APPARATUS AND METHOD FOR COMPOSITE CONCRETE AND STEEL FLOOR CONSTRUCTION

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Abstract

The composite floor system of the present invention comprises a plurality of joists at least partially embedded in the concrete slab of the floor system. In the most preferred embodiments of the present invention, each of the joists is formed from a single piece of cold rolled sheet metal and, in at least one orientation, exhibits a substantially “Z-shaped” or “C-shaped” cross section along a longitudinal axis. In addition, for certain applications, a novel mounting bracket may be affixed to each end of the joists to provide for an underslung installation.
Attach Mounting Brackets to Joists

Place Joists on Supporting Structures

Install Removable Spanner Bars

Install Support Platform

Install Reinforcing Material

Pour Concrete Slab

Remove Spanner Bars and Support Platform

FIG. 4
FIG. 5

FIG. 6

FIG. 7
APPARATUS AND METHOD FOR COMPOSITE CONCRETE AND STEEL FLOOR CONSTRUCTION

RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 10/717,070, now pending, which application is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to the construction of buildings such as large open span buildings. The present invention more particularly relates to composite floor systems and a novel design for joists used in such a floor system and installation of such joists.

BACKGROUND OF THE INVENTION

[0003] Many multi-story commercial buildings and some multi-story residential buildings are constructed primarily of steel and concrete. In many instances, the floors in these multi-story buildings may be constructed by spanning steel joists between structural walls or beams and laying a supporting material such as plywood, metal pan or other type of decking material along or near the top portions of such joists. This supporting material forms a support structure or surface onto which concrete is poured. Generally, the lower chords of the joists form the framework from which ceilings are hung.

[0004] Composite floor systems have been employed in multi-story building construction for many years and improvements are constantly being sought, both in the materials used in the composite floor systems and the methodologies used to erect the buildings that incorporate composite floor systems. The development and sophistication of these structural systems has gradually extended to encompass many varieties of steel and concrete floor construction, the result of which has been to measurably reduce the cost of steel framing for multi-story buildings in the industry.

[0005] It will also be appreciated that the purposes of composite floor construction are to save considerable steel weight and cost, as well as to reduce depth and deflection. In view of the foregoing, it should be appreciated that it would be desirable to provide additional methodologies for constructing various types of composite floor systems that are simpler and less expensive to install, using existing materials and components to the extent possible.

SUMMARY OF THE INVENTION

[0006] The composite floor system of the present invention comprises a plurality of joists at least partially embedded in the concrete slab of the floor system. In the most preferred embodiments of the present invention, each of the joists is formed from a single piece of cold rolled sheet metal and, in at least one orientation, exhibits a substantially “Z-shaped” or “C-shaped” cross section along a longitudinal axis. In addition, for certain applications, a novel mounting bracket may be affixed to each end of the joists to provide for an underslung installation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The present invention will hereinafter be described in conjunction with the appended drawing figures, wherein like numerals denote like elements, and:

[0008] FIG. 1 is a partial perspective cut-away view of a composite floor system in accordance with a preferred embodiment of the present invention;

[0009] FIG. 2 is a vertical section view of a composite floor system in accordance with a preferred embodiment of the present invention;

[0010] FIG. 3 is a vertical section view of a composite floor system in accordance with an alternative preferred embodiment of the present invention;

[0011] FIG. 4 is a flowchart depicting a method of constructing a composite floor system in accordance with a preferred embodiment of the present invention;

[0012] FIG. 5 is a perspective view of a mounting bracket used in constructing a composite floor system in accordance with a preferred embodiment of the present invention;

[0013] FIG. 6 is a perspective view of a joist used in constructing a composite floor system in accordance with a preferred embodiment of the present invention;

[0014] FIG. 7 is a perspective view of a joist in accordance with an alternative preferred embodiment of the present invention;

[0015] FIG. 8 is a side view of a joist in accordance with an alternative preferred embodiment of the present invention; and

[0016] FIG. 9 is a side view of a joist in accordance with an alternative preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0017] The present invention relates to a composite floor system and parts and formwork therefore and erecting method for use in the construction of buildings such as large open span commercial or residential buildings. The present invention is particularly concerned with composite floor systems made from steel and concrete with a novel method of attaching joists used in such a floor system.

