Cedar Avenue (TH 77/CR 23) CORRIDOR TRANSITWAY STUDY

Final Report

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Dakota County

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1.0 Executive Summary

The objective of the Cedar Avenue Corridor Transitway Study is to investigate transit options along Cedar Avenue from the Mall of America in Bloomington to the Transit Station on 157th Street in Apple Valley. Additional objectives of the project include assessing the effect of transit options on land use and the siting of a transit hub near the junction of Cedar Avenue and Trunk Highway 13.

The project began in the summer of 1999 and is concluding in January, 2001. This first phase feasibility study is designed to determine if a transit solution should be pursued for the Cedar Avenue Corridor.

Purpose and Need

The Cedar Avenue Corridor presently experiences periods of congestion and delays during peak traffic hours. The Cedar Avenue Bridge over the Minnesota River is a bottleneck that operates at Level of Service (LOS) E during peak hours. LOS E is bordering on unstable conditions and on any given day it can, and does, move to LOS F resulting in severe congestion and stop-and-go traffic. These conditions continue to worsen and, with the forecast growth in population and employment, the operational characteristics of Cedar Avenue can be expected to deteriorate.

No major roadway capacity improvements are planned or anticipated for the Cedar Avenue Corridor. Therefore, increasing the transit capacity of the corridor may be a viable option for improving the transportation system serving northern Dakota County. The Metropolitan Council's *Transit 2020 Master Plan* identified the extension of the Hiawatha LRT line along Cedar Avenue as a potential transit improvement by the year 2020.

Study Description

The Cedar Avenue Corridor Transitway Study is a first phase feasibility study designed to evaluate the potential of implementing an improved transit system in the corridor. Alternatives have been developed and evaluated both in terms of different transit technologies and different alignment options.

This study is the first phase of the project development process. The following list outlines the major steps in the proposed project development process and their approximate duration:

1. Feasibility Study (current phase)	1.5 Years
2. Combined Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS)	1.5 Years
3. Preliminary Engineering/Final EIS	1 Year
4. Final Design & Engineering	2 Years
5. Construction	3 Years
6. Operations	

Technology Alternatives

An evaluation of available transit technologies resulted in the identification of Light Rail Transit (LRT) and Bus Rapid Transit (BRT) as the most appropriate systems for the Cedar Avenue Corridor.

Alignment Alternatives

Two alignment alternatives have been developed and analyzed during the course of this study: the Cedar alternative and the Galaxie alternative. The Cedar alternative follows Cedar Avenue for the entire project length while the Galaxie alternative deviates from Cedar Avenue south of the Minnesota River bridge and primarily follows Nicols and Galaxie Avenues.

Land Use

The concept of Smart Growth links transportation and land use and has been embraced both nationally and locally as a strategy to enhance economic competitiveness and maintain quality of life. Smart Growth envisions developments of complementary land uses including housing and commercial uses on interconnected streets and pathways amenable to walking, bicycling, or taking transit or private automobile.

The Metropolitan Council's *Draft Transportation Policy Plan (October, 2000)* embraces Smart Growth for the Twin Cities metropolitan region. The plan states that "smart growth development will be fostered along dedicated transit corridors."

Different land use scenarios were considered during this study to see how transit ridership could be effected by implementing transit supportive development at the proposed station locations along the corridor. Three scenarios were analyzed: (1) the planned land use, (2) transit oriented development, and (3) an unconstrained market scenario. The planned land use scenario used the Metropolitan Council forecast of year 2020 growth. The transit oriented development scenario assumed higher, yet reasonably attainable densities along the corridor. The unconstrained market scenario represents population and employment densities that could be accommodated within the corridor beyond the year 2020.

Ridership

The forecast ridership for the transitway alternatives is presented in the table below. The ridership represents the daily number of transit trips across the Minnesota River Bridge.

Forecast Ridership for Transitway Alternatives, Daily 2020 Trips Across the Minnesota River	
Alternative	**Ridership**
No-Build (Planned land use)	12,800
LRT (Planned land use)	15,400
LRT (T.O.D.)	17,000
LRT (Unconstrained)	22,100
BRT (Planned land use)	12,600
BRT (T.O.D.)	14,700
BRT (Unconstrained)	17,200

Cost Estimates

Estimates of the cost of construction or capital cost as well as annual operations and maintenance costs were calculated for each alternative. The results are shown below (in 2000 dollars):

Alternative	*Total Capital Cost*	*Annual Operations & Maintenance Costs*
LRT	$ 500 Million	$ 5 Million
BRT	$ 95 Million	$ 1.5 Million

Cost Effectiveness

In its evaluation of the cost effectiveness of a proposed project, the Federal Transit Administration considers the incremental costs per incremental passenger in the forecast year. The measure, expressed in current year dollar value, is based on the annualized total capital investment and annual operating costs divided by the forecast change in annual transit system ridership, comparing the proposed project to the no-build and the TSM alternatives. Based on the project information for Cedar Avenue, the following cost effectiveness indices have been calculated compared to the no-build scenario:

Alternative	*Cost Effectiveness*
LRT (Planned Land Use)	$ 52.56
LRT (T.O.D.)	$ 32.53
LRT (Unconstrained)	$ 14.69
BRT (Planned Land Use)	N/A
BRT (T.O.D.)	$ 16.61
BRT (Unconstrained)	$ 7.17

Recommendations

The complete analysis of the results of this study indicate that there is a significant opportunity to implement enhanced transit service in the Cedar Avenue Corridor if the local communities support migration to more transit-supportive development and land use. **If the communities along the corridor favor transit oriented development strategies, the Cedar Avenue LRT alternative is the most desirable transit solution.** This conclusion is based on the following factors:

- The LRT alternative has the highest ridership and adds significantly to the transit use in the corridor.
- Mobility within the corridor is enhanced by providing a seamless transit alternative between Dakota County and destinations north of the Minnesota River including the Mall of America, Minneapolis-St. Paul International Airport and downtown Minneapolis.
- Extension of the Hiawatha LRT line is consistent with the Met Council *Transit 2020 Master Plan.*
- The Cedar Avenue LRT alternative capitalizes on implementation of the Hiawatha LRT by extending the line south from the Mall of America, across the Minnesota River. Infrastructure investments in maintenance and storage facilities that are being made for the Hiawatha line may not need to be repeated or may be minimized.
- Potential right of way and environmental impacts are relatively minor.

- The alternative provides excellent opportunities for Transit Oriented Development and economic revitalization.
- The LRT alternative has the greatest potential to accommodate future growth in the region beyond 2020 by increasing the transitway capacity with additional train cars.
- The Cedar Avenue corridor continues as a high volume transportation corridor while the current character of Galaxie Avenue is maintained.

These results indicate that there is an excellent opportunity to bring LRT to Dakota County, however, it will require the commitment of the communities to policies that support enhanced transit oriented development. The communities need to embrace transit supportive policies such as increased residential and commercial densities, changes in zoning and land use patterns, and more pedestrian-friendly developments.

A logical **first phase implementation of this scenario would be to extend the Hiawatha LRT line from the Mall of America station to the proposed Cedarvale station**. This conclusion was reached based on the following factors:

- Capitalizes on implementation of the Hiawatha LRT line as described above.
- Provides a transit alternative for crossing the Minnesota River on Cedar Avenue which is already congested at times and can be expected to continue to operate at poor levels of service.
- Requires dealing with the most sensitive environmental impact – crossing the Minnesota River – early in the project development process.
- Extending LRT to Cedarvale is consistent with local and regional plans and adheres to commitments to implement transit alternatives into Dakota County.
- Capitalizes on the proposed redevelopment at Cedarvale.
- Provides an opportunity for early implementation of transit oriented development in the corridor which can serve as a catalyst for future, similar activities.

These recommendations assume migration to a more transit oriented development scenario. **If the communities decide not to pursue T.O.D. strategies, BRT may be a more appropriate transit solution for the corridor.** This conclusion is based on the following factors:

- BRT provides a lower cost transit solution that will still enhance the transit capacity of the corridor.
- A Cedar Avenue transitway could be constructed without the need for an additional structure over the Minnesota River.
- The right-of-way required for a transitway would be preserved and future conversion to LRT would be possible.

Next Steps

Implementation of the recommendations will be accomplished by defining and executing a series of action steps. The following list of actions are proposed for implementation of the short and long term transit scenarios on Cedar Avenue:

- Secure funding and continue into the next phase of the project development process.

- Initiate a combined Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS).
- Begin to preserve the right of way for the alignment and station locations through zoning and comprehensive planning.
- Begin to explore policies that encourage transit oriented development.
- Begin an aggressive public information and marketing campaign to develop local and regional support for the project.

2.0 INTRODUCTION

2.1 Study Overview

The Cedar Avenue Transitway Study is designed to determine alternative transit improvements in the Cedar Avenue Corridor and to test the feasibility of each with regard to effectiveness (potential ridership and relation to the regional transit system) and impact on properties and businesses in the corridor. The technology alternatives explored include bus, guided bus, and LRT, as well as others.

There are two defining characteristics of the project's study area to be mentioned at the outset. First, the Bloomington/Mall of America (MOA) area has emerged as a major employment and activity center of the region. The terminus and station location of the Hiawatha LRT line at the MOA will further strengthen accessibility and commerce. Secondly, the rapid growth of Dakota County over the past 15 years has been both aided and accommodated by major transportation facilities that link the County to the region. This "feedback effect" is aided, because the increased accessibility provided by new infrastructure investments has encouraged growth of both residential and commercial development. It is also accommodated by the infrastructure that includes bridge crossings of the Minnesota River on I-35E, I-35W, and TH 55. These and other facilities, like I-494, hasten development growth and serve increasing travel demand.

While there has been transit in this infrastructure, it has, to date, been largely constrained to incremental increases in bus capacity and enhancements to transit operations that reduce travel time (e.g., shoulder lanes for buses, transit hubs with timed transfers). Highway capacity has been the predominate feature of the transportation investments that have served Dakota County to date.

Today, however, these highway facilities, particularly the river crossings, are reaching capacity. The solution of the past two decades—increasing roadway capacity for autos—is no longer the sole alternative, given funding and political realities and engineering feasibility. Significant, transit-oriented improvements are now a real possibility for improving the mobility and accessibility for Dakota County travelers. This is acknowledged in Dakota County policies and Apple Valley's land use and transportation plans.

The technical work for the Transitway Study has three main elements: Physical Assessment, Transitway Market Analysis, and Plan Scenarios (in which alternatives are developed and evaluated). Additionally, the study has addressed the siting and conceptual design of a transit hub in the vicinity of TH 13 and TH 77 (Cedar Avenue).

2.2 Corridor Description

The limits of the Cedar Avenue Corridor Transitway Study extend from the Mall of America in Bloomington, south to 160th Street in Apple Valley. In addition to Bloomington and Apple Valley, the corridor also passes through the cities of Eagan and Burnsville. The segment north of the Minnesota River is in Hennepin County. The majority of the corridor is within Dakota County.

Cedar Avenue has several different roadway cross sections as it travels between Bloomington and Apple Valley. To better understand these effects and to facilitate the analysis of alternatives, Cedar Avenue was analyzed using the following four basic segment definitions. The segment

boundaries have been selected to correspond to the locations where the basic roadway cross section changes.

Segment	Boundaries	Description
1	Mall of America to Old Shakopee Road (Bloomington)	This segment of Cedar Avenue is freeway without a central median area (a raised median barrier is used to divide the two directions of traffic)
2	Old Shakopee Road to TH 13 (Eagan, Burnsville)	This segment of Cedar Avenue contains the Minnesota River bridges and their causeway approaches
3	TH 13 to 138th Street (Apple Valley) A. TH 13 to I-35E B. I-35E to 138th Street	This segment of Cedar Avenue is freeway with a central median area. It has two parts because the width of the median area is narrower south of I-35E than it is between TH 13 and I-35E
4	138th Street to 160th Street (Apple Valley)	This segment of Cedar Avenue is a divided expressway with at-grade intersections and direct access from adjacent land uses. A raised median island divides the two directions of travel and provides for left-turn lanes at full intersections.

2.3 Regulatory Framework

This feasibility study is a precursor phase to subsequent stages of the required project development process. If this project proceeds to the next stage of development, the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 et seq.) requires a Major Investment Study (MIS) and concurrent Draft Environmental Impact Study (DEIS). The Federal Transit Administration (FTA) would be the lead agency for Federal review.

The following list outlines the major steps in the proposed project development process and their approximate durations:

1. Feasibility Study (current phase) 1.5 Years
2. Combined MIS/DEIS 1.5 Years
3. Preliminary Engineering/Final EIS 1 Year
4. Final Design & Engineering 2 Years
5. Construction 3 Years
6. Operations

3.0 PUBLIC INVOLVEMENT PROGRAM

3.1 Public Involvement Plan

A comprehensive and multifaceted Public Involvement Plan was developed for the Cedar Avenue Transitway Study. Public involvement has emerged as a central component of project development for several reasons, the most significant being that the general public wants more say in how transportation affects their quality of life and how public dollars are being spent on transportation improvements. Failure to adequately identify and solicit all stakeholders invites resentment, complaint, protest, and avoidable litigation, all of which create delay while simultaneously escalating costs.

Public involvement began at the earliest phase of planning and should continue through design and construction. The approach to public involvement attempted to balance the traditional methods with more innovative techniques so that a focused, responsive program would emerge. The primary components of the Public Involvement Plan include the following:

- **Technical Advisory Committee (TAC)** — This group advises the study team on technical matters, provides information to the study team and assists in explaining technical matters to their agencies and communities.

- **Citizen Advisory Committee (CAC)** — This group consists of residents and businesses interested in the Cedar Avenue Corridor. CAC members help to identify issues and problems, give advisory input to study recommendations, convey study information, and provide a "listening post" for feedback on public involvement activities.

- **Focus Groups** —This innovative group format was a small group discussion under professional leadership that provided qualitative information on the Cedar Avenue Corridor Transitway. Development of this information was facilitated through meetings of carefully selected groups of individuals convened to discuss and give their viewpoints through a short series of questions and answers.

- **Newsletters** – Three project newsletters were developed and distributed to residents along the corridor. The intent of the newsletters was to keep the public informed about the progress of the study as well as publicizing activities such as the Open Houses.

- **Open Houses –** Three series of Open Houses were conducted during the study. Each series consisted of two Open Houses on consecutive days, one in Bloomington and another in Apple Valley.

3.2 TAC and CAC Meetings

Meetings of the TAC and CAC occurred on a regular monthly basis. Meetings were scheduled for the first Thursday of each month. The TAC met at 1:30 P.M. and the CAC met at 7:30 P.M. All meetings were held at the Dakota County Western Service Center.

Representatives to the TAC were selected by their agencies for their expertise in technical issues pertaining to the provision of transportation in the Cedar Avenue Corridor. These technical representatives were responsible for understanding and conveying the goals of their agency and

how technical solutions support these goals, and whether alternatives are compatible or in conflict with local policies or conditions. TAC members also help ensure communications with other participants. For example, understanding how an alternative solves a recognized problem often requires a technical analysis and a technical explanation. Technical advisors provided comments based on experience, assisted in evaluating whether alternatives or issues needed technical analysis, and helped ensure that the results of technical analyses are clearly understood.

Representation on the CAC was by invitation. The local units of government were asked to send the invitations to selected individuals that represent neighborhoods and business groups. Two representatives from each of the following communities were invited to participate:

- City of Apple Valley
- City of Bloomington
- City of Burnsville
- City of Eagan

In addition two at-large representatives for Dakota County and two for Hennepin County were invited to participate.

3.3 Open Houses

Three series of Open Houses were held to provide the public opportunities to keep informed about developments on the project and to give oral and/or written input. A series of prepared exhibits were prepared for each Open House that afforded the public the opportunity to review project information and alternatives. Study team members were available to discuss, one-on-one, the project information. Participants were encouraged to fill out comment cards, which will be used as a public involvement record along with the TAC/CAC meeting summaries.

Press releases were issued to local newspapers advertising the Open Houses. The Open Houses were also publicized in the Cedar Avenue Transitway project newsletter. The Open Houses were held in the following locations:

- Bloomington, Assemblies of God Church, 8600 Bloomington Avenue South
- Apple Valley, Dakota County Western Service Center, 14955 Galaxie Avenue

Open Houses were conducted on the following dates:

- October 11 & 12, 1999
- May 23 & 24, 2000
- November 14 & 15, 2000

4.0 PHYSICAL ASSESSMENT

4.1 Roadway Capacities

One of the key factors necessitating this transitway study is the extent and nature of congestion, both current and forecast, along the Cedar Avenue corridor. When evaluating alternative transitway strategies to reduce traffic congestion on a corridor, it is appropriate to assess how much traffic the existing roadway can accommodate without compromising efficiency or safety. This is called the traffic-carrying capacity of a roadway.

Roadway capacities were determined for each of the segments. On the basis of a set of traffic, roadway, and signalization (where appropriate) characteristics. These characteristics included:

- k-factor—percent of daily vehicles traveling in the peak hour
- d-factor—percent of vehicles traveling in the peak direction during the peak hour
- peak hour factor—hourly volume during the peak hour divided by the peak 15-minute rate of flow within the peak hour
- adjusted saturation flow rate—maximum hourly service flow rate of vehicles in one lane in one hour
- percent turns from exclusive turn lanes—percent turns made from left-turn and right-turn lanes
- arterial class—categorization of arterials involving functional and design categories, as well as free-flow speed; the range of values is from Type I (high speed design and control) through Type IV (typical urban design)
- free flow speed—average desired speed of all vehicles on the roadway; approximately equal to the speed limit posted for the facility
- left-turn bays—indicates presence of left-turn bays at signalized intersections within the segment
- arrival type—description of how the platoons of vehicles arrive at an intersection and is a general categorization of quality of signal progression; the range of values is from 1 (very poor progression) to 6 (ideal progression) with a value of 3 representing random arrivals
- signal system type—type of traffic signal control (actuated, semi-actuated, or pretimed)
- system cycle length—the total time (in seconds) for the signal to complete a complete sequence of signal indications
- weighted through movement g/C—average of the arterial's critical intersection effective through green time-to-cycle length ratio (g/C) and the average of the non-critical intersection's effective through g/C

The results of the capacity analysis are summarized on Figures 4.1.1 through 4.1.5. Each figure contains a table showing the estimated existing capacity of the segment (expressed as a daily, peak hour, and peak direction of peak hour value) for different levels of service.

Figures 4.1.1 through 4.1.5 also include existing daily and peak hour directional volumes where available. Based on the volumes shown and existing capacities from the table, an existing level of service determination (at a planning level) is displayed.

