Alaska Department of Transportation and Public Facilities

Alaska Construction Surveying Requirements (Metric Units)

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Table of Contents

1. Survey accuracy requirements

Third order survey

- ✓ Use a 1/5000 horizontal closure.
- ✓ Use an angle closure of $12\sqrt{N}$ seconds, where N equals the number of setups.
- ✓ The allowable vertical error for misclosure is e = $12\sqrt{E}$ e = maximum misclosure in mm, E = distance in km.
- ✓ An Alaska-registered professional land surveyor must perform or supervise replacement of survey monuments (property, USGS, USC&GS, BLM, etc.) or establishment of monuments (including centerline).
- ✓ All monument work must comply with AS 34.65.040 and meet standards in the latest version of the Alaska Society of Professional Land Surveyors' *Standards of Practice Manual.*

Table 1—Survey accuracy requirements (in millimeters)

	Stationing	HI	Closure	Horizontal Angle	Distance to center line	Grade
Additional cross sections	1000	3	15	**	10	10
Benches		3	10			
Blue tops***	1000	3	10		10	6
Bridges	*	3	10			6
Centerline	*			*		
Clearing & Grubbing	1000				100	
Culverts	100	3	15	**	10	
Curb & gutter	10	3	10		10	6
Grade stakes	1000				10	30
Guardrail	100				100	
Manholes, catch basins & inlets	10	3	10		10	6
Monuments	*			*		
Red tops***	1000	3	10		10	15
Riprap	100	50	15		100	50
Signs	100				100	
Slope stakes & RP's	1000	3	15	**	10	10
Under drains & sewer	100	3	10		10	6

* Third order survey
**Right angle prism or transit angles from center line
*** Use blue tops for top of base course and red tops for the bottom of base coarse.

