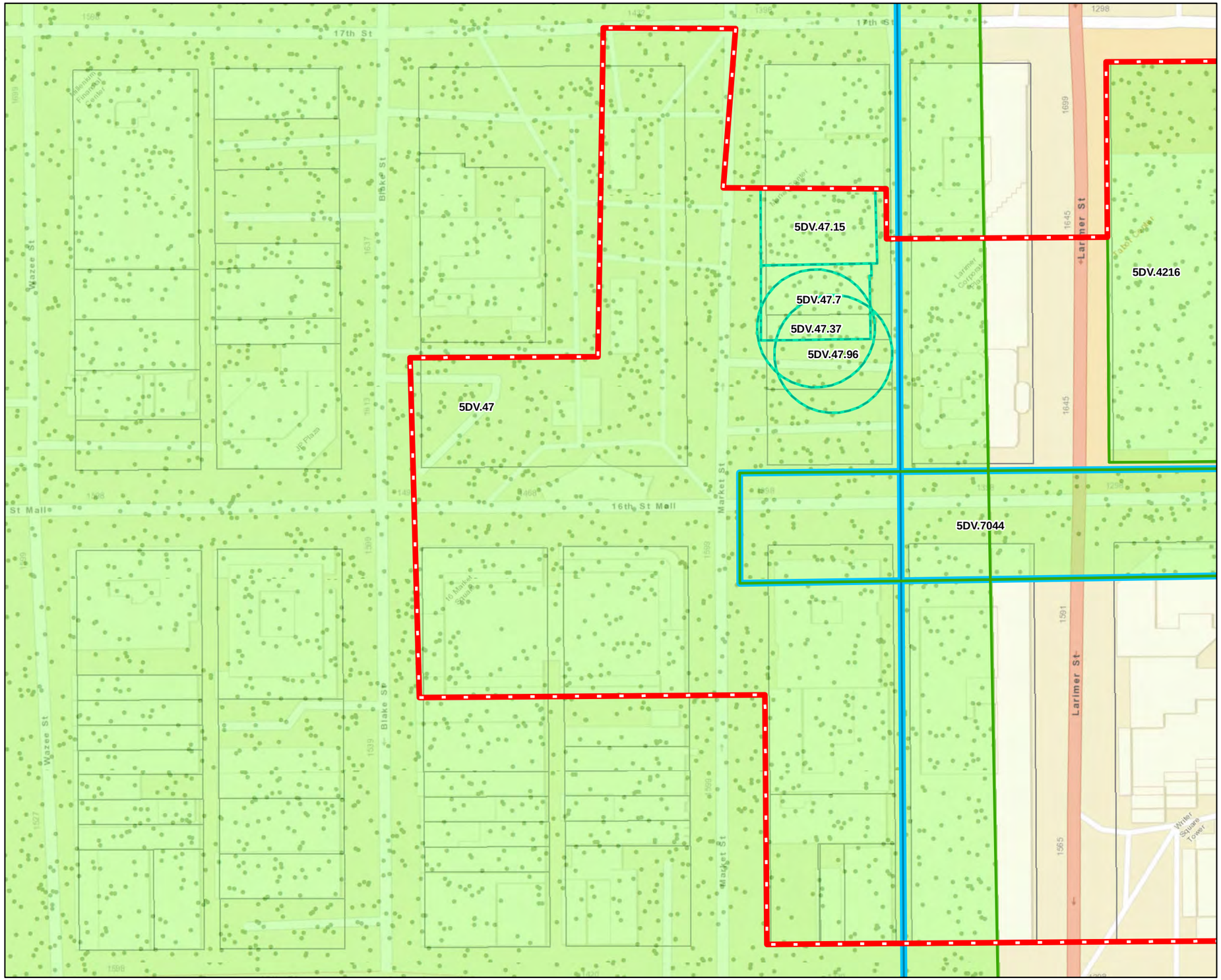
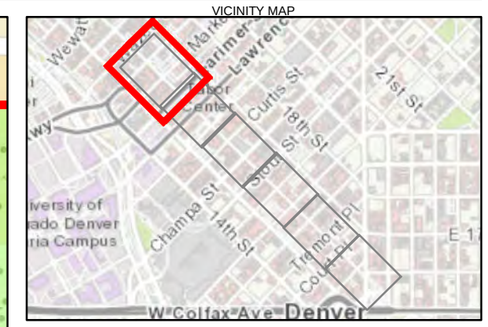
ch2m





LEGEND

Area of Potential Effects

Parcel Boundary

Historic Properties

NRHP Status

Listed on NRHP

Eligible for NRHP

Historic Districts

Eligible for NRHP

Contributes to Historic District

0 100
Feet

Map Book 6
Identified Historic Properties
16th Street Mall
March 2019

ch2m

Attachment 5
Table of Historic Properties within the APE

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.118	Daniels & Fisher Tower ~ Daniels, Fisher & Company (Dry Goods) ~ May D&F Tower	1101 16th Street 1601 Arapahoe Street	1911-1911	Listed on NRHP	
5DV.135	Denver Dry Goods Company Building ~ The Denver Dry Goods Building	702 16th Street California Street and 16th Street	1888-1889	Listed on NRHP	
5DV.136	Masonic Temple Building	1614 Welton Street 535 16th Street	1889-1890	Listed on NRHP	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.139	Kittredge Building	511 16th Street	1889-1891	Listed on NRHP	
5DV.142	A.C. Foster Building ~ University Building	910-918 16th Street	1911-1911	Listed on NRHP	
5DV.1725	Independence Plaza Prudential Plaza	1001 16th Street 1050 17th Street	1971	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.1760	Bridgepoint Plaza Park Central	1110 16th Street 1515 Arapahoe Street 1111 15th Street	1973	NRHP-eligible	
5DV.1832	Security Life Building ~ 1600 Glenarm Place	1600-16 Glenarm Place	1965-1965	NRHP-eligible	
5DV.1854	Hilton Hotel; Radisson Hotel; Adams Mark Hotel	1550 Court Place	1958-1960	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.1856	Dome Tower ~ Great West Plaza ~ World Trade Center	1625 Broadway	1980->1980	NRHP-eligible	
5DV.1877	Zeckendorf Plaza; May D & F Plaza; Hyperbolic Paraboloid; Adams Mark Hotel; Sheraton Hotel	350 16th Street 1550 Court Place	1960-1960>1960	NRHP-eligible	
5DV.1878	Colorado Federal Savings, McDonald's	200 16th Street	1957-1958	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.1880	Petroleum Club Building ~ Petroleum Building ~ 110 Building	110 16th Street	1954-1957	NRHP-eligible	
5DV.1913	Joslin Dry Goods Company Building ~ Tritch Building ~ Savoy Grille ~ Joslin Building ~ Marriott Courtyard Hotel	934-938 16th Street	1887-1887	Listed on NRHP	
5DV.1914	Federal Reserve	1020 16th Street	1968-	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.47	Lower Downtown Denver Historic District	Multiple		NRHP-eligible	
5DV.47.15	Waters Building ~ Market Center	1642 - 1644 Market Street	1885-1885	Contributes to NPS Certified District > Within official eligible district	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.47.37	Hitchings Block	1620 Market Street	1890-1899	Contributes to NPS Certified District > Within official eligible district	
5DV.47.7	Liebhardt-Lindner Building ~ Market Center	1624 Market Street	1881-1881	Contributes to NPS Certified District > Within official eligible district	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.47.96	McCrary Block ~ Market Center	1626-32 Market Street	1884-1884	Contributes to NPS Certified District > Within official eligible district	
5DV.493	Symes Building; F.W. Woolworth Company	820 16th Street	1905-1905	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.494	A.T. Lewis And Son Department Store ~ Holtzman And Appel Block	800-816 16th Street	1891-1891	Listed on NRHP	
5DV.496	Neusteter Building ~ Neusteter's	720-726 16th Street	1924-1924	Listed on NRHP	
5DV.497	Hayden, Dickinson & Feldhauser Building~ Colorado Building	1609-1615 California Street	1891-1891	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.499	McClintock Building	1554 California Street	1911-1911	Listed on NRHP	
5DV.500	Steel's Department Store; Steel's Corner; Steel Building; Fontius Building; Sage Building	1555 Welton 600 16th Street	1922	Contributes to NPS Certified District > Within official eligible district	
5DV.5297	Liebhardt Building;Cottrell Clothing Company	601 16th Street	1915-	Contributes to NPS Certified District > Within official eligible district	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV.5298	Walgreens	801 16th Street	1955-	NRHP-eligible	
5DV.7044	16th Street Mall	1-1300 16th Street	1982-1982	NRHP-eligible	
5DV.8274	Skyline Park	1500-1800 Arapahoe Street	1973-1973	NRHP-eligible	

Site ID	Site Name	Site Address	Construction Date	NRHP Eligibility	Site Photo
5DV. 842	16th Street Mall Historic District	Multiple	1982	NRHP-eligible	

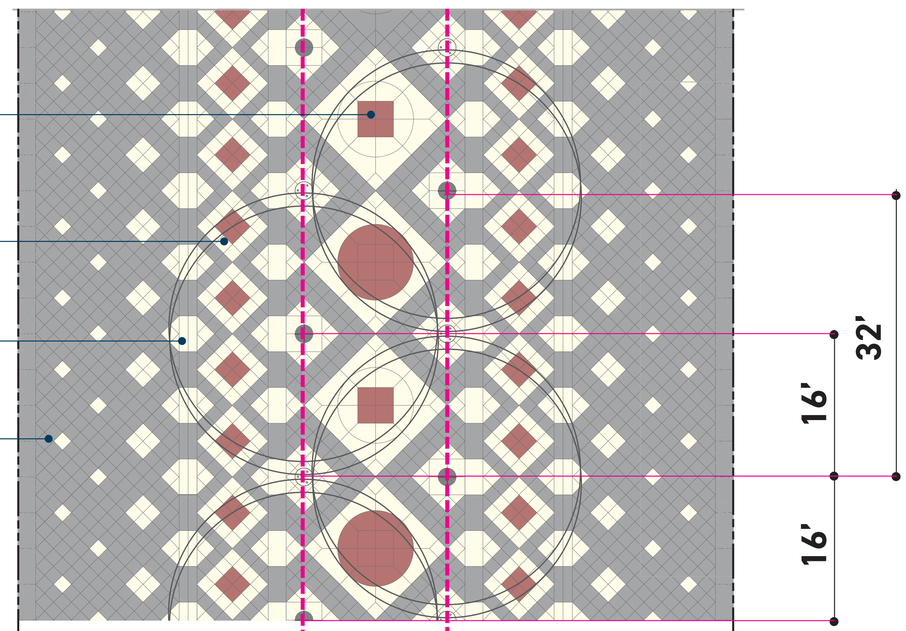
Attachment 6
Pattern and Geometry Studies

THE MALL EXPERIENCE
THE FUTURE OF DENVER'S 16TH STREET MALL
ALTERNATIVES ANALYSIS & ENVIRONMENTAL CLEARANCE

Pattern & Geometry Studies

Existing Configuration

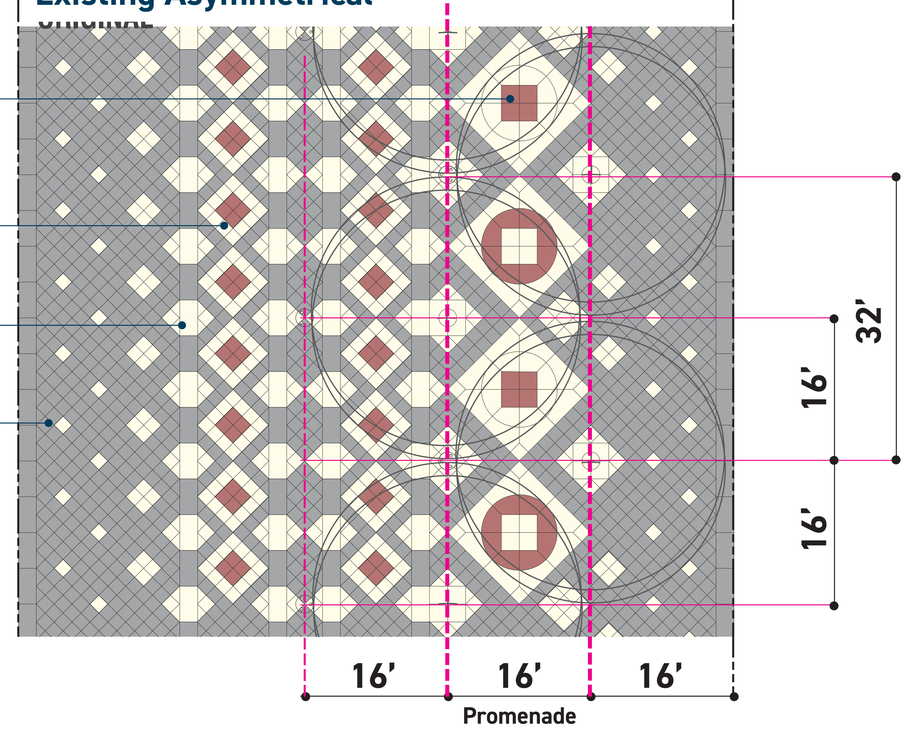
Existing Median



Trees align at 32' from building edge

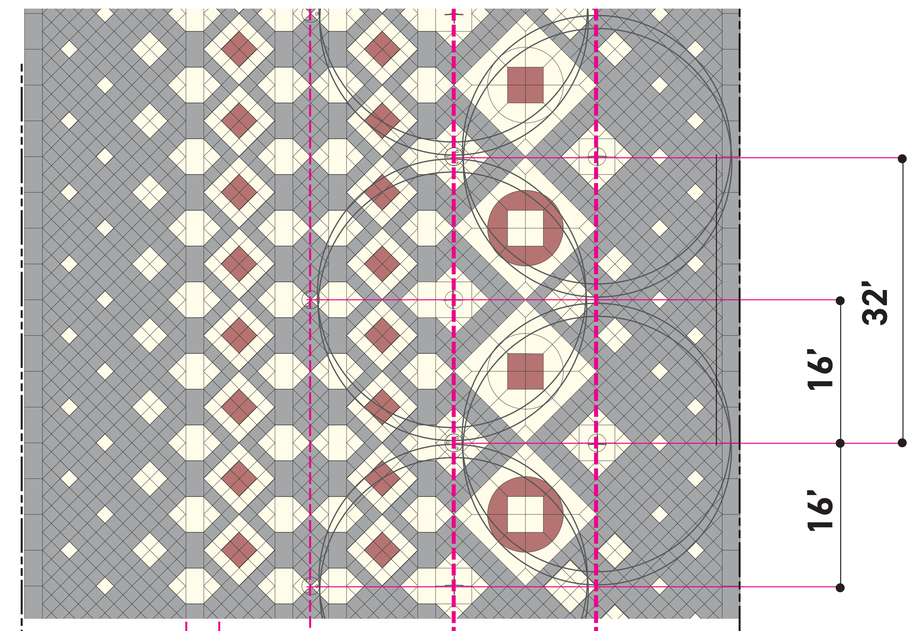
BLOCK 5A

Existing Asymmetrical



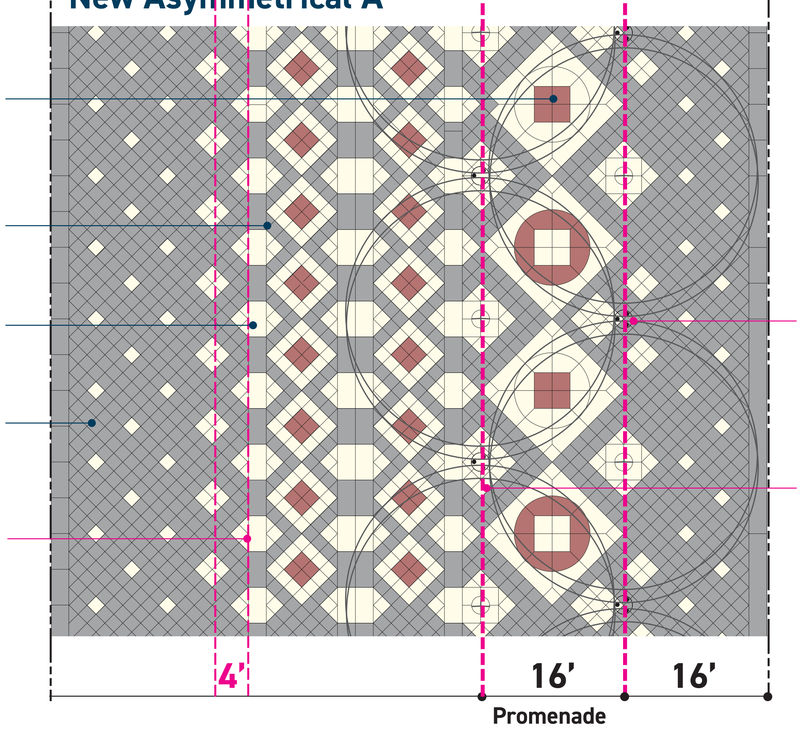
Revised Asymmetrical

Existing Asymmetrical



Trees maintain existing alignment and spacing

New Asymmetrical A



Pedestrian lights moved from median

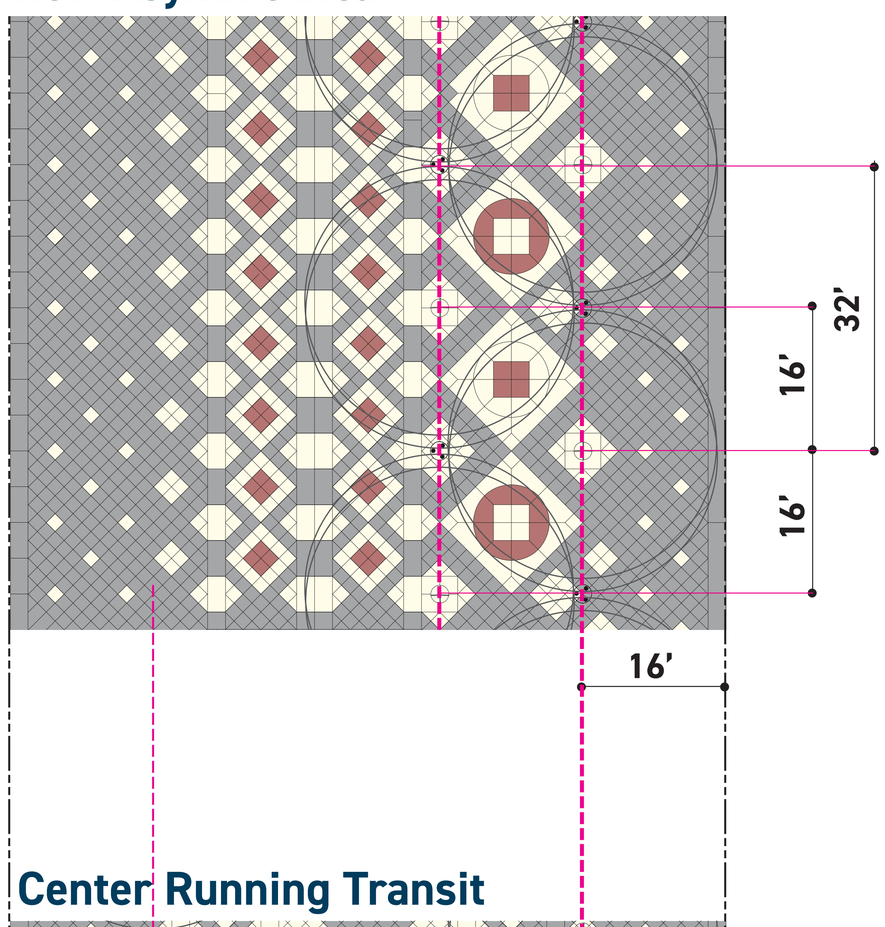
Trees spaced 4' from transit lane: does not meet requirements

DENVER THE MILE HIGH CITY · RTD · DURA · BID · Downtown Denver Partnership, Inc. · Federal Transit Administration

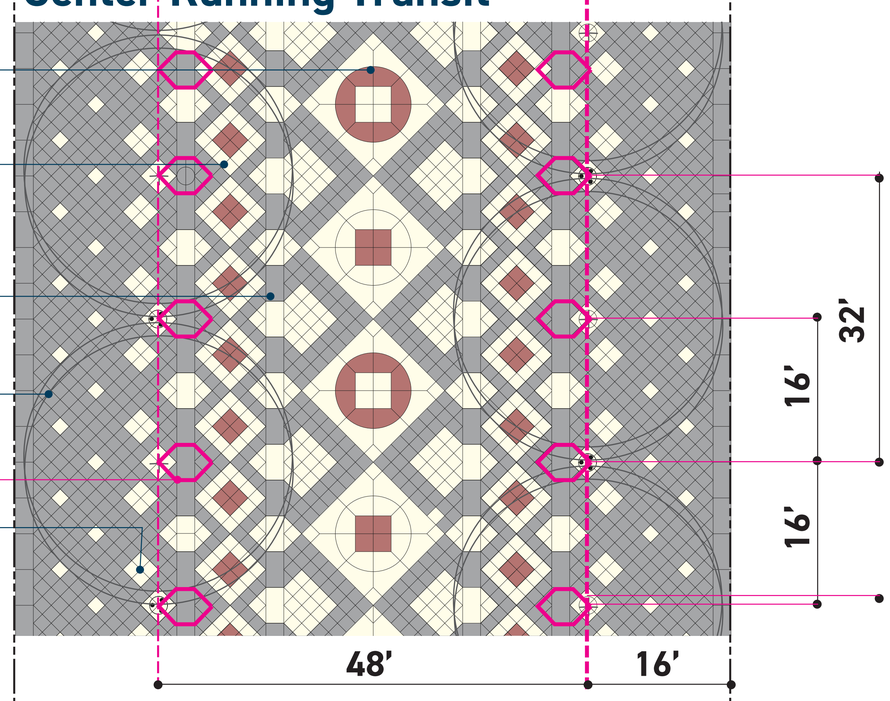
Maintain Spatial Relationships

Option 1: Prioritize Allee Alignment

New Asymmetrical



Center Running Transit



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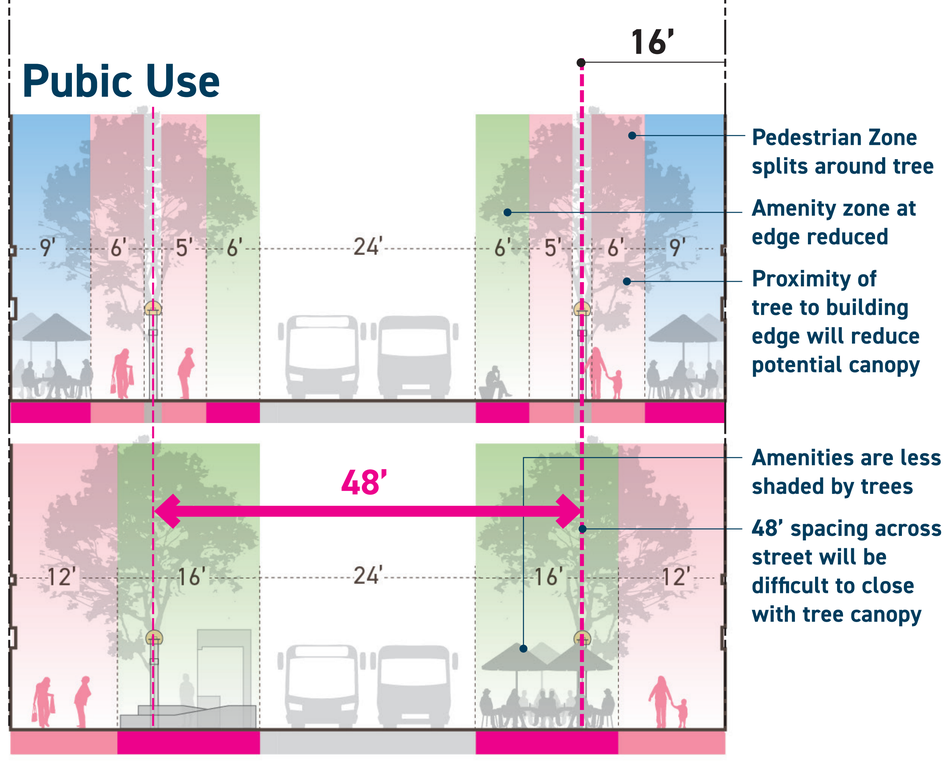
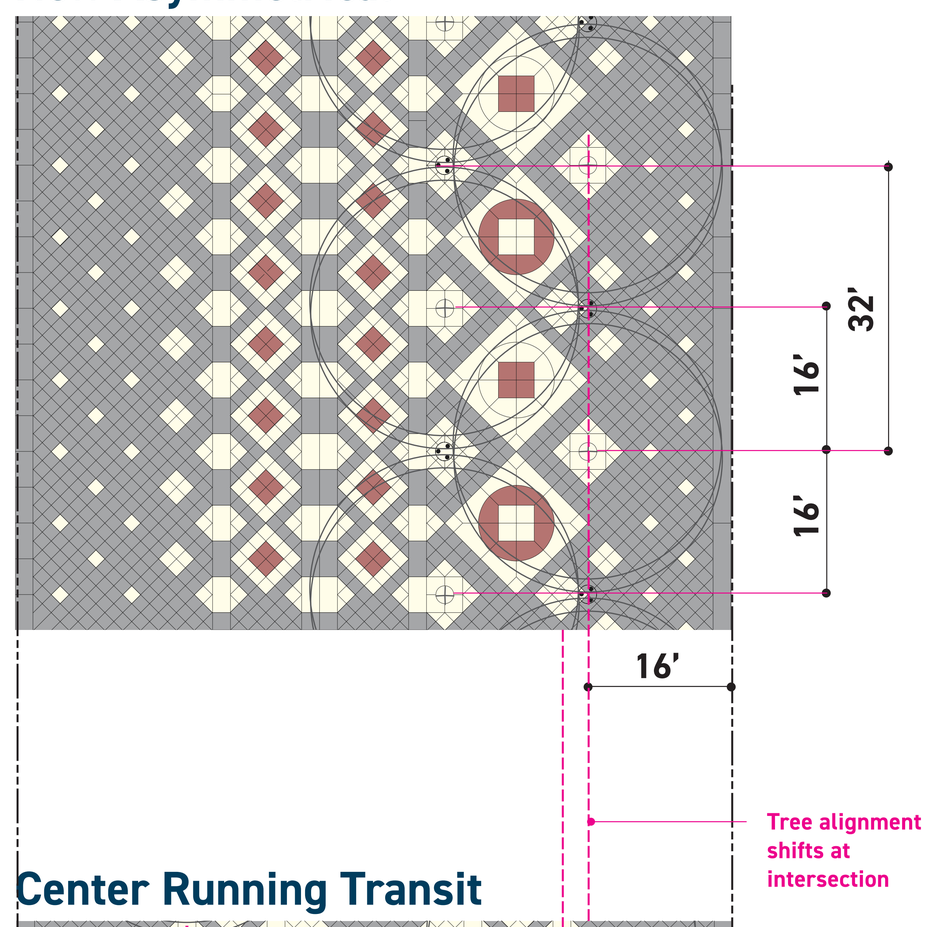


Option 2: Prioritize Pattern Consistency

New Asymmetrical



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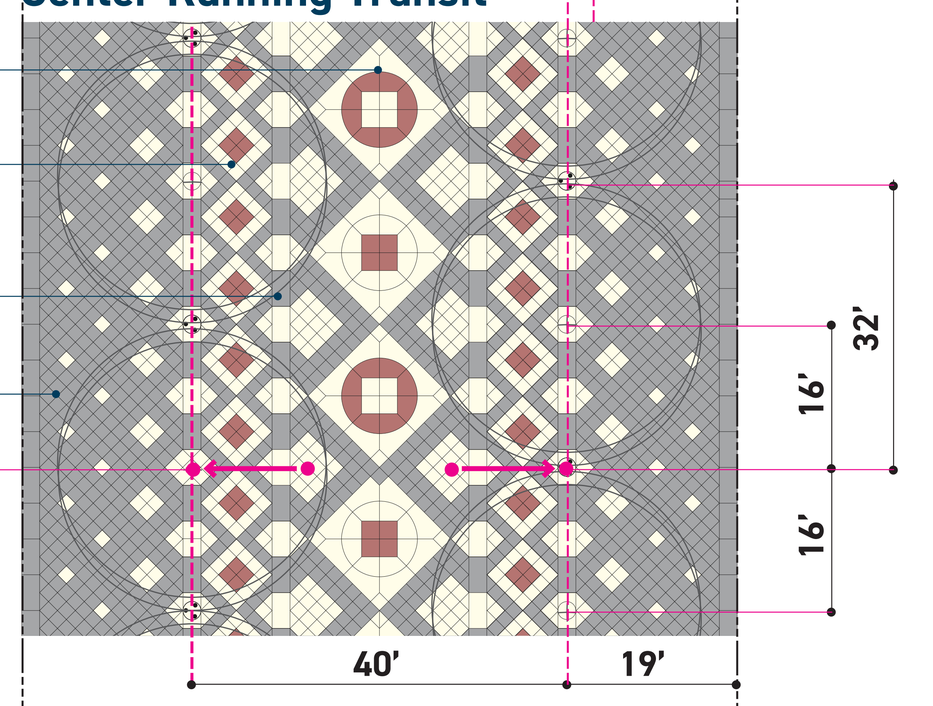

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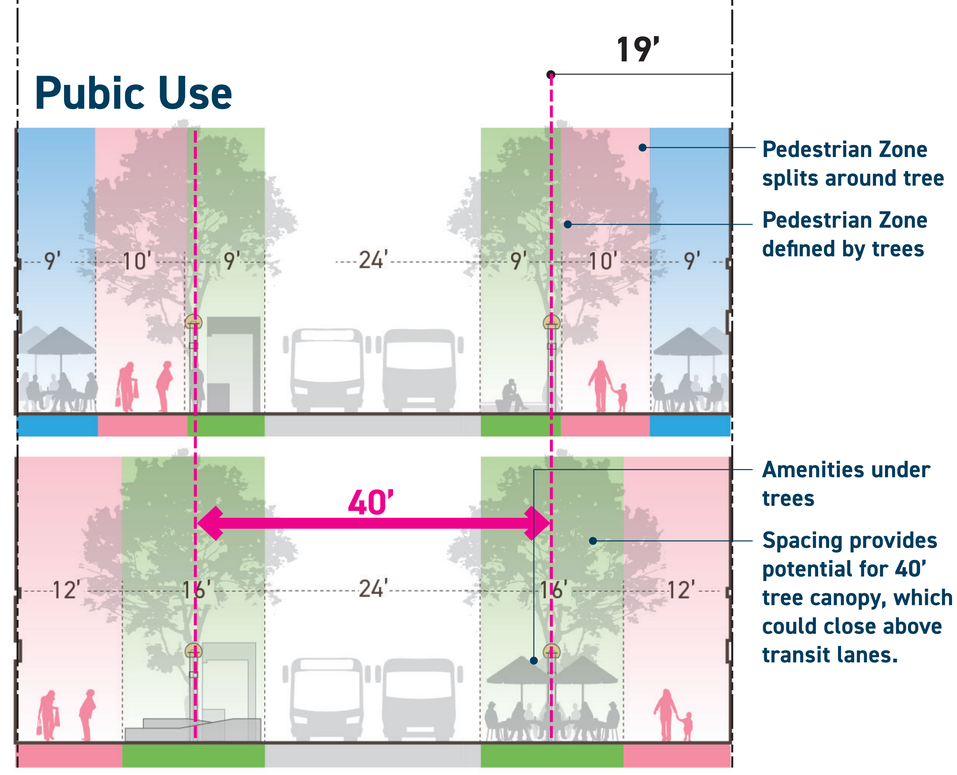
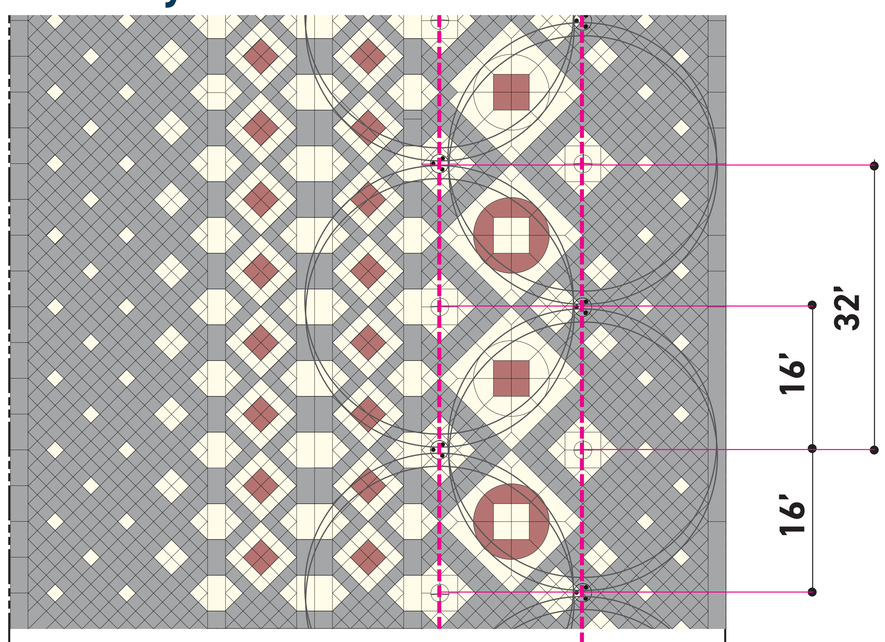


Maintain Programmatic Relationships

Option 1: Prioritize Allee Alignment

New Asymmetrical



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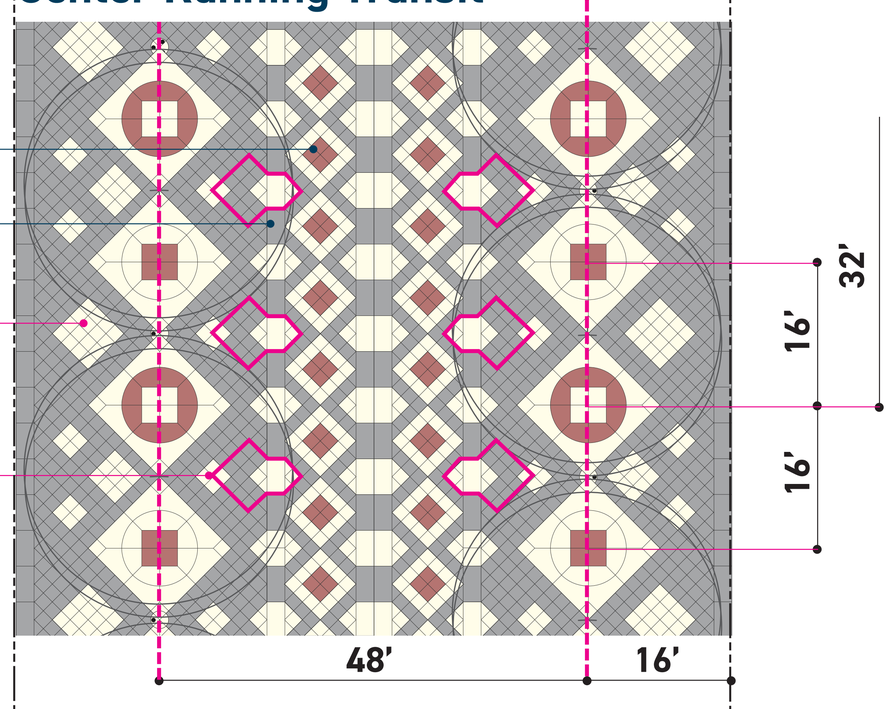

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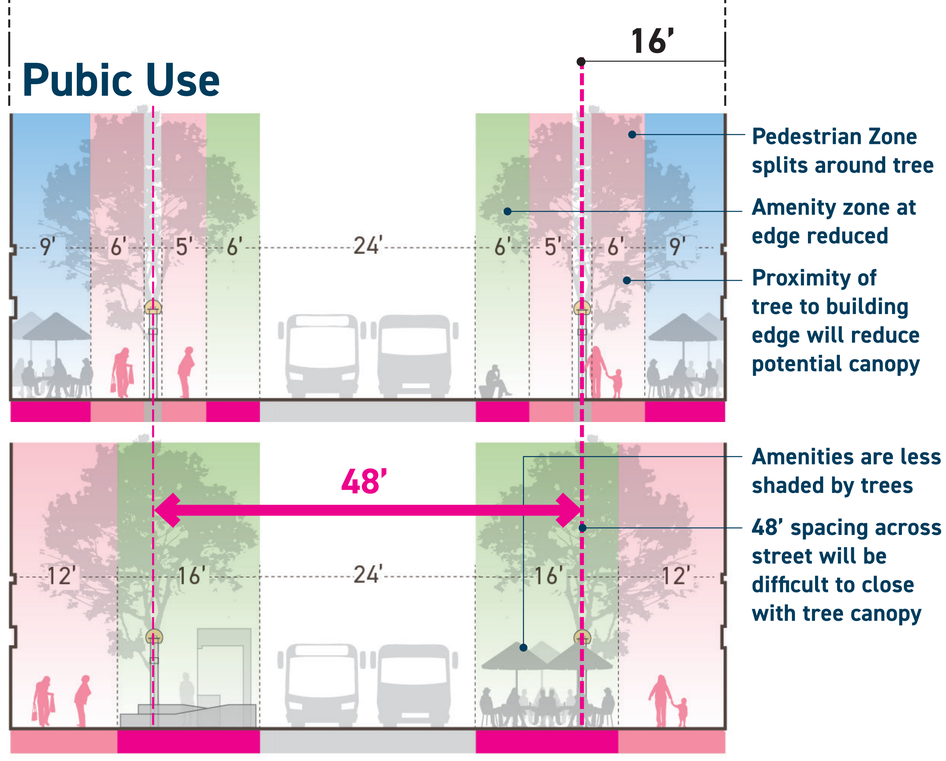
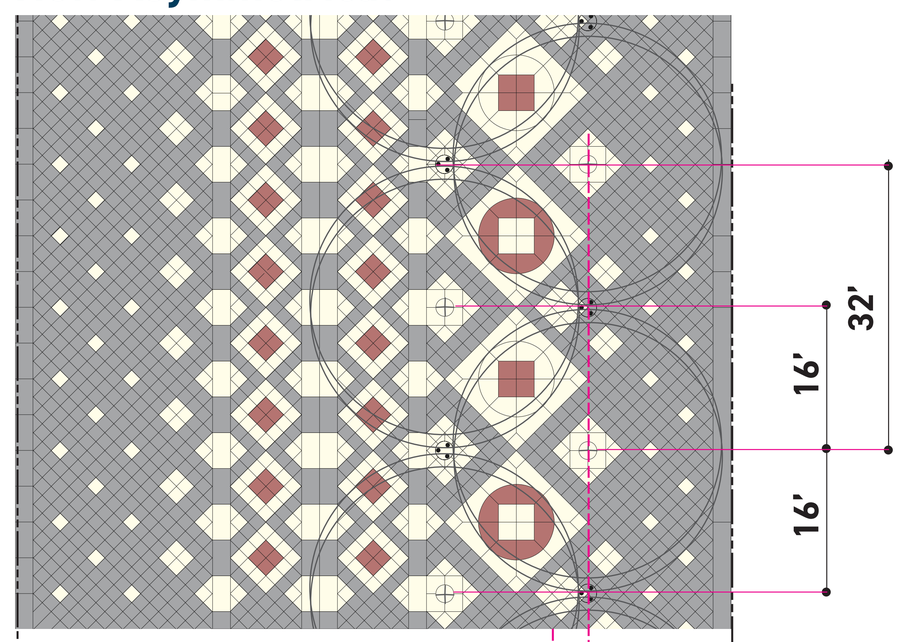


Option 2: Prioritize Pattern Consistency

New Asymmetrical



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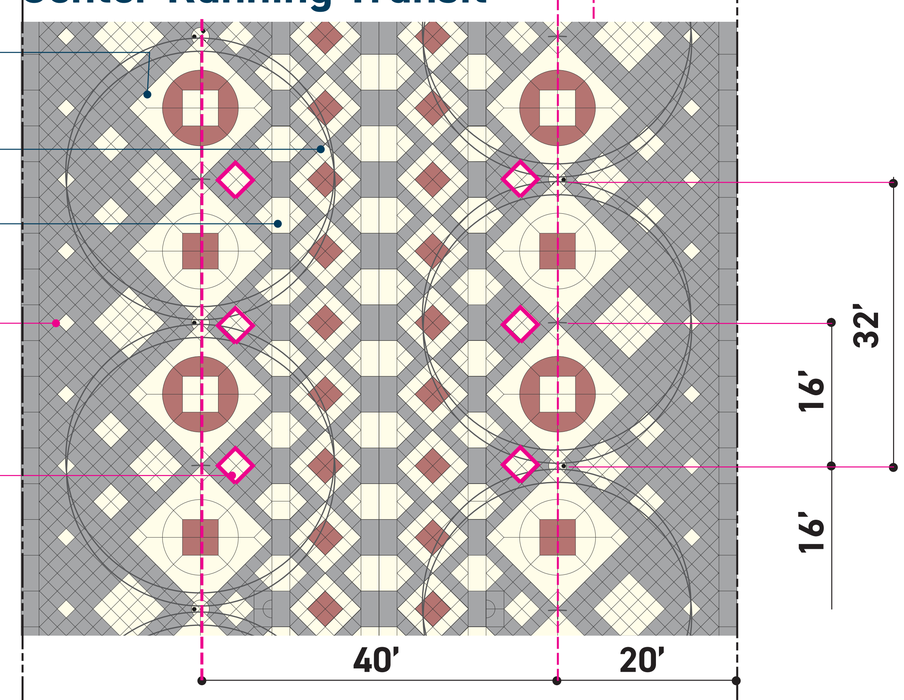

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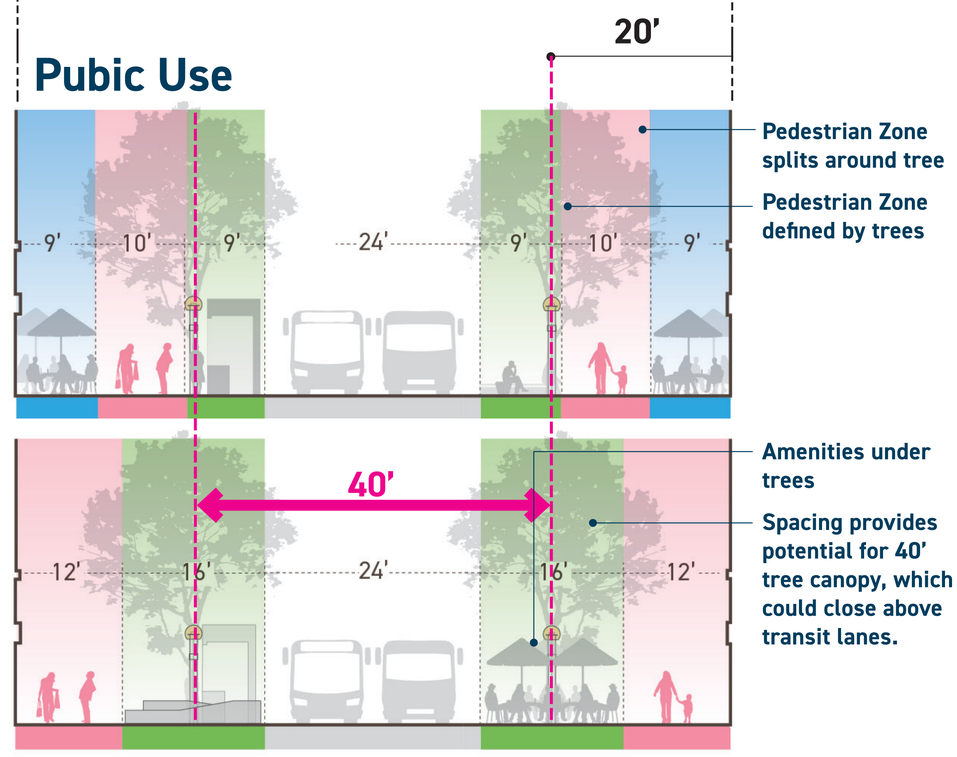
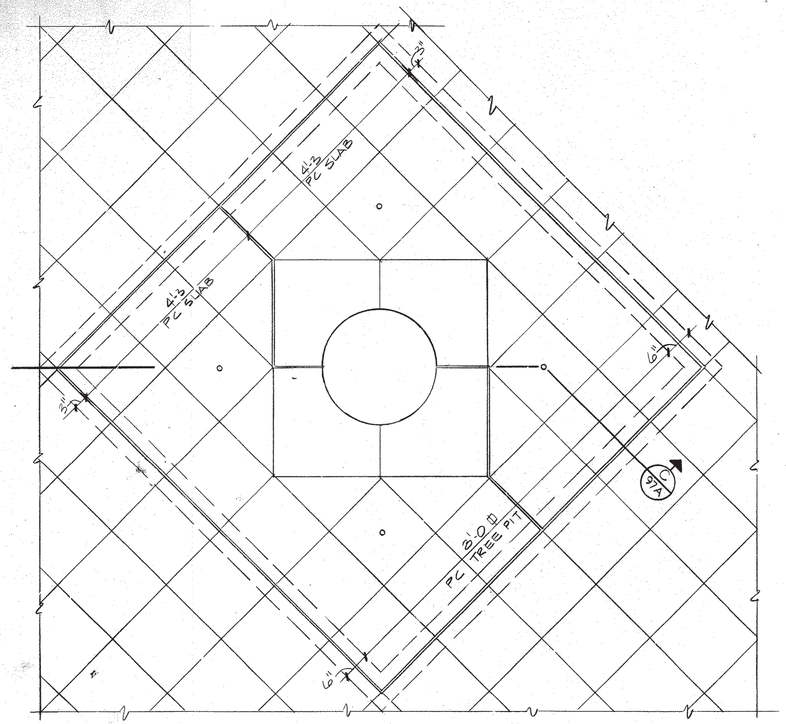
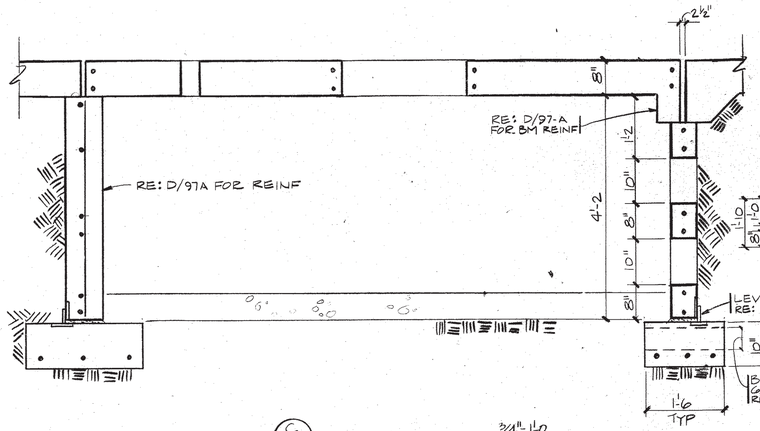


