Washington State Department of Transportation

Memorandum

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Date: February 5, 1998

From: T. M. Allen/N. Dbaibo
OSC Geotechnical Branch

Phone: (360) 709-5469

Subject: SR- 167, OL-2305
15th Avenue SW to 15th Avenue NW
HOV Lanes - Stage 3,
MP 13.73 to MP 15.76
Geotechnical Recommendations for
Wall #9 Design

To: A.E. Stiles / N.J. Creelman
NW Region, NB82-29

As requested, we are providing you with geotechnical recommendations for the design of retaining wall No. 9 needed to construct the 15th Avenue SW to 15th Avenue NW HOV lane on SR-167 along the EW ramp. Based on the site plan provided to our office, the wall begins at station EW 12+43 and ends at station EW 14+02. The construction of the HOV lane will require filling a topographically low area and constructing a retaining wall separating the EW ramp and SR-18. The maximum wall height will be about 2.5 m (8ft), including the embedment.

The analysis, conclusions and recommendations contained in this memorandum are based on the project description, site conditions as they existed at the time of our site visit and preparation of this memo and subsurface information supplied your office and in our files. It is further assumed that the subsurface conditions as interpreted from the borings are representative of the subsurface conditions throughout the project area. If during construction, subsurface conditions are different from those encountered in the exploratory borings, or appear to be present beneath or beyond the excavations, we should be advised so that we can assist you and re-evaluate our recommendations.

Site Soil Conditions

The soil conditions at the project site were interpreted from existing exploratory borings performed along the proposed wall alignment and supplied by your office. The boring locations are shown on the retaining wall site plan. Additional subsurface information was obtained from the exploratory borings performed by WSDOT in 1997 for CH2MHill as part of their geotechnical study for Bridge No. 167/112 E Ramp. Borings H-5-97, H-6,97 and H-10-97 are located in the vicinity of wall #9 and their logs are included in the CH2MHill Geotechnical Report.

The borings performed by your office, dated November 18, 1997, consisted of one boring extending to a depth of 8 m (26.5 ft) and two hand augers to a maximum depth of 2.5 m (4.5 ft). The borings performed for the bridge investigation extended to a maximum depth of 25.5 m (80 ft). The borings and hand augers indicate that the site is underlain by poorly graded, medium dense and dense sand and gravel (fill) to a depth of approximately 1 to 3 m (3.3 to 10 ft). Underlying this fill is loose sandy silt and silty fine sand to about 6 m (19.5 feet) below existing grade. Beyond this depth, the soil transitioned into silty fine to sand. The soil consistency increased with depth as reflected by higher blow count values.

Groundwater was encountered at a depth of approximately 0.91 m (3 ft) below existing grades.

Geotechnical Recommendations

We have evaluated several wall options, including cantilevered reinforced concrete gravity wall, and proprietary retaining walls. Based on settlement considerations, it appears that the most economical wall, that could accommodate settlement up to 80 mm (3 in), is a pre-approved proprietary MSE wall system.

The following design parameters should be included in the Special Provisions for the wall design:

Soil Properties	**Wall Backfill**	**Retained Soil**	**Foundation Soil**
Unit Weight (kN/m^3)	19.6	18.5	18
Friction Angle (deg.)	38	34	34
Cohesion (kN/m^2)	0	0	0

AASHTO Load Group	I	VII
Allowable Bearing Capacity (kN/m^2)	190	290
Seismic Coefficient (g)	N/A	0.27

1. The wall shall be placed on a level foundation in the horizontal direction perpendicular to the wall face.
2. The base width of the wall should be at least 70 percent of the wall height. Wider wall base might be needed to provide adequate internal stability.
3. The uppermost reinforcing layer must be placed no lower than 0.6 m (2 ft) below the top of the wall.
4. Wall base embedment should be at least 0.6 m (2 ft) below final finished grade.

