Appendix C:
Structures Seismic Vulnerability Analyses and Associated Level of Effort

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I-5 PEL Seismic - Seismic Report

Appendix C - Structures Suggested Seismic Analyses and Associated Level of Effort

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Vulnerability Analysis Level of Effort
BRIDGES, TUNNELS & LIDS
Lower (●○○) – 225 to 1,150 hours
Medium (●●○) – 1,151 to 4,200 hours
Higher (●●●) – 4,201 to 19,000 hours

Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
0007618E	5/528	I-5 UNDER BOEING ACCESS RD	158.01	Recovery	5	RSA+Pushover	●●○
0007617A	5/530E	NORFOLK ST SEWER	158.45	Recovery	1	Seat Width Check + Fdn. Stability Check	●○○
0007617B	5/530W	NORFOLK ST SEWER	158.45	Recovery	1	Seat Width Check + Fdn. Stability Check	●○○
0007617C	5/531E	I-5 OVER MILITARY RD	159.67	Recovery	3	RSA+Pushover	●○○
0007617D	5/531W	I-5 OVER MILITARY RD	159.67	Recovery	3	RSA+Pushover	●○○
0007990A	5/532W	SB VIADUCT STA 1918	160.07	Recovery	4	RSA+Pushover	●●○
0008568A	5/532.1	N-SWIFT RAMP	160.63	Ordinary	8	RSA+Pushover	●●○
0007675A	5/532.5	I-5 UNDER ALBRO ST	161.21	Ordinary	4	RSA+Pushover	●○○
0007734E	5/533S-E	S-ALBRO RAMP BR	161.27	Recovery	3	RSA+Pushover	●○○
0007930B	5/534A	N-W RAMP OVER AIRPORT WAY	161.27	Ordinary	8	RSA+Pushover	●●○
0007930A	5/534N-W	N-W RAMP OVER RR	161.27	Ordinary	3	RSA+Pushover	●●○
0007930C	5/534S-W	S-W RAMP OVER LUCILE ST	161.28	Ordinary	7	RSA+Pushover	●●○
0007882A	5/533A	E-N RAMP OVER RR, AIRPORT WAY	161.31	Recovery	11	RSA+Pushover	●●○
0007734D	5/533E-N	E-N RAMP OVER I-5	161.31	Recovery	4	RSA+Pushover	●○○
0007734A	5/533.5W	I-5 SB OVER N-W RAMP	161.54	Recovery	6	RSA+Pushover	●○○
0007734B	5/534E	I-5 OVER LUCILE ST	161.65	Recovery	3	RSA+Pushover	●○○
0007734C	5/534W	I-5 OVER LUCILE ST	161.65	Recovery	3	RSA+Pushover	●○○
0007816A	5/535E	NB VIADUCT STA 2032	162.19	Recovery	9	RSA+Pushover	●●○
0007816B	5/535W	SB VIADUCT STA 2032	162.24	Recovery	6	RSA+Pushover	●●○
0007741A	5/536E	NB VIADUCT STA 2064	162.82	Recovery	18	RSA+Pushover	●●○
0007741B	5/536W	SB VIADUCT STA 2064	162.82	Recovery	18	RSA+Pushover	●●○
0007741G	5/536N-W	N-W RAMP OVER I-5 MAINLINE	162.86	Ordinary	17	RSA+Pushover	●●●

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Lower (●○○) – 225 to 1,150 hours
Medium (●●○) – 1,151 to 4,200 hours
Higher (●●●) – 4,201 to 19,000 hours

Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
0007741T	5/537S	EB LANES OVER I-5	162.97	Ordinary	20	RSA+Pushover	●●●
0007741F	5/536N-E	N-E RAMP BR	162.98	Ordinary	21	RSA+Pushover	●●○
0007741L	5/537E-E	6TH-N RAMP BR	162.98	Ordinary	8	RSA+Pushover	●●○
0007741J	5/537E-N	E-N RAMP OVER I-5	162.98	Ordinary	3	RSA+Pushover	●●○
0007741H	5/537N-W	N-6TH RAMP BRIDGE	162.98	Ordinary	8	RSA+Pushover	●●○
0007741K	5/538E-N	E-N RAMP BR	162.98	Ordinary	10	RSA+Pushover	●●○
0007741I	5/538W-N	W-N RAMP BR	162.98	Recovery	10	RSA+Pushover	●●○
0007741O	5/536E-S	6TH-S RAMP BR	162.99	Ordinary	4	RSA+Pushover	●●○
0007741N	5/537E-S	E-S RAMP BR	162.99	Ordinary	15	RSA+Pushover	●●○
0007741M	5/537W-S	W-S RAMP OVER MAINLINE & RAMPS	162.99	Ordinary	19	RSA+Pushover	●●●
0007741Q	5/538S-W	S-W RAMP BR	162.99	Ordinary	12	RSA+Pushover	●●○
0007741S	5/537W-W	W-6TH RAMP BR	163	Ordinary	10	RSA+Pushover	●●○
0007741R	5/537N	S-W RAMP WB VIADUCT	163.02	Ordinary	33	RSA+Pushover	●●●
0007741C	5/538E	NB VIADUCT STA 2075	163.04	Recovery	21	RSA+Pushover	●●○
0007741P	5/538S-E	S-E RAMP OVER I-5	163.05	Ordinary	25	RSA+Pushover	●●○
0007741D	5/539W	SB VIADUCT STA 2075	163.06	Recovery	157	RSA+Pushover	●●●
0007741E	5/539E	NB VIADUCT STA 2085	163.24	Recovery	138	RSA+Pushover	●●●
0007686A	5/539S-W	S-W RAMP FOREST ST	163.44	Ordinary	8	RSA+Pushover	●●○
0007686B	5/539.5	I-5 UNDER BEACON-HOLGATE	163.96	Ordinary	9	RSA+Pushover	●●○
0007686C	5/539NCD	NBCD RAMP BR	164.12	Ordinary	4	RSA+Pushover	●●○
0007686D	5/539SCD	SBCD VIADUCT STA 2133	164.12	Ordinary	17	RSA+Pushover	●●○
0007565K	5/540S-W	S-AIRPORT WAY BR	164.41	Ordinary	7	RSA+Pushover	●●○

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Higher (●●●) – 4,201 to 19,000 hours

Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
000000OC	90/10E-S	S-AIRPT RAMP UNDER E-S RAMP	164.41	Ordinary	5	NLTH	●●●
0007565A	5/540N-W	N-W RAMP OVER I-5	164.42	Ordinary	13	RSA+Pushover	●●○
0007565B	90/10W-S	I-5 UNDER W-S RAMP	164.48	Ordinary	16	RSA+Pushover	●●○
0007565C	90/10WB	I-90 EB/WB over I-5	164.49	Ordinary	7	NLTH	●●●
0007565D	90/10E-N	I-5 UNDER E-N RAMP	164.5	Ordinary	5	RSA+Pushover	●○○
0013502D	90/5ST	I-5 UNDER ST LEASED BRDG#4	164.52	Ordinary	10	RSA+Pushover	●●○
0007565E	5/542S-E	S-E RAMP OVER I-5	164.57	Ordinary	9	RSA+Pushover	●○○
0007565N	5/541S-W	S-W RAMP	164.6	Ordinary	6	RSA+Pushover	●○○
0007565L	90/10WCD	DEARBORN ST UNDER W-NBCD RAMP	164.6	Ordinary	10	RSA+Pushover	●●○
0007565F	5/542E	I-5 OVER DEARBORN ST	164.62	Recovery	3	RSA+Pushover	●○○
0007565M	5/542E-N	DEARBORN-N RAMP	164.62	Ordinary	8	RSA+Pushover	●○○
0007565I	5/542NCD	NBCD OVER DEARBORN ST	164.62	Ordinary	3	RSA+Pushover	●○○
0007565J	5/542SCD	SBCD OVER DEARBORN ST	164.62	Ordinary	3	RSA+Pushover	●○○
0007565G	5/542W	I-5 OVER DEARBORN ST	164.62	Recovery	3	RSA+Pushover	●○○
0007504A	5/543E	I-5 OVER KING-JACKSON ST	164.8	Recovery	9	RSA+Pushover	●●○
0007504C	5/543NCD	NBCD OVER KING-JACKSON ST	164.8	Ordinary	9	RSA+Pushover	●●○
0007504D	5/543SCD	SBCD OVER KING-JACKSON ST	164.8	Ordinary	9	RSA+Pushover	●○○
0007504B	5/543W	I-5 OVER KING-JACKSON ST	164.8	Recovery	9	RSA+Pushover	●○○
0007504E	5/544	I-5 UNDER YESLER WAY	165.1	Ordinary	5	RSA+Pushover	●○○
0007110K	5/545R	EXP LANES OVER JAMES & CHERRY	165.25	Ordinary	9	RSA+Pushover	●○○
0007110L	5/546REN	5TH-EXP TUNNEL	165.25	Ordinary	0	Tunnel	●●○
0007110B	5/545W	SB VIADUCT STA 2195	165.28	Recovery	11	RSA+Pushover	●○○

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Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
0007110A	5/545E	NB VIADUCT	165.32	Recovery	60	NLTH	●●●
0007110I	5/545N-E	NBCD-7TH RAMP BR	165.32	Ordinary	9	RSA+Pushover	●○○
0007110F	5/545NCD	NBCD VIADUCT STA 2195	165.32	Ordinary	10	RSA+Pushover	●○○
0007110H	5/545N-W	N-SENECA RAMP OVER I-5 SB	165.49	Recovery	12	RSA+Pushover	●●○
0007110C	5/546	I-5 UNDER MADISON ST	165.57	Ordinary	3	RSA+Pushover	●○○
0007110J	5/547E-S	SPRING ST RAMP OVER SBCD	165.61	Ordinary	3	RSA+Pushover	●○○
0007110G	5/545SCD	SBCD VIADUCT STA 2195	165.63	Ordinary	11	RSA+Pushover	●●○
0007110D	5/547	I-5 UNDER SPRING ST	165.63	Ordinary	3	RSA+Pushover	●○○
0009839A	5/548PS	I-5 UNDER S PARK PLAZA	165.68	Ordinary	3	NLTH	●●●
0007110E	5/548	I-5 UNDER SENECA ST	165.69	Ordinary	3	RSA+Pushover	●○○
0006635D	5/553R	EXP TUNNEL	165.7	Ordinary	0	Tunnel	●○○
0006635E	5/553REN	REV LANES UNDER UTILITY BRIDGE	165.7	Ordinary	1	Seat Width Check + Fdn. Stability Check	●○○
0009839B	5/548PW	S-COL RAMP UNDER W PARK PLAZA	165.72	Ordinary	1	NLTH	●●○
0009668A	5/548PN	I-5 UNDER N PARK PLAZA	165.73	Ordinary	4	NLTH	●●●
0007409B	5/549E-N	UNIV-N RAMP OVER I-5 SB	165.73	Recovery	6	RSA+Pushover	●○○
0007409E	5/549A	S-COL RAMP UNDER UNIV ST	165.74	Ordinary	0	Seat Width Check + Fdn. Stability Check	●○○
000000PJ	5/549CNC	WASH ST CONVENTION CENTER	165.75	Ordinary	2	NLTH	●●●
0007409A	5/549	I-5 UNDER 8TH AVE-TRADE CENTER	165.81	Ordinary	9	NLTH	●●●
0007409C	5/550	I-5 UNDER PIKE ST	165.97	Ordinary	2	RSA+Pushover	●○○
0007409D	5/551	I-5 UNDER PINE & BOREN	166.06	Ordinary	8	RSA+Pushover	●●○
0006635A	5/552	I-5 UNDER OLIVE WAY	166.2	Ordinary	3	RSA+Pushover	●○○
0006635C	5/553E-S	YALE ST RAMP OVER REV RAMP	166.32	Recovery	1	Seat Width Check + Fdn. Stability Check	●○○

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Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
0006635B	5/553	I-5 UNDER DENNY WAY	166.36	Ordinary	3	RSA+Pushover	●○○
0006800A	5/566W	DENNY WAY-LAKEVIEW V	166.36	Recovery	85	NLTH	●●●
0006800H	5/564RSW	EXP S-W RAMP BRIDGE	166.46	Ordinary	21	RSA+Pushover	●●○
0006085A	5/570RNE	EXP N-42ND RAMP	166.46	Ordinary	4	RSA+Pushover	●○○
0006653A	5/555S-W	S-STEWART RAMP BR	166.66	Ordinary	3	RSA+Pushover	●○○
0006800D	5/555N-W	N-W RAMP TUNNEL	166.7	Recovery	0	Tunnel	●○○
0006800E	5/555E-S	E-S RAMP TUNNEL	166.8	Recovery	0	Tunnel	●○○
0008195A	5/556N-W	N-W RAMP OVER E-N RAMP	166.82	Ordinary	1	Seat Width Check + Fdn. Stability Check	●○○
0006800G	5/564A	S-W RAMP UNDER EASTLAKE	166.82	Ordinary	2	RSA+Pushover	●○○
0006800B	5/562E	NB LANES VIADUCT	166.91	Recovery	10	RSA+Pushover	●●○
0006800C	5/564	I-5 UNDER LAKEVIEW BLVD	167.04	Ordinary	15	RSA+Pushover	●●○
0006800F	5/566S-W	S-W RAMP BR	167.16	Ordinary	8	RSA+Pushover	●●○
0006303A	5/566E	GALER-LAKEVIEW V	167.35	Recovery	19	RSA+Pushover	●●●
0006303D	5/566R	EXP GALER-LAKEVIEW V	167.36	Ordinary	22	RSA+Pushover	●●●
0006303B	5/566N-E	N-HARVARD RAMP BR	167.37	Recovery	2	RSA+Pushover	●●○
0006303C	5/566E-S	NEWTON-S RAMP BRIDGE	167.66	Recovery	7	RSA+Pushover	●●○
0006861B	520/1	S-E RAMP UNDER 10TH AVE	168	Ordinary	2	RSA+Pushover	●○○
0006861A	520/2	S-E RAMP UNDER DELMAR DR	168	Ordinary	2	RSA+Pushover	●○○
0006470C	520/1W-S	I-5 UNDER W-S RAMP	168.06	Ordinary	3	RSA+Pushover	●○○
0006470A	5/569	I-5 UNDER ROANOKE ST	168.12	Ordinary	3	RSA+Pushover	●○○
0006470B	5/568S-E	S-E RAMP TUNNEL	168.31	Ordinary	0	Tunnel	●○○
0006080A	5/570	LAKE WASHINGTON SHIP CANAL	168.34	Recovery	34	NLTH	●●●