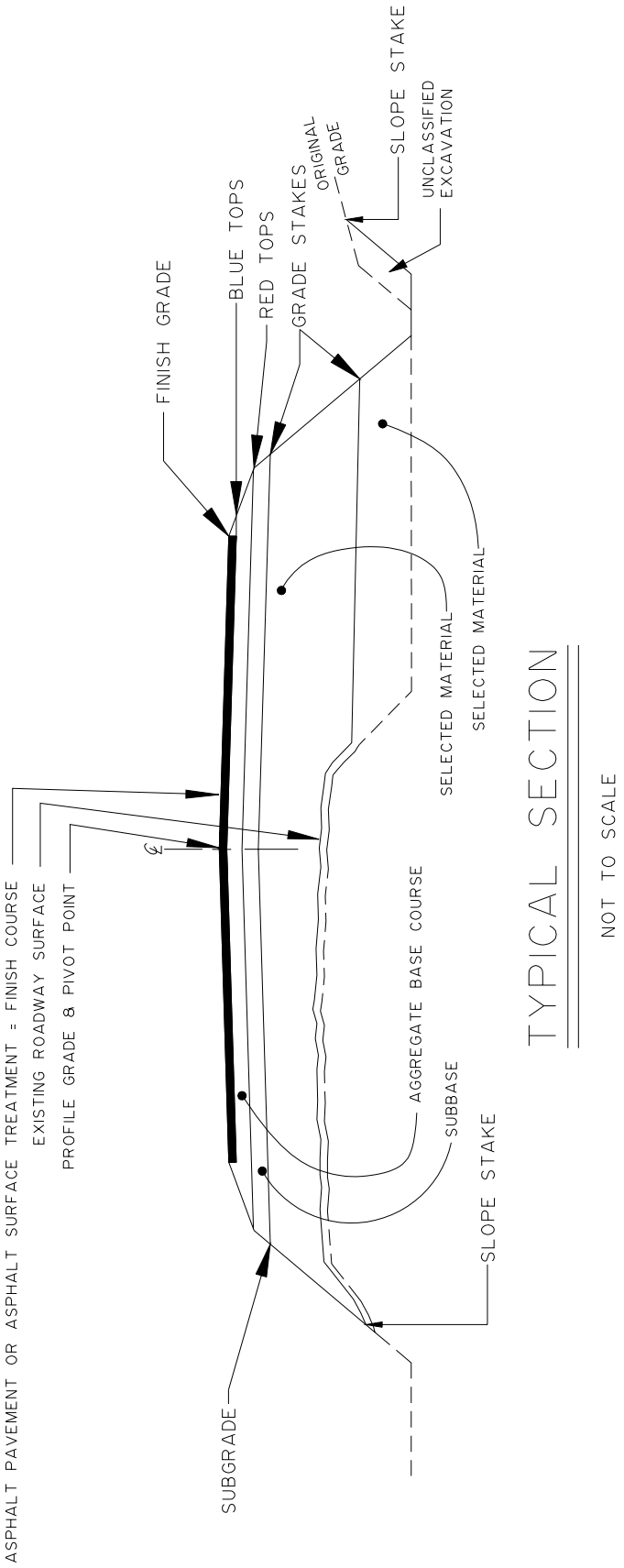
2. Survey frequency requirements

Table 2—Survey frequency requirements (in meters)

	Tangents and curves where R>250m	Curves where 125m<R≤250m	Interchange ramps and curves where R≤125m	Stake each per plan	See special instructions on sample notes
Additional cross sections	*	*	*		
Benchmarks					X
Blue tops	25	12.5	10		
Blue tops within 25 meters both sides of railroad track crossings and bridge approaches	5	5	5		
Bridges				X	
Center line	25	12.5	10		
Clearing	25	12.5	10		X
Culverts				X	
Curb and gutter	10	10	10		
Grade stakes	25	12.5	10		
Guardrail	10	10	10		
Manholes, catch basins & inlets				X	
Monuments				X	
Red tops	25	12.5	10		
Riprap	20	20	20		
Signs				X	
Slope stake / cross sections	25	12.5	10		X
Under drains and sewers	10	10	10		

* Establish additional cross sections and slope stakes at all breaks in topography and where structures begin and end.

3. Typical Section Drawing



4. Survey point materials requirements

- ✓ These are minimum requirements; larger sizes may be necessary.
- ✓ Use only stakes with planed sides.

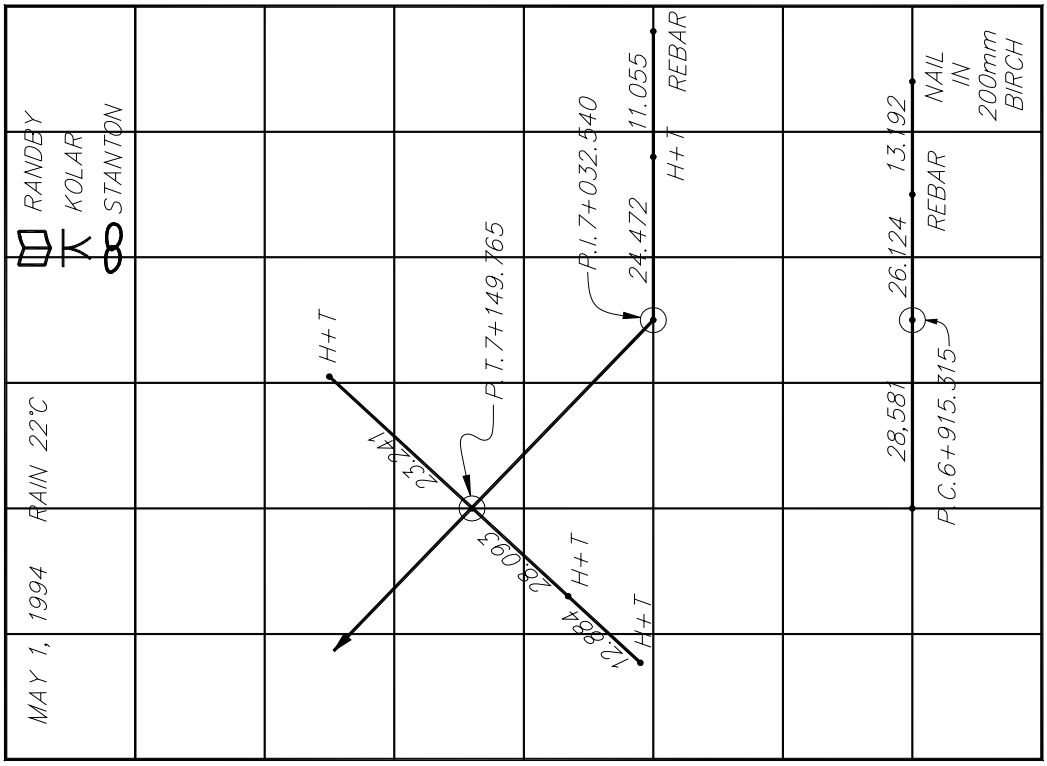
Table 3—Survey point materials requirements

