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Description

[0001] This invention relates to a composite structure with a profiled steel decking. More especially, the invention concerns a composite slab comprising steel decking bonded to a layer of concrete cast in situ over the upper surface of the decking.

[0002] Composite structures produced by pouring light or normal weight concrete onto steel decking are used widely in the building industry for flooring and/or ceiling units. Conventionally, steel decking comprises one or more sheets of steel roll formed to create one or more crests and troughs separated by inclined webs. Shear stud connectors are traditionally used to provide enhanced bonding between the steel decking and the concrete layer. These shear stud connectors are placed in the trough positions of the decking and are enveloped by the concrete layer when it is cast.

[0003] Traditionally, the crests and troughs of profiled steel decking are generally flat with the corners between the crests and the uppermost ends of the inclined webs defined by acute angles. Also, the surfaces of the inclined webs of traditional steel decking are generally planar. The bending capacity of such profiles is limited.

[0004] Examples of traditional steel decking are to be found in US Patents 4144369, 4453364, 4593506, 4675238, 4726159, 4962622 and 3812636. In each of these documents, the corners between the crests of the decking and the uppermost ends of the webs are defined by acute angles.

[0005] GB 1 361 488 discloses a composite structure according to the preamble of claim 1.

[0006] The present invention sets out to provide a composite structure with an improved profiled steel decking which exhibits clear advantages over traditional steel decking.

[0007] According to the present invention in one aspect, there is provided a composite structure according to claim 1.

[0008] Typically, the curvilinear corners have a radius of between 20 and 25mm.

[0009] Each inclined web of the steel decking may include two or more vertically spaced linear rows of embossments which extend outwardly from the outer surface of each inclined web. Each embossment may be generally circular in section and may be produced by roll forming. Each embossment of the uppermost row may be positioned above a land portion separating neighbouring embossments of the lowermost row. The diameter of each embossment preferably lies within the range 9.0 to 15.0mm. A typical diameter is 12.0mm. The spacing between the centres of neighbouring embossments preferably lies within the range 30 to 40mm. A typical spacing is 35mm. The vertical distance between the upper and lower rows may be between 27 and 37mm. A typical distance being 32mm.

[0010] The trough between the two crests of the decking may be formed with two stiffening ribs each of which is spaced generally equidistant from the lowermost end of the respective inclined web. The flange portion defined between the stiffening ribs may provide a site for shear stud connectors.

[0011] The width of each stiffening rib of the trough may be between 15 and 25mm. Typically, the width of one rib is 21mm and that of the other rib 20mm.

[0012] Each crest may be formed with a generally 'V' shaped projection which, in use, defines a shear connector between the decking and a concrete layer cast over the upper surface of the decking.

[0013] The angle subtended by each inclined web to the horizontal preferably lies within the range of 75 to 85°. A typical angle is 78.5°.

[0014] The decking is preferably roll formed from galvanised steel sheet whose gauge is between 0.8 and 1.3mm. Typically gauges are 0.9 to 1.2mm. The decking is preferably manufactured using a high grade steel having, typically, a yield value of 500 N/mm^2.

[0015] The invention will now be described by way of example only, with reference to the accompanying diagrammatic drawings, in which:-

Figure 1 is an end view of profiled steel decking of a composite structure in accordance with the invention;

Figure 2 is a scrap side view to an enlarged of a section of the decking illustrated in Figure 1;

Figure 3 is a scrap plan view from above of a section of the steel decking shown in Figure 1; and

Figure 4 is a side view of a connection between neighbouring steel deckings of a composite structure in accordance with the invention.

[0016] The steel decking illustrated in the drawings is roll formed from a single sheet of galvanised steel and comprises two crests 1 separated by a trough 2. Each crest is bordered with two outwardly inclined webs 3. The lower ends of the webs are bordered by outwardly extending end laps 4, 5. Each of these end laps 4, 5 is formed with interlocks 6, 7 respectively which cooperate with complementary interlocks of neighbouring steel decks to increase the effective span of the overall steel decking.

[0017] The gauge of the steel sheet from which the decking is roll formed is typically between 0.9 and 1.5mm. A preferred gauge is 1.2mm. The steel sheet may be coated with a bonded plastics film for protective and aesthetic purposes. Alternatively, the sheet may be formed with a polyester coating.