[0018] Referring now to FIG. 1, a partial cut-away view of a composite floor system 100 in accordance with a preferred embodiment of the present invention is shown. Composite floor system 100 comprises: a first support structure 105; a second support structure 115; a plurality of joists 160 suspended in place by a plurality of mounting brackets 150, with joists 160 extending between support structures 105 and 115; a plurality of removable spanner bars 170 selectively inserted into slots 135 of joists 160; a support platform 140 placed over and resting on spanner bars 170; a concrete slab 110 poured in place and supported by support platform 140; and a reinforcing material 190 embedded in concrete slab 110. In the most preferred embodiments of the present invention, mounting brackets 150 have a plurality of apertures formed in the body thereof and the apertures are designed to provide a means for attaching mounting brackets 150 to joists 160. Mounting brackets 150 may be attached to joists 160 by screws, bolts, welding, or other appropriate attaching means, with one mounting bracket 150 being attached to either end of each joist 160. Once mounting brackets 150 are in place, joists 160 can be positioned between support structures 110 and 115.
While support structures 110 and 115 are depicted as a block wall and an I-beam respectively, it should be understood that these are merely representative of the types of support structures that may be utilized in conjunction with the present invention. In practice, support structures 105 and 115 may be any type of structure capable of supporting the load of composite floor system 100, including columns, load-bearing interior walls, etc. Apertures 165 are provided for the installation of various utilities such as electrical lines, plumbing pipes and other similar purposes.

Once joists 160 are in place, removable spanner bars 170 are inserted into the body portion of joists 160 by inserting the ends of spanner bars 170 into apertures 135. Apertures 135 are most preferably spaced equidistant along the body portion of joists 160 so that cooperating pairs of apertures 135 can be aligned to receive alternate ends of removable spanner bars 170. The location and number of removable spanner bars 170 used for supporting a given concrete slab 110 can be determined by performing load analysis calculations for composite floor system 100.

With the appropriate number of removable spanner bars 170 in place, support platform 140 can be installed. Support platform 140 rests on and is supported by removable spanner bars 170. Support platform 140 provides a form for defining the bottom of concrete slab 110 and also provides stability to the overall structure prior to the pouring of concrete slab 110.

After support platform 140 has been completed, reinforcing material 190 is placed over the top of joists 160. Reinforcing material 190 is typically a welded wire mesh and is provided to add additional strength and stability to concrete slab 110 and will be embedded within concrete slab 110. Finally, concrete slab 110 can be poured in place over support platform 140 and reinforcing material 190. Support platform 140 is removed when concrete slab 110 is poured. Spanner bars 170 and support structures 105 and 115, support concrete slab 110 while it hardens and cures. After an appropriate period of time, such as approximately one or two days, spanner bars 170 and support platform 140 can be stripped from joists 160. Concrete slab 110 may be further reinforced in the usual way to carry all loads between any vertical walls and columns.

It should be noted that, after positioning joists 160 as shown in FIG. 1, the top chord of each joist 160 is suspended slightly above the top edge of support structures 105 and 115. However, at least a portion of each joist 160, including the lower chord of each joist 160, is located between support structures 105 and 115. This is in contrast to typical floor construction methods where the lower chord of joists 160 are commonly resting on top of support structures 105 and 115. This allows a composite floor to be constructed using less blocking or bracing than typical with other methods. Additionally, although joists 160 are depicted as being “underslung” in this particular exemplary embodiment, it should be noted that in at least one alternative preferred embodiment of the present invention, joists 160 may be installed so that the lower chord of each joist 160 is resting on top of support structures 105 and 115.

Referring now to FIG. 2, a composite floor system 200 in accordance with a preferred embodiment of the present invention is shown. Composite floor system 200 comprises a concrete slab 210; a plurality of joists 220; a reinforcing material 220; a plurality of spanner bars 270; a plurality of handles 240 attached to spanner bars 270; a support platform 260; a hat channel 250; and a ceiling 280.

