QUAD-DECK

Plastbau® Technology

PRODUCT MANUAL

Version 1.10

June 2008

Thank you for considering Quad-Deck for your next project.

This Product Manual includes many construction practices which are accepted standards for form work world-wide, as well as some that are unique to Quad-Deck, or used only in specific regions. While we pride ourselves on having addressed most conditions, means and methods, we realize that situations may arise, which may not be fully described in this manual.

When you encounter such a special condition we invite you to call us with your questions and comments. Our representatives in the field as well as the technical support staff in the head office will assist in providing solutions to any special problems or questions unique to your project. As always, we encourage you to read and understand the entire contents of this manual, even if some sections do not apply to your project.

First and foremost, we strongly recommend that you always consult with the Engineer of Record and Architect of the project, local Building Officials and the chapters of the various codes and standards referenced in this manual.

A thorough understanding of what you are about to build, combined with detailed prior planning will be key to your success. This manual and Quad-Lock Building Systems' commitment to quality and support are designed to help you achieve that goal.

For assistance with this manual or the Quad-Deck product, please contact the Regional Sales Manager serving your area or contact one of our head offices:

NORTH AMERICA/REST OF WORLD:
QUAD-LOCK Building Systems Ltd.
7398 – 132nd Street
Surrey, BC V3W 4M7
Canada
Tel: +1 604.590.3111
Fax: +1 604.590.8412
Toll free: 888.711.5625
Website: www.quadlock.com
Email: technical@quadlock.com

EUROPE:
QUAD-LOCK Building Systems GmbH
Blumenstr. 1
80331 München
Germany
Tel: +49 (0)89 260 3066
Fax: +49 (0)89 360 8471
Toll Free: 0800 7115625
Website: www.quadlock.de
Email: technical@quadlock.de

Quad-Lock Building Systems is constantly reviewing manufacturing and construction methods to ensure a well-engineered, quality product at the lowest installed cost to customers. Quad-Lock Building Systems reserves the right to update this manual as appropriate and asks that you check online for the most recent version or request a printed copy, if needed.

DISCLAIMER

Quad-Lock Building Systems Ltd. believes the information contained herein to be accurate at the time of preparation. The information has been compiled using sources believed to be reliable. Neither Quad-Lock Building Systems Ltd. nor its employees or representatives make any representation or warranty, express or implied, whether arising by statute, operation of law, custom of trade or otherwise, with respect to the accuracy or completeness of information contained in this document or its fitness for any particular purpose, nor do they assume any liability for damages or injury resulting from the application of such information.

Quad-Lock Building Systems Ltd. assumes no responsibility regarding the use of its products or any other third party products referred to in this document. **It is the responsibility of the user to comply with all applicable regulations and building code requirements concerning the use of these products. It is further the responsibility of the user to research and understand safe methods of use and handling of these products.**

Warning about corrosion of metal components.

Quad-Deck metal parts are galvanized to minimize corrosion, however, please be aware that:

- Metal connectors, anchors, fasteners, and other metal components will corrode and lose load carrying capacity, if installed in corrosive environments.
- Many new types of treated wood are highly corrosive to metal components, especially lumber treated with ACQ (alkaline copper quaternary).
- Quad-Lock recommends that metal components should NOT be used in contact with treated lumber in exterior applications or anywhere water is likely to be present (unless you ensure compatibility of your treated lumber with the metal components).
- For exterior applications, the project engineer should specify the type, size and spacing of corrosion resistant bolts, concrete anchors, and other metal fasteners.

PATENTS & TRADEMARKS

Quad-Lock holds patents worldwide for its products.

Quad-Lock®, Quad-Deck® and any other marks, drawings or symbols identifying products and/or services of Quad-Lock Building Systems Ltd. are trademarks of Quad-Lock Building Systems Ltd. All other trademarks are the property of their respective owners.

LIMITED PRODUCT WARRANTY

Quad-Lock Building Systems Ltd. ("Quad-Lock") warrants that its products are free from manufacturing defects affecting the products' intended use as concrete forms ("Defects"). If the customer believes that the products have Defects, the customer will return samples of the defective products to Quad-Lock and upon Quad-Lock being satisfied that the products have defects, Quad-Lock will replace the defective products or refund the purchase price, at Quad-Lock's option. No other warranty is applicable or will be implied. The customer hereby irrevocably waives any and all rights with respect to any implied terms or warranties under the provisions of the Sale of Goods Act or under any law or legislation of similar effect whether now or hereafter in effect. The customer acknowledges and agrees that except as provided herein, there are no conditions, warranties or guarantees whatsoever, express or implied, that the products are of a particular quality or condition, durability, or fit for any particular purpose.

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1 PRODUCT INFORMATION

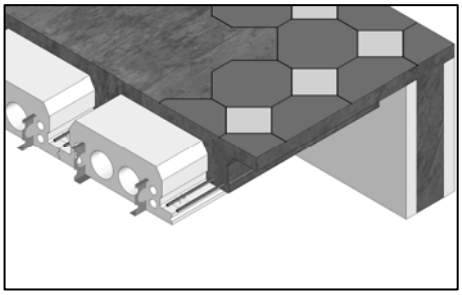
1.1 The Quad-Deck System

Quad-Deck is a light weight, stay-in-place, concrete form designed to create reinforced concrete “T-beam and slab” floors, roofs, tilt-up or pre-cast panels. Invented in Europe in 1978 by Piero Cretti, Quad-Deck was created to reduce weight, reduce shoring requirements and to increase speed and efficiency.

Available throughout Europe, Russia and the Middle East, Quad-Deck has been manufactured in the US since 2001 and in Canada since 2004.

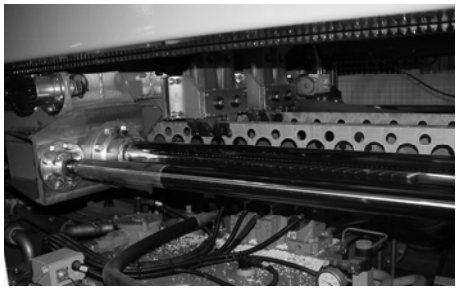
Quad-Deck is made of expanded polystyrene (EPS) insulation, with pre-punched, cold-rolled metal profiles molded in to act as shoring support during the construction phase. When the concrete has reached full strength and the shoring has been removed, the forms stay in place to function as insulation, while the metal profiles can be used to attach ceiling or wall finishes.

A patented manufacturing process is used to create an insulated EPS concrete form of varying thickness, cut to custom length.



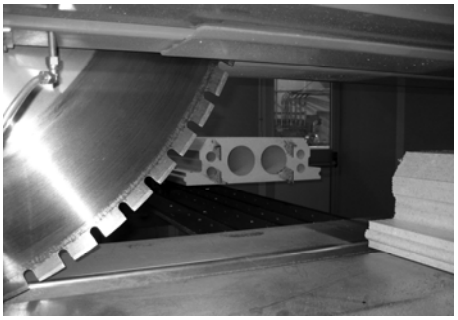
Quad-Deck Cross Section

In this process EPS beads are pre-expanded with steam to about half of their final size and stored in a hopper to stabilize. The pre-punched, galvanized metal is rolled flat in coils of up to a half mile long, weighing around 2000 lbs [909 kg], and stationed on two spools at the back of the production line. Before insertion into the mold cavity, it is roll-formed into the rigid Z-shape and advances in 8' [2.43m] increments, ready to be encapsulated by EPS, while helping transport the previously molded section forward in the machine. The mold then is filled with the pre-expanded EPS and steam is applied to cause the beads to expand again, this time to their full size, fusing them together, around and through the metal profiles, as well as to the previously molded section of the panel, which is acting as the front of the mold. This process is repeated until the desired length is reached and the panel is cut by a large radial diamond saw.



Roll-forming Metal Inserts

1.2 Features and Options

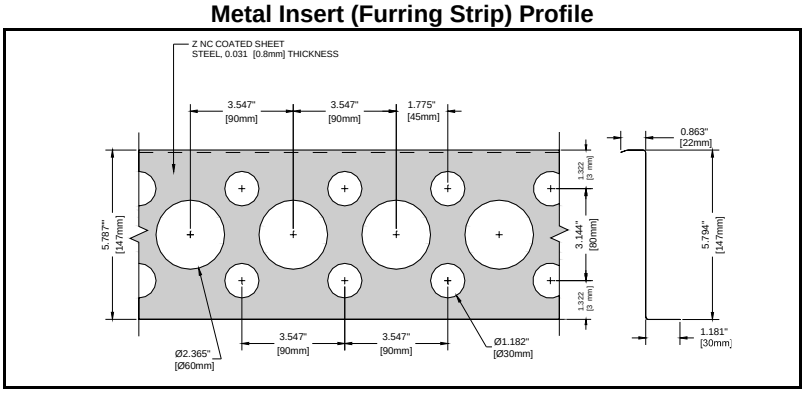


Cutting to Length

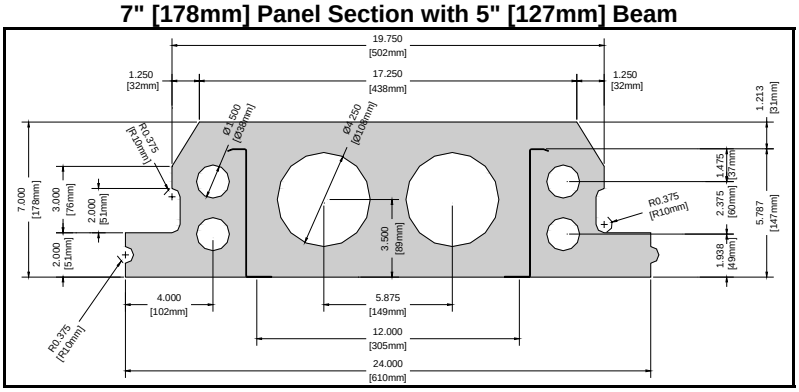
Quad-Deck is available in sizes from 7" [178mm] to 12.5" [318mm] tall and always 24" [610mm] wide overall, weighing less than 2lbs [0.9kg] per square foot. The machine is capable of making panels of any length required. Maximum length is determined by the size of the truck or container, i.e. up to 53' [16m], in which the product is to be shipped.