The region should contact wall proprietors to confirm their interest in being included in the PS&E. The Bridge and Structures office should be updated for a current list of pre-approved proprietary walls.

Closure

We trust this information is sufficient at this time. Should you have questions or require further information, please contact Nabil Dbaibo at (360) 709-5469 or Jim Cuthbertson at (360) 709-5452.

TMA:ntd

NTD

Attachments

cc: M. Lwin, Bridges & Structures, 47340
A. Young, Bridges & Structures, 47340
A. Korynta, OSC Construction, 47354
B. Rennie, NW NB82-114
J. Johnson, NW NB82-143

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. PP-1-97

PROJECT 15th Street S.W. to 15th St. N.W. HOV Lanes Stage 3 — Job No. L-2305

Wall #9 — S.R. 167

Station EW 14+00 — Offset 10' Rt. — C.S.

Equipment Hand Tools — Casing — Ground El 67.0 (20.42 m)

Method of Boring Port. Penetrometer

Start Date November 18, 1997 — Completion Date November 18, 1997 — Sheet 1 of 1

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1 ft.=0.3048 m.		
				50 (25/6")		PP-1		Poorly graded SAND with gravel, rounded, subrounded and subangular, and cobbles, medium dense, gray, moist homogeneous.		
	1			1 4 11 *(8)		PP-2		Silty SAND with gravel, rounded and subrounded, medium dense, gray, wet, homogeneous.	11/18/97	
5	2							End of test hole boring at 4.5 ft (1.4 m) below ground elevation. Water table elevation = 64.0 ft (3.0 ft below ground elevation.). *The portable penetrometer blows per foot have been converted to approximate Standard Penetrometer blows based on WSDOT experience.		
10	3							Samples were retained at penetrometer depths.		
								Station and offset are estimates and were not surveyed. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications.		
15	4									
	5									
20	6									

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. PP-2-97

PROJECT 15th Street S.W. to 15th St. N.W. HOV Lanes Stage 3 — Job No. L-2305

Wall #9 — S.R. 167

Station EW 12+50 — Offset 10' Rt. — C.S.

Equipment Hand Tools — Casing — Ground El 69.0 (21.03 m)

Method of Boring Port. Penetrometer

Start Date November 18, 1997 — Completion Date November 18, 1997 — Sheet 1 of 1

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1 ft. = 0.3048 m.		
				50 *(25/6")		PP-1		Poorly graded SAND with gravel, rounded, subrounded and subangular and cobbles, medium dense, brown, moist, homogeneous.		
	1			16 50 *(33)		PP-2		Poorly graded SAND with gravel, rounded, subrounded and subangular, and cobbles, medium dense, brown, wet, homogeneous.	11/18/97	
5								End of test hole boring at 4.0 ft (1.2 m) below ground elevation.		
	2							Water table elevation at 66.0 ft (3.0 ft below ground elevation).		
								*The portable penetrometer blows per foot have been converted to approximate Standard Penetrometer blows based on WSDOT experience.		
10	3							Samples were retained at penetrometer depths.		
								Station and offset are estimates and were not surveyed.		
	4							This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications.		
15										
	5									
	6									
20										

LOG OF TEST BORING

Washington State Department of Transportation

HOLE No. TH-1-97

PROJECT 15th Street S.W. to 15th St. N.W. HOV Lanes Stage 3 — Job No. L-2305

Wall #9 — S.R. 167

Station EW 13+50 — Offset 10' Rt. — C.S.