Reinforcing material 220 is a welded wire fabric or rebar mat placed over the upper chords of joists 230, prior to the pouring of concrete slab 210. In the most preferred embodiments of the present invention, reinforcing material 220 is a welded wire fabric with a mesh-like appearance. However, it should be noted that any other reinforcing material capable of developing the required structural capacity may be used as well. Reinforcing material 220 is typically draped over the upper chords of joists 230 and hangs in a catenary-like shape between the joists to provide the most effective reinforcement. Reinforcing material 220 is completely encased with the boundaries of concrete slab 210.

Support platform 260 is suspended on spanner bars 270 prior to the pouring of concrete slab 210. Support platform 260 is used as a form for defining the bottom surface of concrete slab 210. Support platform 260 also provides a degree of lateral stability to the structure of composite floor system before concrete slab 210 is poured. After concrete slab 210 has been poured and allowed to cure for an appropriate amount of time, spanner bars 270 are removed by using handles 240 and support platform 260 may be stripped from concrete slab 210 and may be reused in subsequent concrete pouring operations. Hat channel 250 is attached to joists 230 and ceiling 280 is attached to hat channel 250.

With the composite floor system of the present invention, it is possible to utilize standard-sized materials to form the support structure for the concrete slab. For example, the spacing of joists 230 may be advantageously fixed at approximately four-foot centers, thereby enabling the use of readily available and inexpensive standard 4' x 8' sheets of plywood for support platform 260. It should also be recognized that, in accordance with contemporary construction practice, such plywood panels would be treated with a release coating, such as oil, to avoid adherence of concrete slab 210 to plywood used in support platform 260. Such a release coating enables the ready stripping of support platform 260 beneath concrete slab 210 with a minimum loss of formwork due to accidental destruction. Alternatively, support platform 260 may be constructed from typical steel pan formwork or some other material known to those skilled in the art that provides sufficient strength to support concrete slab 210.

Referring now to FIG. 3, a composite floor system 300 in accordance with an alternative preferred embodiment of the present invention is shown. Composite floor system 300 is similar to composite floor system 200 as shown in FIG. 2 above, but the cross section of the joists used in composite floor system 300 is different than joists 230 used in composite floor system 200. Composite floor system 300 comprises a concrete slab 310; a plurality of joists 330; a reinforcing material 320; a plurality of handles 340 attached to spanner bars 370; a support platform 360; a hat channel 350; and a ceiling 380.

Reinforcing material 320 is a welded wire fabric or rebar mat placed over the upper chords of joists 330, prior to the pouring of concrete slab 310. In the most preferred embodiments of the present invention, reinforcing material
320 is a welded wire fabric with a mesh-like appearance. However, it should be noted that any other reinforcing material capable of developing the required structural capacity may be used as well. Reinforcing material 320 is typically draped over the upper chords of joists 330 and hangs in a catenary-like shape between the joists to provide the most effective reinforcement. Reinforcing material 320 is completely encased with the boundaries of concrete slab 310.

[0030] Support platform 360 is suspended on spanner bars 370 prior to the pouring of concrete slab 310. Support platform 360 is used in the form of defining the bottom surface of concrete slab 310. Support platform 360 also provides a degree of lateral stability to the structure of composite floor system before concrete slab 310 is poured. After concrete slab 310 has been poured and allowed to cure for an appropriate amount of time, spanner bars 370 are removed by using handles 340 and support platform 360 may be stripped from concrete slab 310 and may be reused in subsequent concrete pouring operations.

[0031] Referring now to FIG. 4, a flowchart depicting a method 400 of constructing a composite floor system in accordance with a preferred embodiment of the present invention is shown. First, a mounting bracket may be attached to each end of each joist (step 410). It should be noted that this is an optional step because the joists may be placed on top of supporting walls or beams. In understanding installations, the mounting brackets will be installed and the joist will be suspended between the support structures instead of resting on top of the support structures. Next, the joists are positioned on the supporting structures by placing the bearing plate (shown in FIG. 5) of each joist on top of the supporting structures (step 420). If the mounting brackets are not used, then the bottom chord of the joists may be placed directly onto the supporting structures.

