METHOD OF FORMING CONCRETE AND AN APPARATUS FOR TRANSFERRING LOADS BETWEEN CONCRETE SLABS

Inventor: Stephen F. McDonald, Loganville, GA (US)

Correspondence Address:
SHOEMAKER AND MATTARE, LTD
10 POST OFFICE ROAD - SUITE 110
SILVER SPRING, MD 20910 (US)

Appl. No.: 11/077,557
Filed: Mar. 11, 2005

ABSTRACT

An apparatus for forming concrete includes a form having a slot configured to closely receive a plate. The slot is defined by one or more annular surfaces having central axes perpendicular to a direction in which the slot receives the plate. A method for forming same includes providing a sheet of form material; disposing a release layer on the sheet; cutting the sheet into a plurality of forms having a predetermined form height; and cutting a slot in each of each of the plurality of forms. Another apparatus for forming concrete includes a plate having a first portion and a second portion. A coating is disposed on the first portion. When disposed in a joint defined by a first volume of concrete and a second volume of concrete, the first volume of concrete adheres only to the coating and the second volume of concrete adheres only to the second portion. A method for forming concrete includes providing a plate having a coated first portion and a second portion; providing a form having a slot configured to closely receive the second portion; inserting the second portion in the slot; positioning the form to receive concrete; pouring a volume of concrete on the form and the first portion; curing the volume of concrete and defining cured concrete; and removing the form from the cured concrete. The plate remains in the cured concrete.
400

405 PROVIDING A SHEET

410 DISPOSING A RELEASE OVERLAY ON THE SHEET

415 CUTTING THE SHEET INTO A PLURALITY OF FORMS

420 CUTTING A CHAMFER IN EACH OF THE PLURALITY OF FORMS

Fig. 5

500

505 PROVIDING A PLATE WITH A COATING DISPOSED ON A FIRST PORTION

510 PROVIDING A FORM HAVING A SLOT CONFIGURED RECEIVE A SECOND PORTION OF THE PLATE

515 INSERTING THE SECOND PORTION IN THE SLOT

520 POSITIONING THE FORM TO RECEIVE CONCRETE

525 POURING A VOLUME OF CONCRETE ON THE FORM AND THE FIRST PORTION

530 CURING THE VOLUME OF CONCRETE AND DEFINING CURED CONCRETE

535 REMOVING THE FORM FROM THE CURED CONCRETE WHEREIN THE PLATE REMAINS IN THE CURED CONCRETE

Fig. 6
METHOD OF FORMING CONCRETE AND AN APPARATUS FOR TRANSFERRING LOADS BETWEEN CONCRETE SLABS

REFERENCE TO EARLIER APPLICATION

This Application claims the benefit of and is a continuation-in-part of U.S. Provisional Patent Application Ser. No. 60/650954, filed Feb. 9, 2005, by Stephen F. McDonald for Method of Forming Concrete and an Apparatus for Same.

BACKGROUND OF THE INVENTION

Conventional concrete pavement installation involves preparing then positioning forms around an area intended for pavement. The forms have vertical inner surfaces to receive and contain poured concrete. The forms have horizontal top surfaces, which typically are level with the surface of the poured concrete, or, once cured, pavement surface. The forms have back surfaces that rest against appropriately-spaced stakes for holding the forms in place. To provide clearance for finish troweling, concrete workers often field cut chamfers between the top and back surfaces of the forms.

Very large pavements require substantial form preparation and positioning. This is especially true if stock materials for forms are short and/or flexible. Short and flexible forms require more staking than longer, more rigid forms to ensure true, unwavy pavement edges. Short forms also require more setup time for charring. Regardless of whether the forms are long or short, field charring requires considerable time for large pavement areas.

