

**EXPERIMENTAL CONCRETE AND
BITUMINOUS SHOULDERS**

Progress Report



**MICHIGAN DEPARTMENT OF
STATE HIGHWAYS AND TRANSPORTATION**

**EXPERIMENTAL CONCRETE AND
BITUMINOUS SHOULDERS**

Progress Report

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**A Category 2 project conducted in cooperation
with the U. S. Department of Transportation,
Federal Highway Administration**

**Research Laboratory Section
Testing and Research Division
Research Project 72 F-126
Research Report No. R-1035
Work Plan No. 13**

**Michigan State Highway Commission
Peter B. Fletcher, Chairman; Carl V. Pellonpaa,
Vice-Chairman, Hannes Meyers, Jr., Weston E. Vivian
John P. Woodford, Director
Lansing, December 1976**

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Introduction

This report is an update of MDSHT Research Report R-943 (October 1974) concerning experimental concrete and bituminous shoulders. Cost information is given for all projects included in the work plan that were finally built as projected at the time the work plan was prepared.

Several experimental installations of improved shoulder design have been made, such as the project on I 69 southwest of Charlotte, where two improved bituminous shoulder types and a portland cement concrete shoulder are being compared with the standard freeway shoulder. Performance of the experimental shoulders to date shows a marked improvement over the standard 170 lb/sq yd bituminous aggregate shoulders on that project.

Construction details, procedures, initial costs, instrumentation, and methods of measurement have been previously reported for the I 69 shoulders in MDSHT Research Reports R-844 (January 1973) and R-898 (February 1974).

The purpose of this study is to determine the relative cost of the portland cement concrete and improved bituminous stabilized shoulders on several projects.

Qualitative evaluations of the condition and performance of the two types of shoulders in the various locations will be made and reported on at a later date. The shoulders will be evaluated by condition surveys, noting the amount of cracking, and other observable deterioration.

Scope

Twenty-nine projects had been tentatively selected for installation of portland cement concrete and improved bituminous stabilized shoulders. Of the 29 projects only 20 will be reported on (Table 1). Because of the combination of some projects, nine have been eliminated.

Design details for the shoulders are shown in Figures 1 through 3.

Cost

Unit bid prices for the shoulders have been determined and tabulated for each project in Table 1. Since there are no control sections--as such--in each project, direct quantitative comparisons will not be made.

The cost of portland cement concrete shoulders averaged approximately \$6.40/sq yd including hookbolts, longitudinal, and transverse joints. Note that Project I 82123-01270A let October 20, 1976 uses a different shoulder