[0032] Next, a plurality of removable spanner bars are positioned between each pair of joists (step 430). Then, the support platform for the concrete slab is positioned on top of the removable spanner bars (step 440). As previously mentioned, the support platform may be any material capable of supporting the load of the concrete slab. After the support platform is in place, the reinforcing material is positioned by draping it over the upper chords of each of the joists (step 450). The reinforcing material is typically a welded wire mesh material well known to those skilled in the art. Once the reinforcing material has been positioned, the concrete slab can be poured over the support platform and allowed to cure (step 460). Finally, after the concrete slab has been allowed to sufficiently cure, the removable spanner bars and the support platform can be stripped from the underside of the concrete slab (step 470).

[0033] Referring now to FIG. 5, a mounting bracket 500 used in constructing a composite floor system in accordance with a preferred embodiment of the present invention is shown. Mounting bracket 500 comprises a body portion 510; a horizontal mounting or bearing plate 520; a plurality of wall or beam attachment apertures 530; a plurality of upper chord attachment apertures 540; and a plurality of web attachment apertures 560. In a typical application, one mounting bracket 500 will be used on each end of a joist and mounting brackets 500 are used to support the joist over the span between the structural support elements such as walls or beams. Mounting brackets 500 may be adapted for either end of a joist (i.e., left and right-handed mounting brackets).

[0034] Body portion 510 is shaped similar to a piece of steel angle with a 90° bend at the midpoint. Horizontal bearing plate 520 is attached to body portion 510 by welding or other suitable attachment methods. Horizontal bearing plate 520 serves to distribute the load of any joists attached to mounting bracket 500 over a larger surface area, thereby minimizing any undesirable load concentrations that may result in structural failure. Horizontal bearing plate 520 typically rests on a load bearing structure such as a wall.

[0035] Wall or beam attachment apertures 530 are used to securely attach mounting bracket 500 to the top of a supporting or load-bearing structure, such as a wall or a beam, if required. While bolts or screws may be inserted through apertures wall or beam attachment apertures 530, thereby attaching mounting bracket 500 to a wall or beam, in certain applications mounting bracket 500 will be welded in place and apertures 530 will not be used.

[0036] Upper chord attachment apertures 540 are used to securely attach the upper chord of a joist to mounting bracket 500. As with wall or beam attachment apertures 530, bolts or screws may be inserted through upper chord apertures 540 and wall or beam attachment apertures 530, thereby securely attaching mounting bracket 500 to the upper chord of a joist. It is anticipated that the upper chord of the joist may be welded to mounting bracket 500 in certain applications.

[0037] Web attachment apertures 560 are used to secure the body of a joist to mounting bracket 500. As previously explained in conjunction with upper chord attachment apertures 540 and wall or beam attachment apertures 530, bolts or screws may be inserted through web apertures 560, thereby attaching the body portion of a joist to mounting bracket 500. Once again, it is anticipated that mounting bracket 500 will be welded directly to the joist for certain applications. Mounting bracket is connected to a joist and the joist is then positioned as shown and described in FIG. 1.

[0038] Referring now to FIG. 6, a joist 600 used in constructing a composite floor system in accordance with a preferred embodiment of the present invention is shown. Joist 600 comprises a body portion 620 an upper chord 630 and a lower chord 660. Upper chord 630 and lower chord 660 are substantially parallel to each other and substantially perpendicular to body portion 620. Upper chord 630 has a flange 635 that extends outwardly from body portion 620 and forms approximately a 50° angle with the plane defined by body portion 620. Similarly, lower chord 660 has a flange 665 that extends outwardly away from body portion 620 in a like fashion.

[0039] Body portion 620 defines a plurality of body apertures 650. Body apertures 650 are used to support spanner bars that, in turn, are used to support the decking material that will form the surface for the concrete slab when the concrete is poured in place. The spanner bars may be inserted to support the plywood or other material suspended between a plurality of joists 600 and to stabilize the plurality of joists 600 prior to the pouring of the concrete slab. Optional aperture 695 may be used to provide for the installation of utilities such as electrical and plumbing lines.