Equipment Diedrich D-25 — Casing HQ X 25' — Ground El 68.0 (20.73 m)

Method of Boring * See Note

Start Date November 18, 1997 — Completion Date November 18, 1997 — Sheet 1 of 2

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
								1 ft. = 0.3048 m.		
				9 7 8 (16)		D-1		Poorly graded SAND with gravel, rounded, subrounded and subangular, medium dense, brownish gray, moist, homogeneous. Recovered and retained 1.1 ft.	11/18/97	
	1							Note: Drilling became softer at 4.0 ft (1.2 m).		
5				2 1 1 (2)		D-2		No Recovery (SAND wash around casing).		
	2									
				1 2 3 (5)		D-3		Poorly graded SAND with some organics (peat), loose, gray and brown, moist, laminated. Recovered and retained 0.6 ft.		
10	3			9 10 9 (19)		D-4		Poorly graded SAND, medium dense, gray, wet, homogeneous. Recovered and retained 1.0 ft.		
	4									
15				2 3 2 (15)		D-5		Silty SAND, loose, gray, wet, homogeneous. Recovered and retained 1.5 ft.		
	5									
20	6									

LOG OF TEST BORING

Washington State Department of Transportation

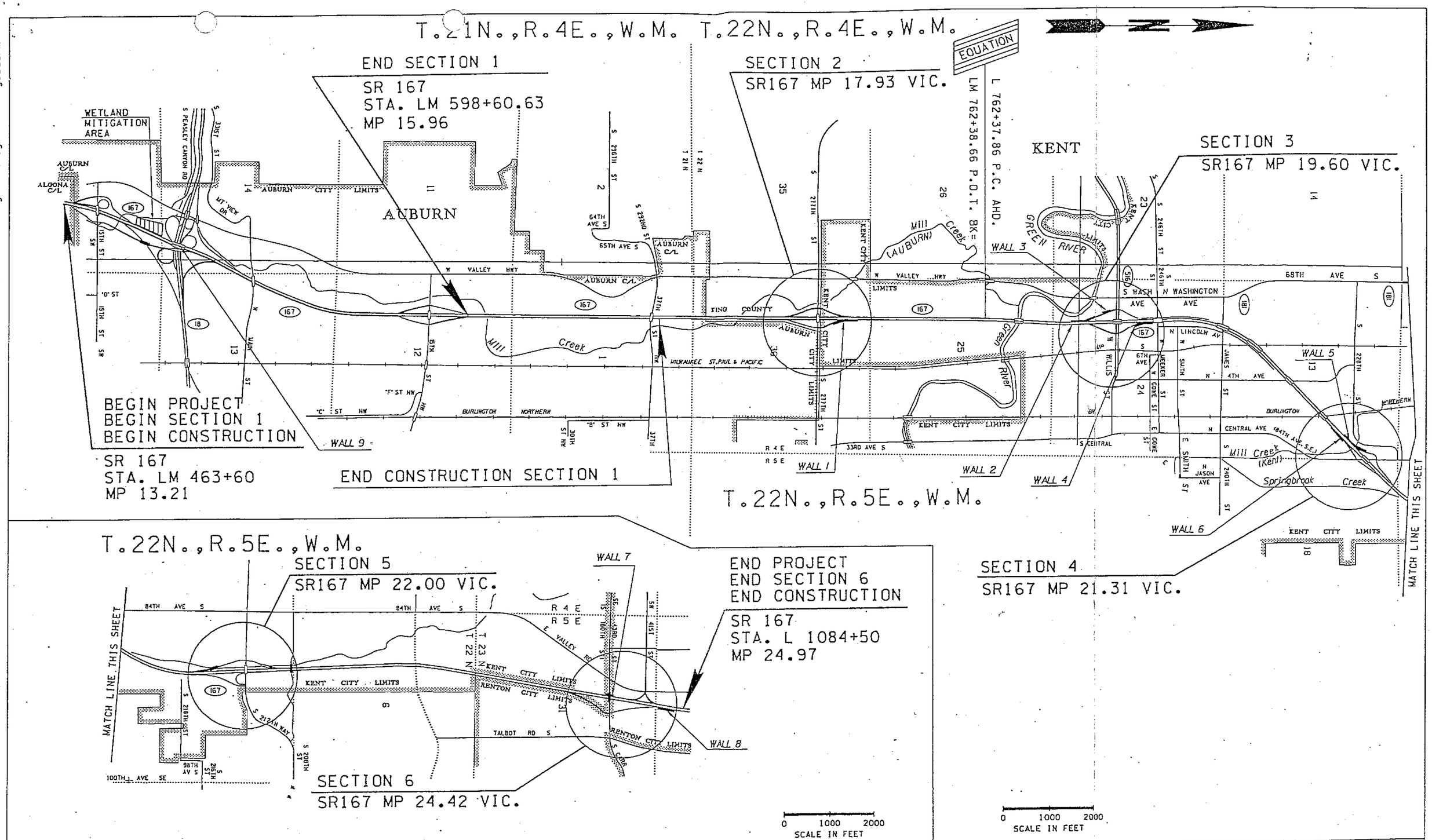
HOLE No. TH-1-97

Sheet 2 of 2

PROJECT 15th Street S.W. to 15th St. N.W. HOV Lanes Stage 3

