

A FIELD EVALUATION OF TRANSFLEX  
BRIDGE JOINT PERFORMANCE

by

Marvin H. Hilton  
Highway Research Engineer

Virginia Highway Research Council  
(A Cooperative Organization Sponsored Jointly by the Virginia  
Department of Highways and the University of Virginia)

Charlottesville, Virginia

November 1972  
VHRC 72-R16



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### INTRODUCTION

During the past few years a relatively new type of bridge deck expansion joint — the General Tire "Transflex" — has been used increasingly on bridges in the United States. Recent articles in several trade publications<sup>(1, 2, 3)</sup>, for example, indicate that Transflex joints are being used on both new construction and for replacement in the maintenance of bridge joints. This type of joint, which has been installed on several bridges in Virginia, is basically comprised of molded neoprene reinforced with steel. In addition to the customary function of providing for movements due to temperature change, the Transflex is designed to seal bridge deck joints against intrusion of debris and moisture. The sealing characteristic is of considerable interest to highway engineers, since the general performance of most other joint designs and sealing materials has not been entirely satisfactory.

### PURPOSE

Due to the poor performance of bridge deck joint sealers, the Federal Highway Administration initiated, under the National Experimental and Evaluation Program, a project called the "Development of Watertight Bridge Deck Joint Seals". Under this project, a number of Transflex type joints were installed by the states participating in the project. Recently the Federal Highway Administration requested that those states having Transflex joint installations perform a critical field evaluation of their performance. The purpose of this paper, therefore, is to report the results of a field evaluation of the various types of Transflex joints known to be in use in Virginia. An effort was made, whenever possible, to qualitatively evaluate the joints with respect to their

- (1) watertightness,
- (2) ability to reject debris,
- (3) stability and noise producing characteristics under traffic impact,
- (4) distortion characteristics and ability to maintain grade and alignment,
- (5) resistance to wear and abuse, and
- (6) ease of installation to the required grade and alignment.

## TRANSFLEX JOINT DESIGNS IN SERVICE

Since the first Transflex joints were installed in Virginia, the manufacturer has discontinued one of the earliest designs and made several modifications in subsequent models. Accordingly, a number of the Transflex joints that are in use in Virginia are either obsolete or do not reflect some of the modifications incorporated in their design to improve upon performance.

Of fifteen bridge sites that have Transflex joints at this time (see Appendix), nine have models not incorporating design modifications by the manufacturer. In order to distinguish between the older and newer designs a brief description of the general types of joints observed during the field inspections is desirable.

Transflex joints, whether the newer or older models, are numbered by the manufacturer in such a manner as to indicate their capacity to take bridge movements. Accordingly, the Transflex 200 will accommodate 2 inches of movement, the 400 will accommodate 4 inches, and so on. All models that have been modified are designated by adding the suffix A to the original model number. Thus, all joints that have been modified from their original design are designated as 200-A, 400-A, etc.

One of the earlier models, which is in service on three Virginia bridges, has been entirely redesigned by the manufacturer. This particular joint, the old model 400, shown in Figure 1, has a perforated or honeycombed surface that was designed to accommodate horizontal movement. As shown in Figure 2, the neoprene portion of the joint is reinforced with a steel plate which falls directly over the bridge deck opening. In addition, two steel angles are located on each side of the joint in the anchorage area. This 26 inch wide joint was supplied in 4 foot lengths and had five mounting slots on each side for the anchoring studs. After the joint has been placed and anchored, the cavity slots are plugged with neoprene caps to aid in sealing out moisture and preventing corrosion. In order to seal the interface between the neoprene joint and the concrete deck, a sealant material must be used on all Transflex joint models.

The new 400-A joint design replaces the perforated structure of the old 400 with solid neoprene rubber reinforced with steel plates in both the upper and lower areas of the transverse section. Although no new 400-A models have been installed in Virginia, their design is essentially a compounded version of the model 200-A or 250 joint shown in Figure 3. In this design, bridge movements are accommodated through shear in the neoprene between the upper and lower steel plates. The 400-A models are manufactured in 6 foot lengths and, unlike the old 400 models, they are provided with tongue and groove at the ends for better interlocking between the 6 foot sections.