	0.6 m lath or whiskers	50 x 50 x 200 hub	50 x 50 x 300 hub	25 x 50 x 450 stake	25 x 50 x 600 stake	1.2 m lath	Hub and tack	40d nail	60d nail	#10M x 0.6 m rebar
Benchmarks									X	
Blue tops	X	X								
Centerline P.C., P.T., P.O.T.			X	X			X *			X*
Centerline reference points			X	X			X *			X *
Centerline station				X				X		
Clearing						X				
Culvert stake			X		X	X				
Culvert stake references			X		X	X				
Curb and gutter			X		X		X			
Guardrail								X		
Major structures			X	X *	X *	X	X *			X *
Red tops	X	X								
Signs						X				
Slope stake					X	X				
Slope stake references			X		X	X				

* Optional depending on conditions, and to be determined by the Engineer.

5. Typical alignment notes

- ✓ The Chief of Parties must prepare the alignment book before actual staking.
- ✓ Use three point right angle ties, two to the right and one left, or vice versa.
- ✓ Reference P.C., P.I., P.T., and P.O.T.
- ✓ Don't use swing ties for reference points.



ALIGNMENT CURVE No. 22
"O" LINE

P.I. STA. = 7+032.540
Δ = 44°46'36"
R = 300m

T = 123.580m
L = 234.450m

STATION	ARC LENGTH	DEFL. ANGLE	DEFL. ∢ FOR STATION	CHORD LENGTH
6+915.315 P.C.	9.685	0°55'29"	0°00'00"	0
+925	25	2°23'14"	0°55'29"	9.685
+950	25	2°23'14"	3°18'43"	24.993
+975	25	2°23'14"	5°41'57"	24.993
7+000	25	2°23'14"	8°05'11"	24.993
+025	25	2°23'14"	10°28'25"	24.993
+050	25	2°23'14"	12°51'39"	24.993
+075	25	2°23'14"	15°14'53"	24.993
+100	25	2°23'14"	17°38'07"	24.993
+125	25	2°23'14"	20°01'21"	24.993
7+149.765 P.T.	24.765	2°21'54"	22°23'15"	24.75

Δ/2 = 22°23'18" CHECK

6. Typical clearing notes

- ✓ Exclude areas not needing clearing.
- ✓ Draw a diagram as required to show unusual or confusing areas.

	CL. RT.	65.5 61.0	65.8 58.5	61.0			
RANDBY KOLAR STANTON		+3.7					
KB 8	CATCH	61.8 57.3	62.1 54.8	57.3			
+ 19°C MAY 20, 1993							
	CATCH	41.7 46.3	44.8 47.2	50.9			
CLEAR, CALM		+3.7					
	CL. LT.	45.4 50.0	48.5 50.9	54.6			
	STA.	4+150 4+175	4+200 4+225	4+250			