The planning level of analysis provides threshold capacities for roadway segments that are used to compare existing volumes and projected volumes. The comparison of traffic volumes to the

calculated capacities indicates the expected level of operation and/or lane needs. From this basis the following characterization of the corridor can be made:

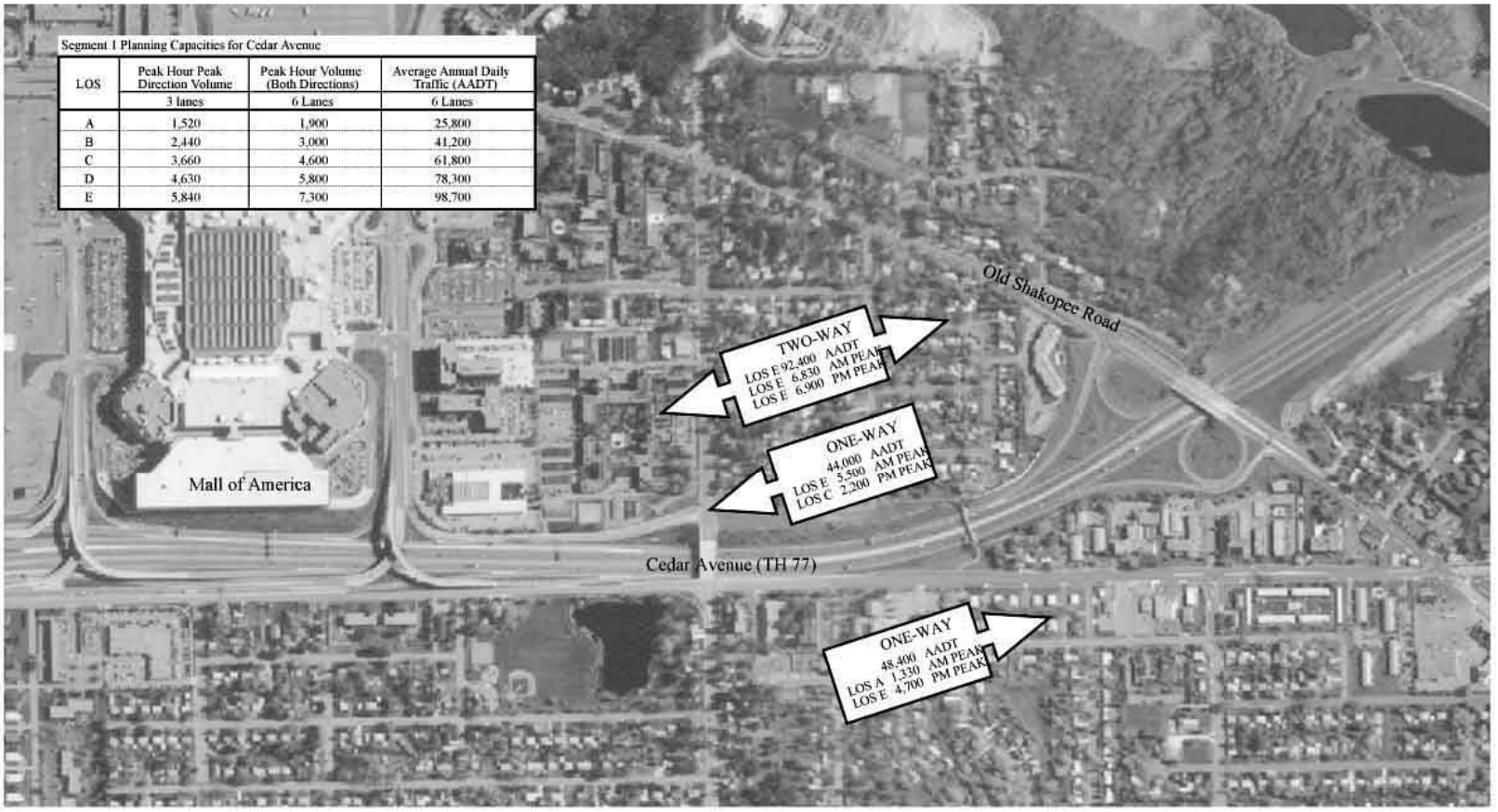
- The Cedar Avenue Corridor steadily accumulates traffic from the south at 160th Street to Old Shakopee Road where traffic begins to lessen at the various interchanges near the Mall of America. The build up of traffic results in a bottleneck at the Cedar Avenue Bridge that impacts the freeway to the south.
- Peak hour directional capacity along Cedar Avenue is greatest between Old Shakopee Road and I-35E (Segments 2 and 3). Capacity is lowered within Segment 1 due to the relatively high number of ramps in a short section of roadway. Segment 4 is the lowest capacity segment due to the presence of traffic signals.
- Segment 2, which includes the Cedar Avenue Bridge, operates at Level of Service E. LOS E is bordering on unstable conditions and on any given day can move to LOS F. LOS F would result in queue spill-backs that would have impacts far to the south of the bridge. This condition is experienced with more frequency on Cedar Avenue.

4.2 Inventory of Transit Providers

The primary bus transit service within the Cedar Avenue Corridor is provided by Minnesota Valley Transit Authority (MVTA). There are numerous crosstown connections operated by Metro Transit with anchoring stops at the Mall of America.

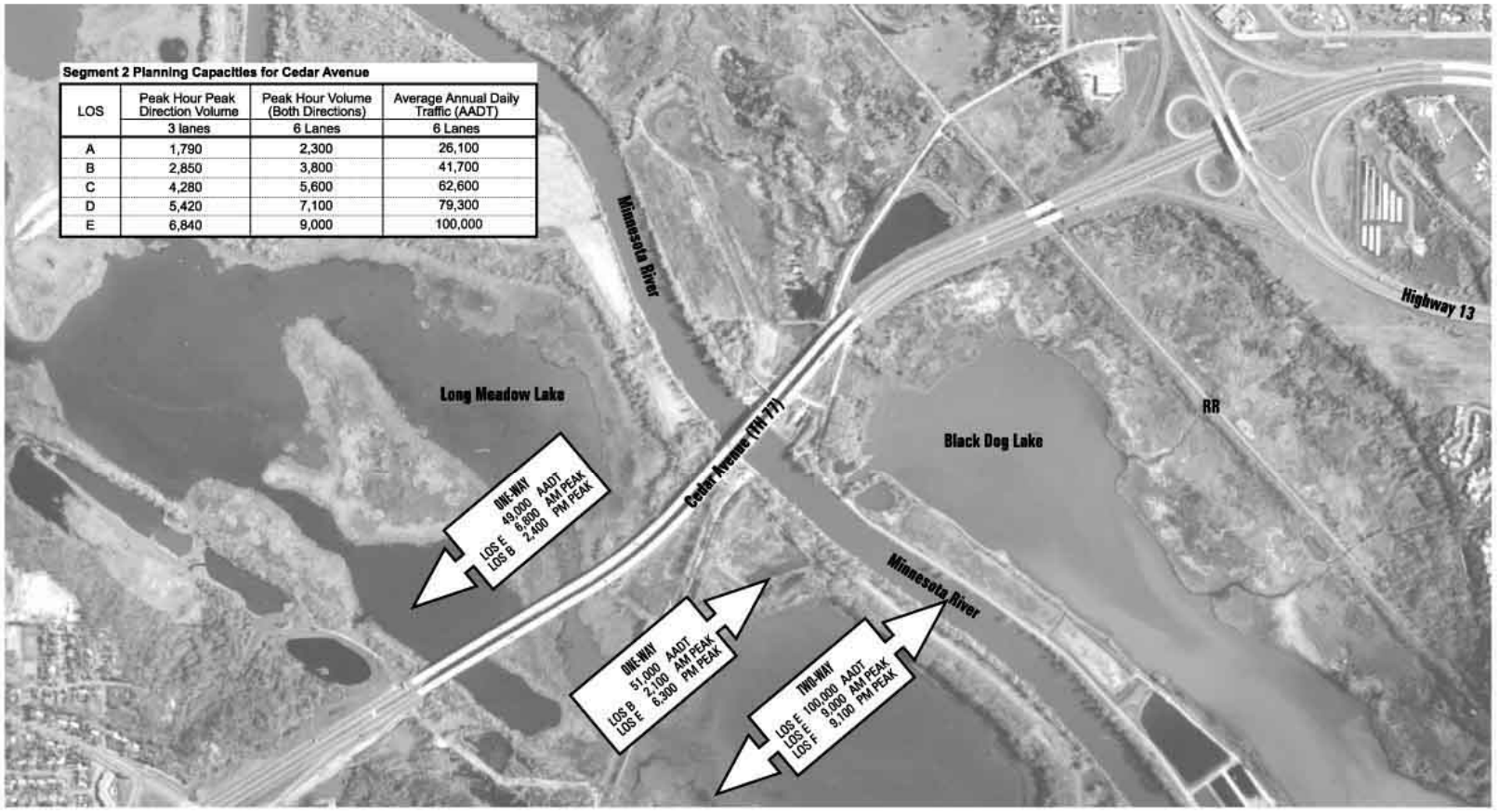
The MVTA began service in 1991 and is the third largest public transportation agency in the State. The public transit agency operates in the Dakota County cities of Apple Valley, Burnsville, Eagan, and Rosemount, and in the Scott County cities of Savage and Prior Lake. MVTA serves commuters to downtown Minneapolis and St. Paul, Mall of America, Bloomington, Edina, Northwest Airlines, GSA, and the Veteran's Administration Hospital.

MVTA provides "flag stop" service, stopping at any safe corner along a bus route and at controlled intersections along major thoroughfares. MVTA is also part of the regional transit system in which a passenger may board other buses using an MVTA transfer. Overall, about 43% of MVTA's daily ridership is to/from downtown Minneapolis. Ridership for the 1998 period increased 10.6% over the prior year. Cedar Avenue Express routes increased ridership by 4.9%, and St. Paul Express service was up 19% over the prior year.



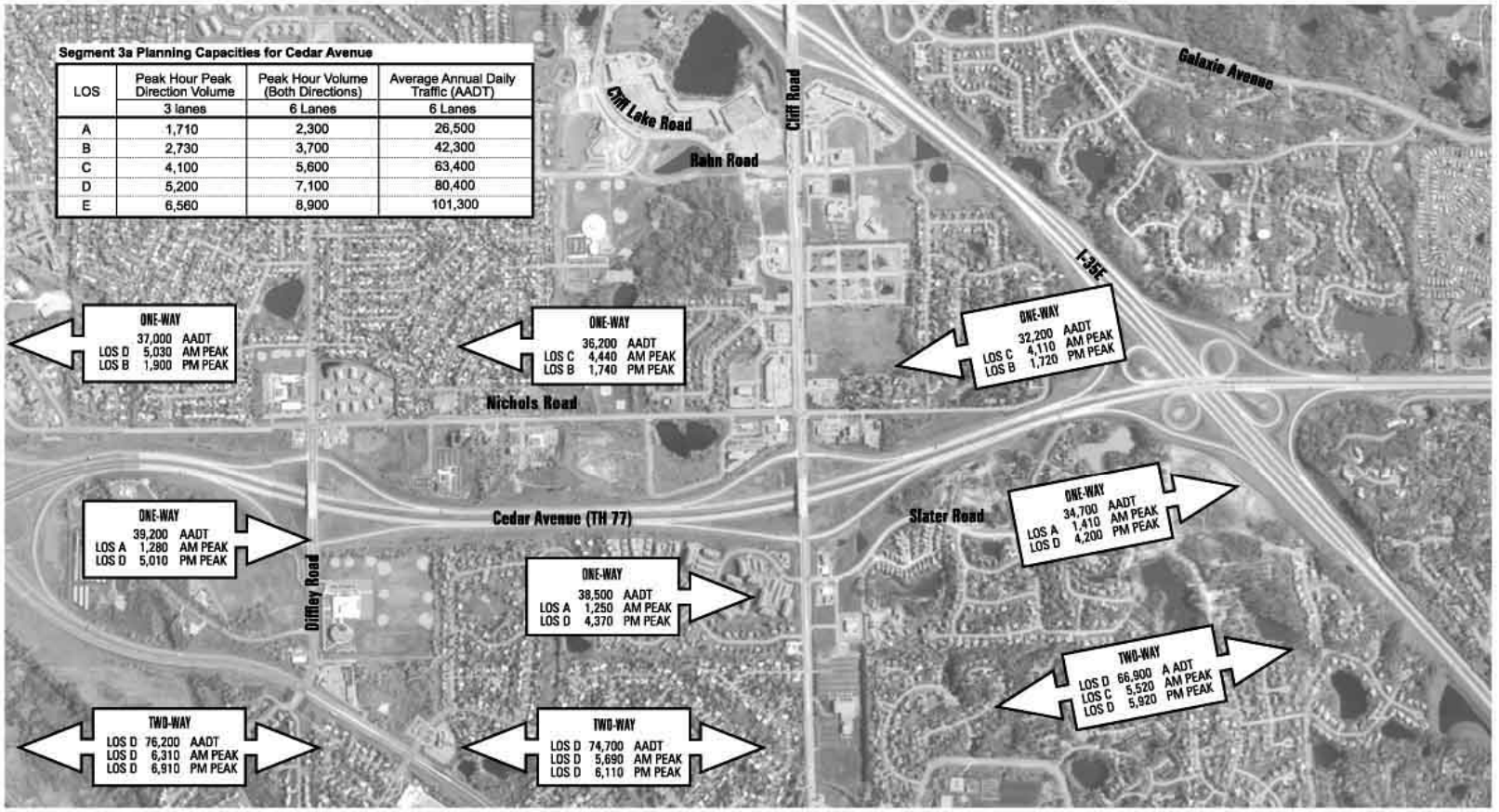
Cedar Avenue (TH 77/CR 23) CORRIDOR TRANSITWAY STUDY

Figure 4.1.1
Existing Traffic Segment Capacities
Segment 1



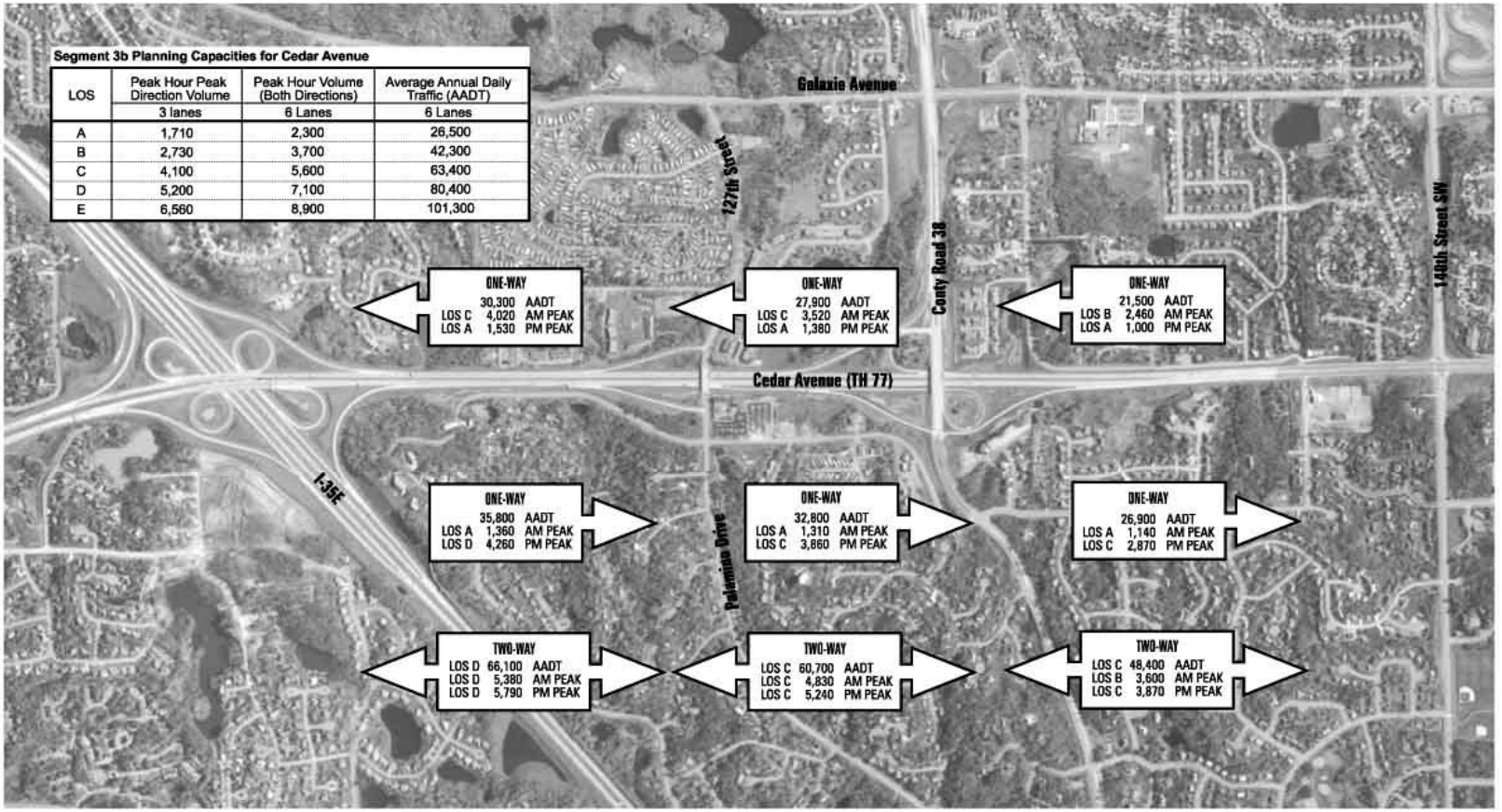
Cedar Avenue (TH 77/CR 77) CORRIDOR TRANSITWAY STUDY