Each panel has two large round service chases molded in. They are 4.75" [120mm] in diameter and can be used to accommodate larger utilities. The four smaller chases are the result of the proprietary, patented manufacturing process and can be used for small utilities. On both sides of the panel there is a 2" [51mm] thick wing. This forms the base of the concrete beam pocket when placed next to another panel. The only difference in the panels is the physical height of the EPS itself. All service chases, metal studs, and side wing dimensions remain the same from panel height to panel height.

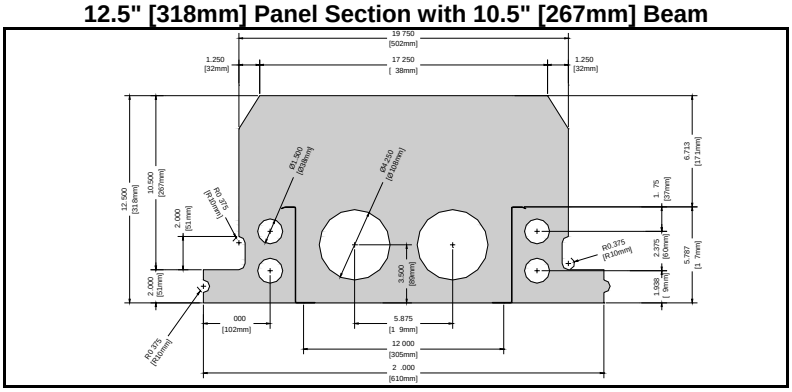
Metal Insert (Furring Strip) Profile



7" [178mm] Panel Section with 5" [127mm] Beam



12.5" [318mm] Panel Section with 10.5" [267mm] Beam

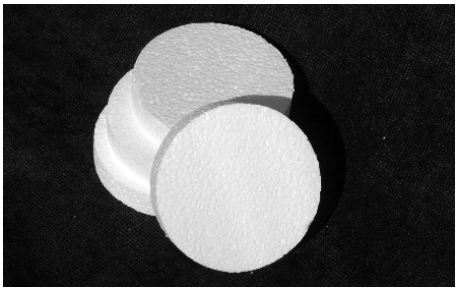


1.3 Technical Data

Estimated Thermal Resistance R-Value					
Panel Thickness	Wing Thickness	Concrete Slab Thickness			
		2" [51mm]	3" [76mm]	4" [102mm]	5" [127mm]
7" [178mm]	2" [51mm]	16 [U=0.35]	16 [U=0.35]	16 [U=0.35]	16 [U=0.35]
8" [203mm]	2" [51mm]	19 [U=0.30]	19 [U=0.30]	19 [U=0.30]	19 [U=0.30]
9" [228mm]	2" [51mm]	22 [U=0.26]	22 [U=0.26]	22 [U=0.26]	22 [U=0.26]
10" [254mm]	2" [51mm]	25 [U=0.23]	25 [U=0.23]	25 [U=0.23]	25 [U=0.23]
11" [279mm]	2" [51mm]	28 [U=0.20]	28 [U=0.20]	28 [U=0.20]	28 [U=0.20]
12" [305mm]	2" [51mm]	31 [U=0.18]	32 [U=0.18]	32 [U=0.18]	32 [U=0.18]
12.5" [317mm]	2" [51mm]	33 [U=0.17]	33 [U=0.17]	33 [U=0.17]	33 [U=0.17]
Estimated Floor Weight in Pounds per Square Foot [2]					
7" [178mm]	2" [51mm]	57 [278.3]	69 [336.9]	81[395.5]	93[454.1]
8" [203mm]	2" [51mm]	59 [288.1]	71[346.7]	83[405.2]	94[458.9]
9" [228mm]	2" [51mm]	61 [297.8]	73[356.4]	85[415.0]	97[473.6]
10" [254mm]	2" [51mm]	63 [307.6]	75[366.2]	87[424.8]	100 [488.2]
11" [279mm]	2" [51mm]	65 [317.4]	78[380.8]	89[434.5]	102[498.0]
12" [305mm]	2" [51mm]	68 [332.0]	80[390.6]	92[449.2]	104[507.8]
12.5" [317mm]	2" [51mm]	69 [336.9]	81[395.5]	93[454.1]	105[512.7]
Estimated Quad-Deck Coverage of Square Feet per 1 Yard of Concrete [m^2/m^3]					
7" [178mm]	2" [51mm]	106 [9.85]	80 [7.43]	64 [5.95]	53 [4.92]
8" [203mm]	2" [51mm]	100 [9.29]	77 [7.15]	62 [5.76]	52 [4.83]
9" [228mm]	2" [51mm]	95 [8.83]	73 [6.78]	60 [5.57]	51 [4.74]
10" [254mm]	2" [51mm]	90 [8.36]	71 [6.60]	58 [5.39]	49 [4.55]
11" [279mm]	2" [51mm]	86 [7.99]	68 [6.32]	56 [5.20]	48 [4.46]
12" [305mm]	2" [51mm]	82 [7.62]	66 [6.13]	55 [5.11]	47 [4.37]
12.5" [317mm]	2" [51mm]	80 [7.43]	64 [5.95]	54 [5.02]	46 [4.27]

1.4 Hole Plugs

Each order comes with the required amount of EPS plugs to cover the large holes on both ends of the panels, to avoid concrete loss and prevent the chases from filling up. They should be stored safely to prevent getting blown away or being lost.



Hole Plugs

1.5 Rebar Chairs

To maintain minimum concrete coverage around the steel bars (usually ¾" [19mm] to 1¼" [32mm]), care must be taken when placing reinforcing bars in Quad-Deck. Reinforcing bar should NEVER be laid directly on the bottom of the T-Beam pockets. The use of pre-molded plastic rebar chairs is strongly recommended. Quad-Deck rebar chairs are a double design which can hold 2 bars in the beam pockets and are placed about every 4' [1.2m]. They can also be split in half for single rebar and to support mats in the slab. Consult site-specific engineering specifications in all cases for minimum concrete coverage. (Also see section 3.17.1 for more details.)

Rebar Chairs

1.6 Production Capacity and Shipping Range

Currently, Quad-Deck is manufactured at two facilities, one in Villa Rica, GA and the other in Vancouver, British Columbia. Each machine can produce about 3200sf [300m^2] during an 8-hour shift, resulting in a combined capacity of approximately 19,000sf [1,800m^2] per day.

Normal production time for most orders is 7 to 10 working days.

Quad-Deck panels are shipped on 53' [16m] enclosed tractor trailers to most locations in North America and by ocean-going containers overseas.

1.7 STC Rating

Quad-Deck has an STC rating from 46 to 53 (ASTM-E90), depending on the thickness of concrete used for the slab and the type and amount of finish material attached. Copies of reports are available on request.

1.8 UL723/ASTM E84 - Surface Burning Characteristics of Building Materials

Quad-Deck meets requirements for “in-situ” flame spread (>25) and smoke development (>450) as per UL723/ASTM E84 and NFPA255. Copies of UL reports are available on request.

1.9 ICC Evaluation Service Reports

The current suppliers of the polystyrene beads used to produce Quad-Deck panels maintain ESR reports # 1798 and # 2195. These reports are available upon request.

1.10 Limited Scope and Application

This manual is written with the assumption that the installer has basic concrete construction knowledge and a good understanding of the requirements for suspended slab form work. This includes a knowledge of carpentry, bracing, shoring, concrete placement and finishing methods. As well, the ability to read and understand plans and build according to construction documents. Accordingly, these procedures should be considered as guidelines only and should be supplemented by consulting with the Engineer of Record (EOR) or Building Official. If help is needed for specific situations or questions in the field, the installer should contact Quad-Lock’s head office.

In all cases, an engineered shoring design should be utilized and shoring should stay in place until the EOR authorizes its removal. In the case of multi-story construction, specifications for re-shoring should be followed exactly.

2 GETTING STARTED

2.1 Preparation and Planning

Advanced planning and preparation are the most important factors for a successful project. Carefully reading and fully understanding the plans is essential. To help avoid stress and costly accidents, properly estimating materials, labor, shoring and bracing, anticipating the challenges and limitations of the building site, clearly understanding the scope and schedule of the project and all other external factors will produce better results.

Up to the day when the shoring has been installed and concrete is being placed on the forms, everything has to have been done correctly. There is simply no room for error, guess-work or shortcuts.