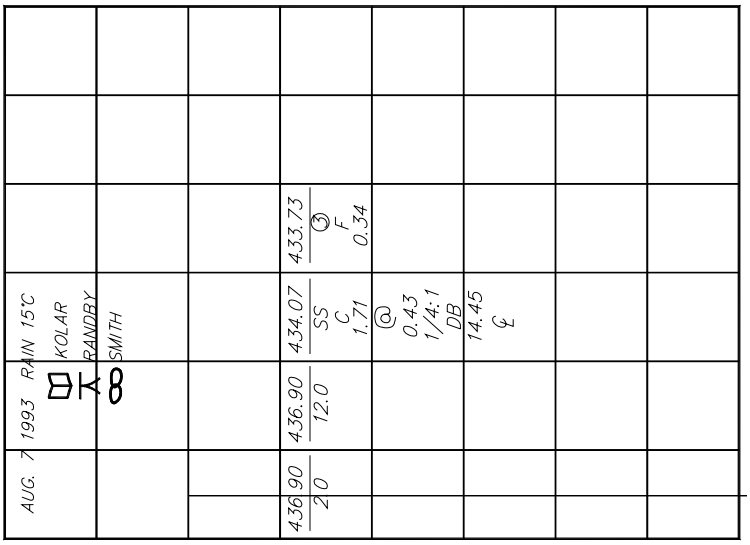
7. Typical level notes

- ✓ Balance backsights and foresights.
- ✓ Establish all benchmarks and take the centerline profile before doing any staking involving elevations.
- ✓ Use the turn through method when establishing benchmarks.
- ✓ Re-check benchmarks after each major freeze/thaw cycle and/or any environmental event that may change the benchmark elevation.
- ✓ Run separate level loops between all benchmarks.
- ✓ Set benchmarks in trees of at least 150-mm diameter, unless approved by the Project Engineer.
- ✓ Correct errors in benchmark elevations so they will not affect the elevations of succeeding benchmarks.
- ✓ Consult with the Project Engineer before placing benchmarks in areas of permafrost or other unstable ground.
- ✓ Establish benchmarks at intervals and locations consistent with good engineering practice, and generally not more than 300 meters.
- ✓ Completely describe benchmarks when establishing or re-establishing their elevation. Give centerline stationing, offset, benchmark projection, and observable benchmark characteristics. When checking into or out of benchmarks, note the book and page number that contains the most recent elevation establishment for that benchmark.
- ✓ Write the station on the top 0.3 meter facing centerline, with numerals a minimum of 35 mm in height.
- ✓ Don't set benchmarks in utility poles.
- ✓ Don't use side shots on benchmarks.
- ✓ Don't use double rodding.

STA	BS+	H.I.	F.S−	ELEV.	AUG. 7, 1993 RAIN +°C WINDY 📖 大 KOLAR / RANDBY				
TBM# 3+272				161.309	NAIL IN BASE OF 300mm SPRUCE 26.2 M LT. 3+372				
	3.877	165.186							
3+300			1.95	163.24					
3+325			2.32	162.87					
3+350 T.P.			2.96 3.246	162.23 161.940					
	1.103	163.043							
3+375			2.31	160.73					
3+400 T.P.			2.56 2.823	160.48 160.220					
	2.332	162.552							
TBM# 3+421			1.143	161.409	NAIL IN BASE OF 450mm STUMP 18.3 M RT. 3+421 ELEV. 161.413				

