MARTIN WAY O'XING CEVA-CRETE EXPANSION JOINT SYSTEM, BRIDGE NO. 5/337

WA-RD 349.1

Final Report
May 1994

Washington State Department of Transportation

Washington State Transportation Commission
Transit, Research, and Intermodal Planning (TRIP) Division
in cooperation with the U.S. Department of Transportation
Federal Highway Administration

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
4. TITLE AND SUBTITLE Martin Way O'Xing Ceva-Crete Expansion Joint System Bridge No. 5/337 E & W		5. REPORT DATE May 1994
		6. PERFORMING ORGANIZATION CODE WA 86-03A
7. AUTHOR(S) Tom H. Roper and Edward H. Henley, Jr.		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Washington State Department of Transportation Transportation Building Olympia, WA 98504		10. WORK UNIT NO.
		11. CONTRACT OR GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Same		13. TYPE OF REPORT AN PERIOD COVERED Final Report May 1994
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

The study was conducted in cooperation with the U. S. Department of Transportation, Federal Highway Administration.

16. ABSTRACT

This final report details the field performance of a Ceva-Crete Expansion Joint system on an I-5 bridge in Olympia, Washington. The Ceva-Crete system employs an elastomeric concrete that is vulcanized in place to handle impact loads on the joint and a low density closed cell material (Evazote 50) that is epoxied to the steel nosing of the joint, to act as the seal.

The performance of the joint system was evaluated after a five year period.

17. KEY WORDS Expansion joints Bridge deck rehabilitation	18. DISTRIBUTION STATEMENT

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	28	

DOT FORM 310-022 (11/86) -1216-

MARTIN WAY O'XING
CEVA-CRETE EXPANSION
JOINT SYSTEM

Bridge No. 5/337

by

Tom H. Roper
and
Edward H. Henley, Jr.
Bridge and Structures Office
Washington State Department of Transportation
Olympia, WA 98504-5201

