

ENGINEERING DIRECTIVE

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Contract Requirements for Bridge Projects Involving the Use of Self-Propelled Modular Transporters (SPMTs)

Effective immediately, all construction contracts that involve the installation and/or removal of bridge structures using Self-Propelled Modular Transporters (“SPMTs”) shall include the following language and associated drawings (figures):

Requirements for the Use of Self-Propelled Modular Transporters

The following provisions and drawings (Figures 1-4) apply to the use of Self-Propelled Modular Transporters (“SPMTs”) for moving new or existing bridge elements under this contract:

1. The design of the shoring system shall account for Vertical and Horizontal Forces that act on the system during the bridge move. The term “shoring” includes all support structure and bracing between the top deck of the SPMT and the underside of the bridge as well as the bracing between the SPMTs, if applicable. The design of the system includes the following forces during the move:
 - a) The Vertical Impact Force caused by uneven surfaces along the SPMT travel path shall be accounted for by using the 15% impact factor applied to the combined weight of the superstructure, the shoring system, and the SPMT. The proposed bridge superstructure shall be checked for these forces to ensure that cracking will not occur in the bridge deck and barriers. The check of the deck shall be performed using the provisions of the AASHTO LRFD Bridge Design Specifications for beams and decks in negative moment regions of continuous spans. The existing bridge the superstructures shall be checked using the Allowable Stress Design method limited to operating stress level, however cracking of the deck is permissible.
 - b) The Horizontal Force caused by starting and stopping of the SPMTs shall be accounted for by using 10% of the combined weight of the superstructure and the shoring system. This force shall be applied at the location of the center of gravity of the combined bridge and shoring system. The entire system shall be designed to resist this force in any direction with a minimum factor of safety of 1.5.

2. Stability of the shoring system shall be checked for various potential failure modes. For the purpose of checking stability of the shoring system, the lateral resistance of an individual SPMT to roll over about its longitudinal axis shall be ignored. Lateral rollover resistance of the entire system shall be assured by either the shoring system alone or by the lateral fixity of the shoring at the top of the SPMT combined with lateral fixity in the connection of the shoring to the superstructure. If the superstructure is used for stability of the entire system, then the superstructure shall be checked for its ability to resist the forces imparted by the shoring system. All connections shall be checked for the above forces. If friction is used to resist these forces, a factor of safety of 4 shall be used to check against sliding. Refer to Figures 3 and 4. At a minimum, the following shall be performed:
 - a) The hydraulic zoning of the axle lines shall be established with a minimum of a three zone set-up, as shown in Figures 1 and 2. Each zone shall be interconnected and controlled by the Operator during the move. The Heavy Lift Engineer shall establish the geometry of the system such that the center of gravity of the superstructure is located within the stability envelope defined by the hydraulic zones, while maintaining the stability criteria specified in items “b” and “c” below. This will ensure relatively equal load distribution to all axle lines. Alternate zoning methods may be used for complex bridges, but only with approval from MassDOT. These methods shall account for the proper stability of the system during the move.
 - b) The stability of the system shall be checked and verified by the Heavy Lift Engineer to ensure that the center of gravity will remain within the stability envelope defined by the hydraulic zoning in the event that the SPMT is tilted by 7 degrees out of level in any direction.
 - c) The system shall be checked and verified by the Heavy Lift Engineer to ensure that none of the hydraulic groups will be loaded beyond their capacity in the event that the SPMT is tilted by 3 degrees out of level in any direction.

