CHAPTER FIVE APPENDICES

Appendix 1:Per Unit Construction Cost Assumptions

Construction Unit Cost Estimate by Mode

	Unit Cost ($ million)	Units
Commercial Vehicle Roadway Construction Unit Costs		
On-grade Construction		
Urban, Level Terrain	6.0	lane-mile
Urban, Rolling Terrain	6.0	lane-mile
Urban, Mountainous Terrain	19.0	lane-mile
Rural, Level Terrain	2.5	lane-mile
Rural, Rolling Terrain	4.0	lane-mile
Rural, Mountainous Terrain	9.0	lane-mile
Structures		
Bridges		
Minor Crossings and Causeways	20.0	lane-mile
Major Crossings	30.0	lane-mile
Tunnels		
Bored Tunnel (Two-Lane Highway or Single RR Track)	80.0	lane-mile
Interchanges		
Diamond Interchange	10.0	each
Maintenance Facility (every 30 miles)	3.0	each
Toll Collection Equipment (per interchange)	0.5	each
Closed Circuit Television Cameras (every mile)	0.05	each
Active Traffic Monitoring Station (3 per interchange)	0.05	each
Double-Track Railroad Construction Unit Costs		
On-Grade Construction	4.4	mile
Structures		
Bridges		
Minor Crossings and Causeways	15.0	mile
Major Crossings	25.0	mile
Tunnels		
Bored Tunnel (Two Tunnel Bores, 1 Track in Each)	160.0	mile

General Purpose Roadway Construction Unit Costs		
On-grade Construction		
Urban, Level Terrain	6.0	lane-mile
Urban, Rolling Terrain	6.0	lane-mile
Urban, Mountainous Terrain	19.0	lane-mile
Rural, Level Terrain	2.5	lane-mile
Rural, Rolling Terrain	4.0	lane-mile
Rural, Mountainous Terrain	9.0	lane-mile
Structures		
Bridges		
Minor Crossings and Causeways	20.0	lane-mile
Major Crossings	30.0	lane-mile
Tunnels		
Bored Tunnel (Two-Lane Highway or Single RR Track)	80.0	lane-mile
Interchanges		
Diamond Interchange	10.0	each
Traffic Systems Management Center (For Truck and GP Facilities)	7.0	each
Toll Collection Equipment (per interchange)	0.5	each
Closed Circuit Television Cameras (every mile)	0.05	each
Active Traffic Monitoring Station (3 per interchange)	0.05	each

Trail Construction Unit Costs		
12 Foot Shared-Use Path, All Conditions	0.3	mile
10 Foot Soft-Surface Equestrian Trail, All Conditions	0.1	mile

Power Line Construction Unit Costs		
Two 500kV Lines, All Conditions	1.5	mile

Pipeline Construction Unit Costs		
16 Inch Diameter Steel, All Conditions	1.0	mile

Appendix 2: Alternative 1 ROW Cost Estimates

Assumptions

Urban Land Value ($M /acre):	4
Rural Land Value ($M / acre):	0.075
Square feet per acre (ft^2):	43,560
Feet per mile (ft):	5,280
Increase in roadway ROW in rolling terrain (ft):	200
Increase in roadway ROW in mountainous terrain (ft):	400