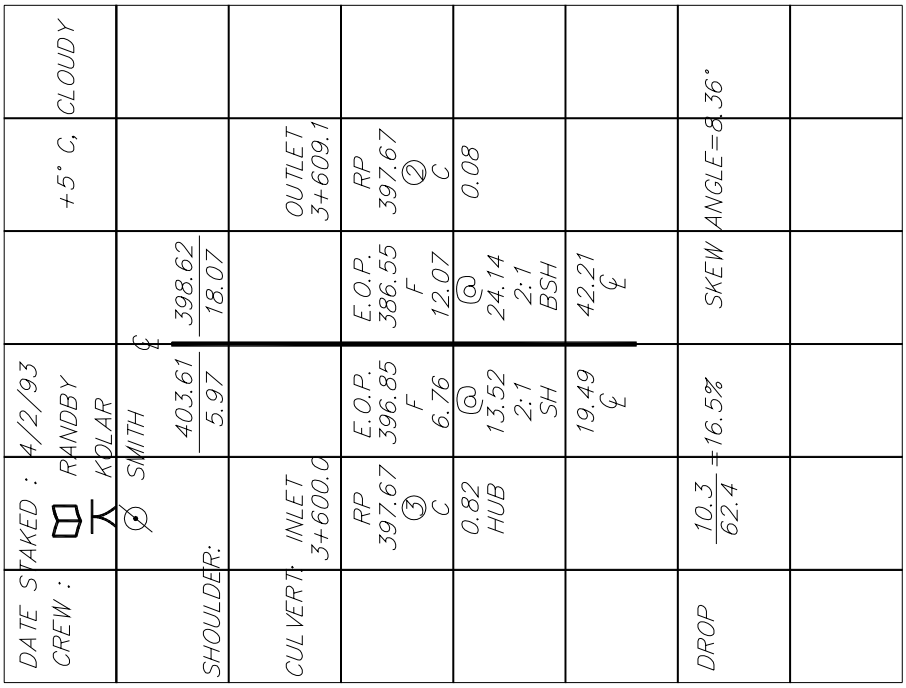
8. Typical slope stake notes

- ✓ Enter the station, elevations, shoulder distance or ditch distances, and slope in the slope stake book before staking begins.
- ✓ In areas where slides or overbreak are anticipated, extend the sections beyond the construction limits.
- ✓ Slope-stake each section that is cross-sectioned.
- ✓ Final re-cross sections are required where there are overbreaks, undercuts, etc. Note re-cross section book and page numbers on the original cross section and slope staking page for the relevant stations.
- ✓ Use a hand level only for one turn up or down from the instrument.
- ✓ Clearly note hand level turns.
- ✓ Use a reference point that is three to six meters beyond the slope stake.
- ✓ The reference point must show the cut or fill to the slope stake and must include the slope stake information.
- ✓ Slope stake all abrupt changes in typical sections.
- ✓ Position all laths to face centerline.
- ✓ Include at least the following information on the stake: (1) where to begin the cut or fill, (2) the slope ratio, (3) the depth of cut or height of fill, and (4) the station.