The remainder of the nine obsolete model installations in Virginia are all model 200's. A transverse section through the old model 200 would be essentially the same as that shown in Figure 3. To the knowledge of the writer the following modifications have



Figure 1. View of an old model Transflex 400 joint with the "honeycomb" type surface texture. (Rte. 154 over Jackson River.)

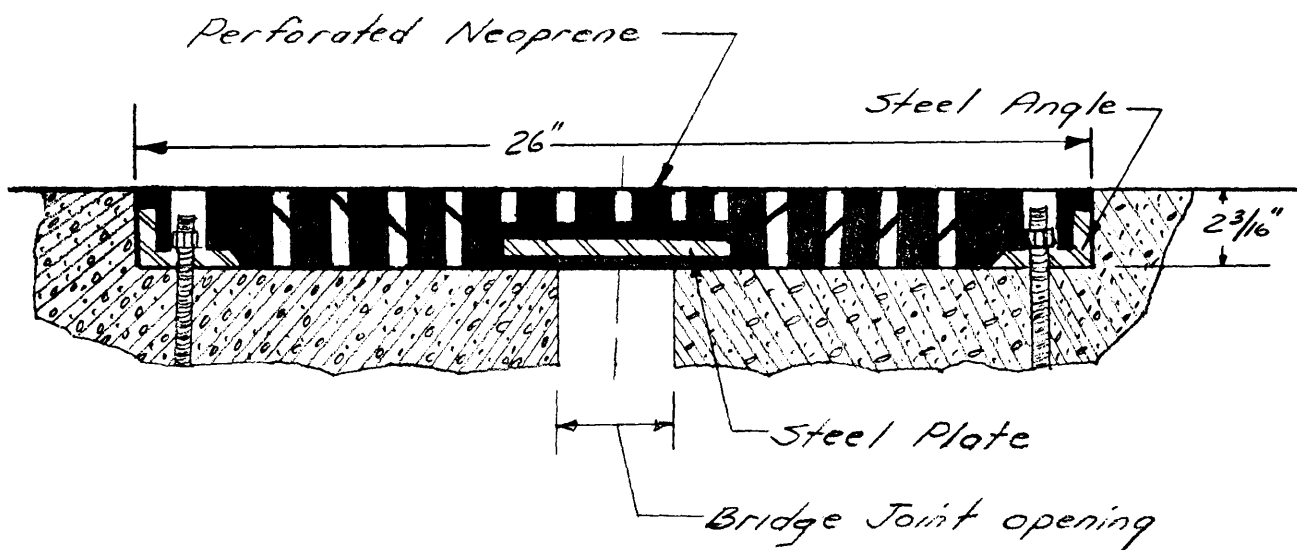


Figure 2. Transverse section of an older model Transflex 400 joint.

