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Composite Floors Using Profiled Deck Sheet in Steel Structure

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Abstract - *The aim of this project is to thoroughly study and understand the codes provisions for composite floor using profiled deck sheet and also give out the design methods and considerations. The deck sheet is not act as a permanent shuttering to the concrete, but it can provide sufficient shear bond with the concrete and acts compositely. The project gives the design recommendation using an assumption of Eurocode-4 and British Standards. This paper includes the research done by the researchers in composite slab design. The essential information about the Profiled deck sheet was taken from the Manufacturer's table.*

Key Words: **Profiled deck sheet, Composite design, Composite floors, Eurocode-4, Permanent Shuttering**

1. INTRODUCTION

The use of Steel Deck in the construction of floors began in 1920's. The concept of using steel deck to act compositely with the concrete slab began in the 1950's. A Composite Slab comprises steel decking, reinforcement, and cast in situ concrete. Modern profiled steel are mostly designed to act as both formwork and composite slab. The important consideration is that the use of rolled steel sections, profiled metal decking and/or prefabricated composite members speeds up execution. And also composite floor construction is highly competitive if spans are increased to 12 to 15m or even 20m. There is, of course, a demand for larger column-free spans in buildings to facilitate open planning or greater flexibility.

The benefits of using composite floors with profiled steel decking are:

- It saves in steel weight are typically 30% to 50% over non composite construction.
- The stiffness of composite beam is greater which reduce the depth for the span of beam.
- It minimizes the height of building and reduces the cladding costs, savings in foundation costs.
- Its construction rate gets faster in composite construction.
- The profiled steel deck acts as formwork during construction & gives platform after construction.
- The adequate composite action with concrete develops to resists the imposed loading.
- In steel decking volume of the concrete in tension zone reduces.

The typical composite floor system using profiled sheets shown in following fig. 1

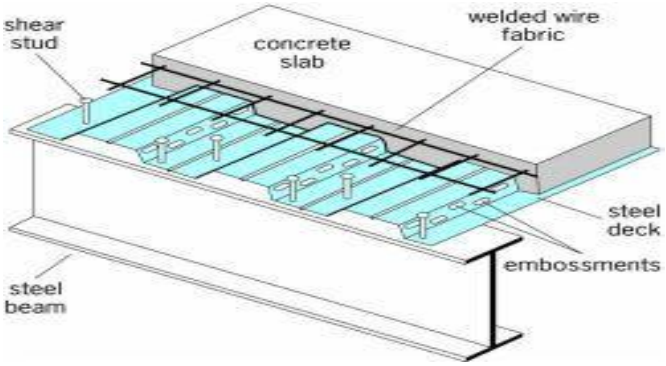

Fig -1: Typical Composite Floor System

1.1 Objectives

1. To study profiled deck sheet as reinforcement in composite floors and acts as permanent shuttering.
2. To study codes provisions for composite floors using profiled deck sheet.
3. To give out the design methodology for Deck sheet using Euro Codes & British Standards.

1.2 Problem Statement

More recently, composite floors using profiled deck sheet have become very popular in high rise office building, residential buildings, factories, etc. Composite floors with profiled steel decking is need to apply in the construction industry so that it reduces the extra cost in the construction for RCC beam, columns, foundation that having greater space and time required.

As there is no Indian standard covering profiled decking, so with reference to Eurocode-4 (EC4) and British Standards for guidance and giving out the design provisions.

2. DESIGN METHODOLOGY

Decking profiles are produced by a number of manufacturers. Although there are similarities between their profiles, the exact shape and dimensions depend on the particular manufacturer. There are two generic types of

shallow decking; re-entrant (dovetail) profiles and trapezoidal profiles. The traditional shallow decking profiles are between 45 to 60 mm high, with a rib spacing usually of 150 to 333 mm. This type of decking typically spans 3 m, leading to frame grids of 9 m X 9 m or similar dimensions, using secondary beams at 3 m spacing, for which temporary propping is usually not required. Profiles up to 95 mm high overall have been developed which can achieve over 4.5 m spans without propping.