TABLE 1
PROJECTS SELECTED FOR IMPROVED SHOULDER DESIGN

Project	Job No.	Description	Letting Date	Shoulder Material	Approximate Quantity, sq yd	Cost, sq yd
I-03035	00024A	I 196, 144th Ave to southeast of Ottawa County Line	4-19-72	Bituminous	52,000	\$3.30
I-82022	04280A	I 94, east of Haggerty to east of Ozra Rd	5-17-72	Bituminous	51,000	4.60
I-03035	00023A	I 196, north of 142nd St to southwest of 144th Ave	7-19-72	Bituminous	68,000	3.10
I-82191	02800A	I 75, Huron Rd to Gibraltar Rd	10-18-72	Bituminous	24,000	4.40
I-82021	05126A	I 94 west of Borgman Rd easterly to west of Morton Rd and I 275 from C&O RR westerly and northerly to south of Huron River Dr, Wayne County	1-17-73	Bituminous	52,000	3.90
I-82021	05125A	I 94, west of Rawsonville Rd to west of Borgman Rd	3-28-73	Bituminous	66,000	3.90
I-82021	05127A	I 94, west of Morton Rd to east of Haggerty Rd	5-16-73	Bituminous	38,000	4.00
I-82293	04742A	I 275, M 153 to Plymouth Rd	2-20-74	Bituminous	70,000	5.10
I-82291 ¹	09904A	I 275, C&O RR north to I 275, I 94 interchange	3-17-76	Bituminous	58,000	4.80
I-82292 ¹	06537A	I 275, Hannan Rd north to PCRR	4-21-76	Bituminous	60,000	4.90
I-82292 ¹	06733A	I 275, PCRR to M 153, US 12 interchange	5-19-76	Bituminous	71,000	4.90
I-25031	04213A	I 75, Maple Rd to north of Arlene Dr, Flint	12-20-72	Concrete	13,000	6.50
I-25032	04215A	I 75, Grand Trunk Western RR to Pasadena Ave	12-20-72	Concrete	23,000	8.50
I-25032	04691A 04990A	I 75, south of M 57 to north of M 54 and M 83	12-20-72	Concrete	61,000	5.90