[0018] As will be seen from the drawings, the corners between the crests 1 and the adjoining webs 3 are radiussed to produce a curvilinear profile 8. These curvilineal profiles increase the bending capacity of the decking and add strength particularly in the corner regions to inhibit

failures which occur with traditional decking. The added strength enables the span lengths of the decking to be increased.

[0019] The actual radius of any given profiled corner 8 will depend *inter alia* on the required dimensions of the decking. Typically, the selected radius will be between 20 and 30mm. Preferred radii are 23.8 and 25mm. The span of each radiussed corner is typically between 30 and 35mm. A preferred span is 32.3mm.

[0020] As will be seen from Figures 1 and 2, each web 3 is formed with two vertically spaced linear rows of embossments 6 which project outwardly from the web surfaces. These embossments are produced during the roll forming process and the boundary between each embossment and the adjoining web surface is circular. Typically, the diameter of each embossment is in the range 9.0 to 15.00mm. A preferred diameter is around 12.0mm.

[0021] As will be seen from Figure 2, the embossments of the upper row are displaced linearly with respect to those of the lower row such that each upper embossment is positioned above a land portion of the web sited approximately midway between neighbouring embossments of the lower linear row.

[0022] The rows of embossments extend along the entire length of each web and their presence enhances the bond between the decking and the concrete layer which, in use, is poured over the upper surface of the decking. Typically, the vertical spacing between the rows is in the range 30 to 35mm (measured between embossment centres); a preferred distance is 32mm. Typically, the centres of the embossments of the lower row are positioned between 13 and 18mm from the respective side laps 4, 5, a preferred distance being 15.9mm. The centres of the embossments of the upper row are typically positioned between 10 and 15mm below the lowermost point of the respective radiussed corner, a preferred distance being 12.2mm.

[0023] The spacings between the centres of neighbouring embossments of both the upper and lower rows is typically between 32 and 37mm, a preferred spacing being 35mm.

[0024] The shape and dimensions of the embossments may vary from those illustrated and discussed. Thus, the embossments could be ovoid or generally rectangular.

[0025] Each crest 1 includes a linear row of hollow projections 9 each of whose interior is generally dovetailed in section. These projections are produced during the roll forming process and define shear connectors between the steel decking and the concrete layer which is poured over the upper surface of the decking in use. The dovetail shaping of each projection allows hanger to be supported therein. The diameter of the lower neck of each projection is typically 12mm and the overall height of each projection is typically 15mm. As will be seen from the drawings, the joins between the crest and the projection are curvilinear. The crests are also formed with two inwardly projecting longitudinal ribs 11 for stiffening purposes. The width of these ribs are typically between 9 and 10mm. A preferred width is 9.5mm.

[0026] The trough 2 is formed with two longitudinal upwardly projecting ribs 14, 15 separated by a solid land section through which shear stud connectors can be positioned. The presence of the ribs assists accurate location of shear stud connectors in use of the decking. The width of each rib 14, 15 is typically 21mm and the spacing between the ribs is typically 50mm.

[0027] Each end lap 4, 5 carries an interlock. These extend along the entire length of each end lap and are shaped in a complementary fashion to enable two or more steel decks to be joined together to produce a decking of any required width.

[0028] It will be appreciated that the foregoing is merely exemplary of steel decking of a composite structure in accordance with the invention and that various modifications can readily be made thereto without departing from the true scope of the invention as set out in the appended claims.

Claims

1. Composite structure for a floor or ceiling comprising a profiled steel decking bonded to a layer of concrete poured on said steel decking, the steel decking comprising a steel sheet roll formed to define at least two crests (1) and a trough (2) separated by inclined webs (3), the boundaries between the webs (3) and the crests (1) are radiussed to define corners each having a smooth curvilinear profile (8), **characterised in that** the radius of each such corner is between 15 and 30mm

2. Composite structure as claimed in claim 1 wherein the curvilinear corners (8) of the steel decking have a radius of between 20 and 25mm.

3. Composite structure as claimed in any one of the preceding claims wherein each inclined web (3) of the steel decking includes two or more vertically spaced linear rows of embossments (10) which extend outwardly from the outer surface of each inclined web.

4. Composite structure as claimed in claim 3 wherein each embossment (10) is generally circular in section and is produced by roll forming.

