An insulated concrete forming panel comprising an insulative interior wall portion (14) that provides a form for supporting uncured concrete, wherein the uncured concrete forms a concrete structural portion upon curing of the uncured concrete, and wherein the insulative interior wall portion (14) remains attached to the concrete structural portion after formation.
SINGLE FACE INSULATED CONCRETE FORM

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CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to U.S. Provisional Patent Application No. 60/978,545, filed October 9, 2007.

BACKGROUND

[0002] Poured concrete walls are often used in construction to make wall assemblies for structures. The concrete is typically poured into a void that is formed between two steel form structures. When the forms are removed after the concrete cures, the wall consists of concrete that has no insulative properties beyond those of the concrete itself. To add to the insulative properties of the concrete, insulated concrete forms (ICFs) are used to construct wall assemblies. ICFs are generally constructed of insulative polymer panels or interlocking blocks that provide a form for the poured concrete and also form a part of the outside and inside finished wall assembly. ICF techniques can be used to pre-fabricate building panels. Examples of such panels and methods of making such panels are contained in U.S. Patent Application Publication No. 2006/0251851 and U.S. Patent Application Publication No. 2006/0191232, both of which are incorporated herein by reference.

[0003] Concrete is the only structural material in a typical ICF and as such carries all of the weight, building and lateral loads imposed on a wall section. The forms do not contribute to the load carrying capacity of the complete wall. The two exposed
foam sections (interior and exterior) of a typical ICF must be covered with a fire resistant material in order to obtain required fire ratings.

SUMMARY

[0004] In various embodiments, the present invention is directed to single face insulated concrete forms in which an insulative polymer acts as one side of a form for fresh (uncured), or poured concrete and a removable concrete form acts as the other side of the form. When used with standard modular concrete forms, embodiments of the present invention allow the typical three step construction process (forming, insulating and furring) to be combined into one step. The modular nature and matching of connecting points and ties with industry standards for the systems and methods described herein require little or no additional worker skills as compared with using typical concrete forms.

[0005] According to various embodiments, the deformed section of the steel stud, when extending into the concrete, supplements or replaces standard reinforcement of the concrete wall section. This allows the steel studs to supplement the concrete by creating a composite action within the wall structure and allows for the concrete section to be reduced in thickness while maintaining the load properties of the finished wall.

[0006] According to various embodiments, after removal of the interior and exterior modular forms a concrete wall is created having an insulating face with exposed furring studs for easy placement of all utilities within the wall.
Those and other details, objects, and advantages of the present invention will become better understood or apparent from the following description and drawings showing embodiments thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate examples of embodiments of the invention. In such drawings:

- Fig. 1 illustrates a perspective view of an embodiment of an insulated concrete form system;
- Fig. 2 illustrates a side view of an embodiment of the insulated concrete form system of Fig. 1;
- Fig. 3 illustrates a perspective view of an embodiment of the interior wall portion of the insulated concrete form system of Fig. 1;
- Fig. 4 illustrates a perspective view of an embodiment of the interior wall portion of the insulated concrete form system of Fig. 1;
- Fig. 5 illustrates an embodiment of a connector portion of the interior wall portion of the insulated concrete form system of Fig. 1 having a reinforcing member extending therethrough;
- Fig. 6 illustrates an embodiment of the connector portion of the interior wall portion of the insulated concrete form system of Fig. 1 having a reinforcing member extending therethrough;
[0015] Fig. 7 illustrates an embodiment of a locking mechanism for securing the reinforcing member to the connector portion of the interior wall portion of the insulated concrete form system of Fig. 1;

[0016] Fig. 8 illustrates an embodiment of the insulated concrete form system of Fig. 1 having reinforcing members located between the interior wall portion and the concrete form;

[0017] Fig. 9 illustrates an embodiment of an insulated concrete form system having a removable interior form;

[0018] Fig. 10 illustrates an embodiment of an insulated concrete form system having exterior and interior concrete form portions configured in a modular fashion;

