

Highway Construction Cost Comparison Survey

April 2002

FINAL REPORT

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Washington State Department of Transportation

Table of Contents

- INTRODUCTION..... 1**
- BACKGROUND 2**
- SURVEY RESULTS 3**
 - PROJECT COST 3
 - LANE-MILE COST..... 3
 - VARIABILITY RANGE 3
 - STATES WITHOUT PREVAILING WAGE LAWS..... 4
 - COST COMPARISON CHARTS 4
 - ENGINEERING RANGES 4
- APPENDIX A 9**
- APPENDIX B 14**

Transportation Construction Cost Comparison

WSDOT Nationwide Survey

April 2002

Introduction

Over the past few years the Washington State Department of Transportation (WSDOT) has been asked numerous questions related to the cost of highway construction in Washington State as compared to other states. In order to address these questions, WSDOT has completed a survey of other states. This report is a summary of that survey.

A WSDOT project, the SE 192nd Avenue Interchange on SR 14 near Vancouver, Washington, was selected. The 1.02 mile portion of the project used for the survey includes improvements to SR 14, including clearing and grubbing, surfacing, constructing a pre-stressed concrete girder bridge, constructing retaining walls, paving with asphalt concrete pavement, constructing beam guardrail, placing concrete barrier, and striping. An aerial photo of the project vicinity, with the project alignment superimposed, and selected plan sheets are included in Appendix A.

Background

Over fifty WSDOT interchange projects were considered as potential candidates for the survey. A team was assembled to review the projects. The criteria used to evaluate candidate projects included: a portion of new alignment, retaining walls and other structures, roadway excavation, and asphalt concrete pavement (ACP). The team looked for a representative project that would be universal in all the states. The SE 192nd Avenue Interchange Project on SR 14 met these criteria. Because of the wide range of variability in cost of right of way and environmental items, they were addressed using a different format as discussed below.

The quantities for the 1.02-mile portion of the project used in the survey were calculated. The team agreed on how to aggregate bid items, established major bid item groups, and identified the unit costs for these items.

WSDOT developed a survey form based on the data requested. This form was converted to an Internet-compatible format. Survey participants were provided an aerial photo of the project, paving plans of the 1.02-mile portion of the project, and typical sections, through a link to a file on a File Transfer Protocol (FTP) server.

The survey form was sent to members of the AASHTO Subcommittee on Design. Participants were asked to provide the unit costs in their states for the bid items included in the survey, and the percentage of project cost devoted to mobilization, preliminary engineering, and construction engineering. The information gathered provides detail for calculation of the construction cost of the interchange and the construction cost of a lane mile of highway. (WSDOT is frequently asked how much it costs to construct a lane mile of highway.) Survey participants were asked to identify the range of project cost in their state for right of way, environmental documentation (SEPA, NEPA, permitting), and environmental compliance and mitigation associated with construction. Participants were also asked if their state has a state prevailing wage law in addition to the federal prevailing wage law. The survey form is included in Appendix B.

Survey Results

Project Cost

For the purpose of the survey, the team used several standard unit bid items from the SE 192nd Avenue project that they felt would give an apples-to-apples comparison. The calculated costs of the items ranged from \$4.0 million to \$26.7 million, with an average of \$9.0 million nationwide. The cost in Washington was \$6.1 million, \$2.9 million below the nationwide average. All subsequent references to interchange construction refer to the bid items selected for evaluation in the survey. The costs from each of the 25 states that responded to the survey are shown in Table 1. Chart 1 graphically represents a relative comparison.

Lane-Mile Cost

The data is presented to show the cost to construct a 1.02 mile diamond interchange project that includes new alignment of a four-lane facility, structures, surfacing, paving, guardrail, concrete barrier, and striping, and to demonstrate the cost to construct a single lane mile of the selected project.

The cost to construct a single lane mile of the selected project ranged from \$1.0 million to \$8.5 million with an average cost of \$2.3 million. The cost to construct this same lane mile in Washington State is \$1.4 million. The cost to construct a single lane mile for this project in Washington State is \$886,000 below the average cost nationwide. The lane-mile costs from each state are shown in Table 2, with a graphic comparison shown by Chart 2.

Variability Range

This study excluded right of way, pre-construction environmental compliance, and construction environmental compliance and mitigation. Right of way and environmental costs are quite variable within Washington State, making the comparison of project costs difficult and unreliable. Other states expressed similar disparities for these items. This study was limited to contract bid items to ensure an apples-to-apples comparison.

Survey participants were asked to identify the range of variability of project cost associated with right of way, pre-construction environmental compliance, and construction environmental compliance and mitigation. The variability rates for right of way ranged from 10 percent or less to over 30 percent of project cost. The rates for environmental documentation (SEPA, NEPA, permitting) ranged from 10 percent or less to as much as 20 percent in three of the reporting states. The rates for construction environmental compliance and mitigation ranged from 10 percent or less to nearly 20 percent reported by four states. Washington fits in the 10 percent or less range for both right of way and environmental documentation, and in the 11 to 20 percent range for environmental compliance and mitigation. The results from each state are shown in Tables 1 and 2.