I-25032	04991A	I 75, Pasadena to south of M 57	12-20-72	Concrete	95,000	5.90
I-82123	04229A	I 96, M 39 east to St. Mary Ave	4-18-73	Concrete	38,000	6.40
I-82122	04533A	I 96, east of US 24 to east of Outer Dr	10-17-73	Concrete	23,000	6.00
I-82122	04534A	I 96, east of Outer Dr to Evergreen Ave	10-17-73	Concrete	46,000	5.90
I-82123	01270A	I 96, St. Mary Ave east	10-24-73	Concrete	65,000	7.30
I-82122 ²	06547A	I 96, west of Newburg Rd east to east of Warren Ct, Livonia	10-20-76	Concrete	77,000	5.50

¹ Note: Let as "Freeway Shoulders."

² Note: Uses revised shoulder design as shown in Figure 3.

cross-section (Fig. 3) which requires 8 percent more concrete than the old design.

Bid prices for the bituminous shoulders were given by the ton up through the 1974 letting. Necessary conversions were made to give a sq yd cost for comparison. Some of the 1976 shoulder construction is let as "Freeway Shoulders" with the bid prices given in sq yd. The contractor has the option of building concrete or bituminous shoulders. Projects I 82291-09904A, I 82292-06537A, and I 82292-06733A were let as "Freeway Shoulders" with the contractor electing to build bituminous shoulders. When let in this fashion the price per sq yd includes all necessary materials needed for the type of shoulder that the contractor elects. Individual unit prices for both concrete and bituminous shoulders are also shown in Table 1.

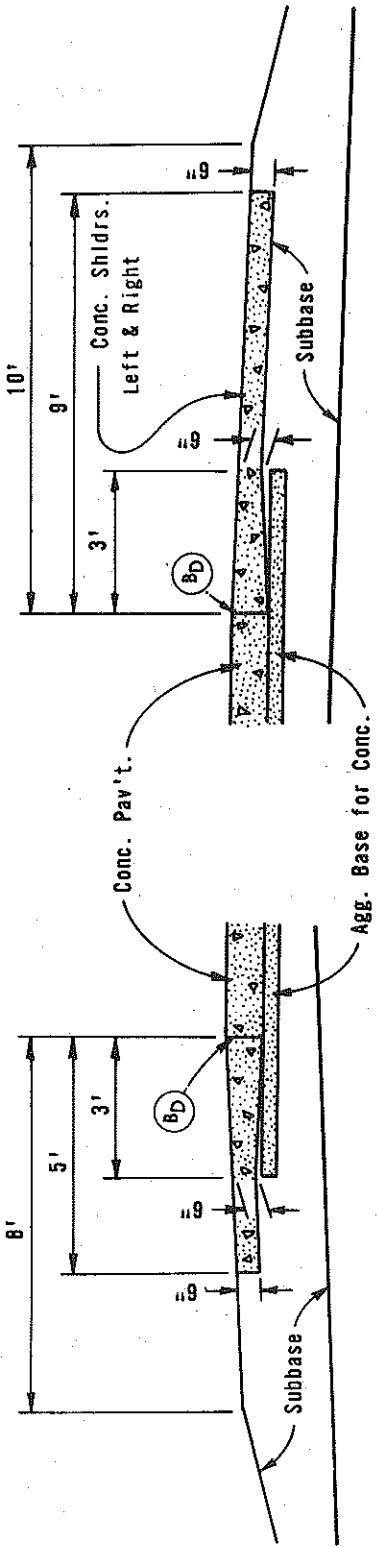
Conclusions

The latest bids on bituminous shoulders show the effect of price increases generated by the energy and inflation problems.

