Part 11 – Concrete Placement

11.1 – Overview

This part of the manual covers the concrete pouring and consolidation process with best applied practices that have been acquired over the years. This information is a valuable resource to help you complete a successful project.

11.2 – Pre-Pouring Checklist

Tip

Extra copies of the following checklist should be made to ensure everything is in order prior to pouring concrete.

Checking Walls

- ❑ Make sure walls are straight, plumb, square and level.
- ❑ Check if corners are square and plumb.
- ❑ Check if top course of forms been secured.
- ❑ If there will be a second pour check if top of forms been covered to avoid concrete filling the interlocking system.
- ❑ Check if string lines have been placed around perimeter of wall.

Checking Wall Openings

- ❑ Check if wall openings are at the correct height elevation.
- ❑ Check if window and door openings are located correctly and if the openings are plumb and square.
- ❑ Check if anchorage for buck material has been provided.

Checking Reinforcing Steel

- ❑ Check if vertical and horizontal reinforcing steel comply with the specified engineering and/or local building code requirements.
- ❑ Check if reinforcing steel bars around wall openings are installed.
- ❑ Check if reinforcing steel bars for lintels (window/door headers) are installed and as per the specified engineering/local building code requirements.

Checking Floor Connections

- ❑ Check if all floor connections have been installed including anchor bolts, Simpson Strong Tie™ connections etc.
- ❑ Check if beam pockets have been provided (if required for the job).
- ❑ Check if sill plate anchor bolts and tie down straps have been located and are clearly marked for wet-setting into the concrete.

Checking Bracing & Alignment

- ❑ Check if alignment and bracing system is properly installed and planking has been secured.
- ❑ Check if all T-joints braced adequately and properly.
- ❑ Check if all offset joints, stack joints are braced adequately and properly.
- ❑ For bracing system higher than 10 feet off the supporting surface make sure to have a proper handrail system installed as per OSHA requirements in the USA or OHSA requirements in Canada.

Checking Wall Penetrations

- ❑ Check that all penetrations (Electric, plumbing, HVAC, dryer vent etc.) have been accommodated and all form support has been installed.

Checking Tool, Equipment and Materials

- ❑ Make sure that you have two working mechanical vibrators on the job site. One will be used to consolidate the concrete during the pour while the other will act as a standby should the first one break.
- ❑ Make sure the concrete ordered is acceptable for the method of placement and engineering or local building code requirements.
- ❑ Make sure that you have coordinated and confirmed the delivery times for both the boom pump and the concrete.
- ❑ Make sure you have a “blowout kit” prepared and ready. (Refer to section 11.12)

Checking Jobsite

- ❑ Check that the site is clean and there is enough room for trucks, workers, etc.

11.3 – Safety Tips for Handling and Placing concrete

The following are suggestions, precautions and safety measures recommended for anyone handling wet concrete.

Wear Hard Hats

Wear a hard hat for head protection. A construction site presents a variety of hazards that can cause serious head injury.

Protect your Skin

Wet fresh concrete is very abrasive to the skin. It can cause skin irritations, chemical burns and prolonged contact can cause third degree burns. Therefore we recommend to:

1. Wear waterproof gloves, long sleeve shirt, long pants and rubber boots.
2. Use waterproof pads to protect your skin, knees, elbows, or hands from contact with fresh concrete during finishing.
3. Flush eyes and skin that come in contact with fresh concrete immediately with clean water.
4. Rinse clothing saturated from contact with fresh concrete quickly with fresh water.

Protect your Eyes

Wear full cover goggles or safety glasses with side shields during the concrete pour.

11.4 – Rate of Pouring Concrete

When fresh concrete is poured into Amvic ICF, it exerts lateral pressure on the sides of the EPS panels. The intensity of this pressure depends on several factors including:

a. Rate of concrete pour

b. Unit weight of concrete

c. Type of cement

d. Concrete slump

e. Concrete temperature

f. Height of pour

g. Depth of internal vibration

Amvic ICF blocks have an ultimate forming capacity of **864 lbs/sq.ft** (**41.4 KPa**) as tested according to section 6.4.4 of the Canadian CCMC technical guide for modular expanded polystyrene concrete forms.

Table 11.1 below shows the design lateral pressure for newly placed concrete that should be used for the wall formworks. The pressures are based on the recommendations and formulas given by **ACI 347-04**.

Lateral Pressure of Vibrated Concrete[1,2]			
Pour Rate ft/hr	Pour Rate mm/hr	50° F 10° C	70° F 21° C
		To 14 ft (4.2 m) Pour Height	To 14 ft (4.2 m) Pour Height
1	305	600 psf	600 psf
2	610	600 psf	600 psf
3	914	690 psf	600 psf
4	1219	870 psf[3]	660 psf
5	1524	1050 psf[3]	720 psf

Recommended Pour Rate

1- Maximum pressure need not exceed w•h, where "w" is the unit weight of concrete (lbs/ft³) and "h" is maximum height of pour in feet

2- Based on Types I and III cement concrete density of 150 pcf (2400 Kg/m³) and 7 inch (178 mm) maximum slump, without additives and a vibration depth of 4 feet (1.2 m) or less

3- Lateral Pressure exceeds Amvic ICF forming capacity

Table 11.1 – Concrete pressures for walls internally vibrated

The recommended pour rate for Amvic ICF is between **3 to 4 ft/hr** (**915 to 1200 mm/hr**). However, for Amvic ICF concrete pour rates of up to 5 ft/hr (1.5 m/hr) are possible in warm temperatures (70° F or 21° C).

