(1) Use a multiple support bar system if the number of elastomeric seals is 9 or less, or if movement ranges are 700 mm (27 in.) or less. Use a single support bar system for larger movements. Use a swivel joint system if large transverse and/or swivel movements are anticipated at the expansion joints.
(2) Fill in blanks for specific job.
(3) Location on bridge (abutments, piers)
(4) Use when staged construction with a longitudinal joint is required.

Created: 6/5/96
Revised: 3/8/2005 (5)

SB- .1 Modular Bridge Joint System

This work consists of furnishing and installing a waterproof modular bridge joint system (MBJS) at the expansion joints on Bridge(s) No. _____. The work shall be performed in accordance with 2402, the Plans and the following:

A. General

These support bars are suspended over the joint opening by sliding on bearings contained within steel support boxes attached to the edge beams and cast into the bridge deck (and abutment). A MBJS consists of preformed elastomeric expansion joint seals mechanically held in place by steel edge and center beams. Center beams are supported by solid steel support bars. MBJS can be classified as multiple or single-support bar and swivel joint systems. For Bridge(s) No. _____, a ((multiple) (single)-support bar) (swivel joint) system shall be provided.

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B. Acceptable Systems

Only manufacturers who have successfully completed fatigue and performance testing will be permitted to supply the MBJS. Final results of all required tests shall be submitted to the Engineer for approval prior to manufacture.

The following systems have been approved for use on Department projects based on successful completion by the manufacturers of the tests.

1. "D.S. Brown Steelflex® Modular Joint System", as shown in the manufacturer's Bridge Products brochure.

Manufacturer:
D.S. Brown Co.
300 E. Cherry St.
No. Baltimore, Ohio 45872-0158
Ph. (419) 257-3561 Fax (419) 257-2200
web site: http://www.dsbrown.com

2. "WABO® Strip Seal Modular Joint System", as shown in the latest edition of the manufacturer's brochure.

Manufacturer
Watson Bowman Acme Corp.
95 Pineview Dr.
Amherst, New York 14228
Ph. (716) 691-7566, Fax (716) 691-9239
web site: http://www.wbacorp.com

C. Pre-qualification Testing Requirements

Before a MBJS can be accepted for installation on this Project, the design must be pre-qualified by the manufacturer through successful fatigue and performance testing administered by an independent testing laboratory. Fatigue and Performance testing shall be done in accordance with Appendix A19 of the AASHTO LRFD Bridge Construction Specifications.

All testing shall be performed on a test specimen(s) of a model similar to that required of this Project. Successful testing will prequalify that model—with allowable variations—for the Project and no further testing will be required.

D. Materials

Materials for the MBJS shall meet the following physical and chemical properties:

1. Structural steel for the edge beams, center beams and support bars shall conform to 3309. Support boxes and anchorages shall conform to either 3306 or 3309. (Sidewalk and (railing) cover-plates shall conform to 3306). No aluminum components or hardware shall be used.

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2. Stainless steel sheet for the sliding surfaces of support bars shall conform to ASTM A 240, Type 304. The surface shall be polished to a Number 8 mirror finish.

3. Fasteners shall conform to the same requirements as those used in the prequalification tests.

4. Welded studs for anchorage purposes shall conform to ASTM A108.

5. Each elastomeric sealing element shall be a single-diaphragm unreinforced neoprene gland. Basic physical and chemical properties of the elastomer shall be in accordance with the requirements of ASTM D 5973.

Each gland shall be 6.35 mm (**¼-inch**) thick, subject to a minimum thickness of 5.6 mm (**7/32-inch**) and shall provide a minimum of 75 mm (**3 inches**) of movement.

6. Polytetrafluoroethylene (PTFE) shall be unfilled 100% virgin material, woven fabric or dimpled sheet conforming to the requirements of Section 18.8 of

the AASHTO LRFD Bridge Construction Specifications.

7. The same material composition and formulation, manufacturer, fabrication procedure and configuration of bearings and springs must be used as was used in the Pre-qualification tests.

8. Lubricant/adhesive shall conform to ASTM D 4070.

9. Control springs shall be a urethane foam product that conforms to the requirements of ASTM D 3574.

E. Design and Detailing Requirements

1. Loading and Movement

The MBJS shall be designed in accordance with Article 14.5 of the AASHTO LRFD Bridge Design Specifications.