Attachment 7
Tree Box Design

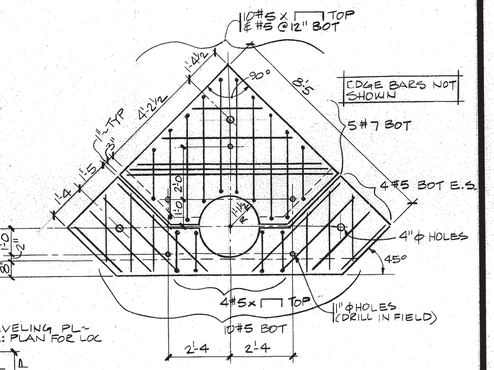
PROJECT: 16TH ST TRANSITWAY MALL
PROJECT MANAGER: JOHN MAAS
DESIGNED BY: DWL DMAN JOB NO. 6102.705
DRAWN BY: AEINN SHEET NO. C-97A



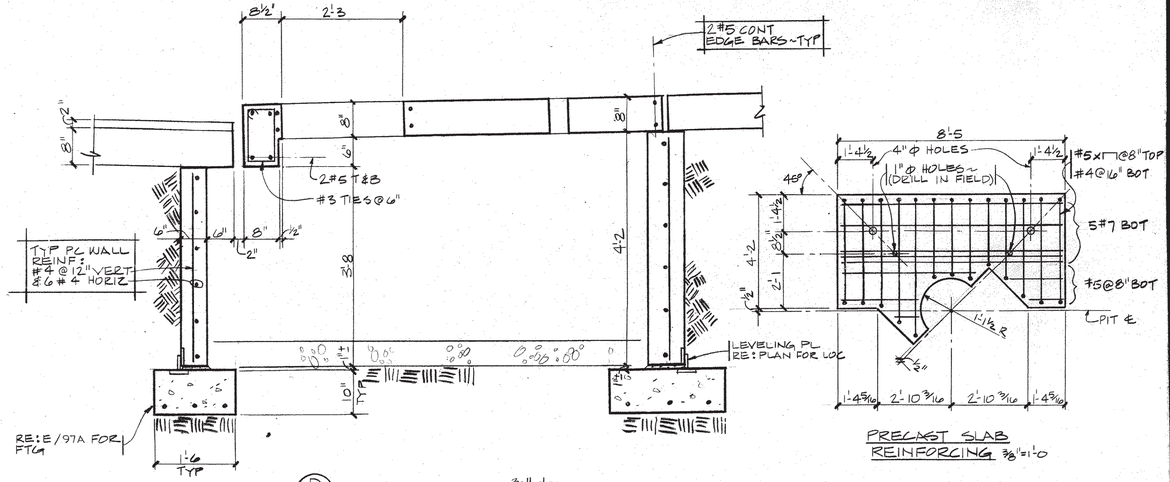
A 97A — 3/4"=1'-0



C 97A — 3/4"=1'-0

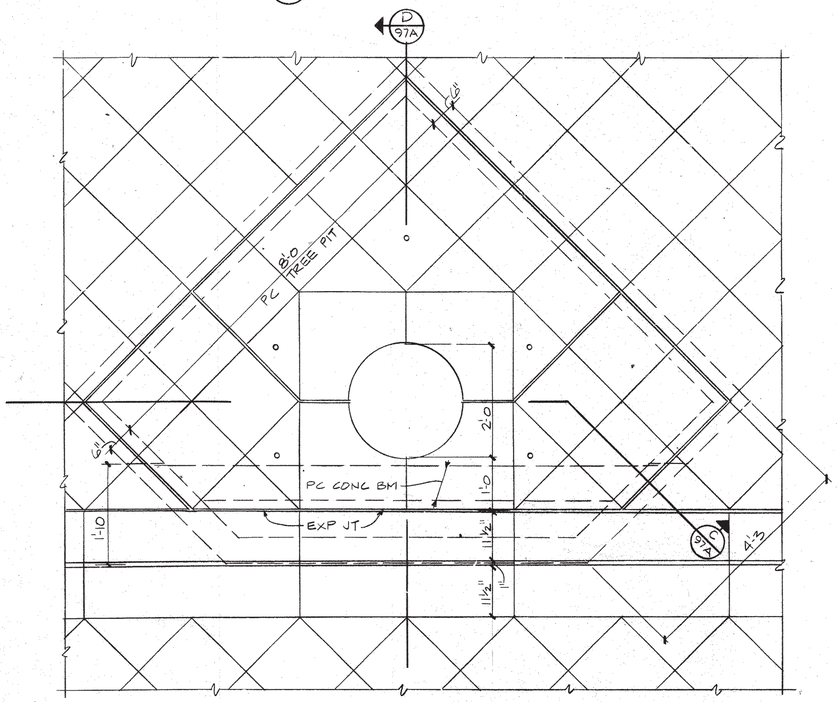


PRECAST SLAB REINFORCING 3/8"=1'-0

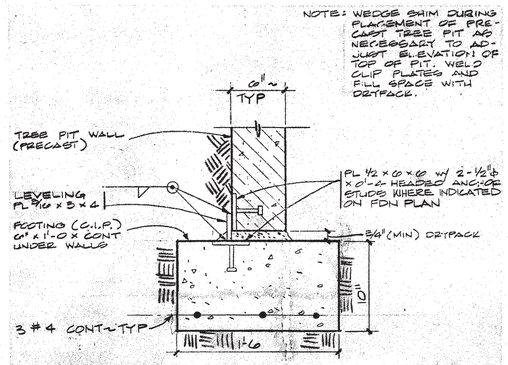


D 97A — 3/4"=1'-0

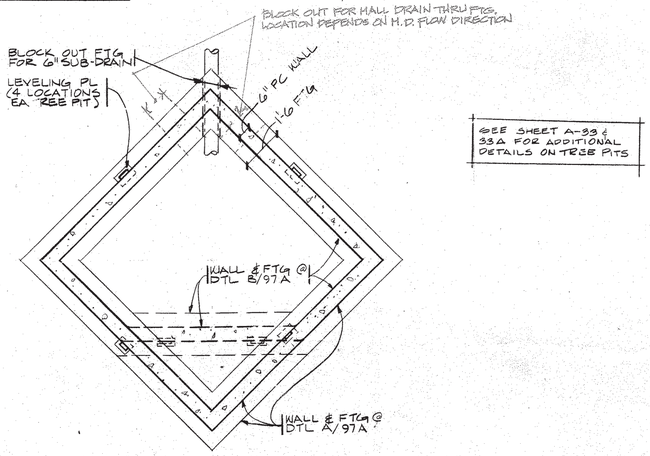
PRECAST SLAB REINFORCING 3/8"=1'-0



B 97A — 3/4"=1'-0



E 97A — LEVELING PL & FOOTING DETAIL FOR PRECAST TREE PITS — 1½" = 1'-0



SEE SHEET A-33 & 33A FOR ADDITIONAL DETAILS ON TREE PITS

F 97A — TYP FOUNDATION PLAN — 3/8"=1'-0

RTD
Regional Transportation District

16th Street

THE TRANSITWAY MALL DENVER, COLORADO

I.M. Pei & Partners
Architects and Planners
New York, New York

KKBNA, Inc.
Civil/Structural Engineers
Denver, Colorado

Hanna/Olin
Landscape Consultant
Philadelphia, Pennsylvania

Phillip E. Flores Associates, Inc.
Landscape Architects
Denver, Colorado

Howard Brandston
Lighting Design Inc.
New York, New York

Barton-Aschman Associates, Inc.
Transportation Consultants
Evanston, Illinois

Page, Arbitrio & Resen, Ltd.
Graphics
New York, New York

Registered Architect

Registered Engineer — CHARLES W. KELLY — 9140 — STATE OF COLORADO

Architect's and Engineer's Approval

Drawn By: S. FENTON
Checked By: L.R.S. Date: FEB. 15
Approved By: H.B.B. Date: FEB. 15

RTD Approvals: Judson Fahnestock; Ralph E. Jackson

Revisions

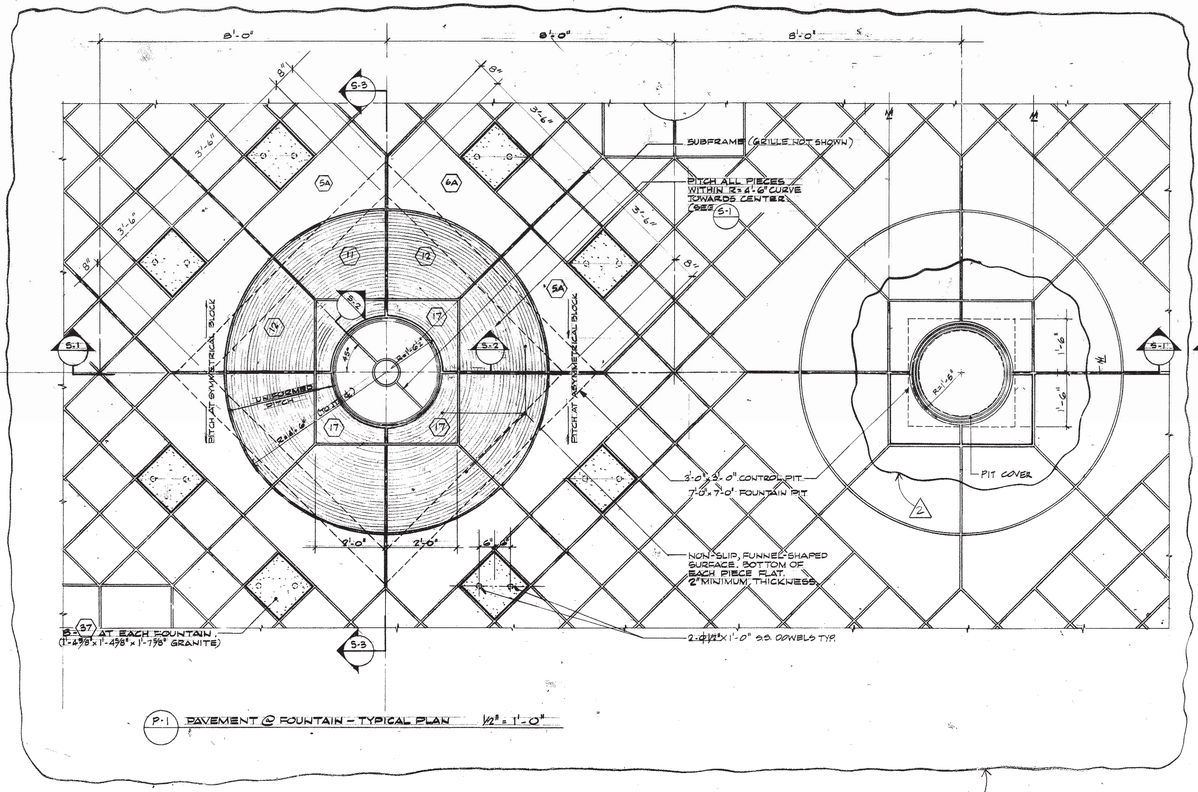
Date	Number	Description

Drawing Title: TREE PIT DETAILS

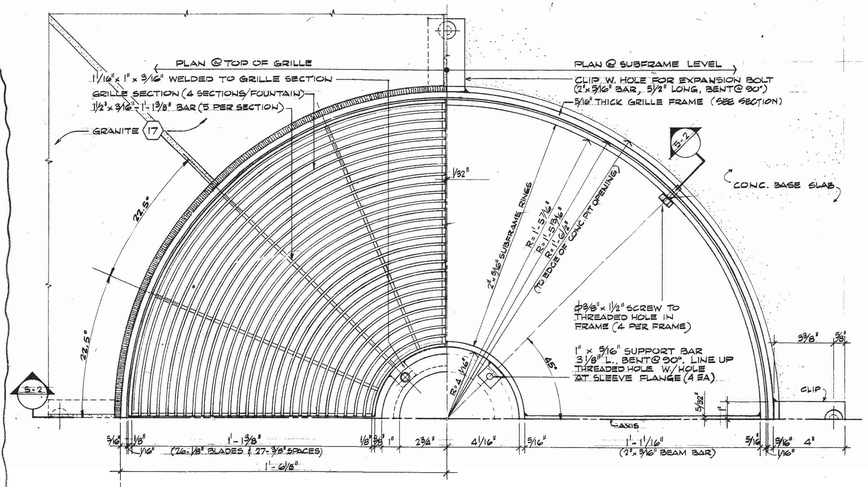
Sheet No.: C-97A (AS-BUILT)

Revision No.

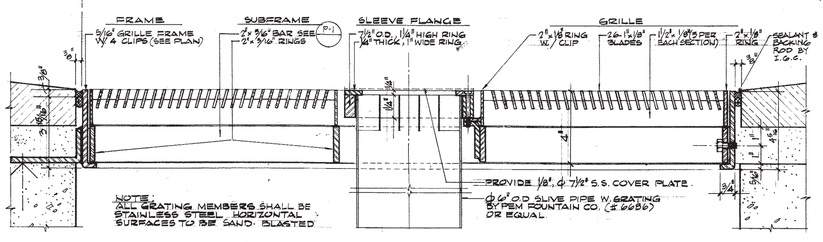
Date of Issue: MAR. 31, 1980



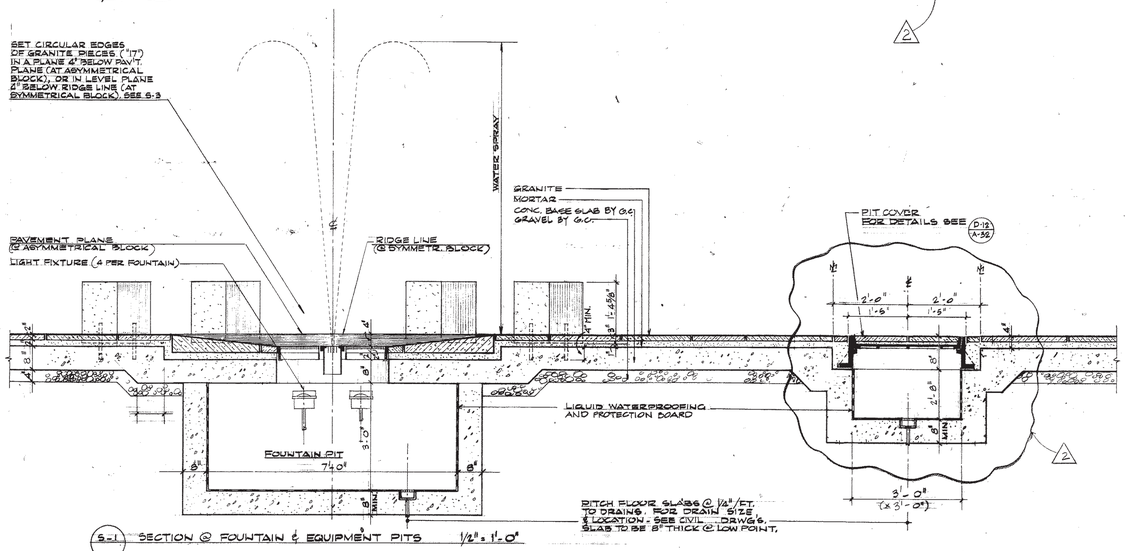
P-1 PAVEMENT @ FOUNTAIN - TYPICAL PLAN 1/2" = 1'-0"



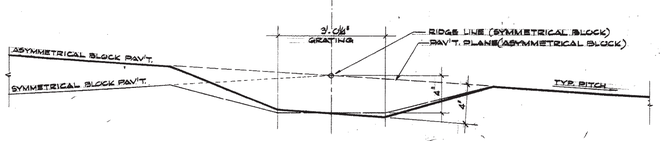
P-2 FOUNTAIN PIT GRATING - HALF PLAN 3" = 1'-0"
BY GENERAL CONTRACTOR



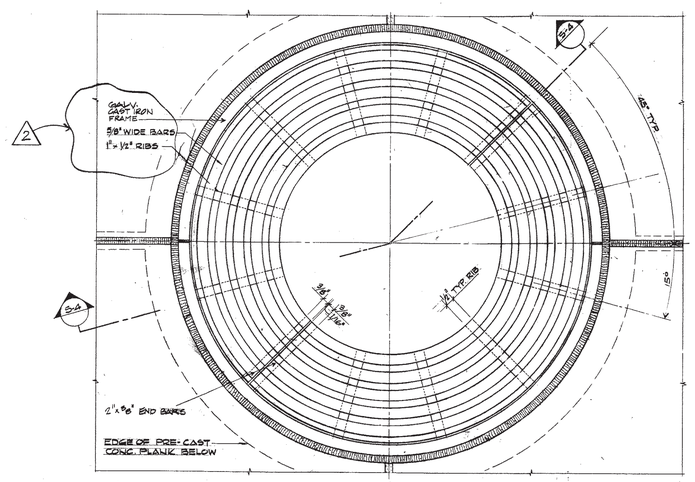
S-2 FOUNTAIN GRATING - SECTION 3" = 1'-0"



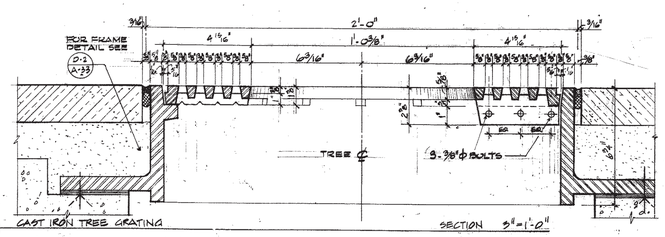
S-1 SECTION @ FOUNTAIN & EQUIPMENT PITS 1/2" = 1'-0"



S-3 SCHEMATIC PAV'T. SECTION 1/2" = 1'-0" HORIZ., 1 1/2" = 1'-0" VERT.



P-4 CAST IRON TREE GRATING PLAN 3" = 1'-0"
BY GENERAL CONTRACTOR



S-4 CAST IRON TREE GRATING SECTION 3" = 1'-0"

RTD
Regional Transportation District

16th Street

THE TRANSITWAY MALL
DENVER, COLORADO

I. M. Pei & Partners
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KKBNA, Inc.
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Page, Arbitric & Rosen, Ltd.
Graphics
New York, New York

Registered Engineer

STATE OF COLORADO
EASON H. LEONARD
C-1755
LICENSED ARCHITECT

Architect's and Engineer's Approval

Drawn By A. M.

Checked By Date

Approved By Date

RTD Approval

Revisions

Date	Number	Description
3·12·80	1	REV. AS INDICATED & COMPLETED
4·15·80	2	REV. AS PER ADDENDUM NO. 3 TCO 7

Drawing Title
GRANITE DETAILS
SHEET 7

Sheet No.
A35

Revision No. 2
Date of Issue 3.31.80
SCALE: AS NOTED

Attachment 8
Tree Candidates

Tree Candidates

Honeylocust and Similar

ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
49	Bignoniaceae	Catalpa speciosa	–	Western Catalpa	5	Xeric to Min	Intermediate	Intermediate	Yes	50	35	Irregular pyramidal to rounded oval	Large, white flowers in spring to summer; showy	Green	Yellow	No	Heat, drought, and alkaline soil tolerant. Decay when wounded or as tree ages may be an issue.
15	Fabaceae	Gleditsia triacanthos inermis	Harve	Northern Acclaim Honeylocust	3b	Xeric	Tolerant	Tolerant	Yes	40	30	Broad pyramidal	Insignificant	Green	Yellow	No	Thornless and fruitless cultivar. Genus overplanted in Denver region.
7	Fabaceae	Gymnocladus dioicus	Espresso	Kentucky Coffeetree	4	–	Tolerant	Tolerant	Yes	–	–	Spreading vase	Greenish-white clusters in late spring	Blue-green	Yellow	Yes	Male (fruitless) cultivar. Tolerant of urban growing conditions. No known insect or disease issues. Leaves, seeds, and pulp reported to be poisonous if ingested.
16	Fabaceae	Gleditsia triacanthos inermis	Shademaster	Shademaster Honeylocust	4	Xeric	Tolerant	Tolerant	Yes	40	30	Vase to rectangular	Insignificant	Green	Yellow	Yes	Thornless and fruitless cultivar. Central leader less present than Skyline. Genus overplanted in Denver region.
52	Platanaceae	Platanus occidentalis	Bismarck	Northern Advance American Sycamore	3	Mod	Intermediate	Intermediate	Yes	75	60	Pyramidal to rounded	Insignificant	Green	Yellow	No	Cold hardy cultivar of parent species. Large root system requires large tree lawn. NDSU introduced – availability may be limited.
54	Platanaceae	Platanus x acerifolia	Morton Circle	Exclamation London Planetree	5	Mod	Intermediate	Intermediate	Yes	50	30	Pyramidal	Insignificant	Green	Yellow	No	Upper branches display showy bark. Cultivar more resistant to anthracnose than parent species. Large root system requires large tree lawn.
18	Sapindaceae	Koelreuteria paniculata	–	Goldenraintree	5	Xeric	Intermediate	Intermediate	Yes	30	30	Open, rounded vase	Yellow in summer, very showy	Green	Yellow	No	Volunteer seedlings could be an issue in mulched areas.
34	Fabaceae	Styphnolobium japonica	Halka	Millstone Japanese Pagodatree	5	Min	Intermediate	Intermediate	Yes	40	30	Broad oval to rounded	Creamy white in summer, showy	Dark green	Yellow	Yes	Tolerant of urban conditions, including heat, drought, and compacted soils. More upright branching habit than parent species. Greatest canker resistance of pagodatree species.
126	Rutaceae	Phellodendron amurense	Macho	Macho Amur Corktree	4	Min to mod	Intermediate	Intermediate	No	40	40	Upright to rounded	Green-white in spring, insignificant	Green	Yellow	No	Male, seedless cultivar of parent species. Large, shallow root system requires large tree lawn.

Shade Trees

ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
11	Fagaceae	Quercus macrocarpa	JFS-KW14	Cobblestone Oak	3	Xeric	Intermediate	Intermediate	Yes	50	40	Broad oval	Insignificant	Dark green	Yellow	No	Bark displays more cork-like features than parent species.
130	Fagaceae	Quercus muehlenbergii	–	Chinkapin Oak	3	Mod	Intermediate	Intermediate	No	45	50	Upright oval to rounded	Insignificant	Yellow-green	Yellow	Yes	Tolerant of alkaline soils. Transplant in spring for best survival. Prune to develop central leader.
31	Ulmaceae	Celtis laevigata	All Seasons, Magnifica	Sugar Hackberry	5	Xeric to Min	Tolerant	Intermediate	Yes	45	40	Rounded vase to broad oval	Green in spring, insignificant	Dark green	Yellow	No	Varieties are more hardy than parent species. Magnifica has similar growth habit to elm and improved insect resistance.
47	Ulmaceae	Celtis occidentalis	Chicagoland	Common Hackberry	3	Xeric to Min	Tolerant	Intermediate to Sensitive	Yes	45	35	Rounded vase, strong central leader	Green in spring, insignificant	Green	Yellow	Yes	Tolerant of urban growing conditions. Nipple gall may be an aesthetic issue. Intolerant of mechanical damage. Transplant in spring (B&B).
25	Ulmaceae	Ulmus americana	Princeton	Princeton American Elm	4	Mod	Intermediate	Intermediate	Yes	60	45	Upright vase	Insignificant	Dark glossy green	Yellow	Yes	Fast growing cultivar. Resistant to Dutch elm disease and elm leaf beetle. Per CSU elm trials, tree may susceptible to scale. Prune to develop strong branching structure.
30	Ulmaceae	Ulmus (wilsoniana x pumila Accolade) x carpinifolia x glabra	Patriot	Patriot Elm	4	Mod	Tolerant	Tolerant	Yes	45	35	Upright, narrow vase	Insignificant	Dark green	Yellow	No	Fast growth rate. Highly resistant to Dutch elm disease. Per CSU elm trials, tree may be susceptible to scale. Not as drought tolerant as other hybrids. Prune to develop strong branching structure.
29	Ulmaceae	Ulmus glabra x carpinifolia	Pioneer	Pioneer Elm	4	Mod	Tolerant	Tolerant	Yes	50	45	Rounded	Insignificant	Dark green	Yellow	Yes	Resistant to Dutch elm disease. Highly susceptible to elm leaf beetle. Per CSU elm trials, tree may be susceptible to scale. Prune to develop strong branching structure.
23	Ulmaceae	Ulmus pumila x japonica x wilsoniana	Morton Glossy	Triumph Elm	4	Min to mod	Tolerant	Tolerant	Yes	50	40	Upright oval to vase	Insignificant	Dark glossy green	Yellow	No	Cold hardy. Excellent resistance to Dutch elm disease. Resistant to elm leaf beetle. Per CSU elm trials, tree may be moderately resistant to scale. Prune to develop strong branching structure.
24	Ulmaceae	Ulmus japonica x wilsoniana	Morton	Accolade Elm	4	Min to mod	Intermediate	Intermediate	Yes	60	50	Vase with arching limbs	Insignificant	Dark glossy green	Yellow	Yes	Cold hardy. Resistant to Dutch elm disease and elm leaf beetle. Per CSU elm trials, tree shows high scale resistance. Prune to develop strong branching structure.
92	Ulmaceae	Ulmus davidiana var. japonica	Discovery	Discovery Elm	3	Mod	Tolerant	Tolerant	No	40	30	Upright oval to arching vase	Insignificant	Dark green	Yellow	Yes	Slow growing, cold hardy variety. Resistant to Dutch elm disease and elm leaf beetle. Resitance to scale unknown. Large root system requires large tree lawn. Growth habit requires consistent crown-thinning. Prune to develop strong branching structure.
91	Ulmaceae	Ulmus pumila x hollandica x carpnifolia	Homestead	Homestead Elm	5	Min to mod	Tolerant	Tolerant	No	50	30	Pyramidal to oval	Insignificant	Dark green	Yellow	No	Fast growth rate. Resistant to Dutch elm disease. Susceptible to elm leaf beetle. Per CSU elm trials, tree may be moderately resistant to scale. Prune to develop strong branching structure.

Tree Candidates

Asymmetrical – Red Oak and Similar

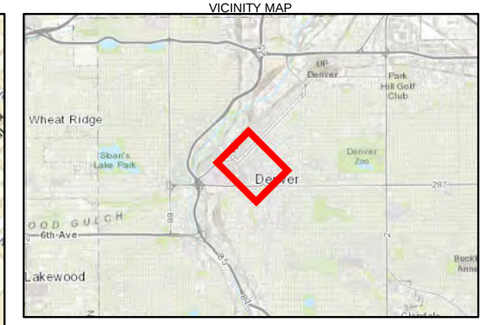
ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
85	Aceraceae	Acer buergeranum	Streetwise	Trident Maple	5	Min	Tolerant	Intermediate	No	30	30	Oval to rounded	Small green-yellow in spring, insignificant	Dark green	Orange-red	Yes	Slow growing. No pests or disease problems at this time. Snow and ice damage may be a concern.
86	Aceraceae	Acer campestre	–	Hedge Maple	5	Min	Tolerant	Tolerant	No	30	30	Oval to rounded, dense	Small green-yellow in spring, insignificant	Dark green	Yellow	Yes	Tolerates dry soil. Intolerant of soil compaction. Prune to develop strong branching structure and overhead clearance.
3	Aceraceae	Acer miyabei	Morton	State Street Maple	4	Mod	Intermediate	Intermediate	Yes	45	35	Upright pyramidal to rounded	Small green-yellow in spring, insignificant	Green	Yellow-orange	Yes	Cold hardy and drought tolerant, chlorosis resistant; pest free.
101	Hippocastana-ceae	Aesculus x Bergeson	–	Prairie Torch Buckeye	3	Mod	Intermediate	Intermediate	No	27	27	Slightly weeping, globose	Yellow-green in spring, showy	Dark green	Orange-red	No	Excellent cold hardiness. Resistant to leaf scorch. Intolerant of drought.
100	Hippocastana-ceae	Aesculus x 'Homestead'	–	Homestead Buckeye	4	Mod	Intermediate	Unknown	No	35	22	Broad oval to rounded, low branching	Yellow-red flowers in spring, showy	Dark green	Bright red-orange	No	Intolerant of excess heat and drought. Powdery mildew, leaf scorch, and leaf drop may be issues. Prune to develop overhead clearance.
62	Rosaceae	Pyrus calleryana	Glen's Form	Chanticleer Pear	4	Min to Mod	Intermediate	Intermediate	Yes	30	15	Upright pyramidal	White in spring, showy	Glossy green	Red	Yes	Greater fireblight resistance than other cultivars. Overplanting is a concern. Prune to develop strong branching structure
118	Fagaceae	Quercus alba	–	White Oak	3	Mod	Tolerant	Tolerant	No	60	60	Oval to rounded	Insignificant	Green	Copper-orange	Yes	Relatively slow growing. May be intolerant of alkaline soils. Chlorosis may be an issue.
115	Fagaceae	Quercus buckleyi	–	Texas Red Oak	5b	Min	Tolerant	Unknown	No	35	35	Broad rounded	Insignificant	Glossy green	Orange-red	No	Native of Texas is closely related to shumard oak. Tolerant of alkaline soils and drought. Check seed source for hardiness and soil tolerance.
112	Fagaceae	Quercus robur x alba	Tabor PP21382	Forest Knight Oak	4	Xeric to Min	Intermediate	Tolerant	No	45	35	Broad oval	Insignificant	Glossy dark green	Orange-red	No	Columnar hybrid of English and white oak. Tolerant of urban conditions. Kermes scale may be an issue.
121	Fagaceae	Quercus shumardii	–	Shumard Oak	5	Mod	Intermediate	Intermediate	No	60	40	Pyramidal to oval	Insignificant	Green	Orange-red	No	Due to large growth range, source as locally as possible for pH, drought, and hardiness tolerance. Large root system requires large tree lawn. Prune to develop central leader.
96	Fagaceae	Quercus x bimundorum	Midwest	Prairie Stature Oak	3	Min to Mod	Intermediate	Intermediate	No	45	35	Broad pyramidal	Insignificant	Insignificant	Dark green	Yes	Cold hardy hybrid of English and white oak. Tolerant of alkaline soils.
120	Ulmaceae	Ulmus davidiana var. japonica	Burgundy Glow	Northern Empress Japanese Elm	3	Mod	Tolerant	Tolerant	No	28	24	Rounded, open	Insignificant	Green	Red	No	Medium growth rate. Resitant to Dutch elm disease and elm leaf beetle. Resistance to scale unknown. Prune to develop strong branching structure.
4	Ulmaceae	Ulmus parvifolia	Dynasty	Dynasty Elm	5	Mod	Intermediate	Intermediate	Yes	35	35	Vase	Insignificant	Green	Yellow-orange	No	Fast growth rate. Resistance to Dutch elm disease, scale, and elm leaf beetle unknown. Prune to develop strong branching structure. Availability may be limited. Unproven in Denver region.
63	Ulmaceae	Ulmus parvifolia	Emer II PP7552	Allee Lacebark Elm	5	Mod	Intermediate	Intermediate	Yes	45	30	Upright vase with arching limbs	Insignificant	Green	Orange-red	Yes	High resistance to Dutch elm disease and elm leaf beetle. Resistance to scale unknown. Thin, showy bark. Prune to develop strong branching structure.
64	Ulmaceae	Ulmus parvifolia	Corticosa	Cork Bark Elm	6	Mod	Intermediate	Intermediate	Yes	40	40	Vase	Insignificant	Dark green	Orange	No	Resistance to Dutch elm disease, scale, and elm leaf beetle unknown. Prune to develop strong branching structure. Cold hardiness may be an issue. Availability may be limited. Unproven in Denver region.
5	Ulmaceae	Zelkova serrata	Halka	Halka Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	50	35	Upright vase, open & loose form	Insignificant	Green	Yellow-orange	No	Growth rate is fastest of zelkova cultivars. Tolerant of urban conditions. Susceptible to canker from mechanical injury. Plant in spring. Prune in fall to develop strong branching structure.
65	Ulmaceae	Zelkova serrata	Green Vase	Green Vase Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	45	30	Vase, upright arching branches	Insignificant	Green	Orange	No	Faster growth rate, but less cold hardy than Village Green. Tolerant of urban conditions. Susceptible to canker from mechanical injury. Plant in spring. Prune in fall to develop strong branching structure.
2	Ulmaceae	Zelkova sinica	–	Chinese Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	35	35	Vase	Insignificant	Dark green	Yellow-orange	No	Resistant to elm leaf beetle. Exfoliating cinnamon-colored bark. Prune in fall to develop strong branching structure. Availability may be limited. Unproven in Denver region.

[a] Trees are subject to change based on design changes, Department of Forestry recommendations, and availability.

Note: The tree species listed are preliminary candidates for future use on the 16th Street Mall, based on design and health/resiliency criteria. Criteria are subject to change based on design changes, Department of Forestry recommendations, and availability.

Attachment 9
Map Book Project Limits

VICINITY MAP



LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 500
Feet

Overview
Historic Properties and Project Limits
16th Street Mall
March 2018

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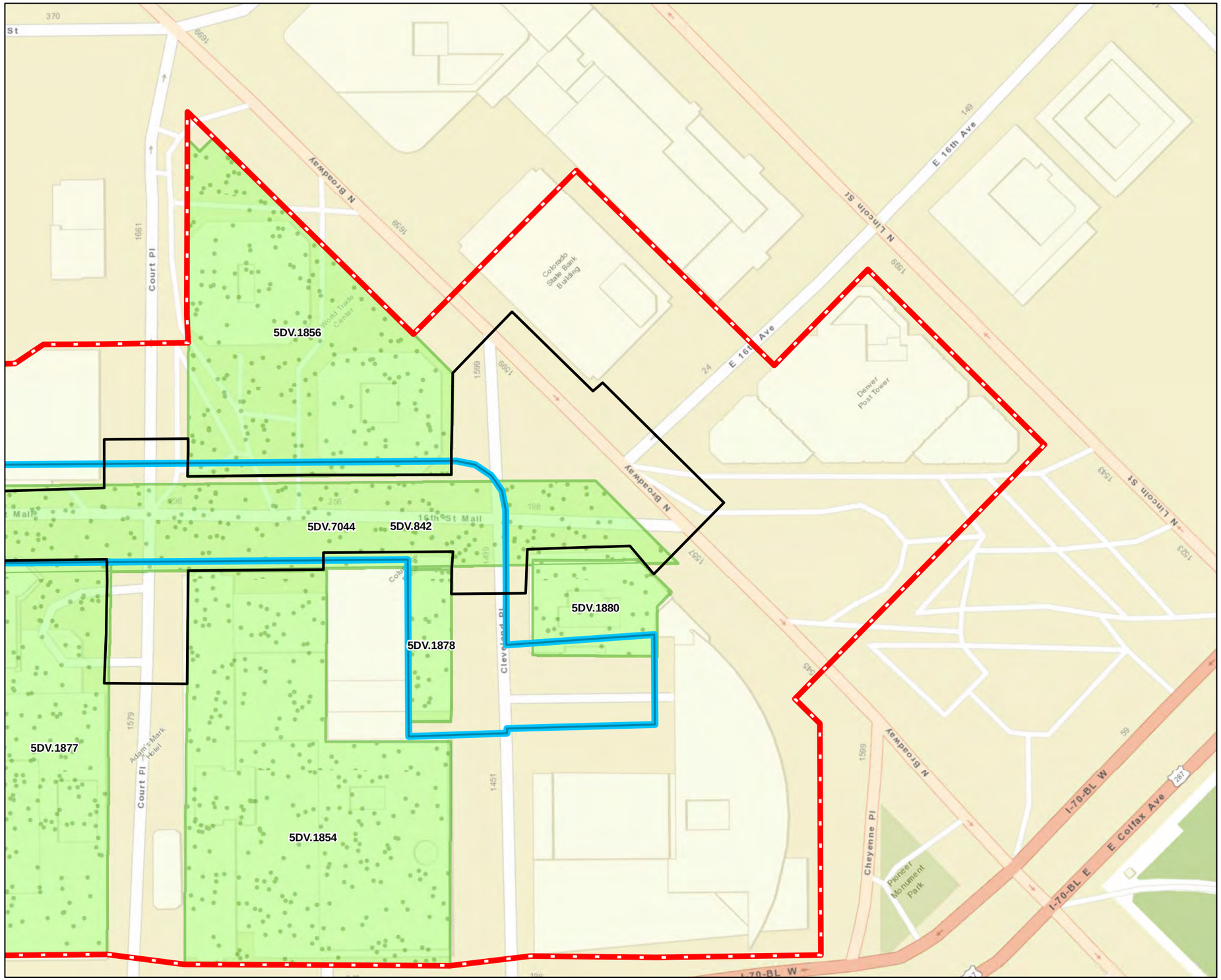

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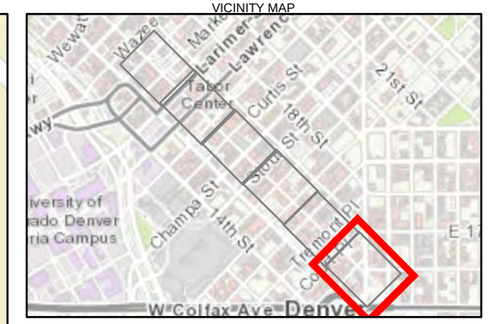

LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 100
Feet

Map Book 1
Historic Properties and Project Limits
16th Street Mall
March 2019

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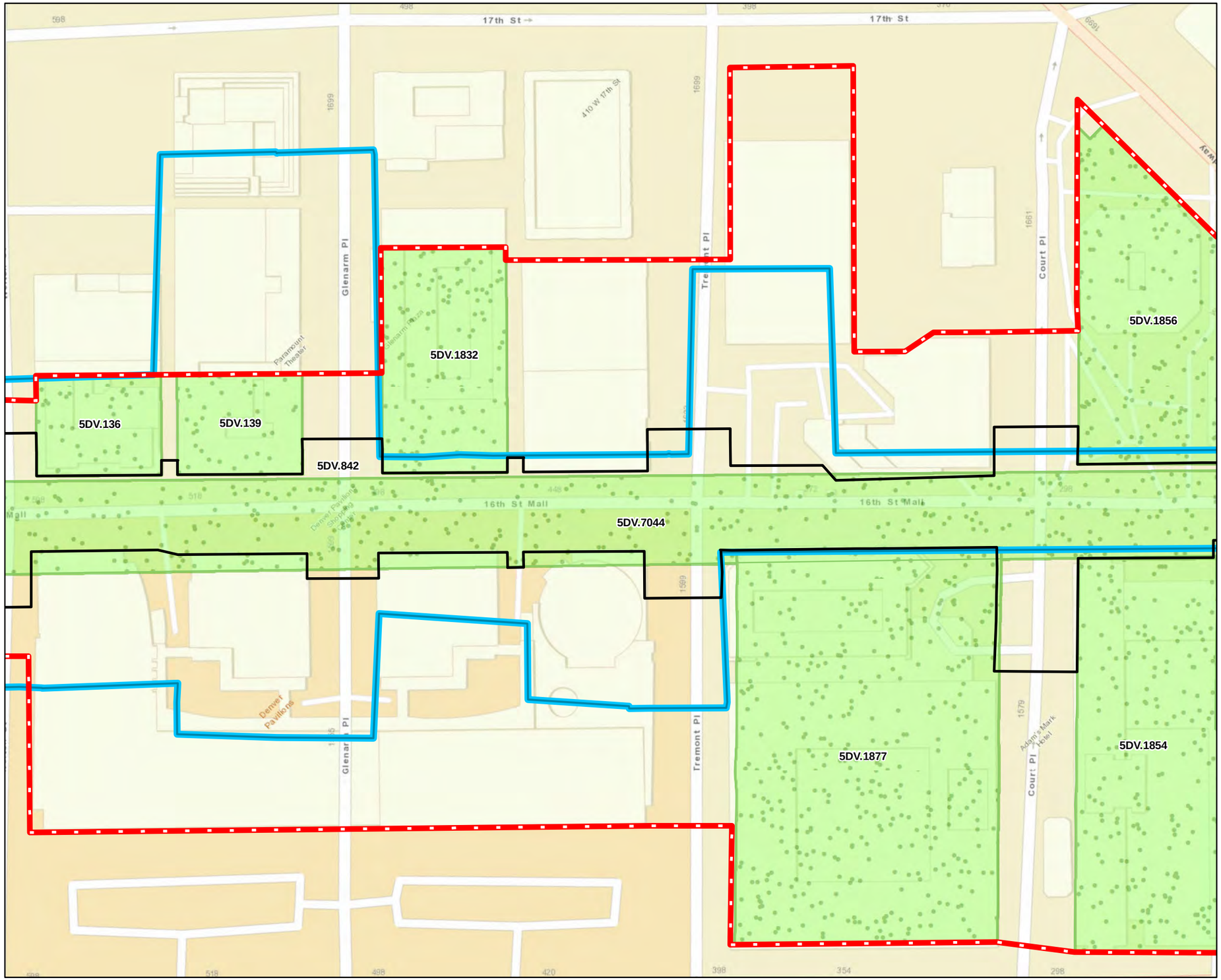

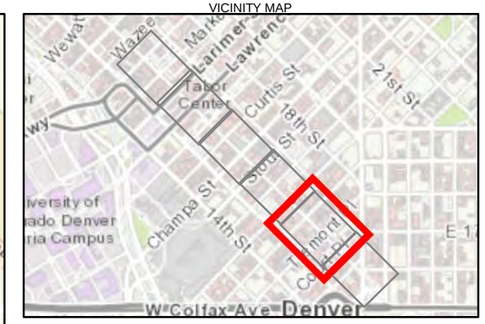

LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 100
Feet

Map Book 2
Historic Properties and Project Limits
16th Street Mall
March 2019

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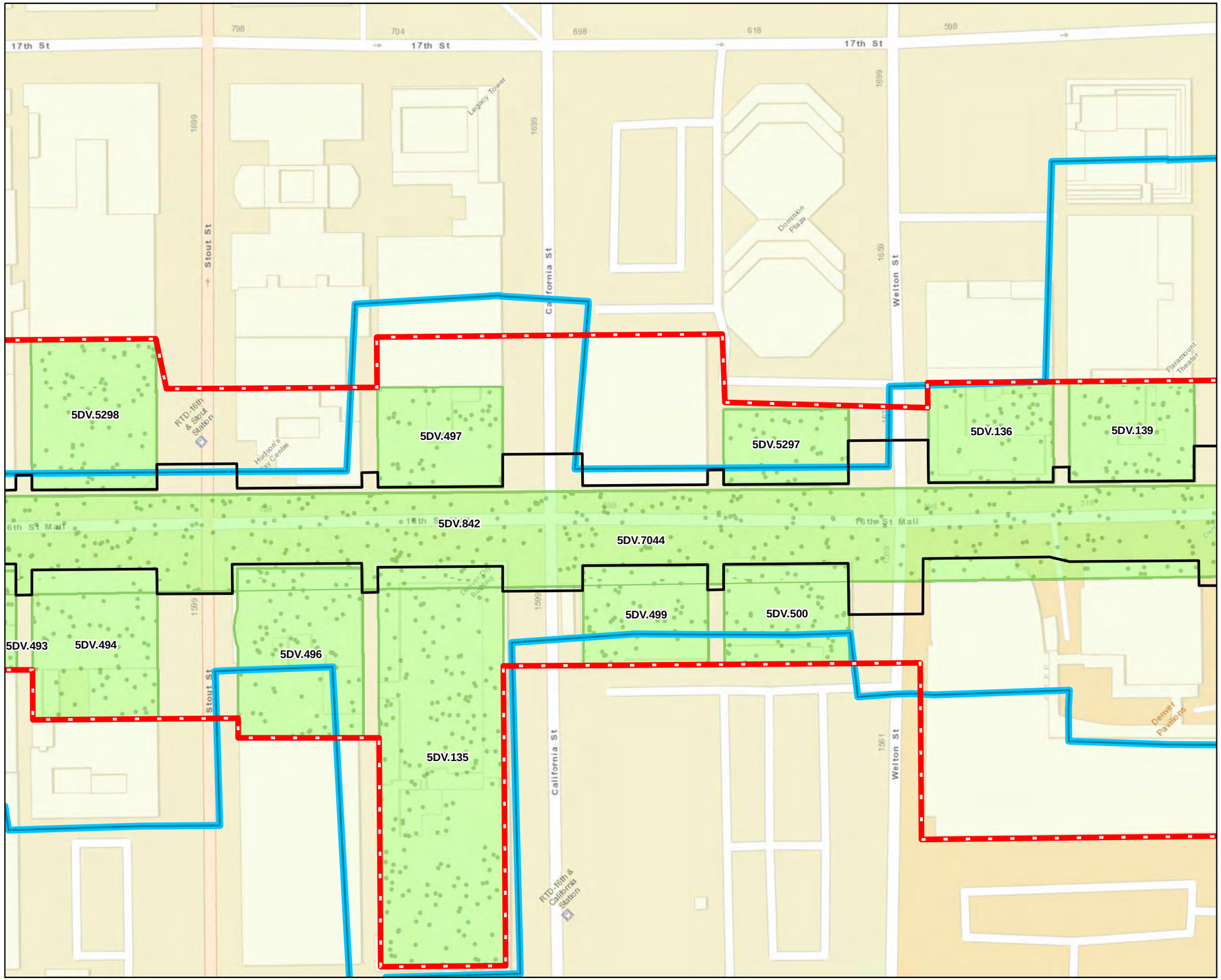