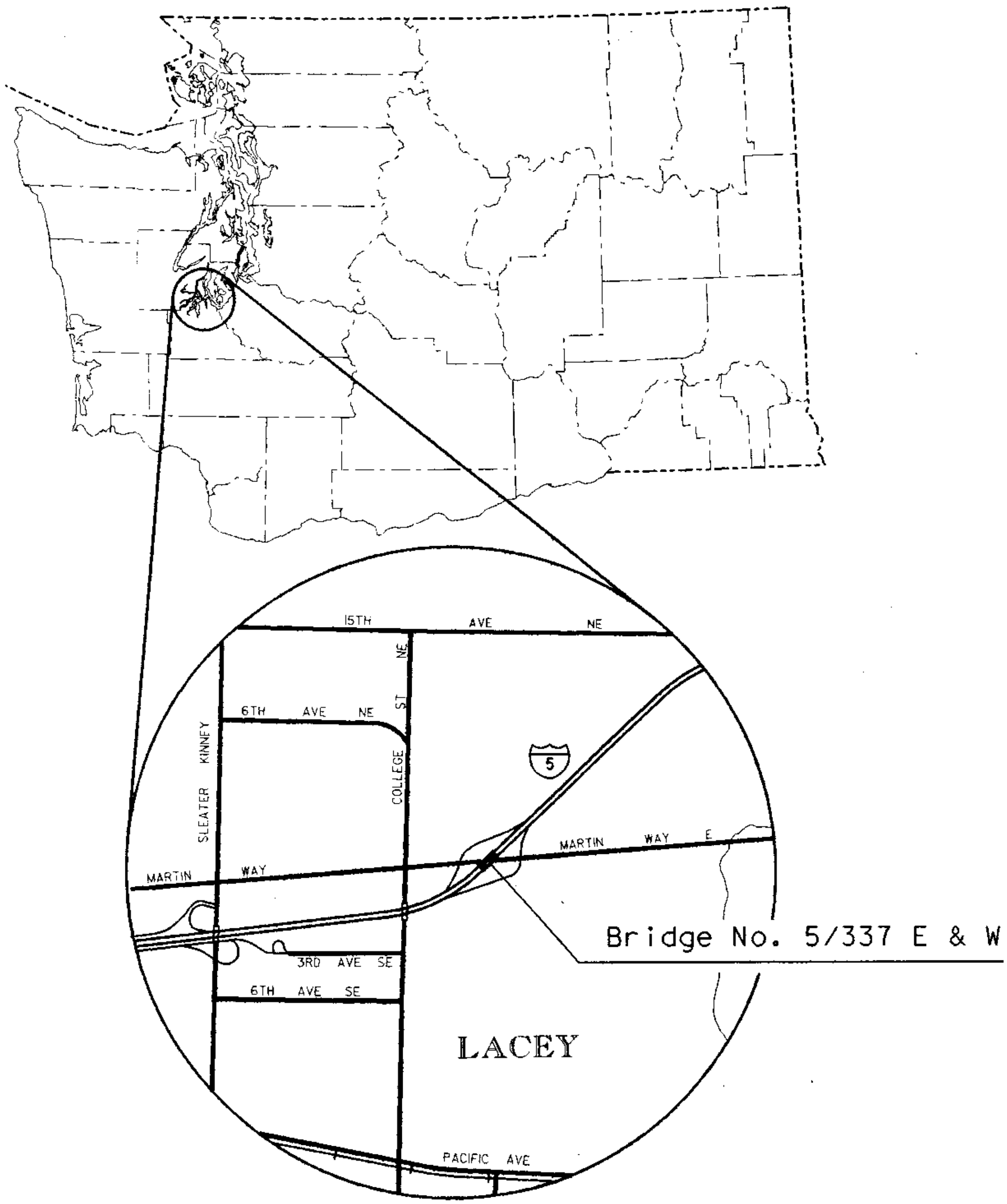
FINAL REPORT

Experimental Project WA 86-03A

Prepared for the Washington State Department of Transportation
in cooperation with the United States Department of Transportation
Federal Highway Administration

Table Of Contents

VICINITY MAP



PROJECT SITE

INTRODUCTION

Bridge expansion joints pose a special problem in the Washington State Department of Transportation (WSDOT) Bridge Deck Management System. These devices are subject to repeated heavy dynamic loading, and premature failure has occurred in many cases. Delaminations in the deck concrete adjacent to the expansion joints, caused by salt contamination, are common. Construction is also a problem. The ability to place concrete with good consolidation around the expansion joint requires careful quality control in the field. If voids are found in the concrete behind the expansion dam, epoxy injection is necessary to restore the integrity of the joint anchorage.

It is WSDOT policy, as part of the Bridge Deck Management System, to make expansion joints watertight, allowing surface water to run off the deck to the bridge drains. This is to prevent water and contaminants from leaking onto the substructure and causing corrosion and appearance problems.

The Ceva Prefabricated Joint System uses two relatively new products that appear to enhance the service life of the expansion joint and make it watertight: 1.) Ceva-Crete is an elastomeric concrete that is poured-in-place to bond the steel expansion joint system to the deck. The expansion joint system employs a steel nosing, but no reinforcement extends between the elastomeric concrete and the existing deck concrete. The Ceva-Crete is reported to have the ability to resist wear and the impact loads from heavy trucks. The material also resists environmental detriments. 2.) The Evazote 50 expansion joint seal material, which is installed between the steel nosings (see Appendix A), is designed to withstand relatively large repetitive joint movements. Its wear and non-corrosion properties are claimed to be excellent, and it is resistant to oils and greases. Its resilience is reported to cause rocks and dirt to bounce off.

The purpose of this experimental project was to gain knowledge about the effectiveness of the Ceva-Crete Expansion Joint System over time and to gain knowledge about field installation techniques for use on future contracts.

STUDY SITE

Martin Way O'xing 5/337 E & W in the Olympia area was selected as the site for an experimental installation of the Ceva-Crete Expansion Joint System. Both east and west structures were widened and a 1-1/2 inch thick Latex Modified Concrete overlay was installed over the entire deck. The existing and new transverse joints both received a Ceva-Crete Expansion Joint system. A total of 664 lineal feet of transverse joint was installed.

