

CONSULTING ENGINEERS  
GENERAL MEMORANDUM 11-04

STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING AND  
CONSTRUCTION  
OFFICE OF ENGINEERING

New Bridge Design Standard Practice

February 25, 2011

To: CONSULTING ENGINEERS

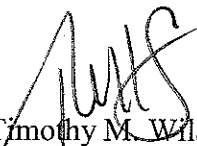
The current Strip Seal Expansion Joint System has a history of performing poorly, primarily related to the steel extrusions pulling away from the elastomeric concrete headers. The "Bridge Design Standard Practices" are hereby revised to address this concern.

**Proposed New Practice**

A new Strip Seal Expansion Joint System has been developed to handle the movement (3" – 4") of the previous Strip Seal Expansion Joint System, while eliminating the concerns regarding its poor performance by replacing the elastomeric headers with concrete headers.

The new bridge plates are enclosed as well as the new owned special provision for new bridges. Bridge plates and a new owned special provision for providing a new strip seal joint in an existing bridge (for rehabilitation projects) are also enclosed. The Bridge Design Manual will be revised accordingly.

Very truly yours,

  
Timothy M. Wilson, P.E.  
Manager of Consultant Design  
Bureau of Engineering and Construction

Enclosure

**ITEM #0520XXXA – STRIP SEAL EXPANSION JOINT SYSTEM**

**Description:** Work under this item shall consist of furnishing and installing the Strip Seal Expansion joint system as shown on the plans, as directed by the Engineer, and in accordance with these specifications.

**Materials:** The following Strip Seal expansion joint systems are qualified for use under this item:

Strip Seal Expansion Joint System	Manufacturer
Wabo StripSeal with Type M or Type Q steel rails, and SE-400 or SE-500 glands	Watson Bowman & Acme Corp. 95 Pineview Drive Amherst, NY 14228
D.S.Brown Co. Steelflex Strip Seal with Type SSCM2 steel rail and the A2R-400 gland	D.S. Brown Company 300 East Cherry Street North Baltimore, OH 45872

Additionally, the joint system components shall conform to the following:

**Steel Extrusions:** The extrusions shall conform to the requirements of ASTM A588.

**Extrusion Anchorage:** The steel extrusions shall be anchored in both the deck and curb areas with anchors spaced a maximum 6" on center. The anchorages shall be headed stud anchors, a minimum 1/2" diameter and 6" long, and conform to the requirements of Article M.06.02-12 of the Form 816.

**Strip Seal Gland:** The gland shall be extruded polychloroprene.

A Materials Certificate will be required, in accordance with article 1.06.07, certifying the conformance of the strip seal expansion joint system components to the requirements set forth in this specification.

Other joint systems which utilize a strip seal set in steel extrusion with dual sets of anchors set 6" on center will be considered for use under this item provided sufficient product documentation is furnished. Such documentation may consist of other State approvals or proof of successful performance of a completed test installation. Approval is at the discretion of the Engineer.

**Construction Methods:** Before fabricating any section of the expansion joint, the Contractor shall submit shop drawings to the Engineer for approval, in accordance with Article 1.05.02. These drawings shall include but not be limited to the following information:

- a. The name of the manufacturer.
- b. Strip seal, steel extrusion, and designations and model numbers.
- c. Details of a typical expansion joint section including the anchorage and method of temporary support.
- d. Plan of the joint showing the location and details of shop and field splices in the steel extrusions. All field splices will require a weld procedure be submitted on the form designated by the Department to the Engineer for review and approval.
- e. The complete details of the methods, materials and equipment proposed to be used in the installation.
- f. Details at the curbs and sidewalks.
- g. The maximum and minimum joint installation widths including an ambient temperature table for joint widths between 40° F and 90° F in 10° F increments.

Unless otherwise shown on the plans or indicated in the Special provisions, welding shall be done in accordance with the latest edition of the ANSI/AASHTO/AWS D1.5M/D1.5 Bridge Welding Code. All field welders shall possess a valid welder certification card issued by the Department's Division of Materials Testing. If such person has not been engaged in welding operations on a Department project or project acceptable to the Department within a period of six months, or if he cannot produce an approved welding certification dated within the previous twelve months from a welding agency acceptable to the Engineer, he shall be required to re-qualify through examination. The Engineer may require re-examination of anyone whose quality of work he questions.

The steel extrusions shall be fabricated in sections and be made continuous by welding during placement. The strip seal shall be fabricated and installed in one piece. No field splicing of the seal will be permitted.

A competent technical representative of the manufacturer shall be present during the installation of the steel extrusions to provide the Contractor such aid and instruction as required to obtain a satisfactory installation, to the approval of the Engineer.

The strip seal expansion joint system shall be installed at the locations shown on the plans and in stages in accordance with the traffic requirements in the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress."

The Contractor shall form the end of the concrete deck or approach slab with block-outs of the size dimensioned in the contract plans so that the strip seal can be installed at a later date. At the parapet and/or curb section unless otherwise noted on the plans, the blockout is optional and is to be accounted for with the Contractors submitted shop drawings and installation procedure.

The steel extrusions and anchorage shall be sandblasted in accordance with SSPC-SP-7, Brush-Off Blast Cleaning, prior to placement. The extrusions shall be aligned with the deck cross slope and breaks in the cross slope. Both the leading and trailing sides of the extrusion shall be recessed ¼" below the adjacent headers as shown on the plans. The extrusions shall be firmly and accurately held in position prior to and during the placement of the concrete header by temporary supports. Adjacent sections of extrusion shall be butt welded together—provisions shall be made in the installation sequencing to maximize the weldable area. All field welding shall be accomplished by an AWS certified Welder.

