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Autor: Yamashita, M. / Yamagata, M. / Jin, H.

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M. YAMASHITA — M. YAMAGATA — H. JIN — M. MAEDA

Honshu-Shikoku Bridge Authority, Tokyo, Japan

ANALYSIS OF CONCRETE PIER WITH ASEISMATIC WALL

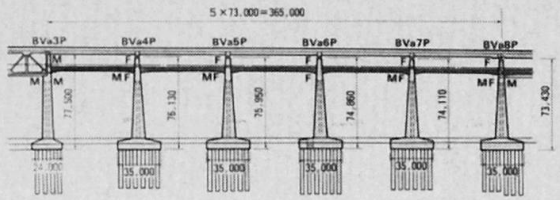


Fig-1 General view of Bannosu Viaduct

1. Bannosu viaduct, the highway-railway combined bridge, has high-rise piers with piles of 3 m in diameter.

Elasto-plastic FEM analysis and loading experiment with a 1/10 model were carried out to evaluate and to estimate the ultimate bearing capacity of concrete pier with aseismatic wall as well as the horizontal displacement at the rail level.
The cases of analysis by FEM consist of fourcases as shown in Table-1
The model for analysis is two dimensional and composed of concrete elements, reinforced ones, and bond ones to link both.

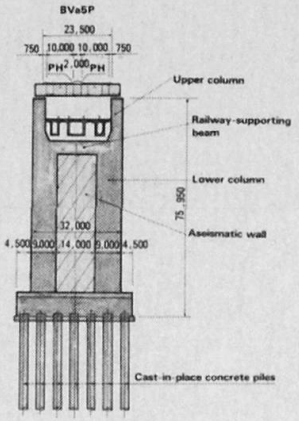


Fig-2 Pier (No.5)

2. Consideration

As shown in Fig-8, the pier does not show sudden deformation and can keep its shape at the time of cracks generation or reinforcements yielding.
This is also confirmed by the experiment with a 1/10 model.
The ultimate bearing capacity of the lower column is judged to be more than 3.5 times the design load.

Table-1 Analysis case

Case No.	Tensile strength of concrete	Ratio of reinforcements (%)	Purpose of analysis
Case-1	Considered up to σ_t=20.5kgf/cm² for both column and wall	0.5	Basic case.
Case-2	Considered up to σ_t=20.5kgf/cm² for column only	0.5	Influence of initial deterioration of wall due to shrinkage etc.
Case-3	Ignored for both.	0.5	Influence of initial deterioration of pier due to earthquake along bridge.
Case-4	Ignored for both.	0.3	Influence of ratio of reinforcements as well as case-3.

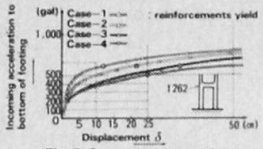


Fig-8 Ground acceleration vs displacement (at 1262nd nodal point)

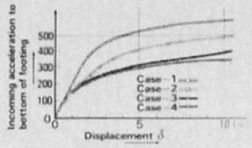
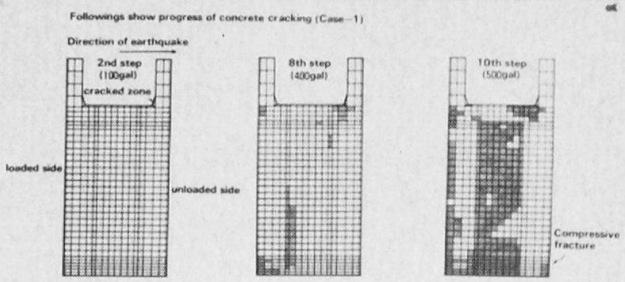


Fig-9 Close-look-up ground acceleration vs displacement (at 1262nd nodal point)



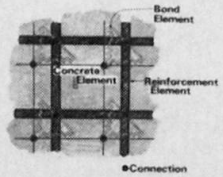


Fig-3 FEM Element

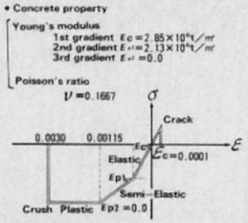


Fig-4 Concrete stress vs strain

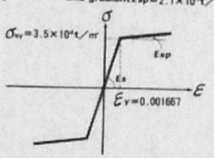


Fig-5 Reinforcements stress vs strain

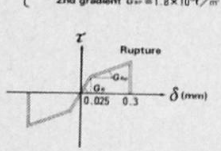


Fig-6 Bond stress vs displacement

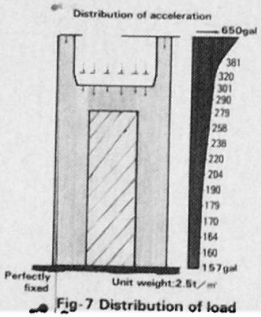


Fig-7 Distribution of load

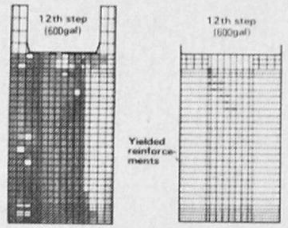


Fig-10 Progress of destruction (Case-1)