VICINITY MAP

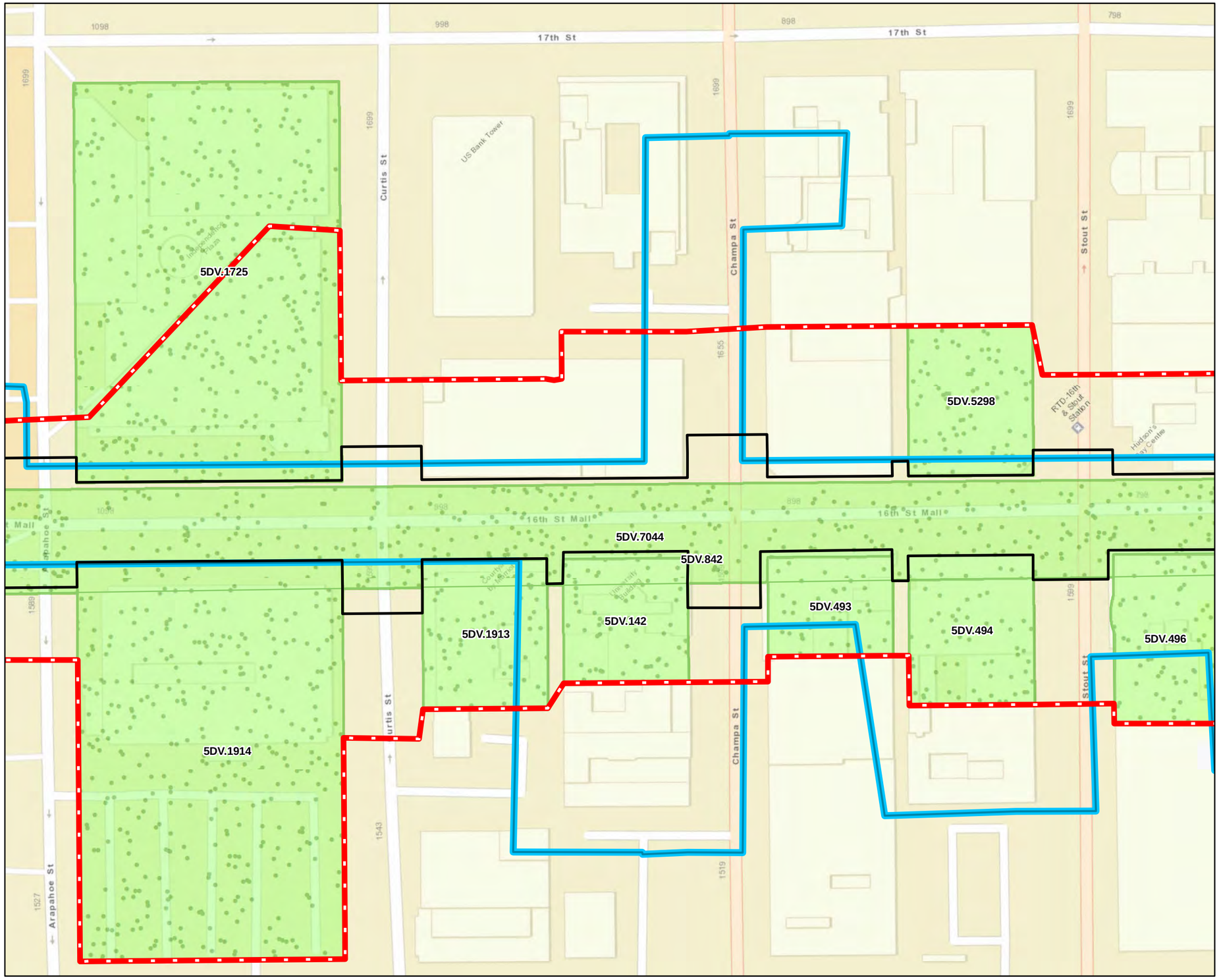
LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 100
Feet

Map Book 3
Historic Properties and Project Limits
16th Street Mall
March 2019

ch2m



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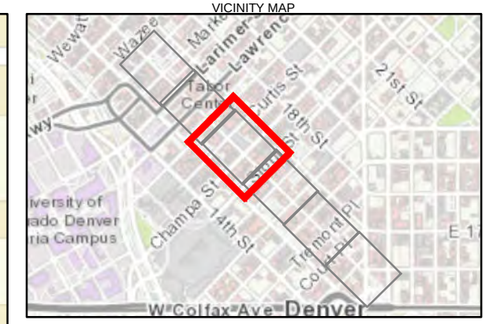

LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 100
Feet

Map Book 4
Historic Properties and Project Limits
16th Street Mall
March 2019

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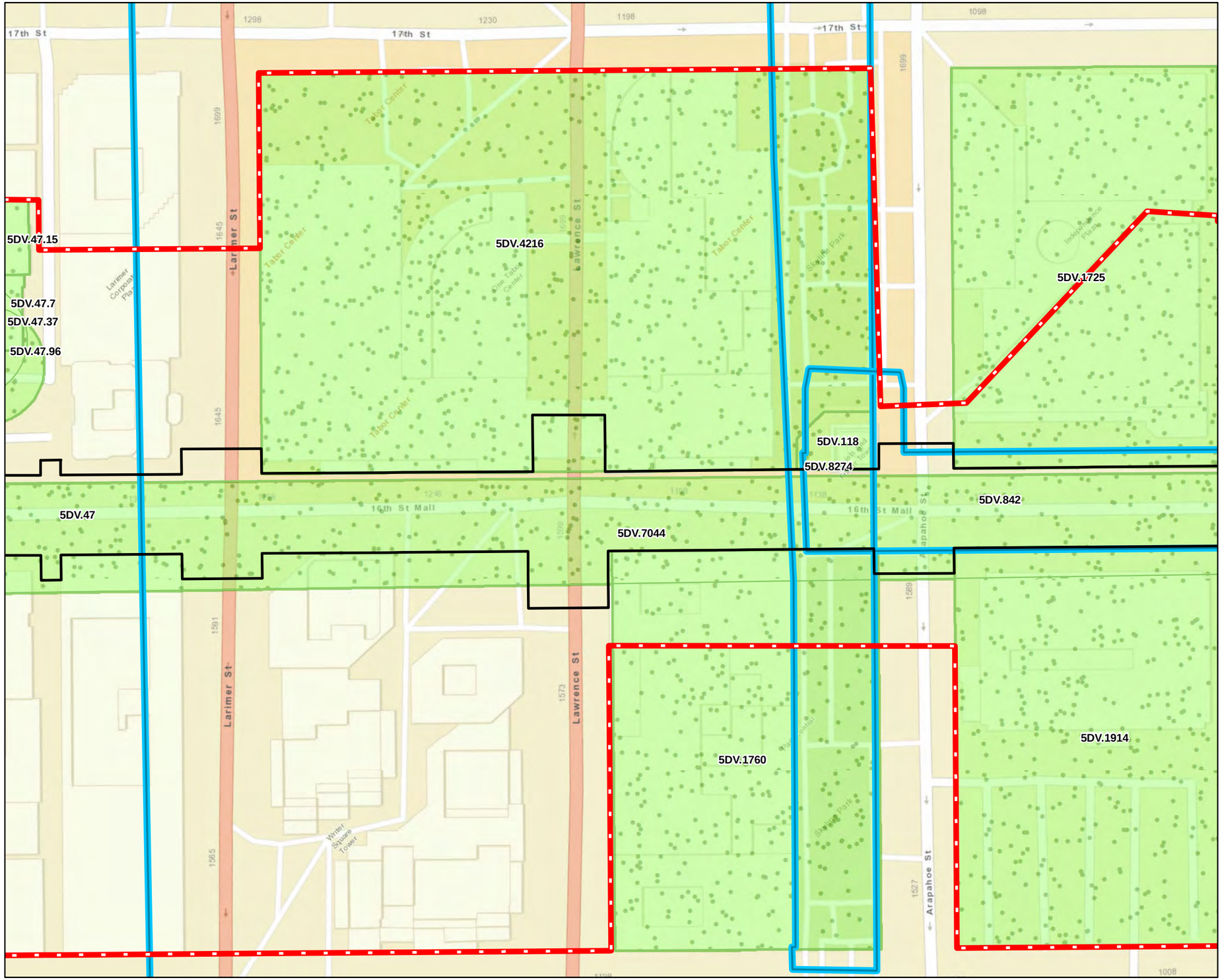

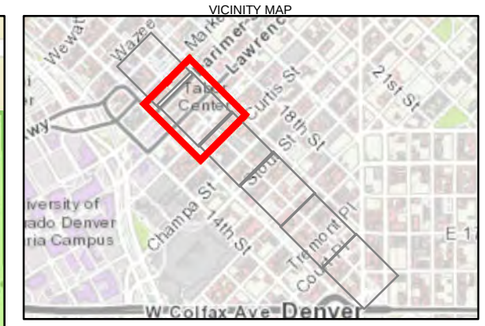

LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

0 100
Feet

Map Book 5
Historic Properties and Project Limits
16th Street Mall
March 2019

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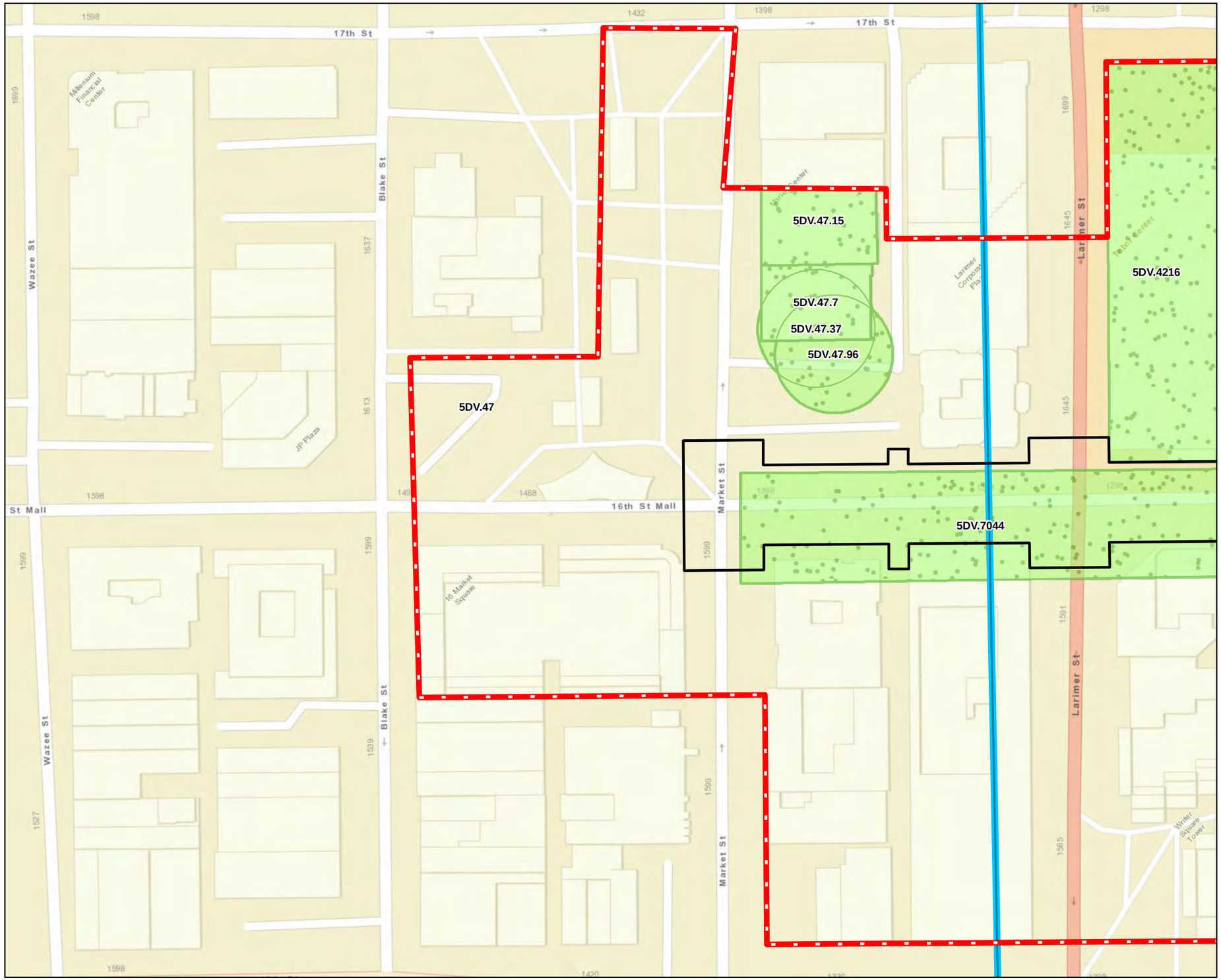

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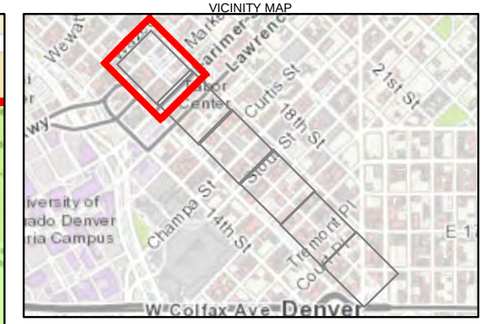


LEGEND

- Area of Potential Effects
- Project Limits
- Historic Properties
- Historic District

N

0 100
Feet

Map Book 6
Historic Properties and Project Limits
16th Street Mall
March 2019

ch2m

TECHNICAL MEMORANDUM

Air Quality Analysis and General Conformity Evaluation

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	October 2018

1. Introduction

The purpose of the 16th Street Mall Alternative Analysis and Environmental Clearance Project (Project), in Denver County, Colorado, is to develop and implement a flexible and sustainable plan to address deteriorating infrastructure, provide equitable and sufficient space for high-quality public gathering opportunities, improve pedestrian and vehicle safety, and continue reliable two-way transit shuttle service on the Mall while honoring the Mall's use and iconic design.

This memorandum summarizes the evaluation of the Project's potential impacts to air quality and addresses whether a general conformity analysis is required. The analysis demonstrates that the Project would not have a substantial adverse impact on air quality.

2. Laws, Regulations, and Orders

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS), which set limits on concentration levels of the criteria pollutants in the air.

The Project is located in Denver County, Colorado. The Project is in an area which is designated as attainment[1] for nitrogen dioxide (NO_2), particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$), sulfur dioxide, and lead for NAAQS. The area is in nonattainment for ozone, and is in maintenance for carbon monoxide (CO) and particulate matter with a diameter of less than or equal to 10 micrometers (PM_{10}). **Table 2-1** summarizes the attainment status for each criteria air pollutant.

[1] Attainment with the NAAQS means the area is consistently meeting the NAAQS.

Table 2-1. Denver County Attainment Status
16th Street Mall Alternative Analysis and Environmental Clearance

Air Pollutant	Attainment Status[a]
Nitrogen Dioxide	Attainment
Carbon Monoxide	Maintenance[b]
(PM_{10})	Maintenance
($PM_{2.5}$)	Attainment
Sulfur Dioxide	Attainment
Ozone	Nonattainment[c]
Lead	Attainment

Notes:

[a] Information taken from the State Implementation Plans (SIP) Website (CDPHE, 2017).

[b] Maintenance means that the area was previously designated as nonattainment area, but is now consistently meeting the NAAQS and has been reclassified by EPA from "nonattainment" to "attainment with a maintenance plan."

[c] Nonattainment means the area is not constantly meeting the standard.

The current air quality plans applicable to the Denver area include the *Carbon Monoxide Maintenance Plan* (CDPHE and RAQC, 2005a), the *PM_{10} Maintenance Plan* (CDPHE and RAQC, 2005b), and the *Ozone Action Plan* (CDPHE et al., 2008).

3. Impact Evaluation

A. Long-term Operational Impacts

Because this Project is not expected to affect traffic patterns or vehicle volumes in the Project area, there would be no substantial long-term air quality impacts associated with the Locally Preferred Alternative (LPA). The long-term impacts to implementing the LPA would be similar to the No Build Alternative.

1. Localized CO and PM Impacts

Vehicle emissions, especially CO and PM, have the potential to cause localized impacts.

In general, localized impacts of CO and PM_{10}/$PM_{2.5}$ are likely to occur at intersections with increased traffic congestion, or at locations with substantial increases in diesel truck traffic. The LPA would not generate new vehicle trips to the Project area nor cause traffic congestion at local intersections; therefore, no new localized CO and PM_{10}/$PM_{2.5}$ impacts would occur in the Project area.

2. Mobile source air toxics

Because the Project would not affect traffic patterns or vehicle volume in the Project area, the Project is not expected to increase mobile source air toxic emission.

B. Short-term Construction Impacts

During construction, short-term air quality impacts would occur from the release of particulate emissions generated by excavation, grading, hauling, and other construction-related activities. Exhaust emissions from construction equipment and vehicles would include CO, NO_x, volatile organic compounds (VOCs), and PM_{10} and $PM_{2.5}$. Timing of the emissions from these sources would vary depending on the construction phasing.

Construction of the Project would last for 3 to 4 years. Construction of the Project would comply with the local, state, and federal requirements. Because emissions and dust will be reduced through implementing local, state and federal requirements, and because construction emissions are temporary and localized, dust and vehicle emissions are expected to be minor.

C. Transportation Conformity

Federal Clean Air Act Section 176(c) and the transportation conformity rule prohibit federal agencies from funding, authorizing, or approving plans, programs, or projects that are not conforming to the SIP for achieving the goals of Clean Air Act requirements related to the NAAQS. Conformity requirements apply in nonattainment and maintenance areas for the NAAQS only for the specific NAAQS that are or were violated.

The Project would have federal funding and is a transit project located in a nonattainment area for ozone, and a maintenance area for CO and PM_{10}. The Project is exempt from transportation conformity requirements because it includes improving safety, enhancing transportation, widening of narrow pavements (without adding new lanes), pavement resurfacing and rehabilitation, and improving a pedestrian facility. These activities are exempt from the transportation conformity requirements per 40 *Code of Federal Regulations* 93.126.

4. References

Colorado Department of Public Health and Environment (CDPHE). 2017. State Implementation Plans (SIPs) Website. https://www.colorado.gov/pacific/cdphe/state-implementation-plans-sips. November.

Colorado Department of Public Health and Environment and Regional Air Quality Council (CDPHE and RAQC). 2005a. *Carbon Monoxide Maintenance Plan.*

Colorado Department of Public Health and Environment and Regional Air Quality Council (CDPHE and RAQC). 2005b. *PM_{10} Maintenance Plan.*

Colorado Department of Public Health and Environment, Regional Air Quality Council, and North Front Range Transportation and Air Quality Planning Council (CDPHE et al.). 2008. *Ozone Action Plan.*

TECHNICAL MEMORANDUM

Visual and Aesthetic Resources Assessment

TO:	City and County of Denver, Regional Transportation District
FROM:	Jacobs
DATE:	March 2019

Summary

The visual environment encompasses elements from both the built and natural environments, including buildings, streetscapes, vistas, and the surrounding landscapes. This analysis examines potential impacts to visual quality of the 16th Street Mall (Mall) Project (Project) and forecasts the expected reaction from sensitive viewers based upon initial input received via a Visual Preference Survey conducted by the City and County of Denver (CCD) in 2007. In addition, it assesses whether the Project would induce additional light and glare in the study area.

Context

The Mall was designed by a team including I.M. Pei and Hanna-Olin, with construction completed in 1982 (I.M. Pei & Partners, 1977). The objectives of the I.M. Pei/Hanna-Olin plan included reducing traffic, establishing an efficient bus service to the city and the surrounding neighborhoods, and creating a new pedestrian environment in downtown Denver. The planning and implementation of the detailed landscape architecture plans structured the visual setting with paving, lighting, street furniture, and a division of pedestrian zones from the transit-way lanes. Since 1986, the *Denver Downtown Area Plan* has deemed the 16th Street Mall to be the spine of downtown, with its corridor anchored by Denver Union Station at Wynkoop Street on the west and by Civic Center Station at Broadway on the east. To cultivate this identity, CCD, the Downtown Denver Partnership (DDP), and Downtown Denver Business Improvement District (BID) have sought to enhance the 16th Street Mall as a priority pedestrian connection by providing appropriate aesthetic treatments, limiting use to transit and pedestrians only, and siting events within this corridor.

The Mall can currently be described as outdated, with failing and deteriorating infrastructure and limited space for safe and engaging public gathering activities. The deteriorating infrastructure causes safety hazards for both pedestrians and vehicles, and requires frequent and costly maintenance. The Project is designed to address these issues by replacing the Mall with new infrastructure and rearranging space definition by adhering to the intent of the original design of the I.M. Pei/Hanna-Olin plan.

Common components from the original design, the proposed Locally Preferred Alternative (LPA), and the LPA Design Option include the pavement pattern, unique light stands, and trees arranged to define the walkways and transit corridors. These are all meaningful elements of discerning the visual character and quality of the study area.

Methods

The visual quality assessment described in this technical report follows the methodology and guidance documented in *Visual Impact Assessment for Highway Projects* (Federal Highway Administration [FHWA], 1988). This methodology provides a systematic and objective approach to evaluating the visual changes that would potentially result from implementation of proposed projects. The assessment considers the change in the landscape's vividness, intactness, and unity on a scale of low, medium-low, medium, medium-high and high. The ratings for these three components are then averaged to provide a total visual quality rating using the same scale.

People walking through, working in, or visiting the pedestrian or seating areas of the Mall are considered sensitive receptors. People working in the Mall or in adjacent buildings are considered less sensitive than those who specifically come to relax, shop, and take advantage of the pedestrian environment of the Mall. The sensitivity and preferences of sensitive receptors is an influencing factor in the visual quality assessment.

The study area extends between the building facades on either side of the Mall and includes vistas at cross streets and toward the Civic Center.

Assessment

The Project limits were divided into landscape units mirroring the I.M. Pei/Hanna-Olin plan, which defined zones by asymmetry along the Mall that correspond to the current Landscape Unit 1 at the western end and Landscape Unit 3 at the eastern end, with a symmetrical design in the middle zone comprising Landscape Unit 2. Landscape units are recognizable units that are distinct in character, land use purpose, land-cover patterns, or a combination thereof.

The existing visual quality conditions were evaluated based on photos, paving and tree surveys, and public input. The results were as follows:

- Landscape Unit 1: West End (Market Street to Arapahoe Street), with an assessment of medium-low visual quality
- Landscape Unit 2: Middle Blocks (Arapahoe Street to Tremont Place), with an assessment of medium visual quality
- Landscape Unit 3: East End (Tremont Place to Broadway), with an assessment of medium visual quality

No Build Alternative

Under the No Build Alternative, no construction would occur within the Mall; routine maintenance would become more difficult, trees would not be replaced, and the health of remaining trees might worsen. The glare of buildings and the continual degradation may affect how and where people go within the 16th Street Mall to sit and relax. The current visual environment is a mix of medium-low to medium-high visual quality, but the fatigue of the environment is showing and reduces the visual experience from its original intention.

Sensitive viewers might not notice an immediate change, but the degradation could mean fewer viewers would visit the Mall. In urban areas, it is typical for shoppers to desire a clean, well-kept, and safe environment to visit. If the environment degrades, the number of visitors may decline over time.

Locally Preferred Alternative

Short-term Impacts (Construction Phase)

Under the LPA, the primary construction impacts to aesthetic and visual resources would be temporary and related to closing portions of streets, removing existing trees, providing night lighting and open staging areas to store equipment and materials, and relocating utilities. Fencing would be required around portions of the work sites, which would have a temporary negative visual impact.

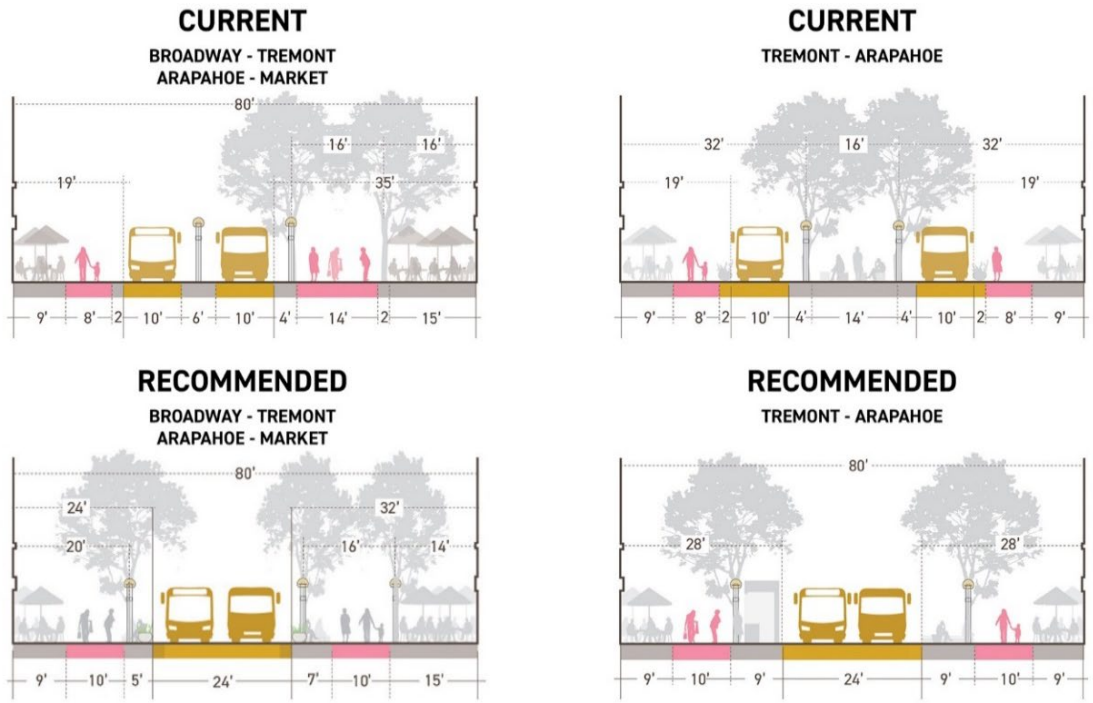
Phasing construction into concentrated segments, maintaining access with planks, and providing interesting screening could minimize some of the visual intrusion for the duration and reduce the intensity of visual disruption.

Long-term Impacts (Permanent/Operational Phase)

The LPA preserves many of the original I.M. Pei/Hanna-Olin plan elements, such as trees to define transit versus pedestrian and relaxation areas, pavement patterns similar to the original plan, and lighting standards that are both unique to the 16th Street Mall and shorter than normal street lights. It also preserves the Mall's composition: an asymmetrical design at the western and eastern ends and a symmetrical design in the middle blocks.

Figure 1 demonstrates how the reorganized spaces can use lighting and tree placement to change the spatial relationships. For instance, by moving the relaxation areas closer to the buildings (and not isolating them in the middle of the transit-way lanes), these areas may become visually 'owned' by adjacent businesses because workers can more easily survey the area; this increases safety and encourages businesses to remove left-over debris, thereby adding to a maintained environment. In both the symmetrical and asymmetrical plans, the transit-way lanes are consolidated side by side.

Figure 1. Comparative Existing versus Proposed Cross-sections for the LPA



At the edge of the transit way the LPA would be designed with vertical curbs, similar to those on the outside edges of the existing transit way lanes, at designated shuttle stops, cross streets, and intersections; the vertical curbs would then transition to a pan similar to the pan on the inside edges of the existing transit way lanes (hybrid option). The visual effect of the hybrid option would result in a slight impact on the visual character of the Mall. While a vertical curb would provide a physical change in the elevation of the pavement, the tones and materials would blend with the pavement design and therefore become visually synonymous with the pavement as it currently functions. This would be even more true with a pan, where the pavement design provides the primary delineation of the transit way, without a vertical elevation change.

Material and design considerations included durability and longevity, specifically in pavement selection and tree selection and planting details, so that the visual elements would be lasting and healthy. This is particularly important for the vertical, strongest visual element – the trees. The LPA proposes to remove the existing 143 trees and plant 249 trees between Market Street and Broadway, for a total estimated canopy of 58,000 square feet within 10 years. There is currently approximately 95,000 estimated square feet of existing tree canopy between Market Street and Broadway. The vertical structure of the trees not only provides a visual identity for the 16th Street Mall as a whole but also defines the three zones of the Mall. The trees are intended to provide shade and a consistent ceiling between the buildings, regardless of individual building heights.

Each of the landscape units is assessed to have improved visual quality as follows:

- For Landscape Unit 1, the visual quality would increase from medium-low to medium.
- For Landscape Unit 2, the visual quality would increase from medium to an overall medium-high visual quality.

- For Landscape Unit 3, the visual quality would increase from medium to medium-high.

Locally Preferred Alternative Design Option

Short-term Impacts (Construction Phase)

The LPA Design Option would have the same short-term impacts as the LPA.

Long-term Impacts (Permanent/Operational Phase)

The LPA Design Option would have similar long-term impacts as the LPA, with differences related to the sizes of the asymmetrical and symmetrical "rooms" of blocks on the Mall and the reorganization of design elements on the asymmetrical blocks.

Along the length of the Mall, the LPA Design Option would extend the Center Running blocks 1 block farther in each direction, thus reducing the extent of the Asymmetrical sections to only 2 blocks at the western end and only 1.5 blocks on the eastern end. The reduced size of the asymmetrical end rooms may not be coherent as separate and distinct units from the symmetrical middle room, undermining the purpose of the change in design between the symmetrical and asymmetrical rooms. Lack of clarity and unity in the design would reduce the visual enhancement when compared with the LPA design. In addition, reducing the number of asymmetrical blocks would result in fewer trees planted, as these blocks are intended to contain three rows of trees versus the two rows of the symmetrical blocks.

The LPA Design Option would reconfigure the space on the asymmetrical blocks to retain the existing pavement pattern location, including the locations of trees and lights, on the wide side of the block (rather than shift the pattern over 2 feet as proposed in the LPA). Patio/gathering space on the narrow side of the block would be reduced, and the adjacent row of trees would not be able to align with the row of trees in the center running blocks. Because vistas play an important role in the cultural use of the corridor, misaligned tree plantings may reduce the visual aesthetic experience compared to the LPA.

The potential for the LPA Design Option to appear broken up into irregular units with reduced visual coherence would result in a reduction of intactness and unity measures over the LPA. The visual quality of the Project with the LPA Design Option would be improved over the No Build Alternative, but would be less visually coherent and have lower intactness than the LPA**.**

In conclusion, for the LPA Design Option, the landscape units are assessed to have the same improved visual quality as the LPA with the following exception: The clarity in purpose of the asymmetrical landscape units may be less clear because they are substantially smaller, the architectural differentiation would be lost, and the slight changes in patio dimension reduce the unity in the alignment of trees and intersection transitions zones.

1. Introduction

Any major infrastructure improvement can result in a permanent change to visual resources in the study area. The degree of impact, either positive or detrimental, will depend on the visual quality of the environment affected and the sensitivity of the receptor.

The visual environment encompasses elements from both the built and natural environments, including buildings, streetscapes, vistas, and the surrounding landscapes. This analysis examines

potential impacts to the visual quality of the Mall Project, forecasts the expected reaction from sensitive viewers based upon initial input received via a Visual Preference Survey conducted by CCD in 2007, and assesses whether the Project would induce additional light and glare in the study area.

In support of that analysis, the following sections (1) describe the regulations and policies protecting visual resources and (2) the methods for assessing visual quality, (3) present an overview of the existing visual quality of the study area, and (4) describe impacts and, as warranted, mitigation measures.

2. Laws, Regulations, and Orders

A. Federal

The federal government has deemed that visual and aesthetic values are an important consideration in transportation projects, as conveyed through the following codes:

- A visual assessment is included in National Environmental Policy Act (NEPA) environmental evaluations based on **42 United States Code (U.S.C.) 4321, Section 101(b)(2),** which states that it is the "continuous responsibility" of the federal government to "use all practicable means" to "assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings."
- **23 U.S.C. 138, Preservation of Parklands,** states "**(a)** It is declared to be the national policy that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites. **(b)** … [t]he Secretary, in cooperation with the Secretary of the Interior and appropriate State and local officials, is authorized to conduct studies as to the most feasible Federal-aid routes for the movement of motor vehicular traffic through or around national parks so as to best serve the needs of the traveling public while preserving the natural beauty of these areas."
- **23 U.S.C. $319, Landscaping and scenic enhancement,** states "The Secretary may approve as a part of the construction of Federal-aid highways the costs of landscape and roadside development, including acquisition and development of publicly owned and controlled rest and recreation areas and sanitary and other facilities reasonably necessary to accommodate the traveling public, and for acquisition of interests in and improvement of strips of land necessary for the restoration, preservation, and enhancement of scenic beauty (including the enhancement of habitat and forage for pollinators) adjacent to such highways."

B. City and County of Denver, Colorado

CCD has adopted plans and zoning to protect and enhance the visual and aesthetic appearance of downtown Denver development. The following sections briefly describe the *Denver Downtown Area Plan* and the applicable portions of the City codes.

1. Denver Downtown Area Plan

The *Denver Downtown Area Plan* notes that "The 16th Street Mall is a nationally recognized symbol of Downtown Denver's vitality." The *Denver Downtown Area Plan* (CCD et al., 2007) centers on strategies and projects organized according to five vision elements that support the overarching vision of a vibrant downtown:

1. A prosperous city
2. A walkable city
3. A diverse city
4. A distinctive city
5. A green city

After the prosperous city element, the remaining four vision elements relate to the physical and visual elements of the city. Each of the themes are reinforced with a set of goals and policies for implementation. The following portions of the *Denver Downtown Area Plan* have been extracted for their direct relationship on how the City plans to improve the 16th Street Mall's visual and aesthetic appearance consistent with the listed themes.

A walkable city, like "the great cities of the West, including Vancouver, Seattle, Portland and San Francisco, all feature street-level experiences that invite and stimulate the pedestrian. Denver's emergence as a truly livable city requires a new emphasis on the pedestrian environment."

GOAL: Make every street safe, comfortable, and attractive for pedestrians as recommended in the Downtown Denver Pedestrian Master Plan.

Policy B1a. Designate Downtown as a "pedestrian priority zone" incorporating universal access standards, Complete Streets policies, which insure safe and convenient access for all transportation modes, and priority to capital investments in pedestrian-oriented improvements in the public right-of-way.

Policy B1c. Develop a comprehensive streetscape plan and funding strategy

- Improve the pedestrian environment on named streets; start with Larimer, Curtis, California and Tremont
- Enhance pedestrian crossings through the use of bulb-outs, mid-block crossings, pedestrian refuge islands, pedestrian count down signals and improved signage and striping

The Prosperous City theme incorporates visual experiences into the plan's adopts goals and policies to enhance the Mall, as follows:

GOAL: Invigorate the Commercial Core by enhancing the pedestrian and transit experiences and creating an economically thriving district for business, retail and tourism.

Policy A2c. Strengthen the vitality of the 16th Street Mall

- Create and enhance recognized sub-districts along the Mall, including Theatre and Visitor districts
- Create and implement a Mall activities strategy
- Develop a balanced retail strategy that includes entertainment, dining and specialty retailers

- Conduct a study of Mall infrastructure to assess needs and reconstruct to meet the goals of sustainability, usability and respect for the existing design
- Re-evaluate 16th Street Mall transit service in light of the Downtown Circulator frequency, operation, and technology

Policy A2d. Create distinct identities along named streets through physical improvements

- Visitor District along California
- Theatre District along Curtis

The Distinctive City theme notes the importance of views and vistas as follows, "Downtown Denver has often been overshadowed by its dramatic sense of place at the foot of the Rocky Mountains. In recent years, Lower Downtown and the 16th Street Mall have emerged as nationally recognized destinations within the city center, creating a definable civic identity. Downtown can build upon these notable features and encourage the creation of a mosaic of distinct districts that each build on their own unique features, and collectively create a city known for its diverse, well-designed and vital urban environment. In turn, the image of Downtown Denver will become as well-known as its setting." This is supported by the following goals and policies:

GOAL: Restore and activated the iconic features, such as mountain views, major public buildings, cherished historic buildings and parks and parkways, that provide distinctive identity to downtown and the Denver region, and foster a collection of identifiable districts throughout Downtown.

Policy D1a. Use features such as transit stations, changes in the grid, terminating vistas, grand boulevards, <u>character</u> of existing buildings, and relationships to adjacent districts and neighborhoods to influence district form including the intensity of development, height of buildings, ground floor activity, and mix of uses. Enact zoning and design guidelines to realize desired district character

- Modify the B-5 Zone District and Design Guidelines to incorporate desired building attributes including views, solar access, energy efficiency, ground floor activity, open space, parking location and appearance, and other factors
- Identify mid- and high-rise building forms that promote intense use while maintaining a pleasant street environment with light, views, and visual interest

The Green City theme gives attention to the value of open space, plazas, recreation with the desire for …" "Enhancing existing amenities, creating outdoor places, and extending the well landscaped public realm of Denver's residential areas - thereby connecting individual green spaces as part of a larger network - will make Downtown Denver a more livable and inviting destination."

GOAL: Strengthen connections between existing parks, plazas and recreation areas, and enhance the public realm to provide venues for outdoor activity throughout Downtown.

Policy E1a. Create a green public realm in Downtown by adding street trees and landscaping in the public right-of-way, in private open spaces and on rooftops

Policy E1d. Activate Skyline Park as a central gathering place for the Downtown community

- Complete the 2004 Skyline Park design, including reactivation of the fountains, enhanced park lighting, signage and paving of selected gravel areas
- Activate the park through programming that appeals to a diverse audience
- Create a family-friendly environment through amenities and activities with particular emphasis on children and youth

2. Applicable City and County of Denver Codes

CCD has adopted view plane boundaries to protect views by restricting building heights; the Civic Center Height Restrictions are enforced from Broadway northwest to Court Street, and include the 16th Street Mall. The following excerpt provides the rationale for the restrictions:

Article IV. - Restrictions On Structures Within Areas Necessary To Preserve Mountain Views

Section 10-56. Purpose. Upon consideration of a recommendation that an ordinance be enacted for the purpose of preserving and protecting the health, safety and general welfare of the people of the city and their property therein situate, the council finds:

1. That the protection and perpetuation of certain panoramic mountain views from various parks and public places within the city is required in the interests of the prosperity, civic pride and general welfare of the people;
2. That it is desirable to designate, preserve and perpetuate certain existing panoramic mountain views for the enjoyment and environmental enrichment of the citizens of the community and visitors hereto;
3. That the preservation of such mountain views will strengthen and preserve the municipality's unique environmental heritage and attributes as a city of the plains at the foot of the Rocky Mountains;
4. That the preservation of such views will foster civic pride in the beauty of the city;
5. That the preservation of such views will stabilize and enhance the aesthetic and economic vitality and values of the surrounding areas within which such views are preserved;
6. That the preservation of such mountain views will protect and enhance the city's attraction to tourists and visitors;
7. That the preservation of such mountain views will promote good urban design;
8. That regular specified areas constituting panoramic views should be established by protecting such panoramic views from encroachment and physical obstruction.

a) Executive Order 123, Chapter 8 – City Tree Preservation

This executive order requires that tree replacement will be equal or greater than number of trees removed. In addition, it requires the preservation of Denver’s overall 19 percent tree canopy.

3. Methodology

The study area is characterized in terms of the built environment (that is, its historic and cultural significance) and the natural environment (including scenic features, vegetation type,

landforms, and open spaces). An assessment of the visual quality is made based on the visual character inventory, which considers CCD plans, policies, and codes to identify designated views and scenic resources. A project's impact is determined by the degree of change and results regarding improved or degraded visual quality when compared to the existing conditions visual assessment. The following sections present the detailed methodology for the Project.

A. Study Area

The study area consists of the views of and from the Project; in this urbanized environment, the study area extends between the building façades on either side of the 16th Street Mall and includes vistas at cross streets and toward the Civic Center. Views extend west and east down the Mall; at intersections, the northern and southern views capture other downtown destinations and important icons of Denver's downtown identity.

B. Sensitive Receptors

People walking in or through, working in, or visiting the pedestrian or seating areas of the 16th Street Mall are all considered sensitive receptors. People working in the Mall or in adjacent buildings are considered less sensitive than those who specifically come to relax, shop, and take advantage of the pedestrian environment of the 16th Street Mall.

C. Data Sources

Information about the visual environment and cultural significance of the landscape was obtained by searches along Google Earth maps, field surveys, photographs of the 16th Street Mall, interviews with landscape architects and cultural historians, and review of the CCD's Downtown Area plans and the I.M. Pei/Hanna-Olin plan for the transit way and Mall. In addition, CCD has adopted ordinances to protect views planes that establish building height restrictions to maintain access to scenic resources.

4. Visual Quality Assessment

The visual quality assessment described in this technical memorandum follows the methodology and guidance documented in *Visual Impact Assessment for Highway Projects* (FHWA, 1988). This methodology provides a systematic and objective approach to evaluating the visual changes that would potentially result from implementation of proposed projects. It includes a broad set of criteria that consider the following factors related to a proposed project:

- The overall visual and aesthetic character and quality of the area through which a proposed project would pass
- The visual and aesthetic experience and expectations of viewers (including residents, users of parks and other public spaces, pedestrians, and motorists)
- The scale and contrast between existing and proposed elements in the area

The FHWA methodology uses the following six steps:

1. Establish the project's area of visual influence by identifying contiguous landscape units and representative viewpoints.

2. Determine who has views of and from the project (viewer), and their viewing sensitivity to changes in the viewed landscape.
3. Describe and assess the landscape (identifiable landscape units) that exists before project construction (existing conditions).
4. Assess the response of viewers looking both at and from the project, before and after project construction.
5. Determine and evaluate views of the project before and after project construction using photo-simulations.
6. Describe the potential visible changes to the study area and its surroundings that would result from the proposed project (project impacts or effects).

To accomplish the first three steps, a visual inventory was performed using (1) Google Earth Pro to record typical views walking east from Market Street to the Project terminus at Broadway and (2) a series of onsite photographs taken using a 50-millimeter lens to represent examples of how the 16th Street Mall looks today.

The last three steps were then conducted to identify how the Project would change the visual character of the assessed area and affect sensitive receptors (viewers). Photo-simulations of the proposed Project from typical or culturally significant views on the representative photographs of the 16th Street Mall were used to provide a before and after view of the Project compared to baseline conditions. The degree of change to the visual character that would be caused by the 16th Street Mall Project was determined by reviewing cross-sections and streetscape plan sets that included materials for and vegetation of the proposed Project. Visual simulations were used to provide the basis for describing potential changes to visual character and visual quality.

A. Visual Character and Visual Quality

Visual character is a description of the viewed landscape and is defined by relationships between existing visible natural and built landscape features. *Visual quality* is an assessment of the composition of the character-defining features for selected views, or key observation points (KOPs). Visual quality in the FHWA methodology is evaluated in terms of vividness, intactness, and unity. These three characteristics are described as follows:

- ***Vividness*** is the degree of drama, memorability, or distinctiveness of the landscape components. Vividness is composed of four elements that usually influence the degree of vividness: landform, vegetation, water-features, and manmade elements.
- ***Intactness*** is a measure of the visual integrity of the natural and manmade landscape and its freedom from encroaching elements. This factor can be present in well-kept urban and rural landscapes and in natural settings. High intactness means that the landscape is not broken up by features that appear to be out of place.
- ***Unity*** is the degree of visual coherence and compositional harmony of the landscape considered as a whole. High unity frequently attests to the careful design of individual components and their relationship in the landscape.

Overall visual quality is the combination of vividness, intactness, and unity. The FHWA methodology uses a numeric rating system to assign visual quality values to viewed areas. For this assessment, a numeric system was not used; instead, visual quality has been categorized as being high, medium-high, medium, medium-low, or low.

A visual quality assessment determines if the vividness, intactness, and unity of the environment would change with the development of the proposed Project and whether the changes would be perceived by sensitive viewers. The assessment also considers whether the proposed Project would be consistent with the existing visual character of areas where the proposed Project would be located.

Per FHWA methodology, the primary portion of the study area was divided into landscape units—identifiable and distinct geographic areas within a linear project corridor from which there are views (the viewshed) of a proposed action. There are three landscape units identified for the 16th Street Mall, from southeast progressing northwest, as follows:

- **Landscape Unit 1:** West End (Market Street to Arapahoe Street) - Asymmetrical blocks on the western end of the Mall from Market Street to Arapahoe Street, with eastward views of the Daniels & Fisher (D&F) Tower and Skyline Park and westward vistas toward the Rocky Mountains
- **Landscape Unit 2:** Middle Blocks (Arapahoe Street to Tremont Place) - Symmetrical blocks in the middle of the Mall from Arapahoe Street to Tremont Place, with westward views of D&F Tower
- **Landscape Unit 3:** East End (Tremont Place to Broadway) - Asymmetrical blocks on the eastern end of the Mall from Tremont Place to Broadway, with views of the State Capitol

To assist in this assessment, representative views, or KOPs, were identified from within the assessment area. The KOPs are used to represent areas along the routes of the 16th Street Mall Project so that existing landscape character and visual quality can be described, and changes to landscape character and visual quality associated with the LPA can be determined. The images and the description also provide an understanding for the light and glare within the existing context. To assess visual changes from the Project, photographs showing existing conditions at four of the KOPs were used to develop computer-generated photo-simulations of the proposed Project.

Both adverse and beneficial visual impacts are characterized. Potential mitigation measures include engaging community input for appropriate landscaping, screening the Project area, incorporating architectural features in design, and implementing litter control.

B. Existing Conditions

1. Context of the 16th Street Mall

Since 1986, the *Denver Downtown Area Plan* has deemed the 16th Street Mall to be the spine of downtown, with its 16-block corridor anchored by Denver Union Station at Wynkoop Street on the west and the Civic Center at Broadway on the east (CCD et al., 2007). This original plan was limited to 13 blocks from Broadway to Market Street. Originally, Market Street (the western Project limit) was the westernmost end of the Mall, because the transit station was located just north of the Market Street intersection.

