

Initial Analysis On The Problems of the Large-scale Equipments Transportation in the Highway Bridges

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Abstract: The large-scale equipments transportation in the highway bridges play an important role. It is very important to satisfy the transportation needs of national major engineering works and construction of national defence. This paper introduced the characteristic of the Large-scale equipments transportation, the principle of route selection and the computation method of bridge bearing capacity, which will provide theoretical basis for the large-scale equipments transportation in the highway Bridges.

Keywords: Large-scale Equipments Transportation; Transportation Characteristic; Route Selection; Bearing Capacity

1. Introduction

Large-scale equipments highway transportation is to transport special specifications of large objects that is over-weight, over-long, over-wide and over-high by unconventional vehicles. In recent years, with the process of industrialization further accelerate, large and heavy industrial equipment is the developing trends. single equipment over 300t is more and more common in the Industry of petrochemical, metallurgy, electric power. over one thousand tons equipment has use after another. These goods are usually the key equipments of national key construction projects, which have the characteristics of large size, high cost and long production cycle. During transport often requires a high safety and reliability. These large or oversized equipments need to go through road transport to reach the destinations. These large-scale equipments load are very different from specification for load standard.

The large-scale equipments transportation in the highway Bridges play an important role. It is very important to satisfy the transportation needs of national major engineering works and construction of national defence. To ensure large-scale equipments transportation safety, and to improve the efficiency of transport organization, is the key of large-scale equipments transportation. With the development of our country's economic construction and transportation, some large or oversize equipment need road transportation, but these loads are far heavier than specification for load standard, there remain many questions in transportations.

2. The Characteristics of Large-scale Equipments Transportation

Different from normal road transportation, large-scale equipments transportation has the following salient features.

2.1. Large-scale Equipments Transportation has a Mandatory

Large-scale equipments transportation usually transport valuables such as the key equipment of the state key investment project. When no other choices to select, road transportation become the only means of transport. Considering the destination is stationary, to ensure project put into operation on time or goods arrive on time, the car of large-scale equipments transportation must pass. So, large-scale equipments transportation has a mandatory.

2.2. Large-scale Equipments Transportation has Low Frequency.

Although the number of large-scale equipments transportation increase with years, its quantity is much less than the normal vehicles driving in the roads. In the same time, before they can pass, the relevant administrative departments for approval is needed. So, the large-scale equipments transportation has low frequency.

2.3. Subject to the Application before Transportation

General cargo vehicles can direct access need not application by the competent authorities. Because of large load and precious cargo, the vehicles of large-scale equipments transportation required of the applicant by the competent authorities, with the approval of traffic.

2.4. Large-scale Equipments Transportation must run According to the Examination and Approval Authority for the Specified time and Route

Large goods in transit will inevitably cause great impact on the traffic situation along the route, Administrative examination and approval department will generally avoid the peak of the vehicle carried bulky cargo transportation, so as to maximize the impact of lower vehicle traffic along the route. And because of the characteristics of the beam and goods vehicles, approval authorities has selected the best time for large transport and optimal route when issue permits. So when the large transport vehicle traveling, no matter for the safety of traffic or infrastructure along the road can be reduced to a minimum influence.

2.5. The Speed of Large-scale Equipments Transportation Strictly Limited

To ensure the safety of goods, vehicles themselves and transport facilities, country has strict limit to the speed of large-scale equipments transportation. Usually on a flat road does not exceed 20 km per hour. when the vehicle intersection does not exceed more than 8 km per hour. When pass through roads and bridges in the mountains, speed does not exceed more than 5 km. Simultaneously, throughout the transport process, emergency braking and hard acceleration should be avoided. At the same time, police departments and highways department usually Adopt closed to traffic, police car leading and other security measures when heavy goods pass.

2.6. Large-scale Equipments Transportation Serious Security Impacts on the Highway Structures

Highway structures are designed by an investigation of the ordinary vehicle. Large-scale equipments transportation vehicles are longer than the ordinary vehicles. The action sphere of vertical load is larger, the impact along the bridge is greater. Additionally, Large-scale equipments transportation usually choose flatbed trailer, which has large axle number, wheel track and load area. Compared with specification vehicles Wheel load, the former has greater impact on road. More noteworthy is that, large-scale equipments transportation vehicles have great total weight, which is far more than the design specification. These differences have a great influence on the safety of highway structures. Therefore, when the large transport vehicles pass the bridges, in order to ensure the safety of bridge structure, the traffic department will take the prohibition of other vehicles and pedestrians and Require large vehicle travel center to ensure maximum safety of highway structures.