CONSTRUCTION SUMMARY

The project, Sleater Kinney to Martin Way Interchange, included replacement of the existing expansion joints with the Ceva 300 System. As shown in Appendix B, the system consisted of an angle iron nosing, sinusoidal anchoring system of #4 rebar, Ceva-Crete concrete, and an Evazote 50 compression seal. Total contract costs were $105.85 per lineal foot.

A manufacturer's representative was on the site during all installation of the Ceva 300 Joint System. In most situations, the contractor followed the manufacturer's advice and directions.

CONCLUSIONS AND RECOMMENDATIONS

The inspection form "Bridge Deck Joint Device Performance Record" from the FHWA Experimental Project No. 5, Bridge Deck Expansion Joints (Appendix D) was used to rate the final inspection of the joint. Also shown is the evaluation procedure used in the FHWA project. The evaluation is based on a visual inspection.

The Evazote 50 expansion seal was debonding from the steel nosing in some areas. The seal had surface wear in the wheel paths and seemed to be loosing its resiliency.

There is a loud metal clanging noise on one bridge as traffic passes over the joint. The metal nosing is probably banging on the sinusoidal rebar due to a weld failure between the metal nosing and the sinusoidal rebar. This would have to be verified by a much more in-depth inspection.

An underside inspection of the joints showed water stains on the concrete where the joints were leaking. The metal nosing and the elastomeric concrete appeared to still be in good condition.

The overall rating of the joints was 2.57, which is less than a poor rating of 3.5 per the FHWA evaluation procedures. The 2.57 rating is also less than the 3.68 average rating for compression seals in the FHWA report.

In December 1992, WSDOT surveyed the other Departments of Transportation by AASHTO electronic mail in regard to the performance of the Evazote 50 material. Half of the respondents indicated a problem with the material debonding from the header. The Evazote 50 material was also installed by WSDOT in 1987 on the Lake Valley Road O.C., Bridge No. 90/124N. Considerable debonding and water leakage is evident. When compared to other bridge deck joint devices listed in the FHWA report, this system does not appear to be a better system.

Appendix A
Manufacturer Recommended Installation Procedures

INSTALLATION PROCEDURE FOR CEVA CRETE ELASTOMERIC CONCRETE AND EXPANSION JOINT

---

1. Set up necessary traffic control.

2. Saw cut new asphalt to exact plan dimensions checking both width and depth against contract documents or to "sound" concrete. Remove all waste asphalt keeping vertical edge neat.

3. Place Ceva 300 System into saw cut area.

4. Level and set joint opening as per plan specification making sure spacer bolts are tightly fastened. (Angle iron might shift during first stages of installation if spacer bolts are not tightly secured.)

5. Sandblast all surfaces of steel, concrete, and asphalt against which Elastomeric Concrete is to be placed. Remove all loose material.

6. Prepare the primer by mixing one part "A" to one part "B", then add 20% Xylene, then mix well and brush. (Note: Approximately 1/2 gallon of "A" with 1/2 gallon of "B" and 20% Xylene will prime all needed surfaces of a 40 foot joint. Rubber gloves should be worn by all persons working with or near the material.)

7. Prime vertical edge and steel areas to be in contact with Elastomeric Concrete. Existing horizontal concrete surface not to be primed.

8. Mix 2 1/2 gallons "A" with 2 1/2 gallons "B" in a clean 5 gallon pail until there is no marbling effect in the material. This should take about five minutes with a good drill or paddle.

9. Put one five gallon pail with aggregate into your mixer. A smaller electric type mixer will work better than a large concrete mixer. After putting in the one pail of aggregate, add the <u>mixed</u> Ceva Resin. Next, add another five gallon pail of aggregate. You will now have one part mixed resin to two parts aggregate. (5 gallons to 10 gallons.) On cool or windy days, warm the aggregate to an average mixing temperature of 110-120°F, and Resin to 80-90°F before mixing to aid in the ease of mixing. Outer edge of aggregate pail will be much warmer than center of pail. Average temperature should be 110°-120°F. This can be done in the heating chamber on the job. Allow the material to mix in the

mixer until there is no "dry" aggregate. The Ceva Mix should be uniformly black before dumping into a wheel barrow. Be sure the primer has been properly applied as stated in Note 7 above.