[0040] Upper chord 630 defines a plurality of apertures 640 spaced along the length of upper chord 630. Apertures
are positioned horizontally in upper chord 630 and allow the portion of the concrete above upper chord 630 to be connected with the portion of the concrete slab beneath upper chord 630. Apertures 640 are concrete-engaging mechanisms that act as an additional shear transfer mechanism. Much of the interface shear is accomplished by the combination of the concrete and steel reinforcement gripping and adhering to the embedded portion of upper chord 630, upper flange 635, and the upper portion of body 620. Lower chord 660 may also have apertures 640 formed therein. In the most preferred embodiments of the present invention, upper chord 630 is entirely encased within the concrete slab during the pouring of the concrete slab. Optional apertures 695 are provided for the installation of various utilities such as electrical lines, plumbing pipes and other similar purposes.

As shown in FIG. 6, joist 600 has a cross section that is substantially “Z-shaped,” or reverse “Z-shaped, depending on the orientation of joist 600. Further, joist 600 exhibits rotational symmetry around a longitudinal axis of symmetry 610 of body 620. Rotational symmetry means that when joist 600 is rotated 180° around axis of symmetry 610, the cross sectional shape of joist 600 will remain substantially, if not exactly, the same. The length of joist 600 will be determined by the specific application. Although not shown in FIG. 6, it should be noted that “stiffening” of joist 600 may be included for additional strength. Stiffening is a process of providing a corrugated-type body portion for joist 600 and is well known to those skilled in the art.

In the most preferred embodiments of the present invention, joist 600 is completely formed of a single piece of cold rolled sheet metal, but may be fabricated in many other ways and additionally reinforced, if necessary. Apertures 640 and 650, along with optional aperture 695 can be created as part of the overall manufacturing process and any of the various methods for creating apertures known to those skilled in the art may be used. Alternatively, instead of apertures 640, upper chord 630 may be fabricated with other concrete-engaging mechanisms such as a series of “dimples” or other protrusions that would further assist in firmly fixing upper chord 630 into a concrete slab.

Referring now to FIG. 7, a joist 700 used in constructing a composite floor system in accordance with an alternative preferred embodiment of the present invention is shown. Joist 700 comprises a body portion 720 an upper chord 730 and a lower chord 760. Upper chord 730 and lower chord 760 are substantially parallel to each other and substantially perpendicular to body portion 720. Upper chord 730 has a flange 735 that is substantially parallel to body portion 720. Similarly, lower chord 760 has a flange 765 that is substantially parallel to body portion 720. Body portion 720 defines a plurality of apertures 750. Apertures 750 are used to support spanner bars that, in turn, are used to support the decking material that will form the surface for the concrete slab when the concrete is poured in place. Optional apertures 795 are provided for the installation of various utilities such as electrical lines, plumbing pipes and other similar purposes.

Upper chord 730 defines a plurality of apertures 740 equally spaced along upper chord 730. Apertures 740 allow the portion of the concrete above upper chord 730 to be connected with the portion of the concrete slab beneath upper chord 730. Apertures 740 are concrete-engaging mechanisms that act as an additional shear transfer mechanism. Lower chord 760 may also have apertures 740 formed therein. In the most preferred embodiments of the present invention, upper chord 730 is entirely encased within the concrete slab during the pouring of the concrete slab. Optional apertures 795 are provided for the installation of various utilities such as electrical lines, plumbing pipes and other similar purposes.

As shown in FIG. 7, joist 700 has a cross section that is substantially “C-shaped,” or reverse “C-shaped,” depending on the orientation of joist 700. Further, joist 700 exhibits reflective symmetry around a longitudinal axis of symmetry 710 of body 720. Reflective symmetry means that the upper portion of the cross section of joist 700 is substantially “reflected” beneath axis of symmetry 710. Further discussion of the symmetry associated with the joists of the present invention is presented in conjunction with FIG. 8 and FIG. 9. The length of joist 700 will be determined by the specific application. Although not shown in FIG. 7, it should be noted that “stiffening” of joist 700 may be included for additional strength. Stiffening is a process of providing a corrugated-type body portion for joist 700 and is well known to those skilled in the art.