[0019] Fig. 11 illustrates a side perspective view of an embodiment of an insulated concrete form system;

[0020] Fig. 12 illustrates an embodiment of an insulated concrete form system that includes locking mechanisms;

[0021] Fig. 13 illustrates an embodiment of a removable interior form that is attached to the interior wall portion of an insulated concrete form system;

[0022] Fig. 14 illustrates an embodiment of a locking mechanism for securing the various portions of an insulated concrete form system that secures the removable interior form, the interior wall portion and the exterior removable form;

[0023] Fig. 15 illustrates a side view of an embodiment of a stud for an interior wall portion of an insulated concrete form system;

[0024] Fig. 16 illustrates a perspective view of a stud for an interior wall portion of an insulated concrete form system;
Fig. 17 illustrates a cross-sectional view of an embodiment of an insulated concrete form system after the forms have been removed;

Fig. 18 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed;

Fig. 19 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed;

Fig. 20 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed;

Fig. 21 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed; and

Fig. 22 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed.

DESCRIPTION

Various embodiments of the present invention are directed to an insulated concrete form system. In various embodiments, the system includes an insulated pre-studded portion that acts as both a form during the concrete pour and an attached interior wall portion after the pour and removal of an exterior form. Various embodiments also include removable interior forms that may be constructed of a lightweight material.

Various embodiments are directed to a single face, stay in place, insulated concrete forming panel. In various embodiments, the forms are designed to
work with industry standard removable modular concrete forms, either in a double sided or single sided configuration. In various embodiments, the foam form panel contains structural members molded within an expandable foam body that fixes the position of and insulates the members which may be constructed of, for example, light gauge steel. In such embodiments, the expandable foam core body with the fixed members contributes to the structural integrity of the assembly during the concrete casting process. Embedding a portion of the members within the concrete portion of a wall allows a reduction in the concrete steel reinforcement. The structural members may be of any length and orientation and are molded within the foam core using, for example, a continuous or semi-continuous process.

[0033] In various embodiments, the exposed portion of the structural members extending from the bottom of the foam panel and running the length of the panel create a composite wall connection that allows the concrete and light gauge metal stud to better resist the forces of gravity, structural loading and soil pressures. The opposing exposed steel member acts as a furring stud to allow for plumbing and electrical chases and as the attachment point for the modular concrete forms. The structural metal studs also aid the modular concrete forms in resisting the forces applied when the concrete is poured.

[0034] In various embodiments, the foam surface of the panel prevents the concrete core from contacting the interior portion of the modular forms, thereby extending their useful life and speeding the cleaning of the forms after use. The foam surface also reduces the amount of temporary form bracing required to withstand the pouring forces of the concrete.
In various embodiments, the opposing exposed stud is used to apply finishing materials such as drywall or other materials to provide the finishing of the interior walls. The opposing flush surface of the steel member may be used to mechanically attach the concrete, window bucks, door bucks, concrete to panel tie steel, etc. The molded portion of the stay in place form can vary in its depth to create the proper insulation based on the building design and intended use. The foam depth can also vary (e.g., from 1 inch to 16 inches) to provide for differing concrete pour thickness support during the casting phase of construction while using the same modular concrete forms and ties.

In various embodiments, the steel members can be varied in dimension (including the gauge of steel used) depending on the concrete depth and reinforcement positioning required by structural engineers in the design of differing wall heights and loading requirements. The panels can be reversed with the foam to the exterior and used as a foam surface to attach cost-effective foam architectural detailing.