A simple 30' x 30' [9.1m x 9.1m] floor or roof deck can weigh between 62,000 lbs [28,123 kg] and 95,000 lbs [43,090 kg], depending on slab thickness and spans between walls and beams. This weight estimate does not include crews or equipment.

Following the design documents, shoring and bracing plans, codes and safety guidelines is extremely important. The EOR should be consulted anytime there is a question concerning these important issues.

2.2 Design Documents and Engineering

Most jurisdictions require a set of plans stamped by an architect or engineer licensed in the state. This is regardless of the method or materials used for construction, whether for residential projects or for commercial construction.

NOTE: Regardless of the project size, Quad-Lock requires having the structure designed by a structural engineer with experience in concrete design, even if the local building department does not.

Starting with soil conditions, foundations, pilings, grade beams, walls, and finally, Quad-Deck floors and roofs, the concrete structure itself must be designed by the EOR according to national or international standards. There is no structural value to the Quad-Deck panels.

Standards used are:

ACI 318-2005 - Building Code Requirement for Structural Concrete

ACI 216 - Standard Method for Determining Fire resistance for Concrete and Masonry Construction Assemblies

ACI 347 - Guide to Formwork for Concrete

As part of the construction documents, many residential and most commercial projects, require a shoring plan designed by the EOR. Alternatively, a qualified shoring engineer can be contracted with final approval by the EOR. This is especially important for tall or multi-floor structures where re-shoring may be needed. Quad-Lock strongly suggests having a shoring plan designed and inspected by the EOR or a shoring engineer approved by the EOR or the local building department.

Quad-Lock offers several engineering services, such as consulting by phone, e-mail or personal meetings with the project architects and engineers.

Quad-Deck Hip Roofs

NOTE: Quad-Lock does not design or engineer the structure, assume the role of the EOR or stamp plans.

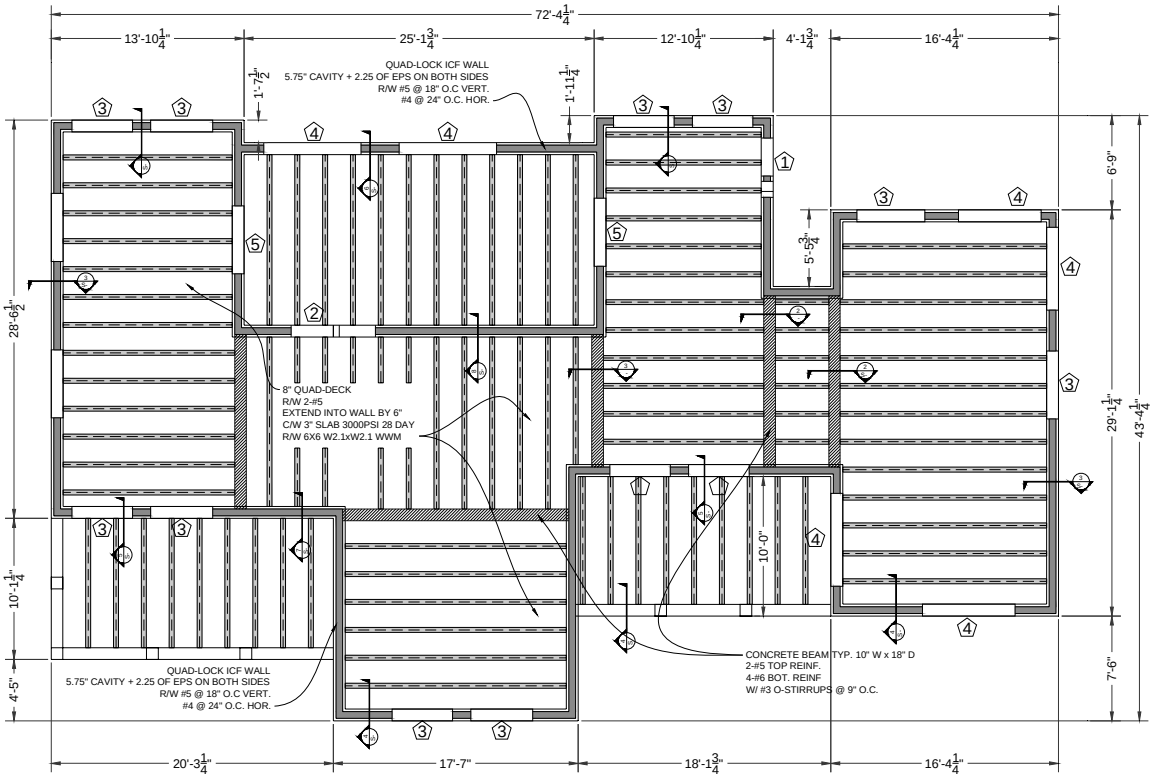
Quad-Lock provides technical support, section and connection CAD details in various formats, estimating guides and span/load tables. Quad-Lock can perform structural calculations for specific panel spans/loads/conditions, to be reviewed and approved by the EOR. A network of independent, licensed professional engineers and architects/designers is available in most states and contact information can be obtained through our head office or a regional sales representative.

If plans are supplied to Quad-Lock in CAD format, with the panel layout/direction and thickness specified, a panel cut-list and estimate can be produced quickly and sent back to the EOR or architect for review and approval.

Once the supporting walls and beams are designed and dimensioned, a cut-list can also be produced by the installer/builder/distributor or by Quad-Lock. Once the cut-list is approved and signed by the customer, panels can be ordered and put into production.

2.3 Panel Layout

A panel layout is a drawing of your project with the panels drawn in. A panel layout shows the panel orientation, lengths and quantities. This will be different for every project. Since the T-beams created by Quad-Deck only bear on 2 sides (just like a wood or steel beam), it is usually best to orient the panels in the shortest span direction. Other factors to be considered when designing the layout are utilities, stairwells, balconies or cantilevers.



If a penetration or utility is passing through, or located close to, one of the Quad-Deck beam pockets, the layout may need to be shifted to the right or left. The shift needs to be enough to clear the 5" [127mm] wide beam pocket base. It is a good idea to have the mechanical/electrical/plumbing trades reviewing the plans prior to ordering panels.

NOTE: It is strongly advised that a "Pre-Construction Meeting" is scheduled, with all trades present, and with full-scale mock-ups of the Quad-Deck product. Trades people are "hands-on" learners and a demonstration will answer most questions in advance. A one-hour meeting will save having to make repeated explanations of what needs to be done. This will also allow each trade to hear the others concerns and see how their own trade may be affected.

DO THIS!!!! It will save you time and money.

Quad-Lock will produce a panel layout which is dependent upon the type of supporting structure, e.g., solid concrete, hollow CMU wall, steel beam, structural steel stud surface or shoring beam. This determines the panel length to be ordered and also affects the shoring design and layout. Any changes from the drawings must be approved by the EOR. It is recommended that Quad-Deck panels are pre-cut at the factory. However, field-cutting of the panels is relatively easy with reciprocating or circular demolition saws of the right size.

Quad-Lock may suggest cutting long panels to maximize truck space. While splicing panels at butt joints has no effect on the structural design, it WILL require additional shoring at the cuts. It may also need additional anchoring of the metal channels into the concrete, and in all cases, should be approved by the EOR.

2.4 Ordering, Freight Quotes and Shipping

Once the signed cut-list and payment information have been received by Quad-Lock, a truck loading map is created. Customers and/or Quad-Lock can then obtain freight quotes and arrange shipping.

2.4.1 Quad-Deck Trailer/Container Load Quantities

	Vessel Type									
	53' [16.1m] Trailer		45' [13.7m] High Cube		40' [12.2m] High Cube		40' [16.1m] Container		20' [6.1m] Container	
Quad-Deck Size	**[sqft]**	**[sqm]**	**[sqft]**	**[sqm]**	**[sqft]**	**[sqm]**	**[sqft]**	**[sqm]**	**[sqft]**	**[sqm]**
Quad-Deck 7" [179mm]	6000	560	4400	410	3900	360	3500	330	1700	160
Quad-Deck 8" [203mm]	5200	480	3800	350	3400	320	3000	280	1500	140
Quad-Deck 9" [229mm]	4400	410	3200	300	2900	270	2500	230	1200	110
Quad-Deck 10" [254mm]	4000	370	2900	270	2600	240	2300	210	1100	100
Quad-Deck 11" [279mm]	3600	330	2700	250	2300	210	2100	200	1000	90
Quad-Deck 12" [305mm]	3200	300	2400	220	2100	200	1800	170	900	80
Quad-Deck 12.5" [318mm]	3200	300	2400	220	2100	200	1800	170	900	80

Notes:

- The quantities above are for estimating purposes only. Actual quantities will vary with actual vessel dimensions and Quad-Deck panel lengths (from cut-list).
- For exact load calculations, please send your finalized cut-list and a 'truck map' or 'container map' can be prepared. To calculate it yourself:
    1. Four stacks of Quad-Deck panels fit next to each other in normal trucks and containers.
    2. Each stack can hold: (inside vessel height – 3" [76mm]) / panel thickness; rounded down.
       For Example:
       53' [16.1m] high cube dry-van: (110" [2794mm] – 3" [76mm]) / 9" [227mm] Quad-Deck = 11 panels per stack
       53' [16.1m] regular dry-van: (106" [2692mm] – 3" [76mm]) / 10" [254mm] Quad-Deck = 10 panels per stack
       40' [12.2m] high cube container: (105" [2667mm] – 3" [76mm]) / 7" [179mm] Quad-Deck = 14 panels per stack
    3. The panels are sorted by length (descending) and put into stacks as calculated above; the four longest stacks are placed at the front of the vessel, stacks are added behind until combined length reaches the vessels inside length.