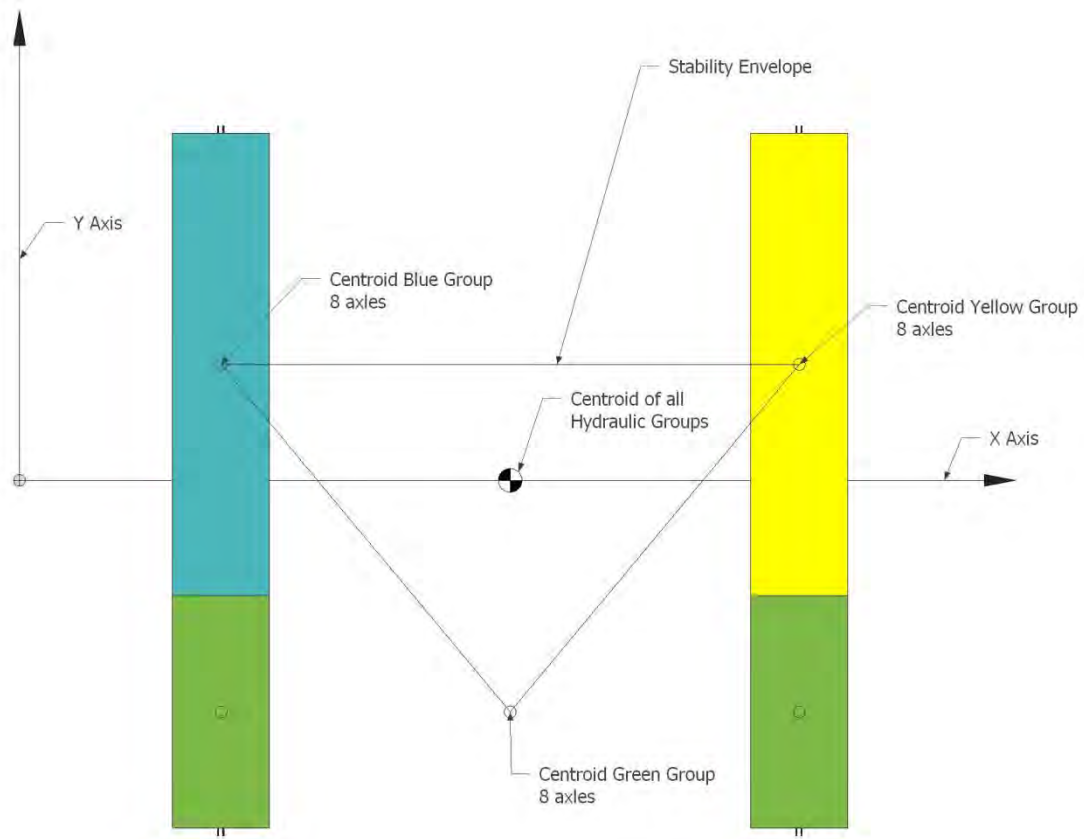


Figure 1 – Sample Plan – SPMTs Showing Hydraulic Zones

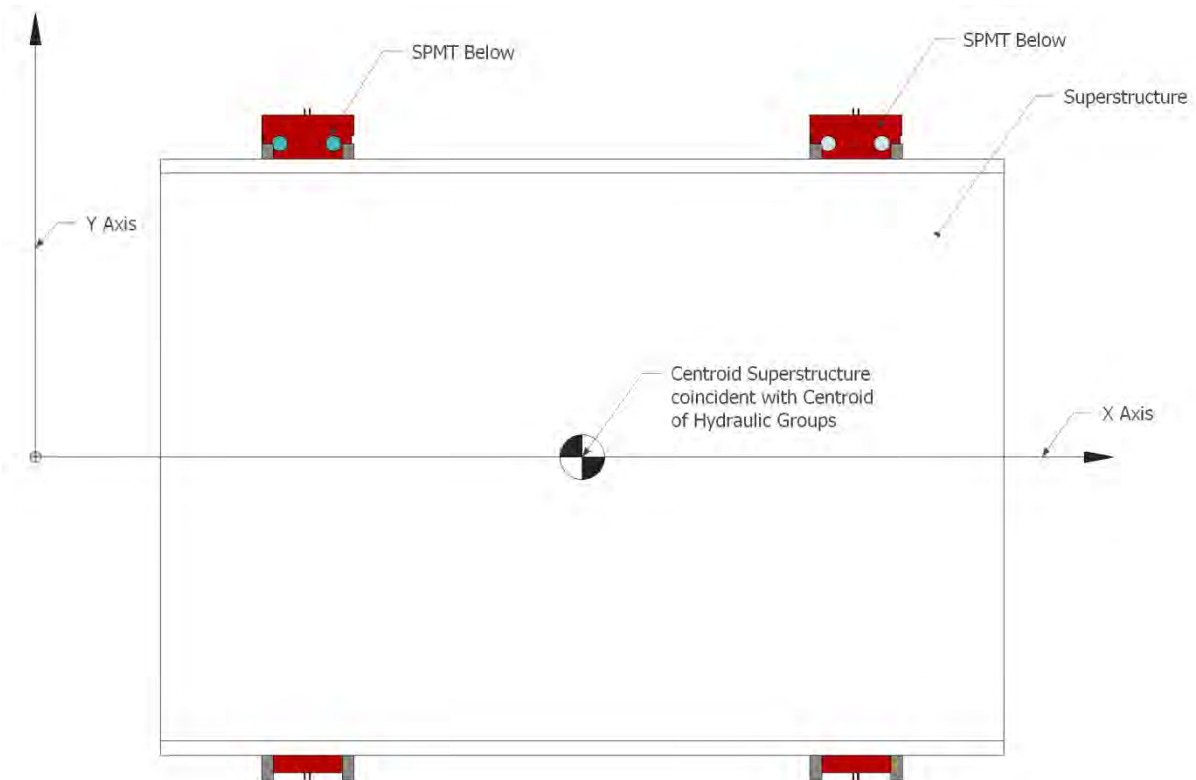


Figure 2 – Sample Plan – SPMTs with Bridge Superstructure