Forms shall be used to keep the concrete from entering the open joint between the concrete deck slabs or parapet sections. The concrete shall be placed, with a trowel if necessary, to insure that it completely fills the header below the extrusion and to prevent honeycombing and voids. The headers shall be finished to match the final cross-slope and grade so that it will be flush upon installation of the final overlay.

Traffic shall not be permitted over the joint until proper curing of the concrete has occurred and has developed adequate strength in accordance with the Form 816.

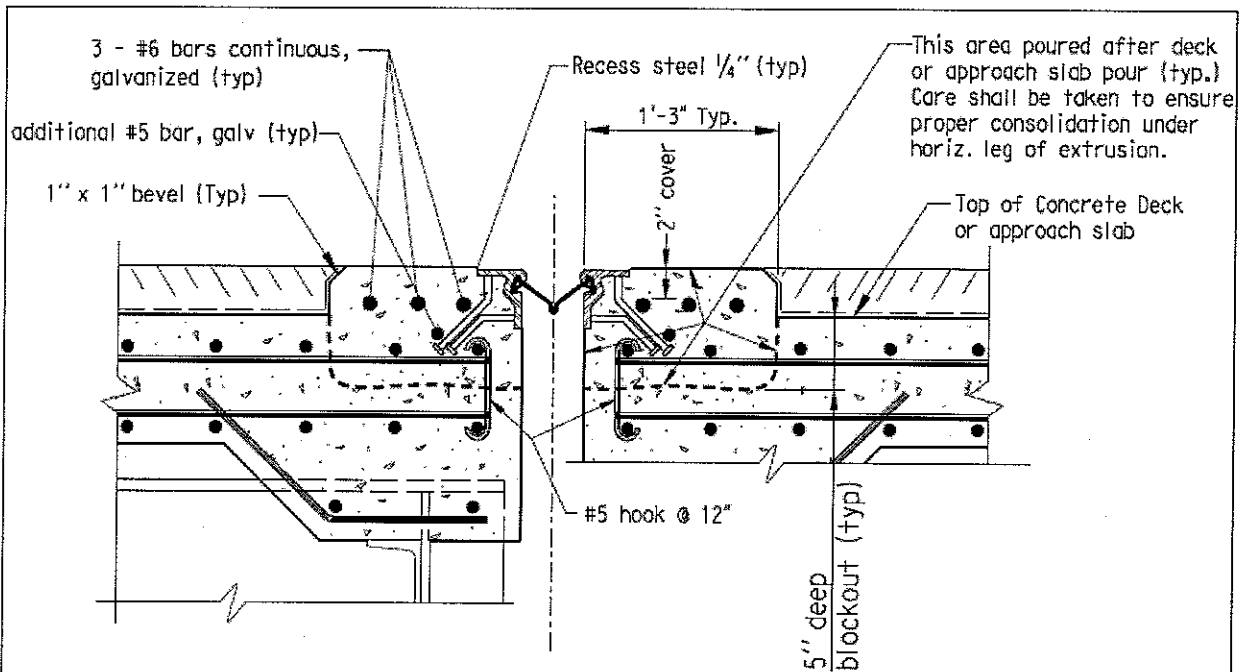
After the extrusions and headers have been placed, the strip seal shall be installed in a continuous length along the deck and up the curbs. An adhesive lubricant shall be used to install the strip seal in the steel extrusions as required by the manufacturer. No field splices will be permitted.

Any section of the strip seal that is punctured, ruptured, cracked, bent or damaged in any other way shall be removed and replaced by the Contractor at no additional cost to the State.

All work shall be done in accordance with the special provisions for "Maintenance and Protection of Traffic" and Prosecution and Progress" contained elsewhere within.

**Method of Measurement:** This work will be measured for payment by the number of linear feet of strip seal, installed and accepted, measured from gutterline to gutterline, unless otherwise noted in the plans, along the centerline of the joint. Strip seal gland and steel extrusion installed in the parapet or curb turn-up section will not be measured for payment but shall be considered included in the general cost of the work.

**Basis of Payment:** This work will be paid for at the contract unit price per linear foot for "Strip Seal Expansion Joint System," complete in place, which price shall include all materials, equipment, tools, and labor incidental thereto.

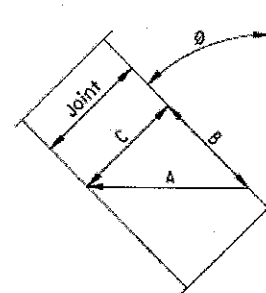


**Note To Designer:** Pay item includes only furnishing and installing the elements of the strip seal joint. Other materials and work shown above (concrete, reinf., etc..) must be accounted for with separate items and quantities.

**DESIGN INFORMATION:**

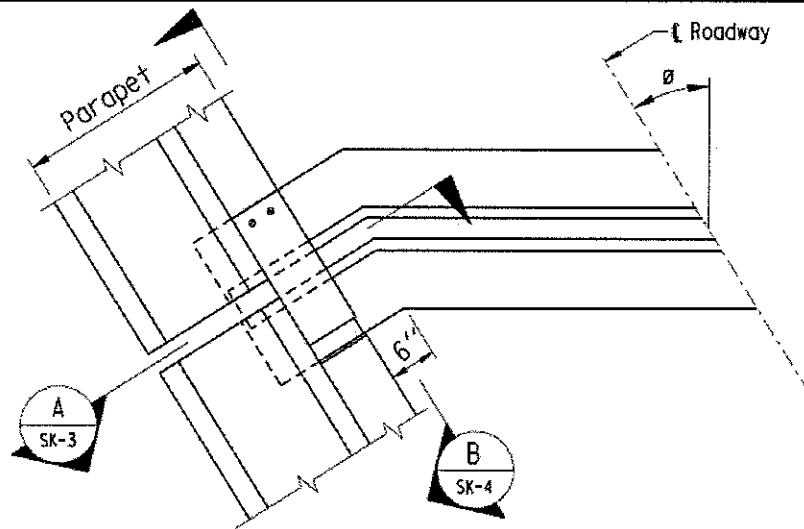
1. Concrete headers with strip seals shall be used at expansion joints with computed movements between 3" and 4".
2. The temperature range used for computation of movement shall be in accordance with Section 10.1 of the CTDOT Bridge Design Manual.
3. The strip seal movement capacity and opening @ 50deg F. shall be determined by the Designer in accordance with approved product information.
4. The Designer shall consider the effects of skew when determining the strip seal movement capacity. The movement rating of the gland shall be greater than or equal to the computed movements along the skew, normal to the joint or along the centerline of bridge. Additionally, review anticipated movements for conformance with manufacturer's recommendations.