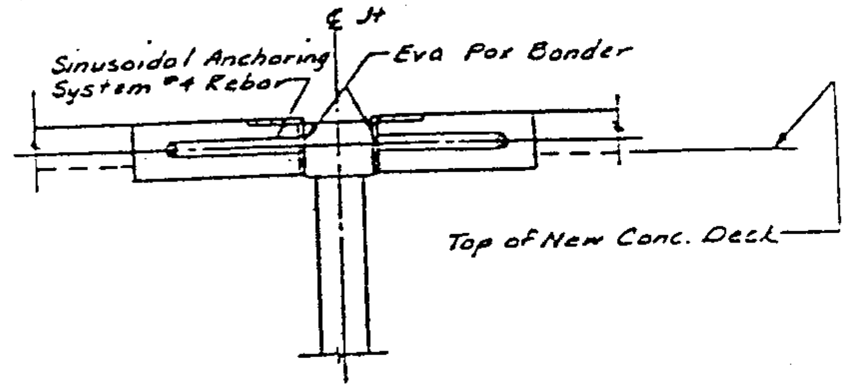
10. Dump the properly mixed Ceva Crete into the prepared area behind the expansion joint, making sure that it is thoroughly packed under all steel areas and anchors (i.e., using piece of rebar) trowel smooth. (Approximate pot life on mixed Ceva Crete is 20-30 minutes.)

11. Continue with additional batches of Ceva Crete to fill void area.

12. Place heating chamber over entire poured joint and heat to an average temperature of 150°-170°F for a minimum of 2 hours.

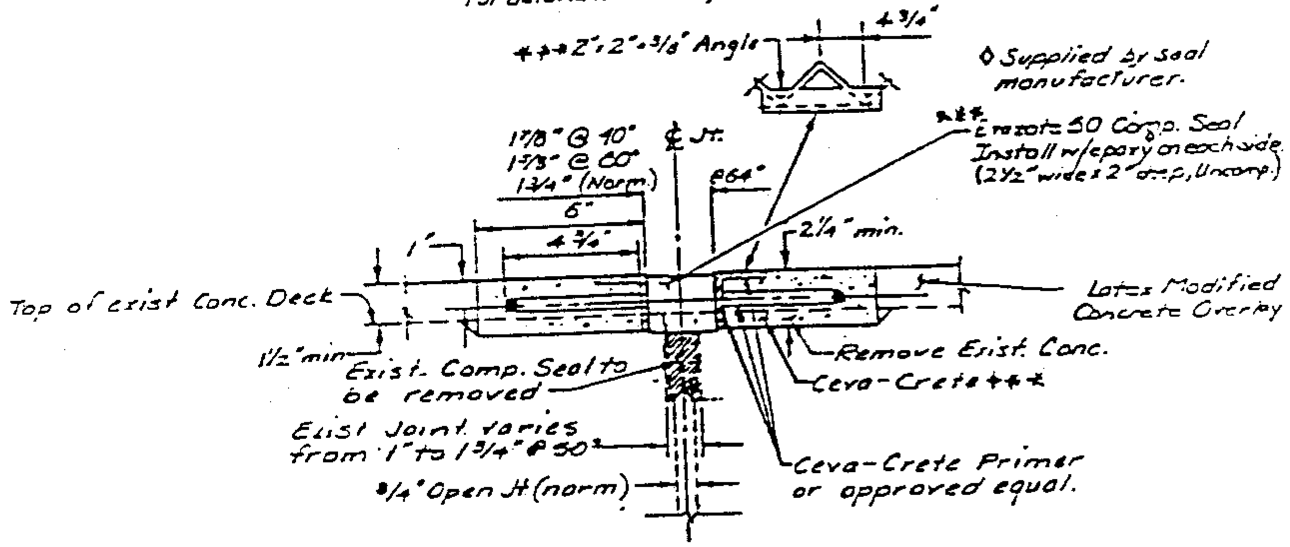
13. Let Ceva 300 Joint System cool for 1 hour before resuming traffic flow.

Appendix B
Plan and Installation Details



NEW JT.