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Structure ID	Bridge No.	Bridge Name	I-5 Mile Post	Seismic Performance Category	No. of Spans	Recommended Seismic Analysis	Estimated Seismic Vulnerability Analysis LOE
0006111A	5/572	I-5 UNDER NE 45TH ST	169.38	Ordinary	3	RSA+Pushover	●○○
0006286C	5/578R	I-5 EXP OVER RAVENNA BLVD	169.38	Ordinary	20	RSA+Pushover	●●○
0006304A	5/573N-N	NE 45TH ST RAMP TO I-5 N	169.5	Ordinary	1	Seat Width Check + Fdn. Stability Check	●○○
0006304B	5/573S-S	I-5 S RAMP TO NE 45TH ST	169.5	Ordinary	4	RSA+Pushover	●○○
0006111B	5/574	I-5 UNDER NE 50TH ST	169.63	Ordinary	3	RSA+Pushover	●○○
0006304C	5/577E-S	RAVENNA-S RAMP TUNNEL	170.25	Ordinary	0	Tunnel	●○○
0006286A	5/578E	I-5 OVER RAVENNA BLVD	170.25	Recovery	20	RSA+Pushover	●●○
0006286B	5/578W	I-5 OVER RAVENNA BLVD	170.25	Recovery	20	RSA+Pushover	●●○
200411	5/579	I-5 OVER FALLOUT SHELTER	170.57	Recovery	2	RSA+Pushover	●○○
0006911A	5/580	I-5 UNDER NE 70TH ST	170.64	Ordinary	5	RSA+Pushover	●○○
0006911B	5/580N-N	8TH-N RAMP BR	170.64	Ordinary	3	RSA+Pushover	●○○
0006911C	5/580RNE	EXPRESS RAMP OVER I-5 NB	170.76	Ordinary	4	RSA+Pushover	●○○
0006911D	522/14W-S	I-5 UNDER SR 522 W-S RAMP	170.81	Recovery	4	RSA+Pushover	●○○

Structure ID: 0006911D; Bridge No: 522/14W-S; Mile Post: 170.81

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER SR 522 W-S RAMP	CBox	358	4	1962	SR 522

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Catcher Block	2004	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.3); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Capbeam Strengthening ; Girder Stops ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP

Notes for WSDOT

Atypical detail at pier 1 - column is behind the retaining wall that shares the same base, leading to extra modelling complexity (accounted for as 'adjacent structure interaction'). In 2004 retrofit plans, column casing goes down part way on pier 1 as it is embedded in soil behind the retaining wall.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	74.92	92.5

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
18	64.4	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	45	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
3	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	28.15	32.69

Bearing Type	Original Foundation Type	Widened Foundation Type
Steel Plate	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

Potential walls that could act as girder stops in Pier 5. Definitely no girder stop at pier 1 footing is skewed for pier 1 and 3, but capbeam is not. Only pier 5 has bearings Retaining wall through/around pier 3

Structure ID: 0006911C; Bridge No: 5/580RNE; Mile Post: 170.76

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
EXPRESS RAMP OVER I-5 NB	CBox	424	4	1962	I-5 EXP RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Overpass	2004	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.3); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	90	120

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
21	55	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
3	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	25.4	28.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Steel Plate	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

2-Cell Cbox. 5.0' dia. column. Footing thickness: Pier 1: 2.25'. Piers 2 & 4: 3.0'. Pier 3: 2.75'.

Structure ID: 0006911A; Bridge No: 5/580; Mile Post: 170.64

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER NE 70TH ST	CBox	330	5	1962	NE 70TH-NE 71ST ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.4); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Girder Stops ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	50.3	79.2

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
16.7	18.5	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
10.1		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
4	0	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	22.5	36.3

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

6-cell CBox 2' thick wall. Footing thickness: Pier 1: 2.0'. Piers 2-6: 1.5'.

Structure ID: 0006911B; Bridge No: 5/580N-N; Mile Post: 170.64

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
8TH-N RAMP BR	CBox	182	3	1963	8TH AVE N TO I-5 N

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	15.7	84

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
14.5	14.5	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	60	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
1	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	20.6	27

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

2-Cell Cbox. 5.0' dia. column. Footing thickness: Pier 1: 4.0'. Pier 2: 2.5'. Pier 3: 1.5'

Structure ID: 00200411; Bridge No: 5/579; Mile Post: 170.57

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER FALLOUT SHELTER	CCulv	57	2	1961	I-5 SB

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Single Span	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only

Anticipated Retrofit Measures

Column jacketing - FRP ; Superstructure Strengthening - FRP

Notes for WSDOT

Very atypical structure for use as a fallout shelter per the plans, 30' radius circular culvert with 1'-3" thick exterior walls, 1'-3" thick roof slab, ~ 5.75' below grade below I-5, with single center circular column

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CCulv	30	30

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	N/A

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
1	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	9.83	9.83

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	NA	NA

Additional Notes

Many fields do not apply. This is not a typical bridge

Structure ID: 0006286A; Bridge No: 5/578E; Mile Post: 170.25

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER RAVENNA BLVD	PCG	1325	20	1961	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Span (2.0)
Geotechnical Factors: Span (2.9); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class E-F

Peat	Cyclic Softening	Landslide Hazard
Yes	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Bridge supported on 4 foot diameter hollow-core pile foundations. Therefore, unlikely to meet criteria.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
VARIES	43.5	99.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1	12.97	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
59.63	23	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
19	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	12.5	19

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

Expansion Joints at every pier. 95 hollow-core piles. Abutments are spill-through abutments.

Structure ID: 0006286B; Bridge No: 5/578W; Mile Post: 170.25

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER RAVENNA BLVD	PCG	1372	20	1961	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Span (2.0)
Geotechnical Factors: Span (2.9); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class E-F

Peat	Cyclic Softening	Landslide Hazard
Yes	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Bridge supported on 4 foot diameter hollow-core pile foundations. Therefore, unlikely to meet criteria.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
VARIES	38.8	104.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1	12.97	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
59.63	23	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
19	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	12	30

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

Expansion Joints at every pier 95 hollow-core piles in the intermediate piers. Abutments are spill-through abutments.

Structure ID: 0006111B; Bridge No: 5/574; Mile Post: 169.63

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER NE 50TH ST	CBox	241	3	1962	NE 50TH ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class E-F

Peat	Cyclic Softening	Landslide Hazard
Yes	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	67	101.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
1.38	45	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	20.2	20.6

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Integral Bents Abutment wall have pilasters. Retaining walls are besides abutments.

Structure ID: 0006304A; Bridge No: 5/573N-N; Mile Post: 169.5

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NE 45TH ST RAMP TO I-5 N	CS	44	1	1961	RAMP 45TH TO I-5 N

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Single Span	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Span (1.0)
Geotechnical Factors: Span (1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Simple Span	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

Connection and Seat Width Checks

Anticipated Retrofit Measures

Catcher block or Seat Widening

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CSlab	44.3	44.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
46.74	32	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
0	0	

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)

Bearing Type	Original Foundation Type	Widened Foundation Type

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Retaining walls are besides bridge abutments.