$\theta$  = Skew Angle  
 A = movement along l Bridge  
 B = movement along Skew  $B = A \sin \theta$   
 C = movement normal to joint  $C = A \cos \theta$

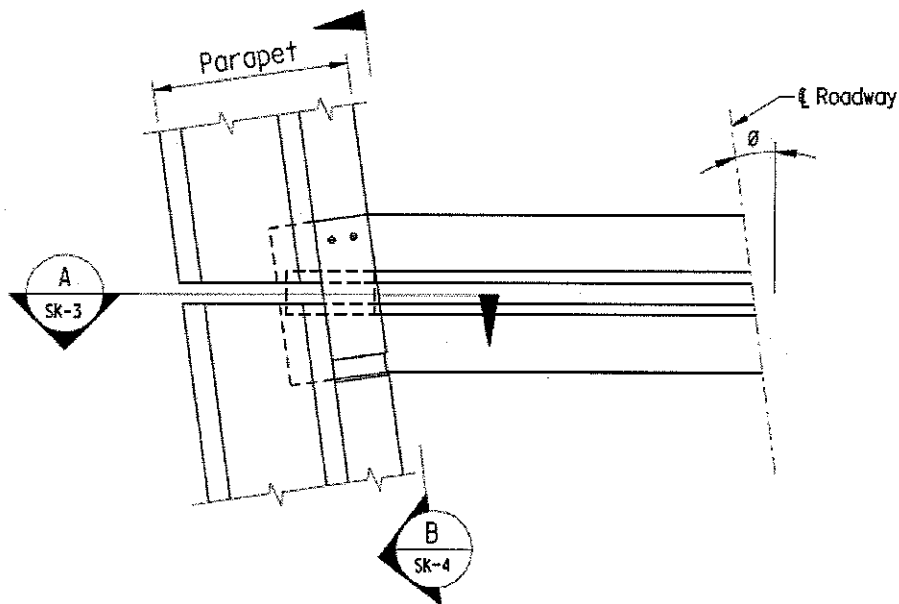


**STRIP SEAL IN CONCRETE HEADER  
 EXPANSION JOINT SYSTEM - - NEW CONSTRUCTION**

**SK-1**



JOINT TREATMENT AT GUTTERLINE --  $\varnothing > 35$



JOINT TREATMENT AT GUTTERLINE --  $\varnothing \le 35$

STRIP SEAL IN CONCRETE HEADER  
EXPANSION JOINT SYSTEM -- NEW CONSTRUCTION

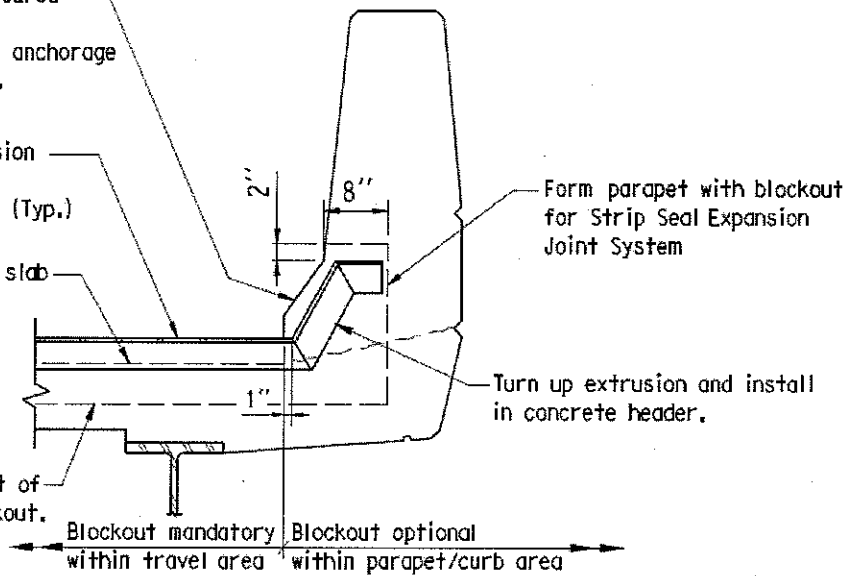
SK-2

Concrete curb to be poured with joint header.  
 Note: Cover plate and anchorage not shown for clarity.

Strip Seal Expansion Joint System in Concrete Headers (Typ.)

Top of deck slab

Bottom limit of header blackout.