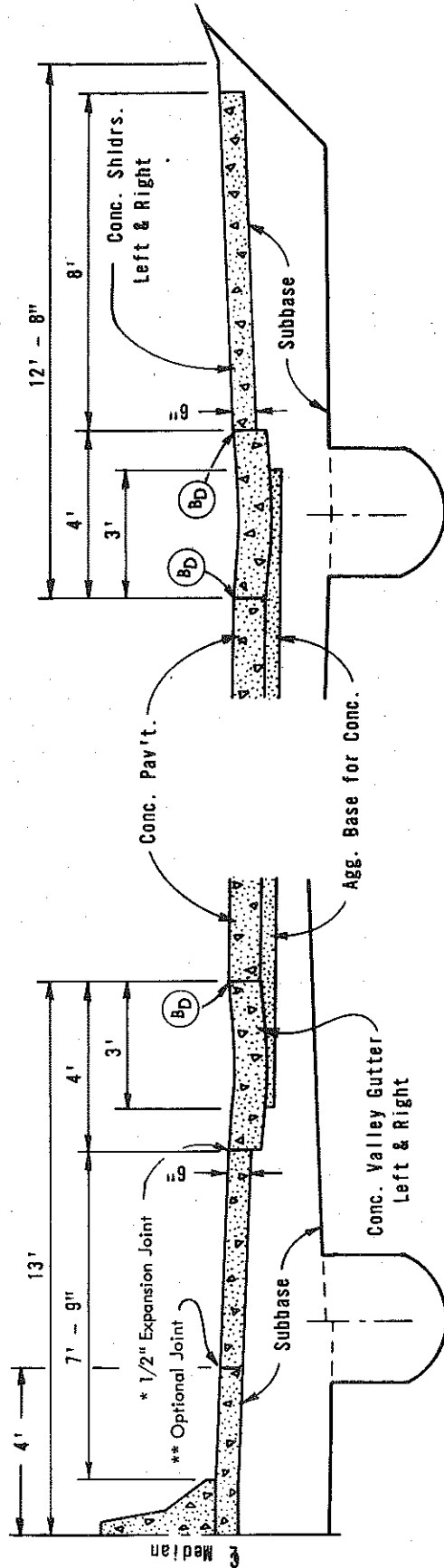
The average cost of concrete shoulders is approximately 50 percent higher than the experimental bituminous shoulders, for the 20 projects covered by this report. However, the projects let during 1976 show only slightly higher costs for concrete than for bituminous, since bituminous prices have increased considerably and concrete prices were lower than for any of the other jobs listed.

Future reports will be issued to cover the condition and performance of the two types of shoulders in the various locations.

CONCRETE PAVED SHOULDERS



RURAL DUAL CONCRETE ROADWAY



URBAN DUAL CONCRETE ROADWAY SECTION FOR CURB & GUTTER SIMILAR

* If contractor elects to pour shoulder monolithically with concrete valley gutter, expansion joint may be omitted where shown and placed at 4' either side of median \bar{c}

** For wider medians, construct bulkhead or plane of weakness joints as shown. For median width shown or narrower, this joint is optional. No hook bolts or lane tie bars required.

Figure 1. Design details for concrete paved shoulders.

