Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 12 (1984)

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DOI: https://doi.org/10.5169/seals-12288

Installation for Runnability on Long Span Bridge

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Runnability of Train on Transit Girder System.

For development of transit girder system, runnability of train had been studyed as mentioned below.

Runnability of trains at the transit girder system can be separately checked for sections of the expansion joint and the dispersion system for angular bend.

At the expansion joint, the structure is designed so that rail tracks may continue to secure a proper gauge line and wheelset load can be structurely supported.

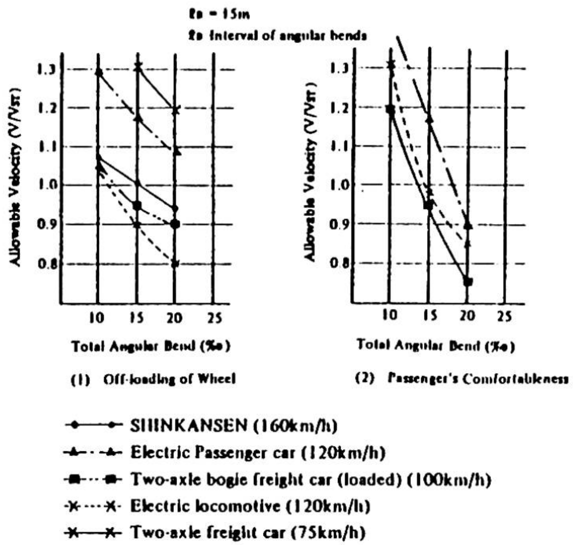
Rail of the inserted girder type expansion joint is cut out partially to keep space for expansion, and the guardrails are arranged to prevent derailment.

For the runnability on the expansion joint, running tests by actual cars were conducted in 1974 to certify safety of trains with speed up to 180 km/hr.

The runnability on the angular bend section is extreamely influenced by a vertical and horizontal angular bend. The safety against derailment when a train run on the transit girder with vertical, horizontal angular bend or composite angular bend of the both and passenger's comfortableness for vertical and horizontal vibration had to be investigated.

The investigations for derailment and comfortableness were carried out for criteria of the rate of off-loading of wheels and the lateral pressure and magnitude of the vibration, respectively, and they were numerically analyzed or simulated for various types of cars.

And, important items among them were confirmed by running tests of actual cars and model cars, and results of the running tests and the calculation were compared. As the result of these investigations, relation between the running speed and the limit of angular bend is established as shown in right figure.



Allowable velocity V/VST above is defined as the ratio of investigated result to standard running speed

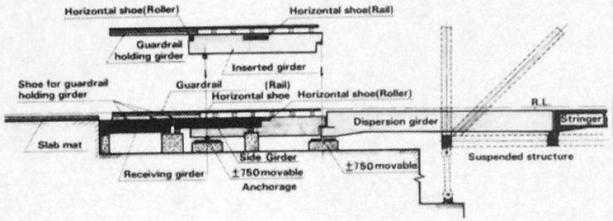
Fig.
Allowable speed of various types of cars

For example, when the total angular bend is 10‰ and span of the dispersion girder is 15m, these figures show that allowable velocity (V/VST) of Shinkansen is 1.07 for the rate of off-loading of wheels, in other words, Shinkansen car can run with 1.07 times speed of standard running speed. As for an electric locomotive, it can run with 1.04 times speed of 120 km/hr.

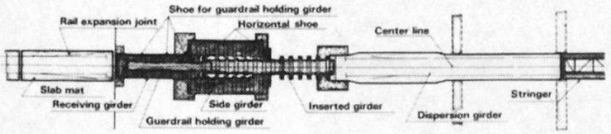
INSTALLATION FOR RUNNABILITY ON LONG-SPAN BRIDGE

In Kojima-Sakaide Route of Honshu-Shikoku Bridge Project, suspension bridges and cable stayed bridges which have high flexibility are being constructed for highway and railroad with high speed trains.
At the end of these bridges, large amount of expansion/contraction and angular bend occur.
In order to let the high speed train run safely on these deformation, transit girder system has been developed.
Two types of expansion joint are developed.
One is called the inserted girder type for expansion (including effect of earthquake) up to ± 750 mm of suspension bridges.
And, another is called the moving sleeper type for expansion up to ± 400 mm of cable stayed bridges.

