

PROJECT TITLE:

RPFP-13-CONC-1: Evaluation of Concrete Parapets with Attachments (Illinois)

STATE’S PROBLEM STATEMENT:

The AASHTO LRFD Bridge Design Specifications has design requirements for traffic/bicycle-pedestrian combination railings. However, the AASHTO and AREMA codes do not have design requirements or criteria for debris fences mounted on top of a concrete parapet. Individual railway companies do have basic geometric criteria for which the Illinois DOT has been requested to satisfy.

Over the past 20 years, there has been extensive research on the crash testing of traffic barriers, including under NCHRP Report 350, entitled “Recommended Procedures for the Safety Performance Evaluation of Highway Features”. Unfortunately, a vast majority of this research and testing has concentrated almost exclusively on traffic barriers alone. There is a need for the testing of typical attachments to these traffic barriers, in particular, metal railings, bicycle rails, and protective fencing/screening. To date, these attachments are installed on concrete parapets throughout the country. If other devices are installed on a crash tested parapet, there is concern that the safety performance of the barrier may be degraded, thus putting the traveling public in danger and making the bridge owners potentially liable for injuries related to impacts with these barriers.

The Illinois Department of Transportation has developed a design detail for one such debris fence for use attached to a 34-in. tall New Jersey shape concrete parapet, as shown in Figure 1 through Figure 4. A need exists to evaluate this debris fence according to the MASH Test Level 4 safety guidelines.

BACKGROUND:

Limited crash testing exists on debris fences attached to concrete parapets. TTI researchers successfully crash tested a debris protection fence attached to a New Jersey safety shape concrete barrier according to the AASHTO PL-2 performance criteria. The full-scale crash testing of this system was limited to a pickup truck vehicle and did not consider a heavy, single-unit truck. Further modifications were made to the PL-2 protection fence system to accommodate concerns when considering its use under NCHRP 350 TL-3 pickup truck impacts. To date, no debris fence designs mounted on concrete parapets have been tested to TL-4 according to MASH.

OBJECTIVE:

The objective of this research effort is to evaluate the Illinois Department of Transportation debris fence when mounted on a 34-in. high New Jersey shape concrete parapet, according to the TL-4 safety performance criteria found in MASH.

RESEARCH PLAN:

The research effort will consist of one full-scale crash test to evaluate the Illinois Department of Transportation debris fence when mounted on a 34-in. high New Jersey shape concrete parapet. MwRSF will prepare CAD details of the debris fence and parapet design. The concrete parapet and debris fence will then be constructed at MwRSF’s outdoor testing facility. Full-scale crash testing will consist of test designation no. 4-12 on the concrete parapet and debris fence using a 10000S vehicle. MwRSF will document and analyze the test results and prepare a summary report with recommendations for future research based on the performance of the system.

Major Task List

Phase 1

Design: Selection of final debris fence design for testing.

CAD:	Prepare CAD details of the debris fencing attached to 34-in. high New Jersey shape concrete parapet.
Construction:	Construction of debris fencing attached to 34-in. high New Jersey shape concrete parapet for full-scale crash testing.
Full-Scale Crash Testing:	MASH test designations 4-12 (10000S).
Summary Report:	Prepare summary report of testing, evaluation of the attachment to concrete parapets, and recommendations for further research.

BENEFITS:

Evaluation of the Illinois Department of Transportation debris fence mounted on a concrete parapet will determine if the design is crashworthy and will benefit all State DOTs by providing insight on the design and implementation of other debris fence designs.