States Without Prevailing Wage Laws

Of the 25 states that responded to the survey, 7 states reported they do not have prevailing wage laws. A follow-up question was posed to those states that indicated they did not have prevailing wage laws. They were asked to estimate the percent of difference in construction costs using the state rate versus the federal rate. Of those 7 states, 4 stated they use federal wage rates on all projects regardless of the funding source, and 3 stated they didn't keep records on the differences.

Cost Comparison Charts

The construction costs that appear in the following charts include unit prices, as indicated on the survey forms, for the various components of the construction project, including mobilization. For example, for the component Asphalt Concrete Paving, the price per ton includes the cost of all the ingredients that make up the asphalt, the cost to mix and prepare it for installation, the cost of delivery by truck to the job site, and the machinery and labor to place it on the highway and compact it to a finished product.

The total dollar values in the charts are the sum of all the components listed on the survey form. In order to make a state-to-state comparison of construction costs, some of the items that normally go into a highway construction project are not included in the chart column titled *Construction Cost*. Items such as the purchase of right of way, environmental permitting, and environmental mitigation are not included because of the price variability that occurs based on project location (for example, urban or rural).

Engineering Ranges

Costs for engineering, shown as a percentage of the total construction dollars, ranged from 4 to 20 percent for both preliminary engineering (PE) and construction engineering (CE). The average for PE is 10.3 percent and for CE is 11.2 percent. PE is defined as the work that goes into preparing a project for construction. CE is defined as the administration and oversight of construction of the project.

Construction Cost for Diamond I/C by State with Percentage of Project Cost Devoted to R/W; NEPA; Mitigation

State Name	Construction Cost	ROW Variability	Environmental Doc. Variability	Env. Mitigation Variability	Prevailing Wage Law	PE %	CE %	Mob. %
Mississippi	\$4,023,692	11 - 20%	0 - 10%	0 - 10%	No	No Data	5%	5%
Arizona	\$5,016,509	> 30%	11 - 20%	11 - 20%	No	8%	15%	10%
Wyoming	\$5,053,898	11 - 20%	0 - 10%	0 - 10%	Yes	10%	12%	8%
Montana	\$5,223,960	0 - 10%	0 - 10%	0 - 10%	Yes	20%	15%	10%
Michigan	\$5,010,915	> 30%	11 - 20%	11 - 20%	Yes	8%	0 to 15%	5%
New Mexico	\$5,555,705	> 30%	0 - 10%	0 - 10%	Yes	8-10%	15-20%	10%
Washington	\$6,137,104	0 - 10%	0 - 10%	11 - 20%	Yes	15%	15%	10%
Ohio	\$5,787,138	11 - 20%	0 - 10%	0 - 10%	Yes	10%	8%	3%
Idaho	\$6,211,088	> 30%	0 - 10%	0 - 10%	No	10%	10%	10%
Oklahoma	\$6,049,407	11 - 20%	0 - 10%	0 - 10%	No	5%	9%	3%
Illinois	\$6,065,936	0 - 10%	0 - 10%	0 - 10%	Yes	10%	12%	3%
North Carolina	\$6,348,413	> 30%	0 - 10%	0 - 10%	Yes	10%	10%	5%
South Dakota	\$6,789,690	0 - 10%	0 - 10%	0 - 10%	Yes	4%	10%	10%
Louisiana	\$6,882,953	> 30%	0 - 10%	0 - 10%	No	15%	4%	5%
Kansas	\$7,035,386	11 - 20%	0 - 10%	0 - 10%	No	7%	10%	6%
West Virginia	\$7,032,505	11 - 20%	0 - 10%	0 - 10%	Yes	15%	18%	1%
Arkansas	\$8,383,150	11 - 20%	0 - 10%	0 - 10%	Yes	10%	10%	10%
Oregon	\$8,613,464	11 - 20%	0 - 10%	0 - 10%	Yes	12%	No Data	10%
California	\$10,096,696	0 - 10%	0 - 10%	0 - 10%	Yes	20%	15%	10%
Maine	\$12,526,323	0 - 10%	0 - 10%	0 - 10%	No	9%	10%	8%
Massachusetts	\$13,122,706	> 30%	0 - 10%	0 - 10%	Yes	10%	10%	0%
New Jersey	\$21,606,424	11 - 20%	0 - 10%	0 - 10%	Yes	15%	10%	10%
New York	\$22,175,560	No Data	No Data	No Data	Yes	5%	10%	4%
Hawaii	\$26,713,274	11 - 20%	11 - 20%	0 - 10%	Yes	10%	15%	10%
Colorado	\$7,261,079	No Data	0-10%	11-20%	No	11%	11%	5%
Total Const. Cost	\$224,722,975							
Average Const. Cost	\$8,988,919							