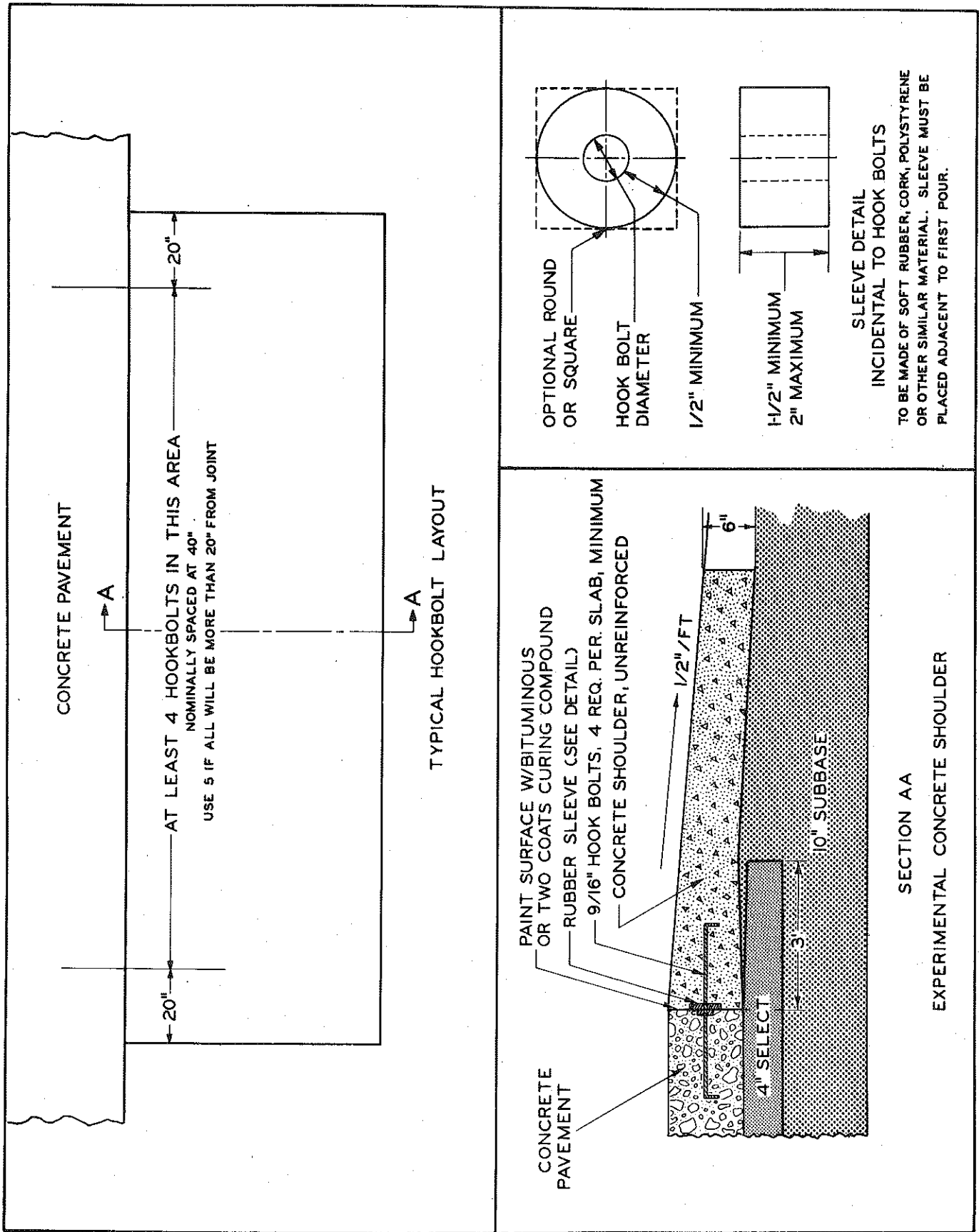
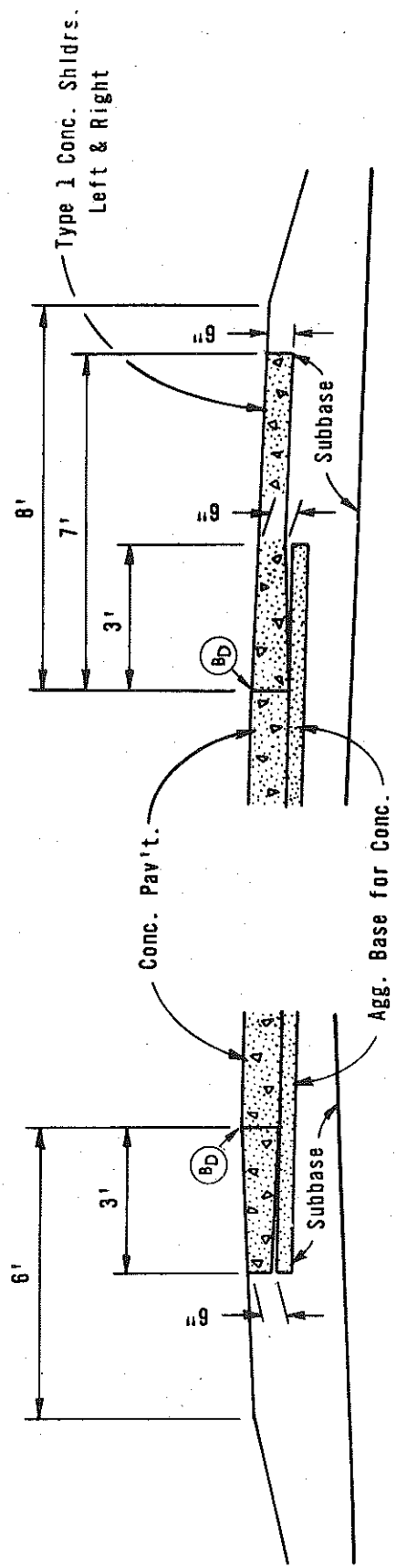