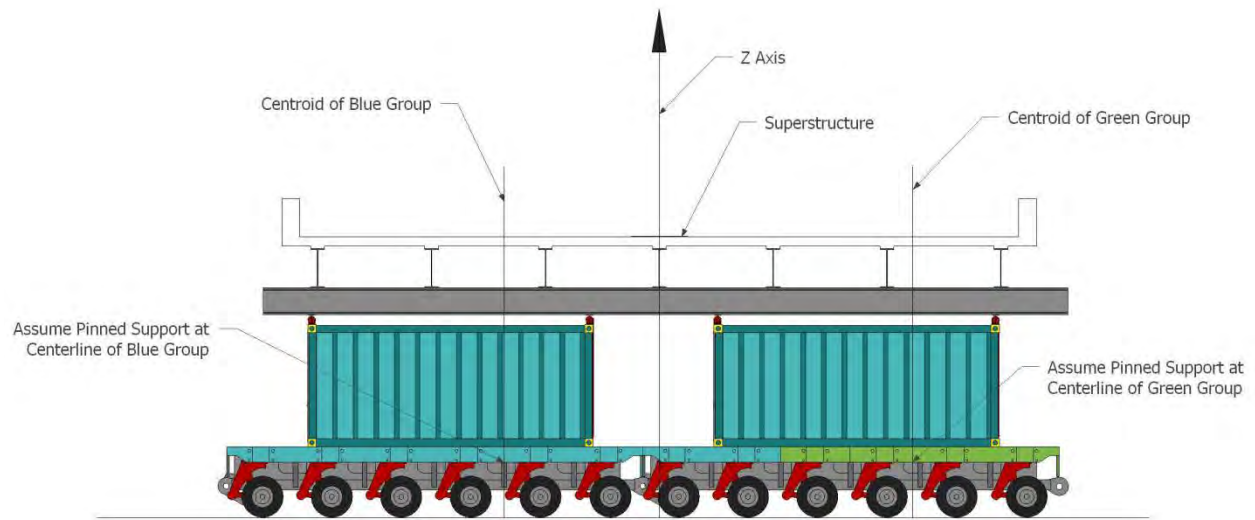


Figure 3 – End View – Stability Assumptions

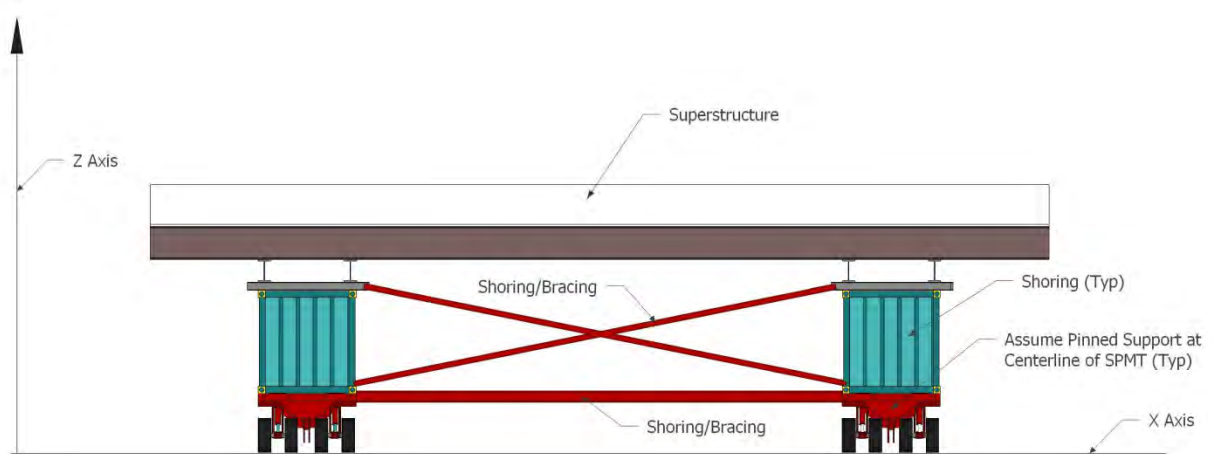


Figure 4 – Side View – Stability Assumptions