Figure 4.1.2
Existing Traffic Segment Capacities
Segment 2



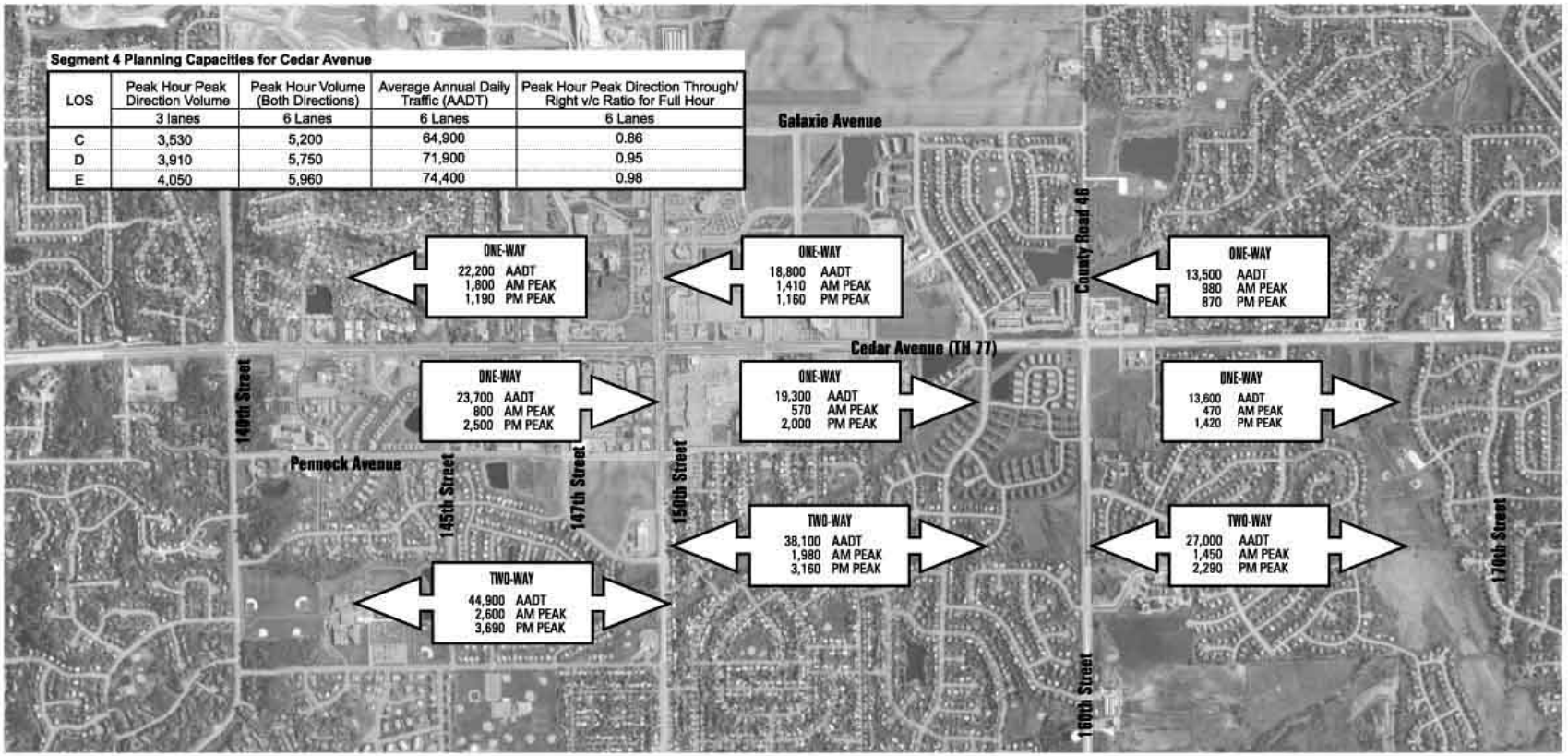
Cedar Avenue (TH 77/CSAH 23)
CORRIDOR TRANSITWAY STUDY

Figure 4.1.3
Existing Traffic Segment Capacities
Segment 3a



Cedar Avenue (TH 77/CSAH 23) CORRIDOR TRANSITWAY STUDY

Figure 4.1.4
Existing Traffic Segment Capacities
Segment 3b



Cedar Avenue (TH 77/CSAH 23) CORRIDOR TRANSITWAY STUDY

Figure 4.1.5
Existing Traffic Segment Capacities
Segment 4

The following express routes are MVTA's top ridership between designated station/park-and-rides to downtown Minneapolis:

Route	Average Daily Riders	Scheduled Travel Time to Downtown Minneapolis
Express 77A: A.M./P.M. peak frequency every 10 minutes.	902	40 - 45 minutes 3 stops from Apple Valley Transit Station.
Express 77 BC: A.M./P.M. peak frequency every 30 minutes	461	37 minutes 4 stops from Cedarvale PNR
Express 77 PV: A.M./P.M. peak frequency Every 10 minutes.	400	50 minutes 8 stops from 145 & Pennock

MVTA services include the following:

- Express bus to the downtowns of Minneapolis and St. Paul, Bloomington, and Edina.
- Reverse commute service from downtown Minneapolis and St. Paul and the Mall of America to Apple Valley, Burnsville, and Eagan businesses.
- Local all-day and weekend service throughout MVTA's six member cities and the Mall of America.
- Carpool matching; Vanpool routes.
- Dial-a-ride service during the summer to Apple Valley, Burnsville, Prior Lake and Savage residents. Flexible routing in Savage and Rosemount.
- Guaranteed Ride Home program.
- Bike information and facilities.

Transit Facilities provided by MVTA include:

- Palomino Hills Park-and Ride (opened in November 1994)
- Burnsville Transit Station and MVTA offices (opened in July 1995)
- MVTA Burnsville Bus Garage (opened December 1996)
- Apply Valley Transit Station (opened February 1999)
- Savage Park-and-Ride (opened December, 1999)
- Yankee Doodle and Blackhawk Park-and-Ride lots (acquired in 1997)

Bloomington Edina (BE Line) service began in November 1991 as a two route circulator service operating in the Bloomington and Edina areas. It runs a fleet of two buses with 18 seats each. The company Laidlaw operates the BE Line service under contract to the Metropolitan Council. The BE Line is cross-town service and anchored by the Mall of America and Southdale. Direct transfers to and from the BE Line can be made with fourteen different routes.

Metro Transit carries over 90 percent of the region's ridership and is the transit provider for Minneapolis, St. Paul, and inner suburbs such as Bloomington, Edina, and Richfield. There are several connections between MVTA and Metro Transit service with transfer reciprocity.

Metro Mobility is the region's public paratransit service for people with disabilities who are unable to use standard regular route bus service. Its ridership per capita is one of the highest in the United States. Riders must become certified to use the service. The program provides "door-through-door" service. The delivery of service is divided into three components: a fleet of 150 vans for general demand service specifically designed to be accessible and safe for people with disabilities; two sedans which provide supplemental service to the demand vehicles; and, a fleet of approximately 97 vans for agencies which provide service to training and rehabilitation centers, extended employment, and adult day care centers.

Dakota Area Resources and Transportation for Seniors (DARTS) is a service for seniors and physically and mentally impaired citizens. DARTS operates with a "sliding fare" of $2.00 each way. Discounted ridecards are also available.

MVTA operates park-and-ride facilities throughout its six member cities. The Apple Valley Transit Station and park-and-ride lot came on line in early 1999. The Transit Station has substantial capacity with arrangements for use of the adjacent movie theater parking.

4.3 Cedar Avenue Bridge Structural Analysis

The Cedar Avenue Bridge across the Minnesota River consists of twin bridges with 43 spans that total approximately 5,200 feet in length. A twin 360-foot tied arch span carries the roadway over the main channel of the river. The remaining 42 twin spans are constructed using pre-stressed concrete deck girders.

4.3.1 Bridge Analysis

Three potential scenarios were presented for use of the river bridges by bus or rail transit in the Cedar Avenue Corridor. One alternative would continue to use the shoulder lanes of the existing bridge as bus lanes during peak commute periods. The use of the shoulder lanes would accommodate the bus alternatives, but would not be adequate for the LRT alternatives, since conversion of the existing bus/shoulder lane to LRT use would require more lane width. Conversion of the shoulder to LRT use cannot be accomplished without losing a travel lane on the bridge. The other two alternatives, shown below, involve modification or additions to the existing structure and would be suitable for either bus or LRT:

- Cantilever the new transitway off the existing structure (i.e., attach the transitway to the edge of the bridges)
- Construct a new floor system that would span between the northbound and southbound bridges that would carry the new transitway

The analysis of the existing tied arch structure involved the following steps:

- Compute section properties of existing bridge components
- Compute weight (dead load) of existing bridge components
- Develop computer model of existing structure
- Compute dead load stresses
- Generate influence lines for analyzing moving loads

- Determine moment amplification factors for arch ribs
- Compute stresses due to standard AASHTO live loads
- Compute reserve capacity (if any) of bridge superstructure
- Determine pier and foundation loads
- Compute reserve capacity (if any) of pier and foundations

Analysis of the effect of the transitway loading with either of the two alternatives involved the following steps:

- Determine transit vehicle loads
- Develop preliminary design of floor system to carry transit vehicles
- Apply transit vehicle and floor system loads to computer model
- Compute stresses from transit vehicle and floor system
- Compare calculated superstructure stresses to allowable
- Compare calculated pier and foundation loads to allowable

4.3.2 Conclusions

The tied arch spans have been determined to not be capable of supporting light rail vehicles either on the highway bridge deck or under either of the two systems (cantilevered or suspended) that would place the transitway between the two highway structures. The concrete girder spans were not analyzed once it was determined that the tied arch spans could not support LRT loads.

It is recommended that the light rail tracks be carried by a new independent structure of the same span as the existing structures crossing the river between the existing tied arches. The preferred bridge type, for aesthetic reasons, would be a tied arch to match the existing structures, although it would be possible to use concrete girder spans. This structure would have its own foundations that would possibly be connected to the existing piers to provide lateral stability. This interconnection may be necessary because the battered piles for the existing structures may interfere with battered piles for the new structure. Additionally, the width of a new LRT span would not require the entire 50 feet between the highway spans, but could be accomplished within approximately 30 feet of width.

4.4 Community Resources

A number of public facilities, community resources and churches are adjacent or proximate to the Cedar Avenue Transitway. These facilities could be either directly or indirectly affected by the project in a beneficial or adverse manner. It is possible that some of these facilities could be generators of trips (transit or vehicular) and therefore they could benefit from improved access if a transitway is implemented. Other facilities could potentially experience neutral or adverse impacts if the transitway technology or alignment creates any direct social or environmental impacts.

Fire Stations

- Apple Valley Fire Station #1, Hayes Road at 145th Street

Ice Arena

- Apple Valley Hayes Park Ice Arena, Hayes Road at 145th Street

Schools

- Cedar School, Cedarvale and Nicols Road
- Greenleaf Elementary School, 13333 Galaxie Avenue, Apple Valley
- John Metcalf Junior High School, Diffley Road
- Rahn Elementary School, Rahn Road
- Southview Elementary School, northwest quadrant of Whitney Lane and Garden View Drive
- Valley Middle School, northwest quadrant of Whitney Lane and Garden View Drive
- Ramalynn Montessori, 15004 Glazier Avenue, Apple Valley

Libraries

- Dakota County Library, Galaxie Avenue, adjacent to County government facilities.

Government Facilities

- Apple Valley City Hall, adjacent to Dakota County Western Service Center
- Apple Valley Community Center and Sports Arena at Pinewood and Valley View Drives
- Dakota County Western Services Center, 14955 Galaxie Avenue
- U. S. Post Office, Apple Valley Station

Medical

- Fairview Cedar Ridge Clinic, 15650 Cedar Avenue, Apple Valley

Churches

- People of Praise Christian Community, 2300 East 88th Street, Bloomington (east of Old Shakopee Road)
- Peace Reformed Church, 2180 Glory Drive, Eagan (borders TH 77 off of Diffley Road)
- Living Word Lutheran Church, 4300 Nicols Road, Eagan
- Mary Mother of the Church, 3333 East Cliff Road, Burnsville
- Christus Victor Lutheran Church, 7510 Palomino Drive, Apple Valley (next to Palomino Hills Park and Ride Facility)
- Mount Olivet Assembly of God, 14201 Cedar Avenue, Apple Valley
- Hope Church, 7455 145th Street West, Apple Valley
- Apple Valley Baptist Church, 964 Gardenview Drive, Apple Valley
- Valley View Church of God, 8130 West 160th Street, Apple Valley
- Messiah Lutheran Church, 16725 Highview Avenue, Lakeville

5.0 TECHNOLOGY ASSESSMENT

5.1 Technology Alternatives

A systematic process was undertaken to evaluate the full range of available transit technology alternatives. The transit technologies that were evaluated include:

- Conventional Bus
- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)
- Monorail
- Personal Rapid Transit (PRT)

5.1.1 Evaluation

Evaluation of transit technology alternatives was accomplished by comparing the physical characteristics of each alternative with the requirements of the Cedar Avenue corridor. The results of this evaluation are summarized below:

Transit Technology Classification

Speed Categories
- 0 to 30 mph – acceptable for circulator, too small for line-haul
- 30+ mph - recommended category for line-haul

Passengers per Minimum Unit
- 1-6 passengers - too small
- 7-24 passengers – acceptable for circulator, too small for line haul
- 25 to 220 passengers - recommended category for line haul
- 221+ passengers - too large, capacity not needed and ROW not available

Type of Service
- Non-stop station to station – could be considered if system can be elevated and network is above minimum threshold level
- Local or express – recommended service type
- Circulator – applies as a local circulator/feeder, either on its own or in conjunction with line-haul system

Physical Characteristics

Traffic/Elevation
- Mixed traffic - acceptable
- Separate ROW at grade - acceptable
- Separate ROW elevated only if guideway is required/justified – not recommended
- Separate ROW tunnel – not recommended

Power supply
- Self propelled - acceptable
- Overhead power supply - acceptable
- Guideway only if elevated – not recommended

Propulsion
- Diesel self propelled – acceptable
- Electric with overhead power supply – acceptable
- Other options with guideway – not recommended

Control/Communication
- Driver/manual – recommended
- Automatic – not recommended because dedicated guideway is required and automation cannot be justified economically

People Container
- Single – acceptable
- Articulated – for high passenger volume routes
- Trains – requires tracks or guideway – must be justified economically with high passenger volumes and capacity flexibility – may be recommended

Suspension
- Rubber tire – acceptable
- Rail – acceptable
- Others available only with guideway – not recommended

Transit Stations
- Conventional bus stops - acceptable
- Transit centers – passenger loading and parking – acceptable
- Transit stations – at grade - acceptable
- Transit stations – elevated for guideway options – not recommended

5.1.2 Conclusions

A transit technology in the Cedar Avenue Corridor should meet the following classifications and physical characteristics.

- Should be capable of speeds 30 mph or greater
- Passenger capacity should be:
  - 7 to 24 for circulator service
  - 25 to 220 for line haul service
- Operate in mixed traffic or separate ROW at grade with bridge and some grade separations
- Power supply should be self contained or overhead
- Propulsion should be diesel or electric
- Control/Communication should be manual
- Vehicles can be single, articulated or combined into trains
- Suspension should be rubber tire or rail
- Technologies that meet criteria from screening process

- Bus Rapid Transit (BRT)
- Light Rail Transit (LRT)

5.2 New Technologies and ITS Applications

There is considerable activity across the country regarding development and implementation of ITS applications that potentially improve the effectiveness and efficiency of transit operations. Many ITS technologies can be used for almost any transit mode in operation. Summarized below are examples of ITS applications that may be appropriate to consider as transit system alternatives are formulated for the Cedar Avenue Corridor.

Data Radios

Data radios are being installed in many large and medium sized metropolitan areas (e.g., Chicago Transit Authority buses, Lane Co. Transit Authority in Eugene, Oregon, and in Seattle, Washington). Besides the security aspects-including a silent alarm, they can provide information on bus location (which can be used for schedule adjustments-slow down or speed up; transfer protection, etc.); bus loading; engine monitoring; etc, etc. Location can be based on GPS (standard or differential), map matching, roadside transponders, etc. The operator also has the ability to key in notification of incidents, which in turn may be used by the transit agency as well as emergency response agencies and other operating agencies

Automated Vehicle Locator (AVL) and Automated Vehicle Identification (AVI)

This provides information on bus locations in combination with the above technology. It can be a feed to a data radio or simply a report to a transit management center (TMC) of the vehicle location. The info can then be used for improved bus management and provision of arrival information to the customers.

Traffic Signal Priority

This can be as simple as always giving a priority to buses on their approach to a signal to very sophisticated systems that determine whether the bus is on time or not and the amount of delay that will be caused other vehicles by the priority.

Intelligent Bus Stops

These can range from kiosks, which may simply show the static bus schedule to those that receive real time info and can provide passengers with the arrival time of the next bus.

Electronic Message Boards

In lieu of kiosks as noted above, these can be used at bus stops. They can also be used in bus vehicles to improve information for passengers.

Closed Circuit Television (CCTV)

A wide variety of applications are possible. These can range from onboard security systems to systems at major bus stops where there is a potential security problem. They have also been used to oversee honor payment systems.

Smart Cards

There are a variety of options available here. At the low end is simply a magnetic card with a prestored amount of money on it that is scanned at each usage and then tossed at the end. At the other end of the spectrum is an actual smart card that could be tied to a credit card. Information on usage, etc. can be obtained from that type of card. Claimed benefits of smart cards include reduced fare evasion and increased revenues. Note, there is also the possibility of using smart cards for more than a single purpose, example for parking, at retailers, etc.

6.0 Land Use

With the exception of the Minnesota Valley National Wildlife Refuge, the corridor is generally settled with inner-ring suburbs (Bloomington) and outer-ring suburbs (Eagan, Apple Valley, and Burnsville). Land use patterns along the Cedar Avenue Corridor can be viewed as reflecting the evolution of transportation investments and intensification of retail/commercial activity at major road intersections. The latter is particularly focussed within the City of Apple Valley at the Southport Centre Shopping area. The overall land use pattern along the corridor is predominantly residential with focused commercial, retail, and mixed-use activity within Eagan at major intersections (e.g., Cliff Road, Diffley Road, and TH 13).

Future land use influencing factors along the corridor include:

- The LRT Station at the Mall of America with transit-supportive land use modifications. Increasing regional-oriented commercial and mixed-use land uses in vicinity of Cedar Avenue. Bloomington's Airport south district is evolving into the regions third major commercial node, after downtown Minneapolis and St. Paul. Future development may include a proposed 52+ acre "Met Center" ("Hyperport") with 5.7 million square feet of mixed-use, hotel, entertainment, and offices.

- Growth within Eagan at TH 13 and I-35E existing business activity concentration.

- Apple Valley Transit Station, Town Center plans, and the extent, location, and marketability of underutilized property in vicinity of corridor.

6.1 Transit Oriented Development

Transit-oriented development (TOD) or transit-supportive development refers to pedestrian-friendly land development activities that are built within easy walking distance of a major transit station. TOD's generally include a compact mix of different land uses that are oriented to public walkways and automobile parking is minimized to promote pedestrian activity. Livable communities are neighborhoods that include a range of housing options, jobs, commercial services, and recreational opportunities all within easy access of transit services. These are communities in which residents, workers, and shoppers can get around without the need of an automobile.

TOD is a project or development area within 1/4 to 1/2 mile of a transit station/stop or "multi-modal center" (bringing together several modes of transportation and transit), that is developed with transit service and access in mind. It is usually mixed-use development, often incorporating residential, with various forms of commercial development (office, hotel, retail, entertainment, etc.) and appropriate public facilities, into a compact and relatively dense urban pattern.

These areas of TOD development or "nodes," around transit stations/centers are generally at a higher density than the surrounding areas. This is because they can be served by transit ridership reducing the need for automobile infrastructure improvements, such as street/highway capacity and intersection/interchange improvements, signalization and parking facilities.

A transit station community is a compact, mixed-use activity area centered around a transit station that by design encourages residents, workers, and shoppers to drive their cars less and ride mass transit more. The centerpiece of a transit community is the transit station - connecting the residents and workers to the rest of the region - and the civic and public spaces that surround it. The design, configuration, and mix of buildings and activities emphasize pedestrian-oriented environments and encourage use of public transportation. The land uses within a transit station community are linked with convenient pedestrian walkways, and parking is managed to discourage dependence on the automobile.

Housing is a major component of a transit station community, along with commercial retail, employment, and cultural and recreational attractions. A variety of housing types - small-lot single-family homes, townhouses, condominiums, and apartments - promote a more compact and diverse community. Commercial uses might include food markets, restaurants, theaters, offices and even light-industrial activities. Urban open spaces and parks furnish focal points for community activity while streets provide settings for social interaction and active community life with wide sidewalks, street trees, and seating for pedestrians.