Ideally, the forms used for receiving poured concrete should have a true height for providing a true slab thickness. Unfortunately, forms in the field typically have a height that is less than a true height for an appropriate slab thickness. These forms of inadequate height typically may be positioned so that the top surfaces are at an appropriate height relative to the desired pavement surface height, but present bottom surfaces that do not contact, thus admit gaps through which poured concrete leaks. This wastes concrete and requires additional work to remove the excess portions.

Concrete leakage from the forms, especially at the butt joints, leaves depressions in a finished slab surface causing poor aesthetics. The depressions also impair surface coverings, such as tile, because the uneven surface promotes uneven or incomplete covering layout and adhesion. Cured leaked concrete also impinges on adjacent slabs causing voids and/or increasing the chances of obtaining a locked construction, which leads to cracks and joint failures. Finally, removing the cured excess typically damages the slab from which the excess is chiseled. Thus, avoiding form leaks is highly desirable.

Unfortunately, none of the foregoing provides a method of forming concrete and an apparatus for same that includes stiff, infinitely long, pre-chamfered forms with predetermined true height.

In construction of concrete pavements for highways, airport runways, large warehouse buildings and the like, preventing random cracking of the concrete necessitates dividing the pavement into convenient slab sections. To this end, concrete workers pour a monolithic concrete slab that is allowed to set for a short period. Then, the workers cut transverse grooves, having a depth on the order of one-fourth of the slab thickness, across the slab, with spacing between cuts selected in accordance with the application and design. Spacings from 12 to 40 feet are common for highway pavements.

As the concrete of the slab cures, forces derived from the exothermic curing reactions cause generally vertical cracks to develop through the slab thickness at the reduced cross-sections below each groove. This controlled cracking effectively divides the slab into predetermined separate slab sections.

The vertical cracks or joints define adjacent and interlocking faces formed by the cement and aggregates in the concrete. The interlocking faces transfer vertical shear stresses among adjacent slab sections, a phenomenon commonly referred to as “aggregate interlock,” as heavy objects, such as motor vehicles, pass over the joint.

Aggregate interlock causes wear among slab intersections with increasing use of the pavement. Additionally, cyclical and extreme temperature changes decrease slab volumes. Thus, over time, as traffic continuously passes over a joint, the intersections wear and become smooth, then fail altogether, resulting in relative vertical displacement of adjacent slab sections, hence a rough pavement surface. Joint failure also becomes increasingly susceptible to water intrusion, which may freeze and cause damage among adjacent slabs.

To discourage relative vertical displacement among adjacent slabs, prior art techniques provide for implanting dowels in concrete extending across the joint intersections. Some dowels are smooth steel rods with diameters on the order of one inch and lengths of two feet. Each rod is coated or otherwise treated so that it will not bond to concrete along its length or at least on one end thereof. Thus, as a slab expands and contracts during curing and subsequently with temperature changes, the dowel is free to move horizontally relative to, yet maintain vertical alignment of adjacent slabs, augmenting the aggregate interlock to transfer vertical shear stresses across the joints. See, for example, U.S. Pat. No. 3,397,626, issued Aug. 20, 1968, to J. B. Kornick et al. for Plastic Coated Dowel Bar for Concrete and U.S. Pat. No. 4,449,844, issued May 22, 1984, to T. J. Larsen for Dowel for Pavement Joints.

Among other problems, the foregoing techniques involve significant time and labor to produce and place the dowels.

Another technique to discourage relative vertical displacement among adjacent slabs involves embedding square-shaped load plates in adjacent slabs with opposed corners of the load plate aligned with the joint. To avoid shrink- or thermally-induced stress creation between the plate and a slab, concrete workers first embed a blockout sheath in one vertical joint face for receiving a load plate. To this end, the workers nail onto a form a mounting plate, from which a blockout sheath extends, then position the form to receive pour concrete. Once the concrete is cured and bonded to the blockout sheath, the workers remove the form board and leave the blockout sheath in place. Then the workers insert a load plate into the blockout sheath. Finally, the workers pour an adjacent slab, which bonds to the
exposed portion of the load plate. See, for example, U.S. Pat. No. 6,354,760, issued Mar. 12, 2002, to Boxall et al., for System for Transferring Loads Between Cast-in-Place Slabs.