The theoretical thermal longitudinal expansion joint movement for the full design ambient temperature range of 65° C (**150°F**) is approximately _____mm (____ **inches**) at the (_____(3)_____). (The actual movements may be more or less than the theoretical figures depending on influencing factors, such as (pier deflection) (creep and shrinkage of prestressed concrete units).

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The MBJS shall be designed to accommodate a minimum of ____mm (___ **inches**) of thermal movement between the lowest anticipated ambient temperature of -35° C (____**-30° F**) and the highest anticipated ambient temperature of +____50°C (____**120° F**). Mean temperature for design shall be 7°C (**45°F**). There shall be no physical contact of any beams at the minimum opening, and the maximum opening between beams shall be 75 mm (**3 inches**)--measured perpendicular to the edge beams--under any conditions.

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(To supplement to the thermal movement described above, the MBJS shall include provisions for an additional movement of ____ mm (___**inches**) caused by possible shifting of substructures on unstable soil and/or deflection of piers.)

2. Edge Beams

The edge beam cross-section shall be the same as the section used for the Seal Push Out Test for the performance testing.

Concrete anchorages for the devices shall be as shown in the Plans, or as modified by the manufacturer to be compatible with the devices furnished.

Modified anchorages shall be designed to resist vertical and horizontal forces from traffic, including impact. Horizontal elements of the edge beams shall also be anchored to resist the upward-acting impact (rebound) from wheel loads. If the skew is greater than 20 degrees, horizontal forces from impact from

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snowplows shall be considered in the design of the anchorages.

3. Support Boxes

Support boxes shall be made from steel plate or tubing with a minimum thickness of 9.5 mm (**3/8 inch**). If the support boxes are greater than 406 mm (**16 inches**) wide, the thickness of the top plate shall be increased so that the width-to-thickness ratio does not exceed 45 unless stiffening ribs are used. For support boxes composed of nested steel tubes, the diameter or width-to-thickness ratio of each tube shall not exceed 45.

4. Bearings and Springs

The MBJS shall be designed to allow removal and replacement of the support bearings, bearing springs, control springs and elastomeric seal elements. A procedure for removal and replacement of these elements shall be given on the shop drawings.

Support bar bearings shall be positively locked into the support boxes with a non-metallic dowel or pin. The connection must permit removal and replacement of the bearing components.

Control springs for the equidistance control shall be situated on the MBJS so that the direction of resistance will be parallel to the direction of movement, and shall accommodate the full range of design movement without distress.

Replacement of parts subject to wear shall be provided for in the design. Submit a written maintenance and parts replacement plan prepared by the MBJS manufacturer for the Engineer's approval. Include a list of parts and instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, and procedures for replacing worn parts.

5. Elastomeric Seals

Seals shall extend beyond the ends of the edge and center beams by, at least, 50 mm (**2 inches**).

6. Field Splices in Edge and Center Beams

Each MBJS shall be fabricated and shipped to the Project site as a single unit unless any or all of the following conditions apply:

a. The bridge will be constructed in stages with longitudinal construction joints.
b. The full length of a MBJS would make shipping impractical.
c. Other factors unique to the Project that would require field splices.

Only field splice details that have been designed in accordance with AASHTO LRFD Bridge Design Specifications can be used for the MBJS.

Splices should be located away from wheel tracks and in areas of least live load stress. Edge beams may be field-welded with fillet welds covering only part of the beam profile.

Center beam splices shall be bolted connections consisting of side plates set in recesses machined out of the center beam profiles and cross-bolted with, at least, four bolts. After field assembly, the nuts shall be tack-welded to the bolt to prevent the nuts from backing off. The span—between support beams—in which the field splices are located, shall be a maximum length of 900 mm (**3 feet**).

If the MBJS contains only a single center beam, a welded field splice may be used in lieu of a bolted splice. Fillet or partial-penetration welds are not permitted.

The design of the MBJS shall take into account any different installation procedures required under conditions that require field splices. Such procedures shall be clearly indicated on the shop drawings.

7. Lifting and Preset Opening Devices

Lifting devices shall be provided for the MBJS. Other devices to maintain the preset openings shall be provided at a uniform spacing not greater than 4580 mm (**15 feet**) along its length. At least, three such devices shall be used per fabricated segment.