6.2 Transit, Land Use, and Economic Development

The presence of a transit line, the location of stations, and the demand factors that stimulate transit ridership all have a bearing on the nature and amount of transit-oriented development near stations. However, many other variables also play important roles in determining the amount of development. Two of the more significant factors are: (1) the state of the present and future regional economy, and (2) opportunities for real estate development in the specific corridor where the transit station is located.

All transit-oriented development projects are different, reflecting the specific location, land value, nearby development pattern, local demographics, history of the area, and related factors. Public policy can also have a powerful impact on the nature, magnitude, and timing of transit-oriented developments. Designation of urban growth areas, implementation of regional and local plans, aggressive zoning, and establishing rigorous standards for density and design in transit corridors are all measures that can support or, if not done properly, detract from development at stations.

A wide range of factors determines the market for transit-oriented development. Each station location will have different influences and will respond to different strategies. Below are some common "ground rules" for better understanding these influences on development potential at transit stations. The ground rules provide direction for assessing development opportunities and constraints around transit stations.

- Define Transit-Oriented Development Objectives
- Understand Responsibilities for Transit-Oriented Development
- Determine Realistic Expectations for Each Station Area
- Understand that Developers Make Real Estate Decisions
- Demonstrate Public Commitment to Private Investment
- Consider Location as Primary Determinant of Market Potential

Market research for transit-oriented development involves analyzing market and economic conditions at various geographic levels. The objective of the market analysis is to look at the state of the economy and real estate market at the regional level and work down to the site level. There are three key levels to focus on in the process for conducting a market analysis of development potential at a transit station area. The different levels require the skills of a number of people as well as a variety of data sources.

- The first level is the regional market analysis. This broad scale analysis is conducted to determine "the big picture" economic and demographic context for transit-oriented development in general. This level of analysis provides an understanding of the housing and job growth environment in which transit-oriented developments do business and compete for market share.

- The second level is the corridor-segment market analysis, which defines the development potential of specific segments of the corridor. In urban regions it may be typical for particular types of land uses to concentrate in a particular sector or a region, or along certain corridors.

- The final level is market analysis for the station area and specific sites. This analysis is the more detailed because it deals with a specific group of properties. It is at this level that careful consideration is given to specific land use relationships and the opportunities for the desired development projects to support transit. The detailed analysis of the station area and individual sites is probably best performed by local government staff working with private developers and neighborhood interests.

Market analysis for transit-oriented development involves understanding multiple levels of the economy and the real estate market. A comprehensive market analysis process involves the review and assessment of market factors at various levels within the regional market. Such an analysis is not a means to an end. Rather, it provides a general idea of the types of development that could locate and be successful within the station area. The information gathered from a market analysis should be incorporated into an action plan or market strategy for promoting transit-oriented development.

6.2.1 Regulations that support Transit Oriented Development

Although transit-oriented development has been hailed for a number of years as an excellent alternative to conventional low-density development, it has still not been institutionalized within the permit and regulatory environment of most jurisdictions in the nation and region. For this to change, local communities will need to look at how their zoning and development codes either hinder or accommodate station area development activities.

Described below are three ways of creating a more effective regulatory and permit review environment for transit-oriented development.

Modify Zoning and Development Regulations

Many local zoning codes discourage transit-oriented development through regulations designed to promote automobile-oriented, single-purpose, suburban-scale development. Identifying and eliminating these regulatory barriers is a necessary first step for creating successful transit station communities. This process is sometimes described as a 'regulatory audit'. When modifying

regulations, it is important to take market forces into consideration. Land use regulations that are too stringent may discourage all development activity while regulations that are too broad may allow development that is not desirable. An economic analysis of new regulations should be conducted to ensure they do not represent a true disincentive to positive development.

Tailor Regulatory Mechanisms to the Station Area

In conducting a zoning or regulatory audit you may find that many of the objectives that you want to achieve within a station area are not desired or appropriate in other parts of the jurisdiction. For instance, implementing reduced parking requirements jurisdiction-wide could cause problems in certain areas. There are many ways to apply or fine-tune regulations to achieve desired objectives in a station area. Many jurisdictions in the region already use different techniques to tailor their code to historic districts, growth centers, or other unique areas. Some common ways that zoning regulations can be tailored for use in achieving station area objectives include:

- Developing new zone classifications
- Creating a transit overlay zone
- Establishing new zoning districts
- Instituting design guidelines

Simplify the Permit Review Process

Many private developers cite length of time and uncertainty in the permit process as primary barriers to development. The permit review process plays a large role in both the time and level of certainty in getting development approval. Facilitating the permit process can provide a powerful incentive for transit-oriented development. Ways to streamline permit review in station areas include:

- Remove or consolidate steps in the process.
- Make sure the applicable regulations are organized and easily accessible.
- Review prior appeals to identify opportunities.
- Allow for flexibility in the permit process.
- Conduct some of the permit steps in advance of the development proposals.

7.0 Plan Scenarios

The technology assessment recommended that LRT and BRT alternatives be developed and analyzed for this study. Two basic alignment options were considered for these technology options: the Cedar Avenue alignment and the Nicols-Galaxie Avenue Alignment. These alignment alternatives are shown in Figures 7.0.1 through 7.0.5.

7.1 Alignment Alternatives

Two general alignment alternatives were identified and investigated for this study: the Cedar Avenue Alignment and the Nicols-Galaxie Alignment. A description of each alternative is presented below and is illustrated on the following pages.

Cedar Avenue Alignment

Starting from the Mall of America, the alignment follows either Killebrew Drive or Old Shakopee Road to the junction with Cedar Avenue. The alignment then follows Cedar Avenue across the Minnesota River to Cedarvale in the vicinity of the southeast quadrant of TH 13 and Cedar Avenue. The alignment then returns to Cedar Avenue for the remaining length of the corridor. Stations would be located at Cedarvale, Cliff Road, Palomino, 140th Street, and the Apple Valley Transit Station.

Nicols-Galaxie Alignment

The alignment options are the same as previously described from the Mall of America to Cedarvale. At Cedarvale, this alternative then follows Nicols Road to just north of the intersection with I-35E. The alignment returns to Cedar Avenue at the I-35E crossing and then deviates to the east to connect with Galaxie Avenue. There alternatives were identified for the connection between Cedar and Galaxie Avenues: (1) the vicinity of the mobile home park, (2) at 127th Street, and (3) along McAndrews Road. The alignment then follows Galaxie Avenue until it reconnects with Cedar Avenue at either 140th, 147th , or 157th Street. Stations would be located at Cedarvale, Cliff Road, Palomino, the Minnesota Zoo, McAndrews Road, the Government Center, and the Apple Valley Transit Station.

7.1.1 Evaluation

An analysis was performed to evaluate the effect of the two alignments on potential transitway ridership. The results indicate that, regardless of mode (LRT or BRT), the two alignment alternatives result in nearly identical ridership. Therefore, ridership will not be a determining factor in choosing an alignment alternative. Other factors that were considered include available right-of-way, adjacent land uses, access to major trip generators, and character of the transportation facility.

7.1.2 Conclusions

The Cedar Avenue alignment has been determined to be the most appropriate location for a transitway serving Dakota County. This conclusion is based on the following factors:

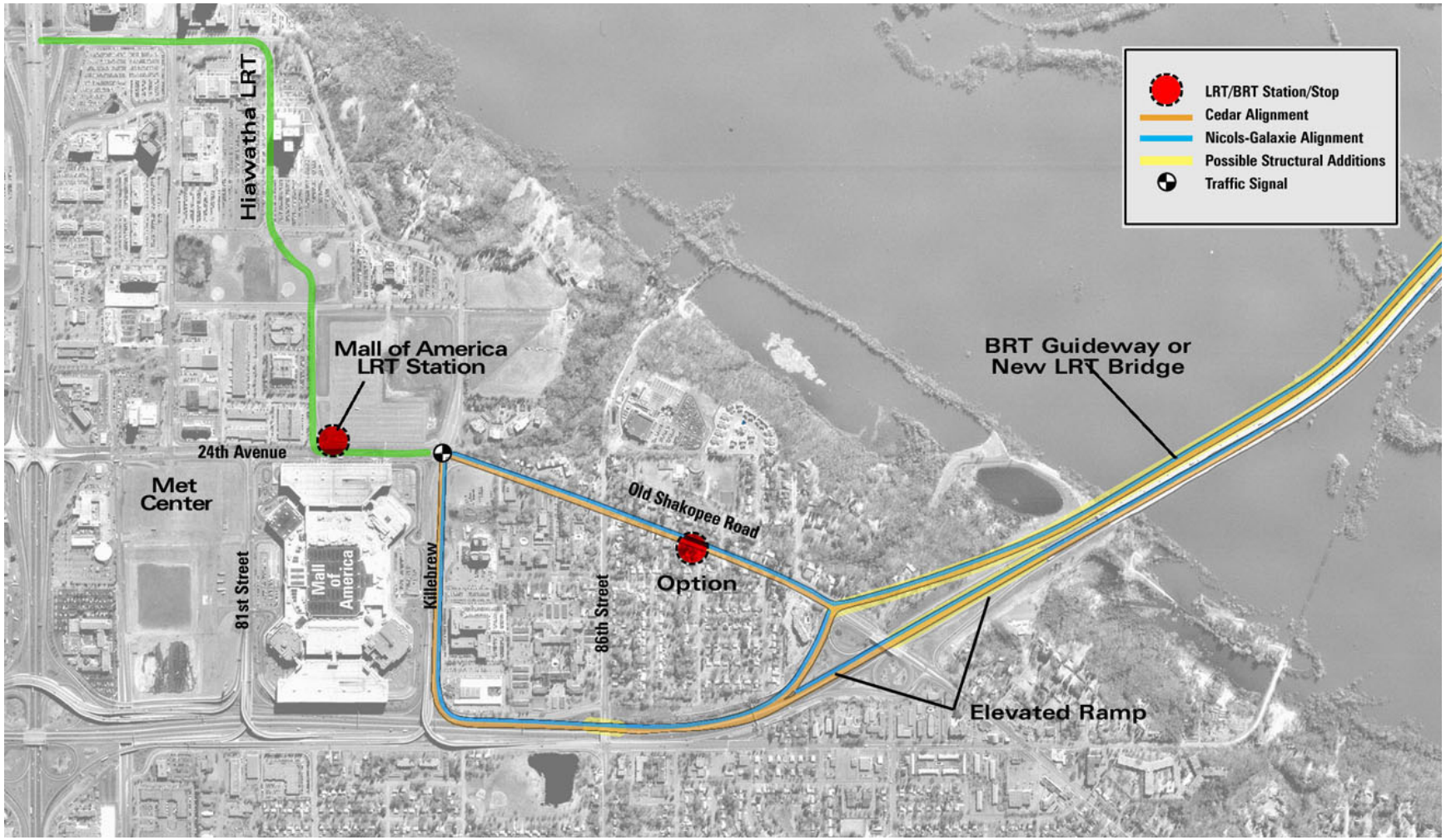

LRT/BRT Station/Stop
Cedar Alignment
Nicols-Galaxie Alignment
Possible Structural Additions
Traffic Signal
Hiawatha LRT
Mall of America
LRT Station
BRT Guideway or
New LRT Bridge
24th Avenue
Met
Center
81st Street
Mall
of
America
Killebrew
Old Shakopee Road
Option
86th Street
Elevated Ramp

Figure 7.1.1

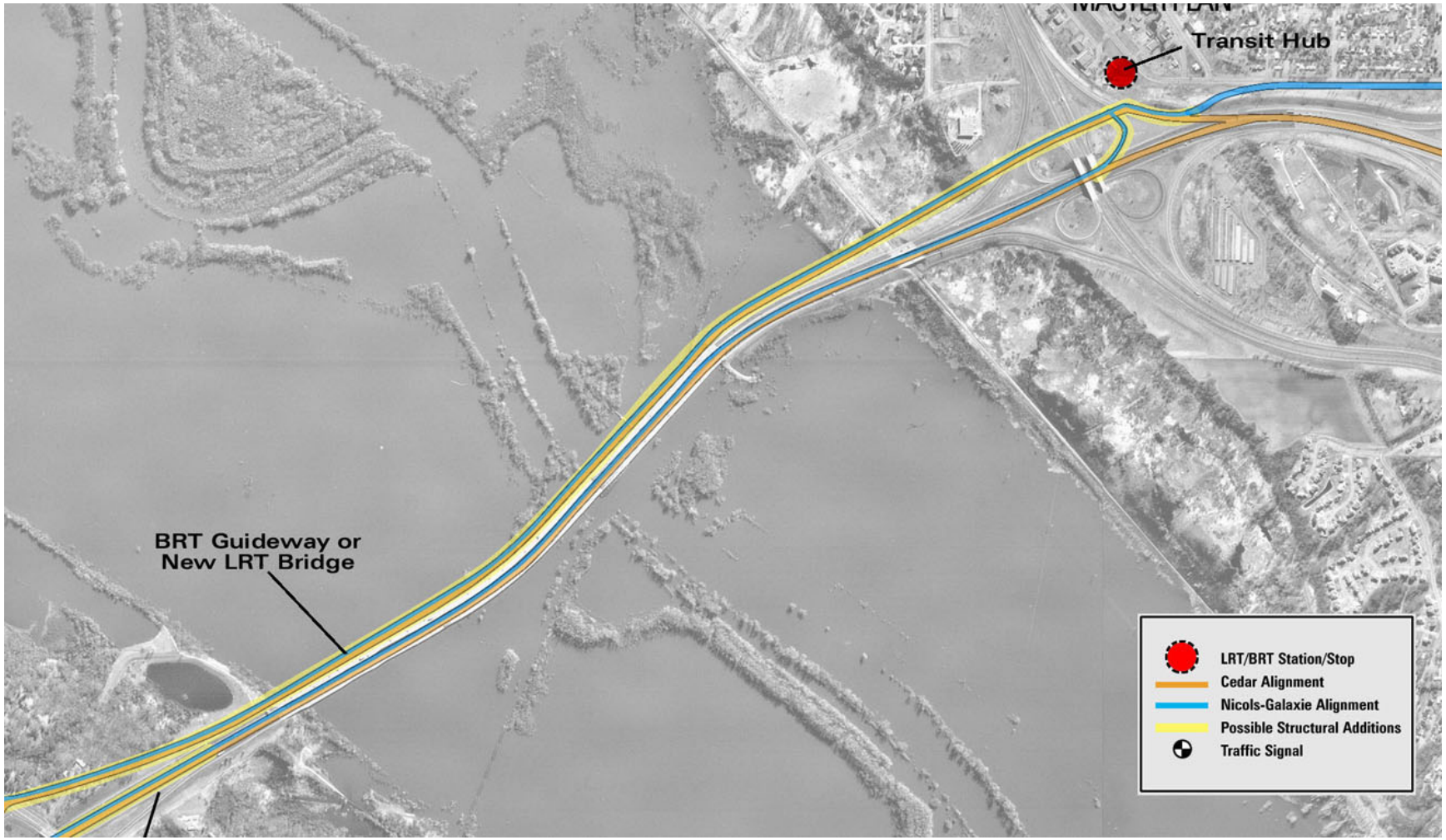

Transit Hub
BRT Guideway or
New LRT Bridge
LRT/BRT Station/Stop
Cedar Alignment
Nicols-Galaxie Alignment
Possible Structural Additions
Traffic Signal

Figure 7.1.2

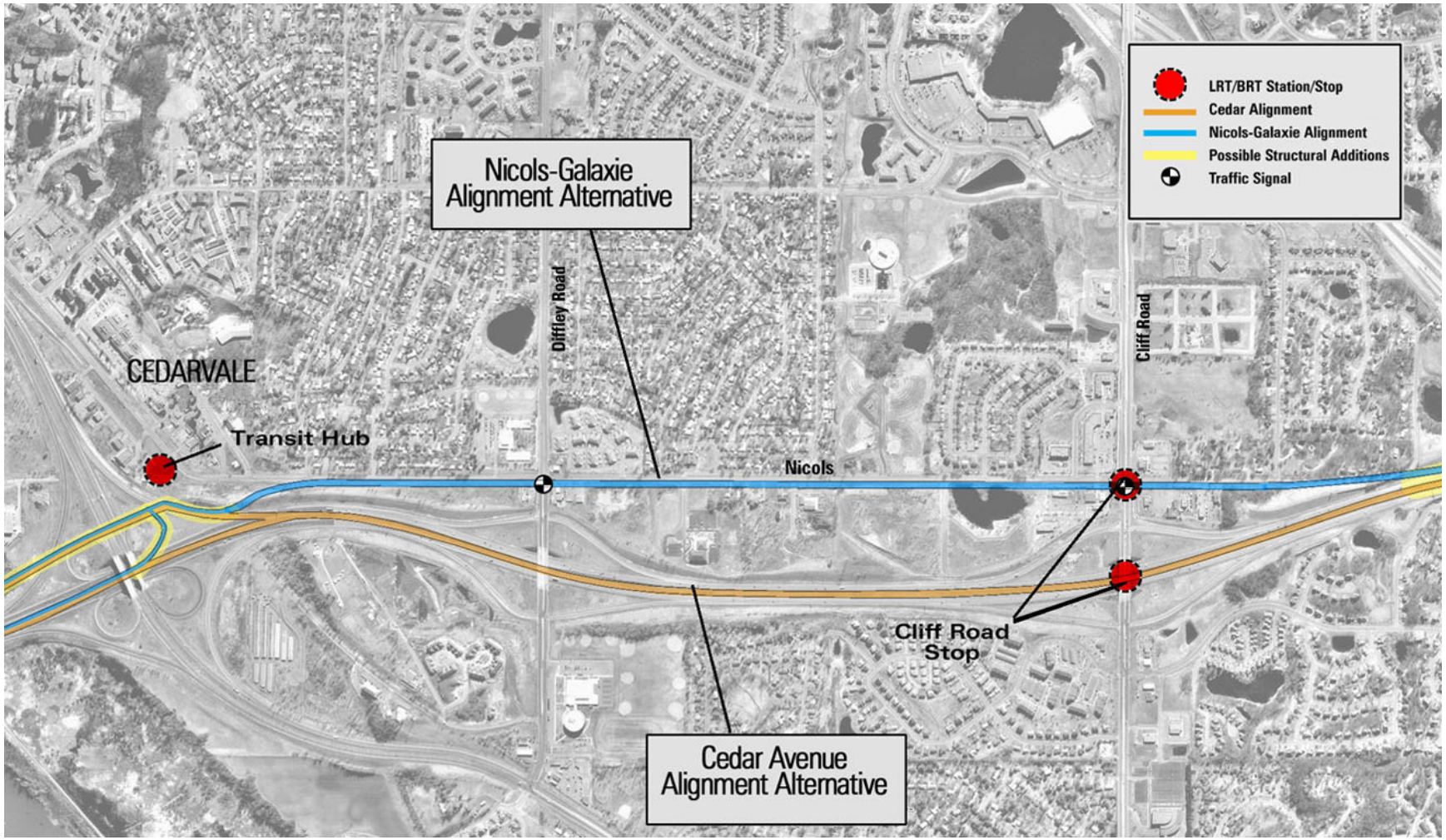

LRT/BRT Station/Stop
Cedar Alignment
Nicols-Galaxie Alignment
Possible Structural Additions
Traffic Signal
Nicols-Galaxie Alignment Alternative
Diffley Road
Cliff Road
CEDARVALE
Transit Hub
Nicols
Cliff Road Stop
Cedar Avenue Alignment Alternative