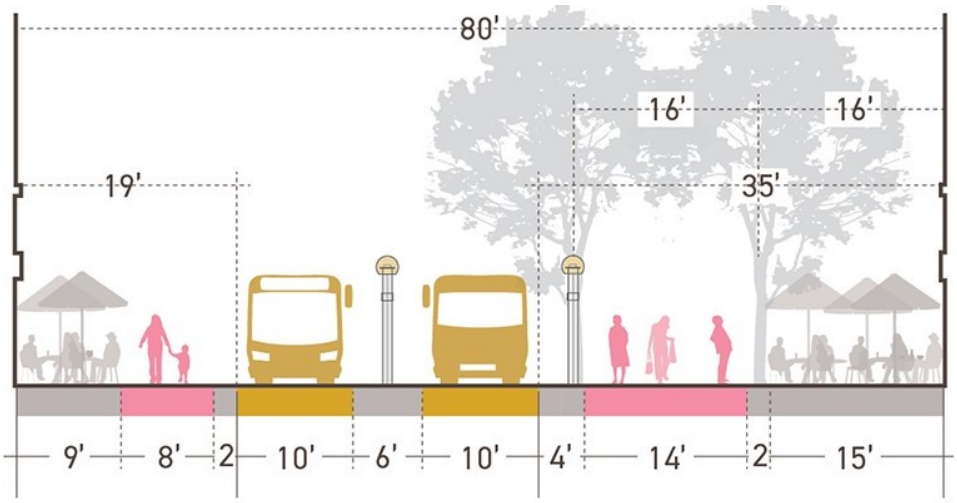
To cultivate the identity of the area, CCD, DDP, and Downtown Denver BID have sought to enhance the 16th Street Mall as a priority pedestrian connection through implementing aesthetic treatments, limiting its use to transit and pedestrians only, and siting events within the corridor. The planning and implementation of the detailed landscape architecture plans structured the visual setting with paving, lighting, street furniture, and a division of pedestrian zones from the transit-way lanes. At the center of this effort is the I.M. Pei/Hanna-Olin plan for what was referred to as the Transitway/Mall (I.M. Pei & Partners, 1977). The objectives of the plan, implemented in 1982, were to reduce traffic, develop an efficient bus service between the city and the surrounding neighborhoods, and create a new pedestrian environment in the downtown area by incorporating the following urban design elements:

- A double row of mature honey locust trees flanking a 22-foot-wide promenade in the center of the street
- Two 10-foot-wide transit way paths on either side of the central zone
- Widened sidewalks along the storefronts
- Pattern paving over the entire street surface is varying tones of muted grays and reds
- A combination of light fixtures, creating a variety of lighting levels at dusk, during the evening, and for late-evening security
- Shelters, benches, and fountains, as well as places for displays, sidewalk cafes, and special events

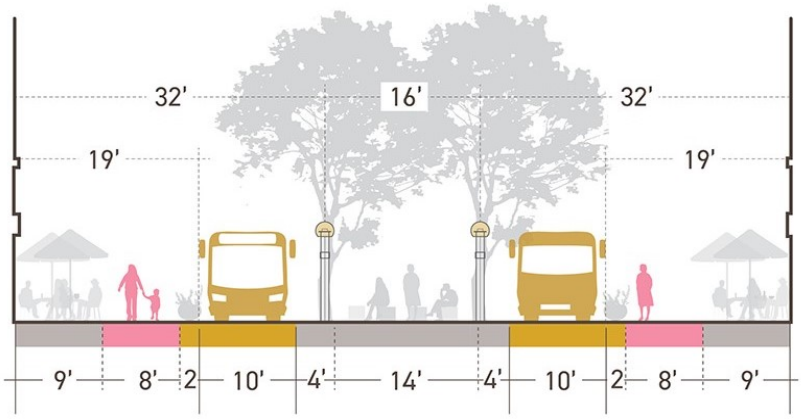
The streetscape plan was organized into three zones (after which the evaluation's landscape units are modeled): the southeastern end, which provides views of the State of Colorado's Capitol dome and rotunda; a middle zone that includes historic buildings with zero-line setbacks; and a northwestern end that opens to the vistas of the new Millennium pedestrian bridge and the Rocky Mountains. Buildings that border the middle-zone blocks have a uniform zero setback and range between four and eight stories high. As a result, they collectively form a wall in many places that seems to create an enclosed room whose walls shade one-half of the Mall corridor during parts of the day. The middle-zone cross-section has two pedestrian areas adjacent to the buildings and two transit-way lanes in the center, separated by a median refuge for visitors with seating available and shade trees lining either side of the median (**Figure 2**). In the end zones, the two transit-way lanes are adjacent except for a row of lights that separate them. The transit-way lanes are offset so that there is a pedestrian zone of 19 feet on one side and 35 feet on the other. Two rows of trees line the pedestrian path on the wider side of the Mall corridor (**Figure 2**). The streetscape plan reinforces the visual experience of the Mall; as a result, the landscape units for this assessment were chosen to mirror the IM Pei/Hanna-Olin plan, as follows (**Figure 3**):

- Landscape Unit 1: West End (Market Street to Arapahoe Street)
- Landscape Unit 2: Middle Blocks (Arapahoe Street to Tremont Place)
- Landscape Unit 3: East End (Tremont Place to Broadway)

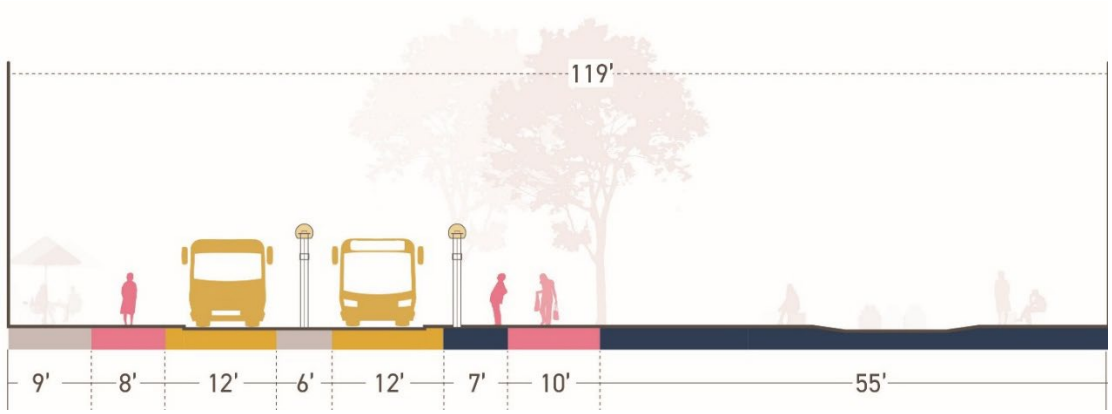
Figure 2. Cross-sections, Existing Conditions, 16th Street Mall (per I.M. Pei Plan)



Existing Cross-section for Landscape Unit 1, Market to Arapahoe, and Landscape Unit 3, Tremont to Cleveland

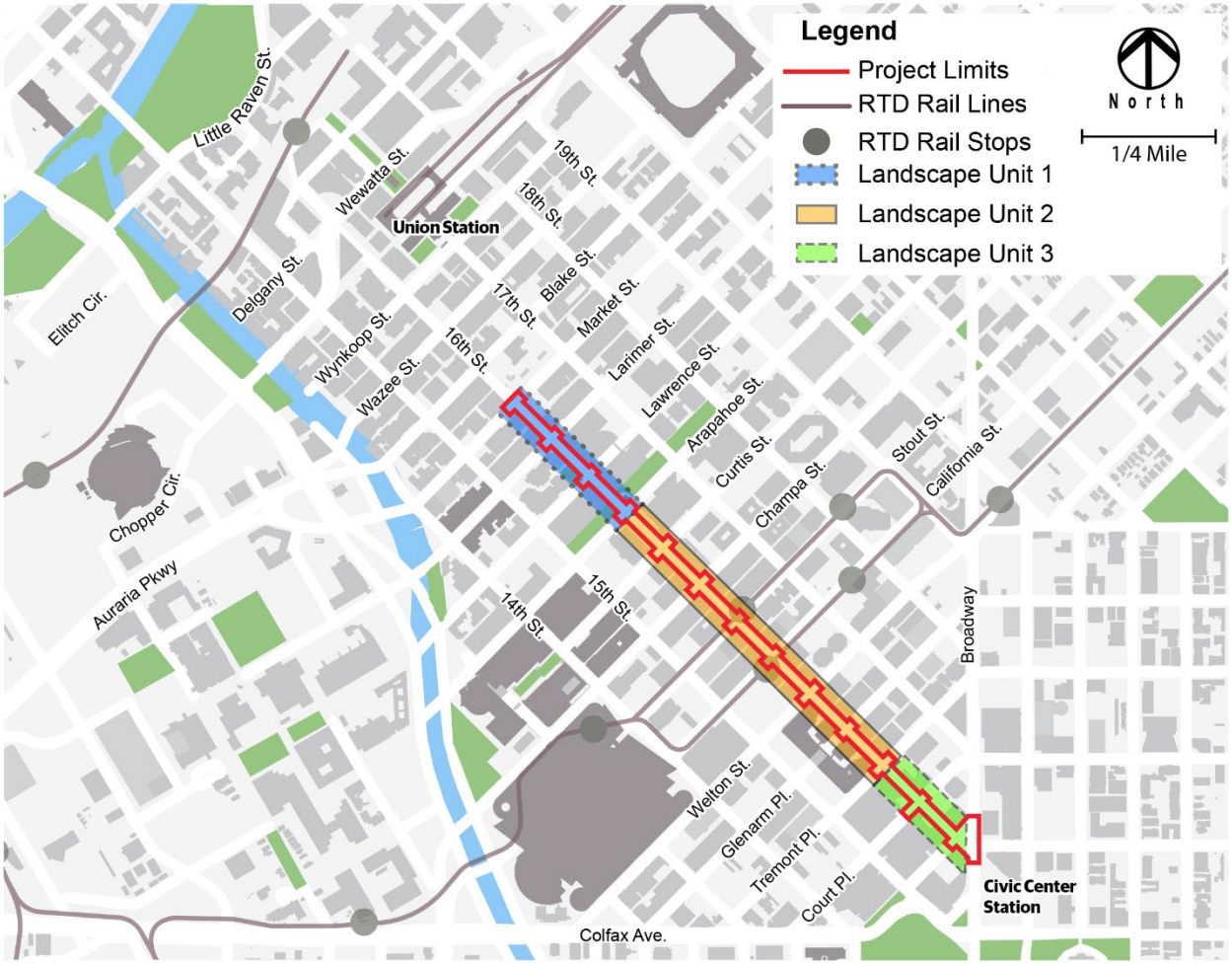


Existing Cross-section for Landscape Unit 2, Arapahoe to Tremont



Existing Cross-section for Landscape Unit 3, Cleveland to Broadway

Figure 3. Project Landscape Units



2. Sensitive Receptors

To some degree, assessment of visual resources is within the eye of the beholder, especially when it comes to valuing the local historic context that brings meaning to the landscape elements. Sensitive receptors for this Project are those people visiting or passing through the 16th Street Mall who may be affected by changes to the visual quality. A degradation of the visual quality may upset them, change their appreciation of the area, or deter them from visiting the area in the future.

To gather insight on the preferences of sensitive receptors, this assessment relies on the Visual Preference Survey Summary prepared to support the Downtown Area Plan development plan (CCD, 2007). This survey provided some understanding of the citizenry's expectations for the downtown core development. Those images that rated highest included the following characteristics:

- Spaces with many people, specifically when they were actively engaged in an activity or event
- Nighttime activities, specifically within well-lit spaces
- Greenery and foliage

- Outdoor seating and dining, specifically with benches and shade that offer a break from the urban intensity
- Bold, colorful, and modern architecture and design

3. Visual Character and Setting

The following provides a description of the existing visual character, followed by an assessment of the existing visual quality for each landscape unit. There are a few unifying elements that define the visual character of the 16th Street Mall, specifically the pavement pattern, the trees, and the lighting. The 16th Mall design uses a shift in the transit corridor, along with a shift in tile pattern and streetscape, to create sub-areas within the Mall to suggest a beginning, middle, and end of the defined Mall. Other elements that vary within the Mall include a variety of architecture, kiosks, planter boxes, seating areas, and plazas or open areas adjacent to the Mall.

The lighting features were recently replaced with historic replica light fixtures to maintain the original unifying features. The Regional Transportation District (RTD) surveyed and determined that the condition of the paving materials is in poor and unsafe condition (Atkinson, 2015). Pavement stones have been worn, broken, chipped, and differently settling, and dirt being embedded in the granite and mortar joints is not being maintained, which affects the quality of the paving patterns. The original design varies slightly among the median and asymmetrical blocks; asymmetrical blocks have a big pattern between the trees, medium pattern in the transit-way lanes, and small pattern against buildings. The median blocks are same except the trees are in the middle, separating the transit-way lanes.

An important aspect of the original design is the tree placement and species. There are 143 living trees within the Project limits. CCD conducted an arborist survey of the honey locust trees that line Landscape Unit 2 and the red oak trees that occupy Landscape Units 1 and 3 (Urban Trees + Soils, 2017). **Tables 1** through **3** record the total number of original trees, the current number of trees in good or excellent condition, and those that are in poor condition or missing. Where the total number of poor or missing trees is over 50 percent of the design intention, the visual integrity of the block is noticeably degrading.

Table 1. Summary of Tree Conditions, Landscape Unit 1

Block (West to East Progression)	Trees in Fair, Good, or Excellent Condition	Trees in Poor Condition or Missing	Intended Trees from I.M. Pei Design	Visual Intactness of Trees in Landscape
Market Street to Larimer Street	8	8	16	Very poor
Larimer Street to Lawrence Street	6	10	16	Very poor
Lawrence Street to Arapahoe Street	0	17	17	Very poor

Table 2. Summary of Tree Conditions, Landscape Unit 2

Block (West to East Progression)	Trees in Fair, Good, or Excellent Condition	Trees in Poor Condition or Missing	Intended Trees from I.M. Pei Design	Visual Intactness of Trees in Landscape
Arapahoe Street to Curtis Street	14	3	17	Fair
Curtis Street to Champa Street	15	1	16	Fair
Champa Street to Stout Street	16	2	18	Excellent
Stout Street to California Street	15	1	16	Fair
California Street to Welton Street	15	2	17	Fair
Welton Street to Glenarm Place	14	2	16	Fair
Glenarm Place to Tremont Place	14	3	17	Fair

Table 3. Summary of Tree Conditions, Landscape Unit 3

Block (West to East Progression)	Trees in Fair, Good, or Excellent Condition	Trees in Poor Condition or Missing	Intended Trees from I.M. Pei Design	Visual Intactness of Trees in Landscape
Tremont Place to Court Place	15	4	19	Poor
Court Place to Cleveland Place	6	11	17	Very poor
Cleveland Place to Broadway	0	4	4	Very poor

Currently, there is a total of 143 living trees in various levels of health throughout the Mall. The original I.M. Pei/Hanna-Olin plan included 206 trees in the Mall design; only 199 of the trees were planted when the Mall was constructed. The results of the study show that, of the 199 planted trees, approximately one-third (61) are in either poor condition, dead, or missing. This has contributed to the visual degradation along the 16th Street Mall. The lighting stands have been replaced with historic replicas, but the degradation of the trees and paving have had a substantial influence on the visual quality of the environment.

4. Visual Quality by Landscape Unit

This section describes each landscape unit first through a block-by-block visual inventory of visual features other than trees, lighting, and pavement, which is used to identify sensitive visual resources (**Tables 4 through 6**). The description begins at the western end from Market Street, and progresses east along the 16th Street Mall. Westbound views that are critical to the visual context are also described. Following the block-by-block visual inventory, the assessment is collected into overall visual character and visual quality for each landscape unit with two to three photos that exemplify the visual character and setting for that Landscape unit. The location of the existing-condition KOPs is shown on **Figure 4**. The description of each landscape unit and photographs at each of the KOPs are provided to represent the visual experience of each landscape unit.

Figure 4. Key Observation Points throughout the Project Corridor

a) Landscape Unit 1: West End (Market Street to Arapahoe Street) with views of Rocky Mountains, Skyline Park, and D&F Tower

Table 4 provides the block-by-block visual character and visual quality assessment elements for Landscape Unit 1. To convey the setting and character of the landscape unit, the table is followed by an assessment of the visual quality for the overall landscape unit and representative existing condition images.

Table 4. Block-by-block Description of Visual Character and Visual Quality Assessment, Landscape Unit 1

Block (west to east progression)	Visual Character Description	Visual Quality Assessment
Market Street to Larimer Street	The intended streetscape and enclosure are lacking in this block. Buildings without street-level uses, varying building heights, and the parking lot on the northwestern corner of this block erode the Mall's uniformity. Views of the Millennium suspension bridge to the west are faint, but do offer a vista or destination. On clear days, the Rocky Mountains may be visible from here.	**Vividness:** medium-low **Intactness**: medium-low **Unity:** medium-low
Larimer Street to Lawrence Street	The Tabor Center building continues from this block to past Lawrence Street, bridging Lawrence Street itself. The open plaza at Writers Square to the south and the varying building heights reduce the continuity and sense of enclosure in this block.	**Vividness:** medium-low **Intactness**: medium **Unity:** medium-low
Lawrence Street to Arapahoe Street	This block includes a mixture of styles, high- and low-rise buildings, and both professional and retail uses (the Tabor Center building). The lack of street trees causes the transit-way lanes to appear more prominent, with light standards in the middle of the lanes. Café seating has been used in an attempt to break up the space, but it lacks intimacy. However, the punctuation of D&F Tower provides an attractive destination.	**Vividness:** medium-low **Intactness**: medium **Unity:** medium-low

Beginning from the western end of the Mall, the visual landscape includes a variety of architecture styles, large buildings with low levels of detail, and varying setback distances from the 16th Street Mall. The scale is not pedestrian-oriented; the Mall seems to be utilitarian rather than a refuge from the urban environment. The transit-way lanes are situated asymmetrically, offset on the southern side of the Mall, with only light stands separating the lanes; there is a wider pedestrian area along the northern side than the southern side.

Landscape Unit 1 has medium-low visual quality. Light is uneven, as there are large open areas where sun is strong with no shield, and other areas where very tall buildings darken the pathways. Most of the trees in this landscape unit are dead or missing. Of the 44 trees originally planted, 8 are alive on the block between Market Street and Larimer Street, 6 are alive on the block between Larimer Street and Lawrence Street, and 1 is alive on the block between Lawrence Street and Arapahoe Street. Neither result in glare for those visiting the area. The two KOPs on **Figures 5 and 6** provide a visual representation of Landscape Unit 1.

Figure 5. KOP 1, Looking North at Larimer Street

Moving along Landscape Unit 1, **Figure 5** (KOP 1) indicates visual voids (exemplified by the solid wall to the left side of this view and the lack of definition or unity on the opposite side) caused by the variety of setbacks in the buildings, presence of a parking lot, and lack of street-level uses. The new building where the transit buses previously turned around may provide a new center of interest, but overall, the design elements of 16th Street Mall seems to have deteriorated or are less evident in this portion. Functions appear more utilitarian and less pedestrian-oriented.

Figure 6. KOP 2, Looking Northwest from the Arapahoe Street Intersection

Looking northwest from Arapahoe Street, **Figure 6** (KOP 2) shows no uniformity in building heights and architectural styles; however, D&F Tower (not seen within this view angle) and the Tabor Center are attractive buildings at street level. Views of Skyline Park, originally designed by renowned landscape architect Lawrence Halprin, draw the viewer to look north and south on Arapahoe Street. The park comprises a linear plaza connected to the buildings that it borders. With the transit-way lanes shifted to one side and nothing to define them from the pedestrian areas except a small curb, the transit area appears more prominent in this section of the Mall.

b) Landscape Unit 2: Middle Blocks (Arapahoe Street to Tremont Place)

Table 5 provides the block-by-block visual character and visual quality assessment elements for Landscape Unit 2. To convey the setting and character of the landscape unit, the table is followed by an assessment of the visual quality for the overall landscape unit and representative existing condition images. In Landscape Unit 2, the streetscape transitions to a pedestrian median that breaks up the Mall thoroughfare into five different pathways: pedestrian area, transit way northbound, median, transit way southbound, then pedestrian area.

Table 5. Block-by-block description of Visual Character and Visual Quality Assessment, Landscape Unit 2

Block (West to East Progression)	Visual Character Description	Visual Quality Assessment
Arapahoe Street to Curtis Street	This block is dominated by 1- to 2-story bold (brutalism) architecture. The concrete cast buildings (e.g., the U.S. Federal Reserve building) do not provide an apparent entry toward the Mall. The south-facing building is set back, providing a plaza space between the Mall and the building that is neither intimate nor pedestrian-friendly. However, the setback preserves open views north toward the gathering area around D&F Tower and the adjacent Skyline Park.	**Vividness:** medium **Intactness:** medium **Unity:** medium
Curtis Street to Champa Street	Smaller business facades, 4- to 8-story buildings, and aligned building facades with cafes and seating areas invite people to stay. The lighting and signage are pedestrian-oriented. The streetscape includes an abundance of furniture and planters; these, along with several divided paths, may make it difficult to discern pedestrian from transit-way lanes. The view north is punctuated by the iconic D&F Tower.	**Vividness:** medium-high **Intactness:** medium-low **Unity:** medium
Champa Street to Stout Street	This block includes big-box shopping areas, reflected in 1970s architecture and low-rise buildings. While street-level seating is present, the building facades lack detail or visual interest and may discourage viewers from lingering. Within this block, views of D&F Tower, a central meeting place, begin to come in view.	**Vividness:** medium-low **Intactness:** medium **Unity:** medium-high
Stout Street to California Street	This block has a mix of historic and new buildings, but the pedestrian scale is preserved and there is a high number of street-level facades, which encourage window shopping. The streetscape includes outdoor seating, signs, and planter boxes.	**Vividness:** medium-high **Intactness:** medium **Unity:** medium
California Street to Welton Street	The height of buildings is lowered to 2 stories, providing more light but also less enclosure, and the limited number of storefronts that actually face the Mall lowers the sense of safety. This block is near a light rail station on Welton Street. The median includes a mix of street furniture such as boxes, tables, and planters.	**Vividness:** medium **Intactness:** medium **Unity:** medium
Welton Street to Glenarm Place	This block includes historic buildings; surrounding buildings are similar in height (3 to 6 stories) and together they frame the Mall, providing a sense of enclosure and protection with enough detail to encourage leisurely walking. The remaining trees create scale that is visually familiar and personal for both pedestrians and window shoppers.	**Vividness:** high **Intactness:** medium-high **Unity:** medium-high

Block (West to East Progression)	Visual Character Description	Visual Quality Assessment
Glenarm Place to Tremont Place	The intricate building facades on the northern side of the block provide a visually enticing setting. Deep setbacks on the southern side provide open, lit areas. The median includes linear box planters and bulky kiosks that define the different users (e.g., separating transit zones from the pedestrian corridor). The high number of street-level uses provides opportunity for interaction with passersby, and streetscape furniture is more abundant. Mature locust trees add dappled light, providing ambiance. Looking north up Tremont Place, an attractive vista is punctuated by Trinity Church.	**Vividness:** medium-low **Intactness:** medium-low **Unity:** medium

The middle landscape unit is the heart of the 16th Street Mall, with an overall visual quality of medium. There are theaters and many evening activities in this portion of the 16th Street Mall, as well as eateries and festive lighting that attract people to gather. Notable aspects of the Mall include trees in the center medians that provide a light umbrella of dappled light, and the visual interest of generally uniform height, material, and historic-era building facades, with some exceptions. The pedestrian space in the median contains planters, seating areas, and kiosks. Some of the cafes and restaurants on the outer pedestrian areas provide outdoor patios along the pedestrian walkways, which is attractive and can be alluring. However, the narrow walkways can force pedestrians into the transit way, as seen in the figures representing KOPs 4 through 6. There seem to be enough fine-leaf tree canopies to shield the light, without making the street too shaded and dark.

Figures 7 through 10 provide a visual representation of Landscape Unit 2, beginning with the view looking west from Curtis Street toward Arapahoe Street, which separates Landscape Unit 1 from Landscape Unit 2.

Figure 7. KOP 3, Looking West from the Curtis Street Intersection

Figure 7 (KOP 3) looks west toward Landscape Unit 1 from Curtis Street, to show the open plaza feeling, visual access to D&F Tower, and large mass of buildings for the block between Curtis and Arapahoe streets. While the northern building includes a setback area and has tables and chairs for seating, the mass of this building and the U.S. Federal Reserve building on the southern side do not create visual interest. Rather, the surroundings present a civic character and scale. However, the setback and low profile does allow uninhibited views of D&F Tower, which helps to define the plaza and provide a focal point for gathering.

Figure 8. KOP 4, Looking East from Curtis

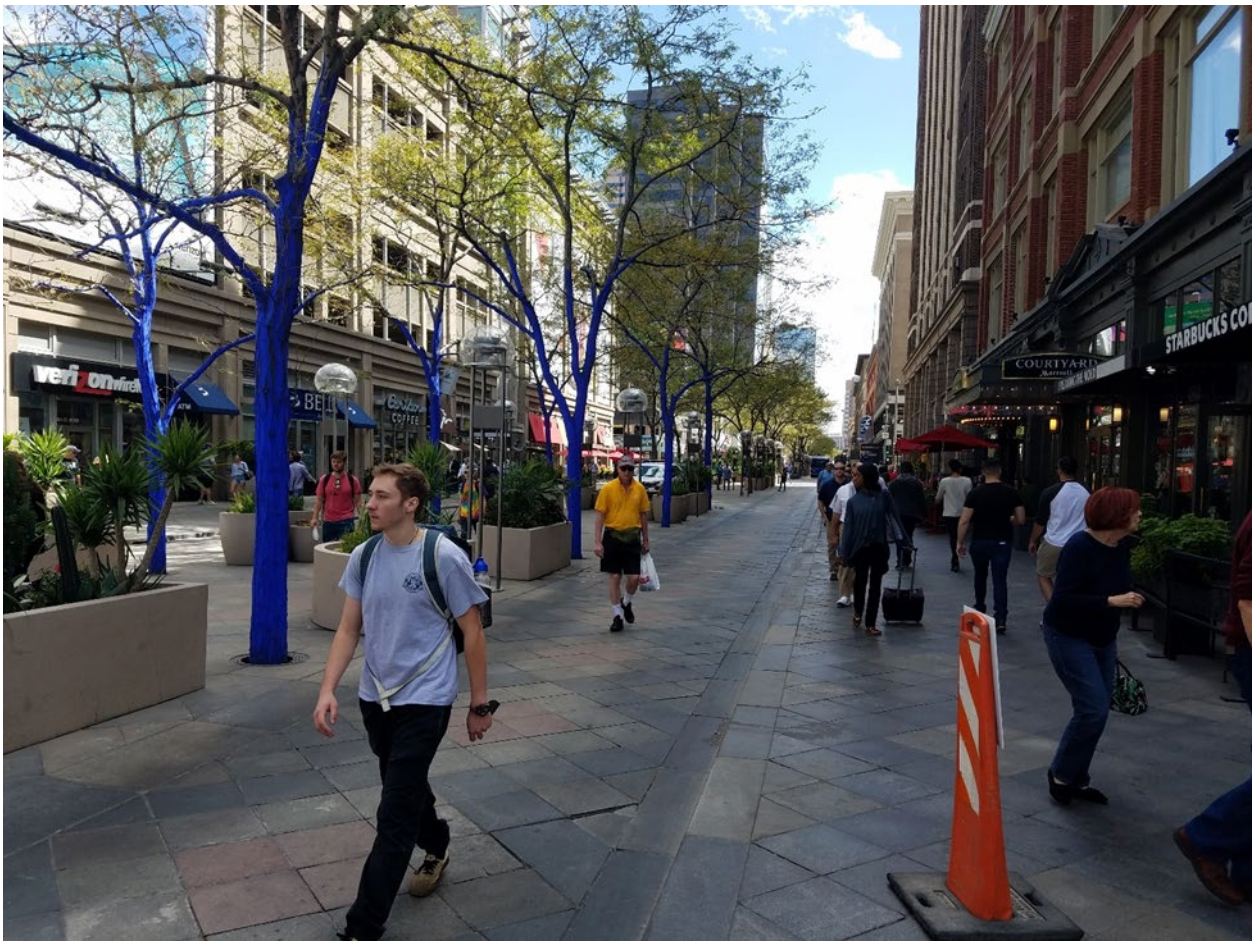


Figure 8 (KOP 4) demonstrates a highly interactive array of retail and service uses that engages passers with visual interest. However, the median in KOP 4 is filled with large boxy planters that appear out of character with their surroundings and serve as linear walls to separate the median and transit way, and the pedestrian area by the buildings often includes sidewalk bistro seating. While they are visually pleasing, these obstacles narrow the pedestrian walkway. With no distinct separation between the pedestrian walkway and transit way, those who want to move freely through the Mall readily walk within the transit way.

Figure 9. KOP 5, Looking West from the Stout Street Intersection

Progressing east, **Figure 9** (KOP 5) represents the block west of Stout Street, which includes a mixture of architectural eras, building heights, and activity types. Large businesses result in less detail in their storefronts for viewers. The variety of building types and the long linear walls reduce the visual interest of this block.

Figure 10. KOP 6, Looking East from Welton Crossing

Figure 10 (KOP 6) shows a variety of street-level business facades to engage passing viewers. The uniform-height, four-story buildings create a pleasant and personal enclosure and still allow daylight to enter the 16th Street Mall, which provides a calm barrier from urban activities. Trees dapple the light and provide an informal ceiling for the Mall area (**Figure 10**).

c) Landscape Unit 3: East End (Tremont Place to Broadway)

Table 6 provides the block-by-block visual character and visual quality assessment elements for Landscape Unit 3. To convey the setting and character of the landscape unit, the table is followed by an assessment of the visual quality for the overall landscape unit and representative existing condition images.

Table 6. Block-by-block Description of Visual Character and Visual Quality Assessment, Landscape Unit 3

Block (West to East Progression)	Visual Character Description	Visual Quality Assessment
Tremont Place to Court Place	The eastward view of the Capitol is less evident. The modern glass buildings and the open plaza at the northeastern corner of the Mall and Tremont Place opens the Mall to daylight. The expanse and surroundings communicate business activities, rather than leisure activities.	**Vividness:** medium **Intactness**: medium-high **Unity:** medium
Court Place to Cleveland Place	Building heights and architecture vary. There are dynamic views eastward toward the State Capitol and south down to Cleveland Place. Northward views up Cleveland Place are mixed, with both very modern high-rise and lower older buildings visible. The World Trade Center Plaza on the northern side of the block contains public art, seating, landscaping, and a unique paving pattern.	**Vividness:** high **Intactness**: medium **Unity:** medium
Cleveland Place to Broadway	This block contains an open plaza, a high-rise modern glass building on the northern side juxtaposed with a single four-story building on the southern side, and no street-level businesses. Republic Plaza (KOP 8) is expansive, which allows plenty of light; however, at times, the adjacent glass building creates glare in the plaza.	**Vividness:** medium-high **Intactness**: high **Unity:** medium

The overall character of Landscape Unit 3 is distinguished by modern, high-rise professional buildings and open plazas, with only a few street-level uses. The juxtaposed street grid, open plazas, and tall buildings of the landscape unit allow views in multiple directions. This area is culturally important because it directs the viewer eastbound toward the Civic Center of Denver, featuring the State Capitol rotunda. This landscape unit is important for persons visiting and connecting with the city and state's Civic Center. The structure of Landscape Unit 3 provides a transition from the intimate pedestrian scale and leisure activities of the Mall's western blocks to Denver's urban, professional business and Civic Center activities on the eastern end. The high-rise buildings reflect light to the well-exposed plazas. This occasionally results in glare because there are currently not many trees to buffer it in this area of the Mall. The overall visual quality for Landscape Unit 3 is medium.

Figures 11 through 13 provide a visual representation of the KOPs associated with Landscape Unit 3.

Figure 11. KOP 7 at Tremont, Looking East

From Tremont Place looking east on the northern side of the Mall (**Figure 11**), the viewer sees a filtered view of the State Capitol (completely covered in this photo), as well as the modern high-rise (and highly reflective) glass buildings that punctuate the end of the Mall. The variety of building heights and the open plaza in the foreground on the northern side provide plenty of uses and seating areas. The view is pleasant and dynamic.

Figure 12. KOP 8, Looking Southeast from Cleveland Place toward the State Capitol Rotunda

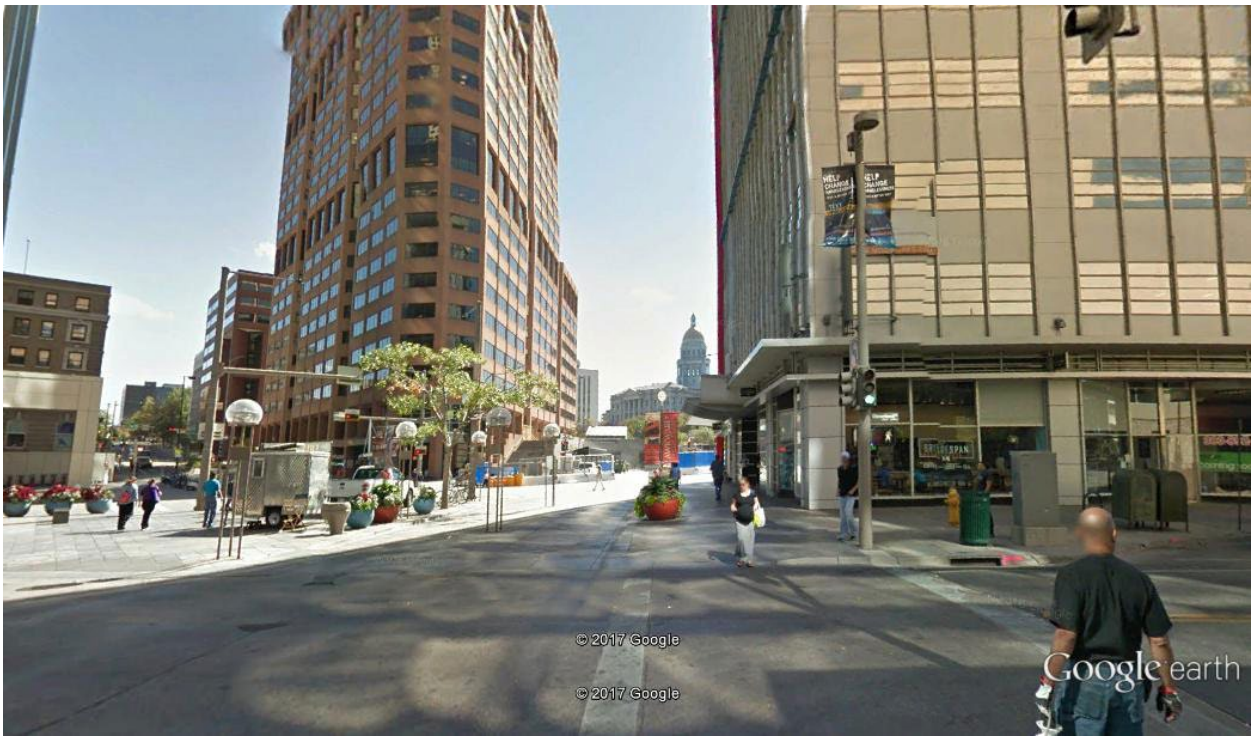
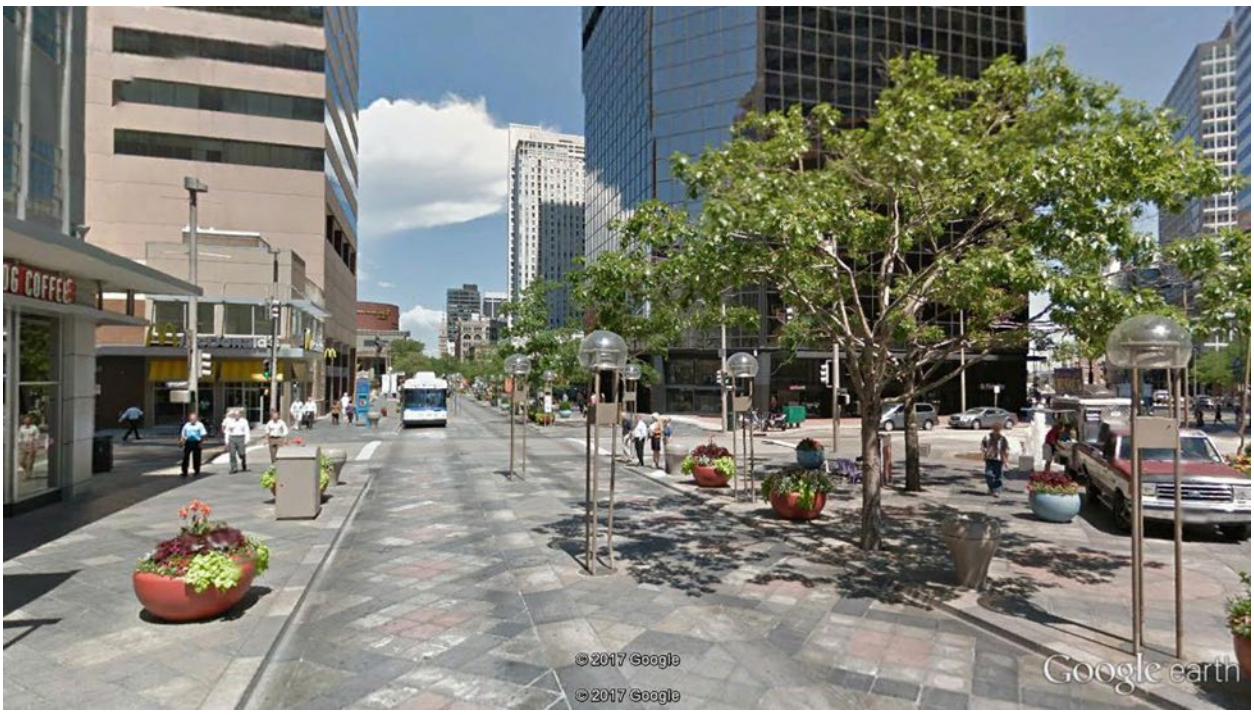


Figure 12 (KOP 8) demonstrates the dominant vista of the Civic Center and the State Capitol. The surrounding buildings and views through Court Place provide visual access to other portions of Broadway. Nearby glass building windows reflect glare on the pavement, even within the shaded area (**Figure 13**). This portion of the 16th Street Mall is not relaxing and calm, but is interesting and attractive.

Figure 13. KOP 9, Looking Northwest from Broadway (toward Cleveland Place)



The northbound view of KOP 9 **(Figure 13)** shows how the plazas and mixed scale of the buildings within it frame views extending in multiple directions. The lack of street furniture and minimal street-level uses create a zone of movement; it is business-oriented, rather than offering leisure or shopping activities.

C. Environmental Consequences and Mitigation

Environmental consequences on the visual and aesthetic resources of the 16th Street Mall are analyzed relative to the No Build Alternative, which represents what would happen to the Project area if nothing is done to the change the existing conditions other than cleaning and routine maintenance to fix safety hazards.

The spectrum of visual quality is applied equally in evaluating both dramatic natural scenery (such as the Grand Canyon, which is characterized as high visual quality) and a typical streetscape in a local community. Physical changes can be noticeable and either positive or negative to the viewer; however, even noticeable changes may result in a relatively low overall change in visual quality. For example, some viewers may feel highly sensitive to visual changes from a Project (which is an influencing consideration), but the Project changes do not necessarily result in substantially changing in the visual quality. The assessment considers the change in the landscape's vividness, intactness, and unity on a scale of low, medium-low, medium, medium-high and high; the ratings for these three components are then averaged to provide a total visual quality rating using the same scale description.

1. No Build Alternative

The No Build Alternative would not result in construction impacts to the visual and aesthetic surroundings.

Because the No Build Alternative would not result in upgrading the 16th Street Mall, the visual quality would remain the same; over time, the degradation of the Mall would result in lowered visual quality. Tree canopies help to block the glare where they have successfully grown. Under the No Build Alternative, Mall users would not be sheltered from the effects of glare from adjacent glass buildings in those areas where trees have died and not been replanted. As stated in the existing conditions review, the visual quality would remain or worsen from the following:

- Landscape Unit 1: West End (Market Street to Arapahoe Street), with an assessment of <u>medium-low</u> visual quality
- Landscape Unit 2: Middle Blocks (Arapahoe Street to Tremont Place), with an assessment of <u>medium</u> visual quality
- Landscape Unit 3: East End (Tremont Place to Broadway), with an assessment of <u>medium</u> visual quality

Routine maintenance would become more difficult, and the health of remaining trees might worsen. The glare of buildings may affect how and where people go within the 16th Street Mall to sit and relax. The current visual environment is a mix of medium-low to medium-high visual quality, but the fatigue of the environment is showing and has reduced the visual experience from its original intention.

Sensitive viewers would not notice immediate change, but degradation of the social environment could mean fewer viewers would visit the Mall than would occur if Project needs are met. It is typical for shoppers to desire a clean, well-kept, and safe environment to visit.

2. Locally Preferred Alternative

a) Short-term Impacts (Construction Phase)

Construction would generally occur in two- to six-block segments, with each segment taking place over multiple construction phases, depending on the ability to maintain access, traffic on cross streets, and transit service. Businesses would possibly have difficulty with long, visually disruptive construction periods, adding pressure to conduct nighttime work to more quickly reopen access adjacent to buildings. Mechanized equipment, lights for evening work, material storage and delivery, and removal of excavated material would be seen to varying degrees by viewers near the construction area. In locations adjacent to residences, there would be a greater likelihood that residential viewers would find construction activities aesthetically and visually disruptive.

Most of the construction-related impacts would be temporary and short-term and therefore would not result in a substantial impact. The primary construction impacts to aesthetic and visual resources would be temporary and related to portions of streets being closed, visual blockage from fencing around portions of the work sites, night lighting, exposed staging areas for storing equipment and materials, and utility relocation. However, the removal of the existing trees would potentially result in the highest visual change. The canopy would recover by approximately two-thirds in 10 years, leaving a more open environment, less shade, and a reduced sense of enclosure while the new trees mature. Mall viewers and users are likely to adjust to the visual change after an initial period of adjustment. Knowing that over half of the current trees are unhealthy and that the new plantings have the potential to live longer, more vigorous life may provide understanding, but the adjustment to this visual change would be substantial.

Most of the visual impacts during construction are of high intensity but low magnitude because they last for a relatively short period of time, except for the removal and replacement of trees. The tree removal and replacement impact would result in both high intensity of change and high magnitude impact.

Phasing construction into concentrated segments, maintaining visual access to adjacent buildings and businesses, and providing interesting screening can minimize some visual intrusion in duration and reduce the intensity of visual disruption.

b) Long-term Impacts (Permanent/Operational Phase)

The Project features discussed are highlighted for their effect on the visual assessment, such as how the spaces are defined by tree-planting and light-stand placement and how the intent of the original I.M. Pei/Hanna-Olin pavement plan is maintained. The visual quality assessment outlines common elements among the landscape units before assessing the effects of the LPA on the visual quality for each landscape unit.

Common Features throughout the Project Limits.
For all landscape units, the LPA includes lighting and tree placement within an amenity zone to delineate and physically separate the transit way from the pedestrian walkways and provide a

visual separation from the transit ways without impeding access to them. The LPA would be designed with vertical curbs, similar to those on the outside edges of the existing transit way lanes, at designated shuttle stops, cross streets, and intersections; the vertical curbs would then transition to a pan similar to the pan on the inside edges of the existing transit way lanes between the transit way and the amenity zone. The visual effect of the hybrid curb option would result in a slight impact on the visual character of the Mall. While a vertical curb would provide a physical change in the elevation of the pavement, the tones and materials would blend with the pavement design and therefore become visually synonymous with the pavement as it currently functions. This would be even more true with a pan, where the pavement design provides the primary delineation of the transit way, without a vertical elevation change. Textured delineation within the pedestrian walkways and between the amenity zone and transit way would add additional contrast and delineation; however, the vertical curb and pan granite units would mimic the existing pattern and colors. Trees, light poles, and furnishings in the amenity zone would further visually delineate the transit way from the pedestrian walkway.

Material and design considerations for the LPA included durability and longevity, specifically in pavement and tree selection. This is particularly important for the vertical, strongest visual element – the trees. The LPA proposes to remove the existing 143 trees and plant 249 trees between Market Street and Broadway, for a total estimated canopy of 58,000 square feet in 10 years. There is currently approximately 95,000 estimated square feet of existing tree canopy between Market Street and Broadway. The LPA includes more trees than exist today, with the goal of expanding the tree canopy, in line with the CCD *2017 Outdoor Downtown Plan.* Tree removal and planting would be consistent with CCD Executive Order 123, Chapter 8, City Tree Preservation requirements. The resulting vertical structure would not only preserve and enhance the visual identity of the Mall as a whole but also help differentiate the three separate zones of the Mall, because the New Asymmetrical end blocks would have three rows of trees and the Center Running blocks would have two rows of trees. One row of trees, an element of the original design, would be a consistent linear element through all three zones. The trees would also provide shade and a consistent ceiling height over the walkways, regardless of adjacent building heights.

The trees proposed (**Attachment A**) are both adaptable to the urban environment conditions, including heavy pruning, and are tall enough that they would not interfere with passing transit vehicles. The selected tree-types have a wide-spreading canopy and range in height from 30 to 50 feet high. Because of the improved tree infrastructure, varied species consistent with CCD forestry standards, and improved nursery practices for growing trees, the new trees are expected to be stronger and more vigorous than those previously planted. The changes would be easy to chart for the viewers from the adjacent buildings. Viewers would be able to see the changes in consolidation of both the transit ways and pedestrian areas, paving patterns, and growth of the trees over time. These views would be substantial in magnitude, but since majority of the visual environment is the indoor areas, the impacts would be of low intensity.

Landscape Units 1 and 3, which are proposed as an asymmetrical design, would include three rows of vegetation comprised of hackberry (*Celtis sp*.) and sycamore maple (*Acer pseudoplatanus)* trees. Both of these tree types offer dense leaves for ample shade during the summer months. The hackberry tree has an oval, and sometimes fan-like, form because they do not have a strong lead trunk. Sycamore maples do have a strong lead trunk and can withstand heavy pruning and urban stresses.

Landscape Unit 2, the center-running and symmetrical design plan, is proposed to include a mixture of honeylocust (*Gleditsia tricanthos inermis),* English oak (*Quercus rubra*), Accolade elm (*Ulmus spp.)* and Japanese pagoda tree (*Sophora Japonica*). Each of these tree types has small leaves and allows light to shine through the canopy. These trees would provide the ceiling intended by the original I.M. Pei/Hanna-Olin plan, but the mixture of four different tree types would offer less chance for disease to transfer and undermine the intended canopy. Each of the trees proposed are both adaptable to the urban environment of pruning and tall enough that they would not interfere with passing buses. **Table 7** lists each tree type, the quantity of each proposed, and the total canopy they would provide in mature form.

Table 7. Tree Types Identified for the LPA and Canopy

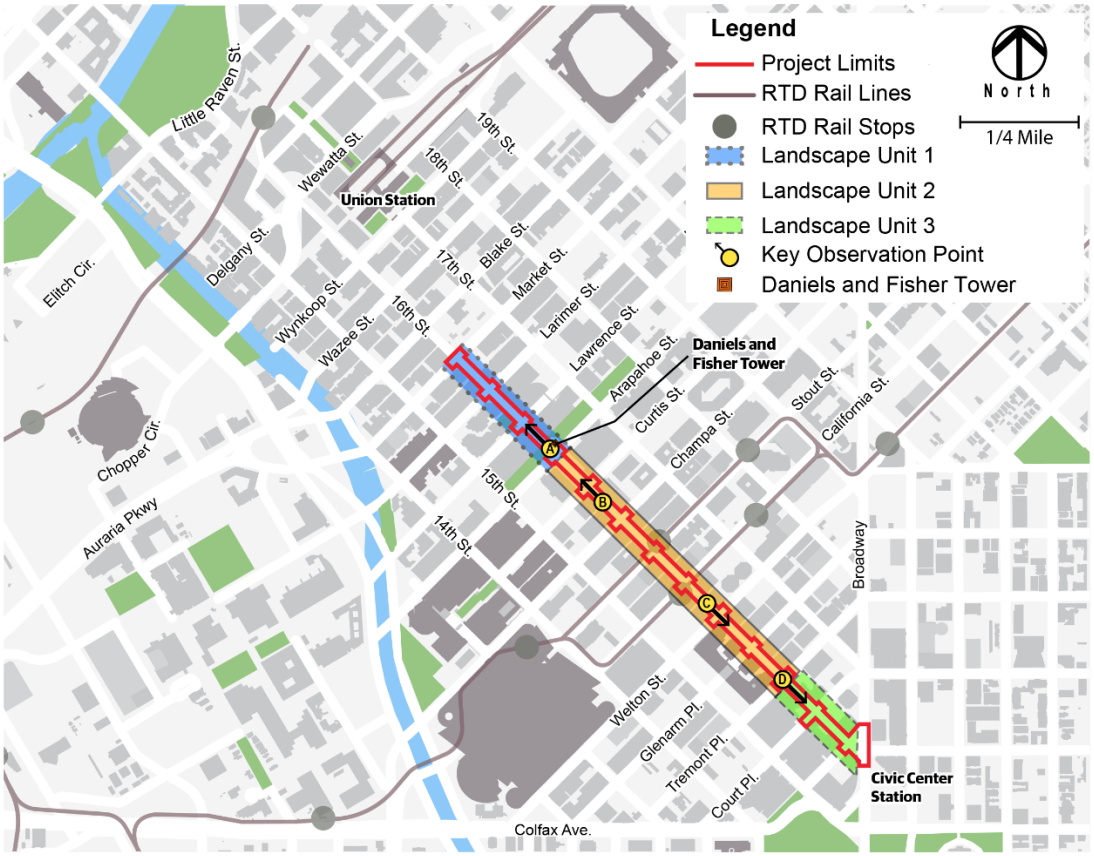
Common Name	Latin Name	Mature Canopy (diameter in feet, area square feet)	Number of Trees to Plant within the Plan	Total Shade when Mature (square feet)
Honeylocust	*Gleditsia tricanthos inermis*	40 to 50, 255	56.00	14,250
English Oak	*Quercus rubra*	40 to 50, 314	26.00	8,168
Accolade Elm	*Ulmus spp.*	40 to 60, 314	30.00	9,425
Japanese Pagoda Tree	*Sophora Japonica*	40 to 50, 254	47.00	11,960
Hackberry	*Celtis spp*	30 to 40, 154	44.00	6,773
Sycamore Maple	*Acer spp.*	30 to 40, 154	46.00	7,081
TOTALS	Not applicable	Not applicable	249	**57,658**

The following sections describe the visual assessment for each landscape unit, beginning at the western end with Landscape Unit 1 and moving east to Landscape Unit 3, and include visual simulations for a subset of KOP locations. To avoid confusion with the KOPs described under Existing Conditions, these KOPs are named alphabetically (**Table 8**). The locations of the KOPs are shown on **Figure 14**.