F. Submittals

1. In accordance with 1603, the Contractor shall furnish Certificates of Compliance to:

Structural Metals Engineer
Minnesota Department of Transportation
Bridge Office
3485 Hadley Ave. N.
Oakdale, MN 55128-3307

The Certificates of Compliance shall include the following additional information:

a. Certification that the control springs are produced by the same manufacturer with the same process and in the same configuration as those used in the OMV Test. Certification that the same lubricant adhesive used for the Seal Push Out Test was also used to assemble the MBJS. These certifications shall include the manufacturer's name and contact information as well as production date and lot identifiers;

b. Certification that MBJS sub-assemblies with similar center beam and support bar cross-sections and joints have passed pre-qualification testing requirements described in SB- .1C.

c. Design calculations sealed by a Licensed Professional Engineer;

d. A written maintenance and part replacement plan prepared by the MBJS manufacturer. This plan shall include a list of parts and instructions for maintenance inspection, acceptable wear tolerances, methods for determining wear, and procedures for replacing worn parts;

e. Method of installation including, but not limited to, sequence, installation gap setting for various temperatures, support during placement of the concrete, and installation at curbs;

f. Any required changes to the blockout reinforcement in order to accommodate the MBJS; and

g. A temporary bridging plan for any MBJS for which construction (and public) traffic is anticipated following installation.

2. The Contractor shall submit a 300 mm (**12-inch**) section of elastomeric seal material from each lot of material furnished, and samples of the PTFE sheet, size 50 mm x 75 mm x 3 mm (**2 inches x 3 inches x 1/8-inch**) from the production material; to the Engineer for testing.

3. Shop drawings for the MBJS shall be submitted in accordance with the requirements of 2471.3B and shall include, but not be limited to, the following additional items:

a. Plans and section views of the MBJS for each movement rating and roadway width showing dimensions and tolerances;

b. All welded center beam-to-support bar joints shall be shown;

c. All welded shop splices, and all welded and/or bolted field splices shall be shown;

d. Complete details of all components and sections showing all material incorporated into the MBJS;

e. All appropriate material designations (Mn/DOT, ASTM, AASHTO. etc.);

f. Corrosion protection system;

g. Lifting locations and lifting mechanisms for installation; and

h. Opening adjustment devices for temperature variations and opening dimensions relative to temperature.

G. Fabrication Requirements

All MBJS components shall be fabricated by the same manufacturer.

All structural steel surfaces, except those made of stainless steel, shall be galvanized after fabrication per 3394.

Stainless steel sheet shall be welded at each end to the steel substrate by the tungsten-arc welding process in accordance with the current AWS specification. The stainless steel sheet shall be clamped down to have full contact with the substrate during welding. Welds shall not protrude beyond the sliding surface of the stainless steel. Intermittent fillet welds will not be allowed.

The full-penetration weld that connects the center beam to the support bar shall be ultrasonically inspected in accordance with 2471 and AWS D1.1. Twenty-five percent of the center beam-to-support bar welds shall be tested, or as directed other wise by the Engineer. If ultrasonic inspection reveals at least one rejectable weld defect, the fabricator shall then ultrasonically inspect another 25% of the center beam-to-support bar welds (25% of the original total of welds.) If rejectable defects are found in the second 25% set of welds (50% of total), all remaining non-inspected welds shall then be inspected. Each weld that is rejected by ultrasonic inspection shall be repaired using a welding procedure approved by the Engineer. The repaired welds shall then be retested by ultrasonic inspection in accordance with the original requirements.

The fabricator will be permitted to shop-weld pre-galvanized sections of the edge and center beams. If the steel beams are pre-galvanized, the fabricator shall:

1. Provide roadway sections that are not less than 3050 mm (**10 feet**) long.

2. Bevel abutting ends 6 mm (**¼-inch**) and deburr the edges.

3. Groove-weld sections with care taken to prevent weld metal from entering the seal groove. All galvanizing shall be completely removed from the weld area. The weld across the top of the beams shall be ground smooth. All areas of galvanizing damaged by welding operations shall be repaired in accordance with 2471.3L1.

4. Attach anchorages and support boxes to the edge beam section prior to galvanizing. Provide an anchorage within 225 mm (**9 inches**) of each end of each pre-galvanized section.

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(If field splices will be used, the ends of the edge and center beams shall be staggered so that they are not at the same point on each beam.)