Figure 7.1.3

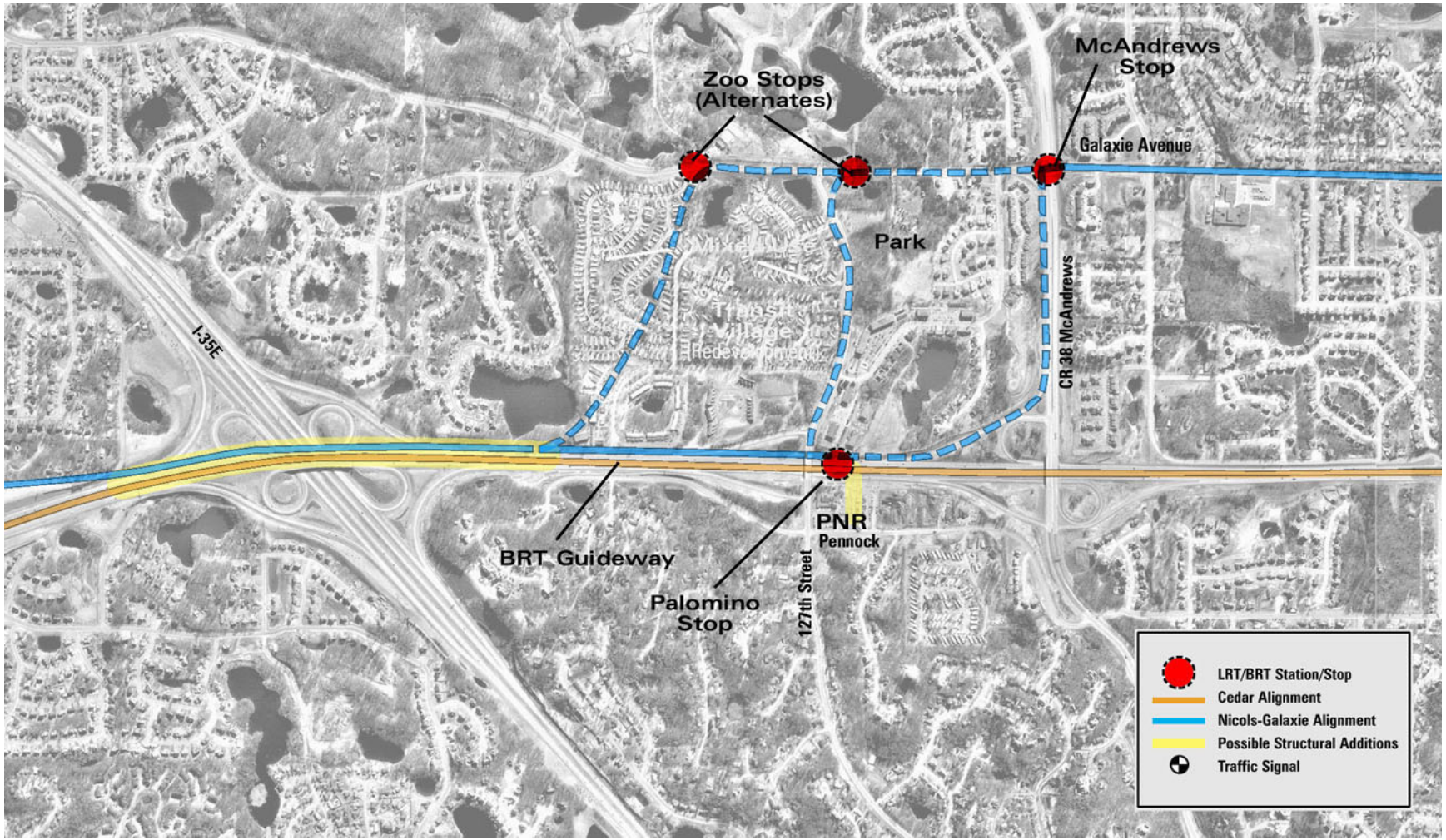

McAndrews Stop
Zoo Stops (Alternates)
Galaxie Avenue
Park
Transit Village
Redevelopment
I-35E
CR 38 McAndrews
PNR
Pennock
BRT Guideway
Palomino Stop
127th Street
LRT/BRT Station/Stop
Cedar Alignment
Nicols-Galaxie Alignment
Possible Structural Additions
Traffic Signal

Figure 7.1.4

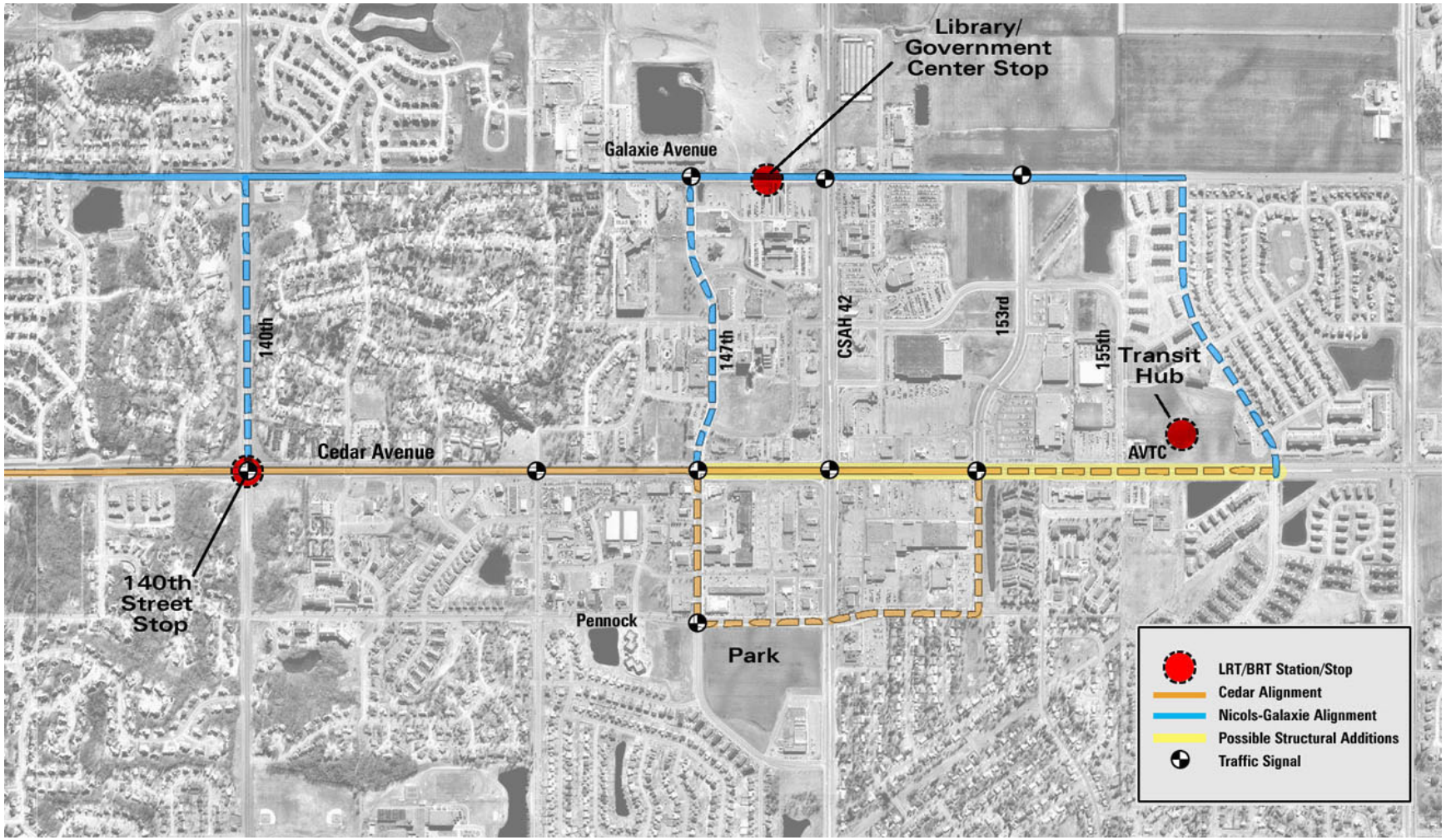

Library/
Government
Center Stop
Galaxie Avenue
140th
147th
CSAH 42
153rd
155th
Transit
Hub
AVTC
Cedar Avenue
140th
Street
Stop
Pennock
Park
LRT/BRT Station/Stop
Cedar Alignment
Nicols-Galaxie Alignment
Possible Structural Additions
Traffic Signal

Figure 7.1.5

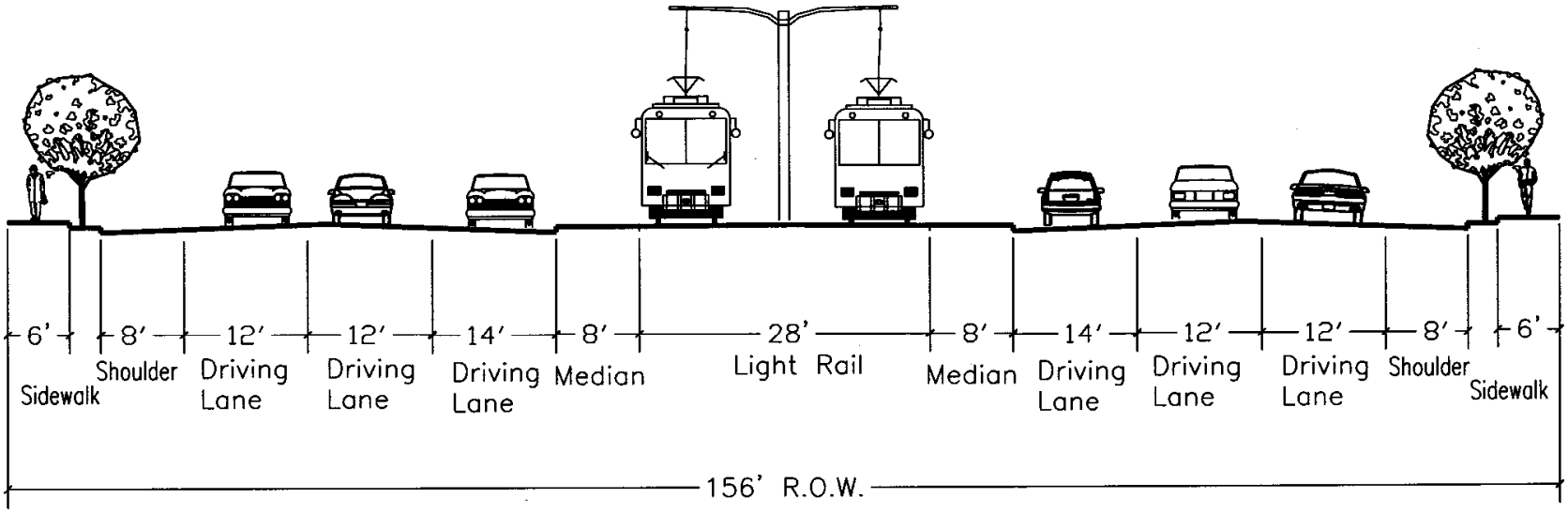
- Adequate right-of-way is more readily available in the Cedar Avenue alignment alternative than the Galaxie alternative.
- A higher concentration of commercial and retail locations are present along Cedar Avenue than along Galaxie-Nicols.
- The Cedar Avenue alternative maintains Cedar Avenue as a high volume transportation corridor, whereas implementing a transitway on Galaxie-Nicols may change the character of those facilities and adjacent properties.

The primary advantage of the Galaxie-Nicols alternative would be providing direct access to the Minnesota Zoo, a major regional attraction. It may be possible to provide a connection to the Minnesota Zoo from the Cedar Avenue alignment and this concept should be explored in more detail in the next phase of this study.

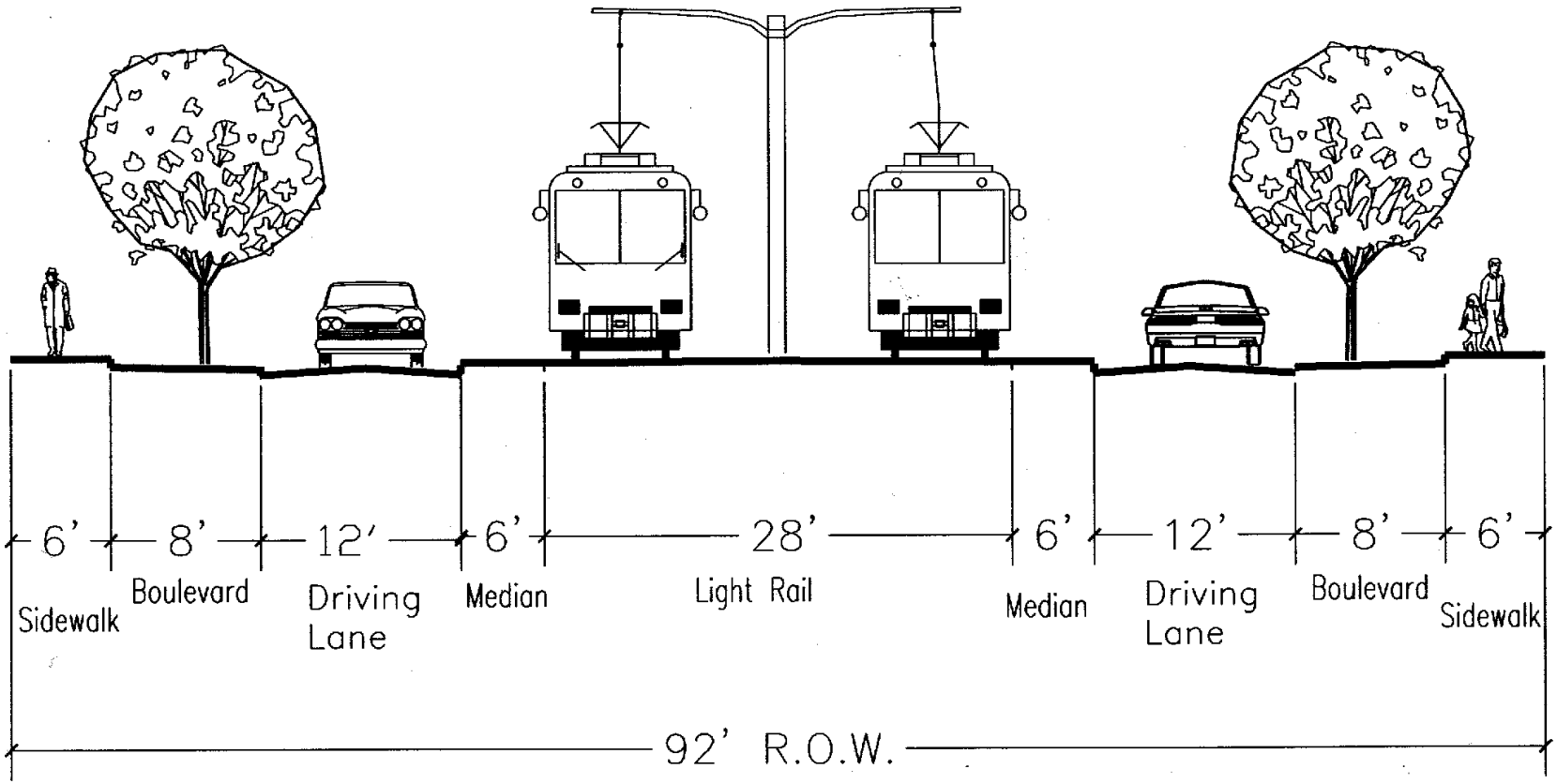
7.2 Right of Way Needs

Light Rail Transit requires a minimum of 28 feet of exclusive right of way throughout the length of the corridor. The proposed LRT right of way for the Cedar Avenue alignment is shown in Figure 7.2.1. The proposed LRT right of way for the Galaxie Avenue alignment is shown in Figure 7.2.2.

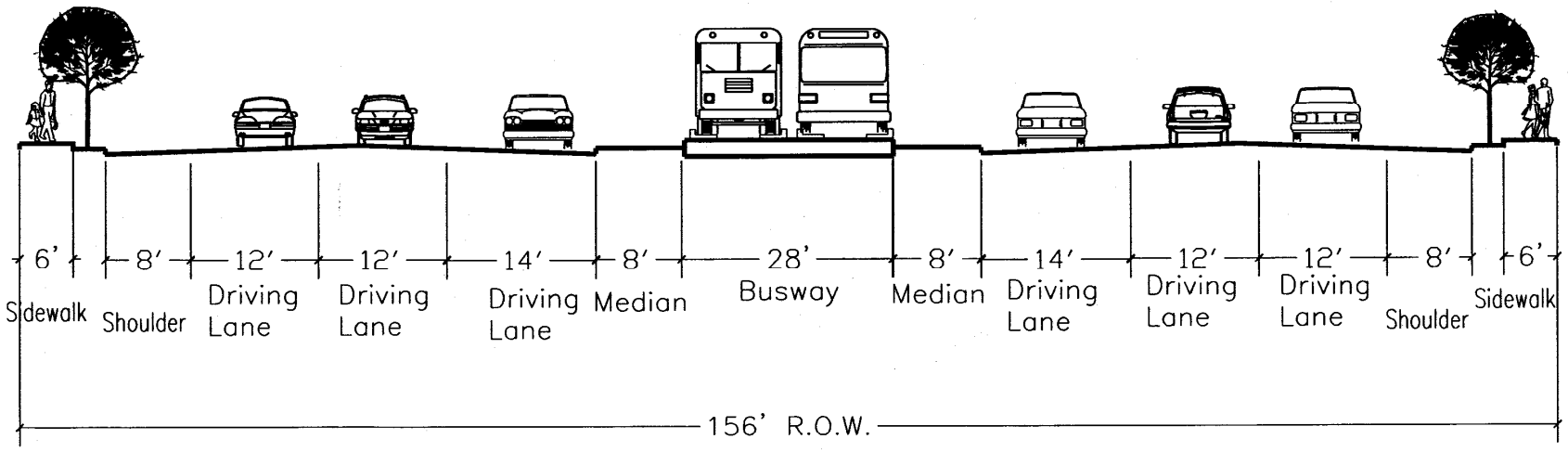
The BRT alternatives also require a minimum of 28 feet of right of way in areas that have an exclusive busway. The proposed BRT right of way for the Cedar Avenue alignment is shown in Figure 7.2.3. The BRT alternatives assume that buses will operate in mixed traffic or along the shoulder across the Minnesota River Bridge and in exclusive right of way in the remaining areas.



Light Rail Transit (LRT)
Conceptual Cross Section
Cedar Avenue, Apple Valley



Light Rail Transit (LRT)
Conceptual Cross Section
Galaxie Avenue, Apple Valley



Bus Rapid Transit (BRT)
Conceptual Cross Section
Cedar Avenue, Apple Valley

8.0 Transit Hub

Making a land use and transportation connection is a guiding principles of the Cedar Avenue project. The relationship can best be seen at the City of Eagan's proposed Cedarvale redevelopment project that was originally the downtown area for Eagan.