SECTION A

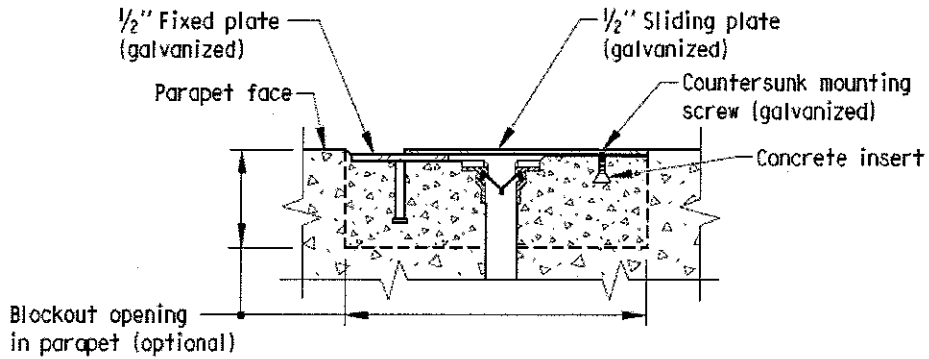
## JOINT TREATMENT AT CONCRETE PARAPET

### DESIGN INFORMATION

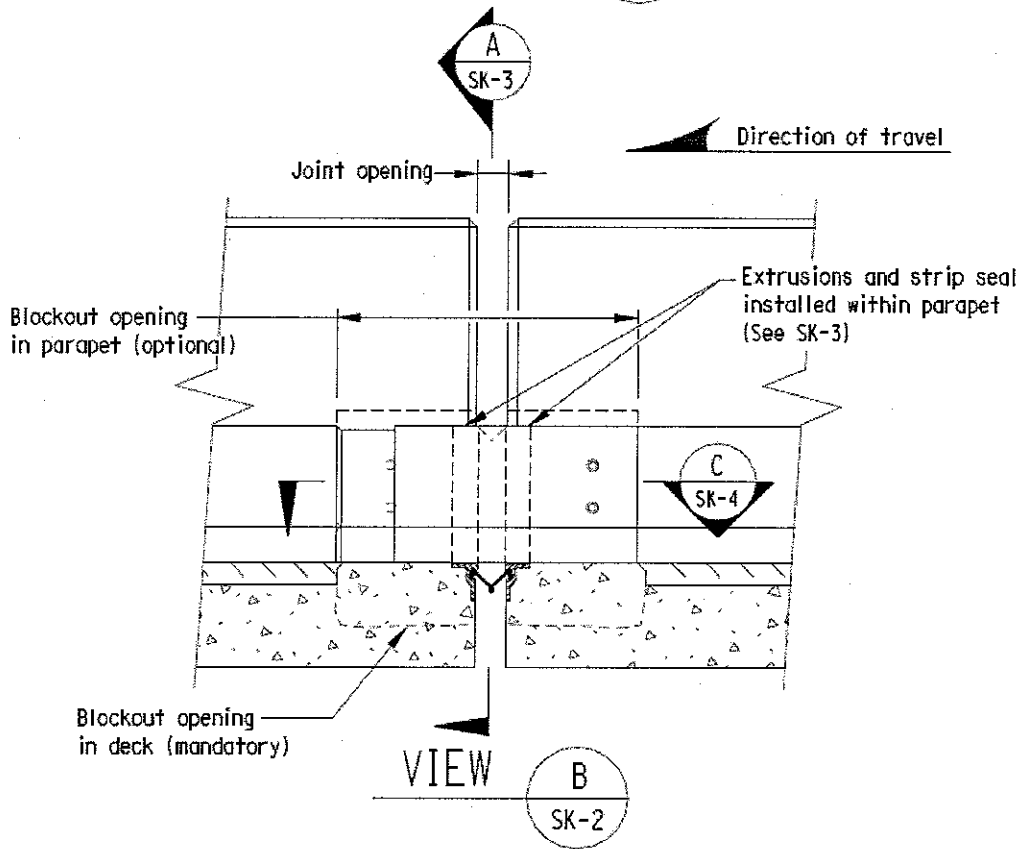
1. This plate shall be used in conjunction with drawings SK-2 and SK-4.

STRIP SEAL IN CONCRETE HEADER  
 EXPANSION JOINT SYSTEM -- NEW CONSTRUCTION

SK-3



SECTION C



JOINT TREATMENT AT CONCRETE PARAPET

STRIP SEAL IN CONCRETE HEADER  
 EXPANSION JOINT SYSTEM -- NEW CONSTRUCTION

SK-4



**ITEM #0520XXXA – STRIP SEAL EXPANSION JOINT SYSTEM FOR REHABILITATION PROJECTS**

**Description:** Work under this item shall consist of removal of a prior existing bridge joint system, removal of concrete to provide a blackout envelope in deck and curb turn-up sections, and furnishing and installation of a Strip Seal Expansion joint system in a steel reinforced concrete header as shown on the plans, as directed by the Engineer, and in accordance with these specifications.

**Materials:**

**A) Strip Seal System:**

The following Strip Seal expansion joint systems are qualified for use under this item:

Strip Seal Expansion Joint System	Manufacturer
Wabo StripSeal with Type M or Type Q steel rails, and SE-400 or SE-500 glands	Watson Bowman & Acme Corp. 95 Pineview Drive Amherst, NY 14228
D.S.Brown Co. Steelflex Strip Seal with Type SSCM2 steel rail and the A2R-400 gland	D.S. Brown Company 300 East Cherry Street North Baltimore, OH 45872

Additionally, the joint system components shall conform to the following:

**Steel Extrusions:** The extrusions shall conform to the requirements of ASTM A588.

**Extrusion Anchorage:** The steel extrusions shall be anchored in both the deck and curb areas with anchors spaced a maximum 6” on center. The anchorages shall be headed stud anchors, a minimum 1/2” diameter and 6” long, and conform to the requirements of Article M.06.02-12 of the Form 816.

**Strip Seal Gland:** The gland shall be extruded polychloroprene.

A Materials Certificate will be required, in accordance with Article 1.06.07, certifying the conformance of the strip seal expansion joint system components to the requirements set forth in this specification.

Other joint systems which utilize a strip seal set in steel extrusion with dual sets of anchors set 6” on center will be considered for use under this item provided sufficient product documentation is furnished. Such documentation may consist of other State approvals or proof of successful performance of a completed test installation. Approval is at the discretion of the Engineer.

**B) Reinforcement:**

Deformed steel bars shall be galvanized and shall conform to the requirements of Article M.06.01.