5. Composite structure as claimed in claim 3 or claim 4 wherein each embossment (10) of the uppermost row is positioned above a land portion separating neighbouring embossments (10) of the lowermost row.

6. Composite structure as claimed in any one of claims 3 to 5 wherein the diameter of each embossment

(10) lies within the range 9.0 to 15.0mm.

7. Composite structure as claimed in any one of claims 3 to 6 wherein the spacing between the centres of neighbouring embossments (10) lies within the range 30 to 40mm.

8. Composite structure as claimed in any one of claims 3 to 7 wherein the vertical distance between the upper and lower rows of embossments (10) is between 27 and 37mm.

9. Composite structure as claimed in any one of the preceding claims wherein the trough (2) between the two crests (1) of the steel decking is formed with two stiffening ribs (14,15) each of which is spaced generally equidistant from the lowermost end of the respective inclined web (3).

10. Composite structure as claimed in claim 9 wherein a flange portion of the steel decking, defined between the stiffening ribs (14,15) provides a site for shear stud connectors.

11. Composite structure as claimed in claim 9 or claim 10 wherein the width of each stiffening rib (14,15) of the trough (2) is between 15 and 25mm.

12. Composite structure as claimed in any one of the preceding claims wherein each crest (1) is formed with a generally 'V' shaped projection (9) which, in use, defines a shear connector between the decking and a concrete layer cast over the upper surface of the decking.

13. Composite structure as claimed in any one of the preceding claims wherein the angle subtended by each inclined web (3) to the horizontal lies within the range of 75 to 85°.

14. Composite structure as claimed in any one of the preceding claims wherein the steel decking is roll formed from galvanised steel sheet whose gauge is between 0.8 and 1. 3mm.

Patentansprüche

1. Verbundstruktur für einen Boden oder eine Decke, die eine Formstahlblecheindeckung umfasst, die mit einer Schicht aus auf die Stahlblecheindeckung gegossenem Beton verbunden ist, wobei die Stahlblecheindeckung eine gewalzte Stahlblechrolle umfasst, die so geformt ist, dass mindestens zwei Hochsicken (1) und eine Tiefsicke (2) entstehen, die durch geneigte Stege (3) voneinander getrennt sind, wobei die Grenzen zwischen den Stegen (3) und den Hochsicken (1) abgerundet sind, um Ecken zu definieren, die jeweils ein glattes kurvenförmiges Profil (8) aufweisen, **dadurch gekennzeichnet, dass** der Radius einer jeden derartigen Ecke 15 bis 30 mm beträgt.

2. Verbundstruktur nach Anspruch 1, bei der die kurvenförmigen Ecken (8) der Stahlblecheindeckung einen Radius von 20 bis 25 mm aufweisen.

3. Verbundstruktur nach einem der vorstehend aufgeführten Ansprüche, bei der jeder geneigte Steg (3) der Stahlblecheindeckung zwei oder mehr vertikal beabstandete lineare Reihen Prägungen (10) beinhaltet, die sich von der äußeren Oberfläche eines jeden geneigten Stegs aus nach außen erstrecken.

4. Verbundstruktur nach Anspruch 3, bei der jede Prägung (10) einen allgemein kreisförmigen Querschnitt aufweist und durch Profilwalzen hergestellt wird.

5. Verbundstruktur nach Anspruch 3 oder Anspruch 4, bei der jede Prägung (10) der obersten Reihe oberhalb eines Flächenabschnitts positioniert ist, der benachbarte Prägungen (10) der untersten Reihe voneinander trennt.

6. Verbundstruktur nach einem der Ansprüche 3 bis 5, bei der der Durchmesser einer jeden Prägung (10) innerhalb des Bereichs von 9,0 bis 15,0 mm liegt.

7. Verbundstruktur nach einem der Ansprüche 3 bis 6, bei der der Abstand zwischen den Mittelpunkten benachbarter Prägungen (10) innerhalb des Bereichs von 30 bis 40 mm liegt.

8. Verbundstruktur nach einem der Ansprüche 3 bis 7, bei der die vertikale Distanz zwischen der oberen und der unteren Reihe Prägungen (10) 27 bis 37 mm beträgt.