In 1999, the Eagan City Council appointed a task force of residents, area business representatives and City advisory commission members to make recommendations regarding possible redevelopment of the Cedar Avenue and Highway 13 area (known as Cedarvale). The growth of major retail centers in other parts of the community placed the Cedarvale area into a slow decline that cannot be reversed without substantial public and private intervention. The reversal of this trend is called Village Plaza – a concept recommended to the City Council. Village Plaza is a mixed-use redevelopment that includes new housing, a hotel and office complex, plaza-style retail, plenty of open green space, and other amenities. Also in the plan is a place for a mass transit hub or some type of transit facility.

Although specific functions of the transit hub may vary in accordance with corridor alignment alternatives, the essential role of the hub within the Cedarvale area is to provide direct, "user friendly" transfers between corridor and local transit routes as well as access to transit for park-n-ride, kiss-n-ride, and walk-in patrons. Thus, for the purposes of our analysis, a transit hub is viewed as a public facility where customers may transfer between local, inter-community and regional transit services.

A transit hub exemplifies four characteristics:

- *Functionality – safety, comfort, cost-effectiveness*
- *Circulation – accommodations for multiple modes; clear information and signage; and barrier free accessibility*
- *Connectivity – linkages to road and non-motorized transportation system; and pedestrian pathways.*
- *Place – architecture and urban design*

The common features of a transit hub will likely include:

- *The Transit Station*
- *Local Bus Boarding*
- *Corridor Bus Platforms*
- *Park & Ride Facilities*
- *Supportive Mix of Development*

8.1 Transit Hub Site Alternatives

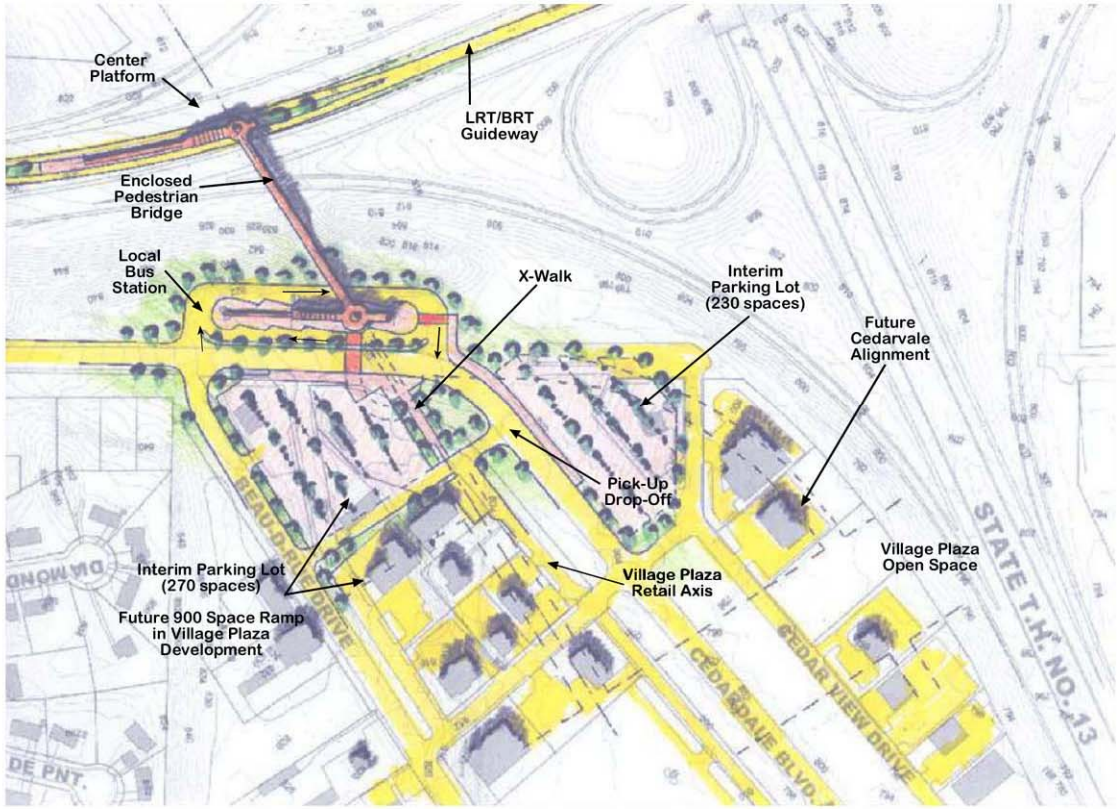
Option 1 – Corridor Station (LRT/BRT) in median of Cedar Avenue (Figure 8.1.1)

The LRT (or BRT) dual guideway follows the center (median) of Cedar Avenue and does not divert off Cedar into the Cedarvale area. The Corridor Transit Station would be in the median immediately south of the Cedar/TH 13 interchange. Transit Hub services (local bus loop, park & ride, drop off/pick up) would be along Nicols Road north of Beau d'Rue Drive (location of transit hub in Village Plaza Conceptual Plan). The Corridor Station and Transit Hub would be linked by an enclosed pedestrian bridge over the northbound lanes of Cedar.

Detailed Description:

The Corridor Station is comparable to a standard LRT station although BRT requires a wider guideway (minimum of 12 feet for each direction for conventional buses). The narrowness of the Cedar Avenue median (approximately 60 feet) suggests a single center-platform (as opposed to a wider dual side-platform) configuration. In deference to Minnesota's varied weather, the station has a mix of open, covered, and fully enclosed platform and waiting areas. Arriving passengers walk to the end of the 300 foot platform and ascend an escalator, stairs, or elevator to reach the enclosed pedestrian bridge that leads to the Transit Hub along the west side of Nicols Road. Due to its length (400 feet), the bridge features a moving sidewalk.

At the Transit Hub, passengers descend to ground level (escalator, stairs, or elevator) inside a fully enclosed waiting and information building (similar to the Apple Valley Transit Station) in the center of the local transit bus boarding island. Transit buses circulate clockwise around the island stopping at eight "sawtooth" bus bays arranged four on each side. A signalized crosswalk connects the Transit Hub with the east side of Nicols Road, serving the Cedarvale business district and a Park & Ride lot (up-gradable to the parking ramp). Both sides of Nicols feature curbside "Kiss & Ride" (passenger pick-up/drop-off) zones.

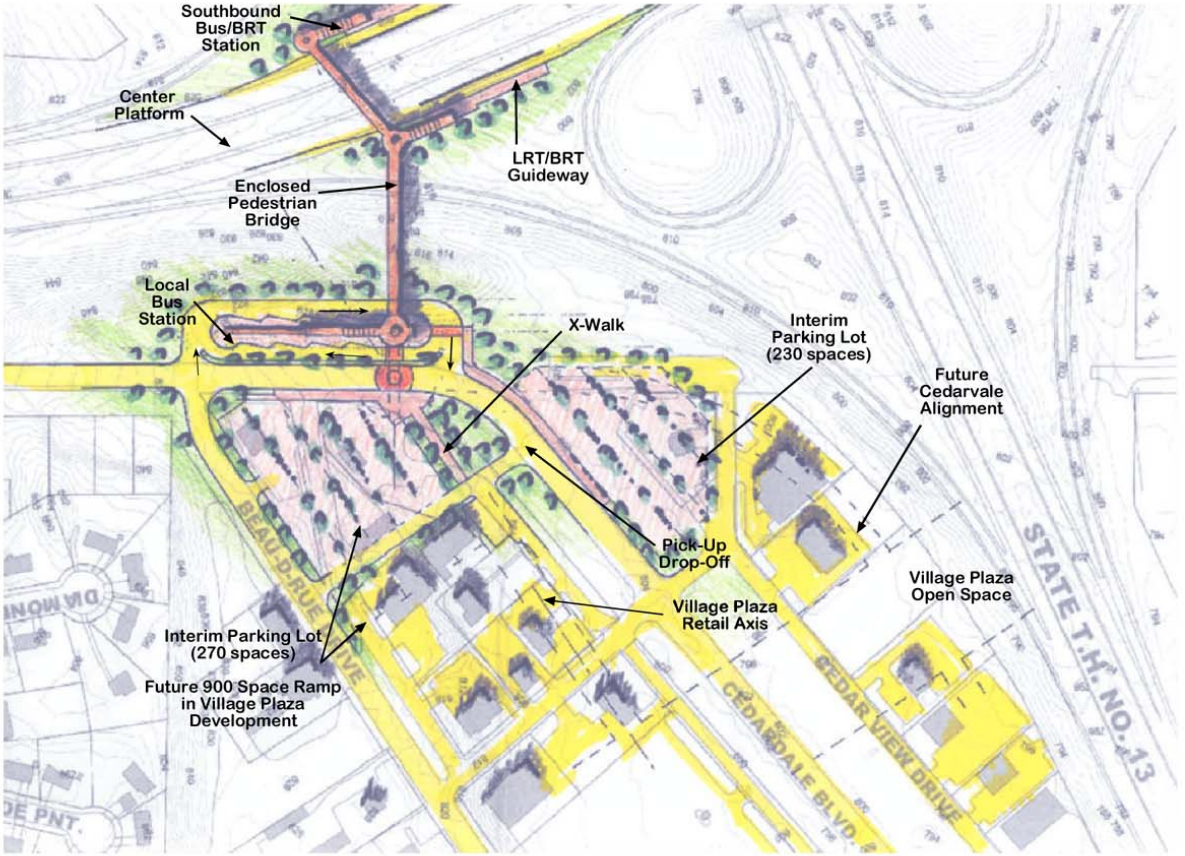


PARSONS TRANSPORTATION GROUP

CEDARVALE TRANSIT HUB

OPTION 1: Median Corridor Station

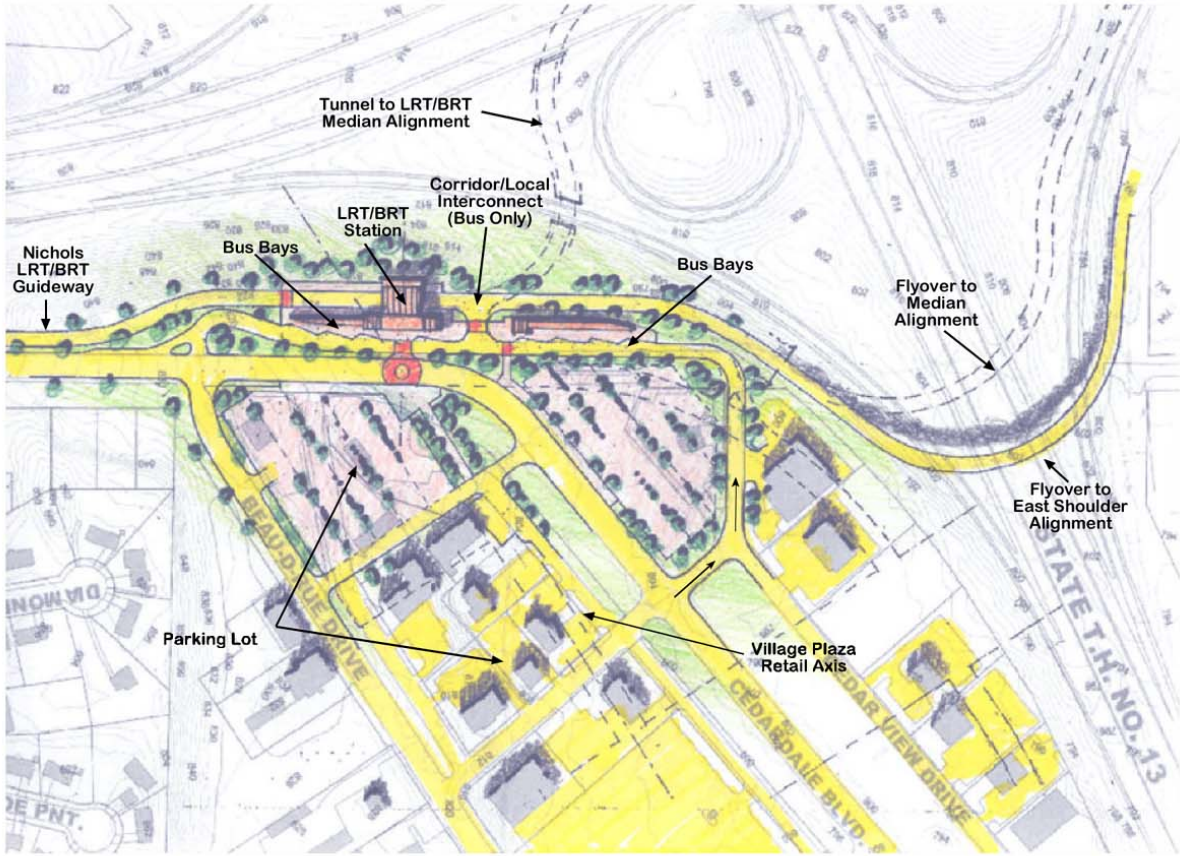
Figure 8.1.1



PARSONS TRANSPORTATION GROUP

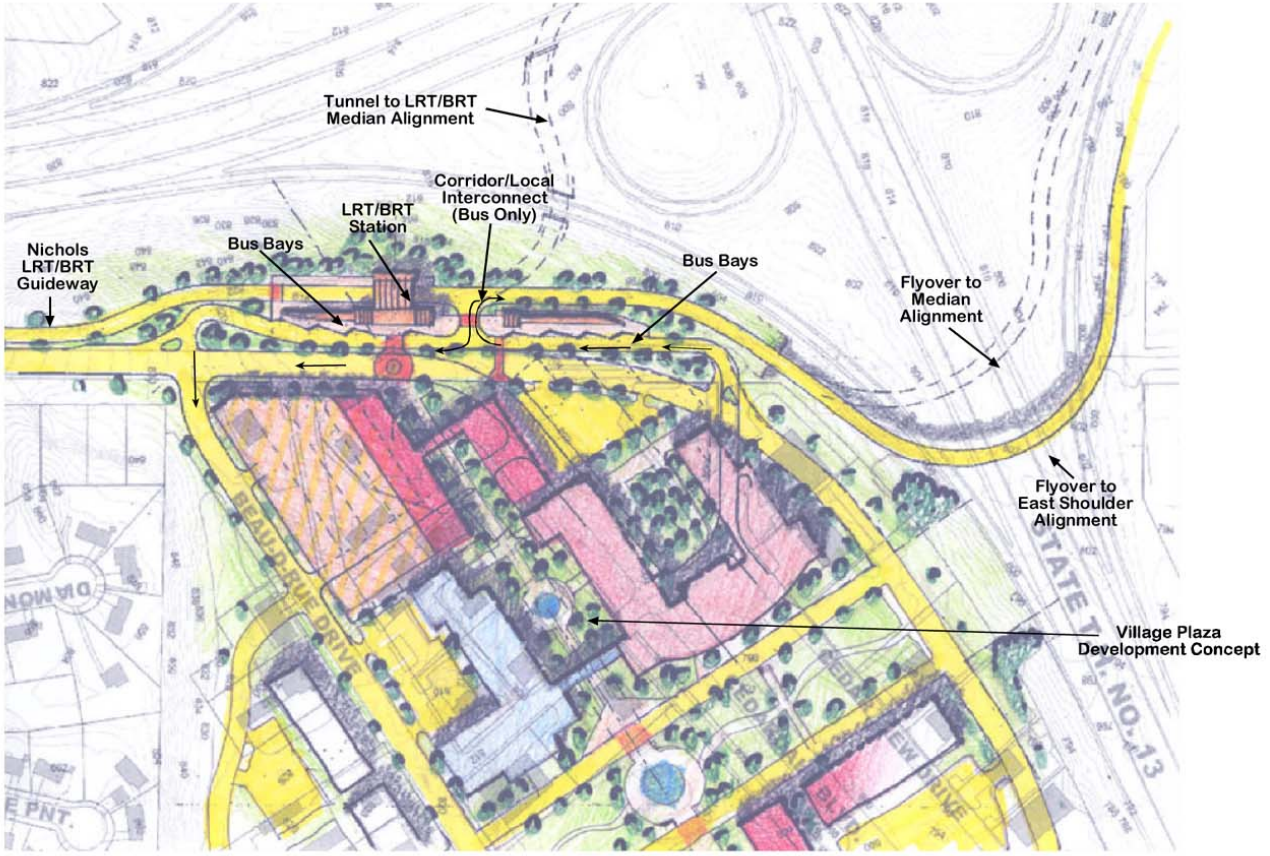
CEDARVALE TRANSIT HUB
OPTION 2: Shoulder Corridor Station