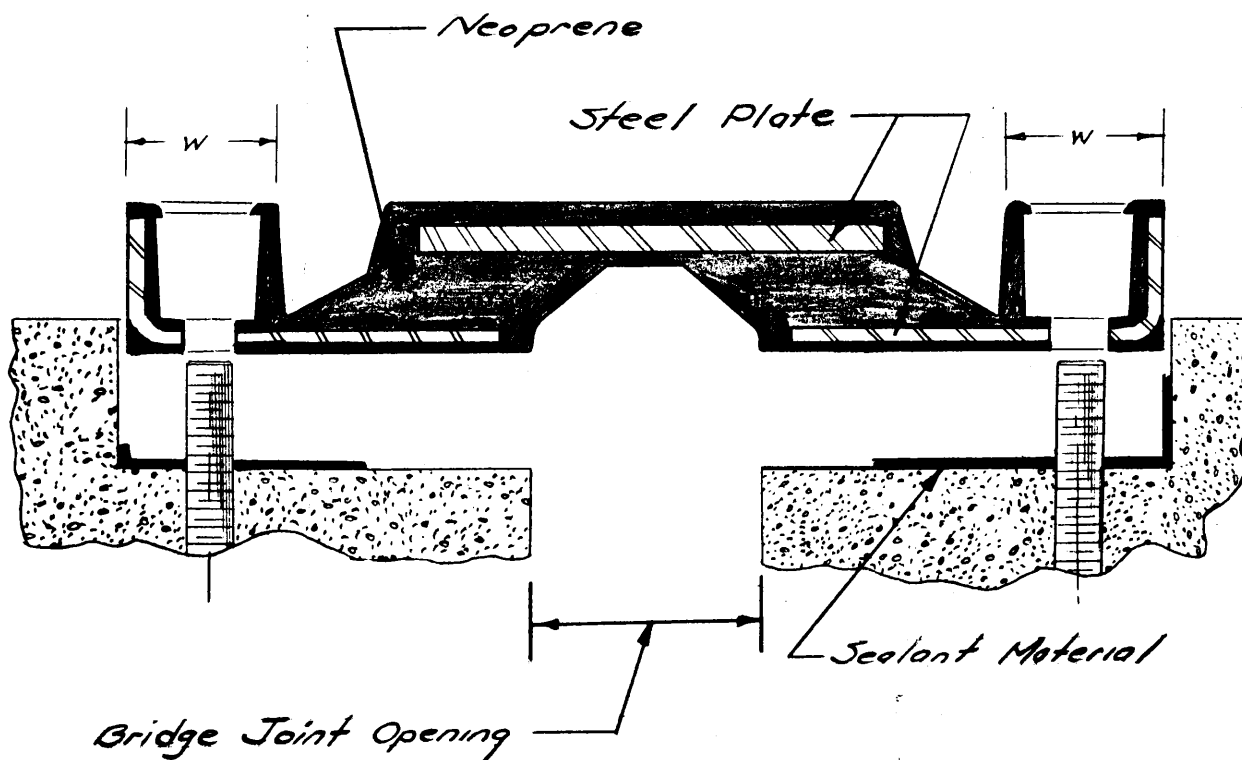


Figure 3. Typical transverse section of Transflex models 200-A and 250.

been incorporated in the 200-A's as well as all the other newer models:

- (1) Expander slots have been eliminated. (In addition to the anchorage slots, expander slots — which were identical to the anchorage slots in appearance — were provided in the older models for the purpose of preexpanding the joint before installation.)
- (2) The width,  $w$ , in Figure 3 has been increased to eliminate the thin, weak edges on each side of the anchorage slots.
- (3) Lips have been provided on the anchorage slot openings to aid in retaining the neoprene plugs.
- (4) The neoprene plugs have been provided relief valves by way of a cutout section in the wall of the plug.
- (5) Longitudinal ridges have been provided across the width of the joint for additional skid resistance.
- (6) Improvements have been made in the curb and gutter sections which are now more adaptable to variables such as skews.

Of the six bridge sites with newer model installations, four are either the 200-A or 250 design. The two remaining bridges have model 150-A installations.

The 150-A design is slightly different from those described earlier. The left and right sides of this joint are reinforced with inverted steel "T" sections. Steel anchorage connections, which are thinly covered with neoprene, are attached to the flanges of the "T" sections. The anchorage system can thus be covered with an asphaltic deck surfacing while the leg of the inverted steel "T" section acts as a retainer dam for the surfacing material. The design of the 150-A is particularly adaptable for joint replacement purposes.

### FIELD EVALUATION

All of the bridges listed in the Appendix were inspected, except one. This particular structure was omitted, since like three similar bridges that were inspected it is a railroad overpass. The Transflex joints on these type structures are not visible because a heavy layer of ballast material covers the joints completely. Of the three railroad overpass structures that were inspected, two have the old 200 and one a 200-A model installed over the piers. Due to the hidden nature of the installation, however, the results of the inspection were inconclusive. There was, however, no substantial evidence to indicate that the joints were not performing satisfactorily.

#### Transflex 400 Joints

The model 400 joint (shown earlier in Figures 1 and 2) is in service on three bridges. One, the Route 154 bridge over the Jackson River at Covington, has a steel joint installed at one abutment and a Transflex joint at the other. Inspection of the bridge revealed a number of stained streaks down the face of the abutment backwalls, which suggests that leakage of both joints has occurred. Assuming that joint leakage caused the streaks, it was apparent from a comparison of the two backwalls that the Transflex joint was allowing much less water to pass through.