Segment	Segment Length (miles)			ROW Base (ft)			Land Use and Terrain Type by Segment (%)						ROW, Adj. for Terrain Type (ft)				Urban ROW (acres)	Rural ROW (acres)	ROW Total ($M)
							Urban Area			Rural Area									
	Total Length	Highway Length	Railroad Length	Pipes	Rail	Power	Level	Rolling	Mount.	Level	Rolling	Mount.	Truck, GP, Pipes	Rail	Power, Trail	Total			
W04	12.5	10.9	10.9	380	65	150	15%	0%	0%	55%	30%	0%	440	65	150	655	134.4	761.7	595
M15	5.4	5.0	5.0	380	65	150	20%	0%	0%	80%	0%	0%	380	65	150	595	73.8	295.1	317
M14	27.7	21.2	20.9	380	65	150	5%	0%	0%	95%	0%	0%	380	65	150	595	82.3	1563.1	446
M12	42.0	40.9	40.9	380	65	150	5%	5%	0%	65%	20%	5%	450	65	150	665	331.9	2986.8	1,551
M10	7.0	6.4	6.4	380	65	150	0%	30%	0%	15%	55%	0%	550	65	150	765	181.6	423.8	758
M09	7.6	3.5	1.5	380	65	150	0%	0%	0%	0%	50%	50%	680	65	150	895	0.0	433.9	33
M08	10.9	10.5	10.5	380	65	150	0%	0%	0%	0%	30%	70%	720	65	150	935	0.0	1194.8	90
M07	21.3	20.2	20.2	380	65	150	25%	0%	0%	10%	50%	15%	540	65	150	755	466.3	1398.8	1,970
M06	14.8	14.3	14.3	380	65	150	0%	0%	0%	90%	10%	0%	400	65	150	615	0.0	1076.1	81
M05	38.2	36.9	36.9	380	65	150	10%	25%	0%	25%	40%	0%	510	65	150	725	1143.8	2124.3	4,735
M04	1.6	1.5	1.5	380	65	150	0%	0%	0%	100%	0%	0%	380	65	150	595	0.0	109.4	8
M03	7.8	7.3	7.3	380	65	150	0%	0%	0%	100%	0%	0%	380	65	150	595	0.0	538.4	40
M02	38.5	21.5	21.5	380	65	150	35%	5%	0%	50%	10%	0%	410	65	150	625	774.3	1161.5	3,184
M01	21.1	15.3	15.3	380	65	150	25%	10%	0%	40%	25%	0%	450	65	150	665	469.0	871.1	1,942
E07	24.6	23.7	23.7	380	65	150	5%	10%	0%	25%	40%	20%	560	65	150	775	336.4	1906.5	1,489
Total	280.9	239.2	236.9																17,239

Appendix 3: Alternative 2 ROW Cost Estimates

Assumptions

Urban Land Value ($M /acre):	4
Rural Land Value ($M / acre):	0.075
Square feet per acre (ft^2):	43,560
Feet per mile (ft):	5,280
Increase in roadway ROW in rolling terrain (ft):	200
Increase in roadway ROW in mountainous terrain (ft):	400

Segment	Segment Length (miles)			ROW Base (ft)			Land Use and Terrain Type by Segment (%)						ROW, Adj. for Terrain			Urban ROW (acres)	Rural ROW (acres)	ROW Total ($M)
							Urban Area			Rural Area								
	Total Length	Highway Length	RR Length	Truck, Gp and Pipe	Rail	Power & Trail	Level	Rolling	Mount.	Level	Rolling	Mount.	Truck, GP, Pipes	Rail	Power, Trail			
W04	12.5	10.9	10.9	380	65	150	15%	0%	0%	55%	30%	0%	440	65	150	134.4	761.7	595
M15	5.4	5.0	5.0	380	65	150	20%	0%	0%	80%	0%	0%	380	65	150	73.8	295.1	317
M14	27.7	21.2	20.9	380	65	150	5%	0%	0%	95%	0%	0%	380	65	150	82.3	1563.1	446
M12	42.0	40.9	40.9	380	65	150	5%	5%	0%	65%	20%	5%	450	65	150	331.9	2986.8	1,551
M10	7.0	6.4	6.4	380		150	0%	30%	0%	15%	55%	0%	550	0	150	166.4	388.3	695
M09	7.6	3.5	1.5	380		150	0%	0%	0%	0%	50%	50%	680	0	150	0.0	422.4	32
M08	10.9	10.5	10.5	380	65	150	0%	0%	0%	0%	30%	70%	720	65	150	0.0	1194.8	90
M07	21.3	20.2	20.2	380	65	150	25%	0%	0%	10%	50%	15%	540	65	150	466.3	1398.8	1,970
M06	14.8	14.3	14.3	380	65	150	0%	0%	0%	90%	10%	0%	400	65	150	0.0	1076.1	81
M05	38.2	36.9	36.9	380	65	150	10%	25%	0%	25%	40%	0%	510	65	150	1143.8	2124.3	4,735
M04	1.6	1.5	1.5	380	65	150	0%	0%	0%	100%	0%	0%	380	65	150	0.0	109.4	8
M03	7.8	7.3	7.3	380	65	150	0%	0%	0%	100%	0%	0%	380	65	150	0.0	538.4	40
M02	38.5	21.5	21.5	380	65	150	35%	5%	0%	50%	10%	0%	410	65	150	774.3	1161.5	3,184
M01	21.1	15.3	15.3	380	65	150	25%	10%	0%	40%	25%	0%	450	65	150	469.0	871.1	1,942
E07	24.6	23.7	23.7	380	65	150	5%	10%	0%	25%	40%	20%	560	65	150	336.4	1906.5	1,489
E06	22.0	18.7	18.7		65		0%	20%	10%	0%	25%	45%		65		44.2	103.1	184
Total	280.9	239.2	247.7															17,359