Drawbacks of the foregoing include the cost and labor associated with producing separate mounting and load plates, then assembling same following curing of a first concrete slab.

Unfortunately, none of the foregoing provide a method of forming concrete and an apparatus for same that includes partially coated load plates carried in slotted forms.

What are needed, and not taught or suggested in the art, are a method of forming concrete and an apparatus for same that provide partially coated load plates carried in slotted, stiff, infinitely long, pre-chamfered forms with predetermined true height.

SUMMARY OF THE INVENTION

The invention overcomes the disadvantages noted above by providing a method of forming concrete and an apparatus for same that provide partially coated load plates carried in slotted, stiff, infinitely long, pre-chamfered forms with predetermined true height. An embodiment configured according to principles of the invention includes a form having a slot configured to closely receive a plate. The slot is defined by one or more annular surfaces having central axes perpendicular to a direction in which the slot receives the plate.

Another embodiment configured according to principles of the invention includes providing a sheet of form material; disposing a release layer on the sheet; cutting the sheet into a plurality of forms having a predetermined form height; and cutting a slot in each of each of the plurality of forms.

A further embodiment configured according to principles of the invention includes a plate having a first portion and a second portion. A coating is disposed on the first portion. When disposed in a joint defined by a first volume of concrete and a second volume of concrete, the first volume of concrete adheres only to the coating and the second volume of concrete adheres only to the second portion.

Yet another embodiment configured according to principles of the invention includes providing a plate having a coated first portion and a second portion; providing a form having a slot configured to closely receive the second portion; inserting the second portion in the slot; positioning the form to receive concrete; pouring a volume of concrete on the form and the first portion; curing the volume of concrete and defining cured concrete; and removing the form from the cured concrete. The plate remains in the cured concrete.

The invention provides improved elements and arrangements thereof, for the purposes described, which are inexpensive, dependable and effective in accomplishing intended purposes of the invention.

Other features and advantages of the invention will become apparent from the following description of the preferred embodiments, which refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is described in detail below with reference to the following figures, throughout which similar reference characters denote corresponding features consistently, wherein:

FIG. 1 is an environmental perspective view of an embodiment of an apparatus for forming concrete configured according to principles of the invention shown adjacent to concrete;

FIG. 2 is a top front right side elevational view of another embodiment of an apparatus for forming concrete configured according to principles of the invention;

FIG. 3 is cross-sectional detail view, drawn along line 3-3 in FIG. 2;

FIG. 4 is a plan view of a plate of the embodiment of FIG. 2;

FIG. 5 is a schematic view of an embodiment of a method of making an apparatus for forming concrete configured according to principles of the invention;

FIG. 6 is a schematic view of an embodiment of a method of forming concrete configured according to principles of the invention; and

FIG. 7 is a plan view of another embodiment of an apparatus for forming concrete configured according to principles of the invention, shown partially in cross-section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention is a method of forming concrete and an apparatus for same that provide partially coated load plates carried in slotted, stiff, infinitely long, pre-chamfered forms with predetermined true height.

Referring to FIG. 1, an embodiment of an apparatus for forming concrete configured according to principles of the invention includes a form 100. Form 100 has a side surface 105, a top surface 110, a back surface 115 and a bottom surface 120. Side surface 105 and back surface 115 define a width 125 ranging from 0.875 to 2.500 inches. Top surface 110 and bottom surface 120 define a height 130 ranging from 3 to 18 inches or more, depending on the thickness required for pavement.

Form 100 has a chamfer 135 between top surface 110 and back surface 115. Chamfer 135 defines an angle 140 relative to top surface 110 ranging from 10° to 89°, preferably 22.5° to 45°. Side surface 105 and chamfer 135 define a top surface width 143 ranging from 0.125 to 0.875 inch. Chamfer 135 provides clearance for trowels and other finishing tools and allows for faster concrete finishing.