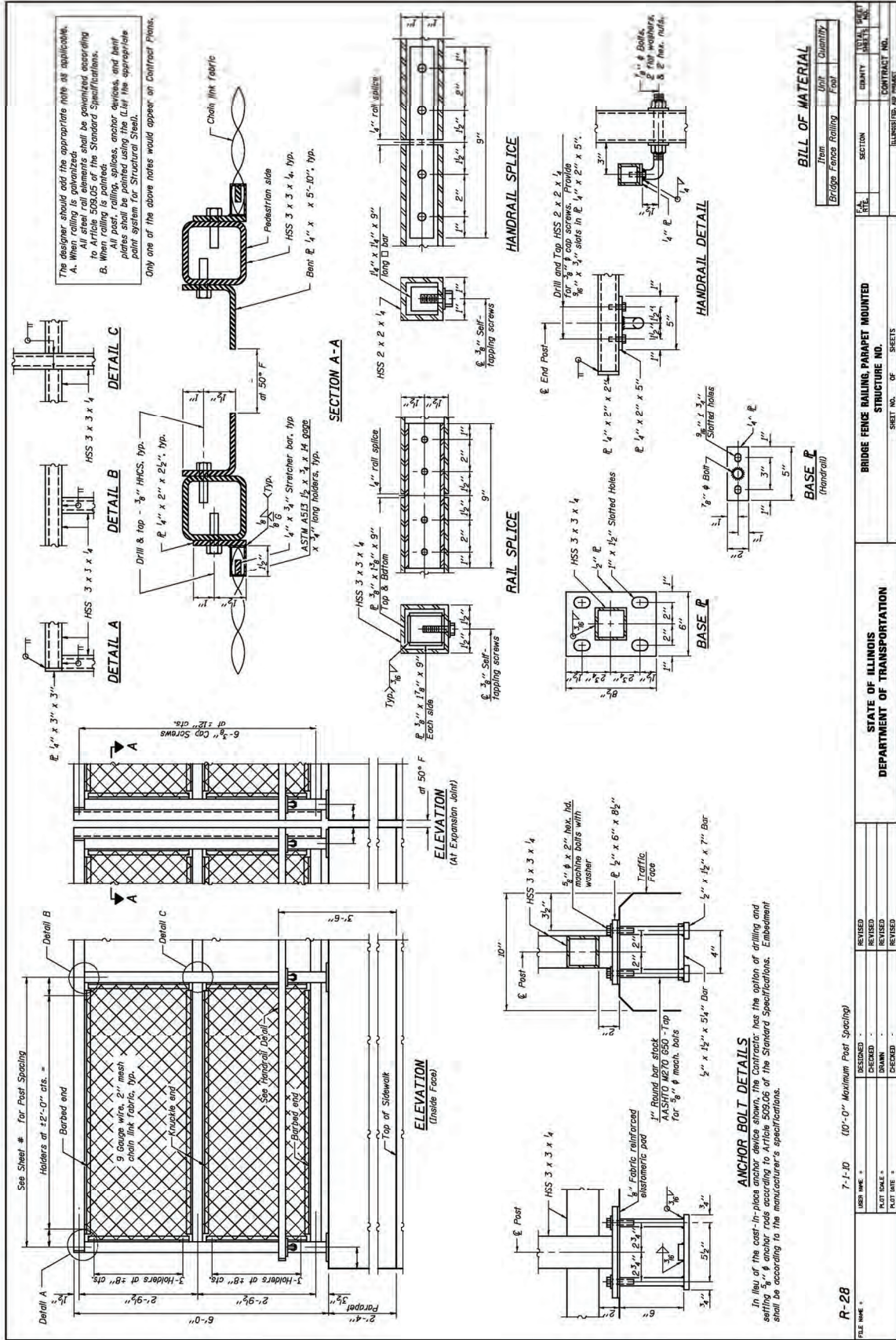