Fig. 1 illustrates a perspective view of an embodiment of an insulated concrete form system 10. The system 10 includes a removable concrete form 12 that may be constructed of any suitable material such as, for example, steel, plastic, wood, etc. The system 10 also includes an interior wall portion 14. The interior wall portion 14 may be constructed of an insulating material such as, for example, a polymer such as a matrix of molded expanded polystyrene (EPS) or any expandable or non-expandable material (e.g., foam based material) or plastic that may, in one embodiment, include one or more performance enhancing additives.
The interior wall portion 14 includes various embedded and exposed structural and non-structural members that are constructed of, for example, light gauge steel, wood, plastic, or a composite material of any natural or engineered composition. The members include studs 16 that allow for utilities to be run in the interior of the finished wall and also allow for finish materials such as drywall to be attached to the interior of the finished wall. Reinforcing members 18 connect the interior wall portion 14 and the concrete form 12 and provide either sole reinforcement or reinforcement that supplements conventional reinforcement of the concrete that is poured to fill void 20 between the interior wall portion 14 and the concrete form 12.

Fig. 2 illustrates a side view of an embodiment of the insulated concrete form system 10 of Fig. 1. Fig. 3 illustrates a perspective view of an embodiment of the interior wall portion 14 of the insulated concrete form system 10 of Fig. 1. Fig. 4 illustrates a perspective view of an embodiment of the interior wall portion 14 of the insulated concrete form system 10 of Fig. 1. The embodiment shown in Fig. 4 includes reinforcement members 22 that further reinforce the interior wall portion 14.

Fig. 5 illustrates an embodiment of a connector portion 24 of the interior wall portion 14 of the insulated concrete form system 10 of Fig. 1. The connector portion 24 is molded into the interior wall portion 14 and provides an attachment point for structural elements 16, 22 and provides points at which the reinforcing members 18 can pass through and be securely connected to the interior wall portion 14. Fig. 6 illustrates an embodiment of the connector portion 24 of the interior wall portion 14 of the insulated concrete form system 10 of Fig. 1 having the reinforcing member 18 extending therethrough.
Fig. 7 illustrates an embodiment of a locking mechanism 26 for securing the reinforcing member 18 to the connector portion 24 (not shown in Fig. 7) of the interior wall portion 14 of the insulated concrete form system 10 of Fig. 1. As can be seen in Fig. 7, the connector portion 24 has a stud 16 attached thereto and the reinforcing member 18 extends through the connector portion 24 and an opening in the stud 16. The locking mechanism 26 secures the reinforcing member 18 to the interior wall portion 14 and prevents the interior wall portion 14 from separating from the concrete form 12 during the concrete pour. The locking mechanism 26 includes a horizontal member 28 and a vertical member 31.

Fig. 8 illustrates an embodiment of the insulated concrete form system 10 of Fig. 1 having reinforcing members 30 located between the interior wall portion 14 and the concrete form 12. As can be seen in Fig. 8, the reinforcing members 30 are reinforcing bars (rebar) that are arranged in a grid. The reinforcing members 30 may be made of any type of material, such as a metal or polymer.

Fig. 9 illustrates an embodiment of an insulated concrete form system 32 having a removable interior form 34. The interior form 34 may be constructed of any suitable material such as, for example, steel, plastic, wood, etc. In one embodiment, the interior form 34 is constructed of molded polypropylene.

Fig. 10 illustrates an embodiment of an insulated concrete form system 36 having exterior and interior concrete form portions 12, 34 configured in a modular fashion such that the interior form portions 34 fit between the studs 16.

Fig. 11 illustrates a side perspective view of an embodiment of an insulated concrete form system 38 that is configured prior to a concrete pour. Fig. 12
illustrates an embodiment of an insulated concrete form system 40 that includes locking mechanisms 26.

[0046] Fig. 13 illustrates an embodiment of a removable interior form 34 that is attached to the interior wall portion 14 of the insulated concrete form systems described herein. As can be seen in Fig. 13, the stud 16 includes a dimpled surface 17 adjacent the interior form 34. The surface 17 facilitates removal of the interior form 34. Fig. 14 illustrates an embodiment of the locking mechanism 26 for securing the various portions of the insulated concrete form systems described herein. The locking mechanism includes the vertical member 28 and the horizontal member 31 and secures the removable interior form 34, the interior wall portion 14 and the exterior removable form (not shown in Fig. 14).