Table 8. Representative KOPs Selected for Visual Simulations

Landscape Unit	Representative KOP	View Description
Landscape Unit 1	KOP A	View looking west from Arapahoe Street – existing condition and visual simulation of proposed asymmetrical design
Landscape Unit 2	KOP B	View from Curtis Street looking west – existing condition and visual simulation of proposed symmetrical design
Landscape Unit 2	KOP C	View looking east from Welton Crossing – existing condition and visual simulation of proposed symmetrical design
Landscape Unit 3	KOP D	View looking east from Tremont Place adjacent to the plaza - existing condition and visual simulation of proposed asymmetrical design

Figure 14. Locations of Representative KOPs Selected for Visual Simulations (A, B, C, D)

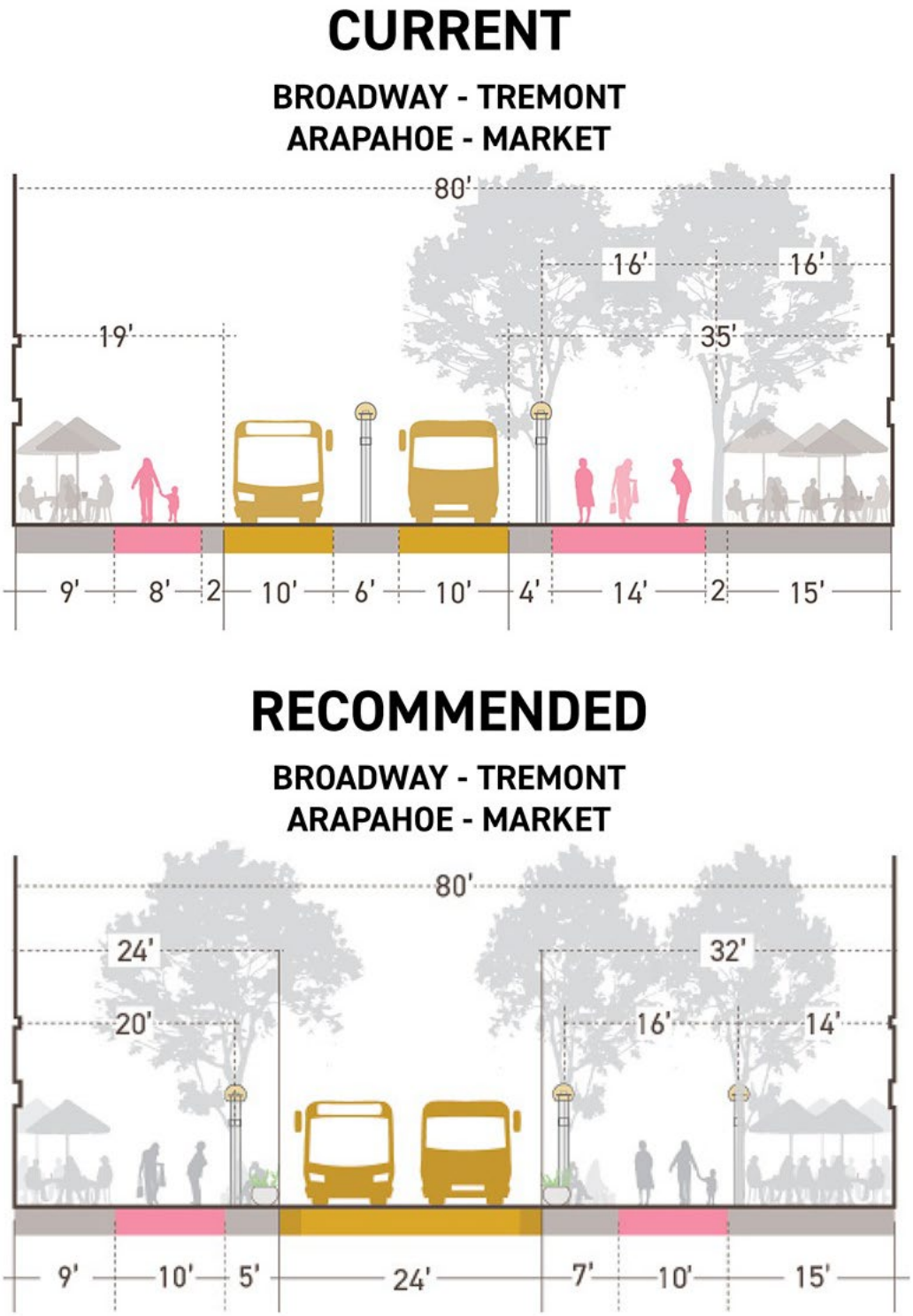


Landscape Unit 1: West End (Market Street to Arapahoe Street)

Of all the units, the potential for visual change may be the most profound within Landscape Unit 1, which currently has only 14 living trees—half of which are in poor health—of the 44 trees originally planted in these blocks. Landscape Unit 1 is proposed with an asymmetrical design, similar to its current design. The LPA would remove the small median with lighting from within the middle of the two transit-way lanes, add space to enlarge the narrow pedestrian walkway, and add a third row of aligned lighting and trees, in an amenity zone, on the narrow side of the cross-section, which is to the south of the transit way (**Figure 15**). In this section, the trees would define the boundaries of transit way while also providing a physical buffer for the pedestrian zone.

The large privately-owned plaza spaces and publicly-owned Skyline Park would remain open for activities. The new Mall trees would add long-term tree canopy, create nested pedestrian enclosure ratios within a wide range of building heights and bulk, and provide a sense of outdoor rooms that would enhance the people-scale experience, which currently does not exist as a result of the number of dead and missing trees. In addition, the new pavement system (including subsurface modifications) would preserve the integrity of the paving pattern, with minor pattern adjustments; this, in conjunction with the tree canopy, would re-establish the design intent of the tree groves in these landscape units. The essence of the original design would therefore remain intact, with strong unifying features contributing to this landscape unit. None of the features would remove views of D&F Tower. Overall, the LPA would provide beneficial impacts to the visual quality, and the assessment would increase from medium-low to medium visual quality.

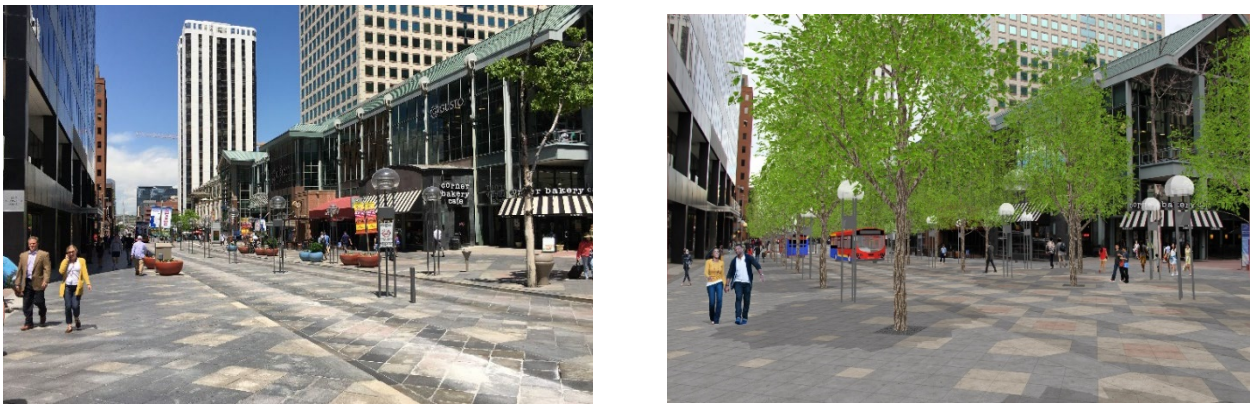
Figure 15. Comparative Existing versus Proposed Cross-section for West and East End Sections (Landscape Units 1 and 3)



*Note: Cleveland to Broadway is proposed to be reconstructed in in the existing cross-section design shown on **Figure 2**.*

KOP A (**Figure 16**) demonstrates the key visual changes within Landscape Unit 1, with a view from Arapahoe Street looking west toward the Tabor Center Mall.

Figure 16. KOP A, Looking West from Arapahoe Street - Existing Conditions and Visual Simulation



Landscape Unit 2: Middle Blocks (Arapahoe Street to Tremont Place)

The cross-section in Landscape Unit 2 is symmetrical in composition. In Landscape Unit 2, the two transit-way lanes would replace the median amenity zone in the center of the Mall. Placing the transit way in the center relocates that space equally to the outside of the transit way. Specifically, the proposal would enlarge what is considered the front porch of the Mall's businesses from 17 feet under current conditions to 28 feet on both sides of the proposed transit way alignment and buffer the vehicular transit traffic from the pedestrian walkway through an amenity zone (**Figure 17**). By placing amenity zones closer to the buildings, they become visually owned by adjacent businesses because workers can more easily survey the area. This sense of ownership increases safety and often makes businesses more apt to remove left-over debris, thereby adding to a maintained environment.

The two rows of trees in the existing amenity zone would be placed closer to the building facades, between the pedestrian walkways and the transit way, as opposed to farther away in the median in the current cross-section. This would provide another soft shield over the amenity zone and pedestrian walkways (**Figure 17)**. In addition, spreading the trees out and placing the transit-way lanes together would provide waiting passengers more visible access to the oncoming or departing transit compared with the current separated lanes, which are divided by the trees. The design would not change the vividness of the historic core of the 16th Street Mall. The composition of the LPA would honor the paving patterns and the lighting, so that the intactness of the I.M. Pei/Hanna-Olin plan is preserved. Unity would be enhanced to medium-high because the visual structure is straightforward and orderly. The LPA would slightly increase the middle landscape unit to overall medium-high visual quality.

Figure 18 (KOP B) provides an example of how the shift of trees closer to the buildings would soften areas of strong architecture, provide pedestrian-scale enclosures in the areas where buildings are set back, and push the transit corridor away from the buildings to increase the overall comfort of pedestrians. The change in the tree canopy would not reduce visual access to D&F Tower because it is in line with the northern pedestrian pathway.

Figure 17. Comparative Existing versus Proposed Cross-section for the Middle Section (Landscape Unit 2)

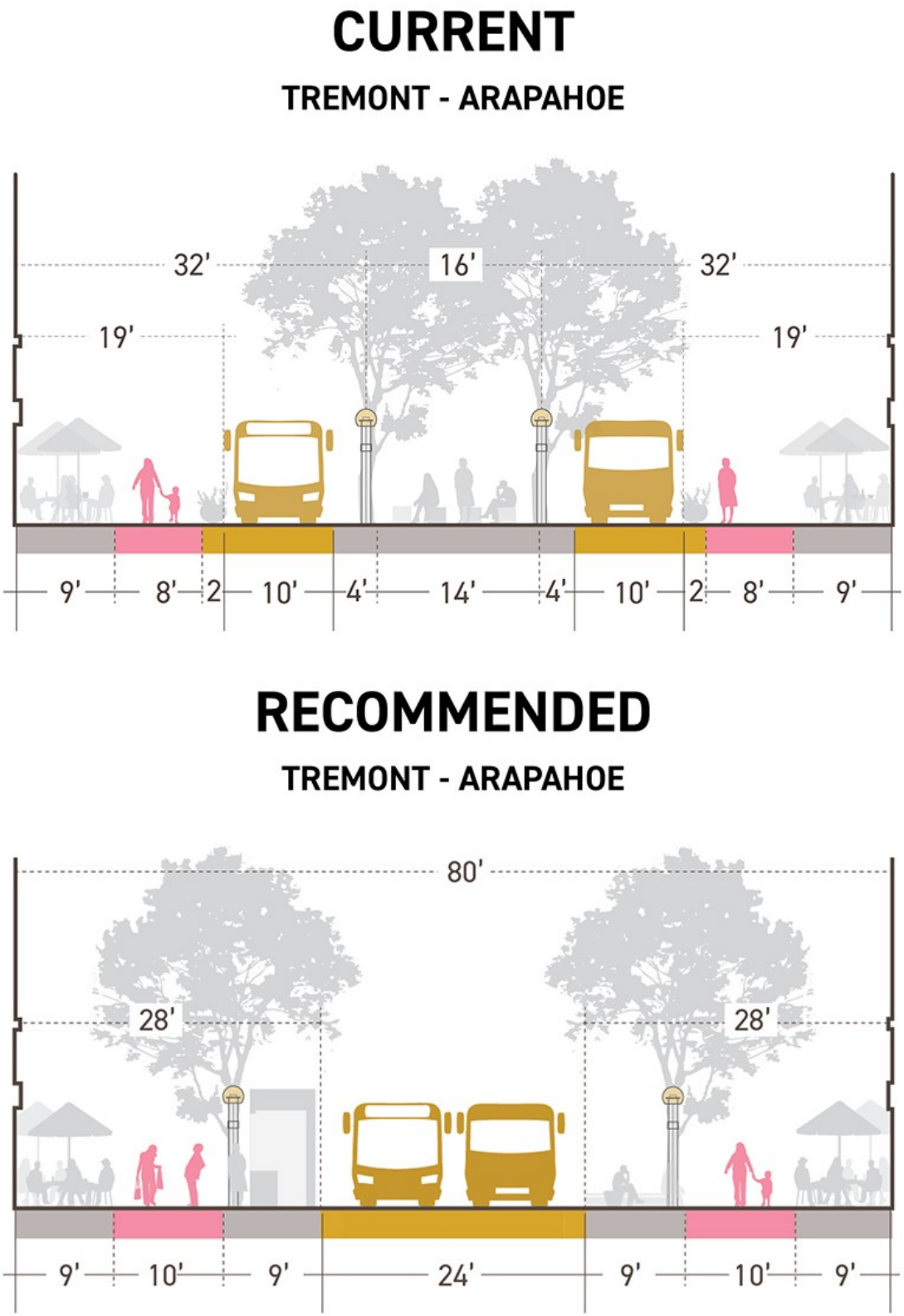


Figure 18. KOP B, Looking West from Curtis Street - Existing Conditions and Visual Simulation

Figure 19 (KOP C) shows how center-running transit-way lanes would provide well-defined and generously wide amenity zones and pedestrian walkways along both outside edges of the transit way. This would reduce the number of pedestrians stepping into the transit way. The design simplifies how the streetscape distinguishes the transit way from the pedestrian walkways: removing pedestrians from between transit-way lanes, sidewalk bulb-outs at the intersections to shorten the distance of crossing the intersecting roadways, and widening the pedestrian walkways on both sides of the transit way and extending them away from the transit way with an amenity zone between them. This clear organization would provide ample space for visitors to linger and relax.

Figure 19. KOP C, View Looking East from Welton Crossing—Existing Conditions and Visual Simulation

In summary, the LPA would enhance Landscape Unit 2 to an overall medium-high visual quality.

Landscape Unit 3: East End (Tremont Place to Broadway)

The still-asymmetrical design for Landscape Unit 3 would include a slight shift of the transit way, with three rows of trees interplanted with rows of light posts; two rows on the north side and one row on the south side of the transit way (**Figure 15**). The three rows of lights centered between trees would collectively define three distinct areas on the north side of the street—one for the patio/gathering space, one for the pedestrian walkway and amenity zone, and one for the transit way. As viewed in the existing conditions and simulated view for KOP D on **Figure 20**, the additional trees could reduce the visibility of the Capitol from Tremont Place;

however, on approaching Broadway, the north-side allée (or line) of trees along the pedestrian walkway would frame the view of the rotunda and maintain the vividness and memorable experience.

Figure 20. KOP D, Eastward View from Tremont Place Adjacent to the Plaza – Existing Conditions and Visual Simulation

The integrity of the pavement emulating the original design, the preservation of the original lighting models and theme, the reinforcement of clearly differentiated zones for pedestrian comfort, and the definition of transit accessibility jointly preserve a medium-high intactness with the objective of the 16th Street Mall design.

The new Mall trees on the north side of the transit way would create an enclosed environment for pedestrians, break up the mass of the tall glass buildings that surround Landscape Unit 3, and provide a sense of distinct outdoor areas (**Figure 20**). The canopy is currently sparse because of the number of dead and missing trees. The tree canopy reduces the light glare that can refract from the glass buildings. The light fixtures would be positioned to frame the distinct outdoor areas of the 16th Street Mall, enhance visibility and safety at night, and spread lighting on the trees from below, further defining the trees as columns supporting the ceiling-like tree canopy. By aligning trees and lighting, the transit way would be clearly defined. The additional row of trees on the south side of the transit way would add long-term tree canopy. The gateway plaza would be reconstructed to look as it does today with the existing transit way alignment, pattern, curbs, tree, and fountain locations maintained. The LPA would support a high sense of unity within Landscape Unit 3, and would enhance the landscape unit to a medium-high visual quality.

Sensitive Viewers

The change in visual quality considers the sensitive viewers within the analysis. The Existing Conditions section, under Sensitive Receptors (**Section 4.B.2**), outlined the elements rated most positively in the Visual Preference Survey (CCD, 2007). **Table 9** demonstrates how the LPA and would achieve these objectives, which influenced how the visual quality was assessed.

Table 9. Project Components Support Viewer Preferences

Highly Ranked Urban Environment Features, per Visual Preference Survey	How the LPA Achieves these Features within the Mall
Spaces with many people, specifically when they were actively engaged in an activity or event	Defined Pedestrian-scale Spaces: Generously defined spaces with rows of trees and lighting. Front-patio effect emphasized with adjacent businesses where activities originate.
Nighttime activities, specifically within well-lit spaces	Safety Lighting Plan: More lighting added. Between-building lights, added lights, and pedestrian corridors with lights to either side.
Greenery and foliage	More Vigorous Planting Plan: LPA has enlisted arborists to define the needed tree wells, watering, and distance for heavy vehicles from the root zone.
Outdoor seating and dining, specifically with benches and shade that offer a break from the urban intensity	Larger Front Patio along Buildings: Higher density of trees, with buffered areas for seating along the pedestrian corridors for people watching. Larger front patios so that café seating does not impinge on pedestrian areas.
Bold, colorful, and modern architecture and design	Maintained Views: Bold design includes trees that are fine-leaved to shield glare, but do not distract from architecture or vistas.

c) Cumulative Impacts

The visual character of the downtown area has largely been influenced by the backdrop of the Rocky Mountains and historic development that has resulted in a dynamic mix of historic and modern high-rise buildings. Within the downtown commercial district, numerous infill developments are either under construction or proposed, further emphasizing this trend.

As analyzed previously, implementation of the LPA would alter the existing visual environment by realigning the transit way, removing and planting new trees in new locations, moving light poles, and installing new pavement. Changes to the appearance of the Mall would mimic elements of the existing character to honor the original design, building upon its character-defining features. As discussed previously, the changes are expected to result in an overall beneficial impact on the visual quality and experience of the Mall.

Visual impacts would be expected during construction and would include the presence of heavy vehicles and dust, staging of materials, and tree removal. Impacts would primarily affect visitors to the area and businesses adjacent to the Mall. Although visual impacts during construction would be a nuisance, they would occur over a relatively short period of time and would not be permanent.

Following construction, the Preferred Alternative would enhance the visual character of the Mall. The beautification of the Civic Center, recently completed Confluence Park, and Denver Union Station provides enhanced visual vistas that draw the users through the Mall. In addition, the Market Station redevelopment site and planned office, residential, and commercial

buildings will continue to provide infill where currently there are gaps in the otherwise uniform enclosure around the Mall. Collectively, these planned improvements should further the vision for creating outdoor areas to gather that are defined by buildings, a ceiling of shade trees, and visually interesting destinations. Therefore, the LPA would contribute substantially to cumulative beneficial visual impacts to the Mall and nearby environment.

3. Locally Preferred Alternative Design Option

a) Short-term Impacts

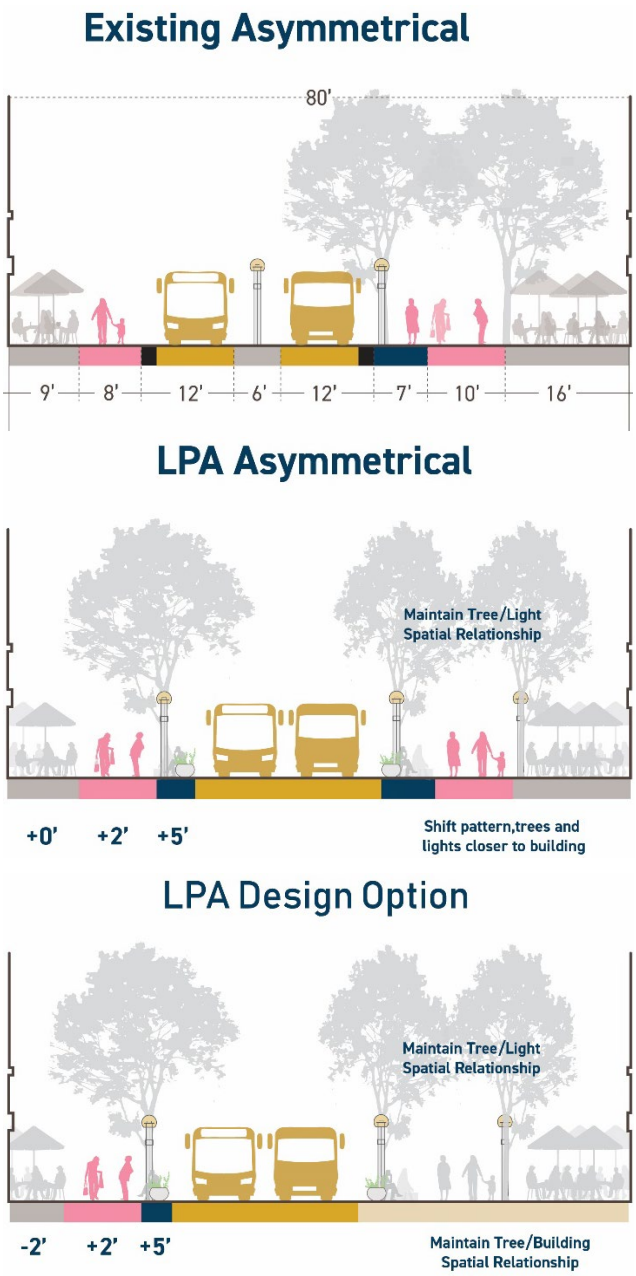
The LPA Design Option would have the same short-term impacts as the LPA.

b) Long-term Impacts

The LPA Design Option would have the same impacts as the LPA related to common features throughout the Project (**Section 4.C.2(c)**) and the fact that the Mall would be divided into three segments: asymmetrical design on the west and east ends with a segment of symmetrical design for the center blocks. The LPA Design Option impacts would differ with respect to landscape units and sensitive viewers. The primary differences of the LPA Design Option from the LPA are as follows:

1. A change in the number of blocks that would feature asymmetrical versus symmetrical design
2. A reduction of the patio/gathering space nearest the buildings on the southern side of the street (narrow side of the block) on the asymmetrical blocks; refer to **Figure 21** for a comparison of existing conditions, LPA, and LPA Design Option dimensions.

Figure 21. Comparison of Existing and Proposed Asymmetrical Cross-sections



Landscape Units

The LPA Design Option would elongate the symmetrical design by 2 blocks, which results in fewer asymmetrical blocks at either end. This is a substantial departure from the I.M. Pei/Hanna-Olin plan with respect to the defined landscape units. The I.M. Pei/Hanna-Olin plan specifically differentiated the symmetrical design of the blocks with historic buildings (Landscape Unit 2) from the asymmetrical design of the blocks with newer buildings, which vary in setbacks from the Mall and architectural influences (Landscape Units 1 and 3). The Project corridor is a total of 12.5 city blocks, including the half-block Gateway Plaza fronting Broadway. The LPA Design Option would diminish the size of the asymmetrical end “rooms” to the extent that the change in experience (1.5 or 2 asymmetrical design blocks at either end) may not be coherent as a separate and distinct unit, thereby undermining the purpose of the change in design between the symmetrical and asymmetrical rooms. Lack of clarity and unity in the

design reduces the visual enhancement when compared with the LPA design. In addition, reducing the number of blocks with asymmetrical design would result in fewer trees planted, as these blocks are intended to contain three rows of trees versus the two rows of the symmetrical blocks.

The reduction from 9 feet to 7 feet of the patio/gathering space on the south side of the asymmetrical blocks would pull both the pedestrian walkway and the amenity zone with a row of trees closer to the buildings by 2 feet. This creates two effects: a narrower patio for those activities nearest the buildings on the south side of the block and the proposed tree plantings not aligning with the trees planted in the symmetrical blocks. A reduction in the patio space in front of businesses may result in a visual encroachment from the pedestrian walkway.

The 2-foot offset of the amenity zone and the tree plantings as compared with the symmetrical blocks may reduce vista opportunities from within the Mall. Because vistas play an important role in the cultural use of the corridor, misaligned tree plantings may reduce the visual aesthetic experience compared to the LPA. Similarly, the transitions between the symmetrical and asymmetrical design for the transit way would result in transit-way lanes being offset by 6 feet versus only 4 feet for the LPA. The transitions would occur at Lawrence Street (versus Arapahoe Street in the LPA) and at Court Place (versus Tremont Place in the LPA). The staggered alignment in transit-way lanes across these two intersections would not be as subtle as the LPA, which may appear disjointed and unintentional.

The potential for the LPA Design Option to appear broken up into irregular units with reduced visual coherence would result in a reduction of intactness and unity measures over the LPA. The visual quality of the Project with the LPA Design Option would be improved over the No Build Alternative, but would be less visually coherent and have lower intactness than the LPA.

Sensitive Viewers

Table 10 demonstrates how the LPA Design Option would achieve the objectives of sensitive viewers based on the elements rated most positively in the Visual Preference Survey (CCD, 2007) to different degrees (as described in **Section 4.B.2**).

Table 9. Project Components Support Viewer Preferences

Highly Ranked Urban Environment Features, per Visual Preference Survey	How the LPA Design Option Differs from the LPA in Achieving these Features
Spaces with many people, specifically when they were actively engaged in an activity or event	Patio/gathering space along the south side of the asymmetrical blocks would be reduced by 2 feet from existing and proposed LPA conditions. Small reductions in space can be visually less relaxing, which may inhibit people to remain in that area.
Nighttime activities, specifically within well-lit spaces	Same as the LPA.
Greenery and foliage	Fewer trees than the LPA.
Outdoor seating and dining, specifically with benches and shade that offer a break from the urban intensity	Reduced area for outdoor patio seating with fewer trees than the LPA.
Bold, colorful, and modern architecture and design	Same as the LPA in terms of trees not distracting from architecture, however, the lack of defined asymmetrical and symmetrical blocks by architectural influence may reduce the unity within the established landscape units and the misaligned trees between the two streetscape designs may reduce known vistas of iconic architectural destinations.

c) Cumulative Impacts

The LPA Design Option would have the same cumulative impacts as the LPA.

5. References

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Attachment A
Proposed Tree Species Candidates

Tree Candidates

Honeylocust and Similar

ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
49	Bignoniaceae	Catalpa speciosa	–	Western Catalpa	5	Xeric to Min	Intermediate	Intermediate	Yes	50	35	Irregular pyramidal to rounded oval	Large, white flowers in spring to summer; showy	Green	Yellow	No	Heat, drought, and alkaline soil tolerant. Decay when wounded or as tree ages may be an issue.
15	Fabaceae	Gleditsia triacanthos inermis	Harve	Northern Acclaim Honeylocust	3b	Xeric	Tolerant	Tolerant	Yes	40	30	Broad pyramidal	Insignificant	Green	Yellow	No	Thornless and fruitless cultivar. Genus overplanted in Denver region.
7	Fabaceae	Gymnocladus dioicus	Espresso	Kentucky Coffeetree	4	–	Tolerant	Tolerant	Yes	–	–	Spreading vase	Greenish-white clusters in late spring	Blue-green	Yellow	Yes	Male (fruitless) cultivar. Tolerant of urban growing conditions. No known insect or disease issues. Leaves, seeds, and pulp reported to be poisonous if ingested.
16	Fabaceae	Gleditsia triacanthos inermis	Shademaster	Shademaster Honeylocust	4	Xeric	Tolerant	Tolerant	Yes	40	30	Vase to rectangular	Insignificant	Green	Yellow	Yes	Thornless and fruitless cultivar. Central leader less present than Skyline. Genus overplanted in Denver region.
52	Platanaceae	Platanus occidentalis	Bismarck	Northern Advance American Sycamore	3	Mod	Intermediate	Intermediate	Yes	75	60	Pyramidal to rounded	Insignificant	Green	Yellow	No	Cold hardy cultivar of parent species. Large root system requires large tree lawn. NDSU introduced – availability may be limited.
54	Platanaceae	Platanus x acerifolia	Morton Circle	Exclamation London Planetree	5	Mod	Intermediate	Intermediate	Yes	50	30	Pyramidal	Insignificant	Green	Yellow	No	Upper branches display showy bark. Cultivar more resistant to anthracnose than parent species. Large root system requires large tree lawn.
18	Sapindaceae	Koelreuteria paniculata	–	Goldenraintree	5	Xeric	Intermediate	Intermediate	Yes	30	30	Open, rounded vase	Yellow in summer, very showy	Green	Yellow	No	Volunteer seedlings could be an issue in mulched areas.
34	Fabaceae	Styphnolobium japonica	Halka	Millstone Japanese Pagodatree	5	Min	Intermediate	Intermediate	Yes	40	30	Broad oval to rounded	Creamy white in summer, showy	Dark green	Yellow	Yes	Tolerant of urban conditions, including heat, drought, and compacted soils. More upright branching habit than parent species. Greatest canker resistance of pagodatree species.
126	Rutaceae	Phellodendron amurense	Macho	Macho Amur Corktree	4	Min to mod	Intermediate	Intermediate	No	40	40	Upright to rounded	Green-white in spring, insignificant	Green	Yellow	No	Male, seedless cultivar of parent species. Large, shallow root system requires large tree lawn.

Shade Trees

ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
11	Fagaceae	Quercus macrocarpa	JFS-KW14	Cobblestone Oak	3	Xeric	Intermediate	Intermediate	Yes	50	40	Broad oval	Insignificant	Dark green	Yellow	No	Bark displays more cork-like features than parent species.
130	Fagaceae	Quercus muehlenbergii	–	Chinkapin Oak	3	Mod	Intermediate	Intermediate	No	45	50	Upright oval to rounded	Insignificant	Yellow-green	Yellow	Yes	Tolerant of alkaline soils. Transplant in spring for best survival. Prune to develop central leader.
31	Ulmaceae	Celtis laevigata	All Seasons, Magnifica	Sugar Hackberry	5	Xeric to Min	Tolerant	Intermediate	Yes	45	40	Rounded vase to broad oval	Green in spring, insignificant	Dark green	Yellow	No	Varieties are more hardy than parent species. Magnifica has similar growth habit to elm and improved insect resistance.
47	Ulmaceae	Celtis occidentalis	Chicagoland	Common Hackberry	3	Xeric to Min	Tolerant	Intermediate to Sensitive	Yes	45	35	Rounded vase, strong central leader	Green in spring, insignificant	Green	Yellow	Yes	Tolerant of urban growing conditions. Nipple gall may be an aesthetic issue. Intolerant of mechanical damage. Transplant in spring (B&B).
25	Ulmaceae	Ulmus americana	Princeton	Princeton American Elm	4	Mod	Intermediate	Intermediate	Yes	60	45	Upright vase	Insignificant	Dark glossy green	Yellow	Yes	Fast growing cultivar. Resistant to Dutch elm disease and elm leaf beetle. Per CSU elm trials, tree may susceptible to scale. Prune to develop strong branching structure.
30	Ulmaceae	Ulmus (wilsoniana x pumila Accolade) x carpinifolia x glabra	Patriot	Patriot Elm	4	Mod	Tolerant	Tolerant	Yes	45	35	Upright, narrow vase	Insignificant	Dark green	Yellow	No	Fast growth rate. Highly resistant to Dutch elm disease. Per CSU elm trials, tree may be susceptible to scale. Not as drought tolerant as other hybrids. Prune to develop strong branching structure.
29	Ulmaceae	Ulmus glabra x carpinifolia	Pioneer	Pioneer Elm	4	Mod	Tolerant	Tolerant	Yes	50	45	Rounded	Insignificant	Dark green	Yellow	Yes	Resistant to Dutch elm disease. Highly susceptible to elm leaf beetle. Per CSU elm trials, tree may be susceptible to scale. Prune to develop strong branching structure.
23	Ulmaceae	Ulmus pumila x japonica x wilsoniana	Morton Glossy	Triumph Elm	4	Min to mod	Tolerant	Tolerant	Yes	50	40	Upright oval to vase	Insignificant	Dark glossy green	Yellow	No	Cold hardy. Excellent resistance to Dutch elm disease. Resistant to elm leaf beetle. Per CSU elm trials, tree may be moderately resistant to scale. Prune to develop strong branching structure.
24	Ulmaceae	Ulmus japonica x wilsoniana	Morton	Accolade Elm	4	Min to mod	Intermediate	Intermediate	Yes	60	50	Vase with arching limbs	Insignificant	Dark glossy green	Yellow	Yes	Cold hardy. Resistant to Dutch elm disease and elm leaf beetle. Per CSU elm trials, tree shows high scale resistance. Prune to develop strong branching structure.
92	Ulmaceae	Ulmus davidiana var. japonica	Discovery	Discovery Elm	3	Mod	Tolerant	Tolerant	No	40	30	Upright oval to arching vase	Insignificant	Dark green	Yellow	Yes	Slow growing, cold hardy variety. Resistant to Dutch elm disease and elm leaf beetle. Resitance to scale unknown. Large root system requires large tree lawn. Growth habit requires consistent crown-thinning. Prune to develop strong branching structure.
91	Ulmaceae	Ulmus pumila x hollandica x carpnifolia	Homestead	Homestead Elm	5	Min to mod	Tolerant	Tolerant	No	50	30	Pyramidal to oval	Insignificant	Dark green	Yellow	No	Fast growth rate. Resistant to Dutch elm disease. Susceptible to elm leaf beetle. Per CSU elm trials, tree may be moderately resistant to scale. Prune to develop strong branching structure.

Tree Candidates

Asymmetrical – Red Oak and Similar

ID	Family	Botanical Name	Acceptable Cultivar	Common Name	Hardiness Zone	Moisture Level	Soil Salt Tolerance	Aerosol Salt Tolerance	Water Quality Area	Height at Maturity	Canopy Spread at Maturity	Growth Form/ Shape	Flowers	Leaf Color – Spring	Leaf Color – Fall	Subject to Change[a]	Additional Notes (includes compaction/tolerances/restrictions)
85	Aceraceae	Acer buergeranum	Streetwise	Trident Maple	5	Min	Tolerant	Intermediate	No	30	30	Oval to rounded	Small green-yellow in spring, insignificant	Dark green	Orange-red	Yes	Slow growing. No pests or disease problems at this time. Snow and ice damage may be a concern.
86	Aceraceae	Acer campestre	–	Hedge Maple	5	Min	Tolerant	Tolerant	No	30	30	Oval to rounded, dense	Small green-yellow in spring, insignificant	Dark green	Yellow	Yes	Tolerates dry soil. Intolerant of soil compaction. Prune to develop strong branching structure and overhead clearance.
3	Aceraceae	Acer miyabei	Morton	State Street Maple	4	Mod	Intermediate	Intermediate	Yes	45	35	Upright pyramidal to rounded	Small green-yellow in spring, insignificant	Green	Yellow-orange	Yes	Cold hardy and drought tolerant, chlorosis resistant; pest free.
101	Hippocastana-ceae	Aesculus x Bergeson	–	Prairie Torch Buckeye	3	Mod	Intermediate	Intermediate	No	27	27	Slightly weeping, globose	Yellow-green in spring, showy	Dark green	Orange-red	No	Excellent cold hardiness. Resistant to leaf scorch. Intolerant of drought.
100	Hippocastana-ceae	Aesculus x 'Homestead'	–	Homestead Buckeye	4	Mod	Intermediate	Unknown	No	35	22	Broad oval to rounded, low branching	Yellow-red flowers in spring, showy	Dark green	Bright red-orange	No	Intolerant of excess heat and drought. Powdery mildew, leaf scorch, and leaf drop may be issues. Prune to develop overhead clearance.
62	Rosaceae	Pyrus calleryana	Glen's Form	Chanticleer Pear	4	Min to Mod	Intermediate	Intermediate	Yes	30	15	Upright pyramidal	White in spring, showy	Glossy green	Red	Yes	Greater fireblight resistance than other cultivars. Overplanting is a concern. Prune to develop strong branching structure
118	Fagaceae	Quercus alba	–	White Oak	3	Mod	Tolerant	Tolerant	No	60	60	Oval to rounded	Insignificant	Green	Copper-orange	Yes	Relatively slow growing. May be intolerant of alkaline soils. Chlorosis may be an issue.
115	Fagaceae	Quercus buckleyi	–	Texas Red Oak	5b	Min	Tolerant	Unknown	No	35	35	Broad rounded	Insignificant	Glossy green	Orange-red	No	Native of Texas is closely related to shumard oak. Tolerant of alkaline soils and drought. Check seed source for hardiness and soil tolerance.
112	Fagaceae	Quercus robur x alba	Tabor PP21382	Forest Knight Oak	4	Xeric to Min	Intermediate	Tolerant	No	45	35	Broad oval	Insignificant	Glossy dark green	Orange-red	No	Columnar hybrid of English and white oak. Tolerant of urban conditions. Kermes scale may be an issue.
121	Fagaceae	Quercus shumardii	–	Shumard Oak	5	Mod	Intermediate	Intermediate	No	60	40	Pyramidal to oval	Insignificant	Green	Orange-red	No	Due to large growth range, source as locally as possible for pH, drought, and hardiness tolerance. Large root system requires large tree lawn. Prune to develop central leader.
96	Fagaceae	Quercus x bimundorum	Midwest	Prairie Stature Oak	3	Min to Mod	Intermediate	Intermediate	No	45	35	Broad pyramidal	Insignificant	Insignificant	Dark green	Yes	Cold hardy hybrid of English and white oak. Tolerant of alkaline soils.
120	Ulmaceae	Ulmus davidiana var. japonica	Burgundy Glow	Northern Empress Japanese Elm	3	Mod	Tolerant	Tolerant	No	28	24	Rounded, open	Insignificant	Green	Red	No	Medium growth rate. Resitant to Dutch elm disease and elm leaf beetle. Resistance to scale unknown. Prune to develop strong branching structure.
4	Ulmaceae	Ulmus parvifolia	Dynasty	Dynasty Elm	5	Mod	Intermediate	Intermediate	Yes	35	35	Vase	Insignificant	Green	Yellow-orange	No	Fast growth rate. Resistance to Dutch elm disease, scale, and elm leaf beetle unknown. Prune to develop strong branching structure. Availability may be limited. Unproven in Denver region.
63	Ulmaceae	Ulmus parvifolia	Emer II PP7552	Allee Lacebark Elm	5	Mod	Intermediate	Intermediate	Yes	45	30	Upright vase with arching limbs	Insignificant	Green	Orange-red	Yes	High resistance to Dutch elm disease and elm leaf beetle. Resistance to scale unknown. Thin, showy bark. Prune to develop strong branching structure.
64	Ulmaceae	Ulmus parvifolia	Corticosa	Cork Bark Elm	6	Mod	Intermediate	Intermediate	Yes	40	40	Vase	Insignificant	Dark green	Orange	No	Resistance to Dutch elm disease, scale, and elm leaf beetle unknown. Prune to develop strong branching structure. Cold hardiness may be an issue. Availability may be limited. Unproven in Denver region.
5	Ulmaceae	Zelkova serrata	Halka	Halka Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	50	35	Upright vase, open & loose form	Insignificant	Green	Yellow-orange	No	Growth rate is fastest of zelkova cultivars. Tolerant of urban conditions. Susceptible to canker from mechanical injury. Plant in spring. Prune in fall to develop strong branching structure.
65	Ulmaceae	Zelkova serrata	Green Vase	Green Vase Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	45	30	Vase, upright arching branches	Insignificant	Green	Orange	No	Faster growth rate, but less cold hardy than Village Green. Tolerant of urban conditions. Susceptible to canker from mechanical injury. Plant in spring. Prune in fall to develop strong branching structure.
2	Ulmaceae	Zelkova sinica	–	Chinese Zelkova	5b	Xeric to Mod	Intermediate	Intermediate	Yes	35	35	Vase	Insignificant	Dark green	Yellow-orange	No	Resistant to elm leaf beetle. Exfoliating cinnamon-colored bark. Prune in fall to develop strong branching structure. Availability may be limited. Unproven in Denver region.

[a] Trees are subject to change based on design changes, Department of Forestry recommendations, and availability.

Note: The tree species listed are preliminary candidates for future use on the 16th Street Mall, based on design and health/resiliency criteria. Criteria are subject to change based on design changes, Department of Forestry recommendations, and availability.

TECHNICAL MEMORANDUM

Noise and Vibration – Existing Conditions: Sensitive Land Uses

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	October 2018

1. Introduction to Analysis

This technical memorandum describes the existing noise and vibration-sensitive resources present in the study area for the 16th Street Mall (Mall) Alternative Analysis and Environmental Clearance Project (Project) in Denver, Colorado. **Section 3.5.3, Noise and Vibration**, in the Environmental Assessment, describes the impact to the sensitive receptors noted in this memorandum. The memorandum includes an overview of applicable laws, regulations, and orders; summary of methodology used for determining the existing sensitive land uses; and description of existing sensitive land uses within the study area.

A. Laws, Regulations, and Orders

The Project will be subject to federal, state, and local noise regulations during construction and operation. However, state and local regulations for the resources either did not exist or did not provide the level of detail included in the federal guidance; as a result, the more stringent Federal Transportation Administration (FTA) requirements were followed for this analysis.

1. Federal

The FTA's guidance manual, *Transit Noise and Vibration Impact Assessmen*t (FTA, 2006), discusses applicable federal regulations, identification of noise-sensitive land uses, and methodology for evaluation of potential noise impacts. The FTA regulations for assessing impacts from projects is codified in 23 *Code of Federal Regulations* (CFR) 711.

2. State

Noise regulations for the State of Colorado (Colorado Statute 25-12-103) were consulted, but they do not reference nor are they applicable to noise sensitive land uses, and they were not used for this evaluation.

3. Local

Noise regulations for the City of Denver (City and County of Denver Code of Ordinances, Chapter 36 – Noise Control) were consulted, but they do not reference nor are they applicable to noise sensitive land uses, and they were not used for this evaluation.

B. Methodology

The evaluations of existing noise and vibration levels were completed using the FTA *Transit Noise and Vibration Impact Assessment* manual (FTA, 2006). Evaluations were conducted using the following geographic information system (GIS)-based data:

- Land use categories and zoning (particularly residential, commercial, and industrial)
- Aerial imagery from Google Earth™ or Internet searches to identify resources

1. Noise

Based on the FTA criteria, the noise study area was defined as a screening distance of 150 feet from the outside edge of the transit way. Existing noise-sensitive uses (resources) in the noise study area were identified by gathering an inventory of existing land uses. Land uses were organized based on the land use categories identified in the *Transit Noise and Vibration Impact Assessment* manual (FTA, 2006). An inventory of the noise-sensitive resources was collected within the 150-foot screening distance.

2. Vibration

Based on the FTA criteria, the vibration study area was defined as a screening distance of 50 feet from the transit travel lanes. Resources were again organized based on the land use categories identified in the *Transit Noise and Vibration Impact Assessment* manual (FTA, 2006). An inventory of the vibration-sensitive resources was collected within the 50-foot screening distance.

2. Sensitive Land Uses

A. Noise

The survey of existing land uses revealed a total of 33 sites with noise-sensitive land uses within the 150-foot screening distance (**Table 2-1** and **Figure 2-1**).