Segments not used in calculation

Appendix 4: Alternative 3 ROW Cost Estimates

Assumptions

Urban Land Value ($M /acre):	4
Rural Land Value ($M / acre):	0.075
Square feet per acre (ft^2):	43,560
Feet per mile (ft):	5,280
Increase in roadway ROW in rolling terrain (ft):	200
Increase in roadway ROW in mountainous terrain (ft):	400

Segment	Segment Length (miles)			ROW Base (ft)			Land Use and Terrain Type by Segment (%)						ROW, Adj. for Terrain			Urban ROW (acres)	Rural ROW (acres)	ROW Total ($M)
							Urban Area			Rural Area								
	Total Length	Highway Length	RR Length	Truck, GP Pipes	Rail	Power, Trail	Level	Rolling	Mount.	Level	Rolling	Mount.	Truck, GP, Pipes	Rail	Power, Trail			
W04	12.5	10.9	10.9	380	65	150	15%	0%	0%	55%	30%	0%	440	65	150	134.4	761.7	595
M15	5.4	5.0	5.0	380	65	150	20%	0%	0%	80%	0%	0%	380	65	150	73.8	295.1	317
M14	27.7	21.2	20.9	380	65	150	5%	0%	0%	95%	0%	0%	380	65	150	82.3	1563.1	446
M12	42.0	40.9	40.9	380	65	150	5%	5%	0%	65%	20%	5%	450	65	150	331.9	2986.8	1,551
M10	7.0	6.4	6.4	380	65	150	0%	30%	0%	15%	55%	0%	550	65	150	181.6	423.8	758
M09	7.6	3.5	1.5	380	65	150	0%	0%	0%	0%	50%	50%	680	65	150	0.0	433.9	33
M08	10.9	10.5	10.5	380	65	150	0%	0%	0%	0%	30%	70%	720	65	150	0.0	1194.8	90
M07	21.3	20.2	20.2	380	65	150	25%	0%	0%	10%	50%	15%	540	65	150	466.3	1398.8	1,970
M02	38.5	21.5	21.5	380	65	150	35%	5%	0%	50%	10%	0%	410	65	150	774.3	1161.5	3,184
M01	21.1	15.3	15.3	380	65	150	25%	10%	0%	40%	25%	0%	450	65	150	469.0	871.1	1,942
E07	24.6	23.7	23.7	380	65	150	5%	10%	0%	25%	40%	20%	560	65	150	336.4	1906.5	1,489
E05	50.0	32.7	32.7	380	65	150	0%	5%	5%	0%	45%	45%	680	65	150	386.1	3474.5	1,805
E02	12.5	12.3	12.3	380	65	150	10%	0%	0%	90%	0%	0%	380	65	150	88.8	799.4	415
Total	281.1	224.0	221.7															14,595

= Segment or mode not included in Alternative.

Appendix 5: Alternative 1 On Grade Vs. Structure Cost Comparison

Segment Identifier	Segment Construction Cost by Mode ($M)												All Modes ($M)		
	Truck			Railroad			General Purpose			Trails	Power	Pipeline			
	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	On Grade	On Grade	On Grade	Total	On Grade	Struc-ture
M01	721	251	469	164	67	96	721	251	469	6	32	21	1,663	629	1,034
M02	1,774	348	1,426	373	94	279	1,774	348	1,426	8	58	39	4,025	894	3,131
M03	119	73	45	41	32	9	119	73	45	3	12	8	302	202	100
M04	22	15	7	8	7	1	22	15	7	1	2	2	56	41	15
M05	772	639	133	197	162	34	772	639	133	14	57	38	1,850	1,550	300
M06	203	152	51	81	63	18	203	152	51	5	22	15	529	409	120
M07	535	411	124	121	89	33	535	411	124	8	32	21	1,252	972	280
M08	359	314	45	55	46	9	359	314	45	4	16	11	805	705	100
M09	730	90	640	941	6	934	730	90	640	1	11	8	2,420	206	2,214
M10	181	112	69	50	28	22	181	112	69	2	10	7	433	273	160
E07	568	467	101	132	104	28	568	467	101	9	37	25	1,338	1,108	230
M12	680	569	111	202	180	22	680	569	111	16	63	42	1,683	1,438	245
W04	296	152	145	84	48	36	296	152	145	4	19	13	712	387	325
M14	1,050	227	823	758	92	666	1,050	227	823	8	42	28	2,936	623	2,313
M15	92	64	27	27	22	5	92	64	27	2	8	5	226	166	60
Subtotal ($M)	8,101	3,885	4,216	3,236	1,042	2,193	8,101	3,885	4,216	91	421	281	20,230	9,604	10,626
Share of Cost		48%	52%		32%	68%		48%	52%					47%	53%