2.5 Estimating Materials

Based on a set of plans designed by the EOR, panels can be ordered from Quad-Lock, pre-cut or bulk-cut, to be cut to size in the field.

Quad-Lock has estimating programs available to assist in determining materials and products required for your specific plan. These are available on request.

Most of the time, panels are ordered pre-cut, following a cut-list prepared by the builder/installer, distributor or Quad-Lock. Bulk cutting is sometimes chosen to save space in containers for shipments off-shore.

Hole plugs are included in the shipment at the rate of 4 plugs per panel. When panels are cut on the job site, extra plugs may need to be ordered.

Rebar chairs for the beam pockets only, are added to the cut-list produced by Quad-Lock. Additional chairs for the slab steel or mats must be ordered in advance, as needed, to be included in the shipment.

Concrete amounts needed can be calculated by using the yield tables provided, as can shoring needs based on weight per sf [m^2] and the shoring plan from the EOR.

2.6 Tools and Supplies

In addition to the common tools used in formwork carpentry, a few special tools are recommended:

- rebar bender and cutter
- chop saw or circular saw with metal cutting blades
- bolt cutters
- tin snips
- hammer drill and concrete drill bits
- cordless drill and bits
- self-tapping, fine thread screws to attach formwork
- hand pruning or drywall saw and/or hot knife to cut foam
- tie wire and/or rebar ties
- wire tie tools (pig tails) and pliers
- small and large cable ties
- metal strapping
- duplex nails, short and long fine thread wood or drywall screws
- concrete screws (tap-cons)
- chalk and string lines
- foam gun, foam adhesive and gun cleaner
- crow bar, demolition bar
- permanent markers
- duct tape
- sun glasses and sun screen
- tarps and wide straps to secure panels

For cutting panels:

- reciprocating saw with long, fine tooth metal blades, or
- demolition saw or beam saw with large 14" [35cm] minimum sized blade

2.7 Receiving, Unloading and Storing Product

Prior planning to receive the shipment and proper handling of the panels is important to prevent damage to materials, accidents and personal injury.

When a truck with a 30' [9.1m] sleeper tractor, pulling a 53' [16m] trailer arrives on the jobsite or at the warehouse, room is needed to park, unload and turn

around or back up an 80' [24.5m] long vehicle. Watch for power lines, trees, signs, fences, mail boxes, parked vehicles, soft spots, mud, etc. If the jobsite is in the mountains or back-country, accessible only by smaller trucks, a staging/re-loading area must be available. Trucks held up for long unloading periods may charge for the extra time while sitting idle.

Panels can typically be unloaded by hand with a crew of 4-5 people. 2 people per panel are needed to carry longer/thicker panels or on windy days. The truck driver does not assist. Wear gloves and glasses to protect against cuts and metal shavings.

NOTE: Do not step onto panel wings in the truck or on the ground, they are fragile and may break off. Do not lift or carry panels by the wings, carry them by the large holes, or the bottom edge.

Handling Quad-Deck Panels

Extra attention during placement and concrete pouring may be required if the panels are damaged. Panels should be set aside for later repair ensuring that the damaged area is clearly marked.

To better fill the truck, panels may be mixed between multiple floors, areas or buildings. It is best to separate them on the ground before storing. Multiple handling may damage the panels. The less often they are moved or handled, the better.

Make a final count to confirm the invoice/bill of lading amount and report any discrepancies to Quad-Lock immediately. If major damage has happened in-transit, take pictures and have the driver sign a damage report before contacting Quad-Lock.

Panels should be stored on flat ground, on wooden timbers, and strapped or covered by tarps if not used within a short time. EPS will develop a yellow, powdery film if left exposed to UV rays for long periods. This has no effect on the strength of the panels or the concrete pour, but may have to be cleaned before stucco-type finishes are applied.

3 INSTALLATION PROCEDURES

Edge Form for Flat Roof with 1½" Overhang

Off-Set Roofs

Floor Step-Down

3.1 Wall/Beam Preparation

To install a Quad-Deck floor or roof, some preparation is needed before pouring the supporting walls, tie beams and columns. In most cases the design will call for wall to floor/roof connecting rebar, as well as rebar splices/dowels for the walls above on multi-story buildings. All rebar must be clean and free from mud, oil or other waste.

Negative moment bars (90 degree angle/corner bars), which should line up with the top of the panel's beam pockets, need to be in place before the wall below is poured, or poured all the way to the top. Most of the time however, they cannot be inserted or bent down until the floor panels have been installed. In some situations the walls can be poured 12" [305mm] to 18" [457mm] short of the top to allow pre-bent angle/corner bar installation and finishing the wall pour when the floors/roofs are cast.

When pouring a tie beam on top of masonry wall, or an independent beam on top of columns, or over a frangible wall (break-away design for flood surge condition), it may be easiest to insert all floor connection rebar and other rebar and to pour the floor/roof and beams below together (refer to Section 3.17.2).

When using the wall above as an up-turned beam the transfer angle bars can be turned up into the upper wall, subject to the EOR's design and/or approval. In this condition, they can simply be tied to the splice bars for the upper wall (the up-turned beam), provided they line up with the beam pockets.

3.2 Determining Shoring Height and Floor/Roof Elevation

With a builder's or laser level, mark a control line around the structure to be decked. Then measure up to the correct elevation for the top of the shoring (this usually equals finished floor height minus slab thickness and panel thickness, or bottom of Quad-Deck) and snap a chalk line. For roofs use the corners of the rooms to measure up, drawing a roof slope diagram at the control line on the wall and transferring it up, if needed.

3.3 Setting up the Shoring System

When decking smaller structures with shorter spans, such as safe-rooms, hallways or basements, the panels are sometimes placed before the shoring is built. In this case, they need to be ordered long enough to temporarily rest on the walls. If they are ordered or cut to fit inside the walls, or if the walls are not level at the top, a temporary metal angle or 2X lumber should be attached to the top of the wall to level and secure the panels before the shoring is finished.

NOTE: Do not allow people or place heavy loads on top of panels until the shoring below is completely installed.

Scaffold Shoring in Place

Wood Shoring and Beam Bottoms

With most large projects, and with longer spans, the shoring system is usually built or erected complete to the final bearing height before the panels are placed on top.

3.4 Shoring Systems

There are many shoring systems on the market, from simple hand-built double 2X and 4X lumber shores, to wooden scissor jacks, wooden and metal post shores and many types of stackable metal frames or towers, connected by X-braces. Unless a particular system, method or brand has been specified on the shoring plan the EOR should be consulted as to the choice of the system.

Listed below are a few web sites for some of the most popular and readily available systems.

www.canadascaffold.com
www.easternscaffolding.com
www.ellisok.com
www.formwork-exchange.com
www.safway.com
www.scaffoldingandshoring.com
www.sciglobal.com
www.ssfi.org
www.universalscaffold.com
www.wacoscaf.com

3.4.1 Shoring Beams

Unless otherwise specified, straight, undamaged double or triple 2X6 [51mm x 152mm] lumber, 4X6 [102mm x 152mm] timbers, aluminum or steel beams should be used for horizontal support on top of the vertical shores and must be placed PERPENDICULAR to the Quad-Deck panels.

If shorter shoring distances are specified, smaller dimension beams may be used. Always check with the EOR before making changes in shoring spacing and support dimensions. (See Section 3.4.2)

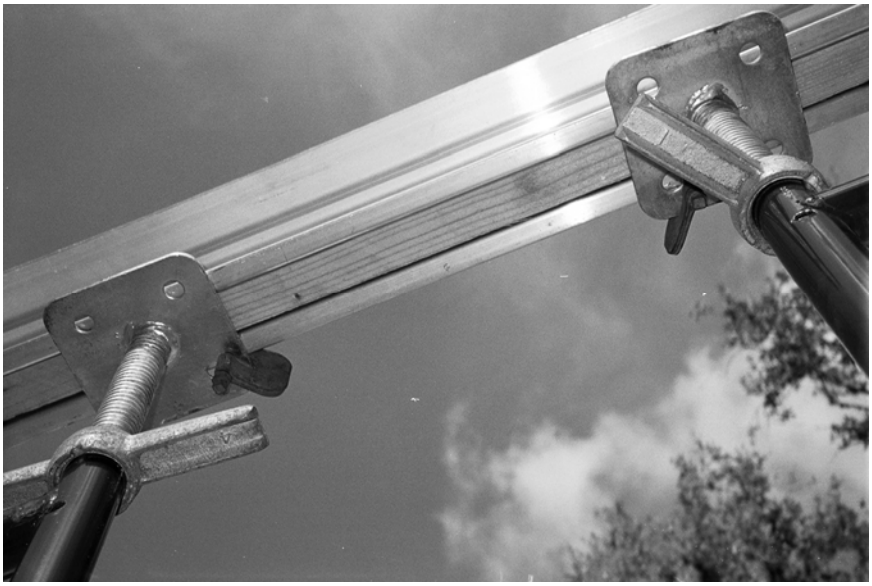
Metal Post Shores

Aluminum Beam & Metal Angle

NOTE: Do not use single 2X [102mm X] lumber or other tall, narrow profiles, as they are highly unstable.

