

DBSB-2499 SPMT BRIDGE CONSTRUCTION

DBSB-2499.1 Scope of Work

This work consists of furnishing all labor, equipment, material and other services necessary to construct bridges using Self Propelled Modular Transporters (SPMT) to move bridge superstructures into their final location. Perform the Work in accordance with the applicable provisions of the MnDOT Standard Specifications, the Design Documents, and these special provisions.

The work shall include, but not be limited to:

- Identifying location of Bridge Staging Area
- Preparing Bridge Staging Area for temporary works
- Constructing temporary supports for bridge superstructure construction
- Identifying and preparing the bridge Travel Path
- Resolving all potential Travel Path impacts including clearances, utilities, etc.
- Determining SPMT capabilities and developing a bridge move plan within these capabilities
- Evaluating estimated and actual impacts to bridge superstructures due to transport
- Constructing bridge superstructures
- Determining allowable superstructure deflection and twist limits for bridge moves
- Providing methods to monitor and record bridge superstructure deflection and twist
- Preparing a bridge move contingency plan and conducting a final pre-move walk through
- Moving bridges into their final location

DBSB-2499.2 Definitions

The following definitions apply to these special provisions.

A. Self Propelled Modular Transporter (SPMT)

Specialized equipment used to move bridge superstructures, consisting of motorized load bearing multi-axle platforms that are linked and controlled through a computer.

B. Bridge Staging Area

The location of the temporary bridge supports where bridge superstructures are constructed.

C. Travel Path

The route along which the SPMT carries new bridge superstructures from the Bridge Staging Area to the final bridge location.

D. Temporary Supports

Any structure used to provide temporary support to a bridge or bridge superstructure.

E. Monitoring

The act of using equipment to measure, record and quantify changes in the geometry and condition of bridge superstructures as a result of temporary support conditions and moving operations.

F. Heavy Lifter

The firm employed by the Contractor to provide heavy lift equipment and operations including SPMTs and related shoring, bracing, and engineering.

G. Working Drawings

Design sheets, or similar, including supporting calculations that the Contractor is required to submit to MnDOT, such as shop drawings, erection plans, and falsework or framework plans, or any other supplementary plans or similar data which illustrate the construction of the Work required in this provision to supplement the Design Documents.

H. Superstructure

Bridge elements above the bearings including but not limited to girders, deck, and barriers.

I. Twist

The condition where a corner of a superstructure deflects up or down relative to the plane defined by the other three corners of the supported bridge span.

J. Safety Plan

The plan put in place by the Contractor to protect all personnel, spectators, and property during the construction and movement of the new bridge.

K. Contingency Plan

A plan linked to the timeline for all bridge movement activities identifying potential threats to the movement activity and schedule. The plan identifies actions to be

taken in case of any event which could cause a safety concern or disrupt the schedule of the bridge move.

DBSB-2499.3 Qualifications of Heavy Lifter

The Heavy Lifter shall have a minimum of five years experience as a Heavy Lifter using SPMTs and shall have successfully completed a bridge move using SPMTs within the United States in the past five years.

The Heavy Lifter's supervisor in charge of this work shall have previous SPMT bridge move experience.

DBSB-2499.4 Submittals

Submit the following information and data to MnDOT for Acceptance prior to NTP2:

- A. Proof that the Heavy Lifter qualifications have been met including a list of similar projects completed within the last five years with names and phone numbers of owner's representatives who can verify the Heavy Lifter's participation in those projects.
- B. Name and experience record of the Heavy Lifter supervisor in charge of the bridge moves.

Working Drawings are required for the following:

- 1. Bridge Staging Area
- 2. Temporary Supports
- 3. Travel Path
- 4. SPMT Lifting System
- 5. Superstructure Monitoring

Working drawings shall be submitted to MnDOT for Acceptance before the start of the affected work. Working drawings shall be prepared and sealed by a professional engineer registered in the State of Minnesota. Working Drawings shall show complete details and supporting calculations of the methods, materials, and equipment to be used.

Management plans are required for the following:

- 1. Superstructure Monitoring Plan
- 2. Safety Plan
- 3. Contingency Plan

Submit a final geometry check within five Working Days from a completed bridge move.

Complete or coordinate all submittals under the direction of the Bridge Design SPMT Engineer.

DBSB-2499.5 Methods and Equipment

A. SPMT Equipment

Use SPMT equipment capable of lifting a bridge superstructure, carrying it to its final location, and setting it down at its final location with an allowable horizontal tolerance of 0.5 inches. The assembly shall function as one unit using one controller with capability to move forward, backward, transversely, at any angle, and pivot 360 degrees in a carousel motion. Support the system on hydraulic jacks that have no less than a 24-inch stroke to raise or lower their platform. SPMT axle loads are limited to 25 tons per axle total load.