Figure 2-1. Noise-sensitive Resources

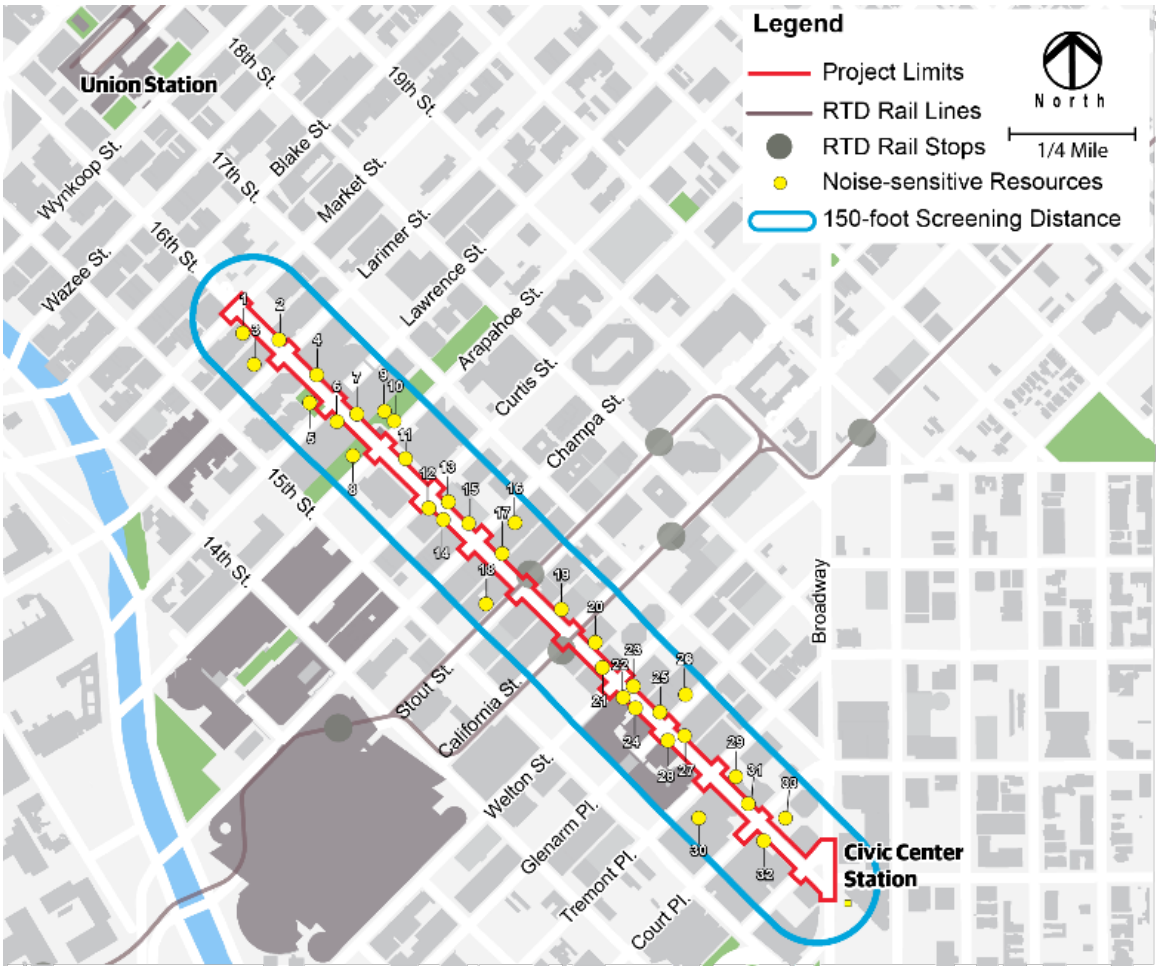


Table 2-1. Noise-sensitive Resources

Identification Number	Name of Resource	Identification	Name of Resource
1	Benches	18	A.T. Lewis Lofts
2	The Barclay	19	Outdoor seating at an office building
3	Larimer Place Condominiums	20	Outdoor seating at Burger Works
4	Outdoor seating at the Cheesecake Factory	21	Bench
5	Benches	22	Outdoor seating at Appaloosa Grill
6	Outdoor seating at Saltgrass Steakhouse	23	Outdoor seating at Henry's Tavern
7	Outdoor seating at Tilted Kilt	24	Bench
8	Denver Chriskindl Market	25	Outdoor seating at Marlowe's
9	Westin Denver Hotel	26	Paramount Theater

Identification Number	Name of Resource	Identification	Name of Resource
10	Skyline Park	27	Outdoor seating at Protein Bar
11	Outdoor seating at Tokyo Joes	28	Outdoor seating at Hard Rock Café
12	Marriot Courtyard Hotel	29	Outdoor seating at Starbucks
13	Outdoor seating at Caribou Coffee	30	Sheraton Denver Hotel
14	Outdoor seating at Railto Café	31	Outdoor seating at Duck Soup
15	Outdoor seating at Chili's	32	Outdoor seating at Katie Mullen's
16	Downtown Library	33	Outdoor seating at Denver Energy Center building

B. Vibration

The existing resource survey revealed three vibration-sensitive resources within the 50-foot screening distance (**Table 2-2** and **Figure 2-2**).

Figure 2-2. Vibration-sensitive Resources

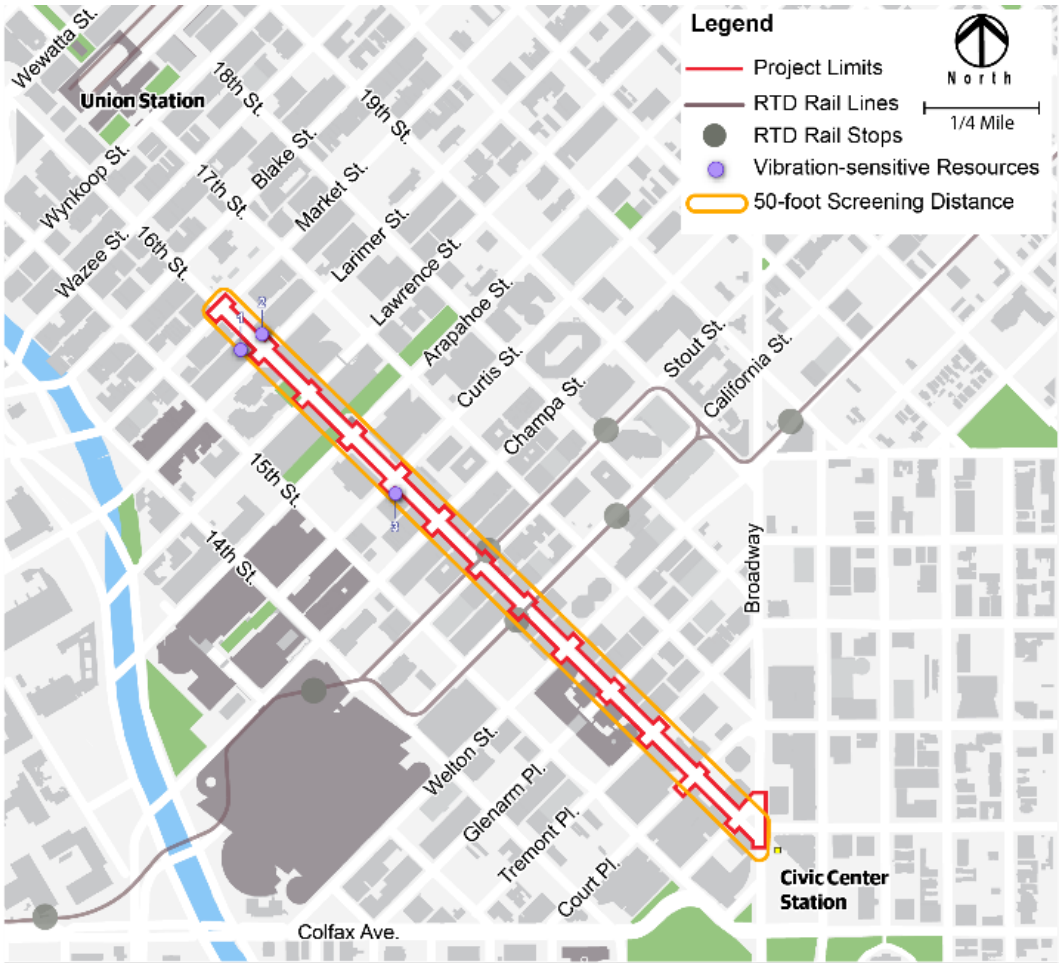
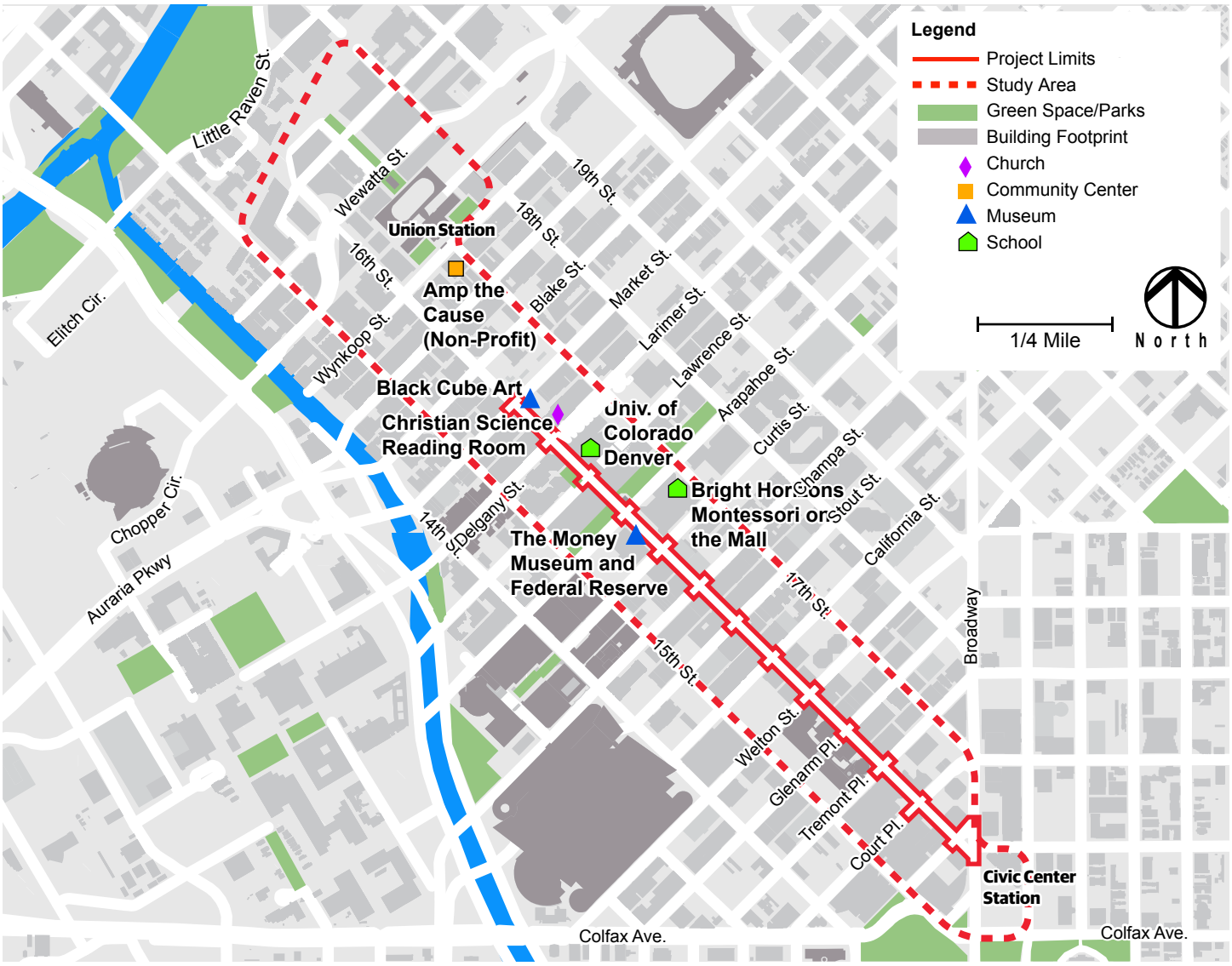


Table 2-2. Vibration-sensitive Receivers

Identification Number	Name of Resource
1	Larimer Place Condominiums
2	The Barclay
3	Marriot Courtyard Hotel

Existing Community Facilities within the Study Area



TECHNICAL MEMORANDUM

Modified Phase 1 Environmental Site Assessment 16th Street Mall Denver, CO

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	October 2018

1. Introduction to Analysis

This document presents the methodology, findings, and conclusions of a limited environmental site assessment (ESA) for the 16th Street Mall (Mall) in Denver, Colorado, prepared for the 16th Street Mall Alternative Analysis and Environmental Clearance Project (Project). The ESA was performed with the goal of identifying known or potential adverse environmental conditions that may need to be considered or addressed during any excavation activities associated with constructing Mall improvements. The study area includes the footprint of the Mall, from building face to building face, and from Market Street southeast to Broadway.

2. Assessment Process

ASTM Standard 1527, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* requires the following two assessment components for ESAs:

1. Environmental records review, to obtain and review publicly-available records that would help identify the presence of potential adverse environmental conditions. Environmental records were provided by Environmental Data Resources (EDR).
2. Site reconnaissance, to conduct a visual inspection and obtain first-hand knowledge of current site conditions that would help identify the presence of potential adverse environmental conditions.

The following sections document how this ESA implemented the two assessment components of the standard needed to meet the Project objective. For the environmental records review, the standard ASTM search distances were used, and the minimum required databases searched.

A. Records Review

The *EDR Radius Map Report with GeoCheck* (EDR Inquiry Number 4990626.2s dated July 12, 2017) presents available environmental records for a 1-mile survey radius encompassing the study area, with a midpoint located at 1001 16th Street in Denver, Colorado. The report consists of listings in standard environmental records (federal and state), additional environmental records (local findings not covered under standard records), and EDR-recovered government archives (solid waste facilities list).

Before starting the site reconnaissance, the report was reviewed to determine if more attention was needed at certain areas within the Project site. There were no report findings that required special attention during the site visit.

B. Site Reconnaissance

On July 20, 2017, CH2M environmental engineer Ian Sutton visited the study area to perform a visual site inspection. Representative photographs from the site visit are provided in Attachment 1. During the site visit, the entirety of the 16th Street Mall was walked and inspected for the following factors:

- Any signs of surface staining (e.g., oil sheen or oil stains)
- Any odors indicating potential hazards (e.g., petroleum and cleaning products)
- Signs of wells (i.e., monitoring, oil, gas, and water)
- Electrical transformer equipment
- Barrels, drums, or containers that were unmarked or identified to contain hazardous material
- Piles of debris (e.g., stockpiles, trash piles, or storm water debris)
- Pools of liquid waste (such as from ponding or storm water drainage)
- Painted or preserved materials (potential for lead paint or asbestos containing materials)
- Stressed vegetation
- Evidence of suspected methamphetamine lab

None of the listed items were observed or encountered during the site reconnaissance. There were also no visual signs or evidence to identify any items listed in the EDR report.

3. Impact Evaluation

A. Methodology for Impact Evaluation

When reviewing the EDR report and conducting the site reconnaissance, hazards were reviewed and identified that would potentially affect worker and public safety during work involving any surface construction or minimal intrusive activities (excavation to reveal and remove potential abandoned utilities and earthwork). The study area is in a developed area with multiple large buildings, many of which include areas below the ground surface (e.g., basements, parking garages, and commercial properties). This information was considered while conducting the assessment.

B. Locations of Known Releases

Known releases occur within 1/16 mile (330 feet) of the Project centerline (**Figure 3-1**) according to data obtained from the following programs:

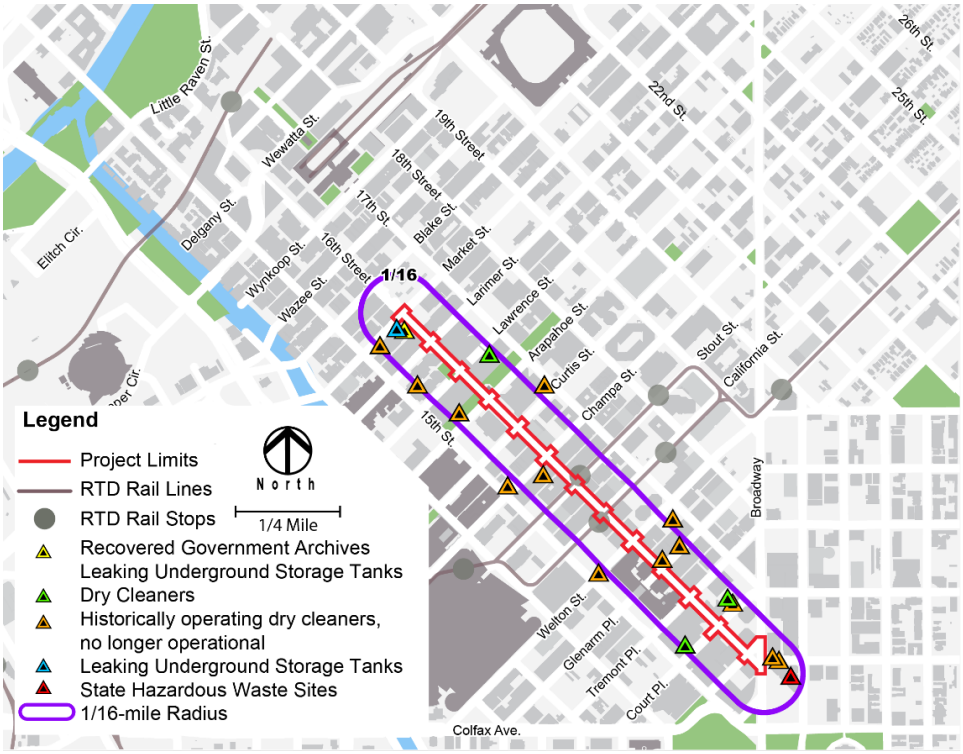
- Leaking Underground Storage Tanks (LUST)
- Recovered Government Archives (RGA) LUST
- State Hazardous Waste Sites (SHWS)

A known release is considered to be a release that was specified as a spill or a release of a chemical within the EDR findings. All releases listed in **Table 3-1** were within 1/16 mile (approximately 1/2 of a city block) of the center line within the site location. Releases outside the 1/16-mile radius were not included because they are not likely to impact the Project location.[1]

Three locations were identified as being a LUST or RGA LUST site, with the most recent occurring in 2012. All LUST locations have been classified as closed. Although all LUST locations have a closed status, the State of Colorado allows for risk-based closures. As a result, closed site may have residual hydrocarbon impacted soil (although at low levels).

One SHWS site was identified as a remediation site stemming from a facility operations spill. The remedial actions used to remove mercury contamination were classified as completed in 1995. There were no additional listings within 1/16 mile of the Project centerline that indicated known releases.

Figure 3-1. Known Releases



[1] This assumption was made based on development in the area and the presence of underground impedances that would hinder movement of hazards (such as basements, parking garages, and other belowground obstructions).

Table 3-1. Known Releases

Site Name	Site Address	Database	Distance from Project Centerline (Miles)
Manhattan Building	1360 16th Street	RGA LUST	0
Manhattan Building Partnership	1360 16th Street	LUST	0
Manhattan Building	1360 16th Street	RGA LUST	0
Steamway of Denver	511 16th Street, Suite 224	Historically operated dry cleaner	0.004
Mountain Maintenance	820 16th Street	Historically operated dry cleaner	0.013
Dependable Cleaners Number 13	1625 Court Place	Dry cleaners	0.02
Dependable Cleaners and shirt Laundry	1625 Court Place	Historically operated dry cleaner	0.02
O'Brien Bros Cleaners and Tailors	17 E 16th Ave	Historically operated dry cleaner	0.02
Ambassador Cleaners	18 E 16th Avenue	Historically operated dry cleaner	0.022
Latcham Fred C Carpet Co Fred C Latcham Pres	1530 Welton Keystone 1 069	Historically operated dry cleaner	0.026
No name listed	1512 Larimer Street	Historically operated dry cleaner	0.04
Executive Image Dry Cleaners	1515 Arapahoe Street, Suite 251	Historically operated dry cleaner	0.041
Famous Bug Cleaners L S	1532 Market	Historically operated dry cleaner	0.042
Benson Minerals	1560 Broadway, Suite 1900	SHWS	0.044
Artcraft Cleaners and Dyers	1641 Glenarm Place	Historically operated dry cleaner	0.044
Westin Hotel Tabor Center	1672 Lawrence Street	Dry cleaners	0.046
Sheraton Denver Downtown Hotel	1550 Court Place	Dry cleaners	0.048
Dry Cleaners Service Inc	1636 Welton	Historically operated dry cleaner	0.055
15th, and	1505 Champa Street	Historically operated dry cleaner	0.061

Site Name	Site Address	Database	Distance from Project Centerline (Miles)
& Delivered	1513 Glenarm Place	Historically operated dry cleaner	0.063
Heritage Cleaners	1617 Curtis Street	Historically operated dry cleaner	0.068

C. Other Potential Hazards and Findings

Besides listed releases and spills, other potential hazards were identified within the EDR report. As with the investigation of releases, review of other EDR findings was focused to a radius of 1/16 mile from the Project centerline because of the nature of the Project location.

Three current and 14 historic dry-cleaners were identified within 1/16 mile of the Project site (two sites are represented by one icon on **Figure 3-1** because of their close proximity). None of these are included in a listing or identification of any current release.

The City and County of Denver has also advised that there is potential to encounter abandoned buried utilities below the Mall walkways and transit way. It is unknown what utilities may be present or if they are encased.

D. Summary and Recommendations

The EDR report and a reconnaissance visit to the site yielded no known potential hazards present within the study area. To protect worker safety and health, it is recommended that the construction plan include information and instructions for addressing unanticipated discoveries of potentially hazardous materials.

Depending on the Project's scope of work, it may be advisable to conduct environmental sampling at or near locations with the highest potential to encounter hazards. These locations can be seen on **Figure 3-1**.

While performing excavation activities, caution should be used to not damage or break open any casing material. A trained and certified asbestos inspector should be present to clear any utility material before it is moved or disturbed. If utilities are encountered, they should be treated as if they are live and haven't been abandoned. If there are live electric, gas or fiber optic lines, disturbing them without properly abandoning them could lead to disruption to surrounding businesses, serious injury, or death to site workers and the surrounding public.

Attachment 1
Site Photographs, July 20, 2017

Photo 1. 16th Street and California Street, Looking Southeast

Photo 2. 16th Street and Welton Street, Looking Southeast

Attachment 2
EDR Radius Map

The EDR Radius Map Report with GeoCheck (EDR Inquiry Number 4990626.2s dated July 12, 2017) is available upon request.

TECHNICAL MEMORANDUM

Environmental Justice

TO: Regional Transportation District

FROM: CH2M HILL Engineers, Inc.

DATE: October 2018

1. Introduction to Analysis

This technical memorandum presents data for the environmental justice analysis that federal regulations require as part of the environmental assessment for the 16th Street Mall (Mall) Alternatives Analysis and Environmental Clearance Project (Project). The study area was identified as the area adjacent to and about 500 feet from the proposed Project limits. This was selected as the study area as impacts during construction and operation would occur within this area. This area overlaps with five census block groups and is within the Denver Union Station (DUS) and Central Business District (CBD) neighborhoods (**Figure 1-1**). A portion of the study area extends to the east of the CBD boundary, but only to tie improvements from the Mall into Broadway and Civic Center Station. No population is anticipated to live within 500 feet of those potential improvements; the buildings on the east side of Broadway are commercial and institutional in nature, not residential.

Figure 1-1. Environmental Justice Analysis Study Area

2. Affected Environment

A. Related Plans and Policies

Title VI of the Civil Rights Act of 1964, enacted on July 2, 1964, outlaws discrimination based on race, color, religion, sex, or national origin in programs and activities receiving federal financial assistance. Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, enacted on February 11, 1994, mandates that federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations. EO 12898 is a renewed focus on the Title VI law with respect to minority populations and adds low-income populations as an emphasis area. In response to EO 12898, the U.S. Department of Transportation (DOT) issued its *Order to Address Environmental Justice in Minority Populations and Low-Income Populations* (DOT Order 5610.2). Updated in 2012, Order 5610.2(a) sets forth procedures and guidance for implementing EO 12898. In turn, the Federal Transit Administration (FTA) published Circular 4703.1 in 2012 to establish guidance for how projects receiving FTA funding are to incorporate environmental justice principles into their plans, projects, and activities.

Order 5610.2(a) defines minority, minority populations, low-income, and low-income populations as follows:

Minority is defined as a person who is Black (a person having origins in any of the black racial groups of Africa), Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or the Spanish culture or origin, regardless of race), Asian (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands), or American Indian or Alaskan Native (a person having origins in any of the original peoples of North America, and who maintains cultural identification through tribal affiliation or community recognition).

Minority population is defined as any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

Low income is defined as a person whose median household income is at or below the Department of Health and Human Services poverty guidelines for that size of household. The poverty level used for this analysis was the adjusted home income limits for 2015 defined by the U.S. Housing and Development Department (HUD) for the Denver-Aurora-Broomfield Metropolitan Statistical Area.

Low-income population is defined as any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy or activity.

Adverse impacts are defined by Order 5610.2(a) as the totality of significant individual or cumulative human health or environmental effects, including interrelated social and economic effects, which may include, but are not limited to: bodily impairment, infirmity, illness or death; air, noise, and water pollution and soil contamination; destruction or disruption of man-made

or natural resources; destruction or diminution of aesthetic values; destruction or disruption of community cohesion or a community's economic vitality; destruction or disruption of the availability of public and private facilities and services; vibration; adverse employment effects; displacement of persons, businesses, farms, or nonprofit organizations; increased traffic congestion, isolation, exclusion or separation of minority or low-income individuals within a given community or from the broader community; and the denial of, reduction in, or significant delay in the receipt of, benefits of DOT programs, policies, or activities.

Order 5610.2(a), defines disproportionately high and adverse effects on minority or low-income populations as an adverse effect that is predominantly borne by a minority population and/or low-income population or would be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse impact that would be suffered by the non-minority population or non-low-income population.

B. Description of Existing Conditions and Any Known Future Conditions or Issues

Demographic information on minority and low-income populations in the study area was compiled from American Community Survey (ACS) data 5-year estimate (2011-2015). The ACS data interpolate changes to the 2010 census data with more current survey samples than 2010 census data. The ACS 5-year estimates use 60 months of data and a relatively large sample size to determine demographic adjustments within census tracts and at a smaller scale (block groups).

Table 2-1 provides a comparison of the demographic characteristics of the study area as compared with the City of Denver. According to the 2011-2015 ACS data, the total population for the study area is 6,385. The study area contained a lower proportion of minorities present compared to the overall 2015 City of Denver population. The median income for the neighborhoods within the study area is higher to considerably higher than the City of Denver's 2015 median income, however the proportion of households below the poverty line is approximately 4 percent greater in the study area than in the City of Denver.

Table 2-1. Demographic Characteristics

Criteria	City of Denver	Study Area[b, c]
Total Population[a]	649,654	6,385
Minority (percentage)[a]	46.9	24.9
Individuals whose income in the Past 12 Months is Below the Poverty Level (percentage)	110,299 (17.3)	1,484 (25.1)
Households whose Income in the Past 12 Months is Below the Poverty Level (percentage)[a]	42,609 (15.5)	1,058 (25.9)
Median Household Income in 2015	$79,959	$121,554[b]; $95,366[c]

[a] American FactFinder, 2015 ACS 5-year population estimates (U.S. Census Bureau, 2018)

[b] DUS (http://denvermetrodata.org/neighborhood/union-station).

[c] CBD (http://denvermetrodata.org/neighborhood/central-business)

1. Minority Population

Data were obtained at the block group level data to determine the presence of minorities in the study area. There are five block groups that overlap the study area. **Table 2-2** provides information on the minority populations from the 2011-2015 ACS. Of the minority populations in the study area, DUS neighborhood contains a higher Asian population than other minority groups, while the CBD contains a greater population identifying as Hispanic or Latino than other minority groups.

Data indicate that the minority population percentage in the five block groups located in the study area ranged from 0.0 to 35.5 percent. **Figure 2-1** shows the percentages of the minority population by block group.

The study area has a lower minority population than the City of Denver (**Table 2-2**).

Table 2-2. Minority Population in the Study Area

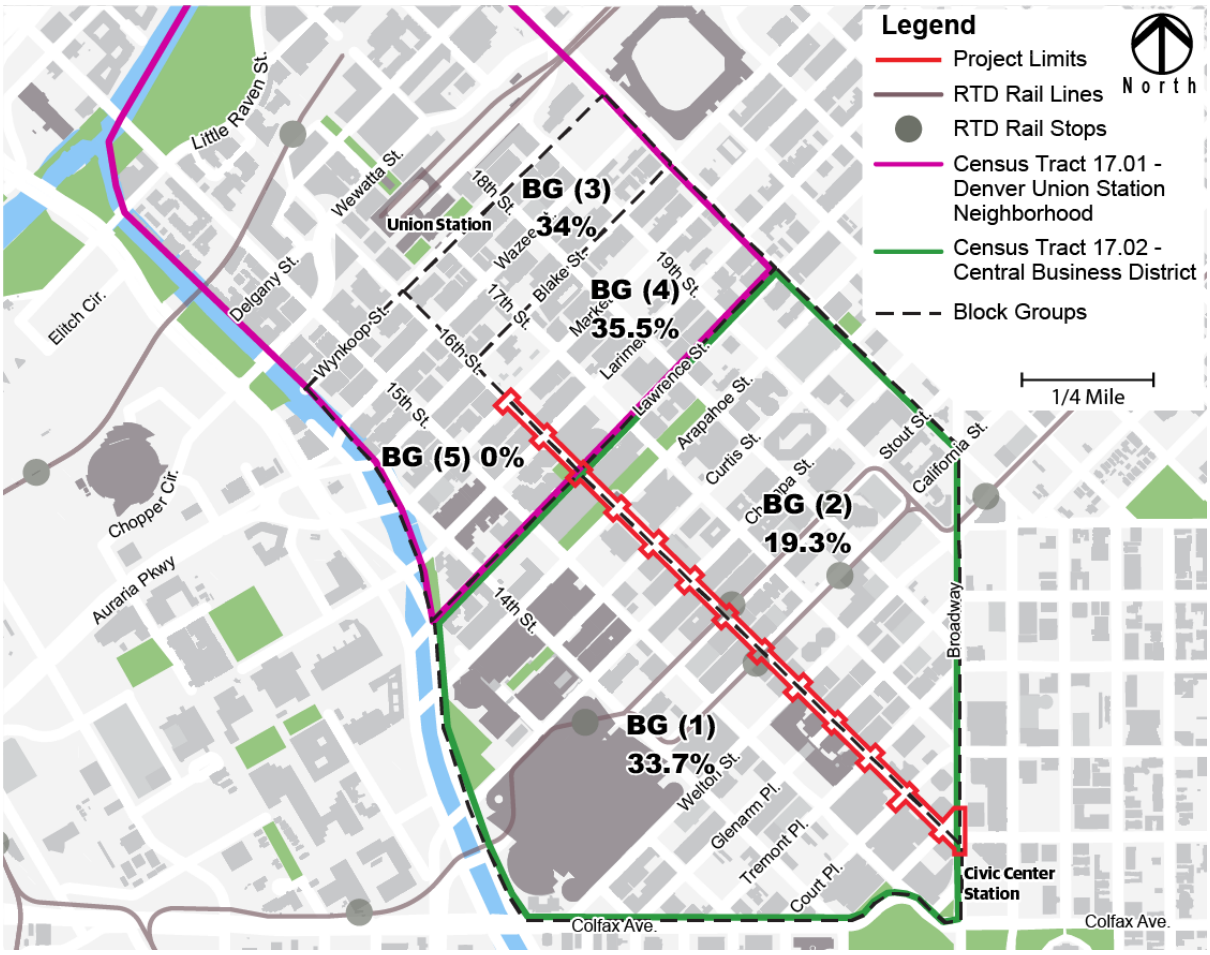
Category	Total Population	White Alone	African American Alone	Asian Alone	American Indian or Alaska Native Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino (of Any Race)	Minority Population (percentage)
Study Area	**6,385**	**4,792**	**362**	**355**	**19**	**0**	**0**	**234**	**623**	**24.9**
Census Tract 17.01 (ACS 2015)[a]	**2,336**	**1,767**	**62**	**243**	**0**	**0**	**0**	**47**	**217**	**24.4**
Block Group 3	297	196	25	0	0	0	0	10	66	34.0
Block Group 4	1317	849	37	243	0	0	0	37	151	35.5
Block Group 5	722	722	0	0	0	0	0	0	0	0.0
Census Tract 17.02 (ACS 2015)[b]	**4,049**	**3,025**	**300**	**112**	**19**	**0**	**0**	**187**	**406**	**25.3**
Block Group 1	1686	1118	223	34	19	0	0	122	170	33.7
Block Group 2	2,363	1907	77	78	0	0	0	65	236	19.3
City of Denver (ACS 2015)	**649,654**	**344,954**	**60,955**	**22,491**	**3,661**	**675**	**1,489**	**14,410**	**201,019**	**46.9**

Source: U.S. Census Bureau. 2018. American Fact Finder. https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Table B03002, Hispanic or Latino Origin by Race – 2011-2015 ACS 5-Year Estimates

[a] Sum of block groups that overlap the Environmental Justice Study Area within Census Tract 17.01.

[b] Sum of block groups that overlap the Environmental Justice Study Area within Census Tract 17.02.

Figure 2-1. 16th Street Mall Existing Minorities by Block Group



2. Low-income Population

According to the 2011-2015 ACS data, the study area had a median household income of $53,218; this is almost the same as the City of Denver, which had a median household income of $53,637.

HUD establishes the low-income thresholds for each county in Colorado and calculates low income as 30 percent of adjusted average monthly income for the area. HUD has determined that the extremely low-income limit (30 percent) within the Denver County is $21,600 for a three-person family (HUD, 2015).

Table 2-3 provides information on the number of individuals and households considered low income within the study area, including information on the census block groups in the study area as compared to the City of Denver. This table reveals that overall, the study area has a higher percentage of individuals and households whose income is below poverty than the City of Denver. However, as shown in **Table 2-3**, all but one of the five block groups that overlap the study area have lower percentages of individuals and households compared to the City of Denver. The one block group with higher percentages is the result of affordable housing within this block group. Data show that the lowest number of low-income households is at the western end of the study area, and that the number of low-income households increases to the east (**Figure 2-2)**.

Table 2-3. Percentages of Low-income Individuals and Households

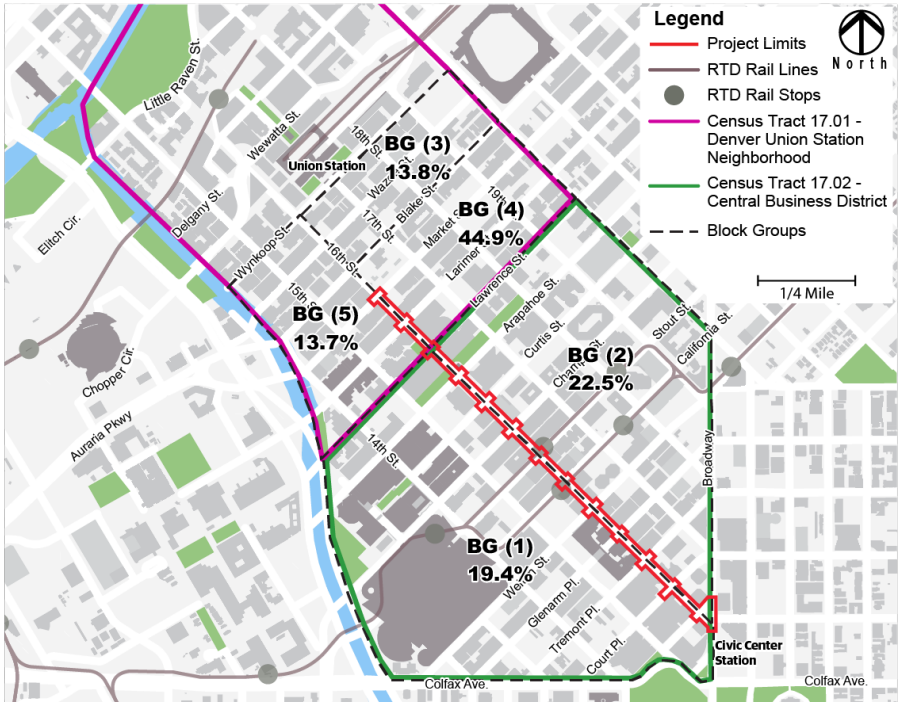
Area	Individuals below Poverty Level	Household Income below Poverty Level	Approximate Households Below HUD Extremely Low Income Threshold[a]
Study Area	1,484 (25.1 percent)	1,058 (25.9 percent)	1,572 (38.5 percent)
Census Tract 17.01[b]	731 (31.8 percent)	576 (36.2 percent)	782 (49.2 percent)
Block Group 3	41 (13.8 percent)	41 (19.4 percent)	72 (34.1 percent)
Block Group 4	591 (44.9 percent)	480 (51.9 percent)	635 (68.7 percent)
Block Group 5	99 (13.7 percent)	55 (12.1 percent)	75 (16.5 percent)
Census Tract 17.02[c]	753 (21.0 percent)	482 (19.3 percent)	790 (31.7 percent)
Block Group 1	327 (19.4 percent)	278 (22.5 percent)	447 (36.3 percent)
Block Group 2	426 (22.5 percent)	204 (16.2 percent)	343 (27.2 percent)
City of Denver	110,299 (17.3 percent)	42,609 (15.5 percent)	63,656 (23 percent)

[a] Information on households below the HUD extremely low income threshold is based upon those households with income less than $24,999 per year and does not factor in the number of persons in the household. Data are used to provide a comparison the HUD data and may not reflect households that are below poverty as calculated by HUD.

[b] Sum of block groups that overlap the Environmental Justice Study Area within Census Tract 17.01.

[c] Sum of block groups that overlap the Environmental Justice Study Area within Census Tract 17.02.

Figure 2-2. 16th St Mall Percentage of Low-income Population within DUS and CBD Neighborhoods



3. Community Outreach

The Regional Transportation District (RTD), City of Denver, and Downtown Denver Partnership engaged interested members of the public, business, and stakeholders through a variety of outreach methods. Organizations advocating for and providing services to the homeless were identified and contacted throughout the Project, as were neighborhood organizations, the Denver Commission on Aging, and the Denver Office of Disability Rights. The Project team has invited all of these organizations to three sets of small group meetings throughout the Project to date, to provide information about the Project and gather input. Notices of public meetings were provided to each group to distribute to their members and those they serve. Notices, handouts, and comment forms were provided in Spanish, and a Spanish translator was present at the public meetings.

Public involvement began with the Project scoping period in May 2017. The following public scoping activities were conducted: meetings with small groups representing advocacy organizations, the hospitality industry, businesses and property owners, and residents; a stakeholder working group workshop; outreach at a Meet in the Street event on the Mall; and a public meeting. Input from the scoping period was taken into account in finalizing the Project Purpose and Need, developing the range of alternatives, analyzing environmental impacts, and developing mitigation measures.

Overall, a two-step process (Level 1 and Level 2) was used to evaluate the Project alternatives on criteria related to various resources, including community and environmental impacts. Small group meetings, stakeholder working group workshops, and public meetings were held during both Level 1 and Level 2 alternatives evaluation steps. The first group of meetings provided information on the range of alternatives developed and the results of the Level 1 evaluation, and gathered input on those results and considerations for the Level 2 evaluation. The second group

of meetings provided information on the results of the Level 2 evaluation and the recommended Locally Preferred Alternative (LPA), and gathered input for consideration in refinement and analysis of the LPA. Input from these meetings resulted in the development of new alternatives and refinements to alternatives.

3. Impact Evaluation

A. Methodology for Impact Evaluation

The methodology for the environmental justice analysis is based on the RTD 2008 *Environmental Methodology Manual*, which outlines data requirements and analytical techniques. The manual suggests a two-part analysis, the first part consisting of outreach and the involvement of the minority and low-income population. The second part of the analysis consists of determining whether disproportionately high and adverse impacts fall on the minority and/or low-income population.

According to RTD's methodology, census block data are to be used for ethnicity and census block groups are to be used for income. This analysis uses block groups for minority and low-income. Block data are not used because the 2010 census data at the block level are now close to 9 years old and there have been changes in the downtown neighborhood with new residential construction that would not be captured. Demographic and low-income data were obtained using the 2011-2015 ACS data from U.S. Census Bureau's American FactFinder. The reference area for the environmental justice analysis is the City of Denver.

Disproportionately or adversely affected populations are defined as follows:

- Impacts to populations, defined at the census block level for ethnicity and the census block group level for income, with greater than 50 percent minority or low-income populations, and/or when the low-income or minority population percentage of the affected area is meaningfully greater than the percentage of low-income or minority populations in the general population of the region.
- Whether or not a low-income or minority community is bearing a disproportionate share of the impacts. The identification of disproportionately high impacts to a population will need to consider three factors, as follows:
  - Whether there will be an environmental impact that will significantly and adversely affect the low-income and minority population
  - Whether the effects will exceed, or are likely to exceed, those on the general population
  - Whether the effects occur, or would occur in a minority or low-income population affected by multiple exposures to environmental hazards
- Whether or not there is a denial, reduction, or delay in the provision of benefits to the minority or low-income communities.

B. No Action Alternative

The No Action Alternative would have no adverse impacts on minority and/or low-income populations. The Mall would remain as-is and no changes along it or the existing cross streets would occur. Indirectly, the degradation of the Mall overtime could result in fewer jobs and fewer economic opportunities if businesses decided to move elsewhere, but this would affect all populations and no adverse impact is anticipated.

C. Locally Preferred Alternative

Resources with no or very minimal short- or long-term impacts during construction and operation include land use, stormwater, utilities, parklands and recreational resources, social conditions and community facilities, and hazardous materials. Because there are no adverse impacts during construction or operation on these resources, no analysis is required.

Noise and air quality impacts are short term and would end once construction is complete. The construction phase would result in short-term impacts because of the construction activities during the 2.5- to 4-year construction duration. Construction would be conducted in two- to six-block segments, but the entire Project limits would eventually be affected, although in a temporary and localized manner. Short-term noise and vibration and air quality impacts (including increases in fugitive dust, construction-related exhaust, and other emissions) would occur during construction, but could be reduced to moderate intensity and to occur only for a short period of time by using avoidance measures and best management practices. Construction-related impacts that could not be fully mitigated (such as noise and dust) would likely be annoying at times, but persons living and working in the area would experience these annoyances for relatively short periods. Construction impacts that are not fully mitigated would affect all populations and no adverse impacts are anticipated.

The following sections describe those resources where more substantial impacts may occur and may result in adverse impacts on minority and/or low-income populations. Information is also provided on the benefits associated with the Project.

1. Economic Conditions

Economic impacts would be felt by businesses directly fronting the Mall during construction. Construction would not impede pedestrian access to businesses, but it may result in pedestrians avoiding the area because of dust, noise, and general visual disruption. Persons seeking restaurants would be less likely to enjoy outdoor seating activities for the duration, and businesses could experience a reduction in revenue during construction. Despite efforts to maintain access and minimize construction inconveniences, some businesses could suffer a temporary decline in sales. Businesses with a marginal capital base are likely to be the most affected. Where businesses experience a reduction in sales, an indirect impact may be a reduction in hours for employees.

Potential negative impacts might be offset by construction workers who purchase goods and services in the study area during Project construction. The economic impacts during construction would affect all populations to the same degree.

Once construction is complete, there would be beneficial economic effects and would not result in adverse impacts. Business activity is expected to increase after construction upgrades on individual blocks along the Mall. In the long term, economic development in the vicinity of the Mall would continue to occur based on market conditions and as facilitated by local land use policy, guidelines, and regulations.

2. Cultural Resources

Construction activities associated with the temporary increases in noise, vibration and fugitive dust would not result in adverse impacts on cultural resources because the impacts would be minimal overall and short term in nature.

The LPA would not result in adverse effects on adjacent structures or buildings eligible for the National Register of Historic Places, but it would result in an adverse effect on the 16th Street Mall historic property. The original design presented in the I.M. Pei/Hanna-Olin plan would not be replicated, but the LPA design honors the original by mimicking its geometry, tree and light placement, three distinct zones, and granite pavers. However, the integrity of association would be reduced. The design of the paving resembles a Navajo blanket, but is not associated culturally with Native American groups; the new design incorporates the original pattern and design intent. The cultural resources impacts would affect all populations to the same degree.

3. Visual and Aesthetic Resources

Construction would result in a short-term visual impact from removal and reconstruction of existing landscaping and pavements as well as the visual presence of staging of materials and equipment. The majority of these impacts are short term, lasting approximately 8 to 12 months in any specific area of the Mall, and do not result in adverse impacts; all populations would be affected to the same degree. However, a total of 143 trees of varying health and canopy size would be replaced with approximately 249 younger trees. The effect would be a difference in canopy and shade within the Mall until the trees mature in approximately 10 years.

After construction ends, the long-term results would be beneficial because approximately 75 percent more trees would be planted, the infrastructure would contribute to healthier tree growth, and the trees are focused around the pedestrian walkways rather than the transit corridors. Therefore, while the impacts from removing and replanting trees would result in short-term visual impact, the long-term benefits result in an overall enhancement of the visual quality for the entire Mall. No residual impacts would be present. The LPA proposes to maintain the integrity of the original paving pattern and the lighting posts and continue the sense of exterior rooms with trees and lighting that would not lower the visual quality of the Mall. No adverse impacts are anticipated during operation.

4. Public Safety and Security

The construction contractor would adhere to Occupational Safety and Health Administration regulations to avoid safety hazards during construction and provide security measures to avoid the potential for theft. A Safety and Security Certification Process would be implemented that would identify both possible risks related to crime and safety and their appropriate avoidance measures. There are no adverse impacts during construction, and the short-term construction impacts would affect all populations to the same degree.

Over the long term, the LPA could continue to use closed-circuit televisions as well as improved emergency telephones and better incorporation of Crime Prevention through Environmental Design principles to provide enhanced public security within the Mall. No adverse impacts associated with safety and security are anticipated during operation.

5. Traffic Operations, Transit Operations, and Pedestrian and Bike Facilities

During construction, a construction mitigation plan would be implemented that provides reasonable pedestrian access to businesses and transit stops for the transit service along the Mall (the Free MallRide shuttle). Traffic on cross streets would be affected if construction requires short-term lane or full closures. The Project will obtain and comply with the City of Denver's Street Occupancy Permit, and adequate detours will be provided.

Construction may require the relocation of the Free MallRide transit service for portions of the Mall or the entire 16th Street transit corridor. It is anticipated that construction could reduce ridership by 15 to 20 percent if transit service remains on the Mall throughout construction, or up to 30 to 40 percent if transit service is detoured completely off the Mall. Any transit detours during construction would require out-of-direction travel and longer trip times. This would affect commuters, employees, and residents who use the Free MallRide to reach their destinations. The impacts would affect all people to the same degree, and would not result in adverse impacts.

During construction, pedestrian access strategies over or around the construction area would comply with all appropriate standards, including Americans with Disabilities Act. The impact would be equally burdensome for all pedestrians (including minority and low-income populations) using the Mall, but the short-term duration would be compensated by long-term use of larger walkways with ample buffers from the transit way. Bicycles would likely be restricted from using portions of the Mall during construction, but this would only affect those areas under construction and only over the weekend periods, as bicycles are prohibited from weekday use of the Mall. Because the impacts to pedestrians and bicyclists are short term in nature and access would still be provided, no adverse impacts anticipated.

Operation of the Project does not result in adverse impacts. The Project would result in beneficial effects including improvements in transit operation and pedestrian improvements. These benefits would apply to all populations to the same degree.

6. Project Benefits

DOT Order 5610.2(a) directs agencies to consider the benefits of a proposed transportation project when determining whether it could result in disproportionately high and adverse impacts on minority and low-income populations. The LPA is anticipated to result in the following benefits:

- Improving the Mall safety and level of attraction for potentially increased economic sustainability
- Providing long-term increased transit reliability, because the transit corridor would have increased buffer from and reduced conflict with the projected increase of pedestrian use along the walkways

These benefits would apply to all populations who live, work, and visit the study area. For all workers, including lower-income workers, an improved Mall may provide enhanced accessibility to a larger number of employment opportunities. The LPA would enhance a safe transit service, increase transit reliability, and improve connections.

D. Environmental Justice Conclusion

As described in Section B, Description of Existing Conditions and Any Known Future Conditions or Issues, the proportion of the minority population is lower than for the City of Denver as a whole. Although some areas in the CBD neighborhood have greater low-income populations than the City of Denver, the Project impacts would not be predominantly borne by a minority and/or low-income population. The historic design would not be replicated, but the LPA design honors the original; however, the integrity of association would be reduced in the study area. The Project would not result in adverse impacts on cultural and social resources especially important to minority and low-income populations. Impacts during construction and operation would affect all populations to the same degree. Most Project impacts would occur during construction; they would be limited in duration, would be further reduced by implementing the proposed mitigation measures, and would not result in adverse impacts.

In addition, the Project would provide benefits for the public as a whole, including minority and low-income populations. These benefits would include a safe and efficient transportation system, improved mobility through the study area, and potentially improved destination attraction bringing improved economic prosperity; this in turn may provide more employment opportunities for low-income and minority populations.