Structure ID: 0006304B; Bridge No: 5/573S-S; Mile Post: 169.5

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 S RAMP TO NE 45TH ST	CBox	243	4	1961	I-5 S RAMP TO 45TH

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2004	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.3); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Partial Crash Wall Demolition or Wall Strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.25	70

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
12.6	21.8	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	29	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
3	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.1	26.7

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Combined Spread Footing Supporting Columns	NA

Additional Notes

Integral Bents

Structure ID: 0006286C; Bridge No: 5/578R; Mile Post: 169.38

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 EXP OVER RAVENNA BLVD	PCG	1349	20	1961	I-5 REV EXP LANES

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1996	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Previously Retrofit (1.1); Span (2.0)
Geotechnical Factors: Span (2.9); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Ordinary|SEE|Significant|No Service	Site Class E-F

Peat	Cyclic Softening	Landslide Hazard
Yes	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Bridge supported on 4 foot diameter hollow-core pile foundations. Therefore, unlikely to meet criteria.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
VARIES	47.7	101.9

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1	12.97	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
59.63	23	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
19	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	14	29

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

Expansion Joints at every pier 81 hollow-core piles in the intermediate piers. Hollow-core piles do not currently have a viable retrofit scheme. Also, abutments are spill-through abutments.

Structure ID: 0006111A; Bridge No: 5/572; Mile Post: 169.38

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER NE 45TH ST	CBox	241	3	1960	NE 45TH ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	63.9	94.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0.31	57	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	25.5	27.9

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Integral Bents Abutment walls have pilasters.

Structure ID: 0006470A; Bridge No: 5/569; Mile Post: 168.12

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER ROANOKE ST	CBox	267	3	1962	ROANOKE ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	72.1	99.6

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	26	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
18		External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	0	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.8	38

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

6-cell CBox 2.0' thick wall. 2.0' thick footing.

Structure ID: 0006470C; Bridge No: 520/1W-S; Mile Post: 168.06

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER W-S RAMP	CBox	351	3	1960	SR 520 W-S RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2001	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Atypical detail - no bearings

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP ; Web Wall Strengthening

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	101.97	146.57

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
13.999	49.07	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	36.08	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.1	24.9

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

No bearings at abutment, just shear keys full length of CJ

Structure ID: 0006861B; Bridge No: 520/1; Mile Post: 168

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-E RAMP UNDER 10TH AVE	CBox	285	2	1961	10TH AVE

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None			Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	84	117

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
8.8		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Round ; Square

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	32.4	39.8

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

6-cell CBox Pier 1 and 4 have rectangualr columns 2.5'x3.75'. Piers 2 and 3 have 3' diameter columns Pier 2 has a Retaining Wall away from columns but within Pier 2 spread footing area.

Structure ID: 0006861A; Bridge No: 520/2; Mile Post: 168

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-E RAMP UNDER DELMAR DR	CBox	154	2	1962	DELMAR DRIVE

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Box girder superstructure sections (1.1); Landslide hazard (1.2); Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 2

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	44.75	108.92

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
39.06	36	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
1	0	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	21.5	23

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

5-cell CBox. Deck curve at NW corner. Non-prismatic wall width. 1.5' thick footing.

Structure ID: 0006303C; Bridge No: 5/566E-S; Mile Post: 167.66

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NEWTON-S RAMP BRIDGE	PCG	619	7	1963	I-5 RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1996	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Landslide hazard (1.2); Span (1.3)
Geotechnical Factors: Span (1.6); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Connection and Seat Width Checks ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Series 90	85.3	94.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1	5	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	15	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
6	2	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	18	75.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Piles-Concrete	NA

Additional Notes

Seismic retrofit schedule specifies 4 transverse girder stops. There are 5 girders, so likely one in each bay, but the details are not included in the plan set available. Table also specifies two longitudinal restrainers at each bent Hollow core piles extend from cap and into ground. Plans do not provide column lengths or tip elevation. Max and min col. lengths provided here are rough estimates measured from elevation sheet. Bearing pad details not included -look like elastomeric brgs Passive pressure possibly at Bent no 33. Opposite side of bridge ties into I-5

Structure ID: 0006303B; Bridge No: 5/566N-E; Mile Post: 167.37

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
N-HARVARD RAMP BR	PCG	181	2	1963	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1993	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Multi-pile deep foundations (1.25); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Landslide hazard (1.2); Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Bridge includes Bent 6, 7 and abutment. Adjacent structure interaction next to Bent 6 with structure 0006303A. Bridge supported on hollow-core concrete piles and is therefore unlikely to meet criteria. Transverse longitudinal restrainer seismic retrofit on pg 64 of 65. Large variation in column heights

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Series 90	90.1	90.9

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
7	5.71	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	21	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	2	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	19.5	38.3

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

abutment footing sloping across different elevations

Structure ID: 0006303D; Bridge No: 5/566R; Mile Post: 167.36

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
EXP GALER-LAKEVIEW V	PCG	1908	22	1961	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1993	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Higher LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Previously Retrofit (1.1); Landslide hazard (1.2); Span (2.0)
Geotechnical Factors: Span (3.1); Curved (1.1); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Various superstructure sections

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

4'-0" diameter hollow-core piles that bear on bell shaped spread footings.
One bent (Bent 15) founded on drilled shafts.
Constant width with two curves and a tangent between each curve. Minimal retrofits completed to date (Longitudinal restrainers)
Large variation in column heights in some locations (between adjacent piers)

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Series 90	54.2	91.1

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3	27.7	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
41.44	24	One in Each Bay

No. Inter. Piers	Column Numbers / Bent	Column Shape
21	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	7	57

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

Expansion Joints at every pier Cantilever on battered piles at Abut. 1, spill through abutment No. 23 Battered piles present at abutment No. 1

Structure ID: 0006303A; Bridge No: 5/566E; Mile Post: 167.35

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
GALER-LAKEVIEW V	PCG	1671	19	1961	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1993	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Higher LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Landslide hazard (1.2); Span (2.0)
Geotechnical Factors: Span (2.8); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Unlikely to meet criteria

Notes for WSDOT

Integral offramp to Lakeview Dr.
4'-0" diameter hollow-core piles that bear on bell shaped spread footings.
Variable width to accommodate start of a ramp in the first 5 spans. Minimal retrofits completed to date (Longitudinal restrainers)
Large variation in column heights in some locations (between adjacent piers)
Deck/Diaphragm has kinked cross slope at ramp.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Series 90	56.3	91.1

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3	17.72	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
48.34	21	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
18	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	2	50

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

Expansion Joints at every pier, Span 5 splits into a ramp, Cantilever on battered piles at Abut. 1, spill through abutment No. 20 Battered piles present at abutment No. 1

Structure ID: 0006800F; Bridge No: 5/566S-W; Mile Post: 167.16

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-W RAMP BR	CBox	732	8	1962	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2000	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Landslide hazard (1.2); Span (1.3)
Geotechnical Factors: Span (1.7); Curved (1.1); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class B-C

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Atypical detail – Split column ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer

Notes for WSDOT

Spine model, 2 frames;
Tension and Compression models needed, unless Pier 5 (split column) is partially restrained. May still be needed to design a partial restraint (allow for thermal). Some footings have battered piles. Except for Pier 5, footings lack top reinf. and pile reinf. extensions.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	79	104

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
7.5	30.9	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	24	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
7	1	Round ; Square ; Rectangular

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	20.1	34.3

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Concrete Group Piles Supporting Column	NA

Additional Notes

superstructure integral with columns except a hinged pin connection at Pier 1. Jacketed column shape is round; original columns square or rectangular Except for Pier 5, footings lack top reinf. and pile reinf. extensions; footings may fail

Structure ID: 0006800C; Bridge No: 5/564; Mile Post: 167.04

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER LAKEVIEW BLVD	CBox	1215	15	1963	LAKEVIEW BLVD

