The Researches on Adaptability of Existed Large Span Railway Steel Bridges Under Heavy Haul Freight Train in China

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Summary: Taken the typical structural type with a span falling into L≥64m as the research object, based on the consideration of the influence from different coefficient of check carrying capacity and dynamic coefficient on existing large-span steel railway bridge as well as the new fatigue train with heavy axle load train, 27t heavy axle load train adaptive analysis of bearing capacity and fatigue life are studied. Strengthen methods are discussed for the structure or members which are locally unsuitable for the heavy train. Research shows that it is feasible for the existing large-span steel railway bridges to carry 27t heavy train, while members with influence line less than 6m can't satisfy the needs, which should be locally strengthened. The load effect caused by heavy train is almost equal to the design load effect，which will decrease the safety margin of the structure and long-term operation would lead to degradation in structural behavior and decrease in fatigue life.

Keywords： Large-span; Steel railway bridge; Heavy train; Bearing capacity; Fatigue life.

1 Introduction

With the rapid economic development for China, Railway transportation is playing more and more important role in the freightage during the modern society the current station of railway operation is hardly to satisfy the great need. As the development of high speed railway in recent years, making the existing railway lines could be carry heavy train in time can alleviate this contradiction. Undoubtedly, for a large-span steel bridges under a railway line, to carry heavy train will cause great stress variety，there are a large amount of members, the influence of increases in train axle load and transport number on different members are not identical. So the urgent need is to make an adaptability study on the existing large-span steel railway bridges by aiming at the trend of heavy haulage.

Up to the end of 2013, there are more than 700 large-span steel railway bridges (L≥64m) in the mainland of China. There are mainly four structural types, they are steel truss, steel arch, arch-beam combination and cable-beam combination. The number of that ones with a structure of through truss is the most, about 90% of the total, the number of the span between 64~112m is about 90% of the total. There are bridges in service for more than 50 years accounted for about 7% of the total, more than half of the total are in service between 20~50 years. The coefficient of check bearing capacity K≥1 are nearly about 70% of the total.

The situations needed to be considered in studying the adaptability for existing large-span steel railway bridges to carry heavy train is quite complex. For steel bridges built in different years, there are different in design loads, materials, construction technique level, structure details and the concept of safety chosen by designers. Besides, the soundness of existing steel railway bridges will gradually decrease because of the effect of train load (with ever-increasing running speed and traffic flow rate), environment (temperature and acid rain) and haphazard (earthquake and fire) during long-time service, which results in the different ability to adapt heavy train for steel bridges in various service states. China railway authority has carried out lots of researches on relevant subjects, which proposes that newly built lines should be interconnected and interworked with existing railway networks and the orientation of axle load of heavy train shall be set as 27t. On account of this, the paper sets the design axle load of existing lines for carrying heavy train as 27t. Take the typical structural type with the span falling into L≥64m for example; bearing capacity and fatigue life are analyzed. For the individual members can't adapt to heavy train, the measures of

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