Job No. L-2305

Depth (ft)	Meters (m)	Profile	Standard Penetration Blows/ft (10 20 30 40)	SPT Blows/6" (N)	Sample Type	Sample No. (Tube No.)	Lab Tests	Description of Material	Groundwater	Instrument
				1 5 8 (13)		D-6		Poorly graded SAND, medium dense, black, wet, homogeneous. Recovered and retained 1.2 ft.		
	7									
25				6 8 10 (18)		D-7		Poorly graded SAND with silt layers, medium dense, dark gray, wet, laminated. Recovered and retained 1.5 ft.		
	8									
								End of test hole boring at 26.5 ft (8.1 m) below ground elevation. Elevation 41.5 ft.		
	9							* Method of Boring: HQ Advancer/Cat Head 140# Hammer		
30								Water table elevation 65.0 ft. (3.0 ft below ground elevation.)		
	10							Station and offset are estimates and were not surveyed.		
35								This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications.		
	11									
	12									
40										
	13									
45										



DESIGNED BY M. LABORN					
ENTERED BY K. MCLEAN					
CHECKED BY M. ASKARIAN					
PROJ. ENGR. J. JOHNSON					
REGIONAL ADM. J. OKAMOTO					
	DATE	DATE	REVISION	BY	

REGION NO.	STATE	FED. AID PROJ. NO.
10	WASH	
JOB NUMBER		
CONTRACT NO.		