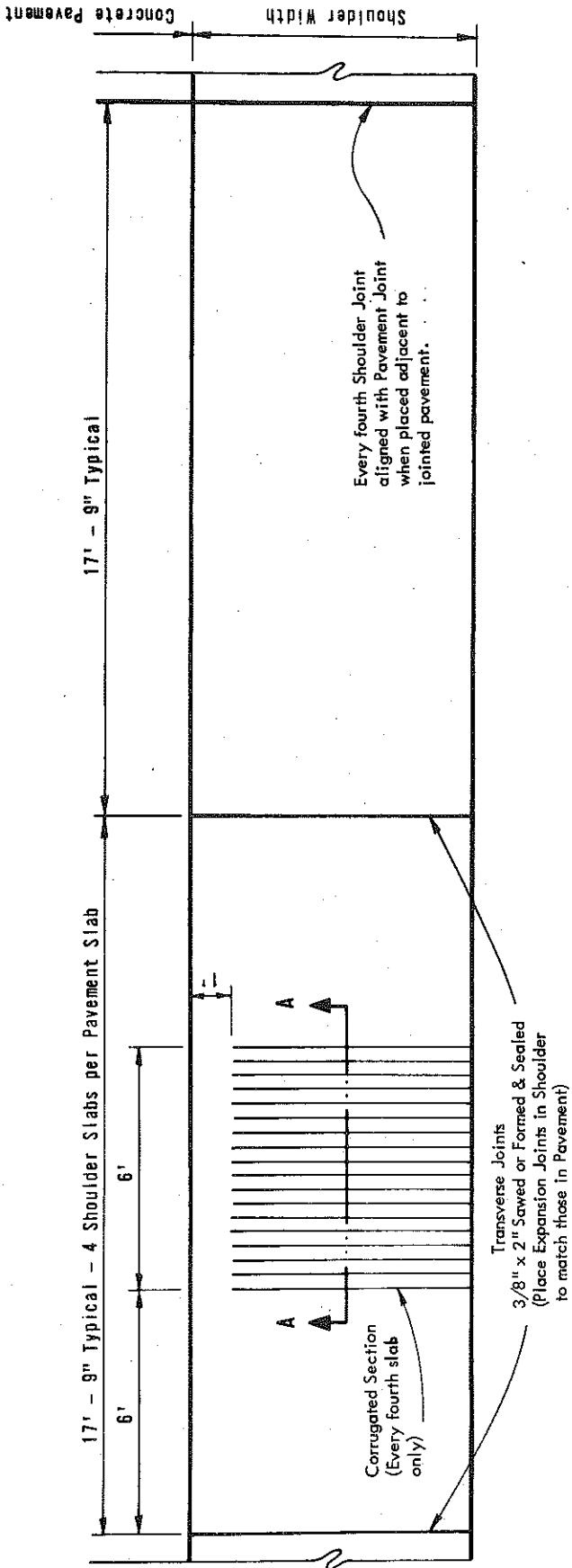