2.1 Design Criteria for Deck Sheet Slab

The flexural moment capacity for both positive and negative strong axis moments, one-way beam shear, punching shear, and deflection are all evaluated and checked. Specifically, the flexural moment capacity for both positive and negative strong axis concentrated loads, the effective slab strip widths for both moment and beam shear are determined. Composite Steel Deck System without Studs Subjected to either Uniform Live load or Concentrated Load. Design by either Allowable Strength Design (ASD) or Load and Resistance Factor design (LRFD) shall be permitted. The section properties and allowable strength (ASD) or design strength (LRFD) for the steel deck shall be computed in accordance with standard code.

2.2 Properties and Data

Manufacturer's Data:

Deck rib bearing width	rw	= 50.8mm
Ave. deck rib width	rw(ave)	= 57.15mm
Deck Thickness	td	= 1.20mm
Area of Steel Deck	Asd	= 490.32mm^2
Inertia of steel deck	Id	= 128.128x103mm^4
Section modulus of steel deck		
Positive	Sp	= 57190.85 mm^3
Negative	Sn	= 5522.44 mm^3

Data considered:

Deck Span	= 1.83m (for 2 span condition)
Uniform Live Load	= 9.58 kN/m^2
Concentrated load	= 22.56 kN
Grade of Concrete	= M30
Grade of Steel	= Fe415
Deck Sheet Yield	= 228 N/mm^2

Design bending moment

a) At Construction Load = 27.33 N.mm
b) At Uniform live load = 6.07 N.mm
c) At Concentrated load = 4.593 N.mm

Design Shear

a) At construction load = 2.3 kN
b) At Uniform Live load = 71.82 kN
c) At concentrated load = 23.79 kN

Deflection

a) At construction load = 2.2 mm
b) At Uniform Live load = 9.65 mm
c) At concentrated load = 3.6 mm

Concrete required for deck slab = 2.645 m^3
Steel Required in Deck Slab
10mm ϕ bars are provided at 250mm C/C

2.3 Design Criteria for Conventional Slab

Data considered:

Self-weight of Slab	= 4KN/m^2
Imposed Load	= 9.58kN/m^2
Roof Finish Load	= 1.5 kN/m^2

Design bending moment
Design Moment = 27.32 kN.m

Steel Required in Deck Slab
12mm ϕ bars are provided at 270mm C/C

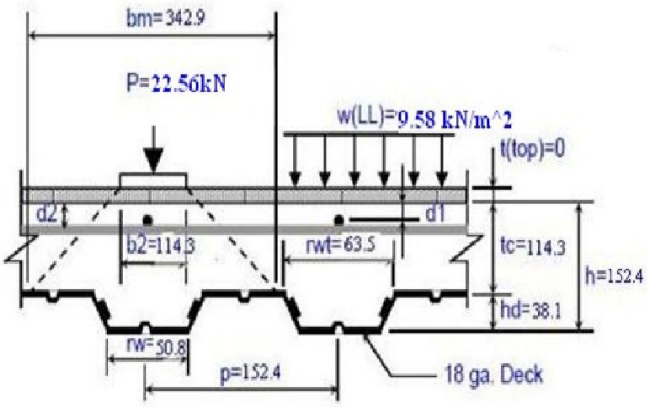

Fig -2: Cross Section of Profiled Sheeting

3. CONCLUSIONS

This paper gives the design methodology for composite floors using profiled deck sheet using Eurocode and British standards. By doing this research the achievement in economy in slab compared to conventional slab as follows:
For Deck Slab 10.47%
Saving in material
Reduced Steel weight
Reduced concrete volume up to 30%
Less Reinforcement up to 50%
Excellent Load carrying capacity
Fire Resistance with minimum Reinforcement
Structural Stability

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