Appendix 6: Alternative 2 On Grade Vs. Structure Cost Comparison

Segment Identifier	Segment Construction Cost by Mode ($M)												All Modes ($M)		
	Truck			Railroad			General Purpose			Trails	Power	Pipeline			
	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	On Grade	On Grade	On Grade	Total	On Grade	Struc-ture
M01	721	251	469	164	67	96	721	251	469	6	32	21	1,663	629	1,034
M02	1,774	348	1,426	373	94	279	1,774	348	1,426	8	58	39	4,025	894	3,131
M03	119	73	45	41	32	9	119	73	45	3	12	8	302	202	100
M04	22	15	7	8	7	1	22	15	7	1	2	2	56	41	15
M05	772	639	133	197	162	34	772	639	133	14	57	38	1,850	1,550	300
M06	203	152	51	81	63	18	203	152	51	5	22	15	529	409	120
M07	535	411	124	121	89	33	535	411	124	8	32	21	1,252	972	280
M08	359	314	45	55	46	9	359	314	45	4	16	11	805	705	100
M09	730	90	640				730	90	640	1	11	8	1,480	200	1,280
M10	181	112	69				181	112	69	2	10	7	383	245	138
E06				139	82	57							139	82	57
E07	568	467	101	132	104	28	568	467	101	9	37	25	1,338	1,108	230
M12	680	569	111	202	180	22	680	569	111	16	63	42	1,683	1,438	245
W04	296	152	145	84	48	36	296	152	145	4	19	13	712	387	325
M14	1,050	227	823	758	92	666	1,050	227	823	8	42	28	2,936	623	2,313
M15	92	64	27	27	22	5	92	64	27	2	8	5	226	166	60
Subtotal ($M)	8,101	3,885	4,216	2,383	1,090	1,294	8,101	3,885	4,216	91	421	281	19,378	9,652	9,726
Share of Cost		48%	52%		46%	54%		48%	52%					50%	50%

Appendix 7: Alternative 3 On Grade Vs. Structure Cost Comparison

Segment Identifier	Segment Construction Cost by Mode ($M)												All Modes ($M)		
	Truck			Railroad			General Purpose			Trails	Power	Pipeline			
	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	Total	On Grade	Struc-ture	On Grade	On Grade	On Grade	Total	On Grade	Struc-ture
M01	721	251	469	164	67	96	721	251	469	6	32	21	1,663	629	1,034
M02	1,774	348	1,426	373	94	279	1,774	348	1,426	8	58	39	4,025	894	3,131
E02	177	140	37	70	54	16	177	140	37	5	19	13	459	369	90
E05	3,609	928	2,680	2,727	144	2,584	3,609	928	2,680	12	75	50	10,082	2,138	7,944
M07	535	411	124	121	89	33	535	411	124	8	32	21	1,252	972	280
M08	359	314	45	55	46	9	359	314	45	4	16	11	805	705	100
M09	730	90	640	941	6	934	730	90	640	1	11	8	2,420	206	2,214
M10	181	112	69	50	28	22	181	112	69	2	10	7	433	273	160
E07	568	467	101	132	104	28	568	467	101	9	37	25	1,338	1,108	230
M12	680	569	111	202	180	22	680	569	111	16	63	42	1,683	1,438	245
W04	296	152	145	84	48	36	296	152	145	4	19	13	712	387	325
M14	1,050	227	823	758	92	666	1,050	227	823	8	42	28	2,936	623	2,313
M15	92	64	27	27	22	5	92	64	27	2	8	5	226	166	60
Subtotal ($M)	10,771	4,073	6,698	5,705	976	4,730	10,771	4,073	6,698	85	422	281	28,035	9,910	18,126
Share of Cost		38%	62%		17%	83%		38%	62%					35%	65%