PE = Preliminary Engineering
 CE = Construction Engineering
 Mob = Mobilization

Table 1
Construction Cost for Diamond Interchange

**Highway Construction Cost Comparison
for
Diamond Interchange
WSDOT
Nationwide Survey April 2002**

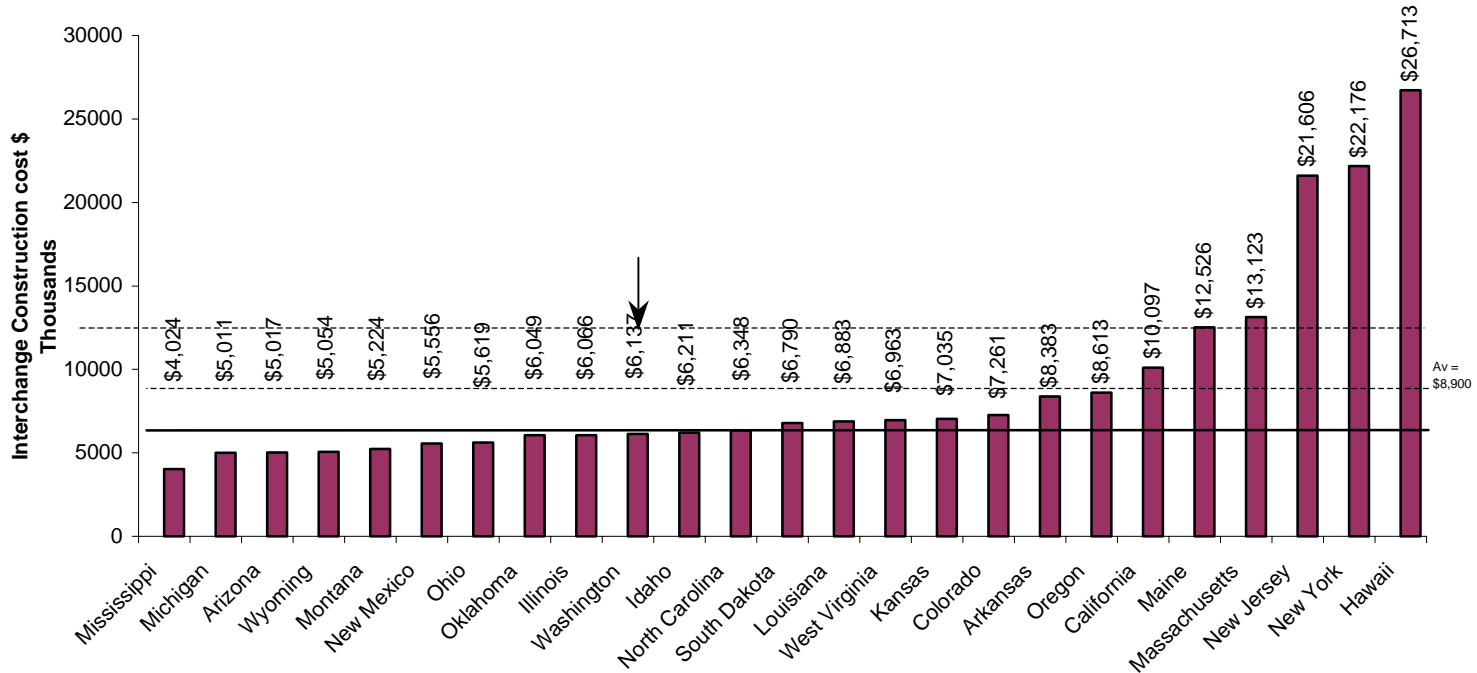


Chart 1 Interchange Cost Comparison

Chart 1
Interchange Cost Comparison

Construction Cost for a Single Lane Mile

State Name	Construction Cost	Right Of Way Variability	Environmental Documentation Variability	Environmental Mitigation Variability	State Prevailing Wage Law	PE %	CE %	Mob. %
Mississippi	\$1,033,576	11 - 20%	0 - 10%	0 - 10%	No	No Data	5%	5%
Montana	\$1,118,827	0 - 10%	0 - 10%	0 - 10%	Yes	<10%	10%	8%
Wyoming	\$1,261,046	11 - 20%	0 - 10%	0 - 10%	Yes	10%	12%	8%
Arizona	\$1,295,908	>30%	11 - 20%	11 - 20%	No	8%	15%	10%
Ohio	\$1,330,176	11 - 20%	0 - 10%	0 - 10%	Yes	10%	8%	3%
Washington	\$1,445,662	0 - 10%	0 - 10%	11 - 20%	Yes	15%	15%	10%
Illinois	\$1,398,314	0 - 10%	0 - 10%	0 - 10%	Yes	10%	12%	3%
Michigan	\$1,454,462	>30%	11 - 20%	11 - 20%	Yes	8%	0 - 15%	5%
New Mexico	\$1,526,631	> 30%	0 - 10%	0 - 10%	Yes	8 - 10%	15 - 20%	10%
Oklahoma	\$1,510,910	11 - 20%	0 - 10%	0 - 10%	No	5%	9%	3%
South Dakota	\$1,616,581	0 - 10%	0 - 10%	0 - 10%	Yes	4%	10%	10%
North Carolina	\$1,590,182	> 30%	0 - 10%	0 - 10%	Yes	10%	10%	5%
West Virginia	\$1,572,946	11 - 20%	0 - 10%	0 - 10%	Yes	15%	18%	1%
Kansas	\$1,914,917	11 - 20%	0 - 10%	0 - 10%	No	7%	10%	6%
Louisiana	\$2,015,042	ROW costly item in urban areas	0 - 10%	0 - 10%	No	15%	4%	5%
Oregon	\$2,112,486	11 - 20%	0 - 10%	0 - 10%	Yes	12%	No Data	10%
Idaho	\$2,178,689	> 30%	0 - 10%	0 - 10%	No	10%	10%	10%
California	\$2,213,519	0 - 10%	0 - 10%	0 - 10%	Yes	20%	15%	10%
Arkansas	\$2,257,449	11 - 20%	0 - 10%	0 - 10%	Yes	10%	10%	10%
Massachusetts	\$3,069,336	Varies Widely	0 - 10%	0 - 10%	Yes	10%	10%	0%
Maine	\$3,594,823	0 - 10%	0 - 10%	0 - 10%	No	9%	10%	8%
New Jersey	\$4,787,288	11 - 20%	0 - 10%	0 - 10%	Yes	15%	10%	10%
Hawaii	\$5,942,278	11 - 20%	11 - 20%	0 - 10%	Yes	10%	15%	10%
New York	\$8,461,288	No Data	No Data	No Data	Yes	5%	10%	4%
Colorado	\$1,602,251	No Data	0-10%	11-20%	No	11%	11%	5%
Total Const. Cost	\$58,304,586							
Average Const. Cost	\$2,332,183							