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Catcher Block	2000	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Landslide hazard (1.2); Span (1.6)
Geotechnical Factors: Span (2.4); Curved (1.1); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 2

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Atypical detail – Split column

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer

Notes for WSDOT

5 frames with split columns at each of the intermediate exp joints.
Steel jacket retrofits on columns and catcher blocks at Pier 1. Columns may perform fairly well but footings likely to have problems.
Restrainers and diaphragm strengthening expected at split column piers.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	106.8

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
30.6	74	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
38.3	39	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
14	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	26	79.9

Bearing Type	Original Foundation Type	Widened Foundation Type
Sliding bearing	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Combination	NA

Additional Notes

skew only at Pier 16/abutment; 5 frames; 6" gas pipe thru superst.; seat extensions at abut's, integral w/ int col's round columns w/ round steel jackets; split columns at exp joints; cantilevered abutments ea end top reinf only at Piers 7 and 10

Structure ID: 0006800B; Bridge No: 5/562E; Mile Post: 166.91

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NB LANES VIADUCT	CTB	381	10	1963	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1993	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Previously Retrofit (1.1); Landslide hazard (1.2); Span (1.3)
Geotechnical Factors: Span (1.9); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 2

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Connection and Seat Width Checks

Anticipated Retrofit Measures

Capbeam Strengthening ; Column jacketing - Steel ; Micropile or foundation enlargement

Notes for WSDOT

Provided plan set missing information on the cylinder wall. Additional information will be required to complete the analysis.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CTB	27.3	38

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3	11.4	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	18	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
9	2	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	9.2	33.67

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad ; Steel Plate	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

(2) 5 span frames Column width varies. Circular column on downslope side, and thicker cylinder wall on uphill side

Structure ID: 0008195A; Bridge No: 5/556N-W; Mile Post: 166.82

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
N-W RAMP OVER E-N RAMP	SG	95	1	1967	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Single Span	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Simple Span	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Connection and Seat Width Checks ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Girder Stops

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Steel Plate Girder	94.7	94.7

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
20	18.93	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
45	21	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
0	0	NA

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
NA	0	0

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

Outside steel girders are curved. 3 interior girders are straight No intermediate columns, therefore, height=0 ft. Only have 2 piers Behavior of walls at Piers 1 and 2 to be considered.

Structure ID: 0006800G; Bridge No: 5/564A; Mile Post: 166.82

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-W RAMP UNDER EASTLAKE	CBox	125	2	1963	EASTLAKE AVE

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Landslide hazard (1.2); Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class B-C

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 2

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	40.8	74.1

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
48.3	24	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
1	1	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	22.2	26.6

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

6-cell CBox 2' thick wall. 1.5' thick footing.

Structure ID: 0006653A; Bridge No: 5/555S-W; Mile Post: 166.66

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-STEWART RAMP BR	CBox	213	3	1962	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2003	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	66	84

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
6	0	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Square

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	22.26	23.33

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Unknown	NA

Additional Notes

Structure ID: 0006800H; Bridge No: 5/564RSW; Mile Post: 166.46

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
EXP S-W RAMP BRIDGE	CS	743	21	1964	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer ; Seat Extension ; Girder Stops	1996	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Previously Retrofit (1.1); Landslide hazard (1.2); Span (2.0)
Geotechnical Factors: Span (3); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class B-C

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections ; Connection and Seat Width Checks

Anticipated Retrofit Measures

Capbeam Strengthening ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CSlab	28	38

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
6	7	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
34.1	27	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
20	6	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	4.25	14.33

Bearing Type	Original Foundation Type	Widened Foundation Type
Sliding bearing	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

The bridge is a 21 span concrete slab bridge with 2 expansion piers. Transvers restrainers were added in the 1990's to piers 1, 8, 15, 22 (end and expansion piers). Seat with of 27" includes catcher blocks. The crossbeams are integral with the slab and are supported on 35 ton concrete piles. Pile reinf appears embedded into crossbeams. Did not find data / details showing pile lengths or diameter. Bearing sliding surface is a self lubricating bronze expansion plate. Pier 22 has some battered piles.

Structure ID: 0006085A; Bridge No: 5/570RNE; Mile Post: 166.46

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
EXP N-42ND RAMP	CBox	273	4	1962	EXP N TO 42ND RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2004	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.3); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections ; Atypical detail – Split column ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	46.5	103.6

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
18.1	47.7	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	28.5	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
3	1	Round ; Unique

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	19.4	32.6

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread footing supporting column	NA

Additional Notes

In-span expansion joint at the pier with split column Integral Bents. Column shape is half cross at the pier with split column. Shear key connections between girders and columns at one abutment, adjacent structure at the other end of this bridge.

Structure ID: 0006800A; Bridge No: 5/566W; Mile Post: 166.36

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
DENNY WAY-LAKEVIEW V	CBox PCG	7077	85	1962	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1996	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Higher LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Skewed (1.1); Multi-frame (1.25); Grillage/shell models required (1.75); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); NLTH (2.5); Previously widened (1.2); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Landslide hazard (1.2); Span (2.0)
Geotechnical Factors: Span (9.4); Curved (1.1); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Recovery|SEE|Moderate|Limited	Site Class D-E

Peat	Cyclic Softening	Landslide Hazard
No	Yes	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; ii. Grillage model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections ; Nonlinear time history ; Extra Modelling complexity (i.e. Previous widening) ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP ; Unlikely to meet criteria

Notes for WSDOT

Complex set of drawings. Two bridge types. The original bridge type (precast girders) constructed in 1959 is to the North and is founded on HOLLOW-CORE CONCRETE PILES. The second bridge type (to the South) is a Box Girder Bridge. A small portion of this south structure has two levels of roadway (double decker).

Anticipated Retrofit Measures only for CIP Box Girder portion of structure.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
Series 90	53	92.2

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3.114	35.74	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
52.4	24	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
34	Varies	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	8	67

Bearing Type	Original Foundation Type	Widened Foundation Type
Elastomeric pad	Hollow-Core Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Unknown	NA

Additional Notes

Add'l Bridge Info for 2nd Structure Type

.Girder Type	.Shortest Span (ft)	.Longest span (ft)
CBox	62	104
.Max Degree of Curvature	**.Sweep Angle btwn Abutments**	**.SS Continuity**
3.14	37.59	Continuous
.Deck Exp Joints?	**.Long. Exp Joints?**	**.In-Span Hinge?**
Yes	No	No
.Skew Angle	**.Seat Width (in)**	**.Girder Stop?**
0		No Girder Stops
.No. Inter. Piers	**.Column Numbers / Bent**	**.Column Shape**
34	Varies	Rectangular
.Column Fixity	**.Shortest Column Height (ft)**	**.Tallest Column Height (ft)**
Fixed-Fixed	20	48.17
.Bearing Type	**.Original Foundation Type**	**.Widened Foundation Type**
NA	Piles - Concrete	NA
.Battered?	**.Original Abutment Foundation Type**	**.Widening Abutment Foundation Type**
Yes	Unknown	NA

.Additional Notes

Variable width CIP box girders. Likely short on positive moment reinforcement at the piers. Split columns at expansion piers. Retaining wall built integral with column footings. Highly variable column heights in straddle piers. Tapered columns. Typical 2 column bents, turns to 3 at Bent 45-46 & 49-51. Majority of piles are not battered, though several piers have battered piles

Structure ID: 0006635B; Bridge No: 5/553; Mile Post: 166.36

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER DENNY WAY	CBox	321	3	1962	DENNY WAY

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	103.6	110.8

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
5.7	30	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	0	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	16	46.2

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Piles - Concrete ; Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

5-cell CBox. 2.5' thick wall. All piers are on battered piles except the Pier 4 which is on spread footing. Footing thickness is 3.25'.

