

Dissertation Abstract

Report no.	(Dissertation-based) No.258	Name	Basit Sarfaraz
Dissertation title	Development of a precast concrete barrier for bridge deck (橋梁用プレキャストコンクリート製壁高欄の開発)		
<p>Abstract</p> <p>※ <i>The abstract should be in keeping with the structure of the dissertation (objective, statement of problem, investigation, conclusion) and should convey the substance of the dissertation.</i></p> <p>Existing concrete barriers with a wall thickness of 250mm are based on the initial standard of construction, which follows the allowable stress design method. Due to aged deterioration and spraying of snow, the melting agent will be caused by the significant corrosion of reinforcing bars. Severe environmental conditions lead to a significant deterioration of the concrete barrier. To achieve rapid mass construction, renovation works, repeated use of formwork, reduction of onsite construction time, minimum traffic obstruction and significant economic benefits can be achieved by using high-performance, high strength precast concrete construction. The precast concrete systems enable fast and effective completion of many different types of concrete structures. The Metropolitan Expressway Tokyo Co. proposed to use of high-performance precast concrete barriers with existing and newly constructed deck slab of the viaduct. By this research, we explore the structural behavior of precast concrete barrier with a varying wall thickness of handrail and verifies its ductile performance up to final failure. A series of tests were performed under an equivalent static design load for the SB class barrier loading, to evaluate the validity of the design precast concrete barrier. Depending upon the connecting arrangements of precast handrail to deck slab, two options of connection methods were tested. By considering the first option of connection, the precast barrier is connected with a newly constructed deck slab by loop reinforced connection. In this series of tests, the four-prototype specimen and one 5m full-scale specimen were tested under an equivalent static load. In the second option of connection, the precast handrail is connected with the existing deck slab by anchor connection. This series of tests have the four-prototype specimen and one full-scale specimen. Furthermore, an experimental study also performed to configure details mechanical behavior of the loop reinforcement connection. The research explores that the cracking pattern and mechanical behavior of the reinforcement are highly influenced by the rearrangement of reinforcement in connection. A numerical model of precast concrete barriers was made by using commercially available finite element software DIANA 10.2, to verify the structural response of precast concrete barriers and its various structural components behavior. Nonlinear finite-element (NLFE) calculations were also conducted to compare and enhancement of the load transfer up to final failure. It can also be used to evaluate the mechanical behavior of the specimens and cracking patterns. It is being observed from the test results, the designed strength and required structural response have been achieved by using the 150mm thick wall barrier. The developed numerical modeling technique adequately reproduces strength, stiffness, and failure mode of the precast concrete barrier under static loading.</p>			