Based on these conclusions, the LPA would not result in disproportionately high and adverse impacts on minority or low-income populations.

4. References

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Table B01003, Total Population – 2011-2015 ACS 5-Year Estimates

Table B03002, Hispanic or Latino Origin by Race – 2011-2015 ACS 5-Year Estimates

Table DP03, Selected Economic Characteristics – 2011-2015 ACS 5-Year Estimates

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TECHNICAL MEMORANDUM

16th Street Mall – Pedestrian, Bicycle, and Transit Vehicle Crash and Incident Report Analysis

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	December 2018

1. Introduction to Analysis

This memorandum describes safety considerations related to three scenarios: existing, short-term (construction), and long-term direct and indirect effects of project alternatives with a focus on pedestrians that are using the 16th Street Mall (Mall) from the corridor in terms of its safety performance.

The first step in the analysis is a summary review of total crashes and incident reports expressed annually. Next is an analysis of reported incidents in the study corridor with transit vehicles involving pedestrians, other vehicles, and other circumstances based on data received from the Regional Transportation District (RTD). The analysis includes an overview of annual general transit vehicle incident report trends for crashes and injuries, and pedestrian-related incidents as reported located by intersection. Lastly, this report includes an analysis of different roadway cross sections (median cross-section design and asymmetrical cross-section design) along the 16th Street corridor with an assessment of incidents compared to pedestrian usage. Cross-section designs are defined in Section 2, Alternative Evaluation, in the Environmental Assessment (EA).

The safety impacts, protocols, analysis approaches, techniques, performance measures, and recommendations are based on guidance from the Federal Highway Administration (FHWA), National Highway Traffic Safety Administration, Federal Transit Administration American Association of State Highway and Transportation Officials (AASHTO), RTD, and City and County of Denver. Specific guidance documents are listed under References at the end of this memorandum.

2. Affected Environment

For the Mall Alternative Analysis and Environmental Clearance (Project), a key consideration is the safety of what are considered to be vulnerable users (non-motorized). In the context of the Mall, Mall users are primary pedestrians, transit users, and bicyclists, particularly related to transit usage and those walking or crossing the Mall. For these users, the analysis conducted develops a qualitative and, where possible, a quantitative assessment of the comparative safety

of pedestrians and bicyclists for existing conditions and for alternatives. These considerations represent a means to assess the safety of vulnerable users, using industry best practices, which is an important goal of RTD as reflected in its mission to provide a safe environment for users of the Free MallRide. The study area used for this analysis is the Mall within the project limits illustrated on **Figure 1-1** in the EA.

The Mall, from a transportation operations context, is a unique facility in both the United States and in Europe, as use for the Mall by motorized vehicles is limited to RTD transit vehicles, emergency and law enforcement, street maintenance, and permitted delivery vehicles. On Saturdays and Sundays, usage by bicycles is also permitted. Throughout the week, in the evenings, licensed pedal cyclists that transport passengers are also permitted. These operational limitations and transit functions are unique because the transit service, called Free MallRide, serves pedestrians that wish to visit and shop at businesses located at the Mall, work in locations on the Mall, and to connect to other transit options. The transit line serves passengers of the buses that connect to destinations at either end of the Mall, such as Union Station and the light rail stations located in roughly the middle of the Mall. All of these factors when considered together help drive protocols and policies of RTD to manage users, and address how best to meet travel demands for the Mall.

Other important factors include that the drivers of transit vehicles are highly trained and licensed to drive the Free MallRide buses consistent with RTD protocols, and that by regulation, the maximum speed of buses is limited to 20 miles per hour. The buses have an average scheduled speed of 5.5 miles per hour. The buses are equipped with audible alerts to warn of their movement along the Mall. All of these attributes are considered when developing formal protocols, policies, or regulations for the transit vehicle operators using the Mall.

There are 12 cross streets within the project limits, not including Broadway and Market Street, and two light rail crossings. All vehicular cross streets are controlled by traffic signals at their respective intersections within the Mall.

As part of the safety review, several local and regional comprehensive plans and studies have been considered. They are noted in the list of references and cited explicitly in this memorandum. As part of the project, a literature search was also conducted to identify any comparable facilities in the United States facilities with respect to the design of the street and motor vehicle usage. No literature was identified for facilities that were exactly similar to the Mall.

A. Methodology for Impact Evaluation

The safety analysis reviewed Free MallRide vehicle incident reports from RTD, information published by the FHWA relating to pedestrian safety, and general information relating to vehicle-pedestrian conflicts.

For the analysis of RTD incident report data, the following data sets were reviewed (this is an evaluation of the existing conditions of reported transit vehicle-pedestrian incidents along the 16th Street Mall study corridor):

1. General Incident Trends, All Crashes and Incidents – 16th Street Mall (2007 to 2017)[1]
   - 16th Street Mall Annual Incidents
   - 16th Street Mall – Annual Incidents with Injury Claim (Crash Severity)
   - 16th Street Mall – Annual Incidents by Incident Types
2. Pedestrian-Transit Incidents by Location – 16th Street Mall
   - Incident Analysis by Location, Street Cross Section, and Perceived Severity
3. Total Reported Pedestrian-Bus Incidents – 16th Street from Market to Broadway by Cross Section

B. Review of Incident Report Data for Existing Conditions

1. General Incident Report Trends

To gain perspective of overall Mall pedestrian and transit incident trends, Free MallRide crash and incident report summaries provided by RTD were reviewed. **Figure 2-1** shows incident reports made by RTD for the Mall from 2007 to 2017, which are contained in a database managed by RTD. Note the 2017 crash data are not complete for the month of December. In general, total number of RTD incident reports were high in 2008, 2009, and 2017.

Figure 2-2, 16th Street Mall Annual Crashes by Type of Claim, indicates that 46 (5.8 percent) of reports included an injury claim. There were no reported fatalities in this period. Overall, there were 784 reports created by RTD for incidents on the Mall.

Figure 2-1. Reported Incidents, By Year (2007-2017)

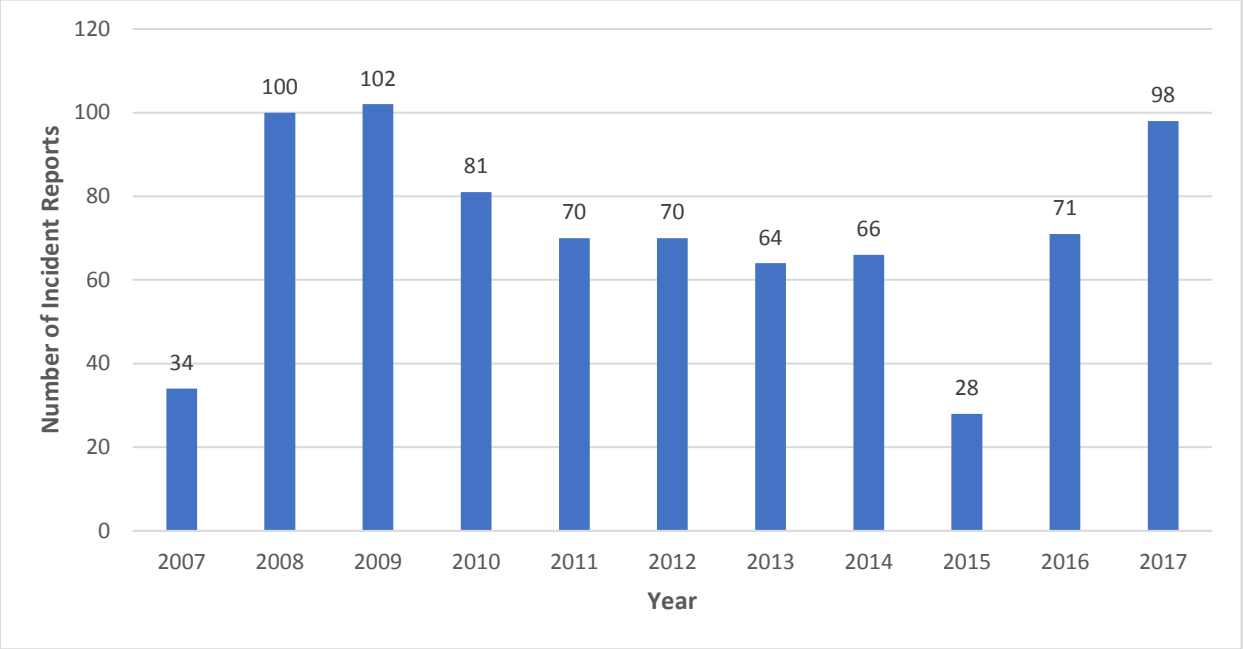
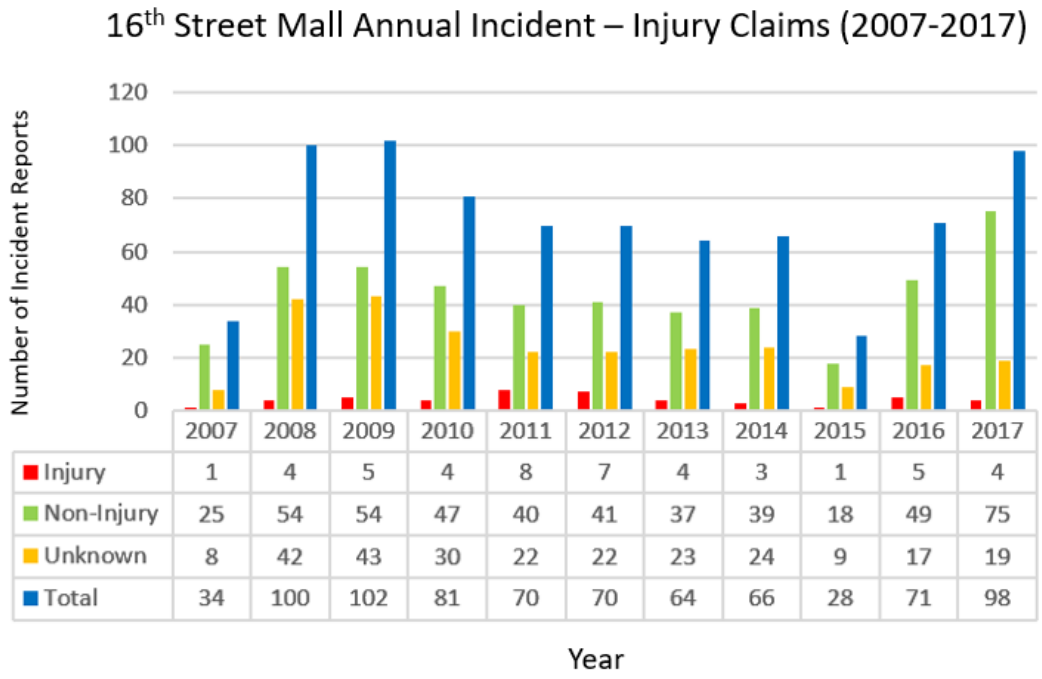


Figure 2-2. Annual Incident Report by Injury Claims (2007-2017)

1 The data provided by RTD are based upon incident reports made by RTD and may or may not have resulted in a formal investigation or disposition. For the year 2017, report data were not complete for November and December 2017. As data were received for the Mall from RTD on December 13, 2017, the following information shown and subsequent analysis is based on this data.

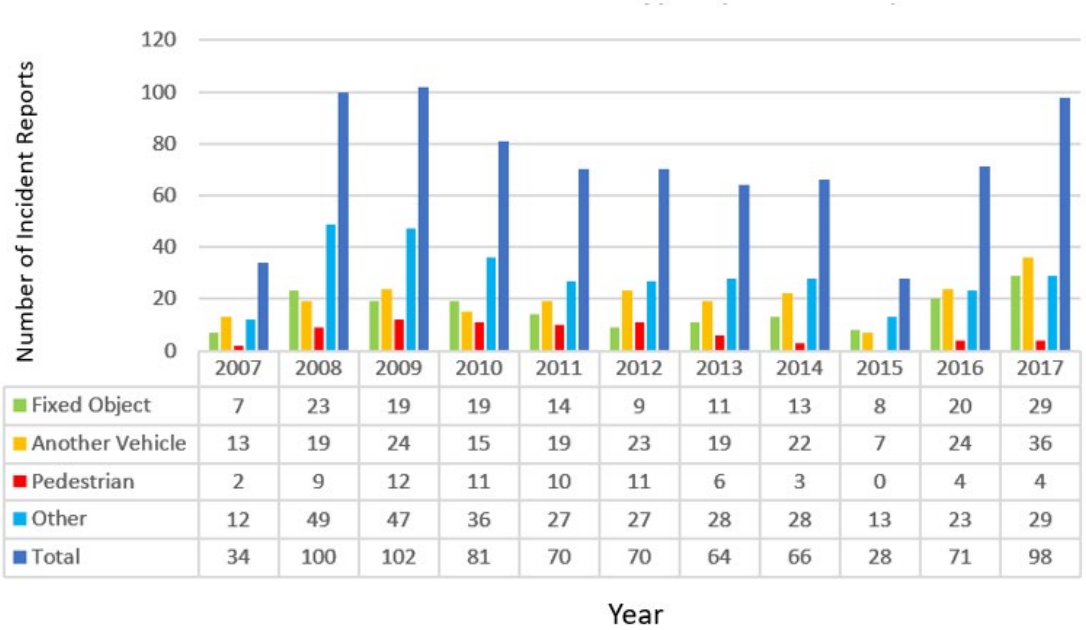


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Injury	1	4	5	4	8	7	4	3	1	5	4	46
Non-Injury	25	54	54	47	40	41	37	39	18	49	75	479
Unknown	8	42	43	30	22	22	23	24	9	17	19	259
Total	34	100	102	81	70	70	64	66	28	71	98	784

Figure 2-3, 16th Street Mall Annual Incident Reports by Type, summarizes RTD's crash and incident report data by the four major-identified incident types.

Of particular interest for this analysis and project are pedestrian-related incident reports. From 2007 to 2017, RTD reported 72 claims involving pedestrians. Pedestrian incidents represent 9.1 percent of all reported incidents. In recent years, there is a lower trend in this crash type.

Figure 2-3. Annual Incident Reports by Type (2007-2017)

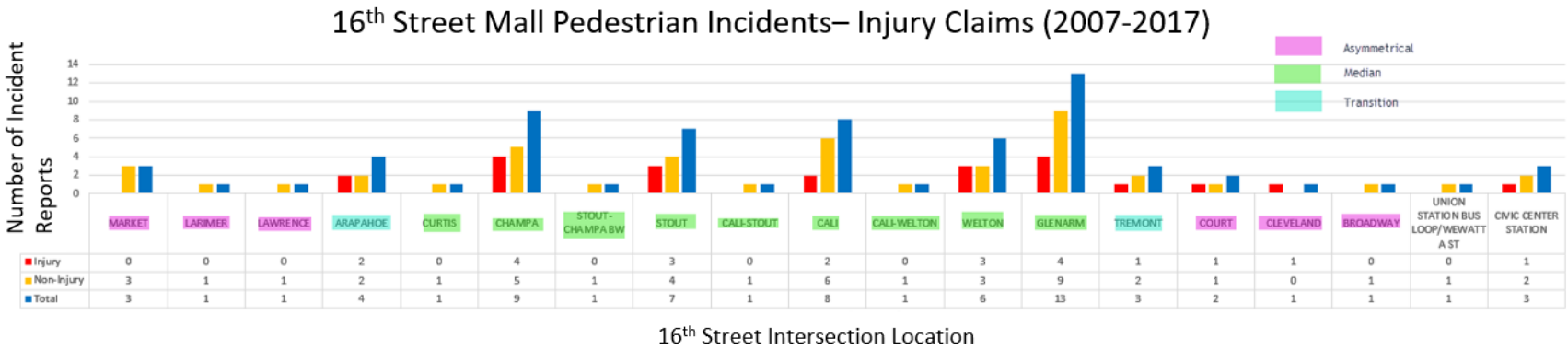


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Fixed Object	7	23	19	19	14	9	11	13	8	20	29	172
Another Vehicle	13	19	24	15	19	23	19	22	7	24	36	221
Pedestrian	2	9	12	11	10	11	6	3	0	4	4	72
Other	12	49	47	36	27	27	28	28	13	23	29	319
Total	34	100	102	81	70	70	64	66	28	71	98	784

2. Pedestrian Incident Reports by Location and Street Cross Section – 16th Street Mall

Using the data provided by RTD, pedestrian-related incident reports were located along the Mall based on the intersection locations provided by RTD. The result was a mapping of pedestrian-related incidents to the nearest intersection or other designated reference point. **Figure 2-4** shows this information by location. Most incidents occur in the median blocks.

Figure 2-4. Pedestrian Incident Reports by RTD (2007-2017)



	MARKET	LARIMER	LAWRENCE	ARAPAHOE	CURTIS	CHAMPA	STOUT-CHAMPA BW	STOUT	CALI-STOUT	CALI	CALI-WELTON	WELTON	GLENARM	TREMONT	COURT	CLEVELAND	BROADWAY	UNION STATION BUS LOOP/WEWATT A ST	CIVIC CENTER STATION
Injury	0	0	0	2	0	4	0	3	0	2	0	3	4	1	1	1	0	0	1
Non-Injury	3	1	1	2	1	5	1	4	1	6	1	3	9	2	1	0	1	1	2
Total	3	1	1	4	1	9	1	7	1	8	1	6	13	3	2	1	1	1	3

Overall, 63 pedestrian incidents were reported with 21 injury claims from 2007 to 2017. There were 42 noninjury pedestrian claims reported. The incidents were located by intersection as previously noted.

Total Reported Pedestrian-Bus Crashes and Incidents — 16th Street Mall from Market to Broadway by Cross Section

The incidents were located by intersection and stratified into three groups by roadway cross section:

1. Group 1: Median cross section
2. Group 2: Asymmetrical cross section
3. Group 3: Intersections located at transition points between median and asymmetrical cross sections

Group 3 was developed because it is not possible to assign incidents to a specific cross section—one side of the intersection is a median block cross section and the other is an asymmetrical block cross section. As shown in **Tables 2-1a, 2-1b, and 2-1c**, these data provide information relating to the frequency of incidents by group.

Also provided is information relating to the frequency of incidents at intersections. Based on these data, several intersections appear to have have a higher frequency of reported incidents. At this stage of analysis these intersections could be considered could be considered as "Candidate Hot Spots." Typically, these locations merit further investigation as the planning and design process proceeds as specific safety countermeasures may be appropriate. The intersections with the highest frequency of reported pedestrian-transit vehicle crashes and incidents are:

- Glenarm 13
- Champa 9
- California & California/Welton 9
- Stout & Stout/Champa 8
- Welton 6

Total Incidents 45

These five locations, all located in areas with median cross sections, account for 45 or 71 percent of all pedestrian-transit-related incidents along the 16th Street Mall corridor.

Table 2-1a. Asymmetrical Cross Section

Cross Section	Injury Claim	Non-Injury	Total
Market (West Section)	0	3	3
Larimer (West Section)	0	1	1
Lawrence (West Section)	0	1	1
Court (East Section)	1	1	2
Cleveland (East Section)	1	0	1
Broadway (East Section)	0	1	1
Total	2	7	9

Table 2-1b. Median Cross Section

Cross Section	Injury Claim	Non-Injury	Total
Curtis	0	1	1
Champa	4	5	9
Stout/Champa	0	1	1
Stout (Light Rail)	3	4	7
California/Stout	0	1	1
California (Light Rail)	2	6	8
California/Welton	0	1	1
Welton	3	3	6
Glenarm	4	9	13
Total	16	31	47

Table 2-1c. Transition: Asymmetrical/Median Cross Sections

Cross Section	Injury Claim	Non-Injury	Total
Arapahoe	2	2	4
Tremont	1	2	3
Total	3	4	7

3. Consideration of Pedestrian Data Related to Reported Crashes and Incidents

A review of pedestrian count data was conducted to provide information relating to pedestrian usage along the corridor. The pedestrian count data were from 2015 and 2016 (Gehl, 2016). The pedestrian data, while extensive, were oriented to provide counts on block-by-block segments and did not correlate well with the approach used to locate RTD incident data because RTD incident reports were reported by intersection. Also, counts were typically tallied on an hourly format by varying hours. To overcome these differences and variations in data collection and representation, the information was first organized into counts by location, an average hourly volume was then combined, and an average of the data were calculated. Essentially, count data from five block segments were identified.

The pedestrian-count data were collected on select blocks and it is assumed the average counts are representative of segments for immediate adjacent blocks. Pedestrian counts were taken on the following blocks: Lawrence to Arapahoe St., Arapahoe to Curtis St., Champa to Stout St., Welton St. to Glenarm Pl., and Court to Tremont Pl. For the asymmetrical blocks, a rounded average of 1,400 pedestrians per hour was determined. For the median block section, a rounded average of 2,200 pedestrians per hour was determined. Comparing the two volumes, the average volume for the median block count sites was approximately 57 percent greater. Based on these data, the median block section may have a greater intensity of pedestrian usage and therefore, the frequency of pedestrian-bus crashes becomes greater (47 RTD incidents for median block section versus 9 RTD incidents for asymmetrical block sections).

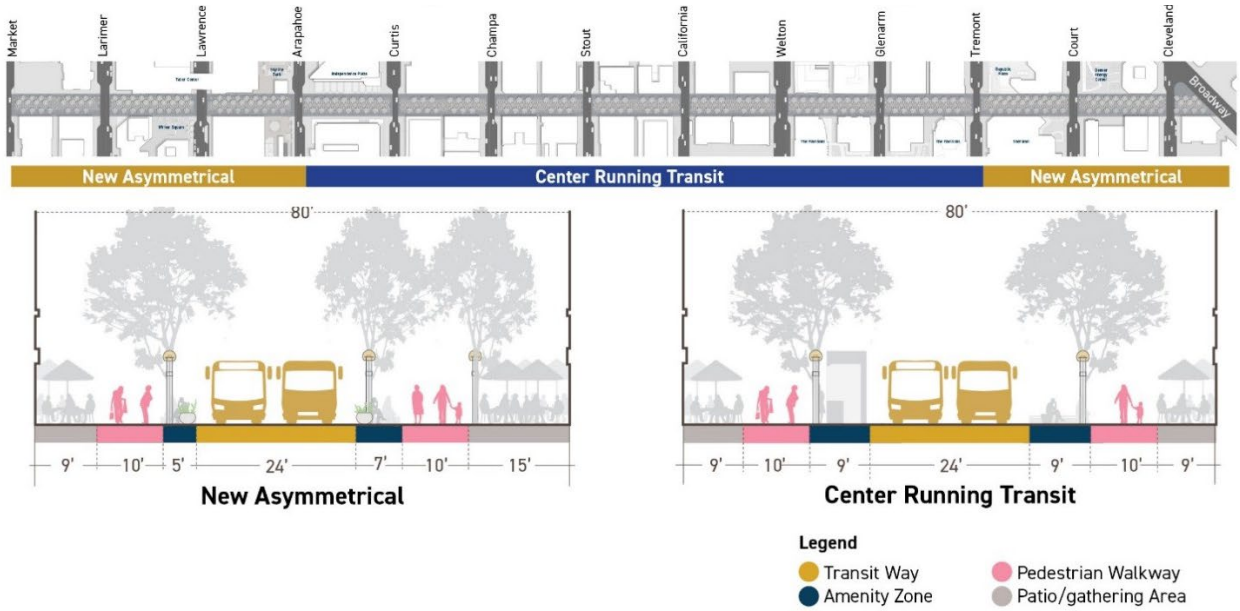
4. No Action Alternative

The No Action Alternative maintains the current situation and roadway cross sections for the Mall corridor, as illustrated in **Figure 2-1** in the EA. It is assumed that current RTD incident report trends previously identified would continue for this alternative and if pedestrian usage and/or transit service increases, then crashes and other incidents would likely increase. Improvements to intersections, such as improved access as required by the Americans with Disabilities Act (ADA), and intersection bulb-outs would not be implemented. Identified improvements to lighting would not be added. Finally, improvements to sidewalk and roadway surface would not be implemented.

5. Proposed Action

This section describes the Proposed Action (Locally Preferred Alternative [LPA]), including significant improvements, any changes in transit operations, and recommendations to mitigate impacts during construction. **Figure 2-5** illustrates the proposed transit way alignment, amenity zone, pedestrian walkway, and patio/gathering area.

Figure 2-5. Locally Preferred Alternative Cross-section Design



6. New Cross Section Design

The new cross section design provides a continuous two-way consolidated transit way, with no center median. Two 12-foot transit-way lanes would be provided, and sidewalk widths are generally increased except the existing asymmetrical sections, where the wide side of the cross section is decreased from 35 feet to 32 feet.

Based on a review of reported crashes for the corridor, the LPA would have a positive effect related to pedestrian and bus crashes and incidents.

An analysis of the existing conditions for the median and asymmetrical cross sections was conducted to study this issue. Summary incident report data are shown in **Table 2-1**, which compares the reported pedestrian-transit vehicle incidents reported for each cross section. The existing median section had 47 total reports and 16 pedestrian injury claims. The asymmetrical cross section had 9 total crashes with 2 pedestrian injuries. While the length of the existing median block cross section is longer than the asymmetrical block cross section, proportionally the incident report frequency for per unit length of the median section is much higher.

Creating space and/or visual and physical delineations between the transit way and pedestrian walkway. The sidewalk space outside of the transit way has been programmed for different uses: amenity zone, pedestrian walkway, and patio/gathering area (**Figure 2-5**). The area between the transit way and pedestrian walkway is the amenity zone, which acts as a buffer between pedestrians and transit use.

In function, this amenity zone provides a physical separation between the transit and pedestrian modes, while clearly defining the separation visually. This visual space is important because it provides sight distance needed for pedestrians to view oncoming transit vehicles and for transit operators to see pedestrians and other users in the corridor. For transit requirements, the buffer area provides a boarding pad and addresses accessibility needs – at least 60 inches by 96 inches is desirable and should be connected to an accessible pedestrian path of travel.

All of these elements serve to enhance safety and the pedestrian experience.

The proposed cross-section compared to the elimination of the median cross section reduces conflict points. A comparison of the incident report data indicates that the asymmetrical section has fewer reported incidents than the median section (**Table 2-1**).

The current median block cross section for pedestrians crossing the Mall results in two separate crossing maneuvers across the two separate transit lanes instead of a single crossing maneuver in the existing asymmetrical block cross section. This single maneuver would also result from the proposed two-way consolidated street. The asymmetrical block cross section or two-way consolidated design simplifies the pedestrian crossing maneuver, consolidating pedestrian crossing conflicts to a well-defined single location. The time needed for pedestrians to cross 16th Street is reduced as the length of the overall crossing maneuver is reduced.

This design also may improve the ability of transit drivers to see pedestrians because pedestrian crossing of transit lanes would be concentrated to one crossing (one consolidated bi-directional transit lane rather than two separate transit lane crossings) and the provision of the buffer zone in the proposed LPA could also improve the driver's ability to see pedestrians.

7. Curb Design

As part of the alternative development process, three alternatives were considered: the use of a vertical curb design, replacing the vertical curb with a pan with contrasting pavement materials, or a hybrid approach that implements vertical curbs at designated shuttle stops and a pan along the remainder of the transit way.

A literature search was conducted to identify comparable situations and to find national guidance for street facilities that have no curbs. PEDSAFE, an FHWA reference, is one of their most comprehensive references related to pedestrian issues and considerations. There is significant discussion on what conditions and criteria they recommend the application of a "shared street" or one that is curb-less. For a facility without a curb to be considered, it was emphasized that vehicles:

- Vehicles travel at slow speeds – at a minimum, approximately 10 to 15 miles per hour.
- This type of facility should be used only in special situations where all users travel at walking speeds, and there are equal volumes of pedestrians, bicyclists, and motorists.
- As a general rule, streets with greater than 100 vehicles per hour during the afternoon peak should not be considered.
- The design needs to keep vehicle speeds very low in order to make the streets safe for children.

With respect to the Mall, it is noted that the speed of the transit vehicles is higher because they also provide service to destinations external to the project limits within the corridor. In reviewing AASHTO documents, one of the functions of a curb is to "control access" (AASHTO, 2011). In the case of the Mall, the curb serves to help manage or control access between the pedestrian way and travel way for transit vehicles. This access control can help keep buses in the transit way during slippery conditions. Buses sometimes also use the curb to gain traction during slippery conditions. The high-friction pavement surface under the LPA would provide better traction during wet or icy weather and improve the existing slippery condition, and the

current shuttle fleet is equipped with dual rear tires that reduce slipping and sliding compared to the previous fleet. Further, the LPA would make use of a transit lane indicator to alert drivers when they are near the inner edge of the transit way.

Under the LPA a vertical curb would provide a physical barrier to keep slow-moving shuttles within the transit way in event of slippage and provides some limited delineation with the vertical feature at the edge of the transit way at designated shuttle stops. The pan would provide no physical barrier from a vertical curb between the transit way and amenity zone but does include vertical elements in the amenity zone such as trees, light poles, and fixed furnishings to provide a physical barrier between the transit way and the pedestrian walkway, if the slow-moving shuttles skid or slide during bad weather. The LPA also includes textured delineation of the pedestrian walkway, between the transit way and the amenity zone, and within the pedestrian walkway.

FHWA recommends using multiple techniques to provide "layers of navigational information to supplement and/or complement other design features" to create a consistent design language that enables all users to navigate the street (2017). The Project team is proposing truncated domes, textured strips, directional indicators, amenity zones with fixed furnishings, and transit lane indicators to meet ADA guidelines and to sufficiently delineate the edge of the transit way to create a safe condition.

8. Lighting

The existing lighting of the Mall was recently replaced in 2016. The preferred alternative would reuse lighting where possible and additional lighting would be provided where needed. National safety studies indicate the quantitative effect of lighting improvements (Elvik and Vaa, 2004). Where no lighting is present (in the case of possible dark spots in the project limits), adding lighting can reduce injury accidents because of darkness by 28 per cent and non-injury accidents because of by 17 percent. The effects of improved lighting have also been quantified, doubling the lighting level, which can decrease injury accidents because of darkness by 8 percent and non-injury accidents because of darkness by 1 percent.

Lighting conditions within the Project limits were considered in the *Evaluation of Existing Lighting Conditions* (Clanton and Associates, 2017). From a safety perspective, continued evaluation of how to improve lighting on the Mall is recommended.

9. Changes to Cross Streets

From a safety perspective, the addition of bulb-outs on cross streets and ADA improvements (including detectable markings) are desirable, as they should calm traffic on cross streets and provide additional refuge for pedestrians. As noted earlier, the elimination of a median consolidates the pedestrian crossing to one location and has a positive effect on the pedestrian conflicts. In addition, it is recommended that appropriate cross walk and other appropriate pavement markings are consistent with the Manual of Uniform Traffic Control Devices, and RTD and other appropriate standards.

10. Short-term Impacts (Construction)

In addition to those mitigation measures suggested in the description of the LPA, attention to construction impacts to business in terms of maintaining access, signage to a business, and communication with stakeholders (public and businesses) should be made.

3. References

American Association of State Highway and Transportation Officials (AASHTO). 2010. *Highway Safety Manual, 1st Edition.*

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TECHNICAL MEMORANDUM

Transit Operations Technical Memorandum

TO:	Regional Transportation District
FROM:	CH2M HILL Engineers, Inc.
DATE:	October 2018

1. Introduction to Analysis

This section describes the short-term (construction) direct and long-term (operational) impacts of the Locally Preferred Alternative (LPA) of the 16th Street Mall (Mall) Alternative Analysis and Environmental Clearance Project (Project) on transit operations. The analysis demonstrates that the Free MallRide is a critical connector to Regional Transportation District (RTD) transit operation, and that the LPA would have varying degrees of short-term impact to its operation depending on the method of construction. The degree of impact could range from negligible to potentially significant. No long-term operational impacts to the Free MallRide are anticipated.

The following narrative includes an overview of applicable laws, regulations, and orders; summary of methodology used for analysis; assessment of existing conditions; and description of environmental consequences and mitigation.

A. Laws, Regulations, and Orders

The Federal Transportation Administration (FTA) Office of Planning and Environment provides the following guidance for assessing transportation impacts (FTA, 2016):

> *By definition, any proposed transit project will potentially influence elements of the local and regional transportation system, including transit facilities and services, bicycle and pedestrian facilities, road traffic patterns and volumes, and parking. Other transportation network impacts may occur, such as to airports, freight railways, or other type of travel. As such, environmental documents for transit projects should include a discussion of potential transportation impacts. For example, the level of analysis depends on the magnitude and scale of the project. In general, transit grant applicants should consult with FTA and local and/or state traffic engineering and planning officials as early as possible to identify potential transportation impacts and determine the level of analysis that will be needed for the environmental document.*

How are impacts to transit operations considered?

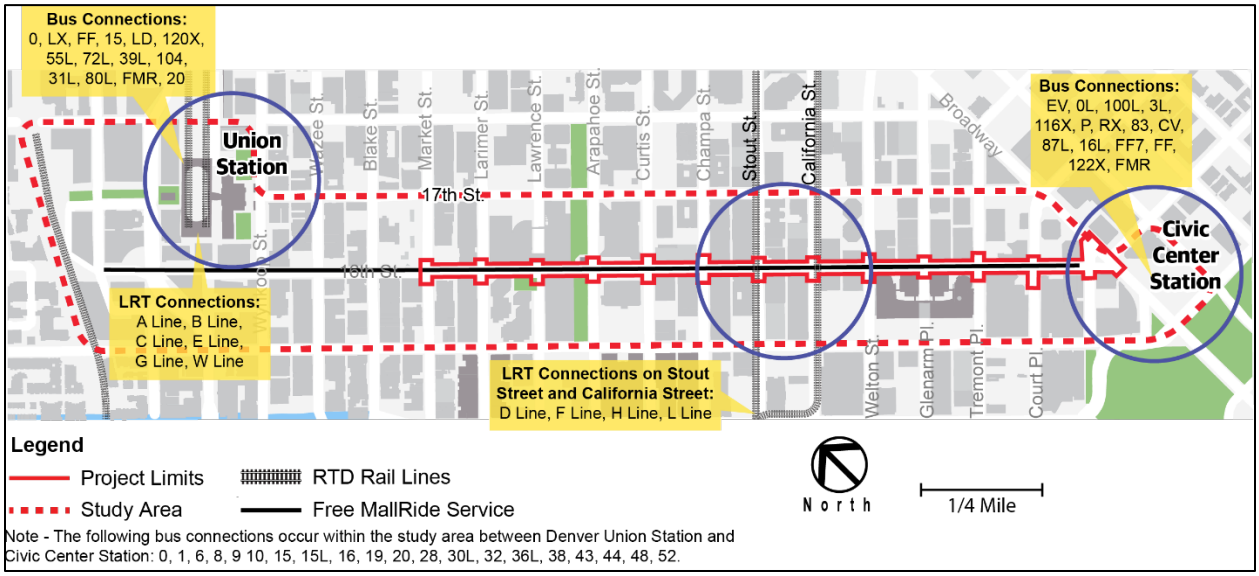
Construction and operation of new transit facilities and/or expansion of transit facilities and services can affect existing transit operations. The environmental documentation for projects should discuss potential impacts of project construction and operation on transit systems. Specific transit considerations for the construction and operation of transit projects include, but are not limited to changes in:

1. *Transit service (e.g. frequency, hours of service, network, etc.)*
2. *Travel times*
3. *Transit ridership and demand*
4. *Bus stop locations and access*
5. *Station access and circulation*

2. Affected Environment

The study area for this analysis extends beyond the Project limits to include the area between DUS on the west, Civic Center Station (CCS) on the east, 15th Street on the south, and 17th Street on the north (**Figure 2-1**). The following information on the affected environment is provided to serve as a baseline from which impacts are defined. As shown on **Figure 2-1**, Denver Union Station (DUS), Light Rail Transit (LRT) connections on Stout and California streets, and Civic Center Station (CCS) function as a system to distribute metro Denver transit users accessing the city. These connections, along with the stop on Wynkoop Street, account for over 88 percent of total daily ridership on the Free MallRide, which travels the Mall between DUS and CCS.

Figure 2-1. Key Connections



The Free MallRide is supplemented by the Free MetroRide, which also originates and terminates at DUS and Civic Center. In addition, multiple bus routes feed into the Project area. Any changes resulting from the implementation of the LPA on this integrated transit system are considered impacts to transit operations.

This section discusses each of the following components of this integrated and interdependent system:

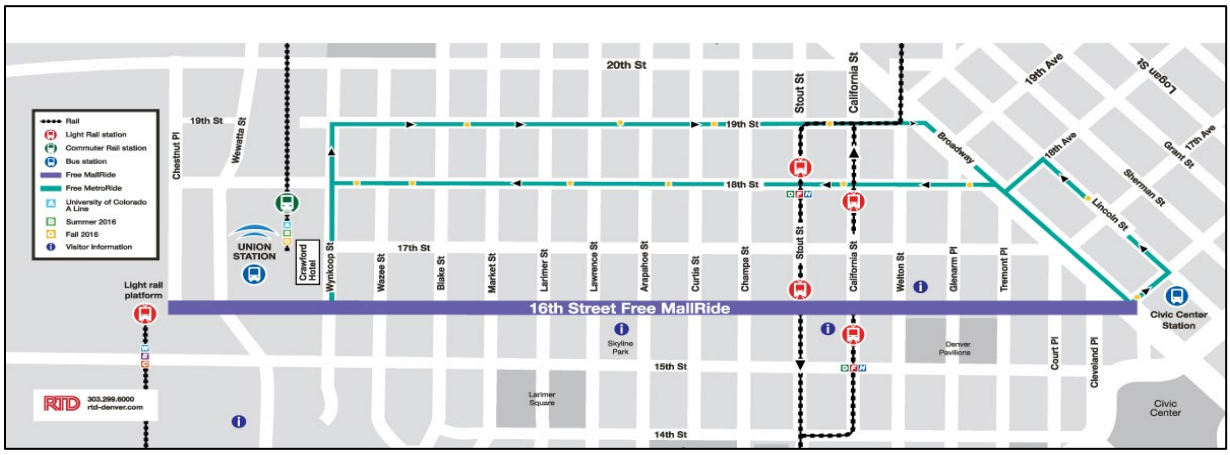
- Free MallRide
- Free MetroRide
- DUS
- CCS
- Other transit connections

A. Free MallRide

1. Background and History

As shown on **Figure 2-2**, the 1.5-mile Free MallRide shuttle was designed as a free transit shuttle bus to service DUS and CCS, the major bus stations/terminals in downtown Denver. Placing the shuttle service on the Mall decreased the number of buses on 16th and 17th Streets by funneling express and regional commuter buses to bus terminals. Today, routes along the Mall eliminate approximately 870 bus trips on downtown streets (Marsella, 2008, pers. comm.), reducing congestion in the downtown area.

Figure 2-2. Free MallRide Alignment



2. Transit Connections are Important

According to a survey conducted for RTD by BBC Research and Consulting in 2012, 70 to 80 percent of Free MallRide passengers are also revenue passengers. Riders may transfer from an RTD bus or the LRT before riding the Free MallRide, transfer to an RTD bus or the LRT after riding the Free MallRide, or have an RTD Eco Pass, Monthly Pass, or Student Pass (BBC, 2012).

3. Fleet

The fleet has recently been replaced with 36 fully electric low-floor buses with a maximum capacity of 90 passengers, as shown on **Figure 2-3**. The new electric buses are highly efficient and produce tail pipe emissions. Because the new shuttles are operating in a pedestrian environment, they offer unique features setting them apart from other RTD vehicles. The operator cabin is located on the right-hand side of the new buses and the floors are low and flat. Three wide doors provide easy and quick boarding. However, because of these

characteristics, the new electric buses are not designed to operate off the Mall, on city streets. The buses are equipped with ramps for ADA accessibility.

Figure 2-3. Electric Shuttle Buses

4. Financial Considerations

The RTD cost information database *Service Performance 2016* includes the cost per boarding of its bus and rail services. The most recent year average bus cost, including labor, materials and depreciation, was $5.19 per boarding for rides on routes serving the Central Business District and $5.54 for bus rides system-wide. By comparison, the Free MallRide cost was $1.04 per boarding. The total annual cost for the Free MallRide was $12.3 million, and the system had 11.8 million boardings.

The FTA considers the Free MallRide to be a "fixed guideway," which affects the federal funding RTD receives as reimbursement for its operational funding. That is, it is funded on the same basis (annual passenger miles [APM]) as is their LRT and commuter rail operations. The proportionate (shuttle APM/total APM) share of FTA funding attributed to the Mall shuttle equals about $500,000 per year. This is important to the analysis of transit operational impacts. For example, if the project construction requires a bus detour off the Mall, RTD would get no financial support for the associated passenger miles.

5. Shuttle Service Plans

The following information was taken directly from RTD staff memoranda to the Project team as part of this planning effort (Bell and Tung, 2017).

RTD operates under three different service plans on the Mall, based on the day of the week: there are Weekday, Saturday and Sunday/Holiday schedules. In the January 2016 service plan, the Free MallRide started running at 4:59 a.m. on weekdays, 5:30 a.m. on Saturdays, and 6:30 a.m. on Sundays and holidays. Service continued throughout the day, with the last complete round-trip of the night starting at 1:21 a.m. from DUS. The service frequency ranged from every 90 seconds to every 15 minutes, based on the time of day. As shown in **Table 2-1**, on average, there are 458 trips on the weekdays, 205 on Saturday, and 184 on Sundays. The mall shuttles ran approximately every 90 seconds to 3 minutes during the following high ridership time periods (Bell and Tung, 2017):

- Morning peak period: 6 a.m. - 9 a.m.
- Lunch: 11 a.m. - 1:00 p.m.
- Evening peak period: 4:00 p.m. - 6:00 p.m.

Under normal operations, the Free MallRide stops at each block.

Table 2-1. Mall Shuttle Daily Service Plan for January 2016

Time	Weekday Leave Civic Center	Saturday Leave Civic Center	Sunday Leave Civic Center	Time	Weekday Leave DUS	Saturday Leave DUS	Sunday Leave DUS
4 to 5 a.m.				4 to 5 a.m.	1		
5 to 6 a.m.	8	2		5 to 6 a.m.	11	3	
6 to 7 a.m.	26	4	3	6 to 7 a.m.	34	4	4
7 to 8 a.m.	40	4	4	7 to 8 a.m.	40	5	5
8 to 9 a.m.	35	9	11	8 to 9 a.m.	29	13	10
9 to 10 a.m.	15	14	11	9 to 10 a.m.	15	13	10
10 to 11 a.m.	19	13	11	10 to 11 a.m.	23	14	11
11 to 12 p.m.	37	15	14	11 to 12 p.m.	40	14	14
12 to 1 p.m.	40	14	13	12 to 1 p.m.	40	13	13
1 to 2 p.m.	39	13	13	1 to 2 p.m.	32	13	13
2 to 3 p.m.	20	13	14	2 to 3 p.m.	20	14	14
3 to 4 p.m.	26	14	13	3 to 4 p.m.	33	13	13
4 to 5 p.m.	40	13	13	4 to 5 p.m.	40	13	13
5 to 6 p.m.	39	13	12	5 to 6 p.m.	32	14	12
6 to 7 p.m.	20	14	9	6 to 7 p.m.	19	13	9
7 to 8 p.m.	14	10	8	7 to 8 p.m.	14	10	8
8 to 9 p.m.	11	10	8	8 to 9 p.m.	9	9	8
9 to 10 p.m.	9	9	8	9 to 10 p.m.	8	8	8
10 to 11 p.m.	8	8	8	10 to 11 p.m.	8	8	8
11 to 12 a.m.	5	6	5	11 to 12 a.m.	4	5	5
12 to 1 a.m.	4	4	4	12 to 1 a.m.	4	4	4
1 to 2 a.m.	3	3	2	1 to 2 a.m.	2	2	2
Total (Daily)	458	205	184	Total (Daily)	458	205	184

Source: Bell and Tung, 2017

6. Current Ridership by Peak Hours and Day of Week

As shown in **Table 2-2**, the average weekday ridership for January 2016 was 38,760, the average for Saturdays was 21,708, and the average for Sundays and holidays was 14,724. **Tables 2-3, 2-4, and 2-5** present ridership by time of day. In general, the midday and evening timeframes are the busiest.

Table 2-2. Daily Ridership, Weekday vs Weekend

Schedule	Average Daily Ridership
Weekday	38,760
Saturday	21,708
Sunday	14,724

Source: Bell and Tung, 2017

Table 2-3. Weekday Ridership by Time Period

Time Period	Time	Average Ridership
A.M. Peak	6 a.m. to 9 a.m.	6,552
Midday	9 a.m. to 3 p.m.	16,023
P.M. Peak	3 p.m. to 6 p.m.	10,775

Source: Bell and Tung, 2017

Table 2-4. Saturday Ridership by Time Period

Time Period	Time	Average Ridership
A.M. Peak	6 a.m. to 9 a.m.	1,109
Midday	9 a.m. to 3 p.m.	8,616
P.M. Peak	3 p.m. to 6 p.m.	5,937

Source: Bell and Tung, 2017

Table 2-5. Sunday/Holiday Ridership by Time Period

Time Period	Time	Average Ridership
A.M. Peak	6 a.m. to 9 a.m.	899
Midday	9 a.m. to 3 p.m.	6,714
P.M. Peak	3 p.m. to 6 p.m.	4,192

Source: Bell and Tung, 2017

7. Boarding and Alighting by Stop

As shown in **Table 2-6**, the end-of-line stops, CCS and DUS, have the highest daily boardings and alightings. The stops at the LRT stations on California and Stout streets also have a high level of activity, and the stop at Wynkoop Street also provides significant ridership. These five connections account for approximately 88 percent of total daily riders; stops other than these account for only 12 percent of total ridership.

Table 2-6. Boarding and Alightings by Stop

Stop	Boardings	Alightings	Total	Percentage
Civic Center Station	4,977	3,911	8,888	23
Union Station	44,68	3,927	8,395	22
16th/Stout Street	2,892	4,308	7,200	19
16th/California Street	2,805	2,578	5,384	14
16th/Wynkoop Street	2,134	2,370	4,505	12

Source: RTD, 2017a

8. Future Ridership

RTD developed ridership forecasts for the Free MallRide and Free MetroRide using the RTD trip-based travel demand model (Compass 5.0). **Table 2-7** shows the ridership forecasted for horizon year 2035 using the Denver Regional Council of Governments socioeconomic datasets from December 2016.