Appendix 8: Truck Facility Cost Estimate by Section

Truck Facility Cost Estimate by Segment

Route Segment	Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%) Urban Area			Rural Area			On-Grade Construction Cost ($M)	Structure Costs ($M)				Total Cost ($M)
				Level	Rolling	Mount.	Level	Rolling	Mount.		Major Bridges	Minor Bridges	Highway Tunnels	Interchanges	
W05	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	90.5	0.0	34.1	0.0	0.0	124.6
W04	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	151.8	22.7	111.8	0.0	10.0	296.4
W03	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	300.8	0.0	11.4	0.0	0.0	312.1
W02	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	136.5	22.7	52.3	0.0	0.0	211.5
W01	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	434.1	45.5	79.5	0.0	0.0	559.1
M15	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	64.4	0.0	27.3	0.0	0.0	91.6
M14	27.7	6.5	21.2	5%	0%	0%	95%	0%	0%	227.0	45.5	207.7	560.0	10.0	1,050.2
M13	13.0	2.5	10.5	0%	0%	0%	60%	40%	0%	130.2	22.7	107.3	160.0	10.0	430.2
M12	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	568.8	68.2	43.2	0.0	0.0	680.2
M11	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	393.9	45.5	292.3	0.0	0.0	731.6
M10	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	112.4	45.5	13.6	0.0	10.0	181.5
M09	7.6	4.1	3.5	0%	0%	0%	0%	50%	50%	89.9	22.7	9.1	608.0	0.0	729.7
M08	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	314.0	22.7	22.7	0.0	0.0	359.5
M07	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	411.1	68.2	45.5	0.0	10.0	534.8
M06	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	151.9	22.7	18.2	0.0	10.0	202.8
M05	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	638.9	68.2	54.5	0.0	10.0	771.6
M04	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	14.9	0.0	6.8	0.0	0.0	21.8
M03	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	73.5	22.7	22.7	0.0	0.0	118.9
M02	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	347.7	159.1	1,256.8	0.0	10.0	1,773.6
M01	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	251.4	0.0	459.1	0.0	10.0	720.5
E07	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	466.8	45.5	45.5	0.0	10.0	567.7
E06	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	609.3	90.9	200.9	0.0	0.0	901.1
E05	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	928.2	45.5	75.0	2,560.0	0.0	3,608.7
E04	29.2	6.6	22.5	0%	0%	0%	45%	15%	40%	480.3	113.6	36.4	832.0	0.0	1,462.3
E03	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	92.2	0.0	20.5	0.0	10.0	122.7
E02	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	139.7	22.7	4.5	0.0	10.0	177.0
E01	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	591.7	45.5	22.7	0.0	0.0	659.9

Appendix 9: Railroad Facility Cost Estimate by Section

Railroad Facility Cost Estimate by Segment

Route Segment	Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%) Urban Area			Rural Area			On-Grade Construction Cost ($M)	Structure Costs ($M)				Total Cost ($M)
				Level	Rolling	Mount.	Level	Rolling	Mount.		Major Bridges	Minor Bridges	RR Tunnels	Interchanges	
W05	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	39.8	0.0	6.4	0.0	0.0	46.2
W04	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	48.1	4.7	21.0	0.0	10.0	83.8
W03	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	56.8	0.0	2.1	0.0	0.0	58.9
W02	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	31.3	4.7	9.8	0.0	0.0	45.8
W01	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	111.0	9.5	14.9	0.0	0.0	135.4
M15	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	22.1	0.0	5.1	0.0	0.0	27.2
M14	27.7	6.8	20.9	5%	0%	0%	95%	0%	0%	92.0	9.5	38.9	608.0	10.0	758.4
M13	13.0	9.5	3.5	0%	0%	0%	60%	40%	0%	15.4	4.7	20.1	1,280.0	10.0	1,330.2
M12	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	180.1	14.2	8.1	0.0	0.0	202.4
M11	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	83.3	9.5	54.8	0.0	0.0	147.6
M10	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	28.3	9.5	2.6	0.0	10.0	50.3
M09	7.6	6.1	1.5	0%	0%	0%	0%	50%	50%	6.4	4.7	1.7	928.0	0.0	940.9
M08	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	46.1	4.7	4.3	0.0	0.0	55.0
M07	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	88.7	14.2	8.5	0.0	10.0	121.4
M06	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	63.1	4.7	3.4	0.0	10.0	81.2
M05	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	162.5	14.2	10.2	0.0	10.0	196.9
M04	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	6.6	0.0	1.3	0.0	0.0	7.9
M03	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	32.3	4.7	4.3	0.0	0.0	41.3
M02	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	94.4	33.1	235.7	0.0	10.0	373.2
M01	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	67.5	0.0	86.1	0.0	10.0	163.5
E07	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	104.2	9.5	8.5	0.0	10.0	132.2
E06	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	82.2	18.9	37.7	0.0	0.0	138.9
E05	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	143.8	9.5	14.1	2,560.0	0.0	2,727.3
E04	29.2	7.1	22.0	0%	0%	0%	45%	15%	40%	97.0	23.7	6.8	912.0	0.0	1,039.5
E03	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	40.6	0.0	3.8	0.0	10.0	54.4
E02	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	53.9	4.7	0.9	0.0	10.0	69.5
E01	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	149.6	9.5	4.3	0.0	0.0	163.4

