



Sustainable Bridge Design Using Precast Concrete Joints with Monolithic Behaviour

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Abstract

This paper introduces solutions for the application of precast concrete in bridge engineering, in which the precast elements, e.g. precast slabs, beams, and columns are connected together monolithic behaviour to achieve integrity in transferring the forces and bending moments at joints. In details, it presents the outcome of the research results for the connections between precast columns and slabs, precast beam column connection, and precast column-foundations pocket connections. In all cases, experimental/analytical investigations are carried out and the results are presented here. The results of this research introduce rational design models using strut and tie method for such complicated load path at this joint. Practical examples this application are presented.

Keywords: Precast Concrete, Bridges Technology, Monolithic, Sustainability.

1 Introduction

In the last decades there is an expansion in road and railways in different parts of the world. Sustainable development is simultaneously become a new trend which should be considered during the realization of infrastructure projects on road and railways. The major pillars of sustainable construction are to achieve the following: less virgin materials, less energy consumption, less pollution and fewer wastes and provide the same benefits of usual construction. Precast concrete technique has several advantages in this context as it has high rate of production and construction, usage of recycled materials (aggregates), the absence or min. use of shuttering and false work, less pollution and min. wastes on site and finally it produces high performance concrete due to high construction precision in the fabrication. Thus, one can state that the application of precast concrete fulfil those pillars in balancing economical, operational and environmental aspects. It is more sustainable than cast in situ technique, provided that solving the structural and physical problems of the construction joints/connection between precast elements.

2 Scope

This research work introduces practical, technical and economical efficient solutions for different connections between precast concrete elements, i.e.

- Beam Column connections
- Slab-Slab connections
- Segmental bridge construction
- Column-Foundation connections
- Column – Flat slab connection

The last application can be applied at footbridges as well as housing projects, which was published previously in SEI Journal [7]

All those can be applied for bridge construction. Additionally, this work presents also different applications of precast concrete beams and slabs in bridge practice, in which monolithically connections are achieved. The basics of those solutions are to achieve easy/economic during construction and reduces the gaps, which improve the durability index of bridges and long term costs that serve directly the sustainability.