Table 2
Lane-Mile Construction Costs

Highway Lane Mile Cost Comparison
WSDOT
April 2002

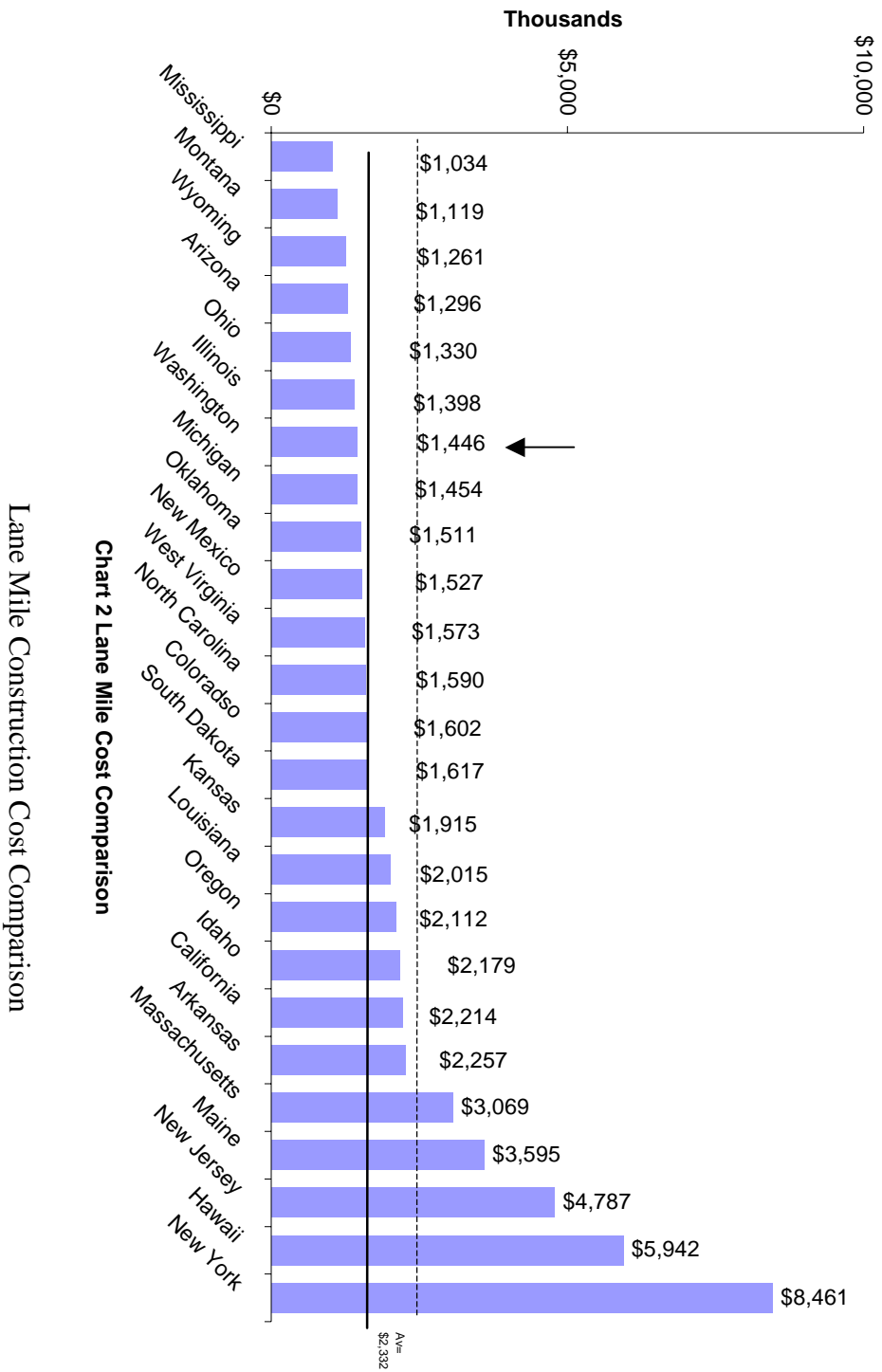


Chart 2

Appendix A
AERIAL PHOTO AND PLAN SHEETS



Figure 1
SE 192nd Ave. Vicinity

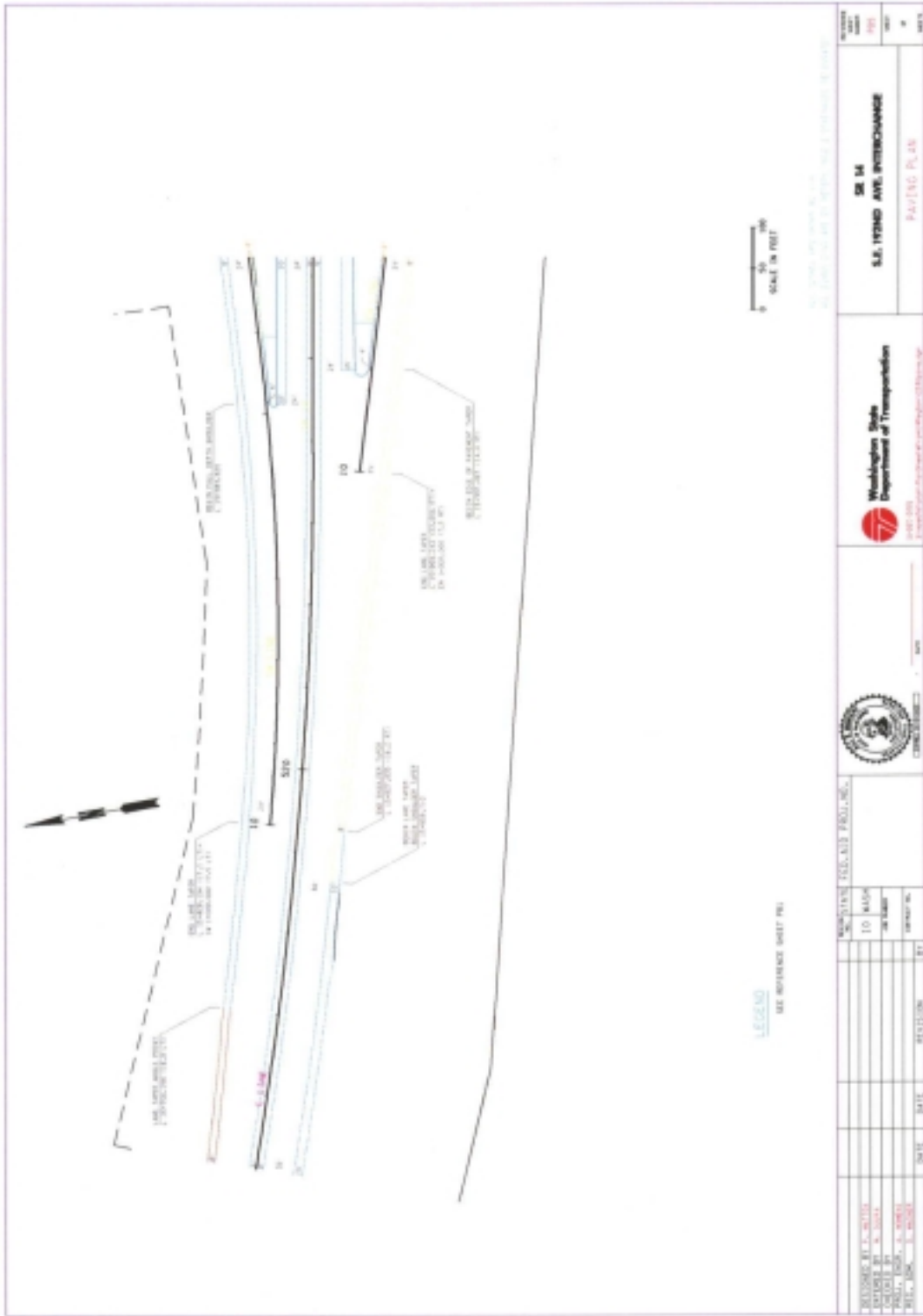


Figure 2
SE 192nd Ave. Paving Plan

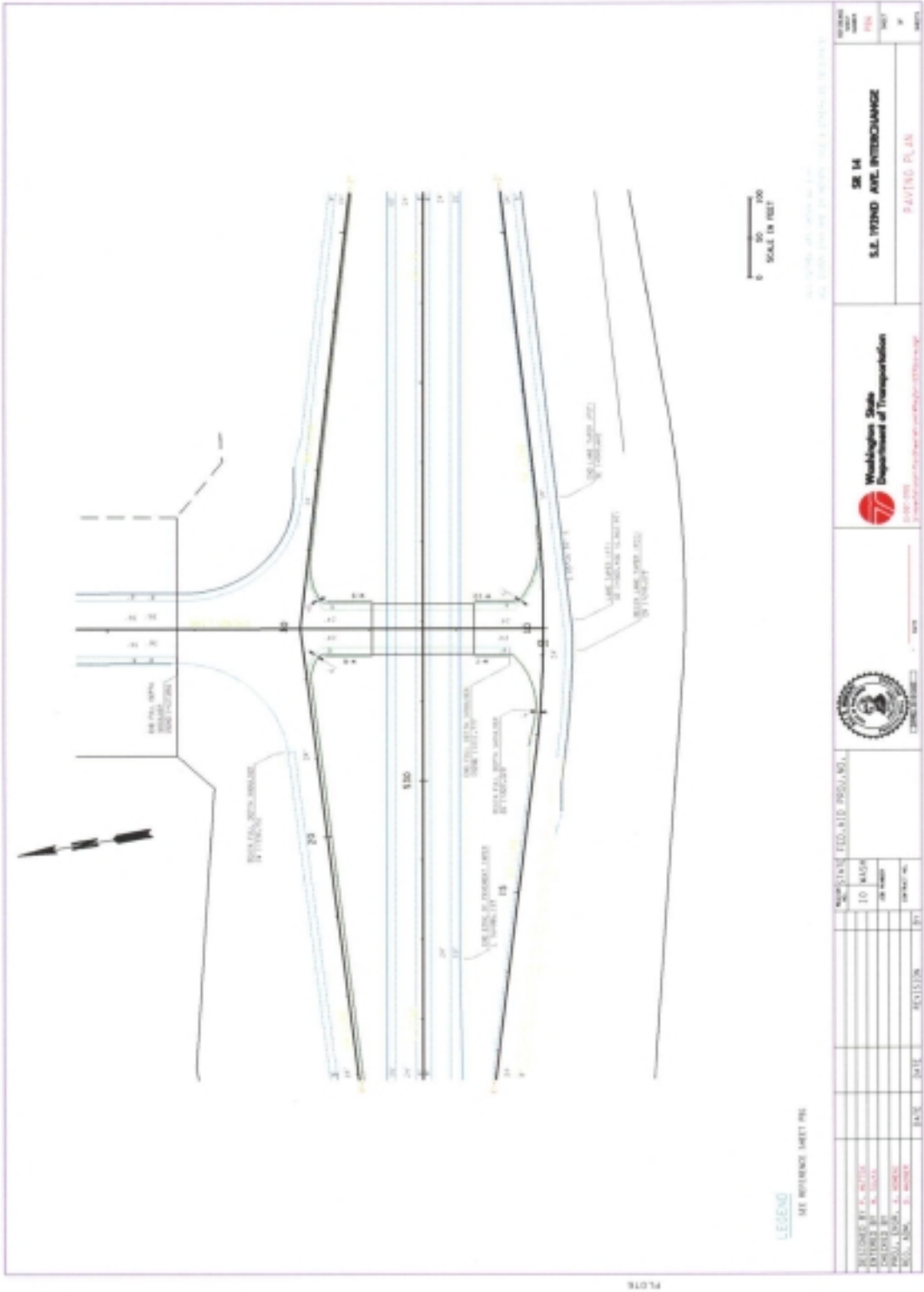


Figure 2a
SE 192nd Ave. Paving Plan

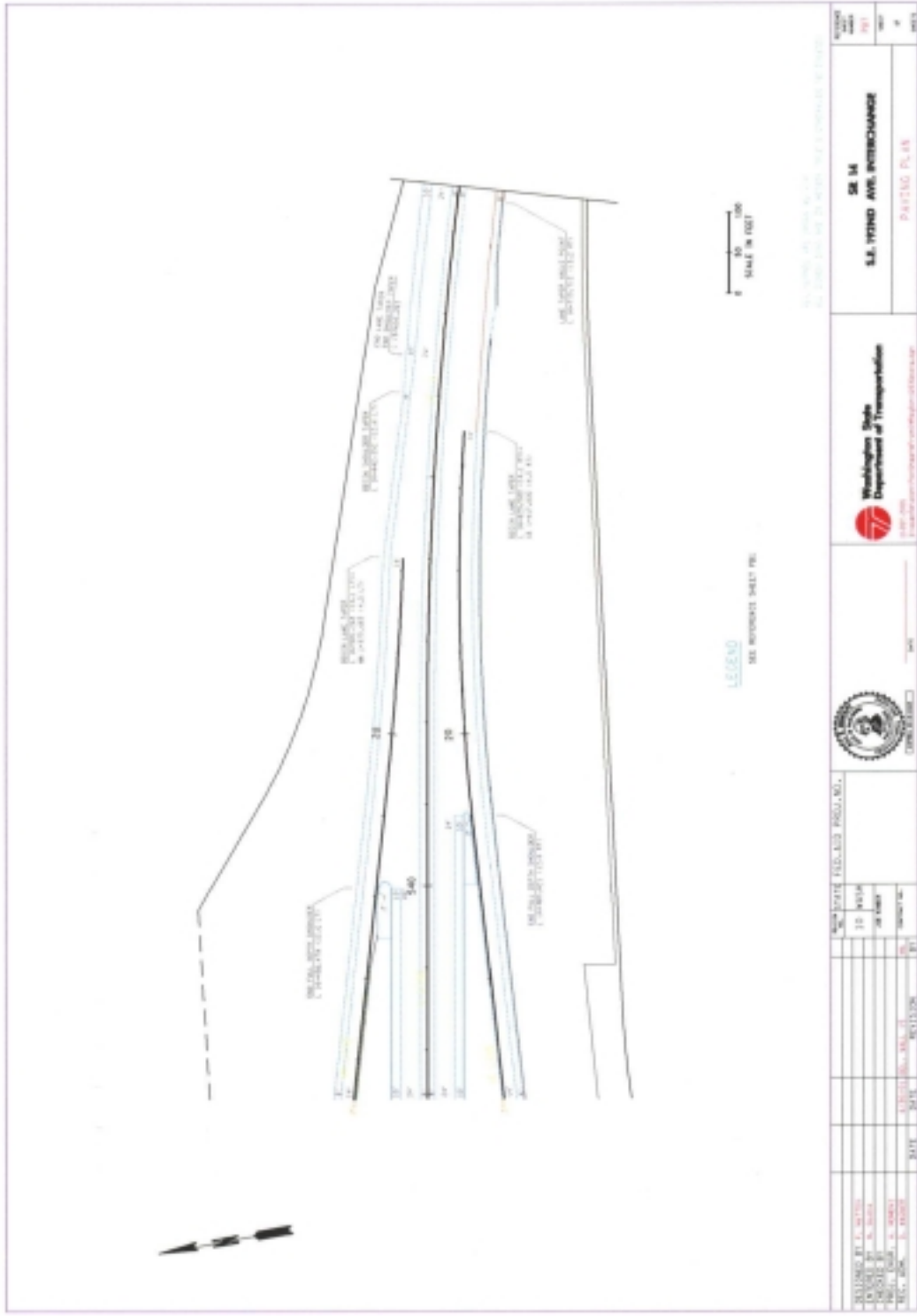


Figure 2b
SE 192nd Ave. Paving Plan

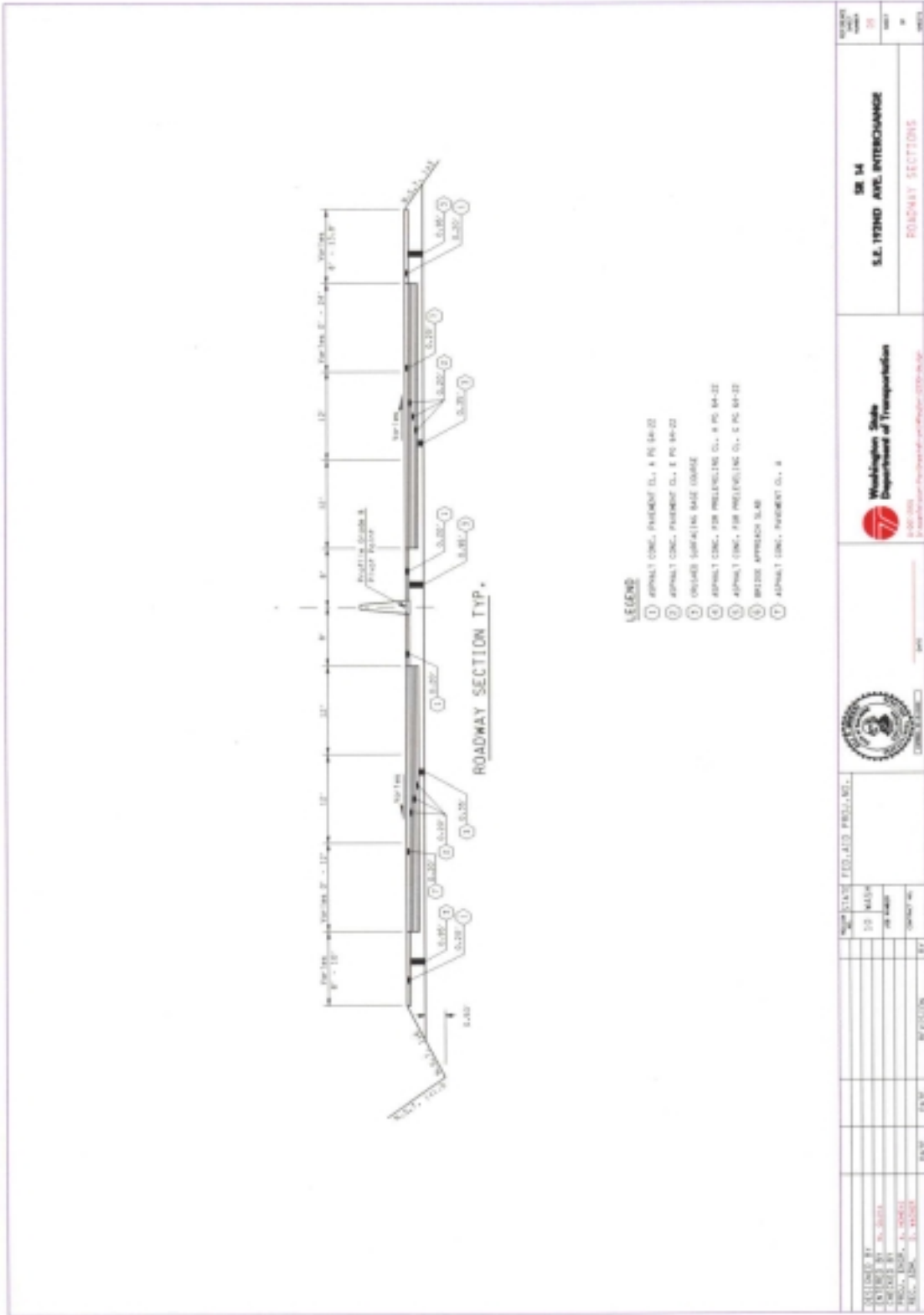


Figure 2c
SE 192nd Ave. Typical Roadway Section