**C) Concrete:**

Concrete material shall be composed of a quick setting cement, fine aggregate, coarse aggregate and water. This concrete shall harden within 40 minutes, and develop min. compressive strengths of 1,000 psi within one hour after set and 3,000 psi within three days.

The Contractor shall design and submit a quick setting mix to the engineer for approval. The mix proportions and method of application shall be in accordance with the manufacturer's recommendations. Sources of supply of all the materials shall be clearly indicated.

Fine aggregate shall conform to the requirements of Subarticle M.03.01-2.

The coarse aggregate shall conform to the requirements of Subarticle M.03.01-1. The required grading shall be obtained by using 100 percent of No. 67 size coarse aggregate. Grading of the aggregate shall conform to the gradation table of Article M.01.01.

Water shall conform to the requirements of Subarticle M.03.01-4.

Unless otherwise approved by the Engineer, the quick setting cement shall be a cementitious-based product. The following products are qualified for use under this item:

Emaco T-415  
Master Builders, Inc.  
23700 Chagrin Blvd.  
Cleveland, OH 44122  
800-628-7378

Perma-Patch  
Dayton Superior Corporation  
PO Box 355  
Oregon, IL 61061  
800-745-3707

Rapid Set DOT Cement  
CTS Cement Manufacturing  
1023 Dogwood Lane  
West Chester, PA 19382  
215-429-4956

Speed Crete Green Line  
Tamms Industries  
730 Casey Ave.  
Wilkes-Barre, PA 18702  
800-218-2667

Fastcrete  
Silpro Corporation  
2 New England Way  
Ayer, MA 01432  
508-772-4444

Other cementitious-based products not currently approved by the Department may be substituted provided that the Contractor submits to the Department the manufacturer's literature and a sufficient quantity of the proposed patching materials for field testing and evaluation.

Further information regarding approval procedures may be obtained by contacting the Department's Research and Materials Testing Laboratory at 280 West Street, Rocky Hill, CT 06067. No substituted material shall be used until it has been approved in writing by the Department.

**D) Chemical Adhesive:**

Chemical anchoring material shall conform to the requirements of Subarticle M.03.01-15.

**Construction Methods:** Before fabricating any section of the expansion joint, the Contractor shall submit shop drawings to the Engineer for approval in accordance with Article 1.05.02. These drawings shall include but not be limited to the following information:

- a. The name of the manufacturer.
- b. Strip seal, steel extrusion, and designations and model numbers.
- c. Details of a typical expansion joint section including the anchorage and method of temporary support.
- d. Plan of the joint showing the location and details of shop and field splices in the steel extrusions. All field splices will require a weld procedure be submitted on the form designated by the Department to the Engineer for review and approval.
- e. The complete details of the methods, materials and equipment proposed to be used in the installation.
- f. Details at the curbs and sidewalks.
- g. The maximum and minimum joint installation widths including an ambient temperature table for joint widths between 40° F and 90° F in 10° F increments.

Unless otherwise shown on the plans or indicated in the Special provisions, welding shall be done in accordance with ANSI/AASHTO/AWS D1.5 Bridge Welding Code. All field welders shall possess a valid welder certification card issued by the Department's Division of Materials Testing. If such person has not been engaged in welding operations on a Department project or project acceptable to the Department within a period of six months, or if he cannot produce an approved welding certification dated within the previous twelve months from a welding agency acceptable to the Engineer, he shall be required to re-qualify through examination. The Engineer may require re-examination of anyone whose quality of work he questions.

The steel extrusions shall be fabricated in sections and be made continuous by welding during placement. The strip seal shall be fabricated and installed in one piece. No field splicing of the seal will be permitted.

A competent technical representative of the manufacturer shall be present during the installation of the steel extrusions to provide the Contractor such aid and instruction as required to obtain a satisfactory installation, to the approval of the Engineer.

**Installation:** The strip seal expansion joint system shall be installed at the locations shown on the plans and in stages in accordance with the traffic requirements in the special provisions "Maintenance and Protection of Traffic" and "Prosecution and Progress."

The Contractor shall create a blackout at the end(s) of the concrete deck, approach slab, parapet and/or curb sections that is to receive the strip seal joint system, by removing the existing joint system and modifying the appropriate structure elements as detailed in the contract plans.

Care shall be taken to limit damage to the structure elements and the reinforcement to remain. The weight of pneumatic hammers shall not exceed 30 pounds for concrete removal above the top reinforcing steel, nor 15 pounds for concrete removal below the top reinforcing steel. The depth of concrete removal shall be at least that shown in the details, 1 inch below the reinforcing steel, but shall be such as to include all spalled, delaminated, or otherwise deteriorated concrete. The Engineer will be sole determiner of what constitutes deteriorated concrete, using sounding methods or other evaluation measures at his discretion.

Where the existing reinforcing steel is damaged or corroded, it shall be cut out and replaced with new reinforcing steel of the same size. Any sound reinforcing steel damaged during the concrete removal operations, shall be repaired or replaced by the Contractor at his expense, as directed by the Engineer. Sound reinforcing steel which is in the proper position in the slab shall be left in place and cleaned of all concrete, the smaller fragments to be removed with hand tools.

The steel extrusions and anchorage shall be sandblasted in accordance with SSPC-SP-7, Brush-Off Blast Cleaning, prior to placement. The extrusions shall be aligned with the deck cross slope and breaks in the cross slope. Both the leading and trailing sides of the extrusion shall be recessed ¼" below the adjacent headers as shown on the plans. The extrusions shall be firmly and accurately held in position prior to and during the placement of the concrete header by temporary supports. Temporary supports shall be designed to account for any thermal movements of the structure through the first 24-hour temperature cycle. Adjacent sections of extrusion shall be butt welded together—provisions shall be made in the installation sequencing to maximize the weldable area. All field welding shall be accomplished by an AWS certified Welder.

