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ANALYSIS OF CONCRETE PIER WITH ASEISMATIC WALL

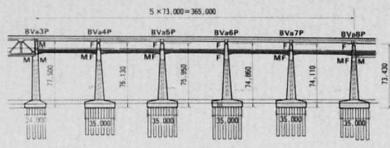


Fig-1 General view of Bannosu Viaduct

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 four cases 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.

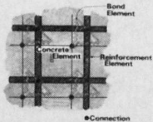


Fig-3 FEM Element

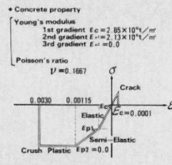


Fig-4 Concrete stress vs strain

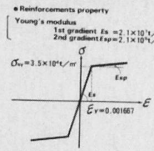


Fig-5 Reinforcements stress vs strain

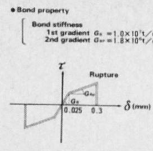


Fig-6 Bond stress vs displacement

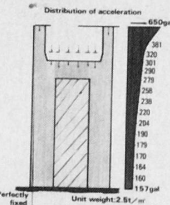
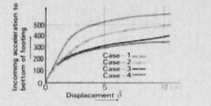
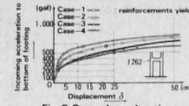


Fig-7 Distribution of load

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.

Case No.	Results strength of concrete	Rate of concrete strength	Purpose of analysis
Case-1	Considered on $\sigma_c = 2.85 \times 10^4 \text{ N/cm}^2$ or $\sigma_c = 2.13 \times 10^4 \text{ N/cm}^2$	0.5	Basic case
Case-2	Considered on $\sigma_c = 2.85 \times 10^4 \text{ N/cm}^2$ or $\sigma_c = 2.13 \times 10^4 \text{ N/cm}^2$	0.5	Influence of initial deterioration of wall due to shrinkage
Case-3	Ignored for both	0.5	Influence of initial deterioration of pier due to earthquake aging factor
Case-4	Ignored for both	0.5	Influence of rate of reinforcement as well as case-3



Followings show progress of concrete cracking (Case-1)

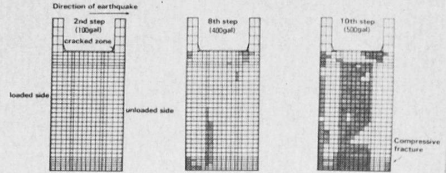


Fig-10 Progress of destruction (Case-1)

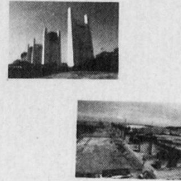


Fig-2 Pier (No.5)