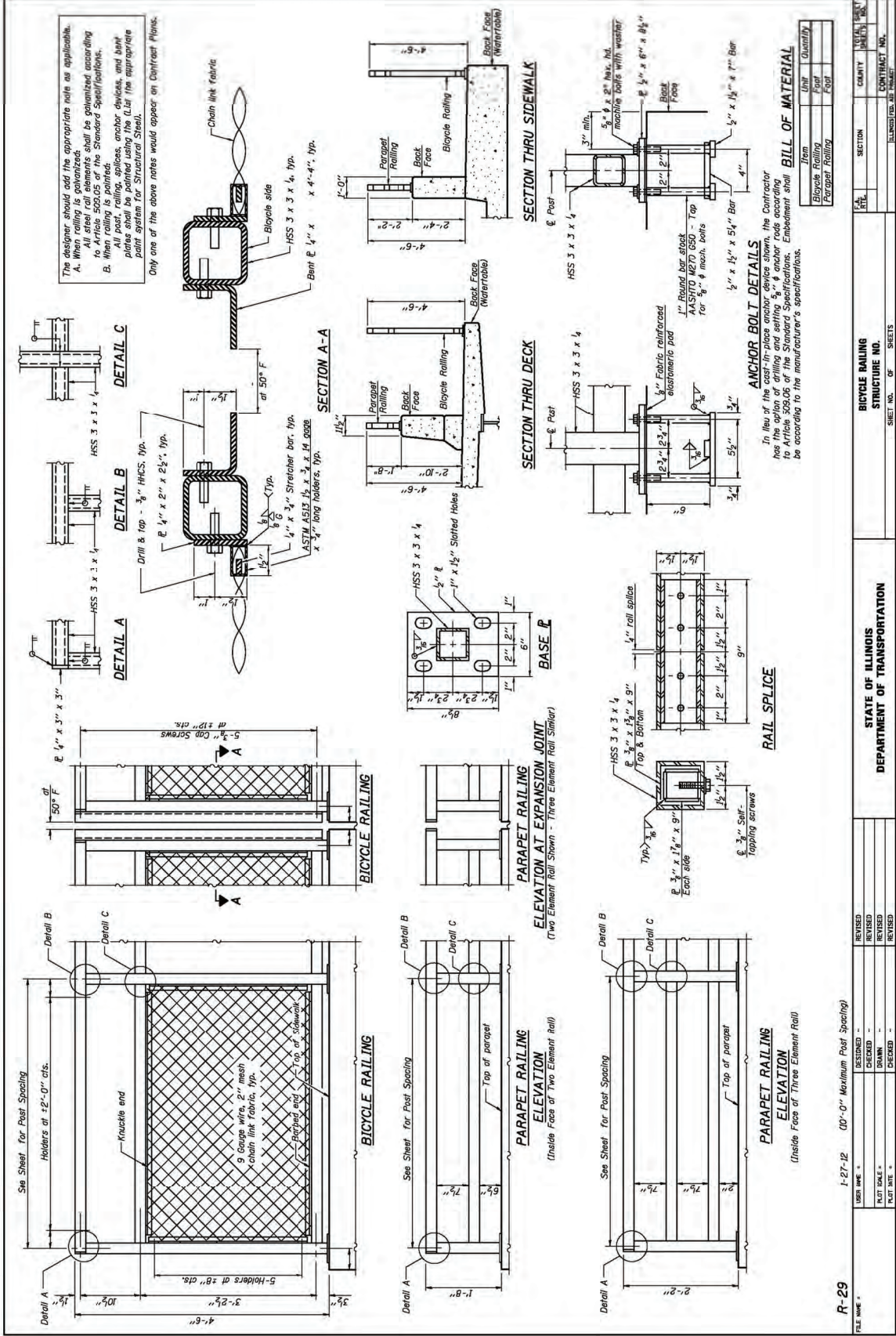


