# IMPROVED JOINT SEALANT MATERIALS FOR CONCRETE PAVEMENTS


MATERIALS and TECHNOLOGY DIVISION

# IMPROVED JOINT SEALANT MATERIALS FOR CONCRETE PAVEMENTS

CONSTRUCTION REPORT

Federal Highway Administration
Experimental Project No. 8

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Research Laboratory Section
Testing and Research Division
Research Project 78 NM-558
Research Report No. R-1259

Michigan Transportation Commission
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James P. Pitz, Director
Lansing, February 1985

This initial evaluation report has been prepared in accordance with Michigan Department of Transportation Work Plan 95 (Research Project 78 NM-558) Federal Highway Work Order No. DTFH 71-85-508-MI-09. It contains general project and cost information concerning a low-modulus silicone sealant (Dow Corning Silicone 888), and a preformed neoprene sealant used in mainline joints on two new concrete pavement projects on I 69 (M 21) west of Port Huron. An evaluation plan, cross-sections of the two joint types, location sketch, and special provisions covering the silicone sealant are included. The project information forms furnished by the Federal Highway Administration have been completed for each project and are included in this report.

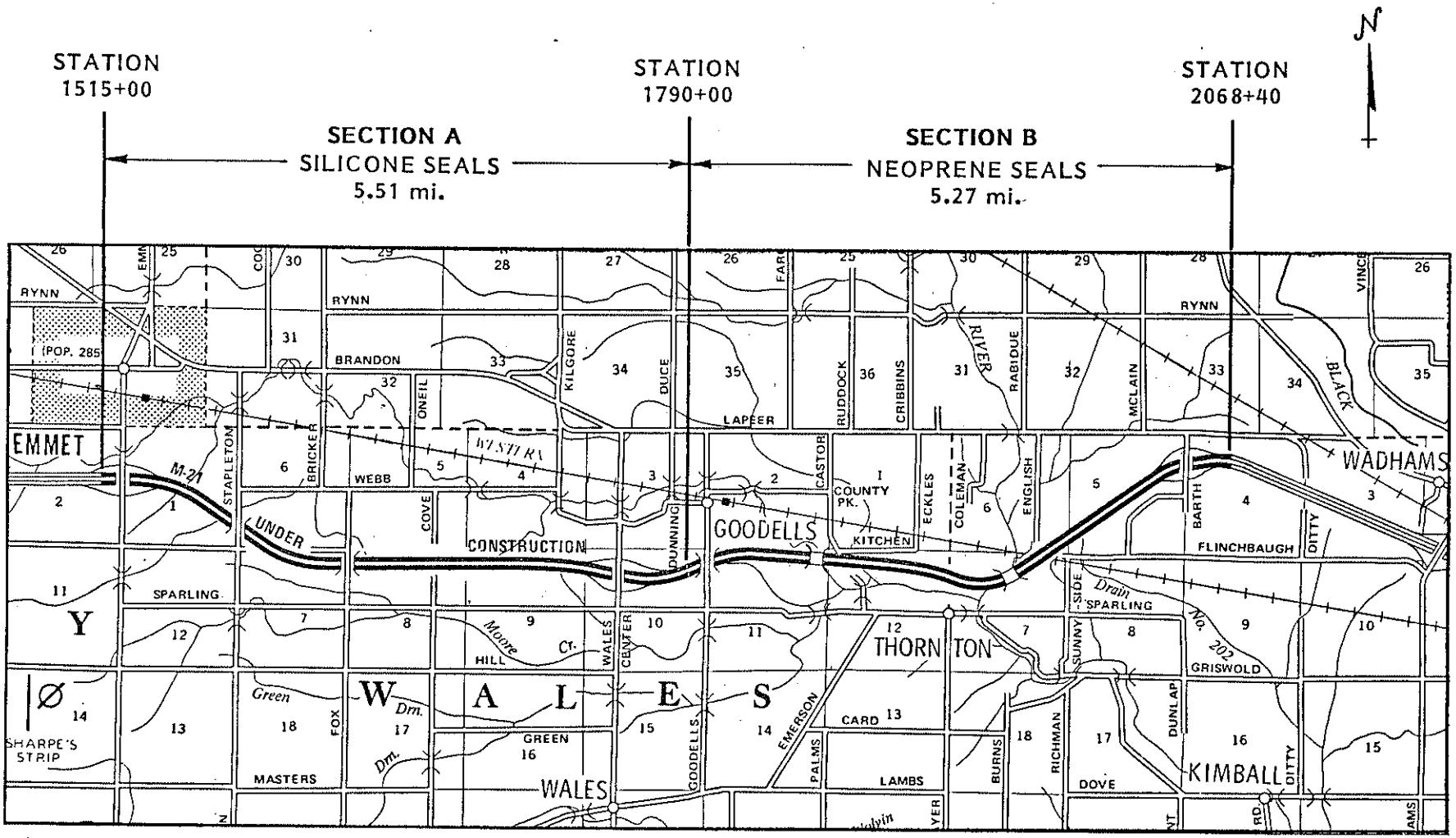
## Evaluation Plan

Four test sections, each containing 20 consecutive joints have been set-up to evaluate the sealants' performance. Their locations are as follows:

| Seal Type | Test Section No. | Roadway | Sta. to Sta. |
|---|---|---|---|
| Silicone | $21\text{-}S_1$ | Eastbound | 1642+90 - 1650+70 |
| | $21\text{-}S_2$ | Westbound | 1654+60 - 1646+80 |
| Neoprene | $21\text{-}N_1$ | Eastbound | 1823+12 - 1830+90 |
| | $21\text{-}N_2$ | Westbound | 1832+60 - 1824+80 |

Each joint in these test sections has been instrumented with stainless steel plugs for the purpose of measuring both horizontal and vertical movements at the joint. Initial readings have been made and subsequent ones will be taken twice a year (summer-winter).