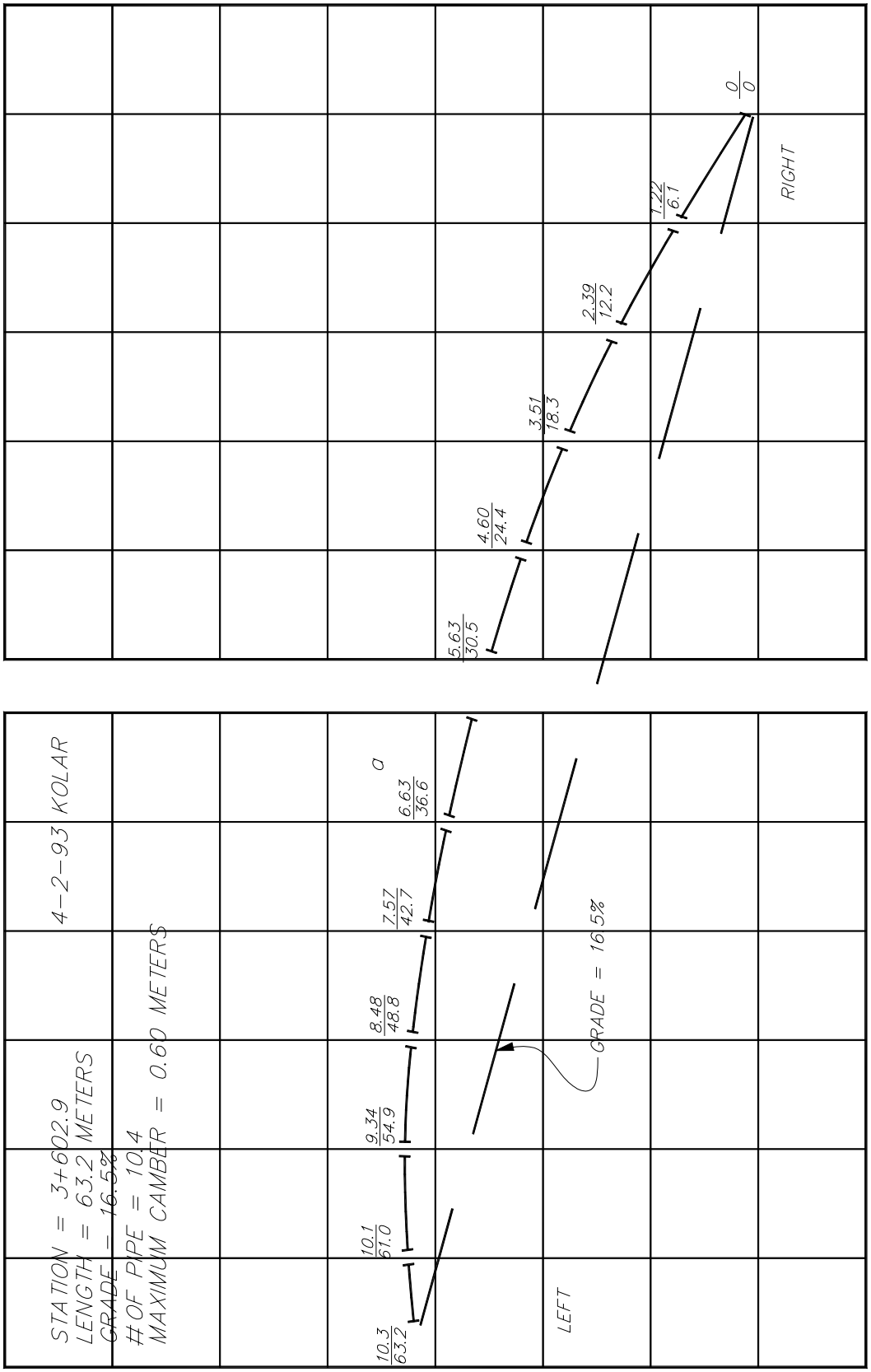


9. Typical culvert notes

- ✓ Show at least the following information on culvert stakes:
  - station
  - size
  - length
  - type of pipe (e.g., 600mm x 24.4m CMP)
  - cut or fill from top of hub to inlet & outlet
  - skew angle
  - horizontal distance from hub to end of pipe
  - gradient of pipe
  - drop of pipe
- ✓ Ensure that all culverts have a minimum camber equal to 1% of the length of the pipe, unless the Project Engineer directs otherwise.
- ✓ Develop a culvert camber diagram showing each section of pipe and its elevation and offset.



10. Typical culvert camber diagram



11. Typical blue or red tops and grade stake notes

- ✓ Place blue and red tops at each break in typical section and on centerline.
- ✓ Use red tops for the bottom of the base course.
- ✓ Use blue tops for top of the base course.
- ✓ Space red/blue tops evenly at and between crown section break points with a maximum spacing of 8 meters between red/blue tops.
- ✓ Establish horizontal control from centerline references and vertical control from benchmarks.
- ✓ Place blue tops at the same interval as slope stakes.
- ✓ Stake all curve transitions.

AUG. 12, 1993 RAIN 10°C NO WIND								
K81 KOLAR SMITH STANTON								
℄ GRADE ROD	R.T. SHLDR GRADE/DIST	RT GRADE ROD						
1.043	50.484/4.79	1.134	TBM#20+940 =48.957					
0.924	50.694/4.79	0.924	ROD = +2.667 HI = 51.618					
0.622	50.905/4.79	0.714						
0.527	50.999/4.79	0.619						
			ROD = 0.497 TBM#21+020 = 51.121 ERROR = 0.001					

STA.	L.T. SHLDR. GRADE/DIST.	L.T. GRADE ROD	℄ GRADE					
20+950	50.484/4.79	1.134	50.575/0.00					
20+975	50.694/4.79	0.924	50.694/0.00					
21+000	50.904/4.79	0.714	50.996/0.00					
21+025	50.999/4.79	0.619	51.091/0.00					