Due to the evidence of leakage on the Jackson River structure, the model 400 installations on two Rte. 58 bridges were tested simply by pouring water on selected portions of the joints and observing the results on the underside of the structure. Leakage occurred at several of the areas tested. Although it was impossible to judge exactly where the water seeped through, it appeared likely that the ends of the 4 foot lengths were the major source of the problem. At the end of each 4 foot length, a "joint in the joint" (see Figure 4) is necessary. At one such joint, which was located in a traffic wheel path area, the test water dripped through rather rapidly.

All of the model 400 joints made considerable noise under traffic impact, and one of the joints on a Rte. 58 bridge appeared to be slightly bulged. This effect is shown by the curvature in the ends of the joint sections which is detectable in Figure 4. The upward bulge and the slapping noise effect could be related to the fact that the full 26 inch width of the joint is not reinforced with steel.

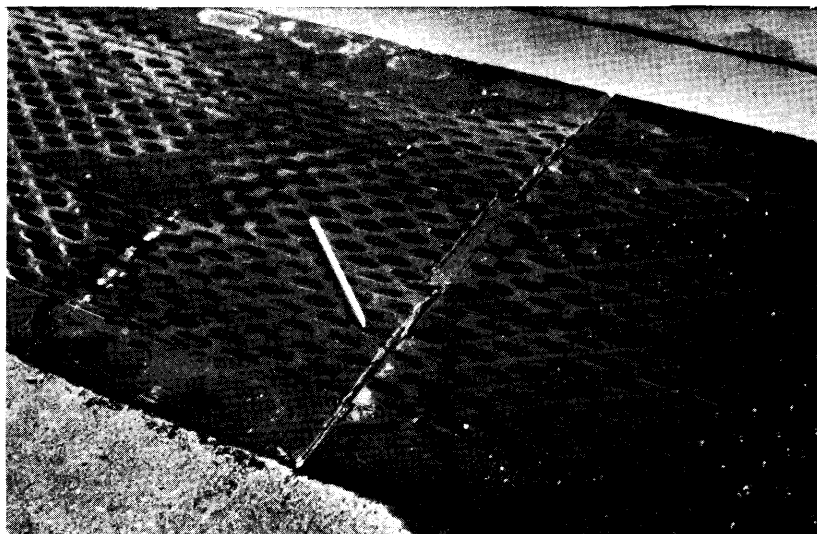


Figure 4. View of a joint in a Transflex 400 joint.  
(Rte. 58 over Arrons Creek.)

There did not appear to be a problem with wear or with debris becoming lodged in the joints on either of the three bridges having the model 400 installations. The appearance of these installations also indicated that little difficulty was encountered in placing the joints to the required grade and alignment during construction.

#### Transflex 200, 200-A and 250 Joints

Unlike the obsolete model 400, the obsolete model 200 and the newer models 200-A and 250 are provided in 6 foot sections — thereby reducing the number of "joints in a joint". Also, there did not appear to be as much evidence of leakage on the face of the abutment backwalls as was the case with the model 400 installations. While some stains were observed on the face of the abutment backwalls at most of the sites inspected, it is possible that much of this staining could have occurred prior to completion of the structure. Consequently, the water test was used on some randomly selected areas of three of the bridges, and it was found that the water seeped through to the underside at several locations on two of them. On the third bridge site, Rte. 6 over Deep Run Creek, no water was observed on the underside at the abutment backwalls. Due to the design of the superstructure, however, these twin structures do not have a joint opening directly over the face of the abutment backwall. Therefore, if the joint did leak, it would not likely be detectable with the test used in this evaluation.



On several installations, such as the model 200-A joint on the Rte. 501 bridge over the Dan River, the major leakage problem appears to be at the end of the 6 foot sections, i.e., at the "joints in the joint". In some cases, however, the source of the leakage could be related to a failure or lack of sealant material at the anchorage bolts or at the interface between the concrete deck and neoprene joint. This possibility is illustrated in Figure 5, which shows an area with a sealant failure and missing slot plugs. This particular joint, an old model 200, has a large number of slot plugs missing — particularly those from the expander slots. While an occasional plug was found missing from the anchor slots in the newer models, the design modifications described earlier have improved upon joint performance and appearance.