Each joint in the above sections and additional selected ones will be evaluated as to the performance of the seals with respect to their sealing ability, intrusion of debris and weathering each winter. The survey procedure developed by the Pennsylvania Department of Transportation or a similar one will be used to rate the sealants' performance.




Location of projects containing Silicone and Neoprene Seals.

## SECTION A - SILICONE SEALS

Improved Joint Sealant Materials

General Project Information

State or Highway Agency: Michigan Department of Transportation

Route No.: Relocated M-21 (see location map - Fig. 1)

Month/Year Pavement Built: May-July 1984

Project Location/Length: M-19 easterly to Goodells Rd/5.15 mi
(Use features readily identifiable on State highway department map)

No. of Lanes, Type Highway: Four-lane rural freeway
(Such as 6 lane Interstate, 4 lane urban arterial, 2 lane rural)

Terrain: Flat (mountainous, hilly, rolling, flat)

Percent Grade(%): Varies from 0.00 to -0.36

Sealant used for this study: Silicone

Manufacturer from which Sealant was obtained: Dow Corning

Trade Name and/or Identification No.: Dow Corning 888 Seal

Quantity used ~~in Cabbages~~: 47,591 lin ft

Specifications:

a) Give specification number if standard specifications used:

Special Provisions attached

b) Include as attachment, supplemental specification or special provision, if used.

Joint Spacing in Feet and Skew, if any: 41 ft-0 in.

Present Traffic Volume (ADT): 8,900

Present Percent Trucks: 12%

Annual Moisture: 29.90 in.

Annual Temperature Range: -7 to 96 F

Approximate Temperature when Project Sealed (this study): 73 F Avg.

List any previous sealants used on this section and year work done: New construction

Pavement Condition when Project Sealed (check appropriate lines): New construction

| Severity Levels | Low | Medium | High |
|---|---|---|---|
| Spalling | | | |
| Faulting | | | |
| D-Cracking | | | |
| Blow-ups | | | |
| Transverse cracking | | | |
| Pumping | | | |
| Other | | | |

Attach a detail with dimensions of a typical joint, joint reservoir and any load transfer devices as constructed and as now in place for this study.