For details not shown, see below

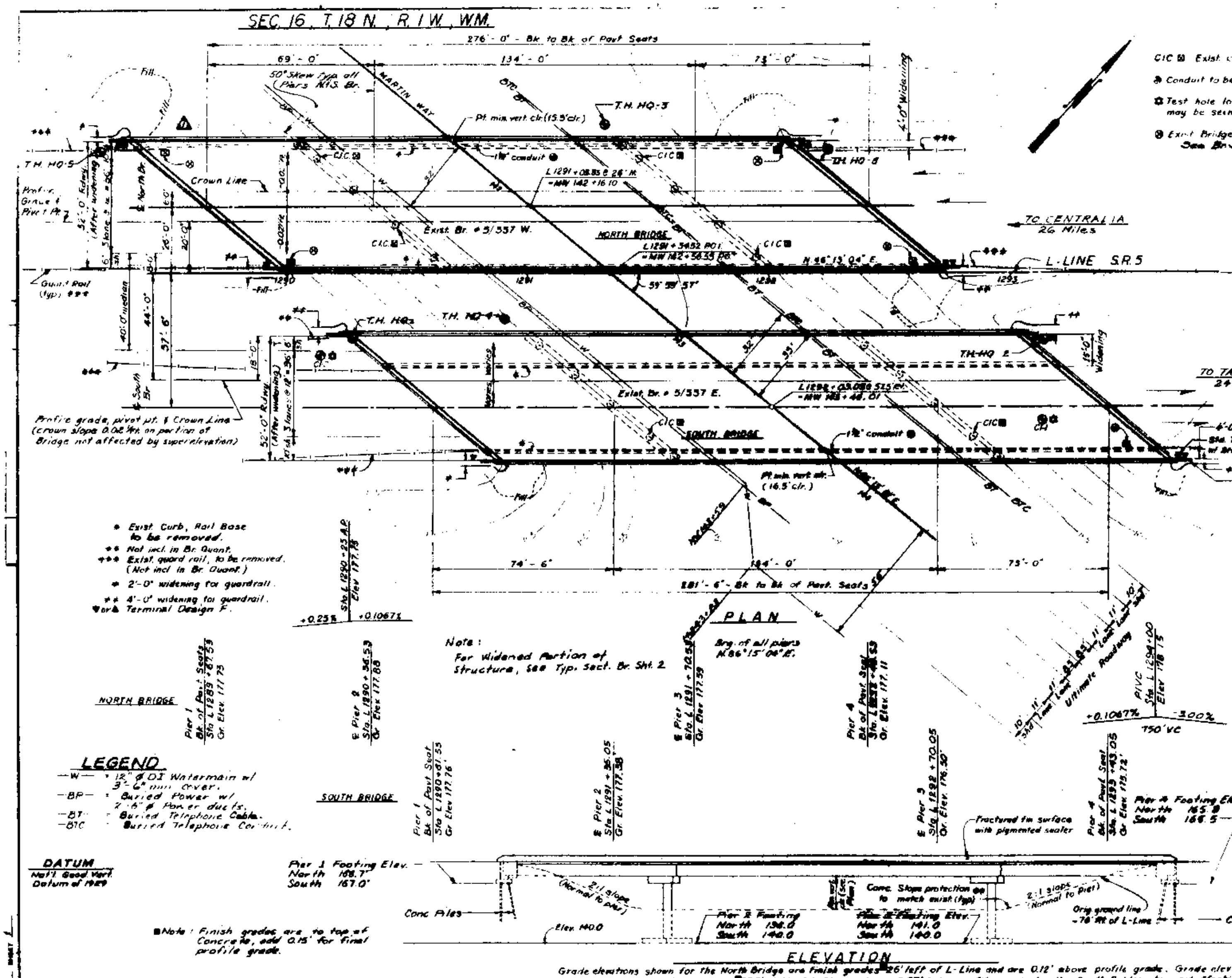


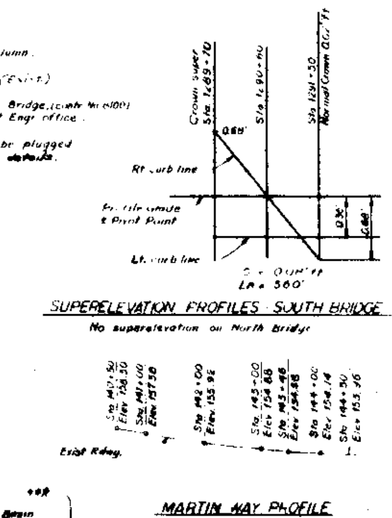
*** CEVA 300 System

EXISTING JT.