Structure ID: 0006635C; Bridge No: 5/553E-S; Mile Post: 166.32

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
YALE ST RAMP OVER REV RAMP	CTB	61	1	1962	YALE ST RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Single Span	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Span (1.0)
Geotechnical Factors: Span (1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Simple Span	Recovery|SEE|Moderate|Limited	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

Connection and Seat Width Checks

Anticipated Retrofit Measures

Capbeam Strengthening ; Catcher block or Seat Widening

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CTB	61.4	61.4

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
12.3	12.3	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	Yes	No

Skew Angle	Seat Width (in)	Girder Stop?
65.94	15	One in Each Bay

No. Inter. Piers	Column Numbers / Bent	Column Shape
0	0	

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)

Bearing Type	Original Foundation Type	Widened Foundation Type

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Retaining walls are besides bridge abutments.

Structure ID: 0006635A; Bridge No: 5/552; Mile Post: 166.2

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER OLIVE WAY	CBox	293	3	1962	OLIVE WAY

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	38.5	132.8

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
46		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	21.8	44.8

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

6-cell cbox. NW coner of the deck has a 10.25' radius curve. SE corner of the deck has 2.197' radius curve. Wall Piers 1 has piles along the width of the spread footing. Pier 2 has spread footing on piles, Pier 3 is on spreads footing with no piles. Pier 4 has spread footing on piles.

Structure ID: 0007409D; Bridge No: 5/551; Mile Post: 166.06

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER PINE & BOREN	CBox	469.3	8	1963	PINE ST-BOREN AVE

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously widened (1.2); Adjacent structure interaction (1.2); Span (1.3)
Geotechnical Factors: Span (1.7); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Complex	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening) ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening

Notes for WSDOT

"X" shaped bridge, piers are generally parallel between the four legs. Relatively large oblong columns on pile footings with top and bottom reinf., some partial pier walls, and some hinge details. Column and partial pier wall strengthening may be required. Internal diaphragm strengthening is also likely.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	19	122.9

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	No

Skew Angle	Seat Width (in)	Girder Stop?
45	0	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
9	3	Square ; Oblong

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed ; Fixed-Pinned	8.5	53.35

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

"X" shaped bridge, 469.3' along one direction and 455.5' along other direction. Piers are generally parallel between the legs. Joints only at the 4 ends of legs. Square columns at Piers 1 and 5 have hinges at top and bottom, 3' x 8' oblong columns at Piers 2-4 ; partial pier walls or retaining walls between some columns at Piers 2 and 4. Various size footings, some piles battered; footings do have top reinf.

Structure ID: 0007409C; Bridge No: 5/550; Mile Post: 165.97

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER PIKE ST	CBox	282	2	1964	PIKE ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column jacketing - FRP ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	133.5	133.5

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
48		N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
1	4	Elliptical

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	41.8	45.58

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

SE corner of the deck has 9' radius deck curve. Rectangular columns are aligned parallel to skew. Int. pier has 101’ long, 16’ wide, 2'-9" thick footing. Abutment 1 has 114.5’ long, 11'-4" wide, 2'-9" thick footing supported with two rows of 24" dia. conc. piles, each row having 28 piles. Abutment 2 has 126’ long, 18.67’ wide, 2'-9" thick footing supported with four rows of 24" dia. conc. piles, each row having 31 piles.

Structure ID: 0007409A; Bridge No: 5/549; Mile Post: 165.81

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER 8TH AVE-TRADE CENTER	CBox	858.5	9	1963	8TH AVE

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Overpass	2001	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Higher LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); NLTH (2.5); Previously Retrofit (1.1); Multilevel bridge (2.0); Adjacent structure interaction (1.2); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Complex	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Nonlinear time history ; Connection and Seat Width Checks ; Adjacent Structure Interaction ; Multi-Level Bridge

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer

Notes for WSDOT

Nearly straight bridge with two segments; mix of 1-column and 2-column piers with one skewed pier. 1-column piers retrofitted with steel jackets and restrainers added to in-span hinge. Expect restrainers will need strengthening, unjacketed columns will likely need retrofit, and footings may need strengthening. Jacketed columns may perform relatively well.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51	144.8

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0.5	1.9	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
39.4	18	Some present

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	1-2	Round ; Square

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	16.5	48.6

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Piles (imported option, update to include material)	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

One 4-span unit and one 5-span unit of reinf conc box girder structure; one in-span hinge. seismic restrainers added in 1992. Only Pier 7 is skewed; mix of 1-column and 2-column piers. 1-column piers retrofitted with steel jackets in 2001. Battered piles at abutments and single column piers. Footings lack top reinforcement.

Structure ID: 0007409E; Bridge No: 5/549A; Mile Post: 165.74

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
S-COL RAMP UNDER UNIV ST	CS	14	0		UNIVERSITY ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		N/A	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multiple superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (0.9); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Unique	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

Various superstructure sections ; Foundation Stability Check

Anticipated Retrofit Measures

Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
VARIES	0	13

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
	180	N/A

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
	60	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
0	0	Wall

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	19	19

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	

Additional Notes

Cantilever deck No piers or columns. Deck cantilevers from 5-ft thick retaining wall adjacent to the highway below. 3-ft thick , 12.5-ft wide, spans the whole length of the deck.

Structure ID: 0007409B; Bridge No: 5/549E-N; Mile Post: 165.73

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
UNIV-N RAMP OVER I-5 SB	CBox	638	6	1965	UNIV-N RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Seismic Restrainer ; Overpass	2001	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.3)
Geotechnical Factors: Span (1.5); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	81.8	156.1

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
26	43	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
	38	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
5	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.3	31.1

Bearing Type	Original Foundation Type	Widened Foundation Type
Steel cylinder roller	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Pier 1 is skewed. Other piers appear normal or close to. Seat width is 38" at Pier 1 and includes catcher block extension of 11". Note catcher block is anchored to backwall. Most original columns are 4' square, some are 4.5' and some are 50'; all with circular steel jackets. Long column bars in Pier 2 are welded at the bottom. Intermediate pier outer piles are battered. Note piles are embedded only 6" with no details on rebar extending into the cap.

Structure ID: 0006635E; Bridge No: 5/553REN; Mile Post: 165.7

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
REV LANES UNDER UTILITY BRIDGE	CBox	28	1	1961	UITILITY

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Single Span	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Simple Span	Ordinary|SEE|Significant|No Service	Site Class C

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis

Anticipated Retrofit Measures

Anticipate no retrofitting

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	28	28

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Simple Span

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	Yes	No

Skew Angle	Seat Width (in)	Girder Stop?
8.85	1	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
0	0	NA

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
NA	0	0

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	NA	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Spread	NA

Additional Notes

Structure decks are composed of removable precast concrete planks. Retaining walls are besides the structure ends.