Each MBJS shall be completely assembled at the fabrication shop. All elastomeric seals shall be installed at the shop. Seals shall be continuous for the full length of each MBJS. Lubricant adhesive shall be applied to all elastomer-to-steel contact areas for seal installation.

(4)(4) (Each MBJS shall be fabricated for shipment in separate sections sized in accordance with the slab construction joints required for the construction stages as shown in the Plans. Ends of the edge and center beams shall be staggered so that construction joints are not at the same point on each beam. Installation of seal elements is not required during fabrication since they must be continuous without splices for the full length of the device.)

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H. Installation Requirements

To aid in assuring proper installation of the MBJS, the manufacturer shall furnish technical assistance to the Contractor and Engineer through a technical representative who is a full-time employee of the manufacturer. The representative shall be accessible to the Engineer and shall be at the site during the work that involves the setting of all parts of each device. The Contractor shall be responsible for informing the representative of the date of installation.

Immediately prior to installation, the MBJS and the blockout will be inspected by the Engineer for 1) proper alignment, 2) complete bond between the seals and the edge/center beams, and 3) placement and effectiveness of the anchorage devices. Bends, kinks, disconnected seals, and other deficiencies, in the judgment of the Engineer, shall be corrected by the Contractor before installation, and at no expense to the owner. Perform an audio hammer test on the welded stud anchors. Studs that do not emit a ringing sound when struck lightly with a hammer, shall be replaced as ordered by the Engineer.

The clearance shown in the Plans and/or shop drawings between the bottoms of the support boxes and the tops of the beams shall be maintained.

Reinforcement bars that are cast into the deck and abutment shall be repositioned, if possible, in lieu of cutting to provide a minimum of 50 mm (**2 inches**) of clearance to the support boxes, anchorage devices and edge beams. Also, a minimum of 100 mm (**2 inches**) of clearance shall be maintained for reinforcement bars placed during installation of the MBJS. Bar spacing shown in the Plans may be altered to clear the MBJS.

If welded field splices are used for the edge and center beams, care must be exercised to prevent weld metal from entering the seal retainer grooves.

Each MBJS shall be installed at the joint opening given on the shop drawings for a specific ambient temperature, or as adjusted by the manufacturer's installation technician for the temperature at time of installation. Tops of the edge and center beams shall be in the same plane with a maximum tolerance of 3 mm (**1/8 inch**) difference in elevation among the tops of the center beams or edge beams. This variation shall be measured vertically from a straight line connecting the top of the deck profile on each side of the MBJS. There shall be no more than 13 mm (**1/2 inch**) longitudinal difference among gap widths at either end of a seal or among multiple gaps.

Formwork for the blockout concrete shall prevent entry of concrete into the support boxes, and not allow concrete to impede free movement of the MBJS.

Fully support the MBJS during placement of the concrete in the blockout. Grout pads under the support boxes are not recommended, but if used, shall terminate beyond the sides of the support boxes.

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No concrete shall be poured until the MBJS installation and joint opening(s)--at the time of the pour--has (have) been inspected and approved by the Engineer.

If there is a vertical grade on the bridge, concrete shall be placed on the down-grade side of the blockout first. The concrete shall be vibrated thoroughly so as to adequately consolidate the concrete underneath the support boxes and against the backside of the edgebeams.

Construction loads will not be allowed on the MBJS for at least 72 hours after installation, including concreting, is complete. If necessary to cross the joint during that 72-hour period, the Contractor shall bridge over the MBJS in a manner approved by the Engineer.

The complete MBJS installation shall be watertight at all points and shall be so tested by filling the joint opening, or portions thereof, as designated by the Engineer, with water and observing the results over a period of not less than one hour.

I. Method of Measurement

Each MBJS will be measured by length in meters (**linear feet**) based on the out-to-out installed length of the device.

J. Basis of Payment

Payment for Item No. 2402.603 “MODULAR BRIDGE JOINT SYSTEM, TYPE _____" will be made at the Contract price per meter and shall be compensation in full for all costs of furnishing and installing the MBJS complete inplace as described above, including all incidentals thereto.

Select One

Payment for Item No. 2402.603 “MODULAR BRIDGE JOINT SYSTEM, TYPE _____" will be made at the Contract price per linear foot and shall be compensation in full for all costs of furnishing and installing the MBJS complete inplace as described above, including all incidentals thereto.