SECTION THRU DECK JOINT

Appendix C
Bridge Plan





Grade elevations shown for the North Bridge are finish grades 26' left of L-Line and are 0.12' above profile grade. Grade elev. shown for the South Bridge are finish grades 57.5' right of L-Line and are 0.87' below profile grade for the South Bridge where not affected by superelevation.

GENERAL NOTES

ALL MATERIAL AND WORK SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE STATE OF WASHINGTON, DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, DATED 1984.

THE WIDENING PORTION OF THIS STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH THE REQUIREMENTS FOR SERVICE LOAD DESIGN, 1983, AASHTO SPECIFICATIONS.

FOOTING ELEVATIONS AND SUBSTRUCTURE DETAILS ARE SUBJECT TO CHANGE DEPENDING UPON FOUNDATION MATERIAL ENCOUNTERED. REINFORCING STEEL FOR THE FOOTINGS, COLUMNS, ABUTMENT WALLS AND WINGWALLS SHALL NOT BE CUT UNTIL FINAL FOOTING ELEVATIONS HAVE BEEN DETERMINED IN THE FIELD.

ELEVATIONS SHOWN ON THE PLANS ARE BASED ON FIELD MEASURED ELEVATIONS FOR THE EXISTING STRUCTURE. THE NEW CONSTRUCTION IS INTENDED TO MATCH THE EXISTING STRUCTURE, THEREFORE, ELEVATIONS GIVEN ON THE PLANS SHALL BE VERIFIED IN THE FIELD, AND SHALL NOT BE USED UNTIL THEIR COMPATIBILITY WITH THE EXISTING STRUCTURE IS CHECKED.

THE CONCRETE IN THE FOOTINGS OF ALL PIERS SHALL BE CLASS B MIX. ALL OTHER CAST-IN-PLACE CONCRETE SHALL BE CLASS AX MIX, EXCEPT WHERE SPECIFICALLY SHOWN OTHERWISE ON THE PLANS.

THE ROADWAY SLAB SHALL NOT BE CAST UNTIL AT LEAST 24 HOURS HAS ELAPSED AFTER THE DIAPHRAGMS HAVE BEEN POURED. THE TRAFFIC BARRIER SHALL BE POURED AFTER ALL OTHER CONCRETE HAS BEEN IN PLACE THE REQUIRED LENGTH OF TIME AND HAS DEVELOPED SUFFICIENT STRENGTH AS OUTLINED IN THE SPECIFICATIONS, AND FALSEWORK HAS BEEN REMOVED AT PIER 2 AND 3. FALSEWORK SHALL BE CAREFULLY RELEASED TO PREVENT IMPACT OR UNDUE STRESSES IN THE STRUCTURE.

THE MAXIMUM DESIGN SOIL PRESSURE PER SQUARE FOOT IS FIVE (5) TONS FOR PIER 2 AND FOUR (4) TONS FOR PIER 3 NORTH BRIDGE AND FIVE (5) TONS FOR PIERS 2 AND 3 SOUTH BRIDGE.

EACH PILE SHALL BE DRIVEN A SUFFICIENT DEPTH TO DEVELOP A MINIMUM LOAD BEARING CAPACITY AS FOLLOWS: FIFTY-FIVE (55) TONS FOR PIERS 1 AND 4 SOUTH BRIDGE.

UNLESS OTHERWISE SHOWN ON THE PLANS, CONCRETE COVER MEASURED FROM THE FACE OF THE CONCRETE TO THE FACE OF ANY REINFORCEMENT BAR SHALL BE 2" AT THE TOP OF THE ROADWAY SLAB, 1" AT THE BOTTOM OF THE ROADWAY SLAB, 2 1/2" AT THE BOTTOM OF FOOTINGS WITHOUT PILES, 8 1/2" AT THE BOTTOM OF FOOTINGS WITH PILES AND 1 1/2" AT ALL OTHER LOCATIONS.