**Appendix B
SURVEY FORM**

<u>PART 1</u>			Your Unit Cost <small>(Please include your data in the blue cells)</small>
Cost Estimate:	Quantity	Unit	Unit Cost \$
STRUCTURES			
Bridge	7.371	SF	<input type="text"/>
Walls Retaining	5,751	SF	<input type="text"/>
GRADING			
Roadway Exc.	933,527	YD 3	<input type="text"/>
Structure Exc. Cl 'B'	14,194	YD 3	<input type="text"/>
Clear/Grub Shrubs/Grass	30.00	Acre	<input type="text"/>
OTHER CONSTRUCTION			
Guardrail (w/anchors & terminals)	4,416	LF	<input type="text"/>
Concrete Barrier - Single Slope, Cast in place	5,000	LF	<input type="text"/>
Striping	139,900	LF	<input type="text"/>
Asphalt Concrete Paving	31,089	Ton	<input type="text"/>
Surfacing - Crushed Surfacing	27,575	Ton	<input type="text"/>
			Your Average Percentage of Project Cost <small>(Please include your data in the blue cells)</small>
MOBILIZATION / CONTINGENCIES			
Mobilization			<input type="text"/>
Contingencies			<input type="text"/>

OTHER ESTIMATED COSTS			
Preliminary Engineering			<input type="text"/>
Are Administrative Costs included in P.E. Estimates?	<input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="text"/>
Construction Engineering			<input type="text"/>

In the options below please enter your best estimate of the range of variability of percentage of project cost for the categories listed. Click in the circle that best fits your estimate.

<u>PART 2</u>	
Right of Way	<input type="checkbox"/> 0 - 10% <input type="checkbox"/> 11 - 20% <input type="checkbox"/> 21 - 30% <input type="checkbox"/> > - 30% Comments: <input type="text"/>
Environmental Compliance (NEPA) - <i>Pre-construction</i>	<input type="checkbox"/> 0 - 10% <input type="checkbox"/> 11 - 20% <input type="checkbox"/> 21 - 30% <input type="checkbox"/> > - 30% Comments: <input type="text"/>
Environmental Mitigation/Permitting - <i>Construction</i>	<input type="checkbox"/> 0 - 10% <input type="checkbox"/> 11 - 20% <input type="checkbox"/> 21 - 30% <input type="checkbox"/> > - 30% Comments: <input type="text"/>
Does your state have a State Prevailing Wage Law?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Thank you for completing the survey!