Appendix 10: General Purpose Facility Cost Estimate by Section

General Purpose Cost Estimate by Segment

Route Segment	Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%) Urban Area			Rural Area			On-Grade Construction Cost ($M)	Structure Costs ($M)				Total Cost ($M)
				Level	Rolling	Mount.	Level	Rolling	Mount.		Major Bridges	Minor Bridges	Highway Tunnels	Interchanges	
W05	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	90.5	0.0	34.1	0.0	0.0	124.6
W04	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	151.8	22.7	111.8	0.0	10.0	296.4
W03	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	300.8	0.0	11.4	0.0	0.0	312.1
W02	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	136.5	22.7	52.3	0.0	0.0	211.5
W01	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	434.1	45.5	79.5	0.0	0.0	559.1
M15	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	64.4	0.0	27.3	0.0	0.0	91.6
M14	27.7	6.5	21.2	5%	0%	0%	95%	0%	0%	227.0	45.5	207.7	560.0	10.0	1,050.2
M13	13.0	2.5	10.5	0%	0%	0%	60%	40%	0%	130.2	22.7	107.3	160.0	10.0	430.2
M12	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	568.8	68.2	43.2	0.0	0.0	680.2
M11	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	393.9	45.5	292.3	0.0	0.0	731.6
M10	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	112.4	45.5	13.6	0.0	10.0	181.5
M09	7.6	4.1	3.5	0%	0%	0%	0%	50%	50%	89.9	22.7	9.1	608.0	0.0	729.7
M08	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	314.0	22.7	22.7	0.0	0.0	359.5
M07	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	411.1	68.2	45.5	0.0	10.0	534.8
M06	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	151.9	22.7	18.2	0.0	10.0	202.8
M05	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	638.9	68.2	54.5	0.0	10.0	771.6
M04	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	14.9	0.0	6.8	0.0	0.0	21.8
M03	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	73.5	22.7	22.7	0.0	0.0	118.9
M02	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	347.7	159.1	1,256.8	0.0	10.0	1,773.6
M01	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	251.4	0.0	459.1	0.0	10.0	720.5
E07	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	466.8	45.5	45.5	0.0	10.0	567.7
E06	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	609.3	90.9	200.9	0.0	0.0	901.1
E05	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	928.2	45.5	75.0	2,560.0	0.0	3,608.7
E04	29.2	6.6	22.5	0%	0%	0%	45%	15%	40%	480.3	113.6	36.4	832.0	0.0	1,462.3
E03	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	92.2	0.0	20.5	0.0	10.0	122.7
E02	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	139.7	22.7	4.5	0.0	10.0	177.0
E01	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	591.7	45.5	22.7	0.0	0.0	659.9

Appendix 11: Power Facility Cost Estimate by Section

Power Facility Cost Estimate by Segment

Route Segment	Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%) Urban Area			Rural Area			On-Grade Construction Cost ($M)	Total Construction Cost ($M)
				Level	Rolling	Mount.	Level	Rolling	Mount.		
W05	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	14.2	14.2
W04	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	18.8	18.8
W03	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	19.6	19.6
W02	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	11.9	11.9
W01	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	39.9	39.9
M15	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	8.1	8.1
M14	27.7	6.5	21.2	5%	0%	0%	95%	0%	0%	41.5	41.5
M13	13.0	2.5	10.5	0%	0%	0%	60%	40%	0%	19.5	19.5
M12	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	63.0	63.0
M11	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	34.5	34.5
M10	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	10.5	10.5
M09	7.6	4.1	3.5	0%	0%	0%	0%	50%	50%	11.3	11.3
M08	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	16.4	16.4
M07	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	31.9	31.9
M06	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	22.1	22.1
M05	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	57.3	57.3
M04	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	2.4	2.4
M03	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	11.7	11.7
M02	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	57.8	57.8
M01	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	31.6	31.6
E07	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	37.0	37.0
E06	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	32.9	32.9
E05	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	75.0	75.0
E04	29.2	6.6	22.5	0%	0%	0%	45%	15%	40%	43.7	43.7
E03	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	14.2	14.2
E02	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	18.8	18.8
E01	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	52.0	52.0