Figure 8.1.2



CEDARVALE TRANSIT HUB
OPTION 3A: Nichols Corridor Station

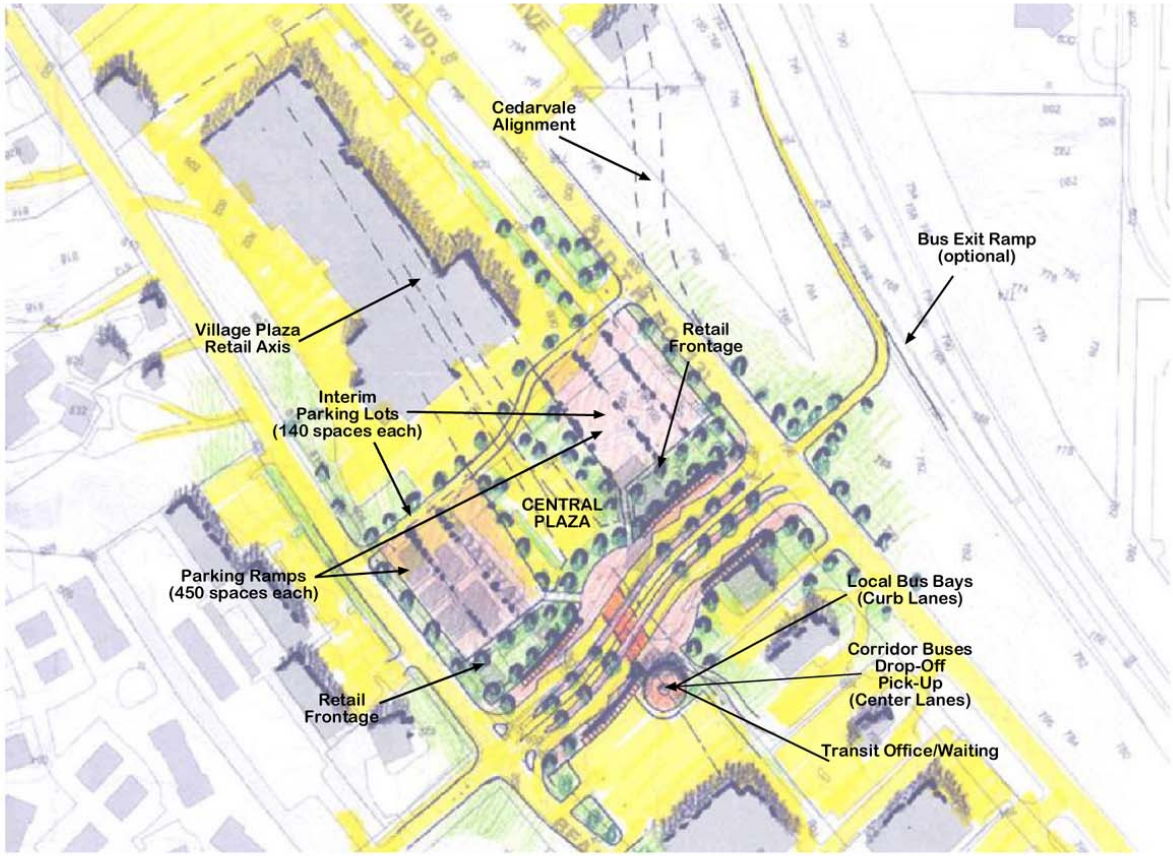
Figure 8.1.3



PARSONS TRANSPORTATION GROUP

CEDARVALE TRANSIT HUB
OPTION 3B: Nichols Corridor Station

Figure 8.1.4



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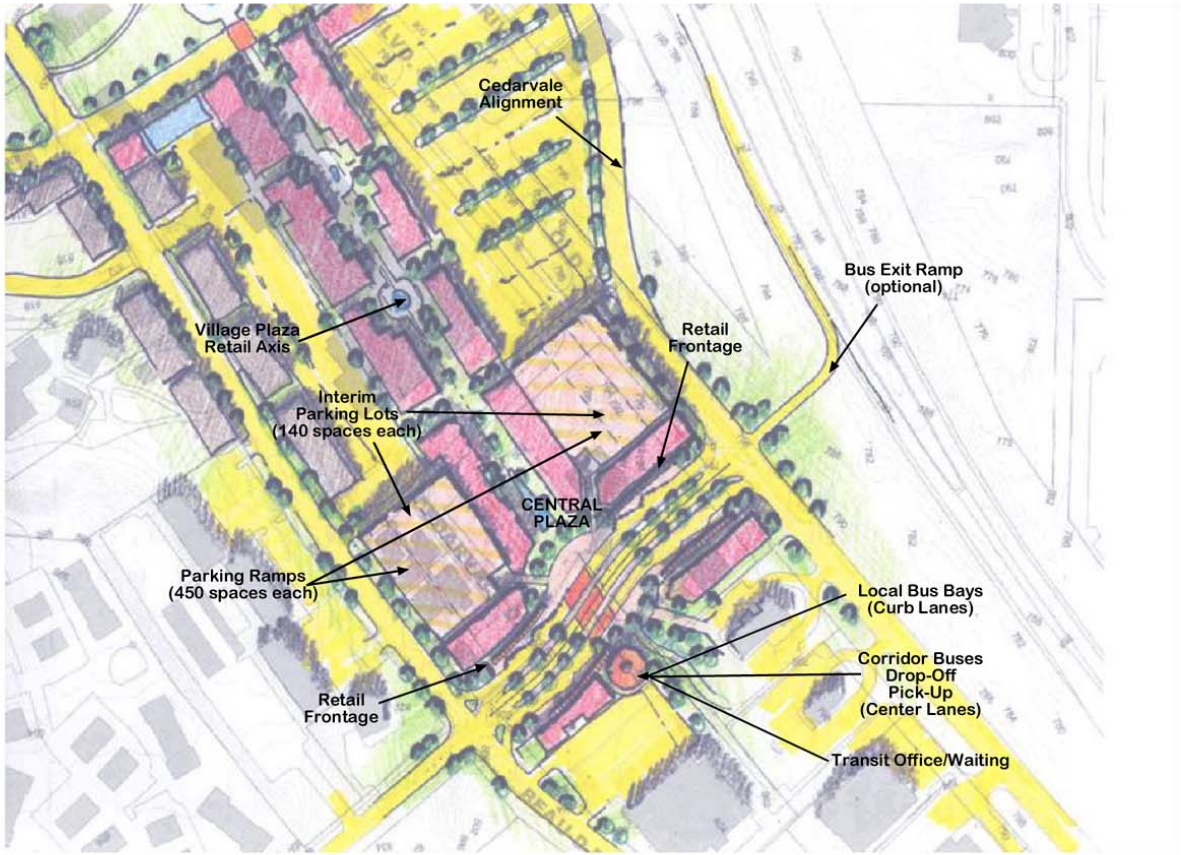
CEDARVALE TRANSIT HUB
OPTION 4A: Rahn Corridor Station

Figure 8.1.5



PARSONS TRANSPORTATION GROUP

CEDARVALE TRANSIT HUB

OPTION 4B: Rahn Corridor Station

Figure 8.1.6

Option 2: Corridor Station (BRT) along shoulders of Cedar Avenue (Figure 8.1.2)

Separate BRT guideways (or simple bus lanes) follow the shoulders of Cedar Avenue and do not divert off Cedar into the Cedarvale area. The separate northbound and southbound busway transit stations would be "nested" between the TH 13 exit and entrance ramp gore points immediately south of the TH 13 overpass. The two stations are linked by an enclosed pedestrian bridge over Cedar. In all other ways, Option 2 is identical to or similar to Option 1.

Detailed Description:

The Option 2 Corridor Stations are similar to the single Corridor Station in Option 1 in scale, design, and amenity. Passengers walking between the southbound station (west side of Cedar) and the Transit Hub cross two pedestrian bridges instead of one: one over Cedar and the other between the northbound station (east side of Cedar) and the Transit Hub.

In terms of the Transit Hub (including all elements and site relationships), Options 2 and 1 are otherwise identical.

Option 3: Corridor Station (LRT/BRT) combined with Transit Hub along Nicols

Option 3 accommodates three separate alignment alternatives for routing the BRT/LRT guideway off of Cedar Avenue to a parallel alignment alongside Nicols Road. Under this option, the Corridor Station and Transit Hub are combined in a single facility along the west side of Nicols north of Beau D'Rue Drive (same location of the Transit Hub itself in Options 1 and 2).

BRT/LRT Alignment Alternatives:

Extensions of the following alignment alternatives along Cedar Avenue north of TH 13 were examined at a conceptual level and judged to be essentially feasible as to plan (horizontal alignment) and profile (vertical alignment), based on conservative, generally accepted physical and operational criteria for buses and LRT. All options will require further study to confirm feasibility at a detailed level.

- Alternative A: Guideway along east side of Cedar Avenue: The guideway flies over TH 13 east of the Cedar Avenue Interchange on a wide radius horizontal curve and descends to a level profile along the west side of Nicols where Nicols curves into Cedarvale Boulevard. The guideway is at grade in the station and south of the station along Nicols (Figure 8.1.3).

- Alternative B: Guideway in the median of Cedar Avenue: The alignment is similar to Alternative A, except that gradients are steeper at the north end of the transition because the guideway has to overpass the northbound lanes of Cedar before leaving Cedar to pass over TH 13. However, preliminary analysis suggests that gradients do not exceed 5%.

- Alternative C: Guideway in the median of Cedar Avenue with tunnel: This alignment (shown conceptually on the Village Plaza Concept Plan) connects to Nicols via a tunnel under the northbound lanes of Cedar south of the TH 13 interchange. Although not aligned as shown on the Village Plaza Plan, a tunnel alignment does appear feasible although it will require further study. Preliminary study indicates that the northbound to eastbound ramp from Cedar to TH 13 will require a modified profile to clear the guideway undercrossing. In

addition, the TH 13 overpass has center piers in the Cedar median which may require significant pier and foundation modifications to accommodate the deep guideway boxes at this point.

Detailed Description:

The design of Option 3 is significantly different from the designs of Options 1 and 2, as all elements are concentrated off the Cedar corridor at the Nicols site. Allowing for the gradient requirements of the flyover and tunnel options, the BRT/LRT Corridor Station is located in the southern half of the facility between the local bus area and the edge of the Cedar right-of-way. Passengers can walk directly between the Corridor Station and the local bus boarding areas, and across Nicols to the Cedarvale business area and the adjacent Park and Ride lot (same as in Options 1 and 2). As in Options 1 and 2, both sides of Nicols feature curbside "Kiss & Ride" (passenger pick-up/drop-off) zones.

In all other aspects (parking, Village Plaza compatibility, etc.), Option 3 is similar to or identical to Options 1 and 2.

Option 4: Transit Hub on Rahn Road (Figures 8.1.4 and 8.1.5)

This option is focused on the needs of local bus services and is not located or designed to directly support LRT/BRT services in the Cedar Avenue Corridor, although it does accommodate corridor buses using TH 13 to access Cedar. Local buses stop along Rahn in the block between Beau d'Rue Drive and Cedarvale Boulevard and Rahn would be developed as a "transit mall" integrated with retail development at the east end of the Village Plaza development. Under this option, a separate Corridor Station could still be developed at the Nicols site, based on elements of Options 1, 2, or 3.

Detailed Description:

The recommended concept is to widen the Rahn right-of-way to allow separated outside bus lanes serving curbside "sawtooth" bus bays. This allows center lanes to accommodate limited through traffic, pick-up/drop-off zones, and stops for express buses diverted off the Cedar Corridor. The features of a "transit mall", developed in conjunction with the future Village Plaza, include wide landscaped sidewalks serving the bus bays, continuous shelters, fronting retail development (such as small shops, indoor/outdoor cafes, etc.), a central "gateway" plaza where Rahn intersects the future "Central Urban Greenway", and a centralized transit office with indoor passenger ticketing and waiting areas.

9.0 TRANSITWAY MARKET ANALYSIS

9.1 Current and Projected Population and Employment Growth

Population and employment information, both current and forecasted levels, are critical to the estimation of ridership for the transit alternatives as they are key inputs within the overall travel demand forecasting process. The population and employment information serves two very important functions in the overall context of this study:

- to serve as input to the regional model, which, in turn, will be used to generate the transit ridership forecasts, and
- to serve as control totals for Dakota County in the development of their own land use forecasts which, in turn, are input to the Dakota County subarea model to determine traffic-impacts of the transitway alternatives

This data is input to the regional travel demand model to estimate auto and transit trips regionwide, including along the Cedar Avenue corridor. These trips are then compared to the observed origin-destination data collected as part of the Transitway Market Analysis to ultimately provide some indication of how well the regional model performs on this sub-area basis. The 2020 population and employment data is used to estimate future auto and transit trips for the base (No-Build) condition and the transit alternatives.

The Dakota County travel demand model uses land use rather than socioeconomic data to forecast trips. However, Dakota County uses the regional socioeconomic data as a control total in developing the land use forecasts for their model. Again, the Dakota County travel demand model will be used to determine traffic-impacts of the transit alternatives.

The source of the population and employment data is the Metropolitan Council, which is the agency responsible for metropolitan-wide transportation planning. The most up-do-date existing (1995) and projected (2020) population and employment data from Metropolitan Council has been gathered for this study. Metropolitan Council projects this data in consultation with affected communities.

Both 1995 and forecast 2020 population and employment data are disaggregated to 1,165 distinct geographic areas (referred to as traffic analysis zones or TAZs) within the seven-county metropolitan region. Forecast population growth is greatest in the southern portion of the corridor, particularly within Apple Valley. Increases in employment levels are concentrated in Apple Valley and around the Mall of America area.

9.2 Origin-Destination Study

An Origin-Destination Study was performed to document the behavior of travelers using Cedar Avenue, as measured through a comprehensive survey of travelers using the corridor. This behavior is measured through the characteristics of their trip-making, including: trip origin and destination, trip purpose, trip length, and vehicle occupancy.

Understanding travel behavior is an important early step in the planning of transportation system investments. At the individual trip level, this behavior is typically expressed in terms of the trip's characteristics--it's origin and destination, purpose, perceived length and travel time, time of day,

and mode. Each travel decision is a response to an array of options determined by land use and the physical environs, access, mobility, and personal characteristics. Collectively, the trip characteristics help to define overall travel behavior in a region or market. Such data forms the foundation for travel demand modeling, including models here in the Twin Cities. These models, and the forecasts that result, are key contributors to the transportation infrastructure planning process.

The overall approach for determining the travel behavior in the Cedar Avenue corridor involved a mail-out mail-back questionnaire to a sample of users (who drive) identified through a video-capture technique. Addresses for mailing the questionnaire were obtained through a query of the Minnesota Department of Motor Vehicle database. The questionnaire included questions about trip origin, trip destination, purpose, perceived trip length, frequency, vehicle occupancy, and other information.

A total of 15,351 questionnaires were mailed to suspecting users of the corridor. To help increase response rate, return postage was paid for by Dakota County. Actual response was 13%, which was considered to be very good for this type of survey. At the outset, a 10% response rate goal was established.

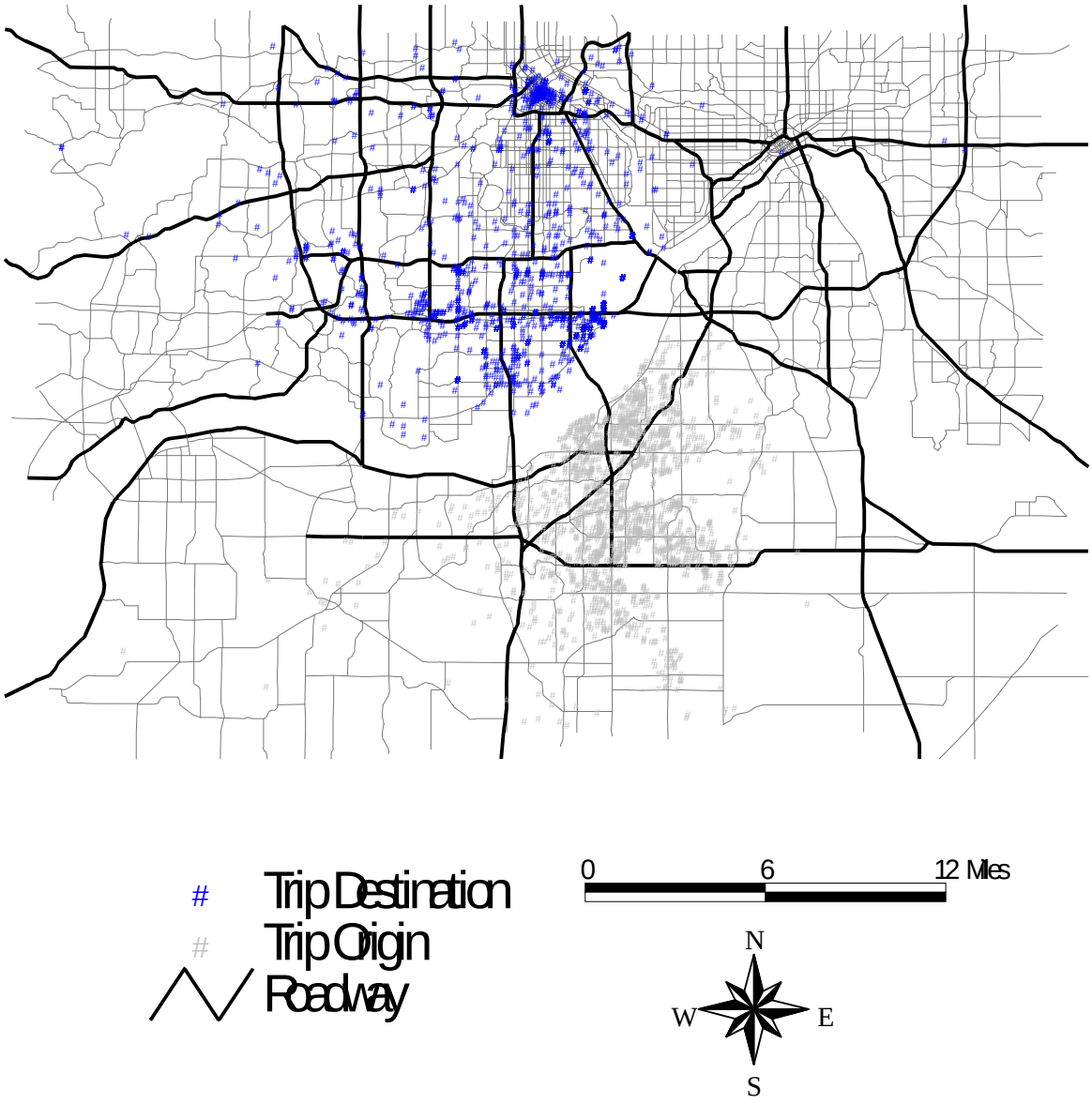
The origin-destination patterns of vehicles traveling north across the Cedar Avenue Bridge are illustrated on Figure 9.2.1. Among the significant findings:

- The travelshed for vehicles traveling across the Cedar Avenue Bridge is not confined to a narrow, isolated corridor having Cedar Avenue as its "spine". Instead, a significant number of trips have origins within the I-35W travelshed. This suggests that route diversion may be occurring due to heavy congestion along I-35W.
- The principal destination centers include the Mall of America area, the I-494 corridor, downtown Minneapolis, and the airport.
- The vast majority of the origins and destinations are served by transit service. The only major exception is south of Apple Valley, which is beyond the current Minnesota Valley Transit Authority service area.

Beyond the basic questions of trip origin and trip destination, many of the survey questions focused on characteristics of the driver and his/her trip north across the bridge. Some of the more significant characteristics are summarized below:

- About 98% of the trips were home-based, meaning one end of the trip was at home. This was broken down as 83% work-related, 11% shopping, and 4% school.
- About 12% of the trips had multiple occupancy.
- Of these multiple occupancy trips, the passengers were not related to the driver 28% of the time. Thus, the high occupancy trips tended to involve families. Occupants that are unrelated may be more likely to be carpooling, and therefore may be more amenable transit options.

Figure 9.2.1
O-D Patterns for Users of Cedar Avenue Bridge (Northbound)



- Two-person, two-car households were the most prevalent combination of household size and autos available. Very few multiple person households had only one car available for their use.
- Just over half (55%) of the trips were from households with two workers. About 15% of the trips are from households with three or more workers.

9.3 Ridership Forecasts for Transit Alternatives

Ridership forecasting is the process of determining how many people will use a particular service or facility. For the Cedar Avenue Transitway Study, the ridership forecast focused on determining transit patronage for each of the transitway alternatives. A second, but equally important focal point, was determining what impact each of the alternatives had on forecast traffic volumes on Cedar Avenue, particularly at the Minnesota River Bridge.

Ridership was forecast using the Twin Cities Regional Travel Demand Model, which is the approved travel demand model for the Twin Cities region. It covers the entire seven county metropolitan area. The forecasts were prepared for a 2020 time horizon, which represented the period farthest out for which information was available for both the transportation supply and demand.

A number of model-related considerations that influence the ridership forecasts were examined. These may be classified as either transportation supply or transportation demand issues.

9.3.1 Transportation Supply

Street and Highway Network--Used the approved 2020 street and highway network, which reflects the future street system, based on improvements that are planned and committed.