9. Verbundstruktur nach einem der vorstehend aufgeführten Ansprüche, bei der die Tiefsicke (2) zwischen den zwei Hochsicken (1) der Stahlblecheindeckung mit zwei Versteifungsrippen (14, 15) ausgebildet ist, die jeweils mit allgemein gleichem Abstand vom untersten Ende des jeweiligen geneigten Stegs (3) beabstandet sind.

10. Verbundstruktur nach Anspruch 9, bei der ein zwischen den Versteifungsrippen (14, 15) definierter Flanschabschnitt der Stahlblecheindeckung eine Stelle für Verbundanker bereitstellt.

11. Verbundstruktur nach Anspruch 9 oder Anspruch 10, bei der die Breite einer jeden Versteifungsrippe (14, 15) der Tiefsicke (2) 15 bis 25 mm beträgt.

12. Verbundstruktur nach einem der vorstehend aufgeführten Ansprüche, bei der jede Hochsicke (1) mit

einem allgemein V-förmigen Vorsprung (9) ausgebildet ist, der im Gebrauch einen Verbundanker zwischen der Eindekkung und einer auf die obere Oberfläche der Eindeckung aufgebrachten Gussbetonschicht definiert.

13. Verbundstruktur nach einem der vorstehend aufgeführten Ansprüche, bei der der jedem geneigten Steg (3) gegenüberliegende Winkel zur Horizontalen innerhalb des Bereichs von 75 bis 85° liegt.

14. Verbundstruktur nach einem der vorstehend aufgeführten Ansprüche, bei der die Stahlblecheindekkung durch Profilwalzen aus verzinktem Stahlblech mit einer 0,8 bis 1,3 mm betragenden Blechstärke hergestellt wird.

Revendications

1. Structure composite pour un plancher ou un plafond, comprenant un coffrage d'acier profilé lié à une couche de béton coulée sur ledit coffrage d'acier, le coffrage d'acier comprenant une tôle d'acier façonnée par roulage pour définir au moins deux crêtes (1) et une vallée (2) séparées par des âmes inclinées (3), les limites entre les âmes (3) et les crêtes (1) étant arrondies de manière à définir des coins présentant chacun un profil curviligne régulier (8), **caractérisée en ce que** le rayon de chaque coin de ce type est compris entre 15 mm et 30 mm.

2. Structure composite selon la revendication 1, dans laquelle les coins curvilignes (8) du coffrage d'acier présentent un rayon de courbure compris entre 20 mm et 25 mm.

3. Structure composite selon l'une quelconque des revendications précédentes, dans laquelle chaque âme inclinée (3) du coffrage d'acier comprend deux ou plus de deux rangées linéaires verticalement espacées de bossages (10) qui s'étendent vers l'extérieur à partir de la surface extérieure de chaque âme inclinée.

4. Structure composite selon la revendication 3, dans laquelle chaque bossage (10) est de section essentiellement circulaire et est produit par roulage.

5. Structure composite selon la revendication 3 ou la revendication 4, dans laquelle chaque bossage (10) de la rangée supérieure est positionné au-dessus d'une partie de plat qui sépare les bossages voisins (10) de la rangée inférieure.

6. Structure composite selon l'une quelconque des revendications 3 à 5, dans laquelle le diamètre de chaque bossage (10) est compris dans la gamme de 9,0 mm à 15,0 mm.

7. Structure composite selon l'une quelconque des revendications 3 à 6, dans laquelle l'espacement entre les centres des bossages voisins (10) est compris dans la gamme de 30 mm à 40 mm.

8. Structure composite selon l'une quelconque des revendications 3 à 7, dans laquelle la distance verticale entre les rangées supérieure et inférieure des bossages (10) est comprise entre 27 mm et 37 mm.

9. Structure composite selon l'une quelconque des revendications précédentes, dans laquelle la vallée (2) entre les deux crêtes (1) du coffrage d'acier comporte deux nervures de raidissement (14, 15) qui sont chacune espacées de façon essentiellement équidistante de l'extrémité inférieure de l'âme inclinée respective (3).

10. Structure composite selon la revendication 9, dans laquelle une partie de bride du coffrage d'acier, qui est définie entre les nervures de raidissement (14, 15), fournit un site pour des connecteurs de goujons de cisaillement.

11. Structure composite selon la revendication 9 ou la revendication 10, dans laquelle la largeur de chaque nervure de raidissement (14, 15) de la vallée (2) est comprise entre 15 mm et 25 mm.