ENVIRONMENTAL AND ENGINEERING SERVICE CENTER

Washington State Department of Transportation

SR 167
15TH ST SW TO 15TH ST NW
HOV AND SC&DI - STAGE 3

VICINITY MAP

V1

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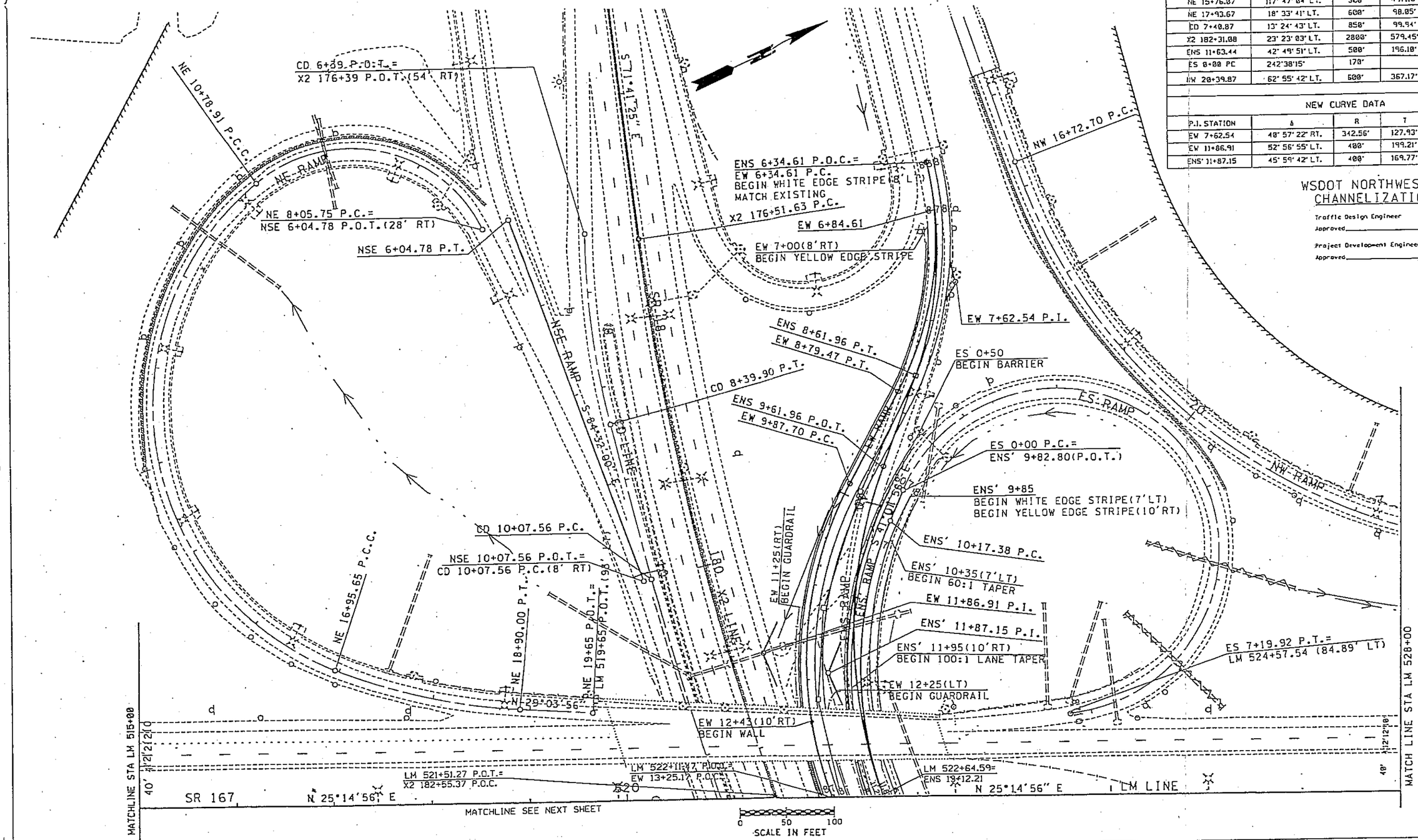
SR 18 INTERCHANGE

T.21N., R.4E., W.M.



EXISTING CURVE DATA					
P.I. STATION	Δ	R	T	L	S
NE 9+98.92	104° 20' 20" LT.	150'	193.17'	273.16'	0.10'/FT.
NE 15+76.07	117° 47' 04" LT.	300'	497.16'	656.72'	0.10'/FT.
NE 17+93.67	18° 33' 41" LT.	600'	98.05'	194.37'	0.08'/FT.
CD 7+40.87	13° 24' 43" LT.	850'	99.94'	189.97'	0.08'/FT.
X2 182+31.08	23° 23' 03" LT.	2800'	579.45'	1142.77'	0.05'/FT.
ENS 11+63.44	42° 49' 51" LT.	500'	196.10'	373.77'	0.09'/FT.
ES 0+00 PC	242°38'15"	170'		719.92'	
NW 20+39.87	62° 55' 42" LT.	500'	367.17'	658.98'	0.08'/FT.