Transit Network--It was agreed that the base transit network used for this study should be the Riverview Corridor Major Investment Study No-Build alternative. This included the Hiawatha light-rail transit corridor operating from Downtown Minneapolis to the Mall of America. Two significant modifications were made to the base "No-Build" and "Build" transit networks. First, in the No-Build transit network, MVTA routes were updated in the model to reflect then current operating schedules. Second, in the Build transit network, a BRT line along the Riverview corridor was included to provide an additional connection at the Mall of America to St. Paul bound travelers. With both the Hiawatha and Riverview corridors assumed operational in the Build transit network, service to Dakota County would be provided every 7.5-minutes during peak periods and every 15-minutes during off-peak periods. Bus service would not be allowed to compete with the transitway service for line-haul riders.

9.3.2 Transportation Demand

Socioeconomic Data--The 2020 regional zonal socioeconomic data forecasts were provided by Metropolitan Council. The forecasts reflect the most recent information at the time and are based on consultation with each jurisdiction and their comprehensive plans. This forecast is referred to as the planned land use scenario throughout this document.

Land Use Adjustments--It was agreed that a more transit-oriented land use scenario should be developed and then tested to see if changes in land use could significantly influence ridership

levels on the transitway alternatives. The adjustments focused on increasing the number of households and employment primarily within the Cedar Avenue transitshed. However, Metropolitan Council forecast County-level totals were maintained. In other words, the total number of forecast households, population, and employment for Dakota County remained the same. The increases within the transitshed were offset with equal amounts beyond the travelshed.

Accessibility --The level of transit accessibility represented in the model was thoroughly reviewed and updated as needed. Level of accessibility is a significant factor in the decision whether to use a particular transit option. Specifically, the model was reviewed and updated to reflect viable access to transit services via both walk and drive modes.

9.3.3 Transit Ridership

The forecast ridership for the transitway alternatives is presented in Table 9.3.1. Different land use scenarios were considered during this study to see how transit ridership could be effected by implementing transit supportive development at the proposed station locations along the corridor. Three scenarios were analyzed: (1) the planned land use, (2) transit oriented development, and (3) an unconstrained market scenario. The planned land use scenario used the Metropolitan Council forecast of year 2020 growth. The transit oriented development scenario assumed higher, yet reasonably attainable densities along the corridor. The unconstrained market scenario represents population and employment densities that could be accommodated within the corridor beyond the year 2020.

Ridership

The forecast ridership for the transitway alternatives is presented in table below. The ridership represents the daily number of transit trips across the Minnesota River Bridge. Note that the ridership presented here includes no intra-Dakota County trips, which would add approximately 5% to these figures.

Table 9.3.1

Forecast Ridership for Transitway Alternatives, Daily 2020 Trips Across the Minnesota River	
Alternative	Ridership
No-Build (Planned land use)	12,800
LRT (Planned land use)	15,400
LRT (T.O.D.)	17,000
LRT (Unconstrained)	22,100
BRT (Planned land use)	12,600
BRT (T.O.D.)	14,700
BRT (Unconstrained)	17,200

Table 9.3.2 illustrates the number of new transit trips generated by the transitway alternative. Generally, when a new transitway is planned, a portion of its ridership comes from current transit users. The Cedar Avenue Transitway alternatives offer new levels of accessibility and therefore the opportunity to increase transit usage as a whole. The number of new transit trips was calculated at the Minnesota River (e.g. new trips crossing the river). Table 9.3.2 shows the

number of new transit trips generated by the transitway alternatives measured at the river crossing. The total number of transit trips across the river is also shown.

Table 9.3.2

Forecast Daily Total and New Transit Trips Across Minnesota River Near Cedar Avenue			
Alternative	Transit Trips	New Trips[1]	
No-Build (Planned land use)	12,800	--	
LRT (Planned land use)	15,400	2,600	
LRT (T.O.D.)	17,000	4,200	
LRT (Unconstrained)	22,100	9,300	
BRT (Planned land use)	12,600	(200)	
BRT (T.O.D.)	14,700	1,900	
BRT (Unconstrained)	17,200	4,400	

[1] Relative to No-Build planned land use scenario.

The reason for the drop in ridership for BRT with the planned land use is that in the No-Build scenario, users can board express buses from different locations along Cedar Avenue to downtown Minneapolis. The losses indicated for the BRT alternative is primarily due to riders having to transfer modes at Mall of America to travel between downtown Minneapolis and locations in Dakota County.

9.3.4 Conclusions

The major findings of the ridership task include:

- A daily ridership of about 15,400 is forecast for the Cedar alignment LRT alternative using the planned land use scenario. By intensifying the land use in the transitshed, it may be possible to increase the ridership by up to 6,700 riders per day for the same alternative, bringing the ridership level up to 22,100. A more detailed review of land use desires and their associated impacts should be undertaken if it is desired to increase the ridership level to near 22,000.
- Mode of travel along the transitway does influence ridership. LRT yields higher ridership than BRT. The advantage shown by LRT is primarily due to not having to transfer modes at Mall of America for trips between the Hiawatha and Cedar corridors.
- The vast majority of the ridership for each alternative has one trip end in Dakota County and the other outside of the County. Less than 5% of the ridership will serve intra-Dakota County trips.
- At minimum, the Cedar alignment LRT under the planned land use scenario will create 2,900 new transit trips (all LRT riders) across the Minnesota River within the Cedar Avenue corridor. This could increase to 9,300 new transit trips under a comparable mode/alignment with the unconstrained land use.
- Extending the LRT only to the Cedarvale station captures about 75% of the ultimate number of riders (e.g. extending down to Apple Valley). However, the overall number of transit trips drops slightly because riders south of Cedarvale are forced to take a bus (or drive) to the Cedarvale station in order to board the LRT to Minneapolis. Under the No-Build, these riders would be able to board an express bus from Apple Valley to downtown Minneapolis. Given the drop in overall transit trips, extending LRT south, only to the Cedarvale station, should be viewed as an interim measure. (e.g. with the understanding that the corridor would

eventually be extended south to the Apple Valley Transit Hub). Therefore, this alternative should not be pursued as a final solution for the transitway.

- All of the ridership forecasts were based on bus service not being allowed to compete with the transitway service for line-haul riders. This will be an important policy consideration should any of the transitway alternatives move forward.

9.4 Sensitivity Analysis

The forecasting process allowed measurement of the sensitivity of certain model inputs to the ridership results. Some of the major inputs and their sensitivities are discussed below.

Land Use--The T.O.D. and unconstrained land use scenarios positively impacted ridership. The T.O.D. scenario resulted in 1,600 more boardings directly attributable to the intensified land use.

Frequency of Service--The headway, or time between successive transit runs along a route, tends to have a significant influence on ridership. Shorter headways (more frequent service) reduce waiting times for patrons and therefore make transit service more convenient to the user. For the modeling tasks, our headways were fixed at 7.5 and 15 minutes during the peak and off-peak hours, respectively. These are the planned frequencies for Hiawatha LRT service and by definition, the Cedar transitway alternatives must match these times. Thus, there would be no opportunity to alter the service frequency.

Alignment--The different transitway alignments ultimately did not influence overall ridership.

Mode--The LRT mode attracted more riders than the BRT mode. LRT attracts more riders primarily because of the seamless transfer at Mall of America for passengers traveling between Dakota County and downtown Minneapolis.

9.5 Cost Estimates

The methodology used in developing the capital cost estimate complies with FTA guidelines for estimating capital costs. Capital cost estimates were prepared using 2000 dollars. An LRT project is presumed to be constructed in a manner similar to the Hiawatha LRT system. Thus, it will be constructed as a single civil and systems turnkey (design-build) contract, with the exception of a separate procurement of the light rail vehicles. A BRT guideway construction is not as capital intensive and complex as an LRT system. The capital cost components with examples of cost elements are grouped into eight categories as defined by the FTA, as follows:

A. Guideway
   - For LRT, includes ballasted trackwork, tunnels and bridges.
   - For BRT, includes surfaced guideway but not at a standard suitable for LRT-service conversion.

B. Passenger Stations
   - Costs include station development and accompanying structures and systems. For light rail stations platform dimensions are approximately 200 feet in length and 20 feet in width; and include bus shelters. The passenger station costs estimates are based on parametric unit prices developed in Hiawatha Corridor LRT system plan. Site-specific facilities were not determined at this juncture. Artwork and other stations amenities were included.

- Cost of bus rapid transit systems included bus shelters with accompanying park-n-ride lots, where appropriate. Design configuration at the Cedarvale location reflect the investment in redevelopment and preliminary concept plans shown in Technical Memorandum I (Transit Hub).

C. Yards and Shops
   - There may be potential to share these facilities with the Hiawatha LRT system. However, since this possibility is uncertain, costs were included for maintenance yards and shops and layover facilities.

D. Special Conditions
   - Development of a guideway system involves some mitigating requirements that may not be directly related to service, but which are required for construction. These cost elements are included in this category, and include utility protection and relocation, bikeway construction, landscaping, artwork, and environmental mitigation costs.
   - Because of the stage of project development, the cost elements shown do not include utility relocation or costs for environmental mitigation.

E. Systems
   - Catenary lines, lighting, signaling and fare collection.

F. Vehicles
   - For LRT, capital costs assumed twelve new LRT vehicles plus an additional two maintenance train vehicles. For BRT system, no new vehicle costs were assumed. The LRT system will also be served by a feeder bus system provided by Metro Transit and MVTA. The feeder bus system will provide access to the stations along the LRT line and a background bus system of local bus routes providing radial and cross town bus service to areas not served by the rail system. The feeder bus system is intended to meet at the LRT stations on a timed-transfer basis. Bus pull-outs and bus shelters are included at the stations, and included in the cost estimates.
   - Competing or duplicative bus services to the proposed LRT or BRT service were removed from cost and ridership consideration.
   - For the BRT alternative, no new vehicles were assumed.

G. Right-of Way Costs – not calculated.

H. Project Soft Costs
   - Estimated allowances for project development, engineering and management, project insurance, and start-up. Calculated based on "top down" method (order of magnitude) and derived from data from a similar project. Engineering and construction contingencies are added to expected construction costs to cover engineering changes through design and development and unanticipated construction changes.

Detailed capital cost estimates can be found in Appendix XX. The capital cost estimates for the alternatives are shown below, including the cost of extending LRT only to Cedarvale:

Alternative	*Total Capital Cost (2000 dollars)*
LRT	$ 500 Million
BRT	$ 95 Million
Cedarvale LRT	$ 121 Million

The Operating and Maintenance Costs for the Cedar LRT alternatives were derived from the Hiawatha Corridor Light Rail Transit, *Transportation and Maintenance Operations Plan* (September 1999). The major cost categories for O &M include Rail Transportation, Rail

Vehicle Maintenance, Rail Facilities Maintenance, and Rail Administration & Support. Annual O & M Costs for Hiawatha are approximately $13.1 million, or $575,450 per route-mile.

The Hiawatha O&M costs were adjusted for the proposed LRT alignments to account for economies of scale and potential for duplication in administrative staffing, maintenance services, and vehicle operators. This is a reasonable assumption, since a unified 22-mile LRT system from downtown Minneapolis to Apple Valley would share some of the same system components and staffing. The next phases of the Cedar Avenue transitway study would further refine cost assumptions, and system integration with Hiawatha. Thus, for the purposes of this study, the annual O&M costs for the Cedar LRT alternatives range from $4.6 million to $5 million, or $230,000 per route-mile.

Bus Rapid Transit operating and maintenance costs were estimated using year 2000 costs from the MVTA of approximately $5.00 per bus vehicle mile. Based on the ridership model assumptions, the O&M cost factor was multiplied by the vehicle miles. Next, adjustments were made for "cost savings" due to competing and duplicative bus services relative to the BRT alternative. The modeled BRT alternative is a reconfigured bus service with enhanced operating efficiency (travel time) and productivity (ridership) along a guideway.

Operations and Maintenance cost estimates are shown below:

Alternative	*Annual O & M Costs (2000 dollars)*
LRT	$ 5 Million
BRT	$ 1.5 Million
Cedarvale LRT	$ 2 Million

9.6 Cost Effectiveness

A measure of cost-effectiveness provides a quantitative benchmark in which to gauge the project's payoff. At this stage of the Cedar Avenue transitway project, it is also a useful measure for assessing the extent of future financial resources and commitments that may be needed to fully implement a transit alternative.

In its evaluation of the cost effectiveness of a proposed project, the Federal Transit Administration considers the incremental costs per incremental passenger in the forecast year. The measure, expressed in current year dollar value, is based on the annualized total capital investment and annual operating costs divided by the forecast change in annual transit system ridership, comparing the proposed project to the no-build and the TSM alternatives. Based on the project information for Cedar Avenue, a cost-effectiveness index is calculated.

For FY 2000 New Starts submissions to the FTA, the cost effectiveness indices ranged from $ 2.90 to $ 48.33 per new rider, with a median reported of $ 10.39 per new rider. The Hiawatha LRT cost effectiveness index was reported at approximately $ 19.00 in its New Start application. The cost effectiveness indices for the various alternatives is shown below:

Alternative	*Cost Effectiveness*
LRT (Planned Land Use)	$ 52.56
LRT (T.O.D.)	$ 32.53
LRT (Unconstrained)	$ 14.69
BRT (Planned Land Use)	N/A
BRT (T.O.D.)	$ 16.61
BRT (Unconstrained)	$ 7.17

10.0 Study Recommendations

10.1 Evaluation of Alternatives

To evaluate the various transitway alternatives a number of criteria need to be defined that will be used to rank the effectiveness of the different concepts. The Federal Transit Administration (FTA) New Starts criteria (Section 5309) will serve as a basis for the criteria.

The following criteria are components of the FTA New Starts Project Justification Rating and will be included as factors in the evaluation of alternatives.

- Mobility Improvements
- Environmental Impacts
- Transit- Supportive Existing Land Use and Future Patterns
- Cost Effectiveness Index

A number of technical analyses have been performed in the previous components of this study. The results of these analyses will also be used as evaluation criteria for the various alternatives. Specifically, the following factors will be included in the evaluation criteria:

- Ridership
- Right of Way
- Capital Costs
- Economic Development
- Consistency with Local and Regional Plans

Each alternative is measured against the nine evaluation criteria defined in the previous section. The alternatives are ranked according to the following scale:

- High – Meets the criterion very well, favorable
- Medium – Meets the criterion sufficiently, less favorable
- Low – Does not adequately meet the criterion, not favorable

The results of the evaluation are summarized in Table 10.1.

Table 10.1

Long Term Recommendations

EVALUATION CRITERIA	ALTERNATIVES									
	PLANNED LAND USE			T.O.D.			UNCONSTRAINED			
	LRT	BRT		LRT	BRT		LRT	BRT		No-Build
Ridership	○	○		◉	○		●	◉		○
Right of Way	◉	◉		◉	◉		◉	◉		●
Mobility Improvements	○	○		◉	○		●	◉		○
Environmental Impacts	◉	●		◉	●		◉	●		◉
Capital Costs	◉	●		◉	●		◉	●		●
Cost Effectiveness	○	○		◉	◉		●	●		○
Transit-Supportive Existing Land Use and Future Patterns	○	○		◉	◉		●	◉		○
Economic Development	◉	◉		●	●		●	●		○
Consistency with Local and Regional Plans	●	◉		●	◉		●	◉		○

KEY	
High	●
Medium	◉
Low	○

10.2 Long Term Recommendations

The complete analysis of the results of this study indicate that there is a significant opportunity to implement enhanced transit service in the Cedar Avenue Corridor if the local communities support migration to more transit-supportive development and land use. **If the communities along the corridor favor transit oriented development strategies, the Cedar Avenue LRT alternative is the most desirable transit solution.** This conclusion is based on the following factors:

- The LRT alternative has the highest ridership and adds significantly to the transit use in the corridor.
- Mobility within the corridor is enhanced by providing a seamless transit alternative between Dakota County and destinations north of the Minnesota River including the Mall of America, Minneapolis-St. Paul International Airport and downtown Minneapolis.
- Extension of the Hiawatha LRT line is consistent with the Met Council *Transit 2020 Master Plan.*
- The Cedar Avenue LRT alternative capitalizes on implementation of the Hiawatha LRT by extending the line south from the Mall of America, across the Minnesota River. Infrastructure investments in maintenance and storage facilities that are being made for the Hiawatha line may not need to be repeated or may be minimized.
- Potential right of way and environmental impacts are relatively minor.
- The alternative provides excellent opportunities for Transit Oriented Development and economic revitalization.
- The LRT alternative has the greatest potential to accommodate future growth in the region beyond 2020 by increasing the transitway capacity with additional train cars.
- The Cedar Avenue corridor continues as a high volume transportation corridor while maintaining the current character of Galaxie Avenue.

These results indicate that there is an excellent opportunity to bring LRT to Dakota County, however, it will require the commitment of the communities to policies that support enhanced transit oriented development. The communities need to embrace transit supportive policies such as increased residential and commercial densities, changes in zoning and land use patterns, and more pedestrian-friendly developments.

These recommendations assume migration to a more transit oriented development scenario. **If the communities decide not to pursue T.O.D. strategies, BRT may be a more appropriate transit solution for the corridor.** This conclusion is based on the following factors:

- BRT provides a lower cost transit solution that will still enhance the transit capacity of the corridor.
- A Cedar Avenue transitway could be constructed without the need for an additional structure over the Minnesota River.
- The right-of-way required for a transitway would be preserved and future conversion to LRT would be possible.

10.3 Short Term Recommendations

The most feasible long term transitway scenario will likely be comprised of a number of individual elements that will be progressively implemented over time. It is important to identify the most feasible short term transitway scenario that is consistent with the long range plan. Factors that may influence the nature and extent of the short term transitway scenario include:

- Design and construction feasibility
- Availability of funding
- Local and Federal support for the project
- Private participation and joint development
- Agency priorities and commitments
- Community acceptance and support
- Operating efficiency and cost effectiveness
- Environmental compatibility

If LRT is the ultimately selected, a logical **first phase implementation of this scenario would be to extend the Hiawatha LRT line from the Mall of America station to the proposed Cedarvale station**. This conclusion was reached based on the following factors:

- Capitalizes on implementation of the Hiawatha LRT line as described above.
- Provides a transit alternative for crossing the Minnesota River on Cedar Avenue which is already heavily congested and can be expected to continue to operate at poor levels of service.
- Requires dealing with the most sensitive environmental impact – crossing the Minnesota River – early in the project development process.
- Extending LRT to Cedarvale is consistent with local and regional plans and adheres to commitments to implement transit alternatives into Dakota County.
- Capitalizes on the proposed redevelopment at Cedarvale.
- Provides an opportunity for early implementation of transit oriented development in the corridor which can serve as a catalyst for future, similar activities.

10.4 Action Steps

Implementation of the recommendations will be accomplished by defining and executing a series of action steps. The following list of actions are proposed for implementation of the short and long term transit scenarios on Cedar Avenue:

- Secure funding and continue into the next phase of the project development process.
- Initiate a Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS) for the Cedar Avenue LRT alternative including a first phase implementation to Cedarvale.
- Begin to preserve the right of way for the alignment and station locations through zoning and comprehensive planning.
- Begin to implement policies that encourage transit oriented development.
- Begin an aggressive public information and marketing campaign to develop local and regional support for the project.