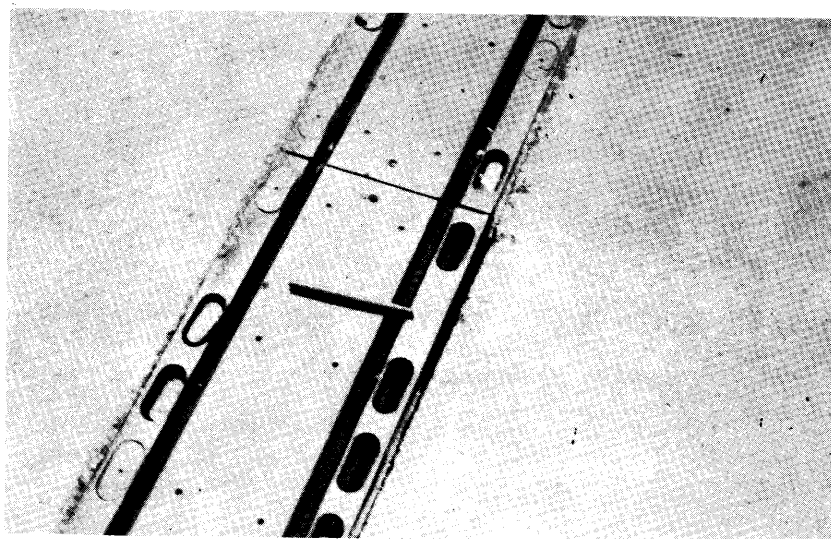


Figure 5. A Transflex 200 installation showing missing slot plugs and sealant material. (Rte. 6 over Deep Run Creek.)

Neither the old or the newer model installations were found to be completely watertight. In comparison with past bridge deck joint designs, however, the leakage problems associated with Transflex joints appear to be relatively minor. It is apparent, however, that the watertightness of the joint can be no better than the sealant material and/or its installation. An increase in the length of the joint sections being supplied would aid in reducing in number the possible sources of leakage.

Traffic impact on the 200, 200-A and 250 models produced little noise except in cases where the joint was installed unevenly. Uneven installations where one side is too high or too low to conform with the deck grade are suggestive of problems related to construction.

As shown in Figure 6, gravel and loose material can accumulate in the expansion dams of the joints. No detrimental effects were observed, however, and in one instance the loose debris was wedged upward, indicating that the joint was functioning as designed.

None of the joints showed distress due to wear. On the other hand, several joints had minor cuts or scrapes that possibly were caused by snowplows (see Figure 7.)

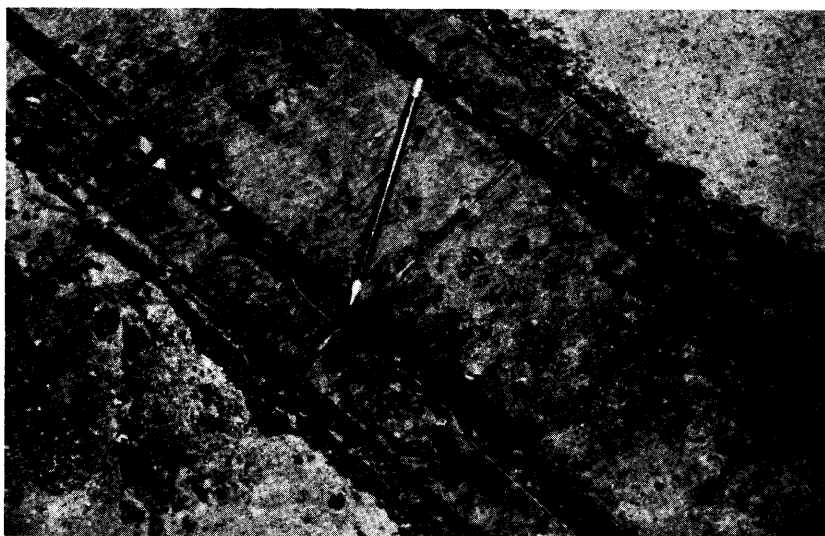


Figure 6. Debris accumulation in the expansion dams of a Transflex 200 joint. (Rte. 601 near Goshen.)