Appendix 12: Trail Facility Cost Estimate by Section

Trail Facility Cost Estimate by Segment

Route Segment	Milepost		Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%)						On-Grade Construction Cost ($M)	Total Construction Cost ($M)
						Urban Area			Rural Area				
	Start	End				Level	Rolling	Mount.	Level	Rolling	Mount.		
W05	274.4	283.9	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	3.4	3.4
W04	233.7	246.2	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	4.2	4.2
W03	151.1	164.2	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	4.9	4.9
W02	143.2	151.1	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	2.7	2.7
W01	121.9	148.5	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	9.6	9.6
M15	274.4	279.8	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	1.9	1.9
M14	246.7	274.4	27.7	6.5	21.2	5%	0%	0%	95%	0%	0%	8.1	8.1
M13	233.7	246.7	13.0	2.5	10.5	0%	0%	0%	60%	40%	0%	4.0	4.0
M12	191.6	233.7	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	15.6	15.6
M11	168.7	191.6	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	7.2	7.2
M10	161.7	168.7	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	2.4	2.4
M09	154.1	161.7	7.6	4.1	3.5	0%	0%	0%	0%	50%	50%	1.3	1.3
M08	143.2	154.1	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	4.0	4.0
M07	121.9	143.2	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	7.7	7.7
M06	107.2	121.9	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	5.4	5.4
M05	069.0	107.2	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	14.0	14.0
M04	067.4	069.0	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	0.6	0.6
M03	059.6	067.4	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	2.8	2.8
M02	021.1	059.6	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	8.2	8.2
M01	000.0	021.1	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	5.8	5.8
E07	168.7	193.3	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	9.0	9.0
E06	154.1	176.1	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	7.1	7.1
E05	072.1	122.1	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	12.4	12.4
E04	069.0	098.1	29.2	6.6	22.5	0%	0%	0%	45%	15%	40%	8.6	8.6
E03	067.4	076.9	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	3.5	3.5
E02	059.6	072.1	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	4.7	4.7
E01	000.0	034.7	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	12.9	12.9

Appendix 13: Pipeline Facility Cost Estimate by Section

Pipeline Facility Cost Estimate by Segment

Route Segment	Milepost		Segment Length (miles)	Structure (miles)	On-Grade Construction (miles)	Terrain and Land Use Type by Segment (%)						On-Grade Construction Cost ($M)	Total Construction Cost ($M)
						Urban Area			Rural Area				
	Start	End				Level	Rolling	Mount.	Level	Rolling	Mount.		
W05	274.4	283.9	9.5	0.4	9.1	0%	0%	0%	100%	0%	0%	9.5	9.5
W04	233.7	246.2	12.5	1.6	10.9	15%	0%	0%	55%	30%	0%	12.5	12.5
W03	151.1	164.2	13.1	0.1	12.9	30%	5%	0%	25%	10%	30%	13.1	13.1
W02	143.2	151.1	7.9	0.8	7.1	0%	40%	0%	0%	60%	0%	7.9	7.9
W01	121.9	148.5	26.6	1.4	25.2	10%	20%	0%	20%	50%	0%	26.6	26.6
M15	274.4	279.8	5.4	0.3	5.0	20%	0%	0%	80%	0%	0%	5.4	5.4
M14	246.7	274.4	27.7	6.5	21.2	5%	0%	0%	95%	0%	0%	27.7	27.7
M13	233.7	246.7	13.0	2.5	10.5	0%	0%	0%	60%	40%	0%	13.0	13.0
M12	191.6	233.7	42.0	1.1	40.9	5%	5%	0%	65%	20%	5%	42.0	42.0
M11	168.7	191.6	23.0	4.0	18.9	10%	10%	0%	30%	25%	25%	23.0	23.0
M10	161.7	168.7	7.0	0.5	6.4	0%	30%	0%	15%	55%	0%	7.0	7.0
M09	154.1	161.7	7.6	4.1	3.5	0%	0%	0%	0%	50%	50%	7.6	7.6
M08	143.2	154.1	10.9	0.5	10.5	0%	0%	0%	0%	30%	70%	10.9	10.9
M07	121.9	143.2	21.3	1.1	20.2	25%	0%	0%	10%	50%	15%	21.3	21.3
M06	107.2	121.9	14.8	0.4	14.3	0%	0%	0%	90%	10%	0%	14.8	14.8
M05	069.0	107.2	38.2	1.3	36.9	10%	25%	0%	25%	40%	0%	38.2	38.2
M04	067.4	069.0	1.6	0.1	1.5	0%	0%	0%	100%	0%	0%	1.6	1.6
M03	059.6	067.4	7.8	0.5	7.3	0%	0%	0%	100%	0%	0%	7.8	7.8
M02	021.1	059.6	38.5	17.0	21.5	35%	5%	0%	50%	10%	0%	38.5	38.5
M01	000.0	021.1	21.1	5.7	15.3	25%	10%	0%	40%	25%	0%	21.1	21.1
E07	168.7	193.3	24.6	0.9	23.7	5%	10%	0%	25%	40%	20%	24.6	24.6
E06	154.1	176.1	22.0	3.3	18.7	0%	20%	10%	0%	25%	45%	22.0	22.0
E05	072.1	122.1	50.0	17.3	32.7	0%	5%	5%	0%	45%	45%	50.0	50.0
E04	069.0	098.1	29.2	6.6	22.5	0%	0%	0%	45%	15%	40%	29.2	29.2
E03	067.4	076.9	9.5	0.3	9.2	0%	0%	0%	100%	0%	0%	9.5	9.5
E02	059.6	072.1	12.5	0.2	12.3	10%	0%	0%	90%	0%	0%	12.5	12.5
E01	000.0	034.7	34.7	0.7	34.0	10%	5%	0%	30%	45%	10%	34.7	34.7