Forms shall be used to keep the concrete from entering the open joint between the concrete deck slabs or parapet sections.

Drilling and grouting of steel dowels shall be as shown on the plans and in accordance with the chemical adhesive's manufacturer's recommendations.

Mixing and placing concrete should not be done unless the ambient temperature is above 35°F. All mixing shall be accomplished by means of a standard drum-type portable mixer. A continuous type mobile mixer may be used if permitted by the Engineer. The Contractor shall calibrate the mobile mixer under supervision of the Engineer. Calibration shall be in accordance with the applicable sections of ASTM method C685. The total mix shall be limited to the quantity that can be mixed, placed and cured to allow access by vehicles in accordance with MP&T specifications.

The concrete mix shall be spread evenly and thoroughly compacted using concrete vibrators. The concrete shall be placed, with a trowel if necessary, to insure that it completely fills the header below the extrusion and to prevent honeycombing and voids. The headers shall be finished to match the final cross-slope and grade of the roadway so that it will be flush with the adjacent roadway surface.

The surface shall be float finished. Finishing operations shall be completed before initial set takes place. Cured areas having a hollow sound when chain dragged or tapped (indicating delamination), shall be replaced by the Contractor at his expense until replacement concrete, acceptable to the Engineer, is in place.

Traffic shall not be permitted over the joint until proper curing of the concrete has occurred and has developed adequate strength in accordance with the Form 816.

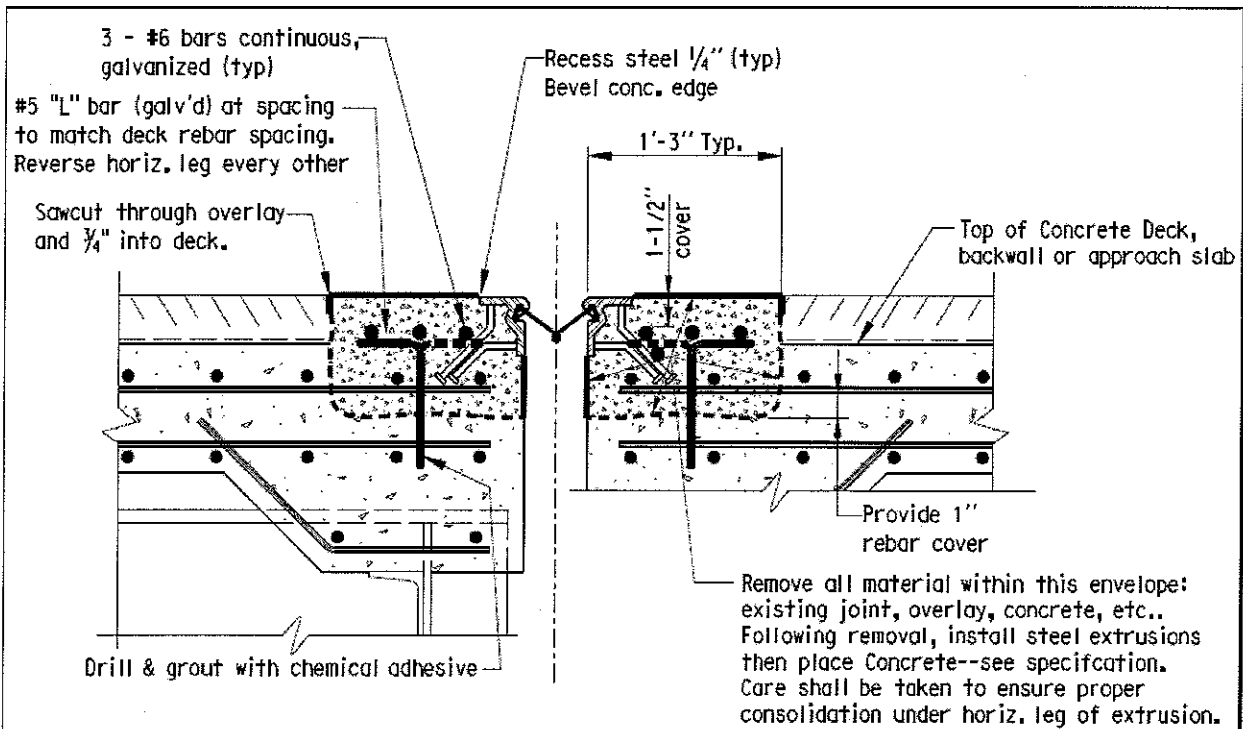
After the extrusions and headers have been placed, the strip seal shall be installed in a continuous length along the deck and up the parapets/curbs. An adhesive lubricant shall be used to install the strip seal in the steel extrusions as required by the manufacturer. No field splices will be permitted.

Any section of the strip seal that is punctured, ruptured, cracked, bent or damaged in any other way shall be removed and replaced by the Contractor at no additional cost to the State.

All work shall be done in accordance with the special provisions for "Maintenance and Protection of Traffic" and Prosecution and Progress" contained elsewhere within.

**Method of Measurement:** This work will be measured for payment by the number of linear feet of strip seal, installed and accepted, measured from gutterline to gutterline, unless otherwise noted in the plans, along the centerline of the joint. Work at the parapet or curb turn-up sections will not be measured for payment but shall be considered included in the general cost of the work.

**Basis of Payment:** This work will be paid for at the contract unit price per linear foot for "Strip Seal Expansion Joint System," complete in place, which price shall include all materials, equipment, tools, and labor incidental thereto.

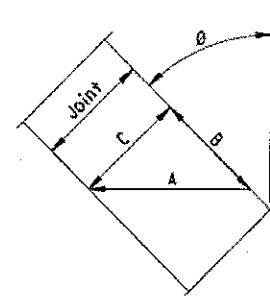


**Note To Designer:** Pay item includes all labor and equipment including furnishing and installing all elements of the strip seal joint, concrete, and reinforcement necessary to completely remove existing joint and install new strip seal in concrete headers.