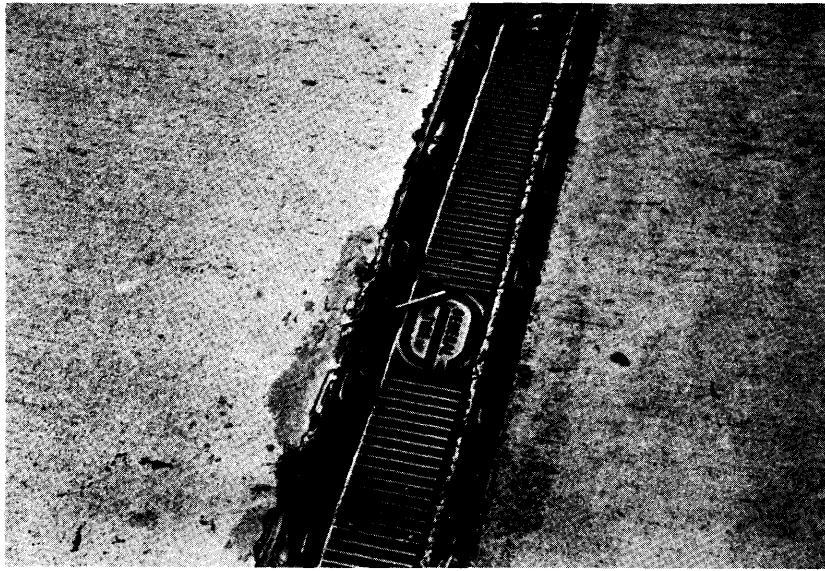


Figure 7. A Transflex 200-A joint with a cut in the neoprene.  
(Rte. 501 over the Dan River.)

#### Transflex 150-A Joints

Two older bridges have Transflex 150-A maintenance replacement installations that have been in service for only approximately two months at this writing. Therefore, their performance was not evaluated.

Traffic impact on the 150-A joints produces a rather loud thump. This is probably due to two factors: (1) The vertical web of each of the two inverted steel "T" sections is approximately  $1/8$  inch higher than the  $3\frac{3}{4}$  inch neoprene surface in between, and (2) in most cases the joints were installed slightly lower than the finished grade on the deck surface.

Compared to the models discussed earlier, the 150-A is apparently more difficult to install to grade and alignment. Typical unevenness of a 150-A joint can be noted in Figure 8, where the center line stripe crossing the joint accentuates the mismatched joint alignment.

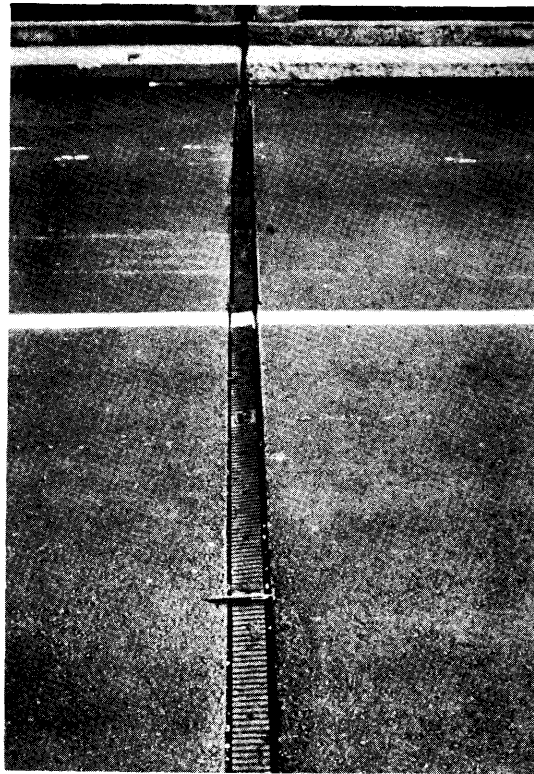


Figure 8. A Transflex 150-A maintenance type joint on a resurfaced deck.