The SPMT system shall include the SPMTs, their blocking which provides the interface from the SPMT platform to a bridge superstructure, and any other devices or apparatus used to move bridge superstructures. Provide sufficient backup equipment to complete the bridge move if a breakdown were to occur during the move process.

DBSB-2499.6 Construction Requirements

A. Bridge Staging Area

Identify the location of the Bridge Staging Area. Develop a site plan that corresponds to the final bridge location. Conduct geotechnical investigation of the site to determine sub-surface conditions in accordance with the Contract Documents. Determine any utility impacts. Determine any geometric constraints including those required for construction activities such as concrete placement and girder erection. Return Bridge Staging Area to its preconstruction condition unless otherwise directed by MnDOT.

Provide to MnDOT Bridge Staging Area Working Drawings that include a layout and grading plan, including all ground improvements, soft soil mitigation, utility protection, identifying such items as sheeting, haul roadways, materials to be stored on the site, temporary structures, temporary storm runoff control, trail relocation and security.

B. Temporary Supports

Design temporary supports for the construction of bridge superstructures. Design temporary supports in accordance with the AASHTO *Guide Design Specifications for Bridge Temporary Works*. Design temporary foundations for a maximum total settlement equal to the lesser of 0.1 percent of the adjacent span length or 1 inch, and for a maximum differential settlement of 0.5 inches within an individual foundation. Use a minimum of a two-year time period for settlement calculations.

Provide MnDOT with weekly elevation control surveys, including top of footing

if exposed and temporary bearing seat elevations, to monitor settlement. Additional surveys are needed once temporary supports are complete and immediately before girders and deck are placed. Provide the surveys until the superstructure is placed in its final location. Remove temporary supports unless otherwise directed by MnDOT.

Provide to MnDOT Temporary Supports Working Drawings that include plans and design calculations for temporary supports. Provide MnDOT the results of the surveys and a comparative settlement analysis.

C. Travel Path

Identify the specific Travel Path from the Bridge Staging Area to the final bridge location. Verify that adequate horizontal and vertical clearances exist to safely move the bridge. Identify all ground improvements, soft soil mitigation and utility protection needed for the move. Verify that the required soil bearing capacity is provided for entire limits of bridge move. Protect all infrastructure crossed. No damage to existing pavements or infrastructure is allowed. Loaded SPMTs shall not cross over any bridge. Return Travel Path to its preconstruction condition unless otherwise directed by MnDOT.

Provide to MnDOT Travel Path Working Drawings that include plans, geotechnical requirements and site specific methods to provide utility protection along the entire length of the Travel Path.

D. SPMT Lifting System

Provide SPMT system to lift bridges from temporary supports and move bridges to their final location. Design the SPMT to lift a bridge at the support points shown in the Design Documents. The lifting system shall provide wheel loads equal to or less than those designated by the Geotechnical Engineer. Provide lifting system with adequate stroke to fully lift a bridge, traverse the Travel Path to the final bridge location, and place it within the allowable limits.

Design SPMT blocking to meet the following specifications in order of precedence:

1. *AASHTO Guide Design Specifications for Bridge Temporary Works*
2. *AASHTO LRFD Bridge Construction Specifications*

Calculate the anticipated lateral forces during the move including but not limited to braking, turning, vertical grades and wind loads. Provide a system to transfer these loads to the SPMT system. Develop a complete bridge move plan from temporary supports to final bridge location within the physical Project and SPMT equipment constraints.

Provide to MnDOT SPMT Lifting System Working Drawings that include plans and calculations for the SPMT, blocking, carrier beams when used, and full bridge move

plan showing SPMT path and SPMT stroke requirements. Indicate the selected lifting system possesses electronic steering capacity allowing for movement forward, backward, transversely, at any angle, and in a carousel motion about any point. Indicate that the selected system will provide adequate support to all girders. Indicate any additional systems required or used to move the structure. Indicate preparatory work necessary for moving personnel, SPMT equipment, supplies, and additional equipment used to move bridges and incidentals to the site before beginning work. Provide a pre-operations checklist.

E. Superstructure Requirements

Provide SPMT supports within 20 percent of the span length from each end of a bridge. Support all girder lines. Do not construct the full length of superstructure spans before the bridge move. Provide sufficient length at the ends of spans to facilitate superstructure connections in the deck and barriers after the bridge move to minimize cracking.

F. Superstructure Monitoring

Calculate the deflected superstructure shape immediately after being lifted from its temporary supports. Also calculate the maximum relative twist the superstructure may undergo and remain within the design limits.