Width 125, height 130, angle 140 and top surface width 143 vary as needed to provide a desired overall stiffness of form 100. Form stiffness dictates the amount of staking required to maintain form 100 in place against the great weight of poured concrete 155. Stiffer forms 100 require less staking, thus less labor to place forms 100 where needed.

More importantly, form stiffness impacts the true ness of an edge 145 defined by side surface 105 and top surface 110, which forms a corresponding edge in concrete.
when cured. Good trueness is important to the overall appearance of a pavement defined by multiple slabs having adjacent edges. For example, if an edge of one slab has poor trueness and is adjacent to another slab edge that has poor trueness, the gap defined between the un-true edges will exhibit unsightly non-uniformity, or portions of the gap that may be too narrow followed by portions that may be too wide. This gap non-uniformity contributes to an overall non-professional image of the area and associated business.

Preferably, form 100 is constructed of oriented strand board (OSB). OSB stock may be manufactured to assume virtually any dimension, which may be machined, as described below, to define forms 100 of virtually any length. As the invention is intended for constructing large-scale pavements, forms 100 with very large lengths are desirable because fewer abutting forms 100 are needed to define a continuous side surface 105 and edge 145, hence slab side. This reduces the labor needed to limit and/or treat discontinuities that may occur in the slab side. OSB stock also is preferred because it may be machined to define a desired height 130. This eliminates the occurrence of concrete leaks between the bottom surface of prior art forms of inadequate height and the supporting surface underlying the concrete.

Also may be constructed of dimensional lumber, particle board, metal, plastic, cardboard, fiber board, polyurethane foam, Styrofoam®, or other rigid synthetic or other suitable materials commensurate with the purposes described herein.

A release overlay 160 is disposed on side surface 105. Release overlay 160 is constructed of phenolic paper, kraft paper, acrylic, latex, melamine, Formica®, foil, oil, high density overlay, metal or other suitable material that provides a smooth, closed-cell surface, substantially free of pores for retaining poured concrete without adhering to or marring the finished surface thereof when cured and separated from form 100.

Referring to FIG. 2, another embodiment of an apparatus for forming concrete configured according to principles of the invention includes a form 200 and one or more plates 300 received in form 200. Form 200 is constructed similarly to form 100 and has slots 260 for receiving plates 300. Slots 260 have a spacing 261 of about two feet, or other dimension suitable for purposes described herein.

Referring also to FIG. 3, each slot 260, preferably, is formed by plunge cutting with a rotary saw blade (not shown). Slot 260 is defined by annular surfaces 263, each having curvatures corresponding to the radius of the plunge-cutting saw blade. Annular surfaces 263 and side surface 205 (comparable to side surface 105 of form 100) define opposed proximal intersections 265. Annular surfaces 263 and back surface 215 (comparable to back surface 115 of form 100) define opposed distal intersections 270.

Referring also to FIG. 4, each plate 300, preferably is constructed of steel or any material suitable for performing as a load transfer device between adjacent concrete slabs in a pavement. To economize production costs, plate 300 may be shear-cut. Plate 300 is 0.250-0.375 inches thick and has a side dimensions 303 of approximately 4.5 inches, or other dimension suitable for purposes described herein. Preferably, plate 300 has a length 305 that is greater than or equal to a width 310. Thus, plate 300, in plan view, assumes the shape of a rhombus or square. Plate may be constructed as set forth in U.S. Pat. No. 6,354,760.

Plate 300 has a first portion 315 and a second portion 320, delineated by a plane 321 defined by the intersections of sides 322 and 323 that are aligned with side surface 205. First portion 315 may be untreated. Second portion 320 has an elastomer coating 325 configured to adhere to concrete, but not to plate 300. Elastomer coating 325 is constructed of polymers, grease or other materials suitable for the purposes described herein.