In the most preferred embodiments of the present invention, joist 700 is completely formed of a single piece of cold rolled sheet metal, but may be fabricated in other ways and additional reinforcement may be added as needed. Apertures 740, 750 and 795 can be created as part of the overall manufacturing process and any of the various methods for creating apertures known to those skilled in the art may be used. Alternatively, instead of apertures 740, upper chord 730 may be fabricated with other concrete-engaging mechanisms such as a series of “dimples” or other protrusions that would further assist in firmly fixing upper chord 730 into a concrete slab.

Referring now to FIG. 8, a side view of a joist 800 according to an alternative preferred exemplary embodiment of the present invention is depicted. As shown in FIG. 8, the cross-sectional profile of joist 800 is substantially “C-shaped.” However, distance 810 is measurably smaller than distance 820. Joist 800 will display a rough reflective symmetry about its midpoint.

Referring now to FIG. 9, a side view of a joist 900 according to an alternative preferred exemplary embodiment of the present invention is depicted. As shown in FIG. 9, the cross-sectional profile of joist 900 is substantially “Z-shaped.” However, distance 910 is measurably smaller than distance 920. Joist 900 will display a rough rotational symmetry about its midpoint.

While certain preferred exemplary embodiments have been presented in the foregoing detailed description, it should be appreciated that a vast number of variations exist. It should also be appreciated that these preferred embodiments are only examples and are not intended to limit the scope, applicability, or configuration of the invention in any way. Rather, the foregoing detailed description provides those skilled in the art with a convenient roadmap for implementing the preferred exemplary embodiments of the invention. It should be understood that various changes may be made in the function and arrangement of elements
described in the exemplary preferred embodiments without departing from the spirit and scope of the invention as set forth in the appended claims.

1. A composite steel and concrete floor construction comprising:
   a poured concrete slab;
   a plurality of individual laterally placed, parallel disposed, and supported joists, wherein each of said plurality of joists comprises an upper chord and a lower chord joined by a body portion, and each upper chord and each lower chord is substantially perpendicular to said body portion, wherein at least a portion of said upper chord is embedded in said concrete slab, each of said plurality of joists having a first end and a second end;
   a plurality of mounting brackets, one of said plurality of mounting brackets being attached to each of said plurality of joists, each of said plurality of mounting brackets comprising:
   a body portion; and
   a horizontal mounting plate affixed to said body portion, each of said horizontal mounting plates resting on a load-bearing structure, said horizontal mounting plate being at least partially embedded in said concrete slab;
   wherein each of said plurality of joists comprises a substantially Z-shaped or C-shaped cross section about a longitudinal axis of said plurality of joists.

2. The composite steel and concrete floor construction of claim 1 wherein said upper chord comprises a plurality of concrete-engaging mechanisms.

3. The composite steel and concrete floor construction of claim one wherein said upper chord defines a plurality of apertures and wherein each of said plurality of apertures provides a connection between a first portion of said concrete slab and a second portion of said concrete slab; and
   a reinforcing mesh at least partially supported upon said upper chords of said plurality of joists and hanging generally in a catenary shape therebetween and being fully embedded in said slab.

4. The composite steel and concrete floor construction of claim 3 wherein said plurality of concrete-engaging mechanisms comprises a plurality of dimples.

5. The composite steel and concrete floor construction of claim 1 further comprising a reinforcing mesh at least partially supported upon said upper chords of said plurality of joists and hanging generally in a catenary shape therebetween and being fully embedded in said slab.

6. The composite steel and concrete floor construction of claim 1 wherein each of said joists is completely formed of a single piece of cold rolled sheet metal.

7. The composite steel and concrete floor construction of claim 1 wherein said connection between a first portion of said concrete slab and a second portion of said concrete slab comprises an additional shear transfer mechanism.

8. The composite steel and concrete floor construction of claim 1 further comprising a plurality of support structures supporting each of said plurality of joists.

9. The composite steel and concrete floor construction of claim 1 wherein each of said upper chord and said lower chord of each of said plurality of joists further comprise a flange extending away from each body portion of each said plurality of joists.