Equipment and methods used in the following operations:

1. Removal of old sealant: New construction

2. Construction of joint reservoir: Sawed with diamond bladed saw

3. Removal of incompressibles, dust, dirt, etc., from joint faces: Flushing with water followed by sandblasting and cleaning with oil-free compressed air just prior to seal installation

4. Drying of joint faces: Air dry only

5. Placement of sealant: Pumped through hose and nozzle into groove and then tooled by hand

## Joint Sealing Costs

Summarize joint sealing cost in either format listed below depending on whether sealing was done by contractor or with agency forces.

### Contract Work

| Item | No. Units | Unit Cost | Item Cost |
|---|---|---|---|
| Contraction Joint Cs, 9" Silicone Sealant | 47,591 | $4.00 | $190,364 |

Note: The project was constructed with concrete shoulders. Shoulder joints in-line with mainline joints were also sealed with silicone sealant.

| | |
|---|---|
| Total cost of listed items | $190,364 |
| (-) Cost of traffic control included in above items | 0 |
| Total sealing cost | $190,364 |
| Linear feet sealed | 47,591 |
| Cost/linear foot | $4.00 |

## SECTION B - NEOPRENE SEALS

Improved Joint Sealant Materials

General Project Information

State or Highway Agency: Michigan Department of Transportation

Route No.: Relocated M-21 (see location map - Fig. 1)

Month/Year Pavement Built: May-July 1984

Project Location/Length: Goodells Rd easterly to Existing M-21 Freeway/5.27 mi
(Use features readily identifiable on State highway department map)

No. of Lanes, Type Highway: Four-lane rural freeway
(Such as 6 lane Interstate, 4 lane urban arterial, 2 lane rural)

Terrain: Flat (mountainous, hilly, rolling, flat) Percent Grade(%): Varies from +1.22 to -1.81

Sealant used for this study: Preformed Neoprene

Manufacturer from which Sealant was obtained: D. S. Brown Co.

Trade Name and/or Identification No.: E-1253

Quantity used ~~xxxxxxxxxxxx~~ ~~xxxxxxxxxxxx~~ 45,876 lin ft

Specifications:

a) Give specification number if standard specifications used:

1979 Standard Specifications 8.16.04-d

b) Include as attachment, supplemental specification or special provision, if used.

Joint Spacing in Feet and Skew, if any: 41 ft-0 in.

Present Traffic Volume (ADT): 8,900

Present Percent Trucks: 12%

Annual Moisture: 29.90 in.

Annual Temperature Range: -7 to 96 F

Approximate Temperature when Project Sealed (this study): 71 F Avg.

List any previous sealants used on this section and year work done: New construction

Pavement Condition when Project Sealed (check appropriate lines): New construction

| Severity Levels | Low | Medium | High |
|---|---|---|---|
| Spalling | | | |
| Faulting | | | |
| D-Cracking | | | |
| Blow-ups | | | |
| Transverse cracking | | | |
| Pumping | | | |
| Other | | | |

Attach a detail with dimensions of a typical joint, joint reservoir and any load transfer devices as constructed and as now in place for this study.

Equipment and methods used in the following operations:

1. Removal of old sealant: New construction

2. Construction of joint reservoir: Sawed with diamond bladed saw

3. Removal of incompressibles, dust, dirt, etc., from joint faces: Flushing with water followed by cleaning with compressed air just prior to seal installation

4. Drying of joint faces: Air dry only

5. Placement of sealant: Lubricant applied to joint groove walls followed by machine installation of sealant

## Joint Sealing Costs

Summarize joint sealing cost in either format listed below depending on whether sealing was done by contractor or with agency forces.

### Contract Work

| Item | No. Units | Unit Cost | Item Cost |
|---|---|---|---|
| Contraction Joint C, 9" 1-1/4 in. Preformed Seal | 45,876 | $4.00 | $183,504 |

Note: The project was constructed with concrete shoulders. Shoulder joints in-line with mainline joints were also sealed with preformed neoprene seals.