Appendix 14: Segment Length Measures

Segment	Total Length (miles)	Length Measures by Segment: Length by Terrain Type			Tunnels by Mode		Bridges by Mode	
		Level (miles)	Rolling (miles)	Mountainous (miles)	Highway (miles)	Railroad (miles)	Highway (miles)	Railroad (miles)
W05	9.5	9.5	0.0	0.0	0.0	0.0	0.4	0.4
W04	12.5	8.8	3.8	0.0	0.0	0.0	1.6	1.6
W03	13.1	7.2	2.0	3.9	0.0	0.0	0.1	0.1
W02	7.9	0.0	7.9	0.0	0.0	0.0	0.8	0.8
W01	26.6	8.0	18.6	0.0	0.0	0.0	1.4	1.4
M15	5.4	5.4	0.0	0.0	0.0	0.0	0.3	0.3
M14	27.7	27.7	0.0	0.0	3.5	3.8	3.0	3.0
M13	13.0	7.8	5.2	0.0	1.0	8.0	1.5	1.5
M12	42.0	29.4	10.5	2.1	0.0	0.0	1.1	1.1
M11	23.0	9.2	8.0	5.7	0.0	0.0	4.0	4.0
M10	7.0	1.0	5.9	0.0	0.0	0.0	0.5	0.5
M09	7.6	0.0	3.8	3.8	3.8	5.8	0.3	0.3
M08	10.9	0.0	3.3	7.7	0.0	0.0	0.5	0.5
M07	21.3	7.5	10.6	3.2	0.0	0.0	1.1	1.1
M06	14.8	13.3	1.5	0.0	0.0	0.0	0.4	0.4
M05	38.2	13.4	24.8	0.0	0.0	0.0	1.3	1.3
M04	1.6	1.6	0.0	0.0	0.0	0.0	0.1	0.1
M03	7.8	7.8	0.0	0.0	0.0	0.0	0.5	0.5
M02	38.5	32.7	5.8	0.0	0.0	0.0	17.0	17.0
M01	21.1	13.7	7.4	0.0	0.0	0.0	5.7	5.7
E07	24.6	7.4	12.3	4.9	0.0	0.0	0.9	0.9
E06	22.0	0.0	9.9	12.1	0.0	0.0	3.3	3.3
E05	50.0	0.0	25.0	25.0	16.0	16.0	1.3	1.3
E04	29.2	13.1	4.4	11.7	5.2	5.7	1.4	1.4
E03	9.5	9.5	0.0	0.0	0.0	0.0	0.3	0.3
E02	12.5	12.5	0.0	0.0	0.0	0.0	0.2	0.2
E01	34.7	13.9	17.3	3.5	0.0	0.0	0.7	0.7

Appendix 15: E-W Connector Cost Estimates

Connector Cost Estimates

County	Improvements to connectors (in Millions)		
	Mode	**Description**	**Cost**
Whatcom	Highway	New 2-lane arterial	$109.3
	Rail	Single Track	$29.0
	Pipeline		$39.1
	Total Cost		**$138.2**
Skagit	Highway	Improve SR 20	$152.8
	Pipeline		$24.8
	Total Cost		**$177.6**
Snohomish	Highway	Improve SR 2	$406.0
	Pipeline		$24.8
	Total Cost		**$430.7**
King	Highway	Improve I-90	$198.3
	Total Cost		**$198.3**
Pierce	Highway	Improve SR 410	$31.7
	Pipeline		$34.5
	Rail		$45.8
	Total Cost		**$111.9**
Thurston	Highway	New 2-lane arterial	$68.8
	Pipeline		$12.4
	Total Cost		$81.3
All Counties	**Total Cost**		**$1,138.1**