**DESIGN INFORMATION:**

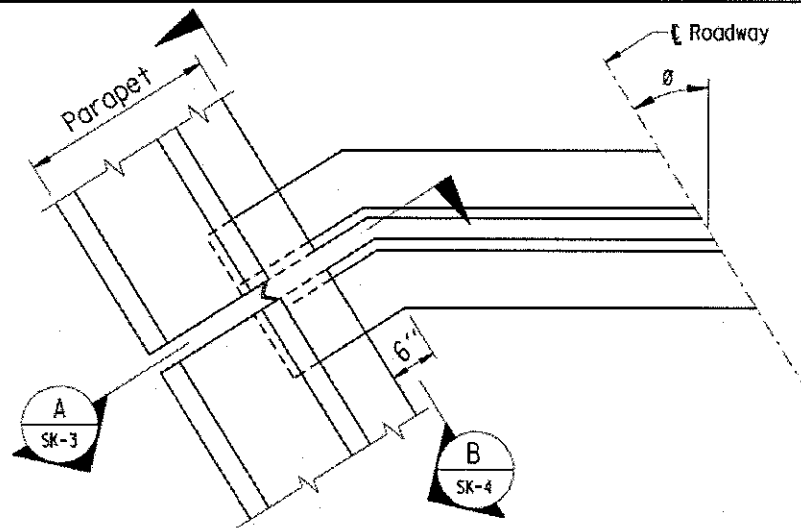
1. Concrete headers with strip seals shall be used at expansion joints with computed movements between 3" and 4".
2. The temperature range used for computation of movement shall be in accordance with Section 10.1 of the CTDOT Bridge Design Manual.
3. The strip seal movement capacity and opening @ 50deg F. shall be determined by the Designer in accordance with approved product information.
4. The Designer shall consider the effects of skew when determining the strip seal movement capacity. The movement rating of the gland shall be greater than or equal to the computed movements along the skew, normal to the joint or along the centerline of bridge. Additionally, review anticipated movements for conformance with manufacturer's recommendations.

$\theta$  = Skew Angle  
 A = movement along Bridge  
 B = movement along Skew  $B = A \sin \theta$   
 C = movement normal to joint  $C = A \cos \theta$