[0047] Fig. 15 illustrates a side view of an embodiment of a stud 16 for the interior wall portion 14 of the insulated concrete form systems described herein. The stud 16 includes fusion slots 44 that facilitate anchoring the portion of the stud 16 that is contained in the interior wall portion 14. The stud 16 also includes wiring chase slots 46 that facilitate the routing of wires, pipes, etc. through the stud 16 during the finishing process of the structure that includes the concrete wall that was constructed using the insulated concrete form systems.

[0048] The stud 16 further includes slots 48 that permit the reinforcing members 18 to extend through the stud 16. The stud also includes wedge bolt punch holes 50.

[0049] Fig. 16 illustrates a perspective view of a stud 16 for the interior wall portion 14 of the insulated concrete form systems described herein. The stud 16 includes
a strip 52 that has fusion slots 44. When in use, the fusion slots 44 are embedded in the interior wall portion 14.

[0050] Fig. 17 illustrates a cross-sectional view of an embodiment of an insulated concrete form system after the forms have been removed and the concrete 54 is cured. The stud 16 includes a portion with the strips 52 embedded in the interior wall portion 14. The stud also includes the slots 48 for insertion of the reinforcing members 18. Fig. 18 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed. In the embodiment of Fig. 18, the stud 16 extends further into the interior wall portion 14.

[0051] Fig. 19 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed. In the embodiment illustrated in Fig. 19, the stud 16 extends through the interior wall portion 14 into the concrete 54 to provide further reinforcement of the system. Also, in the embodiment illustrated in Fig. 19, the interior wall portion 14 includes a V-shaped cutout section.

[0052] Fig. 20 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed. In the embodiment illustrated in Fig. 20, the stud 16 includes extended strips 56 embedded in the interior wall portion 14 that provide further stability to the system.

[0053] Fig. 21 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed. In the embodiment illustrated in Fig. 21, the interior wall portion 14 has a larger V-shaped cutout portion than the embodiment illustrated in Figs. 19 and 20.
Fig. 22 illustrates a cross-sectional view of another embodiment of an insulated concrete form system after the forms have been removed. In the embodiment illustrated in Fig. 22, the stud does not extend beyond the interior wall portion 14, but is instead completely embedded in the interior wall portion 14 and the concrete 54.

In the embodiments illustrated herein in which the stud 16 extends into the concrete 54, the stud 16 acts as a reinforcing member in the concrete and can supplement or replace other reinforcing techniques.

In various embodiments, the interior wall portion 14 may include panels that are oriented on different planes, thus creating walls for specific purposes, such as below-grade and above-grade walls, retaining walls with attached architectural details and sandwich insulated walls containing concrete on both exposed wall surfaces.

Various embodiments of the systems and methods described herein allow for concrete structures that use less concrete, thus reducing costs and the weight of the structure. Various embodiments of the systems and methods described herein eliminates or reduces the amount of bracing necessary for creating poured concrete walls and allow for relatively easier installation than traditional concrete poured walls.

The present invention has been described with reference to specific details of particular embodiments thereof. It is not intended that such details be regarded as limitations upon the scope of the invention.
CLAIMS

I claim:

1. An insulated concrete forming panel comprising an insulative interior wall portion that provides a form for supporting uncured concrete, wherein the uncured concrete forms a concrete structural portion upon curing of the uncured concrete, and wherein the insulative interior wall portion remains attached to the concrete structural portion after formation.

2. The insulated concrete forming panel of claim 1, further comprising a pre-studded portion attached to the insulative interior wall portion.

3. The insulated concrete forming panel of claim 1, wherein the insulative interior wall portion comprises at least one of a foam material and a plastic.

4. The insulated concrete forming panel of claim 1, wherein the insulative interior wall portion comprises a polymer.

5. The insulated concrete forming panel of claim 1, wherein the insulative interior wall portion comprises molded expanded polystyrene.

6. The insulated concrete forming panel of claim 1, further comprising at least one fixed member.

7. The insulated concrete forming panel of claim 6, wherein the fixed member comprises at least one of a metal, a polymer, a wood, a plastic, and a composite material.