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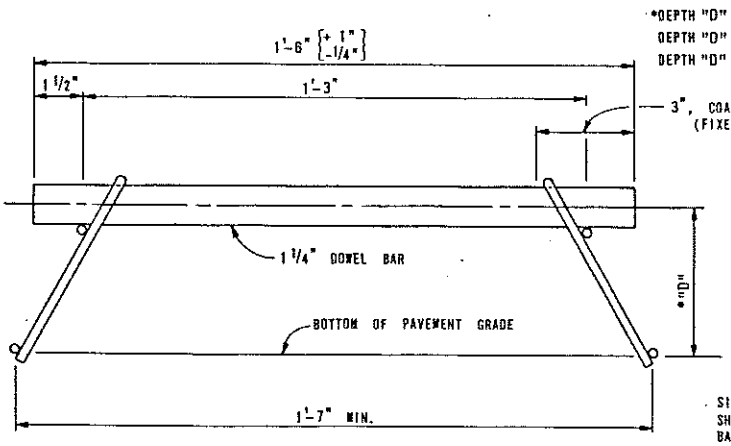
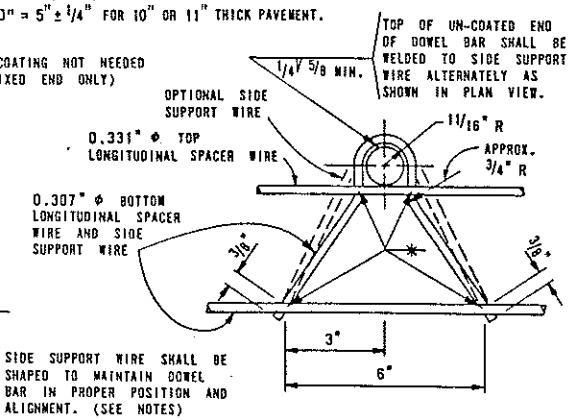
| | |
|---|---|
| Total cost of listed items | $183,504 |
| (-) Cost of traffic control included in above items | 0 |
| Total sealing cost | $183,504 |
| Linear feet sealed | 45,876 |
| Cost/linear foot | $4.00 |




.END VIEW

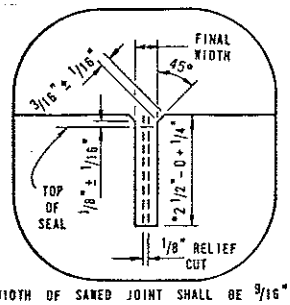
*DEPTH "D" = 4" ± 1/4" FOR 8" THICK PAVEMENT.
DEPTH "D" = 4 1/2" ± 1/4" FOR 9" THICK PAVEMENT.
DEPTH "D" = 5" ± 1/4" FOR 10" OR 11" THICK PAVEMENT.




SIDE SUPPORT WIRE SHALL BE SHAPED TO MAINTAIN DOWEL BAR IN PROPER POSITION AND ALIGNMENT. (SEE NOTES)

DETAIL OF SIDE SUPPORT WIRES

## CONTRACTION JOINT ASSEMBLY

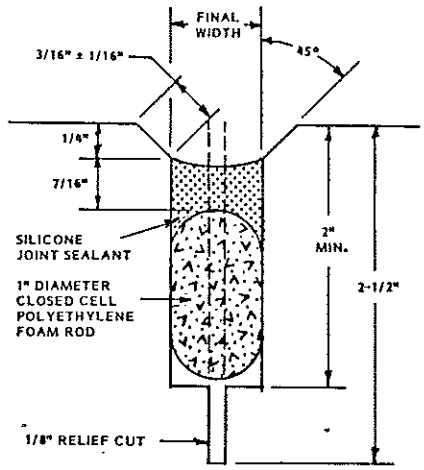



FINAL WIDTH OF SAWED JOINT SHALL BE 9/16" ± 1/16" PLUS ANY INCREASE IN WIDTH OF RELIEF CUT. SEALED WITH 1 1/4" WIDE PREFORMED NEOPRENE JOINT SEAL AS DIRECTED BY THE ENGINEER.