NEW CURVE DATA					
P.I. STATION	Δ	R	T	L	S
EW 7+62.54	48° 57' 22" RT.	342.56'	127.93'	244.86'	
EW 11+86.91	52° 56' 55" LT.	400'	199.21'	369.65'	
ENS' 11+87.15	45° 59' 42" LT.	400'	169.77'	321.11'	

WSDOT NORTHWEST REGION
CHANNELIZATION PLAN

Traffic Design Engineer
Approved_____ Date_____

Project Development Engineer
Approved_____ Date_____

DESIGNED BY	K. EZEOKEKE				
ENTERED BY	M. GOUDARZI				
CHECKED BY	M. ASKARIAN				
PROJ. ENGR.	J. JOHNSON				
DIST. ADM.	J. OKAMOTO				
		DATE	DATE	REVISION	BY

REGION NO.	STATE	FED. AID PROJ. NO.
10	WASH	

JOB NUMBER

CONTRACT NO.

ENVIRONMENTAL AND ENGINEERING SERVICE CENTER

Washington State Department of Transportation

MP 13.73 TO MP 15.76

SR 167
15TH AVE SW TO 15TH NW
HOV LANES - STAGE 3

CHANNELIZATION PLAN FOR APPROVAL

SHEET 6 OF SHEETS.

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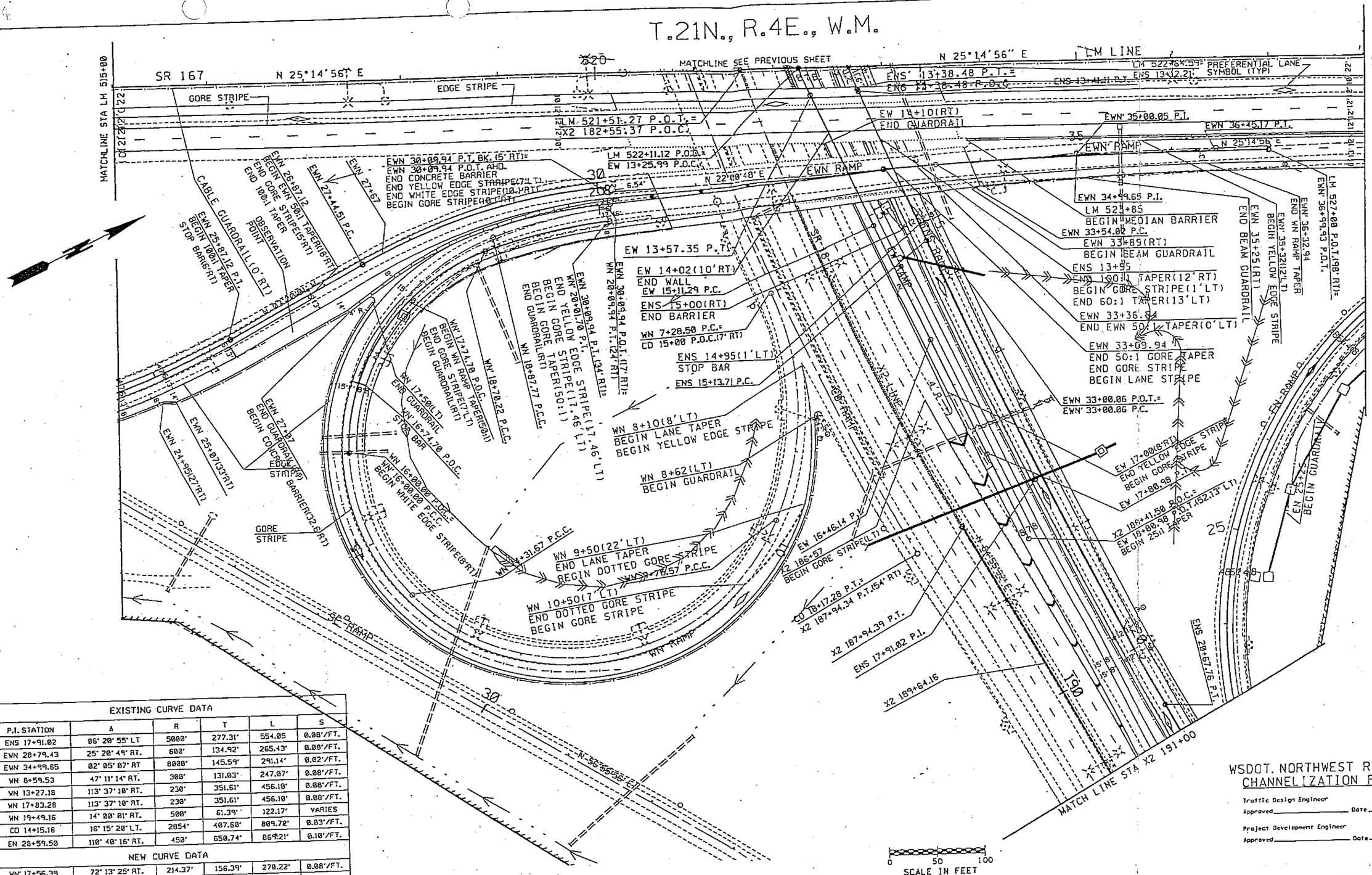