Figure 1. Bridge Fence Railing, Parapet Mounted



BILL OF MATERIAL

Item	Unit	Quantity
Bicycle Railing	Foot	
Parapet Railing	Foot	

R-29 FILE NAME * I-27-12 (0'-0" Maximum Post Spacing)

DESIGNED -
 CHECKED -
 DRAWN -
 PLOT DATE *
 PLOT TIME *

REVISED -
 REVISED -
 REVISED -
 REVISED -

STATE OF ILLINOIS
 DEPARTMENT OF TRANSPORTATION

BICYCLE RAILING
 STRUCTURE NO. _____ SHEET NO. _____ OF _____ SHEETS

SECTION CAVITY SHEET NO. _____ CONTRACT NO. _____ ILLUSTRATED BY: _____

Figure 2. Bicycle Railing

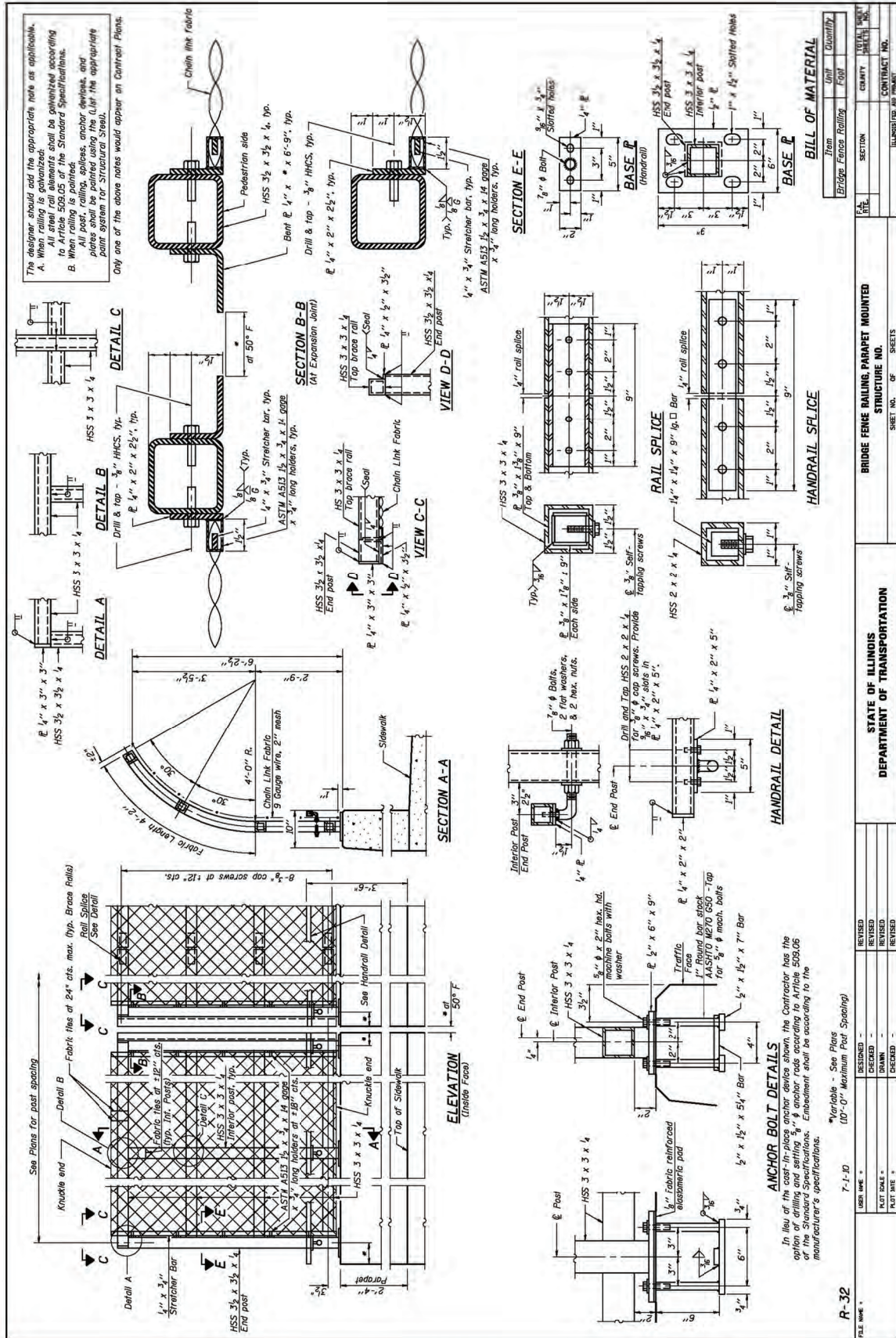


Figure 3. Bridge Fence Railing, Parapet Mounted

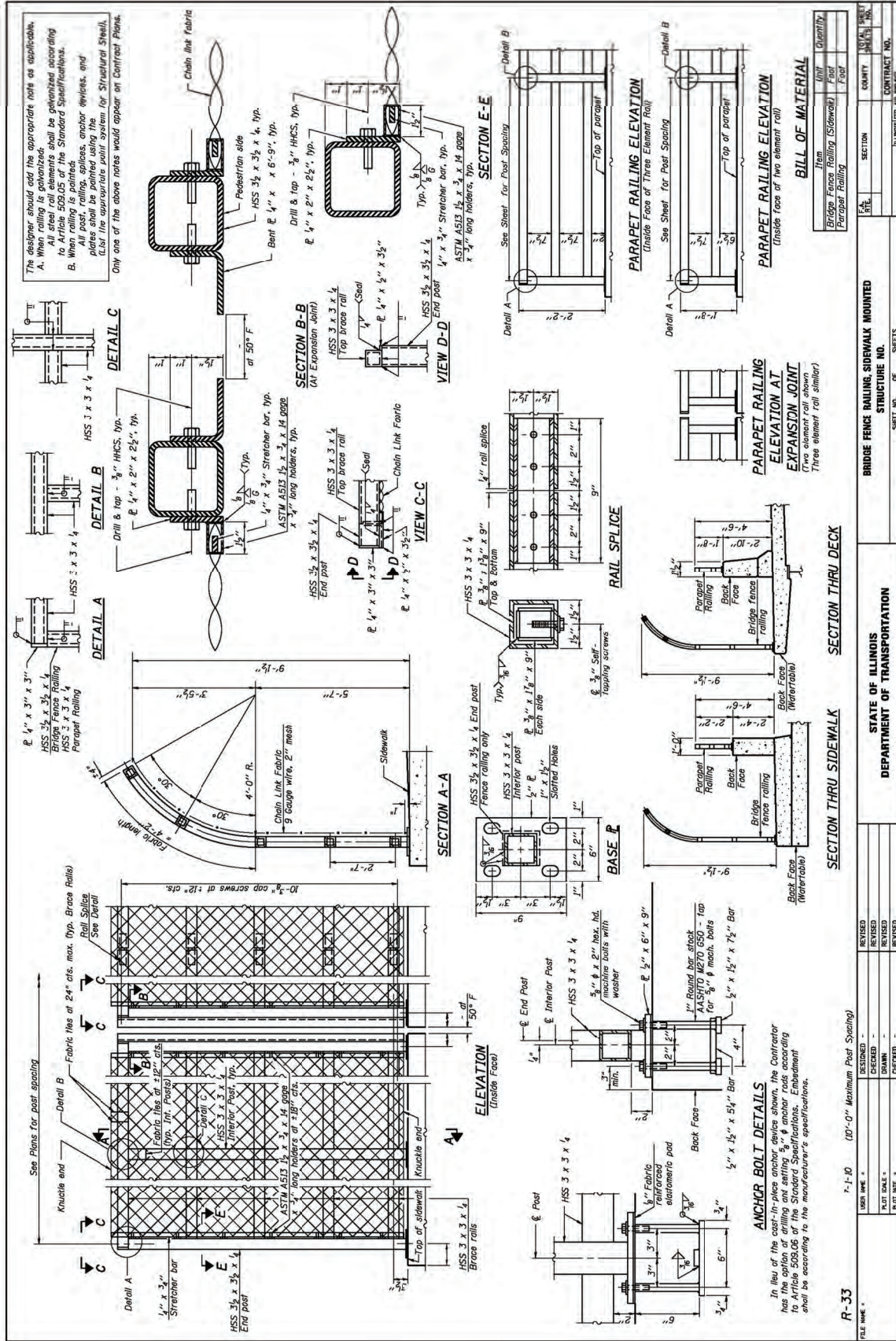


Figure 4. Bridge Fence Railing, Sidewalk Mounted

Item Description	Project Management and Correspondence, Selection of Final Debris Fence System, Preparation of CAD Details, and Design Testing, & Research Recommendations Costs (\$)	Acquisition of Tall Debris Fence & RC Barrier Materials, Construction of RC Barrier & Installation of Debris Fence, and Removal and Disposal of Hardware Costs (\$) (2)	Test No. 1 10000S Single-Unit Truck 10000-kg - 90 kph - 15 deg MASH - CIP TBD Costs (\$)	Total Costs (\$)
Labor Operating Costs (1) (3)	\$16,842	\$30,027	\$42,449	\$89,318
Testing (4)				
Operating	\$900	\$1,150	\$7,000	\$9,050
Materials & Supplies	\$300	\$24,250	\$14,100	\$38,650
Travel				\$0
Subtotal Costs	\$18,042	\$55,427	\$63,549	\$137,018
Overhead Costs 10%	\$1,804	\$5,543	\$6,355	\$13,702
Total Project Costs	\$19,846	\$60,970	\$69,904	\$150,720

Note (1) - Includes administrative labor costs calculated as 2.4% of direct costs.

Note (2) - Construction materials and equipment costs: \$17,050.

Acquisition of tall debris fence hardware (TBD): \$80/ft x 120 ft = \$9,600 (estimate only).

Concrete Materials - \$3,500.

Steel Rebar Materials - \$2,750.

Wood/Steel Formwork Materials - \$2,500.

Epoxy Adhesive Materials - \$500.

Miscellaneous Hardware - \$750.

Construction Equipment - \$2,000.

Shipping - \$3000.

Note (3) - Billed as labor service charge.

Note (4) - Billed as test service charge.

Table 1. RFP-13-CONC-1: Evaluation of Concrete Parapets with Attachments (Illinois)