Table 2-7. Project Ridership, Free MallRide and Free MetroRide

Route	2016	2035	Annual Growth (percentage)
Free MallRide	38,760	70,400	4
Free MetroRide	2,600	6,600	8
Total	41,360	77,000	4

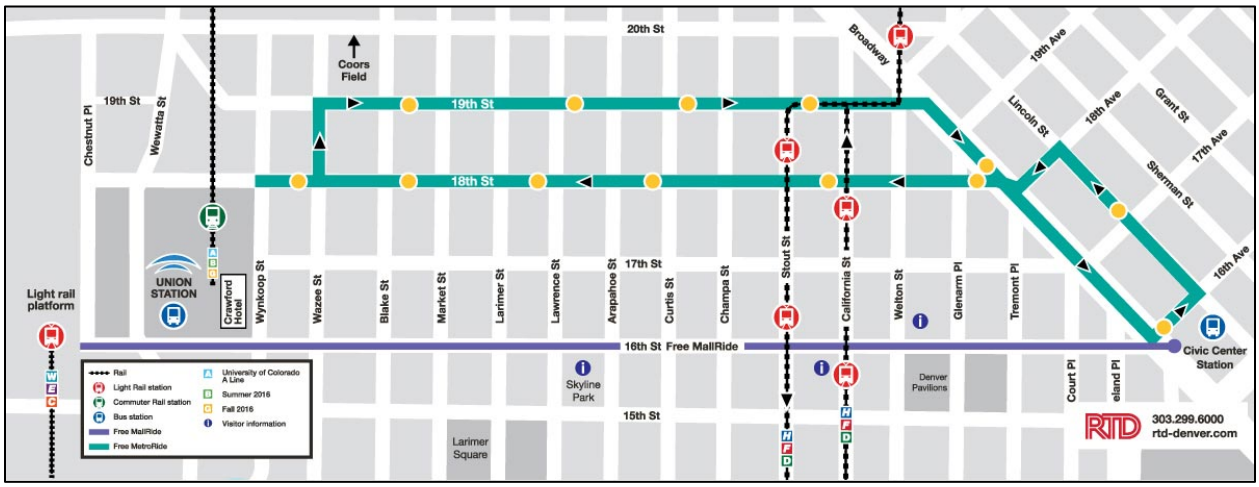
Source: RTD, 2017a and 2017b

B. Free MetroRide

RTD added a second shuttle, the Free MetroRide, in downtown Denver with the opening of the DUS bus concourse in 2014. The second downtown shuttle was included in the FasTracks Program to help alleviate peak period crowding on the Mall shuttle that was forecast with the addition of the new rail and bus rapid transit corridors. With limited stops between DUS and CCS, the Free MetroRide's alignment along 18th and 19th Streets provides a travel option to the Free MallRide during peak periods (**Figure 2-4**). The 18th/19th street alignment was selected in 2005 through the *Downtown Multimodal Access Plan* (CCD et al., 2005) because it provides a direct connection to over 55 percent of the employment in downtown. As shown in **Table 2-7**, the daily ridership of 2,600 is modest compared to the Free MallRide; the lower ridership may be attributed to its fewer stops and restricted period of operation.

As it currently operates, the Free MetroRide is intended mainly to transport downtown commuters. The service runs during typical weekday peak commute times (that is, from 5:00 a.m. to 9:08 a.m. and 2:30 p.m. to 6:35 p.m.) and provides convenient connections to buses, the LRT, and commuter rail. The Free MetroRide could be considered to function as an alternative service to and as a mitigation measure during the construction of the LPA. Information on the operating cost of the Free MetroRide is included with the information provided for the Free MallRide.

Figure 2-4. Free MetroRide



1. Service Plan

The Free MetroRide makes 14 stops on 18th and 19th streets during each round trip between DUS and CCS. The stops markers are distinct from other RTD shuttle stops and have a white canopy, a marker with a map of the route and downtown area, or both. The following route descriptions and the schedule in **Table 2-8** provide information for these 14 stops along the route:

Union Station to Civic Center Station:

- Union Station Bus Concourse
- 19th Street and Blake Street
- 19th Street and Lawrence Street
- 19th Street and Curtis Street
- 19th Street and Stout Street
- Broadway and 18th Street

Civic Center Station to Union Station:

- 17th Avenue and Lincoln Street
- 18th Street and Glenarm Place
- 18th Street and California Street
- 18th Street and Curtis Street
- 18th Street and Lawrence Street
- 18th Street and Market Street
- 18th Street and Wazee Street

Table 2-8. Free MetroRide Schedule

Time of Day	Stop	Union Station Gate 13	Union Station Gate 22	19th and Blake	19th and Lawrence	19th and Curtis	19th and Stout	Broadway and 18th	Civic Center Station	Lincoln and 17th	18th and Glenarm	18th and California	18th and Curtis	18th and Lawrence	18th and Market	18th and Wazee
A.M.	First	5:02	5:03	5:05	5:07	5:08	5:09	5:10	5:14	5:15	5:17	5:19	5:21	5:22	5:24	5:26
A.M.	Last	9:13	9:14	9:16	9:18	9:19	9:20	9:22	9:14	9:15	9:18	9:19	9:22	9:23	9:24	9:26
P.M.	First	2:26	2:27	2:30	2:31	2:33	2:34	2:36	2:29	2:30	2:32	2:34	2:36	2:37	2:38	2:39
P.M.	Last	6:36	6:37	6:39	6:41	6:42	6:43	6:45	6:49	6:50	6:52	6:53	6:55	6:56	6:57	6:58

2. Financial Considerations

The Free MetroRide bus service cost $0.98 per passenger boarding in 2016. Total annual costs in 2016 for the Free MetroRide were $546,500, with 557,005 boardings.

C. Denver Union Station

DUS is the main railway station and central transportation hub for RTD's transit operation. The station includes the historic terminal building, commuter rail train platforms (**Figure 2-5**), a 22-gate underground bus facility that serves 16 distinct bus routes (including the Free MallRide and Free MetroRide services), and an LRT that serves the C, E, and W lines. The rail and bus connections to DUS, which directly and indirectly affect existing and future ridership on the Free MallRide and the Free MetroRide, are listed below and shown on **Figure 2-6**.

Figure 2-5. DUS Commuter Rail Platforms

The following are rail routes at Denver Union Station:

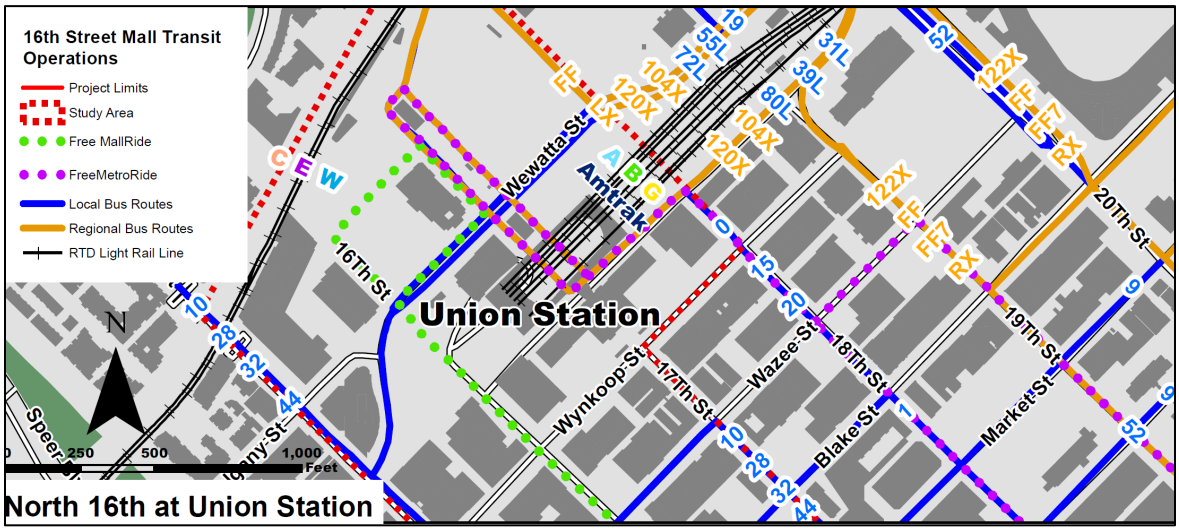
- A (commuter rail to Denver International Airport)
- B (commuter rail to Westminster)
- C (LRT to Littleton)
- E (LRT to Lone Tree)
- W (commuter rail to Golden)
- G (commuter rail to Arvada/Wheat Ridge coming soon)
- N (commuter rail to Commerce City/ Thornton/Northglenn coming soon) Heavy Rail (Amtrak)

The following are bus connections at Denver Union Station:

- 0 South Broadway
- 15 East Colfax Avenue
- 19 North Pecos
- 20 20th Avenue
- 31L North Federal Limited
- 39L North Colorado Limited
- 55L Olde Town Arvada Limited
- 72L Quaker via Ward Limited
- 80L West 80th Limited
- 104X Commerce City/Denver Express
- 120X Thornton/Wagon Road Express

- FF1/FF2/FF3/FF6 Denver/Boulder
- L/LX/LNX/LSX Longmont/Denver
- Free MallRide 16th Street Mall
- Free MetroRide 18th/19th Street to Civic Center Station

Figure 2-6. Transit Connections at Denver Union Station



D. Civic Center Station

As the eastern bookend of the Free MallRide, CCS serves as an important hub for RTD's transit service (**Figure 2-7**). It accommodates nearly 15,000 passenger movements per day. As a complement to the renovation of DUS, RTD recently spent $31 million updating CCS. These improvements were coordinated with the Civic Center Transit District Plan and produced under a partnership of RTD, the City and County of Denver, the Downtown Denver Partnership, and the Downtown Denver Business Improvement District. The new CCS includes the following features:

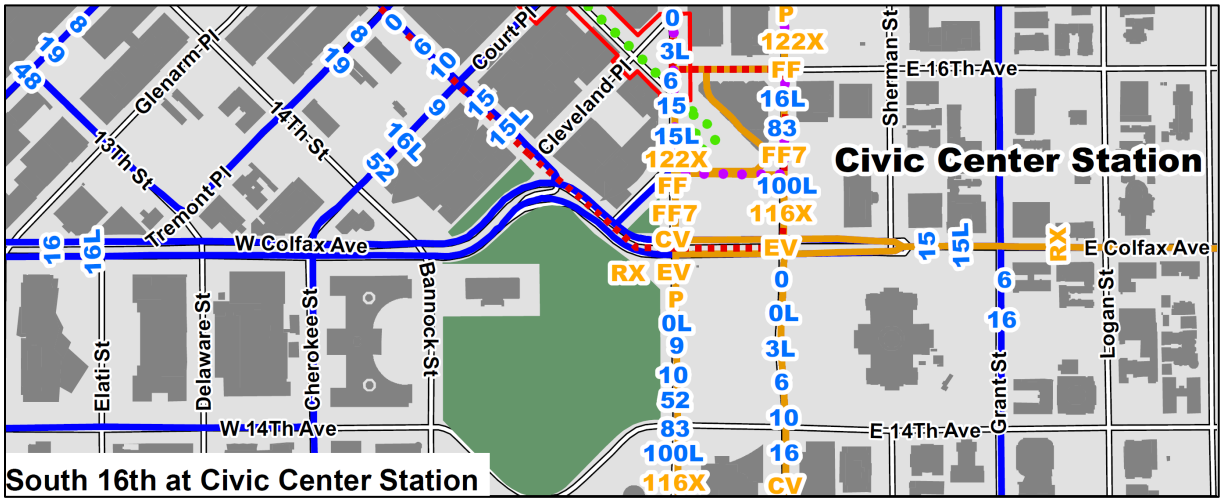
- A building structure that is easier to maintain and repair long-term
- An open and welcoming environment design
- Land parcel preserved for future development opportunities
- Nine bus bays
- Glass-enclosed terminal building
- Bus concourse rebuild
- Bus ramp extension connecting Broadway to Lincoln
- Open view from 16th Street Mall to the State Capitol

Figure 2-7. Civic Center Station

1. Bus Routes

As shown on **Figure 2-8**, the following routes have been assigned gates at the new CCS: 0L, 3L, 16L, 83D, 83L, 87L, 100L, 116X, 122X, CV/CS/CX, EV/ES/EX, FF4, FF7, P, R/RC/RX, Free MallRide, and Free MetroRide.

Figure 2-8. Bus Routes Feeding Civic Center Station



E. Other Transit Connections

Numerous bus routes connect with the Free MallRide between DUS and CCS, and the LRT provides important connections at California and Stout streets (**Figure 2-9**). These connections are summarized in **Table 2-9**.

Figure 2-9. Other Transit Connections Feeding the 16th Street Mall Mainline

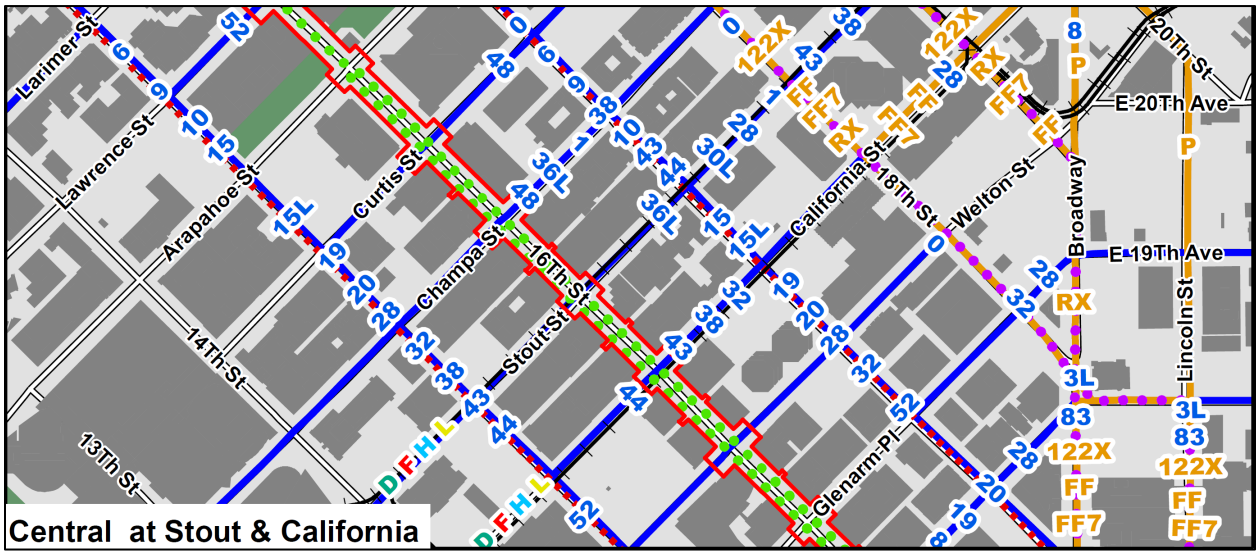


Table 2-9. Other Transit Connections Feeding the 16th Street Mall Mainline

Intersection	Transit Service
Tremont Place and 16th Street Mall	• Bus Routes – 8 – 19 – 20 – 28 – 32 – 52
Welton Street and 16th Street Mall Stout Street and 16th Street Mall • Bus Routes – 1 – 30L – 36L	• Bus Routes – 0
16th Street/California Station	• Rail (LRT) Routes – D – F – H
16th Street/Stoughton Station	• Rail Routes – D – F – H
Curtis Street and 16th Street Mall	• Bus Routes – 8 – 48

Intersection	Transit Service
Lawrence Street and 16th Street Mall	• Bus Routes – 15 – 20 – 38 – 52
Market Street and 16th Street Mall	• Bus Routes – 1 – 6 – 9 – 19L – 43
Blake Street and 16th Street Mall	• Bus Routes – 1
Wazee Street and 16th Street Mall	• Bus Routes – 10 – 19 – 28 – 32 – 44

3. Impact Evaluation

A. Methodology for Impact Evaluation

The impacts of the Project are anticipated to be limited to the construction phase, because it has been agreed that the RTD service plan for the Free MallRide will remain unchanged after implementation of the LPA. Short-term impacts of construction would involve possible activities that could affect bus travel times and access to the Free MallRide and erode ridership. The extent of the impacts would, as detailed here, be dependent on construction phasing, means and methods. Five possible construction scenarios have been postulated to provide a range of conditions that would affect transit operations: Options 1 through 4, with two sub-options under Option 4. It should be noted that the RTD Compass Model travel demand model was not used for this analysis.

RTD staff contributed to the development of this section. The methodology consisted of meetings held with RTD's service planners to estimate the bus ridership losses of each scenario based on experience with past construction projects. Ridership erosion is based on RTD experience with the erosion of bus ridership associated with previous construction activities at DUS and CCS. During the DUS and CCS construction projects, RTD observed that ridership was reduced from 46,000 per day to 39,000 per day, or about 15 percent.

The consultant met with RTD on February 21, 2018, to brainstorm the possible effects to ridership of each construction scenario. It was concluded that ridership reduction of 15 to 20 percent was assumed for Options 1 and 2, with reductions of as much as 30 to 40 percent

for Options 3 and 4. The higher value for the latter options is because of the assumption that the general inconveniences of construction combined with an out-of-direction detour and increased travel times would represent a high disincentive for ridership.

The components of increased cost caused by prolonging the construction schedule included general and administrative (G&A) costs, maintenance of traffic (MOTO, financing (interest), and inflation; this section presents the methodology for determining each. All analyses assume a construction cost of $140 million.

Contractor G&A is assumed at 7 percent of construction, or $9.8 million, but will be affected by the longer construction time for some of the options. Estimating for this longer time period can be difficult, as each construction firm approaches this differently; however, for the purposes of this evaluation, it is assumed that the 40-percent-longer schedule (3.5 years/2.5 years) would translate into a G&A of approximately $4 million more. It should also be noted that risks are increased with options that maintain transit operations on the Mall, which will translate to higher contingencies in the contractor's bid. Hiring of a Construction Manager/General Contractor (CM/GC) contractor may help to minimize these contingencies, as some risks would be shared with the owner.

MOT is assumed at 20 percent of project cost. These funds will be expended for flaggers, safety and constructed facilities to provide the detours, and other accommodations required for construction. It is felt that the options allowing transit to operate on the Mall during construction will require more construction activities, increasing costs. However, given the lack of design information, this value cannot be quantified. It is assumed that a schedule that is 40 percent longer will accrue a proportionate level of added MOT.

Interest is assumed at 6 percent for a short-term construction loan. To simplify the calculation, the mid-point of construction is assumed and it is further assumed that 60 percent of the funds will have been spent at this time. The calculation assumes 60 percent of expended funds times 6 percent, times the months at the mid-point of construction. Total interest is $8.8 million for the 3.5-year schedule versus $6.3 million for the 2.5-year schedule, a difference of approximately $2.5 million.

Inflation is assumed at 3 percent. Over 2.5 years, it is assumed that the contractor would include approximately $4.2 million for inflation. For a 3.5-year schedule, this value would increase by about 40 percent to $5.9 million, for a difference of approximately $1.7 million.

For the purposes of this environmental assessment (EA), a year of additional construction is assumed to cost from $15 million to $20 million.

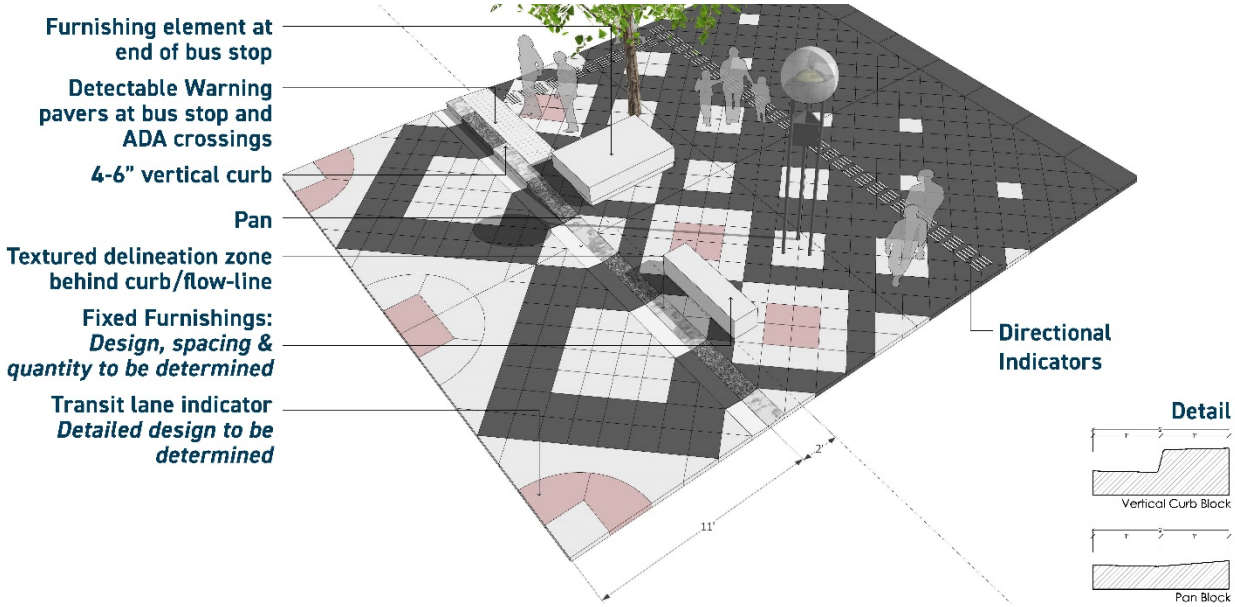
B. No Action Alternative

Transit service on the Free MallRide, the Free MetroRide, and other bus and rail services would remain unchanged with the No Action Alternative. As occurs today, unplanned maintenance of the Mall paver system would continue to periodically disrupt the operation of the Free MallRide. The extent of these disruptions on future service has not been quantified but would likely increase with time, as the Mall paver system deteriorates further.

C. Locally Preferred Alternative

Both the existing asymmetrical blocks and the existing median blocks have a vertical curb (consisting of a 2-foot-wide linear element in the pavement pattern) on the outside of each transit-way lane and a pan (also consisting of a 2-foot-wide linear element in the pavement pattern) on the inside of each transit-way lane. Under the LPA, the edge of the transit way would be defined by a vertical curb at shuttle stops and a pan everywhere else within the same 2-foot-wide linear pavement pattern, so Free MallRide buses would operate within the linear elements of the pattern. The LPA would also include a transit lane indicator in the transit way to help guide the bus drivers. The transit way indicator technique will be decided in subsequent design phases and be consulted on under Section 106. **Figure 3-1** illustrates methods of delineating the transit way.

Figure 3-1. Delineation of Transit Way



The proposed design of the transit way would not represent a long-term impact on the operations of the Free MallRide, as the current service plan would remain in place after Project construction and boarding and alighting would occur as they do today. The height for boarding and alighting buses would continue to be 10 inches with a vertical curb at the shuttle stops. The LPA would comply with American Public Transportation Association guidelines, which call for a step under 16.5 inches. The shuttles contain foldout ramps for accessibility; these ramps are designed to work with a vertical curb or deploy directly to the ground. The pan would not represent a long-term impact on operations as the pattern will produce an edge for the transit way that would be emphasized by fixed furnishings that produce a visual guide.

The LPA would use a high-friction pavement surface, which would improve Free MallRide operation and improve the lack of traction that hinders Free MallRide operation on the existing pavement system. Further, the LPA would provide a small physical barrier at shuttle stops to contain the Free MallRide shuttles in the transit way if they slip on the pavement while starting or stopping during inclement weather. Additionally, fixed furnishings in the amenity zone would provide a physical barrier between the transit way and pedestrian areas should a shuttle exit the transit way.

Short-term, construction-related impacts would occur under the LPA. There would be no short-term indirect construction impacts on transit. The extent of construction impact would be highly dependent on the means and methods deployed by the construction contractor.

This EA considers four possible approaches to construction phasing to demonstrate the possible extent of impacts. RTD prefers phasing Option 1 and Option 2, both of which would retain Free MallRide service on the Mall throughout construction. The approaches described here are not final; each of these, as well as possible similar approaches, would be evaluated further as more Project information is available. However, they serve as bookends for assessing a range of likely impacts. From least to greatest impact on transit ridership and operations, the following options have been considered:

- **Option 1: Retain Bus Service within the Mall Right-of-Way during Construction**. Two-way transit service would be maintained on the Mall during construction by shifting the bus guideways south and north within the Mall ROW. It is assumed to result in a prolonged construction schedule and higher construction cost. For the purpose of this analysis, a 3.5-year construction period was assumed.
- **Option 2: Construct Mall in 1- to 2-Block Increments with Contra-Flow Bus Operation**. The Project would be segmented in one- or two-block construction packages, and transit service would remain on the Mall. The block under construction would operate as a single lane guideway with bi-directional service (buses going in each direction on one lane, timed to avoid collision). With a two-block construction package, flaggers would be required. This option is expected to have a construction schedule and cost impact more favorable than Option 1. For the purpose of this analysis, a 3.5-year construction period was assumed.
- **Option 3: Construct Mall in 3 or More Block Increments with Detour**. The Project would be segmented into three- or four-block construction packages, and transit service would be detoured to adjoining streets (most likely 15th and 17th streets). Headways would be reduced from 1.5 to 3.0 minutes during the peak morning and evening periods. Supplementary service would be provided on the Free MetroRide as mitigation to anticipated lost ridership on the Free MallRide. It is probable that flaggers would be required to operate the detour. This option is expected to have a construction schedule and cost impact lower than Options 1 and 2. For the purpose of this analysis, a 2.5-year construction period was assumed.
- **Option 4: Relocate Bus Operations during Construction**. The Free MallRide service would be taken off the Mall during construction and replaced by another parallel service, such as a modified operation of the Free MetroRide on 18th and 19th streets. This analysis assumed operation on 18th and 19th streets, but other parallel streets could also be considered, each with their own set of challenges. Two sub-options were considered: Sub-option A assumes that the buses would operate in a mixed flow, and Sub-option B considers dedicating a traffic lane for buses only. This option is expected to result in the shortest construction schedule. For the purpose of this analysis, a 2.5-year construction period was assumed.

There are many permutations of these four options; all have pros and cons regarding cost, time, and impacts to transit ridership and the community. The CM/GC method would incorporate the construction discipline into the final design of the LPA, allowing creative approaches to reduce impacts and likely improve on previously discussed concepts. The resulting recommendation

would be endorsed through a Construction Mitigation Plan (CMP) process as described under Mitigation.

1. Transit Impacts

The possible short-term, direct and indirect construction impacts anticipated with each theoretical phasing option are summarized in **Table 3-1**. Further detail is given in the paragraphs following the table. A negligible impact on other localized downtown bus routes and LRT service is possible during construction under all phasing options. However, no additional impacts are expected to RTD's regional transit service during the construction of the LPA.

Option 1: Retain Bus Service within the Mall Right-of-Way during Construction. The short-term construction impacts to annual transit ridership on the Free MallRide for Option 1 would likely be less than Options 3 and 4 but comparable to Option 2. There would be no change in the service plan under this option, meaning that the number and size of buses per day, hours of operation, and stops would stay the same. It is anticipated that the travel time from DUS to CCS during construction would be comparable (within 5 percent) to the current operation.

However, construction would take place over multiple blocks at a time, increasing rider confusion and complicating pedestrian flow to undetermined levels. This level of uncertainty is expected to affect access to the system, resulting in an estimated 15 to 20 percent annual reduction in ridership as compared to the 10 to 15 percent erosion of ridership experienced during the construction of DUS and CCS. This level of ridership erosion is expected to result in an unquantified loss of sales tax generation from businesses along the Mall.

The potential short-term impact to the ADA population would also be somewhat greater than experienced during the construction of DUS and CCS. This option is assumed to require approximately 1 additional year (3.5 years versus 2.5 years for other options) for construction and would prolong rider confusion and inconvenience the general and ADA populations.

Table 3-1. Summary of Impacts by Phasing Option

Option	Travel Time	Number of Stops (Mall)	Ridership Losses[a]	FTA Grant Funding[b]	Impact to ADA	Impact to RTD Fleet	Impact on Regional Transit	Schedule (Years)	Added Capital Cost ($ million)	Bus Service Mitigation Cost ($ million per year)
1	Negligible	No change	15 to 20 percent	$75,000 to $100,000	Negligible	None	Negligible	3.5	$15.0 to $20.0	$1.8 to $2.5
2	Negligible	Reduced by 2 to 3	15 to 20 percent	$75,000 to $100,000	Loss of access to 2 to 3 stops	None	Negligible	3.0	$13.0 to $17.0	$1.8 to $2.5
3	Increase by 2 to 3 minutes	Reduced by 3 to 4	30 to 40 percent	Up to $200,000 per year	Loss of access to 3 to 4 stops	Bus acquisition may be required	Negligible	2.5	None	$4.0 to $5.0
4A	Substantial increase during peak periods	All stops are removed from Mall	All ridership removed from Mall	$500,000 per year	No access to Mall	Bus acquisition is required	Reduction in efficiency	2.5	None	Free MallRide shut down; budget directed to Free MetroRide
4B	Negligible due to dedicated bus lane	All stops are removed from Mall	All ridership removed from Mall	$500,000 per year	No access to Mall	Bus acquisition is required	Negligible	2.5	None	Free MallRide shut down; budget directed to Free MetroRide

[a] RTD experienced 10 to 15 percent ridership losses during the construction of DUS and CCS.

[b] RTD receives $500,000 per year from FTA for fixed-guideway funding.

This option is anticipated to result in a potential loss of 15 to 20 percent of total FTA operational grant funds associated with fixed guideway funding, estimated at $75,000 to $100,000 annually. This is directly proportionate to the projected losses in annual ridership. The anticipated additional 1 year of construction is estimated to result in a capital cost penalty of $15 to $20 million. Further, if the lost ridership is mitigated through additional service on the Free MallRide, the cost would be $1.8 to $2.5 million per year in added operational cost to RTD. This option would have no other regional construction impacts on RTD's bus, LRT, or commuter rail service. From a transit operations standpoint, RTD prefers Options 1 and 2 to Options 3 and 4.

***Option 2: Construct Mall in 1- to 2-Block Increments*.** The short-term construction impacts to transit operations would be similar to that of Option 1, because the number of daily buses and hours of operation would remain unchanged. The only change would be that two to three shuttle stops would be temporarily closed to accommodate construction, and there would be disruption to the Mall pedestrian flow in the area where the work is being completed. The tradeoff, when compared to Option 1, is that construction for Option 2 would be contained to a smaller work area of one to two blocks, perhaps offering the advantage of concentrating pedestrian confusion and flow. This advantage is expected to largely offset the loss of the two to three shuttle stops. In this case, a construction approach limiting the closure to two stops is preferred. In evaluating travel time, it is anticipated that the trip from DUS to CCS would remain within 5 percent of the current 15 minutes.

Considering the closure of two to three stops and the general confusion associated with the single-lane bi-directional operation, the loss of ridership is estimated to be similar to the 15 to 20 percent associated with Option 1. Analogous to Option 1, this level of ridership erosion is expected to result in an unquantified loss of sales tax generation from businesses along the Mall.

Because of the assumed 3-year timeline, the construction cost, loss, or FTA fixed guideway funding and mitigation cost for replacement transit service are also assumed to be somewhat more favorable than Option 1. Again, there are no indirect operational impacts to RTD regional transit operations attributed to Option 2. From a transit operations standpoint, RTD prefers Options 1 and 2 to Options 3 and 4.

Option 3: Construct Mall in 3- to 4-Block Increments with Detour. The operational impacts for Option 3 are different and greater than for Options 1 and 2 because a detour is required. It is anticipated that peak service headways would need to be reduced from 90 seconds to 3 minutes, and travel times would likely increase by 2 to 3 minutes because of the additional two blocks of travel required in each direction. In addition, three to four stops would be temporarily eliminated, and no additional stops would be provided on the detour. It is therefore estimated that annual ridership would erode by 30 to 40 percent with Option 3. This level of ridership erosion is expected to result in an unquantified loss of sales tax generation from businesses along the Mall, however it may be partially offset by sales tax increases on the detour routes.

For the purpose of this analysis, it is anticipated that supplementary service would be provided on the Free MetroRide by augmenting its service plan, including shorter headways and longer hours of service, especially mid-day and weekend service. During the refinement of mitigation,

it is possible that supplemental bus service on 15th and 17th streets may also prove to complement replacement service on the Free MetroRide.

The detour has the advantage of moving transit operations away from the construction area, allowing a construction schedule anticipated to be 6 months to 1 year shorter than Option 2 and Option 1, respectively. The shorter schedule would save capital cost, interest payments, and inflation costs. One tradeoff is that the ADA population would have less access to the Mall during the assumed 2.5-year construction period. Alternate accommodations to the ADA population would need to be addressed in the CMP.

While not designed for operation off the Mall because of their right-hand driving position, the new electric buses could maneuver the required detour. It is assumed that the current number of electric buses would be sufficient to operate the detour, avoiding the need to purchase additional vehicles. However, the need to supplement service on the Free MetroRide may require additional buses. RTD does not have spare buses for this purpose. The cost of supplementing service on the Free MetroRide is estimated at $4 to $5 million per year. Possible losses of FTA operating funds for fixed-guideway transit would be as much as $200,000 per year. Option 3 would have no other short-term indirect construction impacts to RTD's regional transit system.

***Option 4: Relocate Bus Operations during Construction (Options 4A and 4B)*.** Movement of bus operations off the Mall simplifies and expedites construction as described under Option 3. For the purposes of this analysis, it is anticipated that the Free MetroRide would provide the majority of replacement service for the Free MallRide. During the refinement of mitigation, it is possible that supplemental bus service on 15th and 17th streets may also prove to complement replacement service on the Free MetroRide. Two sub-options were considered for Option 4: Sub-option A assumes that buses would travel in mixed flow on 18th and 19th streets, with the general traffic, while Sub-option B specifies that a traffic lane on 18th and 19th streets would be dedicated to bus use. In both cases, the existing Free MetroRide service plan would be augmented to carry the Free MallRide patrons. This would include more stops, more aggressive headways, and extended hours of operation. The following provides impacts common to both sub-options, with impacts specific to each sub-option provided in the subsequent paragraphs.

Issues Common to both Sub-options. The impact of transit operations and ridership would depend on the extent to which the current Free MallRide service plan is retained. With either sub-option, businesses on the mall would no longer be served by transit and the ADA population would no longer have access to the Mall. The removal of transit patrons from the Mall is expected to have a negative but unquantified impact on sales tax generation from businesses located there, however it may be partially offset by sales tax increases on the detour routes.

Further, the electric buses used for the Free MallRide are not ideally suited for exclusive city street operation. Option 4 would require the acquisition of additional buses, measured in millions of dollars, for operation of the new temporary service, or the elimination of other services to obtain the required fleet. Both sub-options would also place more buses on the downtown streets, offsetting the original intention of the shuttle service to remove transit vehicles and reduce congestion in Central Denver. In addition, none of the Free MallRide fixed guideway passenger miles would be eligible for FTA operational funding, resulting in a loss of approximately $500,000 per year in assistance.

Mixed-flow Operation (Option 4A). If the relocated bus service operates in a mixed-flow pattern on 18th and 19th Streets, travel times would likely be much longer due to traffic congestion, with a significant reduction in ridership. It would not be possible to accommodate the 39,000 riders per day provided on the Free MallRide, resulting in a loss of transit users during the assumed 2.5-year construction period. The extent that these patrons would use other bus transit or walk to their destinations is not known. As a result, there would be a temporary loss on an effective transit connection between DUS, the LRT on Stout and California streets, and CCS. The more widespread impact of this sub-option on regional transit cannot be quantified with the current level of information. Traffic congestion would also be significantly increased, especially during the morning and evening peak periods. This could result in public opposition and offset one of the original goals of the shuttle, to reduce bus-related traffic congestion.

Dedicated Lane (Option 4B). Dedication of a travel lane could represent an effective temporary alternate connection between DUS, the LRT on Stout and California streets, and CCS. End-to-end travel times and ridership could be comparable to the Free MallRide. However, persons alighting between DUS and CCS would have further walk distances to access the system. This could reduce transit ridership. If the number of stops was reduced to every other block, the travel times would be faster, benefiting transit ridership and somewhat offsetting the increased walk distance. The key disadvantage to this concept is that the loss of one lane for general traffic on 18th and 19th streets would result in high peak-hour traffic impacts on the remaining lanes. If the dedicated bus lane requires the acquisition of on-street parking, business access would be affected (see Traffic Impacts in the EA for more detail).

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TECHNICAL MEMORANDUM

Cumulative Effects Technical Memorandum

PREPARED FOR:	Regional Transportation District
PREPARED BY:	CH2M HILL Engineers, Inc.
DATE:	October 2018

1. Introduction to Analysis

The Council on Environmental Quality (CEQ) regulations implementing the National Environmental Policy Act (NEPA) define a cumulative impact as follows (40 *Code of Federal Regulations* 1508.7):

> "the impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."

The objective of this technical memorandum is to provide the background information, methodology, and past, present, and reasonably foreseeable actions used in support of the cumulative effects analysis prepared as part of the environmental assessment (EA) for the for the 16th Street Mall (Mall). Impacts have been incorporated into the EA and are not included in this technical memorandum.

2. Laws, Regulations, and Orders

NEPA requires that the direct impacts, indirect effects, and cumulative effects of proposed actions be assessed and disclosed. The following guidance is applicable to the cumulative effects analysis:

- Considering Cumulative Effects Under the National Environmental Policy Act (CEQ, 1997)
- Consideration of Cumulative Impacts in EPA Review of NEPA Documents (EPA, 1999)
- Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process (FHWA, 2003)
- Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (CEQ, 2005)
- Indirect and Cumulative Impact Analysis (National Cooperative Highway Research Program, 2006)

3. Methodology

This cumulative impact assessment follows the approach recommended by the CEQ in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ, 1997). This section addresses the multiple components involved in the analysis.

Key Elements of a Cumulative Effects Analysis

- Identify resources for evaluation
- Define geographic boundaries/study areas and a timeframe for the analysis
- Describe the historic context and current conditions, including past, present, and reasonably foreseeable actions that may contribute to impacts
- Assess the potential for cumulative impacts
- If applicable, identify mitigation to address cumulative impacts

A. Resources Considered

The CEQ recommends that cumulative impact analyses examine resources that could be impacted by the action(s) under investigation or that are known to be vulnerable. For the Project to incur a cumulative impact in combination with other past or future actions, it would itself have to contribute to those impacts. Therefore, resources that are not impacted by the Project (after avoidance, minimization, and mitigation measures are applied) are typically not included in the cumulative effects analysis.

The resources included in the cumulative impacts analysis for the 16th Street Mall include the following: Economic Conditions, Cultural Resources, Visual Quality, and Safety and Security. These resources were identified through scoping and by the degree to which the resources are directly impacted, as documented in the EA. The other resources were either not present in the Project area or were determined to have no or minimal impacts caused by implementation of the Locally Preferred Alternative. Therefore, the Locally Preferred Alternative would not contribute to cumulative effects to these resources and additional analysis related to cumulative effects is not required.

B. Geographic Boundaries and Timeframe

A cumulative effects analysis uses geographic boundaries (resource-specific study areas) and evaluates a timeframe that captures historic and future influences on resources of concern. The geographic study area for Economic Conditions, Cultural Resources, and Safety and Security corresponds to the Commercial Core District and Lower Downtown Neighborhood defined in the 2007 Denver Downtown Area Plan (**Figure 3-1**). The geographic boundary for Visual Quality and Construction corresponds to the study area shown in Figure 1-1 in the EA. This area extends beyond the Project footprint and provides the appropriate geographic context to understand effects to Visual Quality, because it includes buildings adjacent to the Mall that have views of the Mall.

Figure 3-1. Geographic Boundaries for Cumulative Effects Assessment

The timeframe for the analysis extends back to 1970, to capture the initial study, planning, and construction of the 16th Street Mall. A future year of 2040 is used, which corresponds to the planning horizon established by the Denver Regional Council of Governments *2040 Fiscally Constrained Regional Transportation Plan*.

C. Past, Present, and Reasonably Foreseeable Future Actions

With respect to past, present and reasonably foreseeable future actions, the CEQ indicates that information should be relevant to the analysis and necessary to inform decision making. It is not necessary to catalog all actions that have occurred, are underway, or planned; the goal is to focus the analysis on those actions that are meaningful to the assessment. **Table 3-1** presents the past, present, and reasonably foreseeable future actions that are most relevant to this cumulative effects analysis.

Table 3-1. Summary of Past, Present, and Reasonably Foreseeable Actions

Name	Type	Date/Description
Re-lamping	Past	1990: Lighting enhancements on the original mall.
16th Street Mall Extension	Past	2001: Extension of the 16th Street Mall from Blake Street to the Amtrak railroad tracks between Wynkoop and Wewatta streets in Lower Downtown.
Regional Transportation District (RTD) Light Rail	Past	1994: First light rail line (Central Corridor) completed in 1994. Lines D, F, and H cross the 16th Street Mall.
Denver Pavilions	Past	1998: Redevelopment of two blocks of surface parking lots into an entertainment and retail complex.
16th Street Mall Extension	Past	2001: 16th Street Mall extension into the Central Platte Valley; extension of the Free MallRide shuttle service across the Amtrak railroad tracks into a new shuttle turnaround facility on the northwestern side of DUS.
Lower Mall Sidewalk Replacement	Past	2001: Reconstruction of the 16th Street Mall sidewalk between Market and Blake streets; converting granite to sandstone/granite and replacing fixtures.
Fixed-guideway Upgrades	Past	2004: Installation and replacement of benches, alley lighting, and wayfinding signage at Free MallRide shuttle stops.
Lower Mall Sidewalk Replacement	Past	2007: Replacement of the sidewalk area on the southwestern side of the Mall between Wynkoop Street and the Amtrak railroad tracks.
Lower Mall Sidewalk Replacement	Past	2008: Replacement of the sidewalk area on the southwestern side of the Mall between Blake and Wazee streets.
Four Seasons Hotel	Past	2010: Construction of 239-room hotel on 14th Street between Lawrence Street and Arapahoe Street.
Denver Union Station (DUS)	Past	2014: Renovation of DUS, including transit-oriented, mixed-use development, and a hotel.
Free MetroRide (Downtown Denver Circulator)	Past	2014: Additional transit service provided on 18th and 19th streets between DUS and Civic Center Plaza.
aloft Hotel	Past	2014: Construction of 140-room hotel at 15th and Stout streets.
S. Broadway/16th Street Improvements	Past	2016: Addition of new median, bicycle facility improvements, trees, lighting, traffic signals, signage, and striping.
Pedestrian Light Replacement	Past	2016: Installation of 187 replica LED pedestrian lights.

Name	Type	Date/Description
Bicycle Lane Upgrades	Past	2017: Street addition of protected bike lane on 14th Street. 2016: Bicycle lane upgrades to Wynkoop Street between 16th and 18th streets. 2013: 15th Street bike lane installation
Civic Center Station Rehabilitation	Past	2017: Renovation of Civic Center Station.
Lincoln/S. Broadway Improvement	Past	2017: Expansion of dedicated bus-only lanes on S. Broadway Avenue and Lincoln Street.
Xcel Steam Heat Projects	Past	2017: Implementation of utility projects between 17th and Market and 18th and Larimer streets.
The Confluence	Past	2017: Construction of 300 residential units near Confluence Park.
1144 Fifteenth Street	Past	2017: Construction of a 640,000-square-foot office tower adjacent to the Four Seasons Hotel and Residences, with street level retail and 900 parking spaces. Scheduled for completion in December 2017.
Le Meridien/AC Dual Brand Hotel	Past	2017: Construction of a hotel providing 480 rooms, 12,500 square feet of meeting space, rooftop amenities, and ground-floor restaurants.
1776 Curtis Street	Present	Development of 360 apartment units and a 9-story office building linked together by a 6-story parking structure, with 20,000 square feet of retail. Currently under construction and scheduled for completion in early 2018.
19th and 20th Avenues Two-way Conversion	Present	Conversion of 19th Avenue and 20th Avenue to provide two-way vehicular travel between Broadway and Park Avenue West. New bicycle facilities will be included on both 19th and 20th avenues. Grant and Logan streets will also be converted to two-way vehicular operation between 18th and 20th avenues. Elements of the project are currently under construction.
Market Station Redevelopment	Present	Development of 375,000 square feet of new office, retail, and apartment space, as well as a 100,000-square-foot, underground garage. Demolition/construction began in late 2017 and is ongoing.
Alexan Arapahoe Square	Present	Construction of 355 residential units at an average of 780 square feet at 2100 Welton Street. The project is expected to be complete in fall 2018.
Alexan 20th Street Station	Present	Construction of 354 residential units at an average of 783 square feet at 20th and California streets. Includes 393 automobile parking spaces. The project is expected to be complete in fall 2018.

Name	Type	Date/Description
21st and Welton Apartments	Present	Development of 18-story, 329-unit apartment project on Welton Street between 21st and 22nd streets. Construction began in 2017 and is ongoing.
The Coloradan	Present	Development of 34 condominiums at 1750 Wewatta Street as part of the DUS redevelopment project. The project is expected to be completed in fall 2018.
1501 Tremont Street	Future	Development of a 730,000-square-foot office tower behind the Denver Pavilions. Includes street level retail, seven floors of parking, and 26 floors of office space.
Block 162	Future	Development of a 606,500-square-foot office and separate hotel tower at 15th and Welton streets. Includes several floors of parking and ground floor retail.
Tabor Center Tower Two	Future	Development of a 700,000-square-foot office tower at 17th and Larimer streets.
15th and Stout Hotel	Future	Construction of a new 21-story hotel at 801 15th Street, with approximately 382 guest rooms.
Champa Flats	Future	Construction of approximately 169 units of affordable and workforce rental apartments at 2250 Champa Street in the Arapahoe Square district.

4. Background of 16th Street Mall

The history of the 16th Street Mall and its relationship to downtown Denver is well documented in numerous studies and reports. Planning and discussion surrounding the idea of a mall on 16th Street began as early as 1959, but the idea did not gain momentum until 1971, when a study was jointly undertaken by the City and County of Denver and Downtown Denver, Inc. Like many American cities, Denver's urban area was experiencing a decline during this period because of changing demographics (population shifts to the suburbs), increasing reliance on the automobile and decreasing reliance on transit, and increasing congestion and air pollution. The mall concept was seen as a means to enhance urban redevelopment, help downtown retailers compete with the suburban centers, and reduce pollution and congestion (Warzel, 2008).

The 16th Street Mall opened in 1982 after more than a decade of planning, revitalizing 16th Street and the Commercial Core District of Denver. The Tabor Center opened shortly after, in 1984. The original 12.5-block Mall with bus transfer stations at either end was ultimately extended to DUS, which has since been revitalized into a hub of transit-oriented, mixed-use development with a hotel and restaurants. A few years after the 16th Street Mall was constructed, the City and County of Denver adopted the original Downtown Area Plan (1986), which identified several projects that further revitalized downtown Denver, including the construction of Coors Field baseball stadium in 1995, expansion of the Adam's Mark Hotel on

16th between Tremont Place and Cleveland Place in 1997, and the opening of the Denver Pavilions retail and entertainment center along two blocks of the 16th Street Mall in 1998.

As **Table 1** shows, Denver's downtown area is currently experiencing strong growth. The Downtown Denver Partnership reports that, as of mid-2017, 42 total projects are under construction or planned that will add 1,181 additional hotel rooms, 5,341 additional residential units, and 2,509,300 additional square feet of office space (Downtown Denver Partnership, 2017). The mall remains an essential component of RTD's regional transportation system and continues to attract large numbers of visitors. However, as noted in EA **Section 1, Purpose and Need**, visitors are increasingly passing through, rather than stopping to spend time at businesses adjacent to the mall.

5. Results of Cumulative Effects Assessment

The results of the Cumulative Effects Assessment are described in EA **Section 3, Environmental Resources,** and **Section 4, Transportation Systems**.

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