P.S. GIRDER WIDENING
LOADING: HS-20 OR TWO 24K AXLES @ 4' CTRS.

Bridge Design Engineer	[illegible]	10-85
Supervisor	[illegible]	2-85
Designed By	H. Bruesch	1-85
Designed By	H.J. Hooper	5-85
Checked By	T.M. Moore	5-85
Detailed By	S.V. Nguyen	7-84
Architect	R. MHIS	6-85
Preliminary Plan By	H.K. Yates	7-84

DATE	REVISION	BY	APP'D
4/86	△ Removed over head power		

REGION NO.	STATE	FED. AID PROJ. NO.
10	WASH	I-IR-5-2(150)

JOB NUMBER 86W018
CONTRACT NO. 3130

BRIDGES AND STRUCTURES

March 14, 1986 APPROVED

Washington State Department of Transportation

SR 5
SLEATER KINNEY TO MARTIN WAY INTERCHANGE
MARTIN WAY O'XING 5/557 E & W
LAYOUT

BRIDGE SHEET NO. 1
SHEET 77 OF 118 SHEETS

JOB NO. 1674 SHEET 1

DOT FORM 221-013 Revised 6/83

Appendix D
Bridge Deck Joint Device
Performance Record

Bridge Deck Joint Device Performance Record

Sheet of

Data Sheet for Experimental Project: EP-5

State: Washington State DOT

Report Date: December 1993

Joint Device Identification: Bridge No. 5/337 Martin Way O'Xing Ceva-Crete Expansion Joint System

Bridge Data						Joint Data							Joint Rating						
Location (SIA)*	Was NEEP11 Project? Yes/No	ADTT (Trucks)	Spans No.	Spans Total Length Ft.	Age Years	Skew Angle Degrees	Contributing Length Feet	Theoret. Mov'nt Inches	Make Model	Date of Install.	Location P (Pier) A (Abut.)	Eng. Est. of Unit Cost in Place: $/LinFt	A	B	C	D	E	F	G
08100 A	No	6200	3	276	5	45	276	1/2	Ceva	7/88	P, A	$160	4.0	3.0	4.0	3.0	3.0	3.0	3.0
08100 B	No	6200	3	281	5	45	281	1/2	Ceva	7/88	P, A	$160	4.0	0.0	4.0	1.0	3.0	0.0	1.0

Remarks, Additional Info., Recommendations:

A = General Appearance
B = Anchorage, Condition of
C = Debris Accumulation
D = Watertightness
E = Surface Damage
F = Noise Under Traffic
G = Ease of Maintenance
Rating by Number: 5-0
5 = Excellent 0 = Failure

*Note: Use Bridge Inventory Identification

EVALUATION PROCEDURES

Each bridge deck expansion joint was evaluated and rated for the following categories:

A. General Appearance

B. Condition of Anchorage

C. Debris Accumulation

D. Watertightness

E. Surface Damage

F. Noise Under Traffic

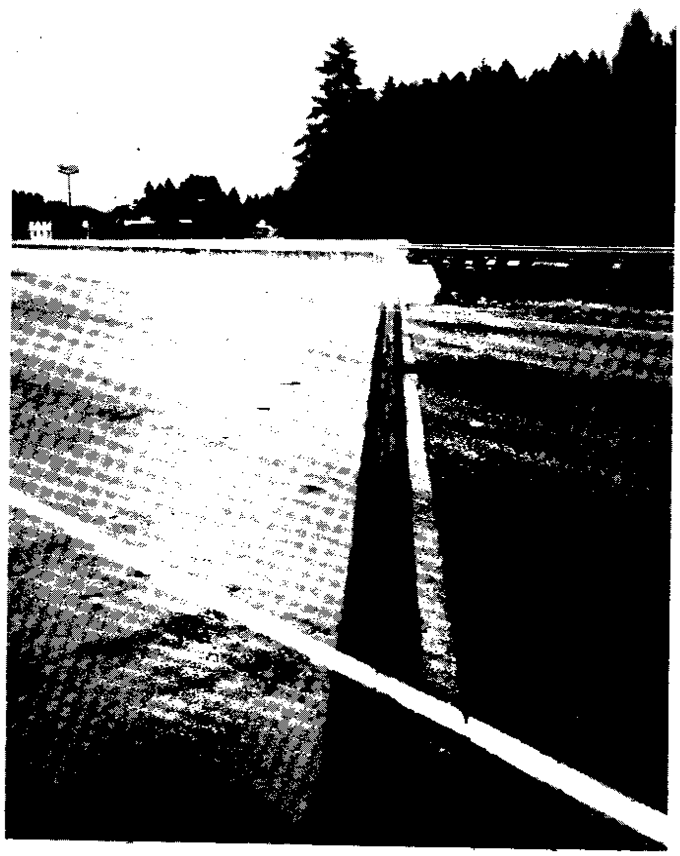
G. Ease of or Need for Maintenance

A numerical rating system, ranging from 0 to 5, was developed and was assigned to each category by the State personnel conducting the evaluation. Each State participating in the project was furnished a description of each numerical rating for the corresponding category. A rating of 5 indicates nearly new condition or no problems while a rating of zero indicates a complete failure of the particular category. The descriptions for the rating criteria are attached to this report.

The average ratings listed in Tables 8-11 can be classified by using the following general condition criteria:

Poor	< 3.50
Fair	3.50 to 3.89
Satisfactory	3.90 to 4.29
Good	4.30 to 4.69
Excellent	> 4.70

Appendix E
Final Inspection Photographs



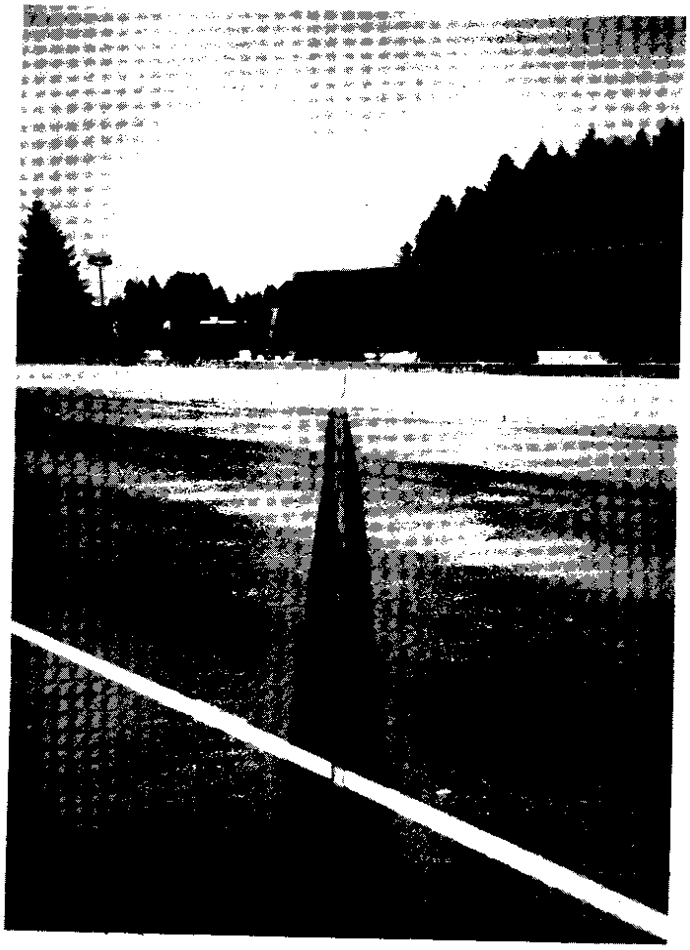
Ceva-Crete Expansion Joint System

at End Pier

Close-Up of

Ceva-Crete Expansion Joint System

at End Pier



Ceva-Crete Expansion Joint System

at Intermediate Pier

Close-Up of

Ceva-Crete Expansion Joint System

at Intermediate Pier