Structure ID: 0007110E; Bridge No: 5/548; Mile Post: 165.69

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER SENECA ST	CBox	250	3	1964	SENECA ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	70.4	96

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
26.68	57	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Elliptical

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	33.2	44.3

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Combination	NA

Additional Notes

One column from another bridge is located near an interior pier of this bridge. Combined spread footing supporting 3 columns: 2 columns from this bridge and 1 is from another bridge. Spread footing for one abutment and pile group footing for the other abutment. Abutments walls have pilasters.

Structure ID: 0007110G; Bridge No: 5/545SCD; Mile Post: 165.63

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
SBCD VIADUCT STA 2195	CBox	806	11	1964	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer ; Widened	1990	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously widened (1.2); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.3)
Geotechnical Factors: Span (2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Extra Modelling complexity (i.e. Previous widening) ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.25	82.5

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1.6	16.1	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
10	2	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	16	30.6

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Piles - Concrete ; Spread	Shafts

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Combination	Single Shaft

Additional Notes

Piles in one abutment and spread footing in the other.

Structure ID: 0007110D; Bridge No: 5/547; Mile Post: 165.63

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER SPRING ST	CBox	279	3	1964	SPRING ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column jacketing - FRP ; Girder Stops ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	80.5	115.6

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
10	30	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Rectangular

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	34.4	48.2

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread	NA

Additional Notes

6-cell CBox with 6.5" top and 6" bot. slab, total depth of box is 6'. Rectangualr columns with semi-cirle ends. 3' thick spread footing. Note on sheet 14 of 16 of combined set states that "Pier 4 has been revised from a spread Footing to a pile Footing and the depth of footing has been increased 6". There is no chaange to the reinforcing steel dimensions.

Structure ID: 0007110J; Bridge No: 5/547E-S; Mile Post: 165.61

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
SPRING ST RAMP OVER SBCD	CS	177	3	1964	SPRING ST RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns	2001	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Grillage/shell models required (1.75); Multiple superstructure sections (1.1); Previously Retrofit (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; ii. Grillage model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
2'-6" Slab	52.2	71.3

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
134.7	90	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	48	N/A

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.7	29

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
	Spread	NA

Additional Notes

Roller at abutment Inter. Piers: 12'x14'x3' spread footing.

Structure ID: 0007110C; Bridge No: 5/546; Mile Post: 165.57

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER MADISON ST	CBox	280	3	1964	MADISON ST

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Overpass		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Column jacketing - Steel ; Girder Stops ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Pier wall strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	74.8	103.6

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
6	96	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Elliptical

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	40.9	49.7

Bearing Type	Original Foundation Type	Widened Foundation Type
	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

8-cell cbox, insignificant skew of 1°, with 6° at the Pier 2 Half the height of pier 2 columns are part of a wall for ramp that crosses under the bridge. Inter. Piers: Rectangular spread footing with rounded corners: Pier 2: 71.5x-7x2. Pier 3: ext. cols: 15'x11'x3', int. col: 17'x11x3'. Pier 4: 2'-steel pipe piles - 3 rows with last row being battered.

Structure ID: 0007110H; Bridge No: 5/545N-W; Mile Post: 165.49

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
N-SENECA RAMP OVER I-5 SB	CBox	972	12	1964	N-SENECA RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Seismic Restrainer ; Catcher Block	2001	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multi-frame (1.25); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.6)
Geotechnical Factors: Span (2.1); Curved (1.1); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Pushover ; Various superstructure sections ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CSlab	65	96.9

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
36.3	54	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
6.37	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
11	1	Rectangular

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	19.6	27.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
N/A	Spread	NA

Additional Notes

Structure ID: 0007110A; Bridge No: 5/545E; Mile Post: 165.32

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NB VIADUCT	CBox	4724	60	1964	I-5 NB

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1992	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Higher LOE

Factors Increasing LOE

Structure Factors: Curved (1.1); Multi-frame (1.25); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); NLTH (2.5); Previously widened (1.2); Previously Retrofit (1.1); Multilevel bridge (2.0); Adjacent structure interaction (1.2); Span (2.0)
Geotechnical Factors: Span (6.9); Curved (1.1); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Complex	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections ; Nonlinear time history ; Extra Modelling complexity (i.e. Previous widening) ; Connection and Seat Width Checks ; Adjacent Structure Interaction ; Multi-Level Bridge

Anticipated Retrofit Measures

Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer

Notes for WSDOT

Very challenging structure to meet Recovery standards; long viaduct sections with retaining walls on one or both sides with roadway beneath structure. Existing seismic restrainers at in-span hinges will likely need strengthening. Rectangular columns either side of in-span hinges tend to be hinged longitudinally at bottom of column. Some pile but mostly spread footings; partial top reinforcement only where retaining wall sections share footing.

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	85

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3.17	44.41	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	18	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
60	2-4	Round ; Rectangular

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	17.6	54.7

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Piles ; Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Piles	NA

Additional Notes

17 units of CIP Conc Box girder, typically 3 to 4 spans per frame; varying width sections due to ramps; seismic restrainers added at in-span hinges in 1992. Unit 1 has 4' dia. round columns; the rest appear to be rectangular columns; bottom column hinges for longitudinal direction tend to be either side of in-span hinges; many sections have retaining wall framing between outside columns on east side; some sections have walls framing between columns on both sides. Roller bearings at in-span hinges; columns integral with superstructure. some pile footings, mostly spread footings; top reinf tends to only be where retaining walls share footing (heel side only).

Structure ID: 0007110I; Bridge No: 5/545N-E; Mile Post: 165.32

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NBCD-7TH RAMP BR	CBox	672	9	1964	I-5 RAMP

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Seismic Restrainer	2001	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Various superstructure sections ; Connection and Seat Width Checks

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	80

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
5	6	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	48	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	20.7	29.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Steel cylinder roller	Piles - Concrete	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

3-cell box. 3 Units w/ in-span hinges (seat width 18", retrofit w/ restrainers) Intermediate pier outer piles are battered. Note piles are embedded only 6" with no details on rebar extending into the cap.

Structure ID: 0007110F; Bridge No: 5/545NCD; Mile Post: 165.32

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NBCD VIADUCT STA 2195	CBox	702	10	1964	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Seismic Restrainer ; Catcher Block	2001	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.3)
Geotechnical Factors: Span (1.9); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; c. Tension and Compression models

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	15	80

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1.6	14	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
9	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	22.5	52.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Piles - Concrete ; Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles-Concrete	NA

Additional Notes

Structure ID: 0007110B; Bridge No: 5/545W; Mile Post: 165.28

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
SB VIADUCT STA 2195	CBox	807	11	1964	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer ; Widened	1990	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously widened (1.2); Previously Retrofit (1.1); Span (1.3)
Geotechnical Factors: Span (2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening)

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	52.25	80

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1.6	16.1	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
10	2	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	15.5	41.4

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing ; Multi-directional bearing	Piles - Concrete ; Spread	Shafts

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Combination	Combination

Additional Notes

Concrete piles at one abutment, spread footing at the other.

Structure ID: 0007110K; Bridge No: 5/545R; Mile Post: 165.25

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
EXP LANES OVER JAMES & CHERRY	CBox	672	9	1964	I-5 EXPRESS LANES

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Jacketed Columns ; Seismic Restrainer ; Seat Extension	2001	Multiple Spans	

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Multi-pile deep foundations (1.25); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Adjacent structure interaction (1.2); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Connection and Seat Width Checks ; Adjacent Structure Interaction

Anticipated Retrofit Measures

Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
N/A	60	80

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
3.5	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
0	36	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	1	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.8	30.5

Bearing Type	Original Foundation Type	Widened Foundation Type
Steel cylinder roller	Piles	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Piles	NA

Additional Notes

3-cell box. 3 Units w/ in-span hinges (seat width 18", retrofit w/ restrainers) Single column piers, w/ starter bars and integral with superstr. Columns have been jacketed Intermediate pier outer piles are battered. Note piles are embedded only 6" with no details on rebar extending into the cap.