Supply monitoring equipment to actively monitor and record deflection and twist control during the superstructure lift and transport. Use monitoring equipment capable of measuring relative movements to 0.125 inches. Halt operations immediately if deflection or twist exceeds allowable limits. Return the superstructure to temporary supports if necessary.

Provide to MnDOT Superstructure Monitoring Working Drawings that include a monitoring plan and calculations. Provide MnDOT a Superstructure Monitoring Plan indicating all equipment and activities to monitor bridge deflection and twist. Provide monitoring records to MnDOT within 5 Working Days of completing the move.

G. Safety and Contingency Plans

A minimum of four weeks prior to the move, conduct a safety and contingency coordination meeting involving all Contractor, Heavy Lifter, and MnDOT project level leaders. Prepare extensive safety and contingency plans for the bridge move. Identify all issues or items that have potential to impact the safety of any personnel, actual bridge move, or the bridge move schedule. Identify key contacts for decisions during the bridge move. Establish authority and communication tree for immediate issue resolution during the move. Submit these plans a minimum of 10 Working Days prior to the bridge move. Update these plans and confirm they are complete prior to the final walk through pre-move safety meeting.

Conduct a final walk through pre-move safety meeting immediately prior to moving the bridge with all Contractor, Heavy Lifter, and MnDOT project level leaders at bridge site for the bridge move. Verify all items identified in the contingency and safety plans have been completed. Walk the travel path to verify surfaces have been prepared adequately, all utility protection is in place, all side slopes have been adequately supported, and verify all work has been completed for the move. Reinforce communication and authority responsibilities during the bridge move. Submit final contingency and safety plans to MnDOT a minimum of 48 hours before bridge lifting or moving any bridge.

H. Final Geometric Check

Prior to lifting the superstructure, conduct a pre-lift crack survey of the barriers and top of deck marking the limits of all visual cracks. Conduct final (X,Y,Z) survey of top of permanent supports and top of temporary supports and locations of superstructures to determine the extent of any remedial work that may be required prior to moving bridges into place. Remedial work may include grinding or other adjustments of final substructure. Immediately prior to lifting, determine the vertical orientation of bridge superstructures for verification of allowable deflection and twist once lifted.

Provide MnDOT with the survey results and the detailed remedial work and/or shim thicknesses and locations needed.

I. Lift and transport bridge superstructure

Engage SPMT lifting system and slowly lift bridge superstructures from their temporary supports. Ensure all bearing locations are lifted off their supports simultaneously. Check engaged weight against anticipated weight defined on the working drawings.

Compare the actual performance of the spans as they are lifted from their temporary shoring to the required jack stroke estimates, the maximum anticipated deflection, and the maximum allowable deflection. Confirm with the Bridge Design SPMT Engineer that the monitoring devices are within tolerance and expected ranges. Proceed with transport.

During the bridge move, continuously monitor bridge superstructures. If the twist appears likely to exceed the allowable limit, adjust the SPMT supports to correct. Stop the move if necessary.

Refer to the contingency plan for required response and resolution for issues that arise during the move. Deliver superstructures to their final location within allowable damage limits with no loss of strength, performance, or long-term durability.

J. Placement of Superstructure

Prior to setting down bridge superstructures, verify that all bridge bearing locations have been properly prepared and all elevations have been confirmed. Verify that all required shims have been placed. Lower bridges into place and load all bearing units uniformly. Place bridges within 0.5 inches horizontally and 0.125 inches vertically of their defined final location.

Conduct check of deflected shape and survey to confirm that bridges are in tolerance at their final location. Conduct post move crack survey of the deck and barrier within seven Days of the bridge move and after temporary supports attached to the superstructure have been completely removed. Provide both crack surveys to MnDOT. Repair all cracks greater than .020 inches wide.

Cracks between 0.020 inches (0.51 mm) and 0.040 inches (1.50 mm) in width shall be filled by the Contractor using a MnDOT approved epoxy injection system and materials. The epoxy injection operation shall be in accordance with the material and equipment manufacturer's published recommendations. All cracks shall be filled within 14 Days of permanent environmental exposure.

Concrete elements with cracks greater than or equal to 0.040 inches (1.50 mm) in width at the final bridge location shall be repaired or removed and replaced by the Contractor. Repair work will only be allowed for cracks that do not compromise the integrity of the design or the fitness of use as determined by the Engineer and agreed upon by MnDOT. All proposed repair work shall be approved by to the Engineer and submitted to MnDOT for Approval.

Repair of cracks in the deck or barrier shall be performed with materials that are compatible with the chip seal wearing course. All injection ports, excess epoxy and sealing epoxy shall be removed from the concrete surface.