*RELIEF CUT FOR JOINT (C), 1/4 THE PAVEMENT THICKNESS OR 2 1/2" MINIMUM, WHICHEVER IS GREATER.

| SYMBOL | LOAD TRANSFER ASSEMBLY | JOINT USE |
|---|---|---|
| (C) | YES | PAVEMENT |
| (C3) | NO | SHOULDER |

### NEOPRENE




FINAL WIDTH OF SAWED JOINT SHALL BE 3/8" ± 1/16" PLUS ANY INCREASE IN WIDTH OF THE RELIEF CUT. SEALED WITH SILICONE JOINT SEALANT AS DIRECTED BY THE ENGINEER.

### SILICONE

Details of load transfer assembly and joint grooves as constructed on Project FR 77023-21586A.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SEALING TRANSVERSE CONTRACTION
JOINTS WITH SILICONE SEALANT

## SCOPE

This work includes furnishing all labor, equipment, and material necessary to saw, clean, and seal transverse pavement contraction joints and corresponding shoulder joints.

The joint material used to seal these joints shall be a Low Modulus Silicone.

All work and material shall be in accordance with the 1979 Standard Specifications with the exceptions and additions herein.

## MATERIAL

The Low Modulus Silicone Sealant shall be a one part formulation which does not require a primer for proper bonding to portland cement concrete.

The silicone sealant shall meet the following requirements.

| Property | Value | Test Method |
|---|---|---|
| Flow, in. | 0.2 max | MIL S 8802 |
| Extrusion Rate, grams/minute | 90-250 | MIL S 8802 |
| Tack Free Time, minutes | 35-75 | MIL S 8802 |
| Specific Gravity | 1.450-1.515 | ASTM D 792 |
| Tests on Sealant Cured 7 Days at 75 F and 50% RH | | |
| Durometer Hardness, Shore A | 10-25 | ASTM D 2240 |
| Tensile Stress at 100% Elongation, psi | 45 max | ASTM D 412 (Die C) |
| Elongation, % | 1200 min | ASTM D 412 (Die C) |
| Peel Strength on Unprimed Aluminum Substrate With Aluminum Screen, lb | 20 min with 75% min cohesive failure | MIL S 8802 |

The manufacturer of the joint sealant shall furnish certified test results for each lot of material. The containers shall be plainly marked with the manufacturer's name or trade name and lot number.

6/15/83
A. W. Price

## JOINT GROOVE SAWING

The joint groove shall be sawed to the dimensions shown on the Special Joint Detail Sheet and in accordance with the procedures outlined in Standard Specification 4.50.17. The joint groove for the transverse pavement contraction joint shall be extended down the vertical edges of the pavement by sawing or forming. When adjacent to concrete shoulders or concrete widening, the joint shall not extend down the edge of the pavement, but shall be continued across the shoulder or widening and down its edge. The vertical edge joints will not require a relief cut.

Immediately after the final sawing, the joint groove shall be cleaned with water of sufficient pressure to remove all slurry and debris from the joint faces and reservoir.

## JOINT REPAIR

Prior to sealing, all spalls or voids in the joint area shall be repaired as specified in Standard Specification 4.50.19. The repaired areas shall be sandblasted prior to sealing the joint to clean and texture the surface.

## JOINT PREPARATION

Immediately prior to sealing, the joint shall be cleaned to remove all dust and contamination from the joint faces and reservoir. In addition to cleaning the transverse contraction joints, all abutting longitudinal joints shall be cleaned for a minimum distance of one foot in both directions from the transverse joints.

