A New Building System – Spiked Steel Sheet – Composite Slab

Un nouveau système de construction: dalle mixte avec une tôle et des ancrages particuliers

Ein neues Bausystem: Verbunddecke mit Stahlblech mit Verbundhaken

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Background

In many countries fluted steel sheets are used also as form and reinforcement of slabs in the concrete construction. In these solution the bond between concrete and thin sheet is achieved by shaping sheet and/or by making knobs, grooves or folds on the surface of the sheet. The drawback in these solutions is poor bond between concrete and fluted sheet. That is why the ends of the fluted sheet have to be welded to the structure below, which on its half limits the use of the structure especially in steel frame buildings.

The aim of this development work has been to find such bonding projections which would turn thin sheet into a usable reinforcement. As a result of the work is the spiked steel sheet. The developed "nailty" ensures the thin sheet and concrete working together so that the area of steel cross-section can be taken as effective reinforcement.

The fluted and spiked steel sheets are usable with steel structures, ordinary reinforced concrete structures, reinforced concrete and prestressed element structures and wooden structures in almost all house construction.

Simplifying of reinforcement in slab constructions is possible because the thin sheet reinforcement is so effective that ordinary slab can be designed as one-way reinforced slab.

Compared with traditional concrete structures, the spiked steel sheets are light-weight building elements with which the construction work can also be carried out succesfully at sites where hoisting equipment cannot be used or is not available.

Technical features

- surface anchorage by means of the "nails"
- no additional end anchorage required at support
- application: all floor constructions in multistore buildings
- continuous manufacture of the anchorage "nails"
- use of dimensioning methods for reinforced concrete structures

Patents

Patent granded in Finland, Sweden, Norway, BRD, Switzerland, USA and Canada. Registered designs granded in Finland, England, France and Benelux.

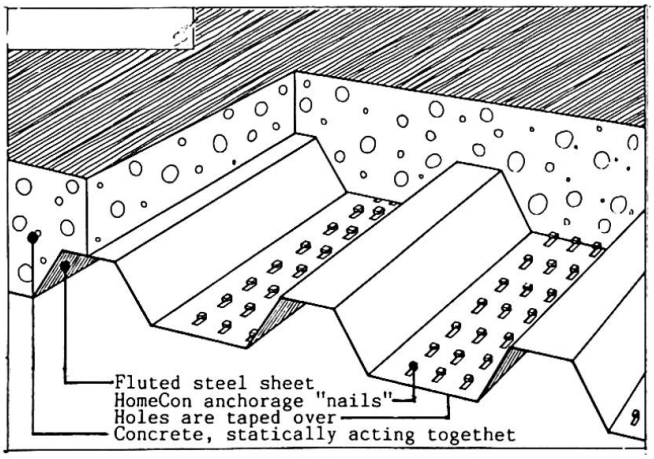

Fig. 1 Principle of HomeCon-fluted and spiked steel sheet.

Ultimate shear between spiked steel sheet and concrete

Shear capasity of "nailty" R_{ud} in the composite slab structure is obtained from the formula:

$$R_{ud} = n\, r_{ud}\, b\, a$$

where

- n is amount of "nails" (pcs/m^2)
- r_{ud} is shear capasity of one "nail" ($r_{ud} = b_n\, t_{cal}\, f_{yd}$)
- b is width of slab under consideration
- a is calculated value of bond length
- b_n is width of one "nail" (b_n = 4 mm)
- t_{cal} is calculated thickness of steel cross-section of thin sheet
- f_{yd} is design strength of steel sheet

Tensile force Z in thin sheet reinforcement is received from the formula:

$$Z = A_s\, \varepsilon_s\, E_s \leqslant A_s\, f_{yd}$$

where

- A_s is area of thin sheet reinforcement
- ε_s is strain of steel ($^o/oo$)
- E_s is modulus of elasticity of steel (E_s = 210 kN/mm^2)

When $Z = R_{ud}$, it is possible to check the value of bond length a. When all capasity of steel sheet are used the folloving formula is received:

$$a = \frac{A_s\, f_{yd}}{n\, b\, r_{ud}}$$

Table 1 The value of bond length a and shear capasity R_{ud}

Fluted steel sheet	t_{cal} mm	n pcs/m^2	b m	r_{ud} kN	A_s mm^2/m	f_{yd} N/mm^2	a mm	R_{ud} *) kN/m^2
HomeCon 45	0.63	588	1	0.73	820	291	556	429.2
	0.82	588	1	0.95	1070	291	556	558.6

*) Holorib R_{ud} = 50 kN/m^2

The HomeCon building system

- simplifies construction work
- reduces construction time
- enables widely the use of unskilled labour
- eliminates the need and transport of formwork materials
- improves order at the building site
- reduces the need for storage space because the sheets can be piled up in a small area without damage to the "nails"
- facilidates do-it-yourself construction
- is the important invention for on-site construction

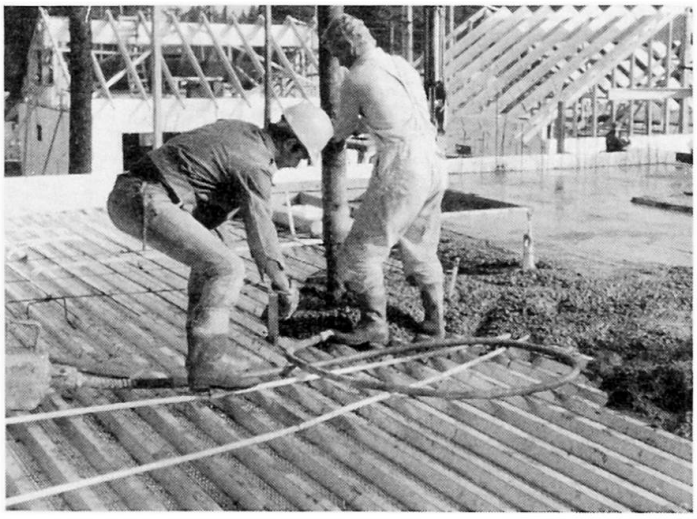

Fig.2 The fluted and spiked steel sheet is lightweight building element