In practice, when a first concrete slab adheres to elastomer coating 325 on second portion 320 and a second concrete slab adheres to first portion 315, lateral movement among the slabs, due to shrinkage, etc., will not cause localized stresses because the first and second slabs are not fixed to plate 300, rather, one slab is permitted to move relative to plate 300 because it is adhered to elastomer coating 325. While elastomer coating 325 originally adheres to plate 300 when plate 300 is manufactured, curing concrete exerts forces on elastomer coating 325 which urges elastomer coating 325 to slide relative to plate 300 once installed.

Alternative embodiments of the invention include coatings that: (1) adhere to plate 300, but not to concrete, thereby allowing concrete to slide relative to the coating; or (2) do not adhere to plate 300 or concrete, thereby allowing concrete to slide relative to plate 300 and/or the coating.

Referring again to FIG. 2, first portion 315 is received in slot 260. Preferably, slot 260 has a tolerance of 0.03125 inch among horizontal surfaces of slot 260 and first portion 315. This close tolerancing promotes closely receiving first portion 315 in slot 260. This provides for maintaining plate 300 at a desired attitude. Elastomer coating 325 is likely to have a thickness exceeding this tolerance that would prevent slot 260 from receiving second portion 320.

Referring also to FIG. 3, plate 300 is configured such that intersections of sides 322 and 323 at the widest extremes of plate 300 mate with proximal intersections 265 of form 200. This configuration promotes a gap-free junction between plate 300 and form 200 that discourages concrete from seeping therethrough. This ensures that concrete only contacts elastomer coating 325 and not plate 300.

Plate 300 also is configured, and the radius of a saw (not shown) used for plunge cutting slot 260 is selected, such that distal intersections 270 in form 200 firmly cradle first portion 315. This configuration prevents plate 300 from undesired rotation or movement relative to form 200 despite significant forces exerted on plate 300 by concrete when poured on form 200 and plate 300.

Referring to FIG. 7, another embodiment of a plate 700 configured according to principles of the invention has a first portion 715 and a second portion 720, delineated by a plane 721. First portion 715 may be untreated. Second portion 720 has an elastomer coating 725 that is similar to elastomer coating 325.

In practice, first portion 715 is received in a slot 860 in a form 800 in a direction aligned with a side 730 extending along first portion 715 and second portion 720. Coating 725, having a preferred thickness of about 0.05
inches and being compressible, allows a cured slab (not shown) adhered thereto to move somewhat relative to second portion 720.

[0050] Referring to FIG. 5, an embodiment of a method 400 configured according to principles of the invention includes: a step 405 of providing a sheet; a step 410 of disposing a release overlay on the sheet; a step 415 of cutting the sheet into a plurality of forms; and a step 420 of cutting a chamfer in each of the plurality of forms.

[0051] Step 405 of providing a sheet of material includes material suitable for performing as a concrete form, preferably OSB stock material. However, the material may be dimensioned lumber, particle board, steel and other suitable materials if commensurate with the purposes described herein. OSB material is preferred because it can assume virtually any width, length or thickness that may be machined into forms of appropriate, true dimensions for defining the desired pavement. The length of the material, ideally, should be as long as the longest side of the pavement desired. However, manufacturing material that is, e.g., two miles long, is problematic for contemporary manufacturers.

[0052] Step 410 of disposing a release overlay on the sheet includes an overlay that is suitable for retaining poured concrete without adhering thereto or marring the finished surface thereof when the concrete cures and is separated from the form.

[0053] Step 415 of cutting the sheet into a plurality of forms ties into step 405 in that the material to be cut should be selected to maximize the number of forms machined and minimize any scrap not suitable to be a form. The number of forms derived from the sheet depends on the thickness of pavement desired, which dictates the height of the forms needed. Ideally, the width of the sheet of material provided in step 405 should be an even multiple of the form height, plus some allowance for cutting.

