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SOME OBSERVATIONS ON BRIDGES DYNAMIC BEHAVIOUR

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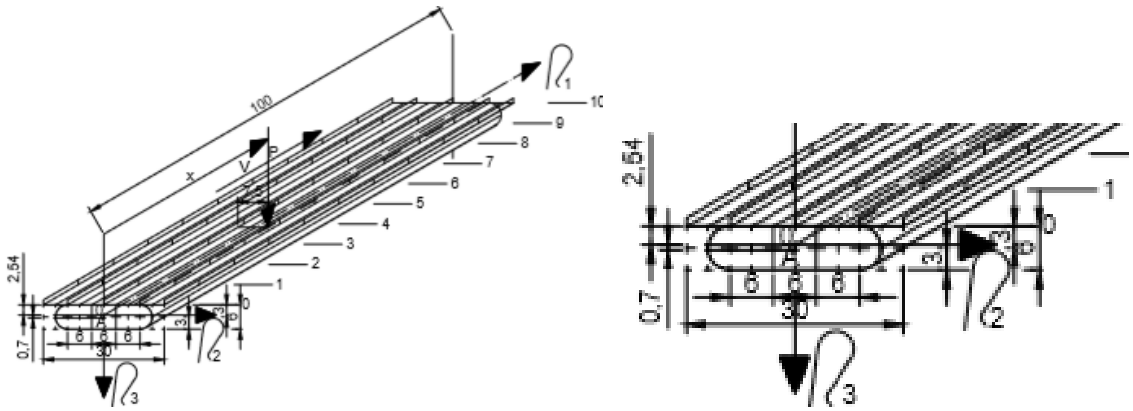
ABSTRACT

The paper presents rather some conclusions from large investigations over dynamic behavior of bridges under travelling loads. There, as basic tool was applied the *3D-Time Space Method* in edition proposed by present author. The method uses four-dimensional space, where besides of usual 3D space, the time is assumed as the fourth dimension. The bridge simply supported girder is here modeled by means of theory for thin-walled bars. In final calculations, solutions are obtained here on numerical way applying well known and simple *Finite Differences Method*. In consequence the task is brought to trivial determination of unknowns from set of linear algebraic equations. There, essential part of these equations is so called *dynamical stiffness matrix*.

Such description of dynamical tasks gives some important possibilities: determination of displacements of e.g. bridges or high-rise buildings; to show behavior of structure in all considered time-moments (structure modes for positions of force P from 1 to 10 on the figure below); *critical velocities* of load (loads) traveling over the bridge; or *critical length* of bridge answering on traveling mass with given velocity. In the both mentioned cases, the bridge or high-rise buildings are treated as the large thin-walled bar.

Presented analyses of calculated numerous comparative examples concern of simply supported, one span bridge steel thin-walled girder. The lengths of the compared bridges L=50, 60, 70, 80, 90, 100 m, and cross-section, defined in the figure given below.



The bridges have in both directions three traffic belts for cars and belt for bicycles and pedestrian. So, overall dimensions of bridge cross-section are: 30×6 m. In compared examples, the mass 20 or 100 t is travelling along the outward belt, with velocities v= 50, 100, 200, 300, .. , 600 km/h (and in a few tasks v= 1200, 1500, 1800, 2100, 2400, 2700 km/h). The other, next undertaken assumptions will be defined in the full paper.

Presented results show diagrams of girder deflections and torsions. Besides of it will be quoted critical velocities of traveling load and critical lengths of girder. All presented data will be completed by some general analyses and conclusions.