Do not use lumber laying flat. Check with the EOR for the correct orientation of the shoring beams.

To securely carry the shoring beams and keep them from moving or tipping, screw jacks with U-shaped or J-shaped top plates are recommended for the tops of shoring frames, post shores or jacks. If only flat top plates are available, clamps, bolts, screws or welds may need to be used to secure the beams to the shores.

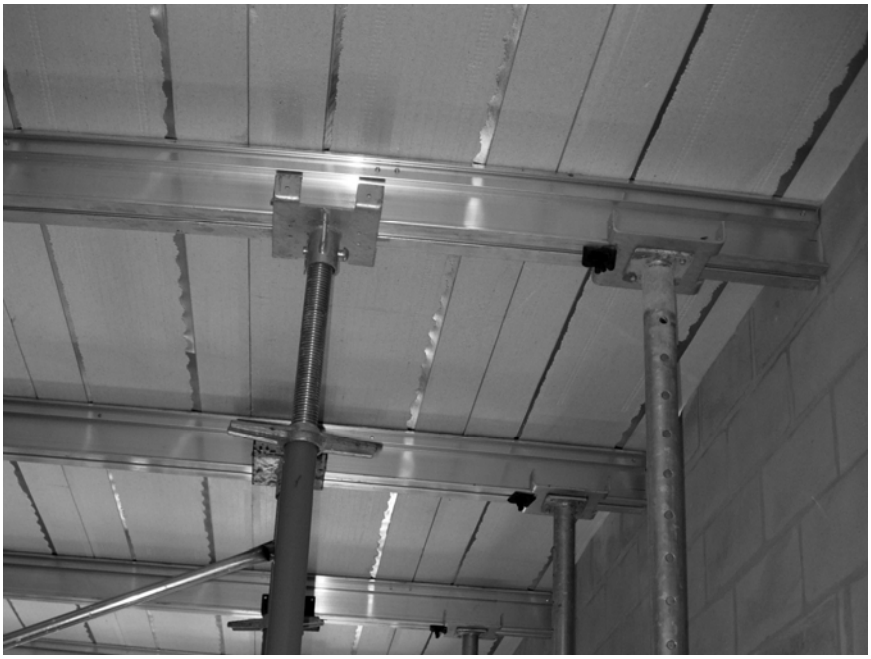


C-Clamps Securing Beam

3.4.2 Shoring Supports

On the bottom, screw jacks with 4X4 [102mm x 102mm] or 6X6 [152mm x 152mm] base plates are most convenient, especially when shoring on soft ground. Wooden mud sills or full length planks must be used for soft soils. Consult with the EOR when shoring on frozen ground, as the concrete weight may thaw the ground and allow the shoring to sink. Do not use CMU block or brick to raise shoring, unless sandwiched securely between mud sills or planks and approved by the EOR.

Use only approved methods of raising shoring off the ground.



Shoring Beams Supported within 6" from Wall

Panels Bearing on CMU Wall

Follow the shoring manufacturer's guideline for tall, multiple tower shoring, cross bracing and anchoring to adjacent structures.

Unless otherwise specified by the EOR, Quad-Lock recommends a shoring grid of no more than 6' [1.8m] apart, starting at no more than 6" [152mm] from a wall or beam.

Example: concrete weight on shoring supports

4'X4' [1.2m x 1.2m] grid, 5" [127mm] slab
on 12.5" [318mm] panel (105 lbs/sf [487 kg/m^2])
weight = 1680 lbs [762 kg] per post shore/shoring frame leg

6'X6' [1.8m x 1.8m] grid, 5" [127mm] slab
on 12.5" [318mm] panel (105 lbs/sf) [487 kg/m^2])
weight = 3780 lbs [1714 kg] per post shore/shoring frame leg

3.5 Multi-Floor Shoring

When building a multi-story building, shoring or re-shoring of lower floors may be required as the upper floors are constructed. This must be specified on the shoring plan and approved/inspected by the EOR or shoring engineer.

Shoring may be removed in as little as a few days or weeks, but only with approval of the shoring engineer. Consult with the Ready-Mix concrete supplier for a mix design with accelerated strength specifications, as well as the specified lbs/psi (Mpa) design strength. Usually, shoring can be removed when concrete has achieved 75% of its specified strength. Tests of concrete compressive strength may be required before shoring is reduced or removed.

Multi-Floor Shoring

3.6 Placing Panels

Placing Panels

National and local safety guidelines calling for rebar caps, perimeter or stairwell railings and/or fall protection must be strictly observed, especially on taller or multi-story buildings.

Starting at one end of the building and working across, the panels can be laid down when the bearing walls, beams and shoring system are in place. Shorter/thinner panels can be installed by one person. For longer panels, or on windy days, 2 people per panel is recommended.

Align the Quad-Deck panels so that the tongues line up with the grooves of the next panel. The panels do not need to be glued together, although some installers choose to do so to limit movement and to reduce rain water flow for the floor below. As soon as the panel is joined to the previous one and rests safely on the shoring, it can be walked on to install the next one.

Panels placed on a slope should be secured to shoring beams and/or walls with suitable screws and large washers. Shoring beams may need to be ripped on an angle to allow for full contact with the panel and metal channels and should be toe-screwed to the channels. When using metal beams, a ripped, full-length wooden wedge may need to be inserted and secured between the beam and the panels.

NOTE: Do not step in the beam pockets. They are designed to support the rebar and concrete but not the weight of a person. Repair damaged panel wings using glue and plywood screwed to the surrounding furring strips. If a large section needs to be repaired, additional shoring below the damaged section may be required.

Never place a membrane over the Quad-Deck panels to water-proof the roof. This will incorrectly shape the concrete and compromise the strength of the floor.

3.7 Slab Edge-Forms

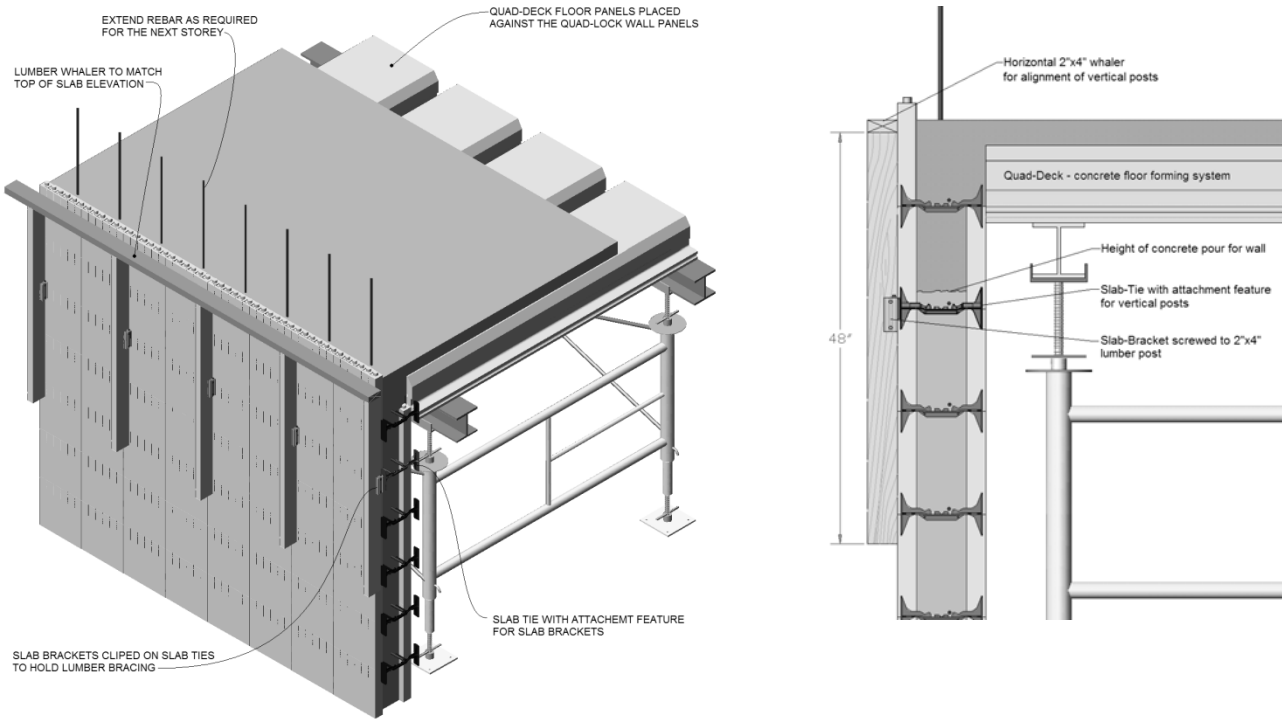
Quad-Lock Panels may be used as the "edge-form" around the perimeter of the slab area where it intersects the exterior walls. This can occur at a flat-roof to wall connection, a parapet wall to roof connection, or an intermediate floor to wall connection. (See figure right)

Quad-Lock's Slab Tie & Bracket Edge-Form Solution

The best means of stabilizing the Quad-Lock edge-form panels is to install Quad-Lock Slab Ties (at 24" [610mm] horizontal intervals) two courses down from the top-of-slab elevation, and brace with 2x4s [610mm x 1219mm] attached to the Slab Ties with Quad-Lock Slab Brackets (see figure on the following page). As concrete is poured into the wall and encases the Slab Ties, they form a solid attachment point for the vertical 2x4 braces, which extend 2 to 3' [610-914mm] down, and to the top of the edge-form panels above (about 2' [610mm]). The Slab Tie acts as a fulcrum as concrete pressure is exerted against the edge-form panels, and the 2x4 [610mm x 1219mm] brace is prevented from rotating around that attachment by the solid concrete wall below. A horizontal whaler is attached at the tops of the 2x4 [610mm x 1219mm] vertical braces, and Metal Track is temporarily placed over the top panel edge to make the edge more rigid.