10. The composite steel and concrete floor construction of claim 9 wherein said body portion of each of said plurality of joists is substantially suspended between said plurality of support structures by at least two mounting brackets.

11. The composite steel and concrete floor construction of claim 1 wherein each of said plurality of joists exhibits rotational symmetry about said longitudinal axis.

12. The composite steel and concrete floor construction of claim 1 wherein each of said plurality of joists exhibits reflective symmetry about said longitudinal axis.

13. A composite steel and concrete floor construction comprising:
   a concrete slab;
   a plurality of individual laterally placed, parallel disposed joists, wherein each of said plurality of joists comprises a upper chord and a lower chord joined by a body portion, and each upper chord and each lower chord is substantially perpendicular to said body portion, wherein each of said plurality of joists comprises a substantially Z-shaped or C-shaped cross section about a longitudinal axis of said plurality of joists, wherein said upper chord comprises a plurality of concrete-engaging mechanisms, wherein at least a portion of said upper chord of each of said plurality of joists is embedded in said slab;
   a plurality of mounting brackets, one of said plurality of mounting brackets being attached to each of said plurality of joists, each of said plurality of mounting brackets comprising:
   a body portion; and
   a horizontal mounting plate affixed to said body portion, each of said horizontal mounting plates resting on a load-bearing structure, said horizontal mounting plate being at least partially embedded in said concrete slab; and
   a reinforcing mesh at least partially supported upon said upper chords of said plurality of joists and hanging generally in a catenary shape therebetween and being fully embedded in said slab.

14. The composite steel and concrete floor construction of claim 13 wherein said plurality of concrete-engaging mechanisms comprises a plurality of dimples.

15. The composite steel and concrete floor construction of claim 13 wherein each of said joists is completely formed of a single piece of cold rolled sheet metal.

16. The composite steel and concrete floor construction of claim 13 wherein each of said plurality of joists exhibits rotational symmetry about said longitudinal axis.

17. The composite steel and concrete floor construction of claim 13 wherein each of said plurality of joists exhibits reflective symmetry about said longitudinal axis.

18. The composite steel and concrete floor construction of claim 13 wherein said body portion of each of said plurality of joists is substantially suspended between said plurality of support structures by at least two mounting brackets.
19. A method comprising the steps of:

placing a plurality of mounting brackets on a load-bearing structure, each of said plurality of mounting brackets comprising:

- a body portion; and

- a horizontal mounting plate affixed to said body portion, each of said horizontal mounting plates resting on a load-bearing structure;

affixing a plurality of individual laterally placed, parallel disposed joists between said plurality of mounting brackets, thereby supporting each of said plurality of joists, each of said plurality of joists comprising a substantially “Z-shaped” or “C-shaped” cross section along a longitudinal axis;

placing a plurality of removable spanner bars extending between said plurality of joists;

placing a support platform over said plurality of removable spanner bars; and

pouring a concrete over said support platform, thereby embedding at least a portion of each of said plurality of joists and at least a portion of each of said plurality of horizontal mounting plates in said concrete.

20. The method of claim 19 further comprising the steps of:

- waiting for said concrete slab to cure;
- removing said plurality of removable spanner bars; and
- removing said support platform.

21. The method of claim 19 wherein said support platform comprises a plurality of plywood sheets.

22. The method of claim 19 wherein said step of supporting said plurality of joists between a plurality of support structures comprises the steps of:

- affixing a first mounting bracket to a first end of each of said plurality of joists;
- affixing a second mounting bracket to a second end of each of said plurality of joists; and
- affixing each of said first and second mounting brackets for each of said plurality of joists to said plurality of support structures, thereby suspending each of said plurality of joists between said plurality of support structures.

23. The method of claim 19 further comprising the step of suspending a reinforcing mesh at least partially upon said upper chords of said plurality of joists prior to pouring said concrete slab, said reinforcing mesh hanging generally in a catenary shape therebetween and being fully embedded in said concrete slab.

24. The method of claim 19 further comprising the step of engaging at least a portion of said concrete slab with a plurality of concrete-engaging mechanisms, said plurality of concrete-engaging mechanisms being formed in an upper chord of each of said plurality of joists.