Figure 1 (Cont.). Design details for concrete paved shoulders.



CONCRETE RAMP

Figure 1 (Cont.). Design details for concrete paved shoulders.



CONCRETE SHOULDER JOINT & CORRUGATED SECTION

NOTE: For medians, stop corrugation 6" from Median Barrier.

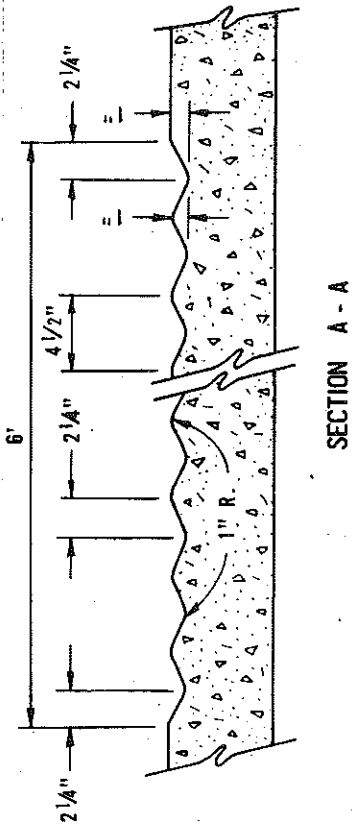
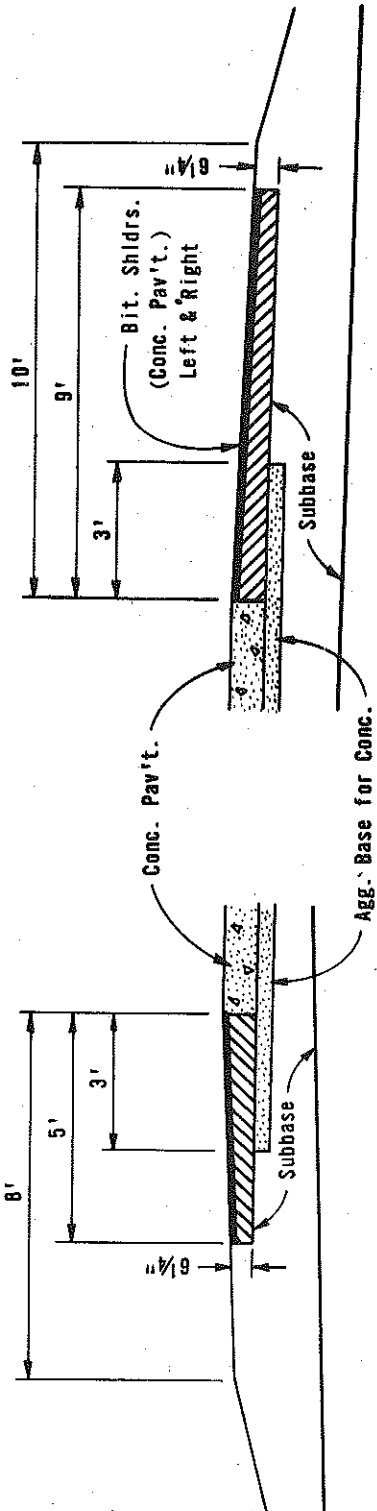
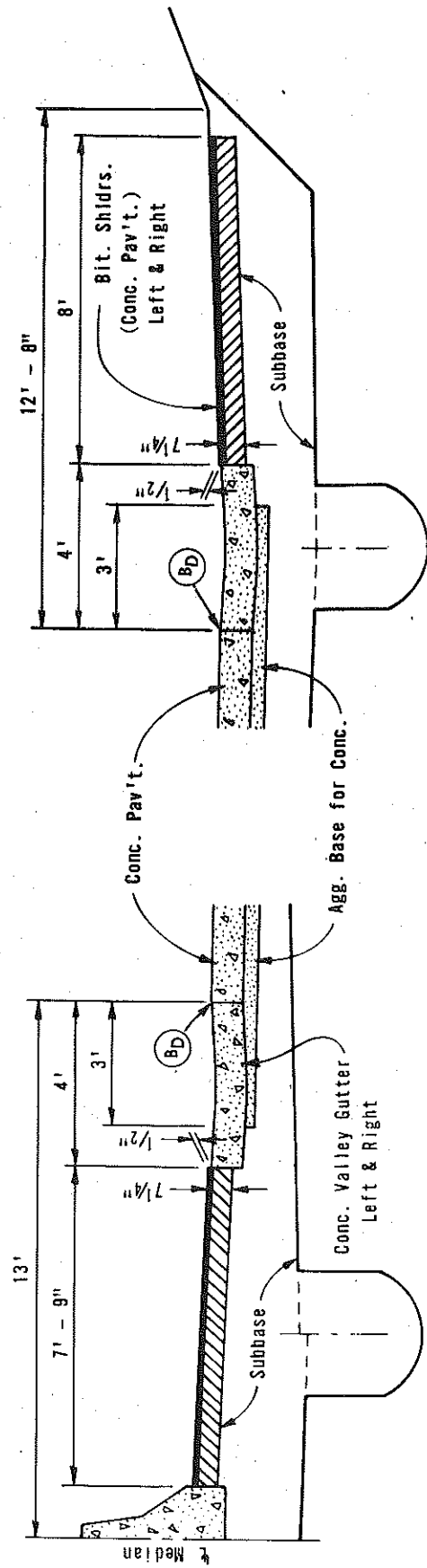