WSDOT. NORTHWEST REGION
CHANNELIZATION PLAN

Traffic Design Engineer
Approved _____ Date _____

Project Development Engineer
Approved _____ Date _____

EXISTING CURVE DATA

P.I. STATION	Δ	R	T	L	S
ENS 17+91.02	06° 20' 55" LT	5000'	277.31'	554.05	0.08'/FT.
EWN 28+79.43	25° 20' 49" RT.	600'	134.92'	265.43'	0.08'/FT.
EWN 34+99.65	02° 05' 07" RT	8000'	145.59'	291.14'	0.02'/FT.
WN 8+59.53	47° 11' 14" RT.	300'	131.03'	247.07'	0.08'/FT.
WN 13+27.18	113° 37' 10" RT.	230'	351.61'	456.10'	0.08'/FT.
WN 17+83.28	113° 37' 10" RT.	230'	351.61'	456.10'	0.08'/FT.
WN 19+49.16	14° 00' 01" RT.	500'	61.39'	122.17'	VARIES
CO 14+15.16	16° 15' 20" LT.	2654'	407.60'	809.72'	0.03'/FT.
EN 28+59.50	110° 40' 16" RT.	450'	650.74'	866.21'	0.10'/FT.

NEW CURVE DATA

WN' 17+56.39	72° 13' 25" RT.	214.37'	156.39'	270.22'	0.08'/FT.
WN' 19+36.26	13° 27' 10.3" RT.	559.98'	66.84'	131.48'	VARIES
EW 16+46.14	00° 13' 54" RT	66698.63'	134.84'	269.69'	0.02'/FT.
EWN' 35+00.05	03° 14' 08" RT	7080.88'	199.99'	399.87'	0.02'/FT.

DESIGNED BY	K. EZEOKEKE
ENTERED BY	M. GOUDARZI
CHECKED BY	M. ASKARIAN
PROJ. ENGR.	J. JOHNSON
DIST. ADV.	J. OKAMOTO

REGION NO.	STATE	FED. AID PROJ. NO.
10	WASH	

JOB NUMBER

CONTRACT NO.