If the above method is used, the entire structure can be assembled from platforms on succeeding floors, without having to work on the outside of the building. This is a major advantage on multi-story construction.

NOTE: Vertical 2x4 [610mm x 1219mm] braces used in conjunction with Quad-Lock Slab Ties and Slab Tie Brackets have NOT been certified to be in compliance with OSHA or other safety requirements to be used as guardrails or other fall protection. Guardrails generally must be a minimum height of 39" [991mm] and be able to withstand 200lbs [91kg] of lateral force. Consult your regional government safety official for current requirements on scaffolding, guardrails, and fall protection.

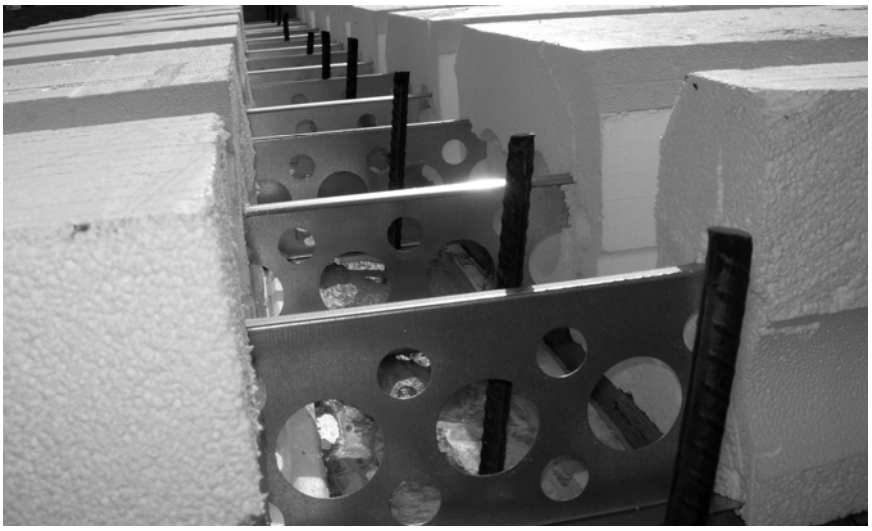


Concrete Floor Construction Details

3.8 Crossing Over Bearing Walls or Beams

When panels are ordered long enough to cross over multiple bearing points, the foam may need to be removed entirely across the whole panel, or in small sections at the wings (the width of the beam pocket) to let the concrete cast onto the support below for bearing contact. In this case the bearing support can be used as shoring, since the metal profiles will remain continuous.

NOTE: Never cross a bearing wall without removing the foam at the floor-to-wall connection point. The foam will compress under the weight of the concrete structure and the structure will be unusable.



Foam Removed Over Beam

When steel beams are used, many times “Nelson Studs” may be welded to the top of the beam to anchor into the concrete; panels may need to be shifted to line up with these studs and provide concrete clearance. If the steel beam is designed as a composite beam (steel beam under tension - concrete above in compression), all foam and/or metal may have to be cut out to the width specified by the EOR to achieve composite action.

If a CMU wall calls for a tie beam, or if a free-spanning bearing concrete beam is to be formed in the floor, the metal profiles may need to be trimmed back to accommodate the beam rebar. In this case, it is easier and may be required by the EOR, to cut the panel completely (or order them pre-cut) and shore the ends independently or have them supported by resting on the edge of the beam form.

For flush concrete beams, sheets of plywood can be placed on top of the shoring and screwed to the Quad-Deck panels. A layer of foam may be required to be placed on the plywood to insulate the bottom of the beam and keep drywall away from the concrete later on. In this case, the foam may need to have inserts sticking out to be embedded into the concrete. Depending on the width and depth, the beam may need to be shored independently.

To form dropped beams, plywood and/or 2X [102mm X] lumber and additional/separate shoring are needed that lower the bottom of the beam below the base of the Quad-Deck. This allows any poured in place beams to be cast monolithically with the Quad-Deck floor/roof.

3.9 Openings, Cantilevers, Balconies

Forming large openings in the floor, such as a stairwell, elevator shaft or a skylight in a roof, is just like forming a supporting beam. Most likely there will be additional/separate concrete beams/headers or widened beam pockets designed to surround the opening.

Stairwell with Header Beams

Balcony Formed Conventionally

Cantilevered Roofs

Cantilevers or balconies can be formed using Quad-Deck panels, or may be specified to be conventional formwork. In most cases these are formed, shored and poured together with the rest of the floor.

Quad-Deck Balcony

3.10 Complex Floors and Roofs

Complex floors/roofs may use multiple panel thicknesses and/or different panel orientation. For this condition, it is very important to pay attention when installing the shoring system. Changes in elevation and direction need to be considered before the panels are placed. Accommodating a change in panel thickness can usually be handled by the shoring system. When changing floor elevation, watch out for any areas of neighboring panels which may be open to below and would allow concrete to pour out.

3.11 Edge and Roof Overhang Forming

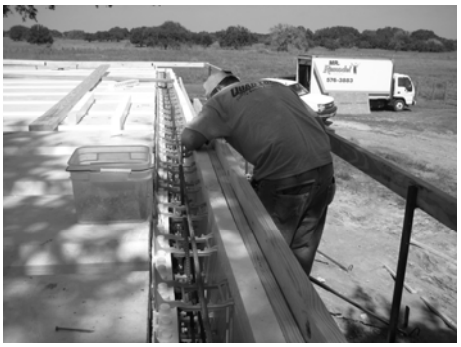
For edge-forming the most common method is to use lumber, ICF panel halves, or EPS sheet insulation.

The outer portion of an ICF wall will make for a great edge-form. (See Section 3.7 for more details.) However, the wall form needs to be supported, braced or tied to prevent bulging when the concrete slab is poured and finished. ICFs other than Quad-Lock ICF can be tied back to the wall splice rebar, angle bars or top reinforcement using tie wire or large plastic zip ties, provided there will be no movement when the concrete is placed. On masonry walls, plywood is fastened to the wall, supported by strong-backs or braced from the ground, or tied to the rebar the same as an ICF outer panel section.

VBuck offers a single and double “Yoke and Tie Whaler” system specifically designed for edge-forming with ICF wall systems other than Quad-Lock ICFs or sheet foam. This is a quick and secure method on multi-story buildings where working outside the wall is difficult. Check for details on www.vbuck.com or with your VBuck distributor.

Some other ICF wall systems use similar methods like cut-in-half forms or panel halves and modified inserts.

Shed Roof Edge-Form



Edge-Form for a Flat Roof with 1.5" Overhang

Balcony-Edge Form

Roof overhangs can be accomplished by extending Quad-Deck beyond the walls and using a narrow poured edge or soffit beam, or casting in place an anchored 2X [102mm X] PT lumber soffit or drip edge. The design may call for a conventionally formed slab overhang (like a balcony slab), which needs to be shored to the ground or to the wall below, according to the shoring plan.

Perimeter Edge-Beam

3.12 Pier and Piling Systems

In coastal areas, elevated slabs resting on piers, driven wood or pre-cast concrete piles as well as auger-cast systems (usually connected by grade beams at ground level, with poured columns extending upward) are very popular. Recent hurricanes have proven these types of designs to be highly resistant to wind and storm surge conditions. The structure above is protected against uplift forces, while providing excellent insulation properties.

Elevated Floor Deck

To achieve a structure that will be stronger than other known construction methods, the beams connecting the vertical pilings or columns should be formed and poured monolithically with a Quad-Deck floor, connected upwards by a poured concrete wall and a Quad-Deck roof.

3.13 Penetrations, Blockouts, Sleeves, Inserts

Utilities and items that need to pass through the floor from one level to the next must be placed in the slab portion of the Quad-Deck panel. It is usually better to install these penetrations prior to placing the rebar, as they may need to be surrounded by extra rebar to help control cracking of the concrete in that area.

NOTE: Penetrations should never be located in the concrete beam pocket (wings).They should be located in the thick section of the panel.

A penetration that is located in the beam pocket needs to be removed and relocated into the thick portion of the formwork. If not, the area has to be treated like a large opening surrounded by a frame of concrete beams. Consult with the EOR for such field conditions.

To avoid the risk of cutting through the beam pocket and compromising the strength of the structure, utilities which are not blocked, sleeved or installed prior to the concrete pour may require core drilling/chipping from the bottom.

If there is a requirement for heavy objects to be hung from the ceiling, inserts, threaded rods, anchor bolts etc., should be installed now, prior to the concrete pour.