12. Structure composite selon l'une quelconque des revendications précédentes, dans laquelle chaque crête (1) comporte une saillie essentiellement en forme de "V" (9) qui, lors de l'utilisation, définit un connecteur de cisaillement entre le coffrage et une couche de béton coulée sur la surface supérieure du coffrage.

13. Structure composite selon l'une quelconque des revendications précédentes, dans laquelle l'angle sous-tendu par chaque âme inclinée (3) par rapport au plan horizontal est compris dans la gamme de 75° à 85°.

14. Structure composite selon l'une quelconque des revendications précédentes, dans laquelle le coffrage d'acier est façonné par roulage à partir d'une tôle en acier galvanisé dont l'épaisseur est comprise entre 0,8 mm et 1,3 mm.

FIG. 1

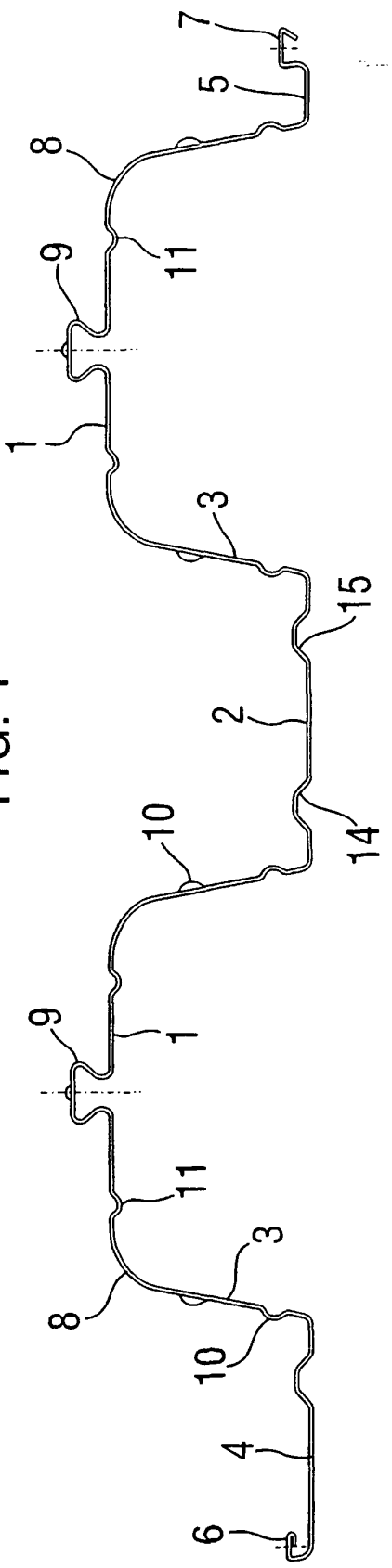


FIG. 2

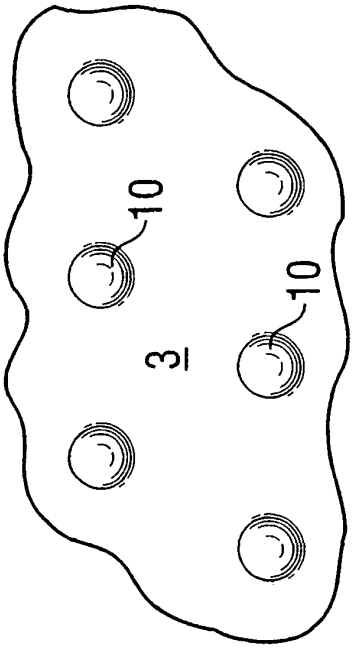


FIG. 3

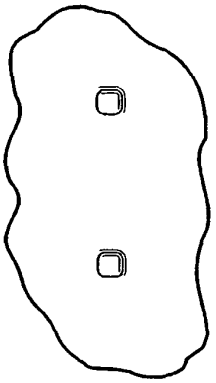
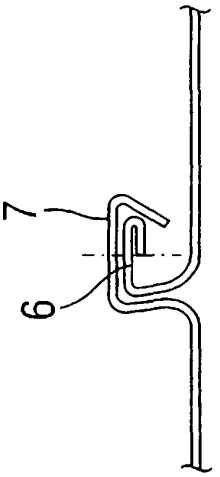


FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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