[0054] Step 420 of cutting a chamfer in each of the plurality of forms involves machining each form derived from step 415 with a chamfer machine that cuts chamfers in board stock. The chamfer may assume any angle suitable for purposes described herein, but preferably ranges from 22° to 45°. Step 420 provides tremendous labor savings over prior art techniques and materials. Ordinarilly, concrete workers field cut chamfers into concrete forms on site, which consumes considerable time. Providing workers with pre-chamfered forms eliminates this on-site step and allows for faster completion of the paving job at hand.

[0055] Referring to FIG. 6, an embodiment of another method 500 configured according to principles of the invention includes: a step 505 of providing a plate with a plate coating disposed on a first portion thereof; a step 510 of providing a form having a slot configured receive a second portion of the plate; a step 515 of inserting the second portion in the slot; a step 520 of positioning the form to receive concrete; a step 525 of pouring a volume of concrete against the form and the first portion; a step 530 of curing the volume of concrete and defining cured concrete; and a step 535 of removing the form from the cured concrete, wherein the plate remains in the cured concrete.

[0056] Step 505 of providing a plate with a plate coating disposed on a first portion thereof involves preparing a plate 300 as described above. An elastomer coating, configured to adhere to concrete, but not to the plate, is disposed on the first portion of a plate.

[0057] Step 510 of providing a form having a slot configured receive a second portion of the plate involves plunge cutting the side surface of a form with a rotary blade having a pre-determined radius selected according to the configuration of the plate received in the slot, as described above.

[0058] Step 515 of inserting the second portion in the slot represents a significant cost savings over prior load plate installation apparatuses and methods. Rather than attaching to a form a mounting plate and blockout sheet, then, after the slab has cured, removing the form while breaking free the blockout sheet followed by inserting a load plate in the blockout sheet, the present method embeds a load plate directly into the concrete slab as it cures. Once the concrete cures, the forms are removed with the load plate already embedded in the concrete and no further installation required.

[0059] Step 520 of positioning the form for receiving concrete also represents an advance over many typical concrete pouring techniques in use. Because the forms are precisely cut prior to being stacked around the desired pavement area, they present a true height from support surface to pavement surface. This deters concrete from leaking through any gap that often exists between the support surface and the bottom surface of inadequately sized prior art forms.

[0060] Step 525 of pouring a volume of concrete against the form and the first portion and step 530 of curing the volume of concrete and defining cured concrete are conventional, thus described no further.

[0061] Step 535 of removing the form from the cured concrete wherein the plate remains in the cured concrete, as described above, represents a significant departure from current practices. Once the concrete cures, the forms are removed with the load plate already embedded in the concrete. Other methods require detaching a form from a mounting plate previously attached thereto, then installing a load plate in the pocket formed in the concrete.

[0062] The invention is not limited to the particular embodiments described and depicted herein, rather only to the following claims.

1. Apparatus for forming concrete comprising a form having a slot configured to closely receive a plate, wherein said slot is defined by one or more annular surfaces having central axes perpendicular to a direction in which said slot receives the plate.

2. Apparatus of claim 1, wherein said form has a side surface and a back surface with which said annular surfaces define proximal intersections and distal intersections configured to contact corresponding proximal portions and distal portions of a plate.

3. Apparatus of claim 1, wherein said form has a back surface, a top surface and a chamfer interposed therebetween defining an angle relative to said top surface ranging from 10° to 89°.

4. Apparatus of claim 1, further comprising a release layer on said form.
5. Apparatus of claim 4, wherein said release layer is constructed of phenolic paper, kraft paper, acrylic, latex, melamine, Formica®, foil, oil, high density overlay, metal or combinations thereof.

6. Apparatus of claim 1, wherein said form is constructed of oriented strand board, dimensional lumber, particle board, metal, plastic, cardboard, fiber board, polyurethane foam, Styrofoam® or combinations thereof.