Plumbing Vent Stack

Electrical Conduit Stubs

3.14 Repairing Panels, Piecing, Splicing

Damaged panels (usually broken wings) need to be glued together and supported by plywood, extra shoring, etc.

Shorter sections of the same thickness can be butt-joined and glued together to form a longer panel. However, these sections may need to be supported in their entirety by plywood and extra shoring.

Damaged Section

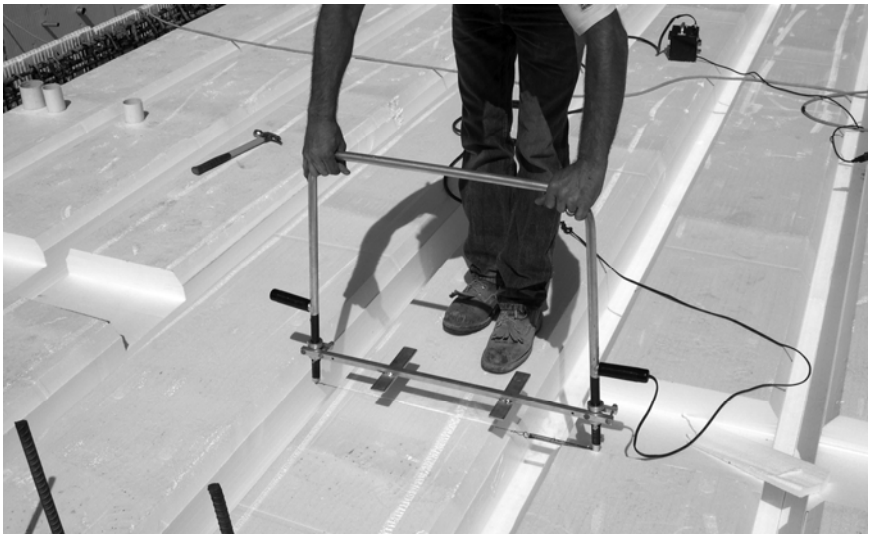
Repaired Section

3.15 Cross-Ribs, Thickened Sections

Cross-ribs are integral transverse beams, perpendicular to the direction of the panels, which may be designed or specified for special areas such as flood, hurricane, tornado or earthquake regions. They may be specified on longer spans and may be multiple designs per span.

A cross-rib is similar to cross-bracing or x-bracing used on framed floors, which braces the floor against lateral loads.

The EPS foam may have to be removed from the top of the panel to a certain width and depth with a hot-wire bow cutter (shown below), to form a lateral beam in the floor, and may be reinforced with additional rebar. Self tapping screws/bolts may be specified to be screwed into the top of the metal furring strips, with the heads sticking out that will cast into the concrete. In the event of fire, this will provide a positive connection between the metal strips (which may support drywall underneath) and the concrete structure.



Hot-Wire Cutting Cross-Rib

To counter balance the weight of a cantilever or balcony and to accommodate additional or z-shaped cantilever rebar for stepped down conditions (water stops), a thickened section may be specified. To thicken the slab, a section of the EPS can be removed from the top of the panel to a certain depth. This may require additional shoring of the panels in this area to carry the extra weight.

Thickened sections in the slab may also be required to accommodate fire stop methods/collars, etc., between floors.

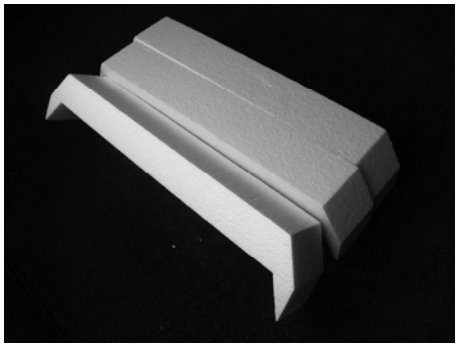
Thickened Beam Section

3.16 Building Thicker Panels

In order to create shallower or taller T-beams, Quad-Deck is manufactured in thicknesses ranging from 7" [178mm] to 12.5" [318mm]. The design of a project may require the thickness to be larger than that of a 12.5" [318mm] panel. For higher loads and longer spans the cross section depth of the T-beam may need to be increased. Specifically, the height of the T-beam from the top of the slab to the bottom of the beam pocket can be thickened by adding top caps of EPS. A local EPS supplier can hot-wire shape cut the top caps. The EPS used must meet ANSI/UL 723 or ASTM E84 requirements for flame spread and smoke development. CAD details of the profile needed are available from Quad-Lock.

Another accepted method is to add a 17.25" [438mm] wide sheet of EPS material, in the thickness needed, to the top of the panels.

Top caps, as well as sheet material, must be glued down to avoid floating during the concrete pour.



Top Caps

3.17 Reinforcing Types and Methods

By far the most common method for reinforcing is varying grades and thicknesses of conventional rebar (also called mild steel).

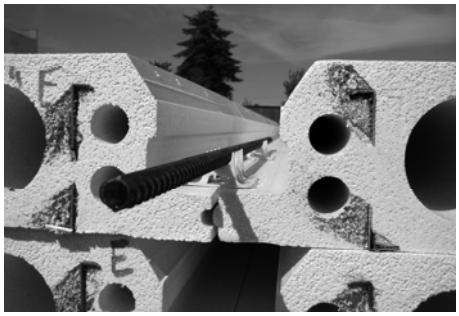
Another method is post-tensioning. It utilizes cable strands installed before the pour and post-tensioned by a specialist with hydraulic rams, once the concrete has reached certain strength. Post-tensioning reduces or eliminates conventional rebar.

Pre-stressing is the third method. This is usually performed under plant-controlled conditions and is very similar to post-tensioning. Pre-stressing is used for pre-cast panels, beams, pilings etc. (see Section 1.5 for additional information).

3.17.1 Rebar Chairs

Molded plastic saddles hold the rebar up off of the formwork. In order for the structure to perform at full strength, the concrete must surround and encapsulate the rebar that is placed. For protected concrete (such as Quad-Deck provides) the rebar chairs must be at least ¾" [19mm], or as the engineer has specified, and be placed in such a manner that they support the rebar. Rebar chairs maintain the minimum spacing off the formwork during and after the pour.

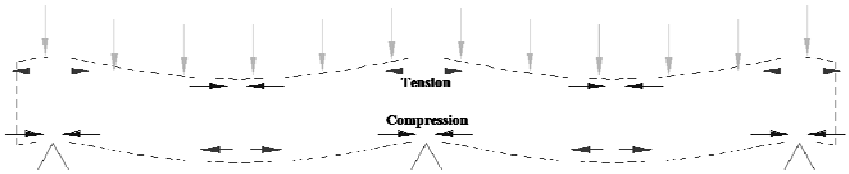
On the Quad-Deck cut-list a column calculates the rebar chairs needed for the beam pockets (10% is added to the total calculation). This quantity assumes one double rebar chair as one unit. The cut-list only counts the rebar chairs in the beam pockets. The chairs used in the slab on top of the panel will be controlled by the slab reinforcing to be used and may be taller. The details for the rebar chairs to be located on top of the panel should be called out on the plans.



Plastic Rebar Chairs

3.17.2 Rebar Installation

Engineering practice calls for reinforcing steel to be placed into the tension areas of concrete to compensate for concrete's low tensile strength. Quad-Deck produces reinforced concrete T-beams. Quad-Deck shapes the concrete (the "compressive" element). Together, the compressive and tensile elements create the strength.



Rebar works by developing friction in the concrete, using its cold deformed, ribbed profile. The length of a piece of rebar is dictated by the length of the tension zone requiring the rebar that will create enough friction to do its job. The extra length on each side of the tension zone is called the development length. Its sole purpose is to make sure the rebar in the tensile area is at full strength and won't slip due to lack of friction.

Negative Moment Bars

Rebar at the bottom of the beam pocket is called bottom reinforcing. This is the rebar which is resisting the tension loads of the beam. It must extend into the bearing walls or beams as specified on the plans.

Rebar at the top of the beam pocket is called negative moment reinforcing. This is required for areas of the floor/roof where the tension loads are reversed (wall to floor connections or multiple span conditions). This rebar will likely be located at or near the center of the slab portion of the concrete. It will line up with the beam pockets on two sides of the slab and over multiple spans. Due to higher loads generated in this area, it is not uncommon for this rebar to be shorter, but thicker, than the bottom steel.

Connection rebar is used to tie the concrete floor to its supporting walls or beams. This rebar will generally extend into the slab portion of the floor and then into the center of the wall or beam with a 90-degree bend. For sloped roofs, the angle of wall-to-roof will be followed.

Tied #3 Rebar Mat

Slab reinforcement can be welded wire fabric of various size, or smaller diameter rebar, tied in a grid at 90-degree angle.

Shear reinforcing are vertical bars placed into the T-beam, usually in the end zone. This can be designed as S- or C-shaped hooks, conventional hoops turned sideways or continuous zigzag shaped galloping stirrups. In essence, wherever the concrete will be put into tension and may crack, is where the reinforcing steel is placed.

Rebar splices are needed when reinforcement is not long enough to cover the length required. In this case, splices are used to turn multiple pieces of rebar into one single piece.

To make rebar longer, weld the rebar together ensuring that you follow the EOR's specifications for splicing the rebar. This may involve setting up a welding area away from the panels or protecting Quad-Deck against molten metal and sparks. Please note that freshly welded steel will be extremely hot and should not be touched until cooled.

