DOWNLOAD PDF PERFORMANCE TESTING FOR MODULAR BRIDGE JOINT SYSTEMS

Chapter 1 : SteelflexÂ® Modular Expansion Joint Systems

Performance Testing for Modular Bridge Joint Systems TRB's National Cooperative Highway Research Program (NCHRP) Report Performance Testing for Modular Bridge Joint Systems presents recommended testing specifications; material, fabrication, and construction guidelines; and a joint anchorage design example for modular bridge joint systems.

The bridge model without CMEJs and pulse effect. The bridge model with CMEJs and pulse effect Isolated bridge adopts friction pendulum bearings, which are widely used in engineering practice. Figure 7 is typical bilinear FPS hysteresis. The number is 10cm in this paper which means when the compression deformation is greater than 10cm, it can be considered that adjacent girders has been collided. In order to satisfy the requirements of the bridge temperature change and normal operation, the gap was assumed 0. If the relative displacement between girders is larger than 8cm, cable can play its roles; if the displacement is larger than 10cm, the cables can be seen as failing to achieve the expected goals. Because the structure is symmetrical, we only consider the half bridge as discussed in this paper. To better reveal the effect of CMEJs in limiting the relative displacement of the adjacent girders under six pulse-type ground motions, we introduced the seismic response in detail under No. Figure 12 shows the relative displacement between left deck and middle deck under the No. The responses of neglecting the effect of CMEJs in the analysis are also shown in Figure 12 for comparison. There are three times in the tensile direction and two times in the compressive direction, which is also clear in Figure Because the free movement of cables is 8cm, the cables can work when the gap is larger than 8cm. As is obvious from Figure 10 , there is pulse acceleration with high magnitude spikes from 8s to 15s. But the difference is that No. In conclusion, in the bridge with CMEJs, the peak relative displacement between the adjacent girders is significantly decreased, thus avoiding collision. The relative displacement of adjacent girders can be reduced within 0. The installation of a CMEJs can reduce the relative displacement and achieve a more economical design. Velocity pulse will increase the acceleration, velocity, displacement impact. For small damping, the effect of velocity pulse is larger and it allows bridges under high-energy impact, which may result in large displacements and deformations. As is obvious from Figure 16 , the No. Though they have the same PGA, but No. Figure 17 shows the relative displacement between decks and piles and used left deck and P5 as an example. It is important to note that the relative displacements are significantly amplified if the PE is considered in analysis. The maximum relative displacement is However, this value is That means when near-fault earthquakes occur, the relative displacement between decks and piles becomes 7. From this figure, we can see that CMEJs cannot work very well in restraining the relative displacement between piers and girders. Once the relative displacement is larger than allowable displacement overlap length , girder falling will occur. Whether the cables can hold the girders or not, further work is needed to validate this point. But in theory, the capacity of cables can satisfy the requirements. Figure 18 shows the relative displacement between adjacent girders with PE or without PE. Focusing on the responses during s, the displacements significantly amplified with PE. The relative displacements are 0. It is found that when near-fault earthquakes occur, the relative displacements are 5. However, the displacements are restricted to 0. On the other hand, the decks without CMEJs will be destroyed by pounding and aggravated the destruction of piers and girders under near-fault earthquake. Figure 19 shows the corresponding pulling forces at the expansion joints between left deck and middle deck. Figure 20 is the displacement at the right end of the left deck. The maximum displacement is However, this value is 0. And Figure 21 is corresponding acceleration at the right end of the left end. It is interesting to note that the shape of Figure 16 is very similar to Figure As is obvious from Figure 21 , there is significant pulse wave with PE. As is obvious from Table 5 , all the five indexes have significantly increased by 1. Therefore, in the situations of pulse effect, neglecting its possible effects leads to non-conservative designs. So the installation of CMEJs can be a protection device for the bridge near the earthquake fault zone and limit the relative displacement of the adjacent girders.

Chapter 2 : Field Load Test on the New Maryland Modular Slab Bridge System | BEST Center

requirements for modular bridge joint systems and developed test methods and test equipment for the prequalificcation and acceptance of such systems to meet these requirements.