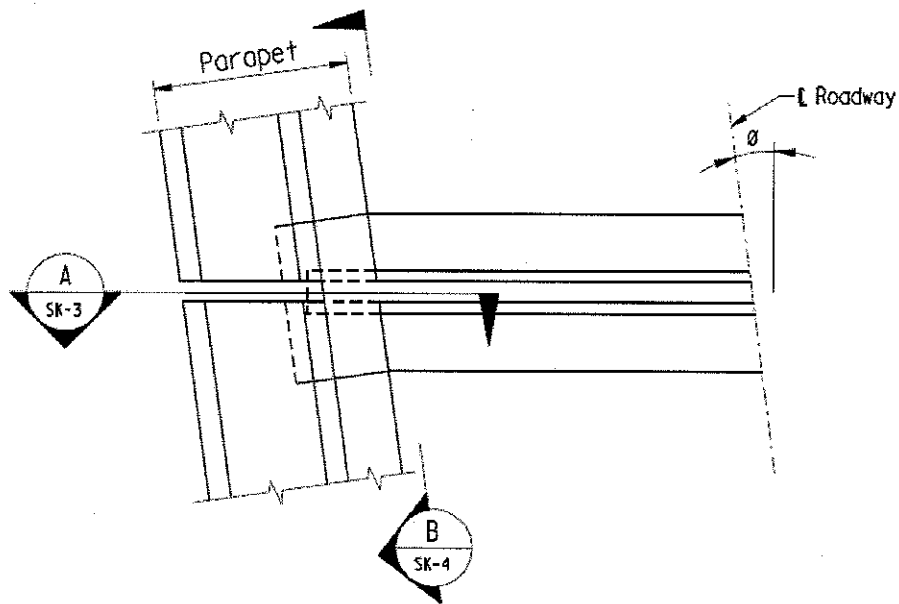


**STRIP SEAL IN CONCRETE HEADER  
EXPANSION JOINT SYSTEM -- REHAB PROJECT**

**SK-1**



JOINT TREATMENT AT GUTTERLINE --  $\emptyset > 25$

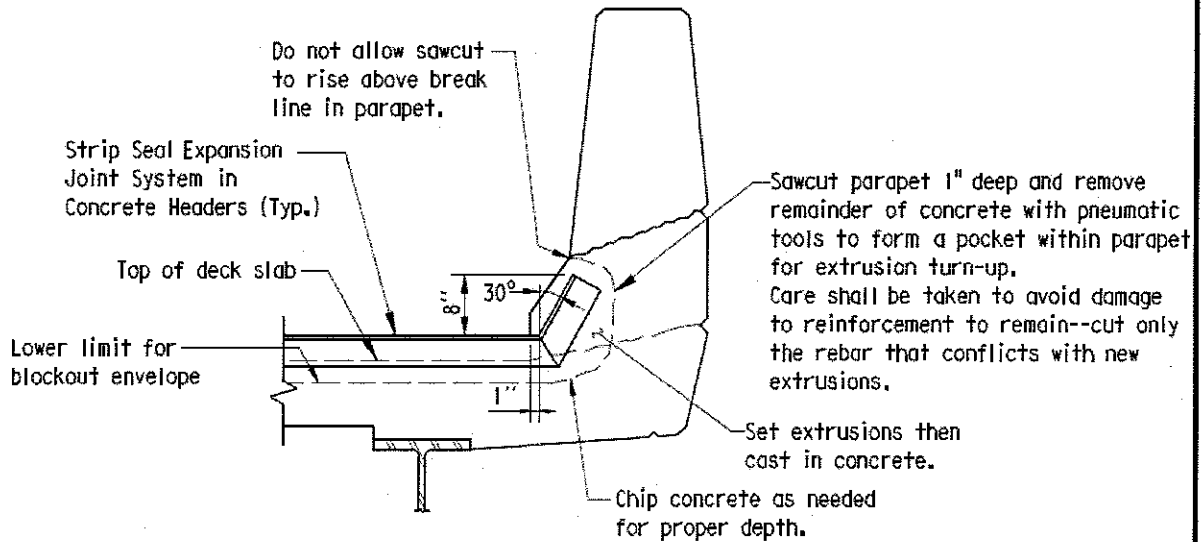


JOINT TREATMENT AT GUTTERLINE --  $\emptyset \leq 25$

STRIP SEAL IN CONCRETE HEADER  
EXPANSION JOINT SYSTEM -- REHAB PROJECT

SK-2

Note: Detail shown is for "F" shaped parapet.  
 Modify as needed for different parapet  
 shape configuration.



SECTION

A

## JOINT TREATMENT AT CONCRETE PARAPET

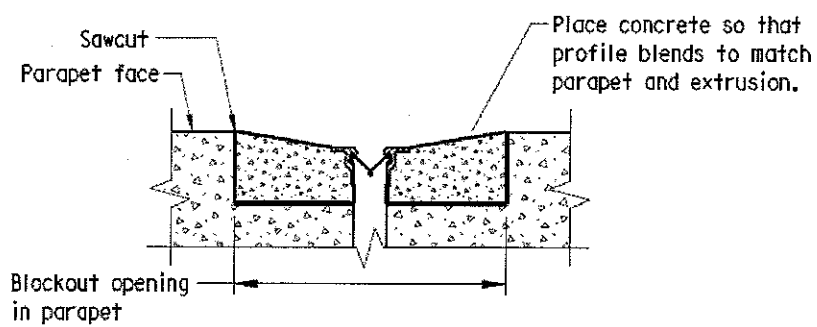
### DESIGN INFORMATION

1. This plate shall be used in conjunction with plate SK-3 and SK-4.

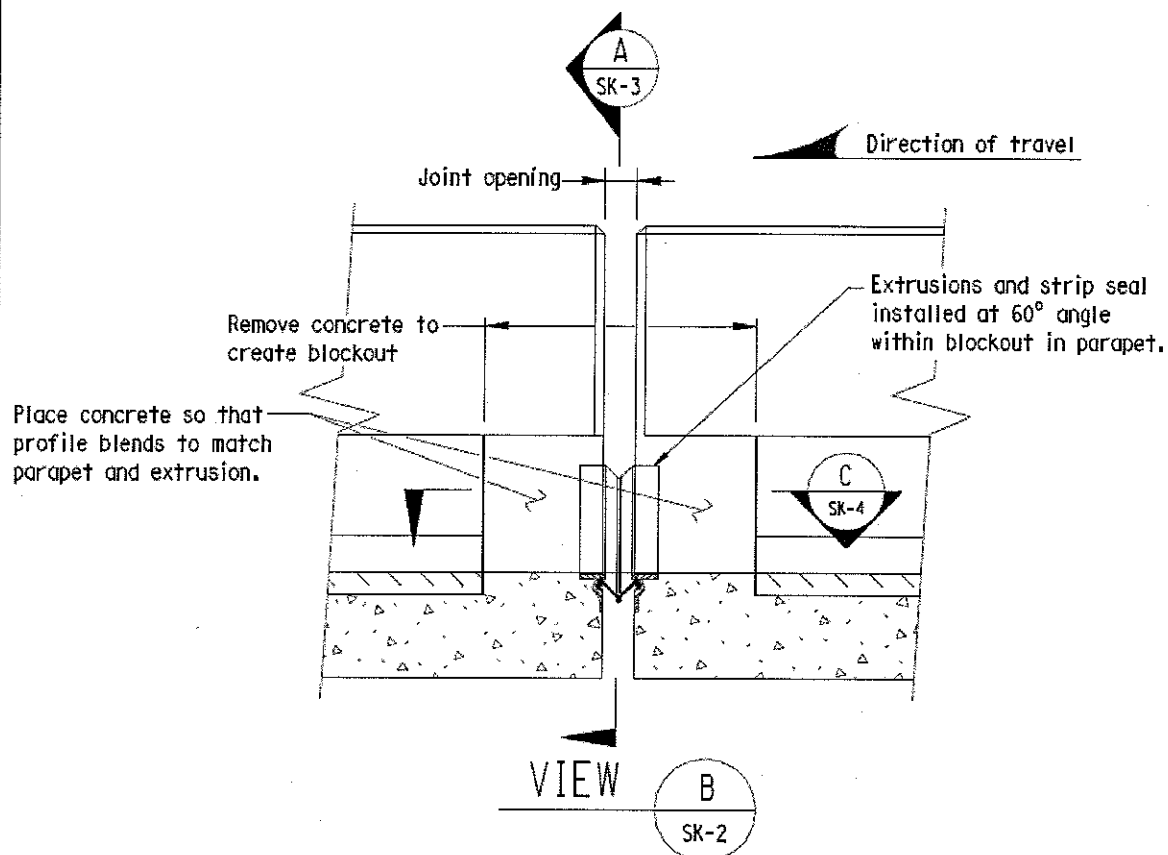
STRIP SEAL IN CONCRETE HEADER  
 EXPANSION JOINT SYSTEM -- REHAB PROJECT

SK-3





SECTION C



JOINT TREATMENT AT CONCRETE PARAPET

STRIP SEAL IN CONCRETE HEADER  
EXPANSION JOINT SYSTEM -- REHAB PROJECT

SK-4