Another accepted method is to use a mechanical splice. This may be a clamp or device that physically connects the two pieces of rebar together making them one.

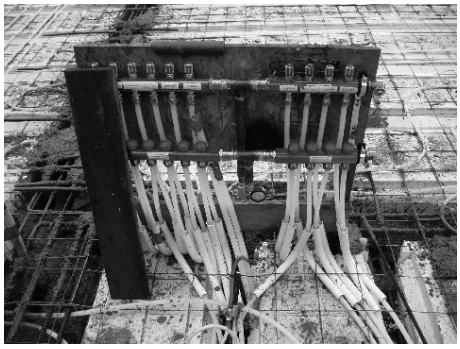
The most widely used method is to lap the bars. This means the development length (overlap) of the rebar must be specified by the EOR or by code.

Lapped Rebar Splices

3.18 Installing Utilities, Floor Heating Systems

Radiant floor heating systems are very popular and highly effective in conjunction with Quad-Deck floors, the panels provide insulation. They are typically installed before the concrete is poured, before or after the rebar is placed. When using these systems, the manufacturer's warranty information and installation procedures must be followed. There are placement requirements that must be met to keep the warranty valid, such as placing the radiant tubes in the center of the slab. Some suppliers will allow radiant tube placement directly onto the formwork. Check the installation instructions from your preferred brand of floor heating systems.

Plumbing and HVAC pipes as well as electrical conduits can easily be placed under or above the slab reinforcement, in compliance with local codes. Penetrations or sleeves to the area below should be installed at this time, even if the utilities are later run in the panel foam.

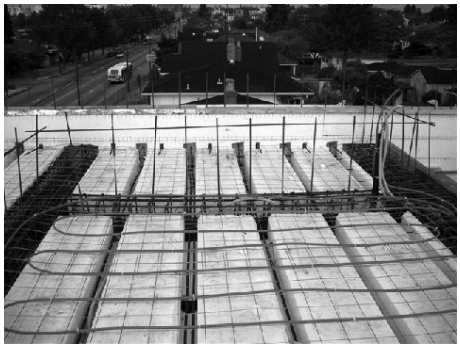


Radiant Heating

3.19 Clean-Up and Final Inspection

Forms must be free of debris, ice, tools or other obstructions which could affect concrete placement, flow, consolidation or finishing. Check for proper rebar clearance, string-line and check all perimeter forms. Hole-plugs should be installed. Be aware that if rain water has been present for a longer period or temperatures drop to freezing levels, water in the panel chases should be drained or blown out before hole-plug installation.

NOTE: Inspect the shoring one last time and adjust if needed before calling for inspection by the EOR and/or building department.



Radiant Heating

3.20 Concrete Specifications and Placing Methods

Quad-Deck requires far less shoring than conventional systems. Local placement and finishing crews who have never worked with Quad-Deck should be thoroughly briefed prior to working on the deck (see Section 2.3 for more information). Placement techniques such as filling and vibrating the T-beams should be reviewed and a pour plan formulated. A sample of Quad-Deck can be

2" [51mm] Trailer Line Pump

set up to span across two supporting blocks up to 6' [1.8m] apart, so the crew can stand on it and appreciate its strength.

The EOR should have, or will have, specified the design mix and slump. Cylinders may be required to be filled for later testing. Aggregate size should be no larger than ½" [13mm] to ensure sufficient cover around the bottom reinforcement. On larger or commercial projects, slump tests and cylinder testing is usually standard procedure and protects the installer, contractor and engineer for liability related to improper concrete mix.

Concrete is typically placed by using a trailer or boom pump. These offer the best speed, control and consistency of delivery. When using a boom pump, concrete should be pumped onto the thick section of the panels and allowed to flow down into the beam pockets. Pumping directly into the pocket may damage the wings. Use elbows or a reducer hose to slow the delivery speed and keep the hose-end close to the panels.

NOTE: Placement/finishing crews may not be familiar with the unique T-beam design of a Quad-Deck structure. The thinner slab section of the structure may seem inadequate and they may arbitrarily pour a thicker slab section. This practice will add considerable weight to the slab element and violate the engineered-design of the original structure. Field modifications of this kind should never be made.

5" [127mm] Boom Pump

NOTE: Do not place large amounts of concrete in one spot. Move the hose or shut the pump down if any delays occur in spreading or screeding. When using a bucket or conveyor belt never accumulate mounds of concrete in one area.

It is **very** important to instruct the finishers **not** to step into the beam pockets. Remember, these are no longer visible, once covered with concrete.

Pouring ICF Wall from Roof

Screeding Floor

Screeding Roof

From a safe place, i.e. never directly beneath the floor/roof being poured, a spotter should be watching the pour and shoring below. During the pour, if a repair or adjustment needs to be made on the formwork, stop the pour. Verify the safety of the shoring below and make the repair safely and quickly. As soon as possible, get the crew out from underneath the pour area before resuming pumping.

To ensure good flow and coverage of the reinforcing steel, concrete should be vibrated, but not over-vibrated. For good consolidation, where multiple or thick bars are used, it is of even greater importance to **not** over-vibrate .

NOTE: Use of plasticizing agents in the concrete mix is recommended. Use of additional water to increase slump is discouraged – it will negatively affect the water/cement ratio and the ultimate strength of the concrete. If concrete slump becomes too low, re-dose the mix in the truck with additional plasticizer until the desired slump is reached. Be sure that the Ready-Mixed supplier understands your slump requirements.

Using conventional methods, concrete can be finished smooth, textured or stamped. On sloped roofs, if stamping or texturing are impractical during the initial pour, a secondary over-pour may be required to achieve the desired finish. In this case, a rough surface finish may be advantageous to ensure adhesion of the over-pour.

Self Consolidating Concrete (SCC) has been used very successfully to pour Quad-Deck. Consult with your Ready-Mixed Concrete supplier regarding these special mix designs.

Hand-finishing Pitch Roof

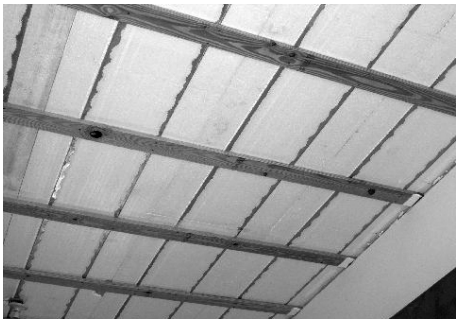
3.21 Shoring Removal, Re-Shoring

When the concrete has reached the desired strength (typically 75% of the strength specified by the EOR), shoring may be removed. To support multiple floors, shoring may need to remain longer. Consult with the EOR and the local Ready-Mix Concrete supplier for a mix design that will achieve a sufficient, accelerated strength in the time span desired. Depending on the scope of the project, re-shoring of lower floors may be required and will need to be in place before the regular shoring is removed. The procedure and amount needed for re-

shoring should be described in the shoring plan and inspected by the EOR before upper floors are poured.

When removing shoring, follow the shoring manufacture's guidelines for disassembly. Concrete floors will deflect when shoring is removed. Deflection will be deepest in the center and less at the side of the span. Shoring in the center may be harder to remove when the side rows are removed first, therefore, it is recommended to start with the center rows and work towards the walls/beams.

3.22 Utilities and Finishes Installation

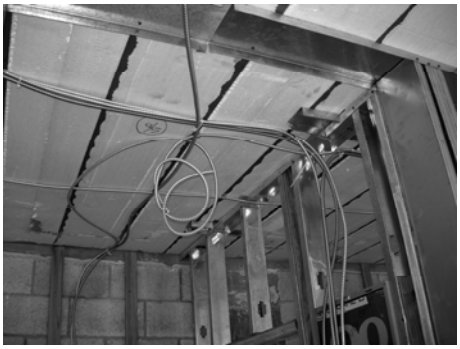


Wood Furring Added

Once the concrete is cured, the Quad-Deck forms have served their purpose as forming units. They are now the best stay-in-place insulation on the market for any type of building.

The 22-gauge metal profiles can now be used as furring strips to attach drywall, stucco or any other finish. Attachment can be made with fine thread self-tapping metal or drywall screws. Recessed ceiling lighting can be installed between the joists using insulation-rated boxes. These can be attached to the furring strips or to the concrete itself. To install a wood ceiling, wooden furring may need to be attached to the metal furring strips to allow finish nailing methods. Dropped, coffered or cathedral ceilings can easily be framed down using light-gauge metal studs attached to the furring strips.

Electrical wires can be run in the small or large chases (subject to local codes and standards), as can plumbing or other utilities. Electrical, plumbing and HVAC trades should be instructed that removing the foam is **not** detrimental to the structure and can be done as needed.



Metal Framing

Interior Metal Framing

HVAC ducts can be run between the beams and all EPS can be removed if needed. Heavy objects may need to be attached directly into the concrete beams or slabs with concrete fasteners (unless inserts have been embedded during the concrete pour).

If core drilling or chipping are needed it must be done from below. It can only be done in the slab portion of the floor/roof after the foam has been removed. A larger hole can be drilled from the top, once a small pilot hole is drilled from below to mark the center of the larger hole.

NOTE: Never make modifications to the structure that will cut into a T-beam.

Notes:

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