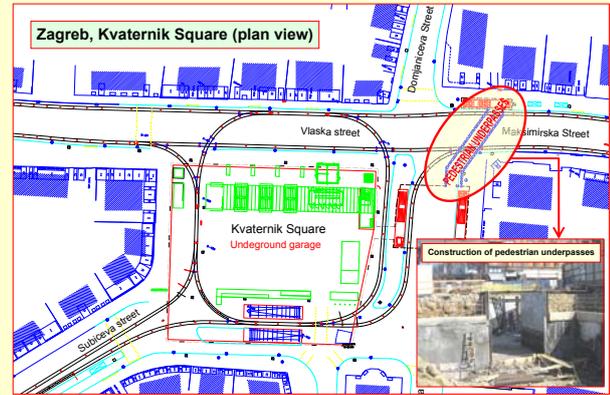


EXPERIMENTAL AND THEORETICAL ANALYSIS OF TRAM PROVISIONAL BRIDGE ON KVATERNIK SQUARE IN ZAGREB

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1. INTRODUCTION

- Transport on rails is the frequent main transportation means of the public transport
- Construction of underground structures in the narrow city centres, such as pedestrian underpasses, underground garages, etc., often require stopping of the public transport, both of the road and rail traffic
- Finding out some solutions to prevent stopping of the public traffic during construction works is always welcome
- In such cases, provisional bridges are frequently used, which enables undisturbed progress, both of the traffic and of the construction works
- During the construction of the pedestrian underpass at Kvaternik Square (Zagreb) **provisional tram bridge** was used for the first time



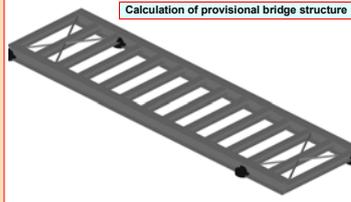
2. PROVISIONAL TRAM BRIDGE

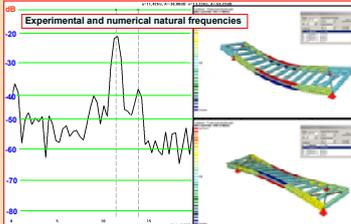
Description of structure

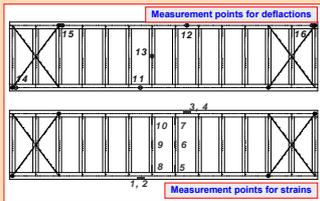
- The span of provisional bridge is 9.35 m, and the total length 11.0 m
- The structure was made of steel girders and the supports are founded on pilots (length: 8.0 m, diameter: 38 cm)
- The main girders are HEB 400 profiles at the distance of 2.7 m, while cross girders are HEB 220 profiles at the distance of 85 cm
- The main girder is supported on four steel bearings, two movable on both sides, one immovable, and one movable on one side only

Measurements and results

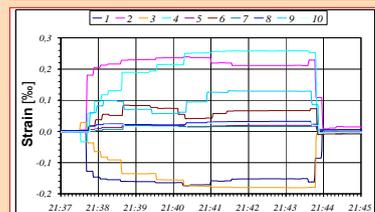
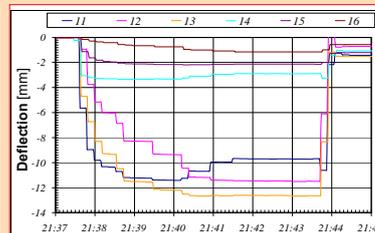
- Deflections were measured by LVDT sensors at main and cross girders of the structure at 6 measuring points (MP 11 – MP 16)
- Strain was measured at 10 MP using LVDT sensors (gauge length of 200 mm)
- Numerical analysis of the structure was conducted by SOFISTIC programme
- The bridge was excited by tram type TMK 101 (load per axis 112 kN). Static and dynamic testings ($V = 20$ km/h) were performed.




Measuring point	Measured deflection [mm]	Numerical deflection [mm]	Mode of vibration	Experimental frequencies [Hz]	Numerical frequencies [Hz]
MP 11	10.4	12.1	1	11.42	11.71
MP 12	10.5	12.1	2	13.72	13.37
MP 13	11.7	12.3	3	22.40	21.21



3. CONCLUSIONS

- Maximal experimental values of deflections and strains of the structure are within the expected limits and show very good correspondence with the theoretical values
- There are no significant remaining deflections and strains after unloading of the structure
- The experimental dynamic response of the structure is expected and realistic, and basic dynamic parameters are in accordance with the theoretical values

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