3. The Basic Principles of Route Selection

Owing to the particularity of large-scale equipments transportation on weight and volume, transport loads on ordinary roads, mainly constrained by the following five factors: (1)The carrying capacity of the bridge structure along the roads; (2)The road turning radius requirements; (3)Stability and road conditions along the roadbed; (4)The maximum road slope and cross slope requirements; (5)Line access clearance requirements. It should also consider the time and economic factors. Selected route should ensure shorter transport distance and less retrofitting cost for safe transport.

Considering the above factors, to ensure that the selected transport routes to complete the transportation task safely, quickly and economically. It is the basic principles of route selection

4. Checking Method Introduction of Bridge Carrying Capacity

Currently, checking bearing capacity of the bridge can be summarized as the actual load calculation method, bridge load test method and equivalent-Load method. Three methods have their own advantages and disadvantages. In the actual project should be based on the need to select the appropriate checking method.

(1) Actual load calculation method. Calculated separately internal force effect when the vehicle pass bridge and Bearing capacity of the structure design. compare the two to determine whether the size can be passed. This method just verify whether the Bridge design resistance meet internal forces generated by large vehicles. However, the calculation of the actual existence of the state of the bridge can not accurately locate. For example, after a period of bridge operation, its design load will be reduced. Bridge structure appears damage. Different damage have different effects on the bearing capacity of the bridge. Some bridges previously been reinforced, but the effect can not be accurately determined after reinforcement. So, accurate positioning of the bridge in the immediate presence of the state is critical computing. Current research in this area is still relatively small. On the other hand, as there are many bridge on the large transport route, and different types of bridge need different calculation methods. This method is also very complicated to calculate and requires a lot of time and labor. So actual load calculation method can just suitable to the route with a small number of bridges and simple structure.

(2) Bridge load test method. The method can be used for step loading until the same load effects produced by large vehicles on bridge. The changes of bridge deflection should be carefully observed during loading process. When the load exceeds the deflection limit, the load should stop immediately. So bridge load test method is able to accurately determine the carrying capacity of the bridge. But this method is complicated, time-consuming and high costly. Usually Applied to bridges that opera-

tional for a long time, exist many diseases and can not accurately determine the carrying capacity.

(3) equivalent-Load method. This method only needs to calculate equivalent-load of the bridge design loads and loads of large goods loads. Then compared to determine whether large vehicles can go through the bridge. the equivalent-load of this method can be compiled into a table based on different types of bridges, main beam span and number of roots, which can save computing time. It is a quick way to determine the feasibility of large bridge transport vehicles. However currently using this criterion, consider few to the factors that impact the bridge carrying capacity. But these factors have a great influence on the calculated results check, which has a great influence on the accuracy of determination.

Conclusion

This paper describes the characteristics of large-scale equipments transportation. For the route choice, analysis the principles of route large transport, this paper studied and compared several methods to check bearing capacity of the bridge. and analysis the advantages and disadvantages.

References

- [1] Illia Racunica.Laura.Optimal location of internodes freight hubs.Transportation Research Part B39,2005
- [2] Chen-Tung Chen,Ching-Toring Lin,Sue-Fn Huang.A fuzzy approach for supplier evaluation and selection in supply chain management.[J].Production Economics 2006.
- [3] Zhang Pei,Jun Liu,Yang Xu.linguistic Values Based Intelligent information Processing:Theory,Method,and Applications.[M].Atlantic Press,2009,10.
- [4] F Lamiroux, JP Laumond.Trailer truck trajectory optimization: the transportation of components for the Airbus A380.[J]. IEEE Robotics and Automation Society,2005.
- [5] Jiyin Liu,Chung-Lun Li,Chun-Yan Chan. Mixed truck delivery systems with both hub-and-spoke and direct shipment[J]. Transportation Research Part E . 2003 (4)
- [6] Hani S. Mahmassani. Dynamic Network Traffic Assignment and Simulation Methodology for Advanced System Management Applications[J]. Networks and Spatial Economics . 2001 (3-4)
- [7] Qiao Lan,Yibing Li,Xu Jun.Weights Determination Based on Combined Objective and Subjective method in Traffic Safety Evaluation. The Sixth International Forum of Automotive Traffic Safety . 2008
- [8] The AASHTO Board of Directors.AASHTO Strat-egic Highway Safety Plan. . 2005
- [9] F. van Hoorn.Container Crane Transport Options:Self-Propelled Ship Versus Towed Barge. Marine Heavy Transport & Lift . 2005
- [10] Arpaia Pasquale,Lucariello Giuseppe,Zanesco Antonio.Multi-agent remote predictive diagnosis of dangerous good transports. Conference Record-IEEE Instrumentation and Measurement Technology Conference . 2005