The total movement of the bridge deck is divided among a number of individual gaps which are created by horizontal surface beams centerbeams. In addition to supporting wheel loads, a properly designed modular joint will prevent water and debris from draining onto the underlying substructure. MBJS can be designed in a number ways to cater for different loads and movement combinations. Above that, SSB structure is considered. The entire movement of a MBJS is the nos of the cells times 80mm. Each support bar supports only one centerbeam. For the multiple-support-bar system, a support box will hold as many support bars as there are centerbeams. According to NCHRP Report , the maximum numbers o centerbeams that a support box can encase is 7 8-cell modular joint. Each support bar supports all the centerbeams. Control springs are applied to centerbeams and edgebeams to work as a total kinematic system. The support boxes are cast into concrete on both sides of the joint. The support boxes connected to the edgebeams are also anchored in the concrete structure by fixing the studs. For steel bridges, the connecting method shall be prearranged to be able to fix the joint. The vertical load on edgebeams will be transferred through the anchors to the substructure. These loads are all transferred to the support bar via the rigid connection between centerbeams and support bars, then distributed to the adjacent substructure through the pre-compressed spring and bearing which have a certain rigidity. Support bars are made of solid metal and act like a continuous beam. The horizontal force is also transmitted through the elastomeric control buffer equidistance movement. Through this elastic bearing the momentum of the wheels is damped when transferred to the absorbent elements or to the neighboring anchor assemblies. The arrangement of the elastomer bearing prevents any metal-to-metal contact and assures at the same time high damping of nosing within the vulcanized rubber elements. The elastomeric bearing elements allow rotations in all three axes, whereby unplanned restraint forces can be prevented. The stiffness of bearings and springs is complementary thus the compression due to wheel loads can be compensated through the releasing of spring. An array of such devices inside a MBJS is able to keep the support right in its working position. The support boxes have welded head studs to get connected to the neighboring concrete. In other words, each gap shall expand or contract at the same level. To realize this, the necessary equidistance devices have to be arranged on the joint. There are a number of different ways to achieve this. At Baoli, the following 3 methods are adopted. This type of rigid connection works thanks to mechanical principle of the design. The metal pieces are bolt-connected along the longitudinal direction so the movement is delivered from the first set of scissor to the last. A good thing is by this method there is no concern about the non-uniform deformations which are prone to occur in elastomeric devices. But this rigid connection devices do make a noise when the traffic passes by. Another negative factor is such rigid devices can hardly take any transversal movement and vertical deflection. Schematic illustration showing the structure of scissor-type equidistance deviceâ€"rigid connection to equally distribute the movement to each cell of MBJS. Alternatively, the rigid device can also be placed horizontally. The rigid device can be placed horizontally just beneath the centerbeams. Testing of million load cycles 7 MPa had been performed and result showed the enhanced polyurethane exhibited no cracks or other failures. Ideally this material has been proven to suit the application for MBJS. The working principle is apparent. All the buffers are installed in a tandem and together they absorb the incurred movement. By control the positions of these devices to be right and exact, the equal spacing for each centerbeam opening is achievable. A comparison of polyurethane control spring freshly made and aged Illustration of a typical layout of control springs attaching to the underside of a cell MBJS An illustration explaining how the control buffers perform during joint expansion and contraction An image showing the control springs are in service during a movement test on MBJS 1. They take control of the movements of individual centerbeam and the shear force lure them to work as a single kinematic system. The movements of each centerbeam relative to its neighbors are regulated by control scheme, which are rigidly connected to that centerbeam by steel and to the neighboring centerbeams by connecting frame. At each edgebeam, the control spring sets are connected to the bridge structure by control boxes as per below image showing. The elastic gap control system increases the service life of the entire joint by damping the impact loading from traffic impact. These shear springs are actually specially designed steel-reinforced rubber bearings. Due to the attribute of rubber and the round shape design, the springs can deflect to any direction under shear force. Therefore a good expect of transversal movement and vertical deflection can be realized. When there is large transversal movement request, this design is often considered. Approved lubricant adhesive prior to inserting of rubber seals is necessary. The sealing element is set below the road surface level which can prevent wheels from contact with them. Push-out test for seals guarantees the bonding between the rubber seal and the mechanically interlocking mechanismcavities inside the edgebeam and centerbeam. Sealing can be replaced from above with a bar when the individual gaps are not less than 30mm. Gap width can be enlarged by moving the beams.

Chapter 3 : Performance Testing for Modular Bridge Joint Systems | Blurbs New | Blurbs | Publications

Damage to expansion joints has been reported due to various causes, such as heavy traffic loads, failure of bonding agents, and poor installation and maintenance (Chang and Lee).

Chapter 4 : Formats and Editions of Performance testing for modular bridge joint systems [calendrierdelasc

Note: Citations are based on reference standards. However, formatting rules can vary widely between applications and fields of interest or study. The specific requirements or preferences of your reviewing publisher, classroom teacher, institution or organization should be applied.

Chapter 5 : Formats and Editions of Performance testing for modular bridge joint systems [calendrierdelasc

Title / Author Type Language Date / Edition Publication; 1. Performance testing for modular bridge joint systems: 1.

Chapter 6 : Product Line :: WaboÂ®X-cel Modular

This paper presents results of an experimental investigation on the fatigue performance of the welded multiple support bar modular bridge expansion joint (MBEJ) used for the recent Jacques Cartier Bridge rehabilitation in Montreal.

Chapter 7 : Maurer Systemâ„¢ Swivel Expansion Joint Assembly

manufacturers who have successfully completed fatigue and performance testing will be permitted to supply the Modular Bridge Joint System (MBJS). Final results of all.

Chapter 8 : Maurer Systemâ„¢ Swivel Expansion Joint Assembly

Seismic Performance Estimation of Modular Bridge Expansion Joints System Jungwoo Lee1, Eunsuk Choi2, Jongwon Kwark3 ABSTRACT In order to evaluate the seismic performance of the rail-type expansion joint known for its.

Chapter 9 : SteelflexÂ® Modular Expansion Joint Systems

"Doing it right costs money. Doing it wrong costs more." Just ask Texas DOT, which had to repair the modular bridge

joint systems on its expansive Houston Ship Channel Bridge.