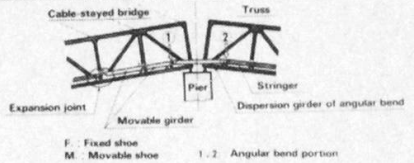
General view of inserted girder type transit girder system



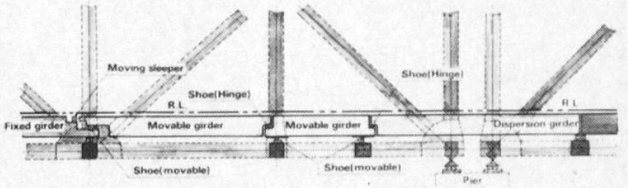
Plane Figure



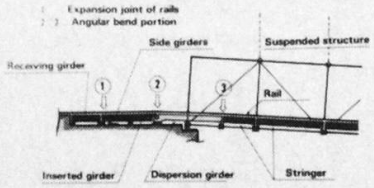
Typical transit girder system of moving sleeper type



General view of moving sleeper type transit girder system



Typical transit girder system of inserted girder system



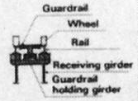
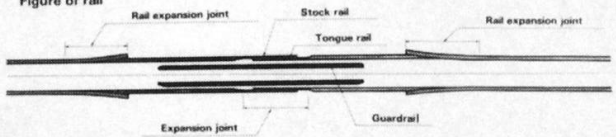
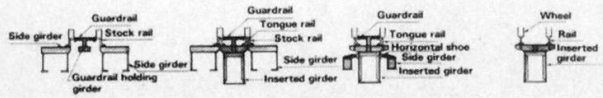


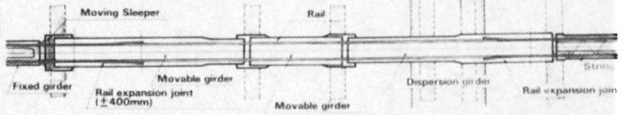
Figure of rail



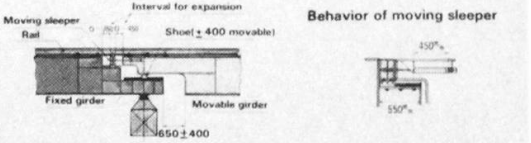
Wheel passing on expansion joint



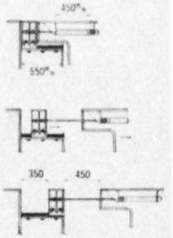
Plane Figure

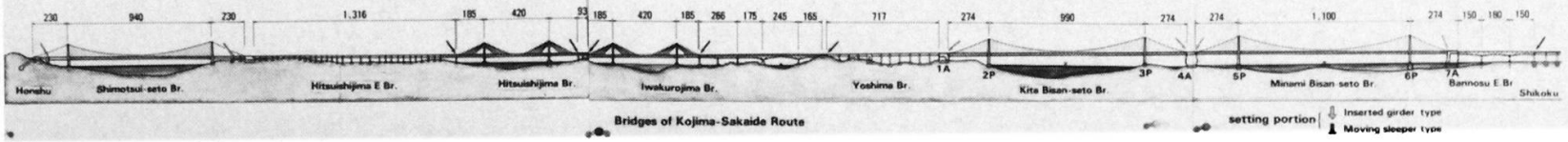


Behavior of moving sleeper



Detail of expansion joint





Bridges of Kojima-Sakaide Route

setting portion { Inserted girder type / Moving sleeper type