Structure ID: 0007504E; Bridge No: 5/544; Mile Post: 165.1

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 UNDER YESLER WAY	CBox	391	5	1965	YESLER WAY

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.4); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Partial Crash Wall Demolition or Wall Strengthening ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	95.5

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
40.98	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
4	3	Elliptical

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	22	40.1

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
Yes	Combination	NA

Additional Notes

Long. Exp Joint exists at one end of the bridge, the other end is a spill through abutment. Partial crash walls are between columns in Piers 3&5. Integral Bents. Individual spread footings in Piers2&4, Combined spread footings in Piers 3&5. For abutment, Pier 1 has columns supported by individual spread footings, Pier 6 has pier wall with pilasters.

Structure ID: 0007504A; Bridge No: 5/543E; Mile Post: 164.8

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER KING-JACKSON ST	CBox	709	9	1965	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer ; Widened	1990	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Shaft deep foundations (1.1); Box girder superstructure sections (1.1); Previously widened (1.2); Previously Retrofit (1.1); Landslide hazard (1.2); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (0.5)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 2

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening)

Anticipated Retrofit Measures

Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.5	100

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
2.3	16.6	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
30.8	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	Varies (2 or 3)	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	4.3	28.8

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Shafts	Single Shaft

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Shafts	Single Shaft

Additional Notes

Elevations are taken from the bridge widening plans.

Structure ID: 0007504C; Bridge No: 5/543NCD; Mile Post: 164.8

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
NBCD OVER KING-JACKSON ST	CBox	709	9	1965	I-5 NBCD

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1992	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Medium LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Shaft deep foundations (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Landslide hazard (1.2); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (1)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	Level 1

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover

Anticipated Retrofit Measures

Column jacketing - Steel ; Girder Stops ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.5	100

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
0	0	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
58	48	No Girder Stops

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	2 or 3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	17.9	27.99

Bearing Type	Original Foundation Type	Widened Foundation Type
Roller bearing	Shafts	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Shafts	NA

Additional Notes

Pier 1: Rect. 2'x2.5. Piers 2 - 9: 4'-Round. Pier 1: 4'-Shaft. Piers 2 - 9: 5'-Shaft.

Structure ID: 0007504D; Bridge No: 5/543SCD; Mile Post: 164.8

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
SBCD OVER KING-JACKSON ST	CBox	709	9	1965	I-5 SBCD

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer	1992	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multi-frame (1.25); Shaft deep foundations (1.1); Box girder superstructure sections (1.1); Previously Retrofit (1.1); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover

Anticipated Retrofit Measures

Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.5	100

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
2.5	17.7	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
29.61	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	17.6	29.3

Bearing Type	Original Foundation Type	Widened Foundation Type
	Shafts	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Shafts	NA

Additional Notes

Structure ID: 0007504B; Bridge No: 5/543W; Mile Post: 164.8

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER KING-JACKSON ST	CBox	715	9	1965	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
Seismic Restrainer ; Widened	1990	Multiple Spans	No

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Skewed (1.1); Multi-frame (1.25); Shaft deep foundations (1.1); Box girder superstructure sections (1.1); Previously widened (1.2); Previously Retrofit (1.1); Span (1.3)
Geotechnical Factors: Span (1.8); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
No	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; b. Tension and Compression models ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening)

Anticipated Retrofit Measures

Column Isolation ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Seismic Restrainer ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	51.5	100

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
2.5	17.9	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
Yes	No	Yes

Skew Angle	Seat Width (in)	Girder Stop?
30.8	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
8	3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	9.2	34.4

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Shafts	Single Shaft

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Combination	Shaft

Additional Notes

Elevations are taken from the bridge widening plans. Spread footing at one abutment and shafts at the other.

Structure ID: 0007565J; Bridge No: 5/542SCD; Mile Post: 164.62

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
SBCD OVER DEARBORN ST	CBox	216	3	1965	I-5 SBCD

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None		Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Multiple superstructure sections (1.1); Box girder superstructure sections (1.1); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Ordinary|SEE|Significant|No Service	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Pushover ; Various superstructure sections

Anticipated Retrofit Measures

Catcher block or Seat Widening ; Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	96

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
1.9	4.3	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
4	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	26.3	30.6

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	NA

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread footing supporting column	NA

Additional Notes

Bridge is slightly skewed. Integral Bents

Structure ID: 0007565F; Bridge No: 5/542E; Mile Post: 164.62

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER DEARBORN ST	CBox	216	3	1965	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None ; Widened	1990	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Lower LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Previously widened (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening)

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	96

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
2.4	5.5	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
0	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	23.2	31.7

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	Single Shaft

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread footing supporting column	Single Shaft

Additional Notes

Integral Bents

Structure ID: 0007565G; Bridge No: 5/542W; Mile Post: 164.62

Bridge Basic Information

Bridge Name	Span Type	Br. Len. (ft)	No. of Spans	Year Built	Facilities Carried
I-5 OVER DEARBORN ST	CBox	216	3	1965	I-5

Previous Seismic Retrofit	Last Retrofit Yr	Multiple/Single Span	Boring Log
None ; Widened	1990	Multiple Spans	Yes

Assessment Summary

Seismic Vulnerability Assessment LOE

Factors Increasing LOE

Structure Factors: Box girder superstructure sections (1.1); Previously widened (1.2); Span (1.0)
Geotechnical Factors: Span (1.2); Hazard analysis flag (0)

Retrofit Category	Expected Seismic Performance	Seismic Site Class
Typical	Recovery|SEE|Moderate|Limited	Site Class C-D

Peat	Cyclic Softening	Landslide Hazard
No	No	NA

Abutment Passive Resistance?	Liquefiable	Ground Motion Level
Yes	No	Upper Level (1000 years)

Anticipated Analysis Measures

a. RSA Analysis ; c. Compression model only ; i. Spine model ; Deep foundations/Fdn spring iteration ; Pushover ; Extra Modelling complexity (i.e. Previous widening)

Anticipated Retrofit Measures

Column jacketing - Steel ; Internal Diaphragm Strengthening (Requires Access Hatches) ; Micropile or foundation enlargement ; Superstructure Strengthening - FRP

Notes for WSDOT

Additional Bridge Information

Girder Type	Shortest Span (ft)	Longest span (ft)
CBox	60	96

Max Degree of Curvature	Sweep Angle btwn Abutments	SS Continuity
2.4	5.4	Continuous

Deck Exp Joints?	Long. Exp Joints?	In-Span Hinge?
No	No	No

Skew Angle	Seat Width (in)	Girder Stop?
7.76	27	External Only

No. Inter. Piers	Column Numbers / Bent	Column Shape
2	3	Round

Column Fixity	Shortest Column Height (ft)	Tallest Column Height (ft)
Fixed-Fixed	21.8	27.7

Bearing Type	Original Foundation Type	Widened Foundation Type
NA	Spread	Shafts

Battered?	Original Abutment Foundation Type	Widening Abutment Foundation Type
No	Spread footing supporting column	Shaft

Additional Notes

Integral Bents