Figure 1 (Cont.). Design details for concrete paved shoulders.

BITUMINOUS PAVED SHOULDERS

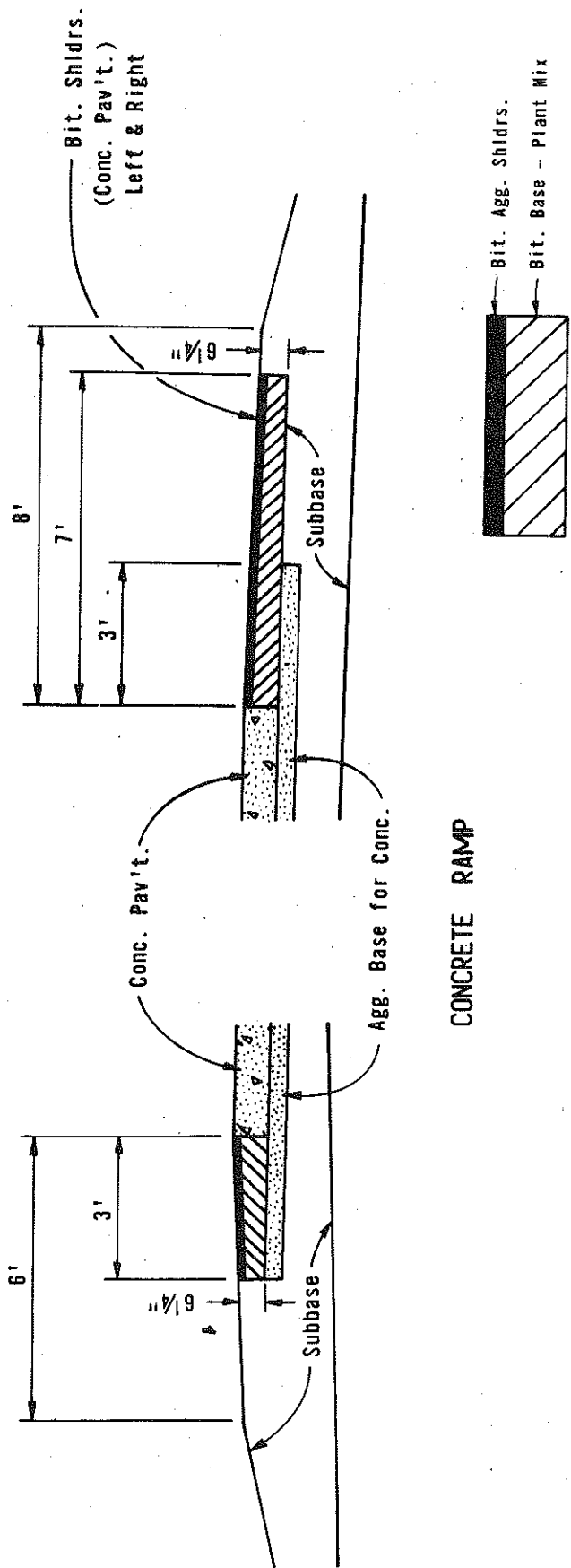


RURAL DUAL CONCRETE ROADWAY



URBAN DUAL CONCRETE ROADWAY
SECTION FOR CURB & GUTTER SIMILAR

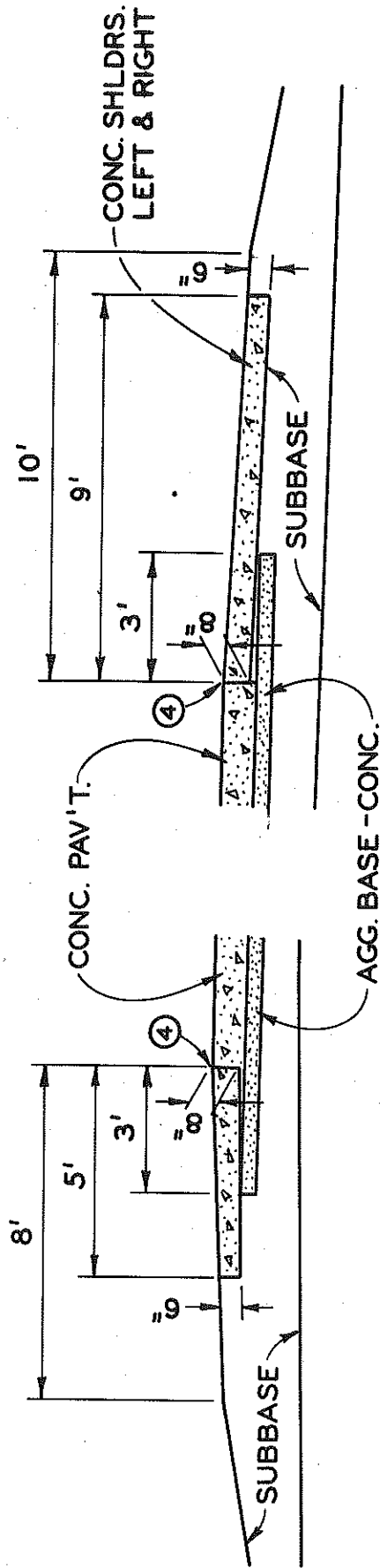
Figure 2. Design details for bituminous paved shoulders.



KEY FOR
 TYPE I BITUMINOUS SHOULDERS

Figure 2 (Cont.) Design details for bituminous paved shoulders.

CONCRETE PAVED SHOULDERS



RURAL DUAL CONCRETE ROADWAY

Figure 3. Revised detail for concrete paved shoulders.