ENVIRONMENTAL AND ENGINEERING SERVICE CENTER

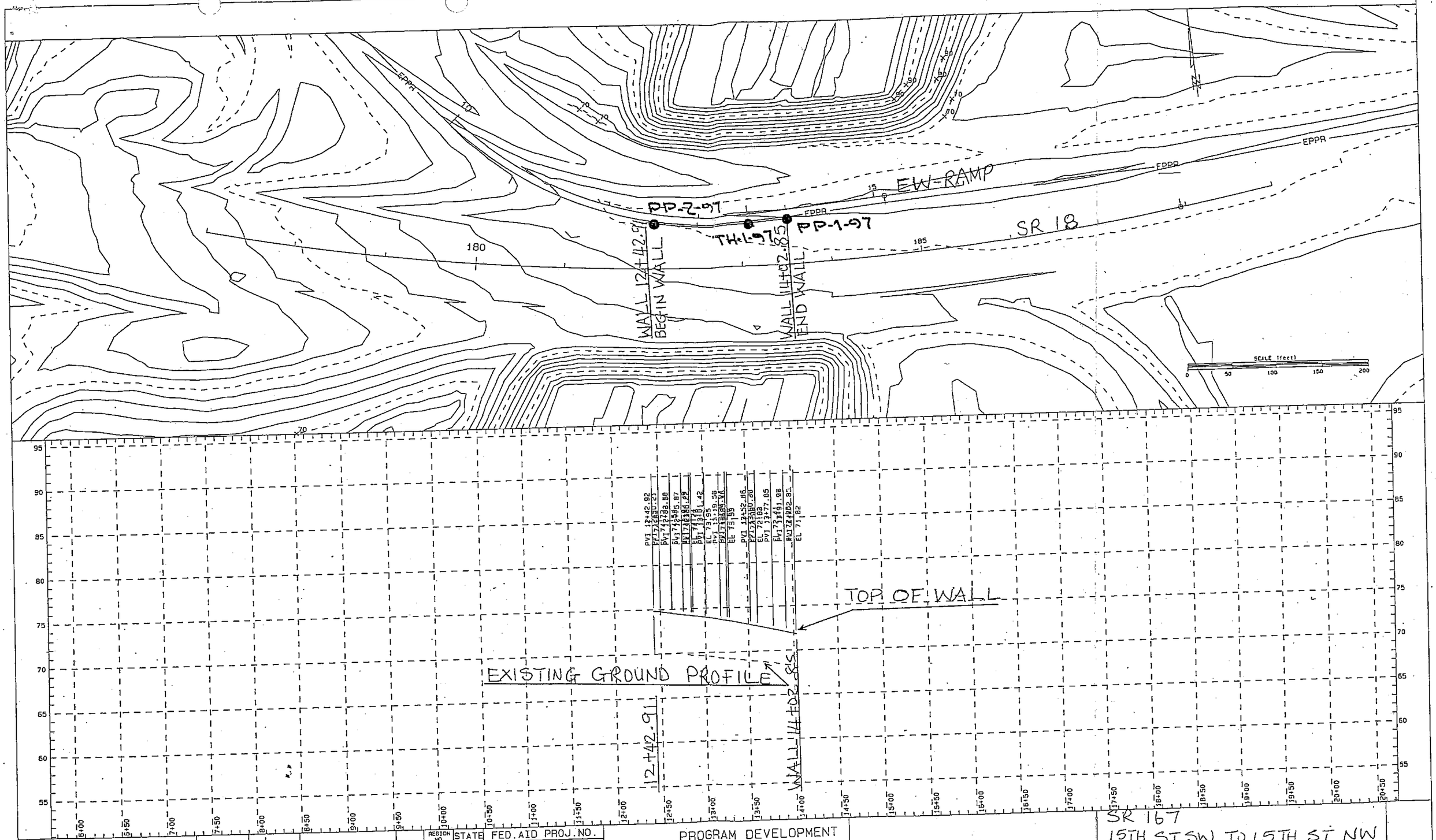
Washington State Department of Transportation

MP 13.73 TO MP 15.76

SR 167
15TH AVE SW TO 15TH NW
HOV LANES - STAGE 3

CHANNELIZATION PLAN FOR APPROVAL

SHEET 7 OF SHEETS



DESIGNED BY				REGION NO.	STATE	FED. AID PROJ. NO.	PROGRAM DEVELOPMENT DIVISION
ENTERED BY				10	WASH		
CHECKED BY				JOB NUMBER			
PROJ. ENGR.				CONTRACT NO.			
DIST. ADM.	DATE	DATE	REVISION	BY			

Washington State Department Of Transportation

SR 167
15TH ST SW TO 15TH ST NW
HOV LANES - STAGE 3

EW RETAINING WALL

SHEET OF SHEETS