7. Apparatus of claim 1, wherein said form has a width ranging from 0.125 to 3.000 inches.

8. Apparatus of claim 1, wherein said form has a top surface width ranging from 0.125 to 0.875 inch.

9. Method of making an apparatus for forming concrete comprising:
   providing a sheet of form material;
   disposing a release layer on the sheet;
   cutting the sheet into a plurality of forms having a predetermined form height; and
   cutting a slot in each of each of the plurality of forms.

10. Method of claim 9, wherein the slot is defined by one or more annular surfaces having central axes perpendicular to a direction in which the slot receives a plate.

11. Method of claim 9, wherein each of the plurality of forms has a side surface and a back surface with which the annular surfaces define proximal intersections and distal intersections configured to contact corresponding proximal portions and distal portions of a plate.

12. Method of claim 9, wherein each of the plurality of forms has a back surface and a top surface, further comprising cutting a chamfer between the back surface and the top surface in each of the plurality of forms.

13. Apparatus for transferring a load between a first concrete slab and a second concrete slab, defining a joint, comprising:
   a plate having a first portion and a second portion; and
   a coating disposed on said first portion;
   whereby, when disposed in the joint;
   the first concrete slab contacts only said coating and the second concrete slab adheres only to said second portion; and
   the first concrete slab may rotate relative to said plate.

14. Apparatus of claim 13, wherein said coating has a thickness of about 0.03 inches.

15. Apparatus of claim 13, wherein said coating slides relative to said plate, said coating slides relative to the first concrete slab or combinations thereof.

16. Apparatus of claim 13, wherein, when disposed in the joint, said plate defines a rhombus or rectangle having opposite corners aligned with the joint when disposed therein.

17. Apparatus of claim 13, wherein, when disposed in the joint, said plate defines a rhombus or rectangle in a plane perpendicular to the joint and having sides aligned with and perpendicular to the joint.

18. Apparatus of claim 13, wherein said plate is shear formed.

19. Apparatus of claim 13, further comprising a form having a slot configured to closely receive said second portion.

20. Apparatus of claim 19, wherein said form is constructed of oriented strand board, dimensional lumber, particle board, metal, plastic, cardboard, fiber board, polyurethane foam, Styrofoam® or combinations thereof.

21. Apparatus of claim 19, wherein said form has a back surface, a top surface and a chamfer interposed therebetween defining an angle relative to said top surface ranging from 10° to 89°.

22. Apparatus of claim 19, wherein said form has a width ranging from 0.125 to 3.000 inches.

23. Apparatus of claim 19, wherein said form has a top surface width ranging from 0.125 to 0.875 inch.

24. Apparatus of claim 19, wherein said slot defines one or more annular surfaces having central axes perpendicular to a direction in which said slot receives said second portion.

25. Apparatus of claim 24, wherein said form has a side surface and a back surface with which said annular surfaces define proximal intersections and distal intersections configured to contact corresponding proximal portions and distal portions of said plate.

26. Apparatus of claim 19, further comprising a release layer on said form.

27. Apparatus of claim 26, wherein said release layer is constructed of phenolic paper, kraft paper, acrylic, latex, melamine, Formica®, foil, oil, high density overlay, metal or combinations thereof.

28. Method of forming concrete comprising:
   providing a plate having a coated first portion and a second portion;
   providing a form having a slot configured to closely receive the second portion;
   inserting the second portion in the slot;
   positioning the form to receive concrete;
   pouring a volume of concrete on the form and the first portion;
   curing the volume of concrete and defining cured concrete; and
   removing the form from the cured concrete;
   wherein the plate remains in the cured concrete.

29. Method of claim 28, further comprising:
   pouring a second volume of concrete adjacent to the cured concrete and on the second portion; and
   curing the second volume of concrete and defining a second cured concrete.

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