Cleaning shall consist of sandblasting followed by a final cleaning with oil and water free compressed air with a minimum pressure of 90 psi. After the final cleaning the closed cell polyethylene backer rod shall be inserted into the transverse joint groove to the depth shown on the Special Joint Detail Sheet. A backer rod is not required in the longitudinal joint groove.

## JOINT SEALING

Transverse joints shall be sealed prior to sealing the longitudinal joints.

The joint groove shall be sealed after the insertion of the backer rod and prior to becoming contaminated. At the time of sealing, the joint groove faces shall be dry and dust free. The silicone shall be pumped into the joint groove (including the vertical groove) in a continuous forward operation to properly fill and seal the joint groove. A list of recommended pumps for this procedure can be obtained from the supplier of the sealant. In conjunction with or immediately after placement, the sealant shall be tooled to force it against the joint faces and to obtain the correct depth. The sealant in the vertical edge groove shall be tooled flush with the surface of the vertical groove.

All abutting longitudinal joints shall be sealed with silicone sealant for a distance of one foot in each direction from the transverse contraction joint. The sealant shall be tooled 1/4 inch below the pavement surface.

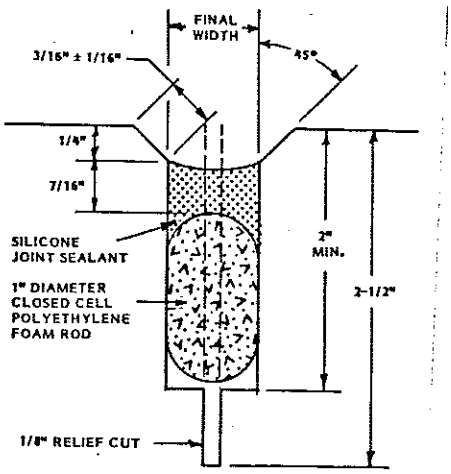
Traffic shall not be allowed on the sealed joints for a minimum of 3 hours after tooling.

## METHOD OF MEASUREMENT

Sealing Transverse Contraction Joints will be measured in linear feet with no allowance made for the vertical edge groove or that portion of the longitudinal joint sealed.

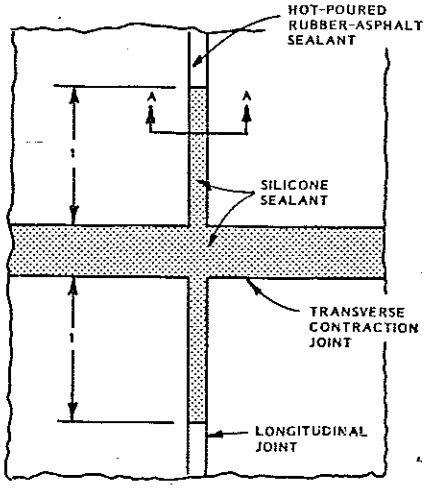
## BASIS OF PAYMENT

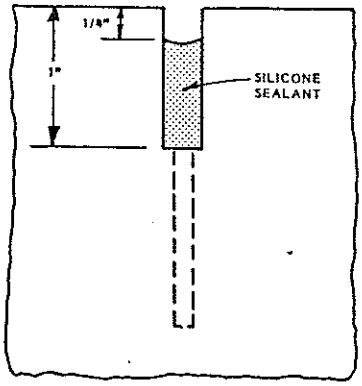
Sealing Transverse Contraction Joints With Silicone Sealant shall be paid for at the contract price per linear foot. Payment for these items will include all labor, equipment, and material required to saw the joint groove, repair spalls or voids, clean the joint groove, and seal the joint groove.




FINAL WIDTH OF SAWED JOINT SHALL BE 3/4" ± 1/16" PLUS ANY INCREASE IN WIDTH OF THE RELIEF CUT. SEALED WITH SILICONE JOINT SEALANT AS DIRECTED BY THE ENGINEER.

## TRANSVERSE CONTRACTION JOINT




SECTION A-A

## JUNCTURE – TRANSVERSE & LONGITUDINAL JOINTS

Special joint detail sheet for silicone sealed joints.