# RESEARCH ON THE DAMAGE MECHANISM AND SEISMIC ISOLATION SYSTEM OF HIGH-SPEED RAILWAY SIMPLY SUPPORTED BRIDGE UNDER NEAR-FAULT EARTHQUAKE

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## *Extended Abstract*

The near-fault earthquake poses a serious challenge to high-speed railway (HSR) bridges due to its strong velocity pulse, large displacement demand and the necessity of maintaining traffic function after the earthquake. The traditional seismic isolation system is often unable to coordinate the residual deformation of the track, limit the displacement of the bearing and optimize the seismic performance of the pier under different seismic intensities. In this study, a design method of seismic isolation system considering the dual-objective seismic performance coordination of HSR track-bridge system is proposed.

This keynote speech introduces a design method of seismic isolation system to meet the dual objective requirements of "structural safety-traffic safety" of high-speed railway bridges under near-fault earthquakes. Its core idea is to realize the orderly switching of the load path and control objectives between ' stiffness constraint-displacement accommodation-energy dissipation-self-centering ' through the strength-triggered system transformation mechanism under different seismic intensity levels. Based on the Code for seismic design of railway engineering (GB50111-2006) of China, earthquakes with different intensities under a certain seismic fortification level are divided into three levels, Low-level earthquake (LLE), Design-level earthquake (DLE), and High-level earthquake (HLE), and the target requirements under the above three levels of seismic intensity are defined: (1) Under the condition of LLE, the operation demand of the bridge supported by the track structure is preferred, the bearing remains non-slip, the limit device works elastically, and the pier system is in the low demand elastic range. (2) Under the condition of LLE, under the premise of ensuring that the beam does not fall and the track can be operated, the bearing is allowed to slip and trigger the conversion threshold, and the limit and transition stiffness are provided by the limit device, so

that the interface demand is controlled and the pier remains elastic. (3) Under the condition of HLE, the limit is released, the large displacement is accommodated, and the self-centering energy dissipation device is activated to restore the smoothness of the track structure with the minimum residual displacement, while maintaining sufficient safety reserve of beam falling and near-elastic response of pier.

In order to achieve the above collaborative goals, this paper takes the device combination with bearing, limit, energy consumption and self-centering division of labor as the method carrier, and defines the track-bearing-pier system of high-speed railway bridge through the following systems : the bearing system providing the vertical support of the main beam, the bearing restraint system ensuring the normal use conditions, and the self-centering damping system providing the seismic energy dissipation function and the post-earthquake reset function, and establishes the general parametric design rules and evaluation system. It should be emphasized that this study does not carry out the specific design of the device, but takes the method and coordination mechanism as the key content that can be promoted.

The peculiarity of this research lies in the proposed design method of seismic isolation system with dual-objective seismic performance coordination can meet the seismic requirements of high-speed railway bridge for structural safety and traffic safety, and has good applicability for the operation demand of high-speed railway bridge.

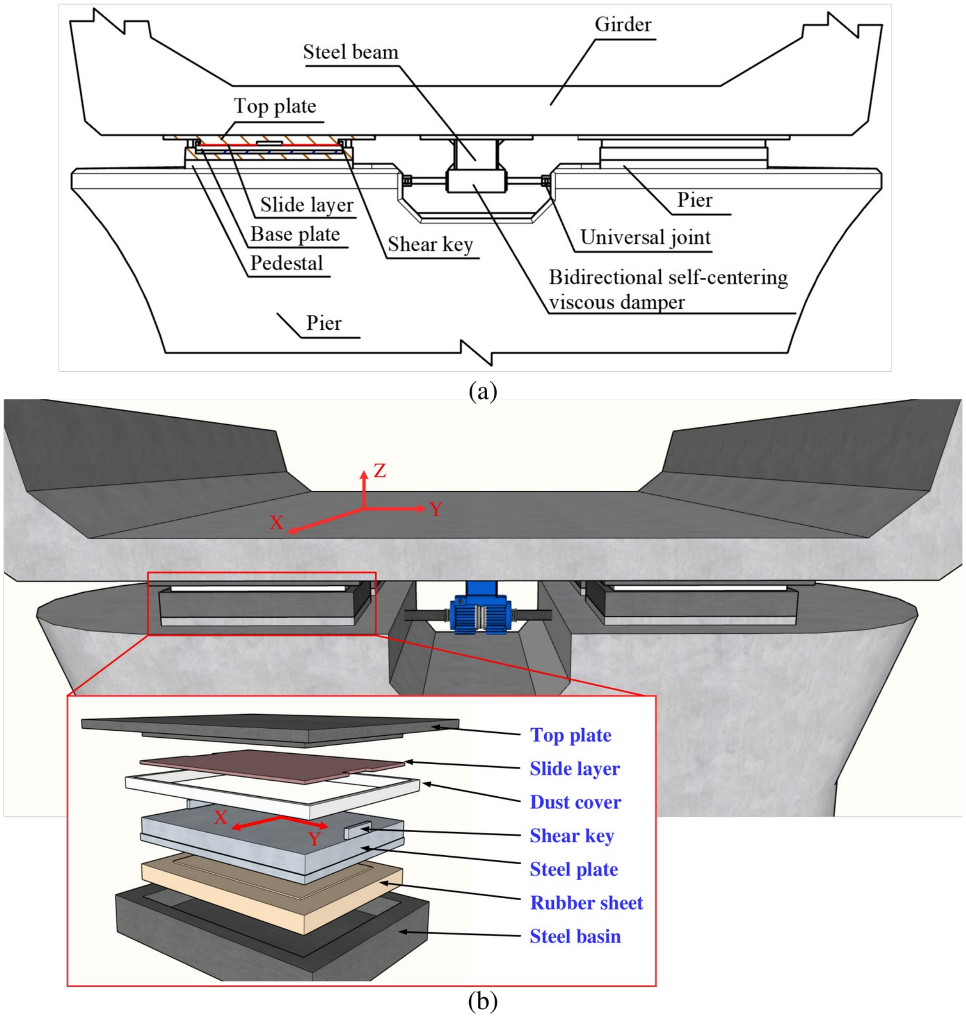


Figure 1- Structural form of Functional separated isolation system.

The results prove that，through the division of labor and time sequence coordination of limit, energy dissipation, and self-centering, the seismic capacity of the pier is fully utilized while ensuring that the pier does not yield damage during the earthquake. Under the condition of DLE, the seismic performance utilization rate of piers in PCIS is 43.9% and 46.8% higher than that of FPBMDT system and SSBSK system, respectively.

***Keywords****: Near-fault earthquake, High-speed railway, Damage mechanism, Seismic isolation system.*