8. The insulated concrete forming panel of claim 7, wherein the metal is a light gauge steel.
9. The insulated concrete forming panel of claim 6, wherein the fixed member is at least partially embedded within at least one of the interior wall portion and the concrete structural portion.

10. The insulated concrete forming panel of claim 6, wherein the fixed member is a structural member.

11. The insulated concrete forming panel of claim 6, wherein the fixed member is a stud or a reinforcing member.

12. The insulated concrete forming panel of claim 1, further comprising at least one connector portion, wherein the connector portion is molded into the insulative interior wall portion, and wherein the connector portion provides an attachment point for at least one structural element and for at least one reinforcing member to extend therethrough.

13. The insulated concrete forming panel of claim 12, further comprising at least one locking mechanism for securing the reinforcing member to the connector portion, wherein the locking mechanism has a horizontal member and a vertical member.

14. The insulated concrete forming panel of claim 12, wherein the connector portion further comprises a stud attached thereto, wherein the stud has an opening for the reinforcing member to extend therethrough.

15. The insulated concrete forming panel of claim 11, wherein the reinforcing member is at least one reinforcing bar arranged in a grid of reinforcing bars.

16. The insulated concrete forming panel of claim 11, wherein the stud has at least one slot selected from the group consisting of fusion slots, wiring chase slots, reinforcing member slots, and wedge bolt punch hole slots.
17. The insulated concrete forming panel of claim 11, wherein the stud has a strip with at least one fusion slot, and wherein the fusion slot is embedded in the insulative interior wall portion.

18. The insulated concrete forming panel of claim 1, wherein the insulative interior wall portion has a v-shaped cutout section.

19. The insulated concrete forming panel of claim 11, wherein the stud is a reinforcing member extending into the concrete structural portion.

20. The insulated concrete forming panel of claim 11, wherein the stud has at least one extended strip embedded in the insulative interior wall portion.

21. The insulated concrete forming panel of claim 11, wherein the stud does not extend beyond the insulative interior wall portion and is completely embedded in the insulative interior wall portion and the concrete structural portion.

22. The insulated concrete forming panel of claim 1, wherein the insulative interior wall portion comprises panels oriented on different planes.

23. The insulated concrete forming panel of claim 11, wherein the stud comprises a dimpled surface adjacent an interior form portion.

24. An insulated concrete form system, the system comprising

   at least one removable form; and

   an insulative interior wall portion;

   wherein the removable form and the insulative interior wall portion provide a form for supporting uncured concrete, wherein the uncured concrete forms a concrete structural portion upon curing of the uncured concrete, and wherein the insulative interior wall portion remains attached to the concrete structural portion after formation.
25. The insulated concrete form system of claim 24, wherein the removable form is an exterior form.

26. The insulated concrete form system of claim 24, wherein the removable form is an interior form portion.

27. The insulated concrete form system of claim 24, wherein the removable form comprises at least one material selected from the group consisting of steel, plastic, and wood.

28. The insulated concrete form system of claim 26, wherein the interior form portion comprises molded polypropylene.

29. The insulated concrete form system of claim 26, wherein the interior form portion is configured in a modular fashion such that the interior form portion fits between a first stud and a second stud, and wherein the first stud and the second stud are embedded in the insulative interior wall portion.

30. The insulated concrete form system of claim 24, further comprising at least one locking mechanism for securing at least one fixed member to a connector portion, wherein the locking mechanism has a horizontal member and a vertical member.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

INV. E04B2/86

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>paragraphs [0167] - [0170], [0176], [0179] - [0181], [0201], [0208], [0209], [0214], [0224]; figures 1,35,8,10</td>
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Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents

'A' document defining the general state of the art which is not considered to be of particular relevance

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'T' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'X' document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Y' document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Name and mailing address of the ISA/

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Fax (+31-70) 340-3016

Authorized officer

Stern, Claudio
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