Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 64 (1991)

Artikel: Inspection of bridges after recent Armenian earthquake
Autor: Shestoperov, G.S. / Kazei, I.I. / Platonov, A.S.
DOI: https://doi.org/10.5169/seals-49281

Inspection of Bridges after Recent Armenian Earthquake

Examen des ponts après le tremblement de terre en Arménie

Die Untersuchung der Brücken nach dem Erdbeben in Armenien

G.S. SHESTOPEROV Cand. Sc. (Eng.)
I.I. KAZEI Cand. Sc. (Eng.)
A.S. PLATONOV Cand. Sc. (Eng.)
A.V. KRUCHINKIN Engineer
L.L. LAPSHIN Engineer
All-Union Scientific Research Institute of Transport Construction
Moscow, USSR

1. THE EARTHQUAKE OF THE 7 th DECEMBER 1988

Magnitude of the main shock M=7.0. The focal depth was 14 km. The intensity in the epicentre 9-10 points of the MSK-64 scale. The earthquake was accompanied by landslides and rockfalls along river banks, on steep mountain slopes and in the vicinity of tectonic fractures.

The earthquake of the 7th December belongs to the most destructive natural calamities of the XX century. The town Spitak located near the epicentre was practically completely annihilated by the underground shocks. In the Northern Armenia perished more than 25 thousand people.

Traffic was closed on the one section of the railway, retaining walls damaged,service buildings destroyed, railway cuttings filled with sliding ground, embankments deformed. More than ten railway and highway bridges were considerably damaged on the roads.

2. BRIDGES IN THE EARTHQUAKE ZONE

In Armenia,there are many railway bridges built in the first half of the current century. The span structures of small bridges were made mostly of reinforced concrete. In large bridges and viaducts were used metal trusses.The bridge piers were constructed of stone and concrete.

From the old bridges most of all suffered a middle-size bridge having two beam superstructures of cast-in place reinforced concrete. As a result of earthquake, one abutment was destroyed, the intermediate pier and another abutment damaged. The bridges having metal superstructures suffered light damages.

On the new railway bridges reinforced concrete prestressed beams and steel-concrete composite constructions were installed. The bridge piers are massive with a reinforced concrete core. Modern constructions of the railway bridges did not receive damages.

In erection of highway bridges in Armenia constructors use reinfor-

ced concrete,steel- reinforced concrete and metal superstructures of beam, continuous beam and frame systems.The piers are constructed of precast reinforced concrete (conventional and prestressed).

Near the epicentre deep cracks appeared in the ends of the reinforced concrete girders. In some cases reinforcement was deformed, metal bearings were destroyed. In one object the superstructures collapsed. Character of destructions indicates that as a result of very intensive vertical shocks the girder bearings were torn away from the piers.

In the earthquake zone damages of piers were observed.The abutment of highway overcrossings were displaced under the ground pressure. The stone and concrete piers of old bridges suffered moderate and heavy damages such as cracks and ruptures. Cracks appeared also in the reinforced concrete columns of the modern overcrossings.The prestressed reinforced concrete piers of the viaduct were not damaged.

3. BASIC CONCLUSIONS

In construction of large- and middle- span bridges in the areas with intensity 9 (MSK scale) it is advisable to use the lightest superstructures furnished antiseismic devices to prevent their shift along the subgirder plates and to soften impacts in deformation joints.

In designing pier foundations they should be based on the hardest possible grounds.In this case there is positive experience of operation of prestressed reinforced concrete piers of up to 50 m height under the seismic loads.

The bridges under construction are highly vulnarable at earthquakes.In storaging and assembly of precast reinforced concrete elements usually the possibility of an earthquake is not taken into account. It is advisable to supplement the acting standards with rules for testing the seismic stability of the bridges under construction.

In the destructive earthquakes, the stone, concrete and reinforced concrete constructions of old bridges may receive heavy damages and become impractical for further operation.To ensure the durability of such objects, it is necessary to elaborate the realistic methods of evaluation their seismic stability and reinforce their, as required.