### CONCLUSIONS

1. Most of the Transflex joint installations are not watertight. Leakage appears to occur mostly at points where the 6 foot or 4 foot sections are joined. Failure in the sealant material could also contribute to the leakage problem. The newer modified Transflex designs, however, appear to be more nearly watertight than all the other types of bridge deck expansion joint designs used in Virginia. With further refinements in design and installation technique, the joint offers the potential of being watertight.
2. Accumulation of debris in the joint installations did not appear to be a problem. Although gravels were sometimes found wedged in the expansion dams, no detrimental effects were observed.
3. The obsolete 400 models are noisy under traffic impact because they tend to slap up and down. The 200, 200-A and 250 models are relatively quiet if installed evenly to grade and alignment. The 150-A models give off a relatively loud thump when crossed by traffic.
4. All the Transflex joints appear to maintain grade and alignment except the obsolete 400 model, which appeared to have a slight tendency to bulge upward at one installation observed.

5. Transflex joints resist wear but they may be susceptible to scrapes and cuts caused by snowplows or other unusual abuse.
6. The alignment and grade on a few of the joints observed suggest that more care and experience with installation are needed.
7. The design modifications incorporated in the newer Transflex models appear to have improved upon the joints' performance and appearance.

#### RECOMMENDATIONS

1. If any older model Transflex 400 type expansion joints remain to be installed on bridges under contract, this design should be replaced with the newer model 400-A in order to achieve better joint performance.
2. The short-term performance of the newer model Transflex designs warrant that they be considered as a viable alternative to other types of bridge expansion joint designs. It should be recognized, however, that the long-term performance of the Transflex joints is yet to be proven.
3. The feasibility of the following suggestions might be considered by the manufacturer:
  - (a) Increase the section length in order to minimize the leakage potential at the ends of the sections.
  - (b) The neoprene wall of the anchorage slot openings might be strengthened by placing the sloped side of the expansion dam wall on the anchorage slot side.



## REFERENCES

1. Keller, Kurt A., "Flexible Expansion Joints Protect Viaduct", Public Works, April 1972.
2. Zitelli, Joseph P., "Developments in the Maintenance of Structures," Public Works, April 1972.
3. Galler, Sal, "City Agencies Test Rubber Bridge Expansion Joints," Rural and Urban Roads, August 1972.





## APPENDIX A

## VIRGINIA BRIDGES WITH TRANSFLEX JOINT INSTALLATIONS

Bridge No.	District	Location			Model No.	Date Installed (Approx.)	Condition (9/72)
		Rte.	City or County	St. or Rd. Name			
1	Staunton	154	Covington	Durant Rd.	400	8/70	Good
2	Richmond	58	8 mi. W. Clarksville Mecklenburg	WBL Arrons Cr.	400	1/71	Good
3	Richmond	58	4 mi. W. Clarksville	WBL Little Buffalo Cr.	400	1/71	Good
4	Staunton	601 just off 39	Rockbridge	Maury R.	200	7/70	Good
5	Richmond	58	6 mi. W. Clarksville	WBL over #3 Branch EBL & WBL	200	1/71	Good
6	Richmond	6	.8 mi. E. Goochland CL, Henrico Co.	Deep Run Cr.	200	12/70	Good
7	Lynchburg	460	Rice, Pr. Edward Co.	N & W RR over Rte. 419	200	70-71	Good
8	Salem	419	Roanoke	N & W RR over Rte. 419	200	70	Good
9	Salem	460	Roanoke	N & W RR over Orange Ave.	200-A	71	Good
10	Suffolk		Norfolk	N & W RR over Colley Ave.	200	—	—
11	Salem		Roanoke	Franklin Ave.	New 250	70	Good
12	Salem		Roanoke	Bridge over Roanoke R. 10th St.	200-A	71	Good
13	Lynchburg	501	So. Boston	Br. Over Dan River	200-A	71	Good
14	Richmond	360	Chester-field Co.	Swift Cr.	150-A	10/72	Good
15	Richmond	1	Brunswick Co.	Meherrin River	150-A	10/72	Good