11.5 – Methods & Equipment for Pouring Concrete

Concrete can be placed in several ways depending on the application and job-site conditions available. The following table summarizes the most common methods for placing concrete in Amvic ICF.

Placement Method	Type of work best suited for	Advantages	Special Notes
Concrete Boom Pump	Used to convey concrete directly from discharge point like concrete truck mixer into Amvic ICF forms.	Different boom reaches available. Delivers concrete in continuous stream. Pump can move concrete vertically and horizontally. Pump mounted on truck has high mobility and very versatile to many pouring situations.	For maximum efficiency, schedule concrete trucks appropriately to provide continuous supply of concrete to the pump with minimal idle times. Employ 3", 2.5" or 2" reducers and flexible hose at end of pipeline to reduce rate of concrete pour.
Crane & Bucket	Used mainly for conveying concrete above ground level directly from discharge point into Amvic ICF forms.	Provides clean discharge and there are many bucket capacities available. Cranes may be used to convey other materials such as reinforcing steel.	Make sure bucket has a handle to control the rate of concrete discharge. Select fitting at bottom of bucket to suit placement in ICF walls.
Chutes on Truck Mixers	For conveying concrete to a lower level, usually below gound level directly from discharge point into Amvic ICF forms.	Very economic and easy to maneuver. No power required since gravity does most of work.	Slopes should range between 1:2 and 1:3. Chute should be adequately supported in all positions. End discharge arrangements required to prevent segregation.
Belt Conveyors	For conveying concrete horizontally or to a higher or lower level. May be used to discharge concrete directly into Amvic ICF but usually positioned between main discharge and second discharge point	Belt conveyors have adjustable reach, traveling diverter and variable speed for forward and reverse. Can place large volumes of concrete for limited access situations.	End discharge arrangements needed to prevent segregation. In extreme weather conditions, long reaches of belt may need cover to protect concrete.

Table 11.2 – Most common methods for concrete placement used with Amvic ICF

Figure 11.1 – Using boom pump to pour concrete in Amvic ICF

11.5.1 – Placing Concrete with a Boom Pump

It is highly recommended to use a double "S" bend or double 90° fitting at the discharge point of the pump line. This will help reduce the flow rate of concrete to the desired levels. A flexible hose of appropriate length is always recommended for controlling flow rates and for safety issues.

Tip

Using a boom pump to pour concrete is the most preferred and efficient method.

Many ICF contractors also use 3, $2^{1}/_{2}$ or 2 inch reducer fittings with a flexible hose. Although the reducers may make it more convenient to pour the concrete, they can also have the effect of increasing the pressure and flow rate at which the concrete is discharged.

It is up to the contractor to use whatever fittings he is comfortable with as long as the concrete is poured at the recommended rates and without damaging the forms.

Tip

Discuss your pour thoroughly with your pump operator when you place your order. Make sure the concrete ready mix company has the pump line fittings required like "S" bend connection, reducers and flexible hose.

11.5.2 – Crew Size

On pour day a crew of 4 is the minimum to work with plus the pump operator. At least three crew members are needed on the scaffolds; one handling the hose and two working the vibrator. One crew member is required on the ground for filling and blocking window bucks, cleaning slops, untangling the electrical cords of the vibrator, etc. A crew of 5-6 is optimal.

11.6 – Pouring the Concrete

Important Notes!

Remember, concrete should always be poured at a steady rate and in lifts between 3 to 4 ft (915 to 1200 mm) maximum at a time. Using the recommended pour rate of 3 to 4ft/hr a typical 9 ft (2.7 meters) high wall should be poured within a minimum span of 3 hours.

If you are using a boom pump, it is important to have the operator dump the "pump prime" (sludge that initially comes out of the hose) outside of the forms or back into the pump.

Pouring Concrete in 90° Corners

Warning!

DO NOT allow concrete to accumulate on one side of a corner block at any time. This may cause a blowout during the concrete pour.

It is advisable to start pouring concrete at a corner and then work your way around the wall perimeter in a circular manner. However, corners require special attention during the pour because of their geometry. Corner blocks are always subjected to more lateral pressure due to concrete placement than the straight blocks. The key is to equalize the concrete pressure on both sides of corner blocks as much as possible. The following steps should be followed:

1. Start by pouring concrete at approximately a distance of 2 to 3 ft (0.6 to 0.9 meters) away from the corner center.
2. When filling the walls to the required lift height, make sure to pour concrete at approximately the same rate on both sides of the corner block by moving the pump hose or discharge point in a back and forth rhythm.

Figure 11.2 – Pouring concrete for 90° Corner

3. Concrete should not be poured for a subsequent lift in and around the same corner block until at least an hour has passed.
4. Ensure proper concrete consolidation.

Pouring Concrete around Windows/ Doors & Straight Sections

1. Typically, contractors will start by bringing the boom hose down and filling the bottom of the window bucks first. Each window bottom should be **consolidated** using a concrete vibrator (refer to section 11.7 for details on concrete consolidation) and then screeded off.

Tip

Depending on your slump, it is advisable to nail or screw an OSB cap over the opening(s) in the bottom of the window buck, to prevent the concrete from bulging up or overflowing when you pour down the sides from above in the next passes.

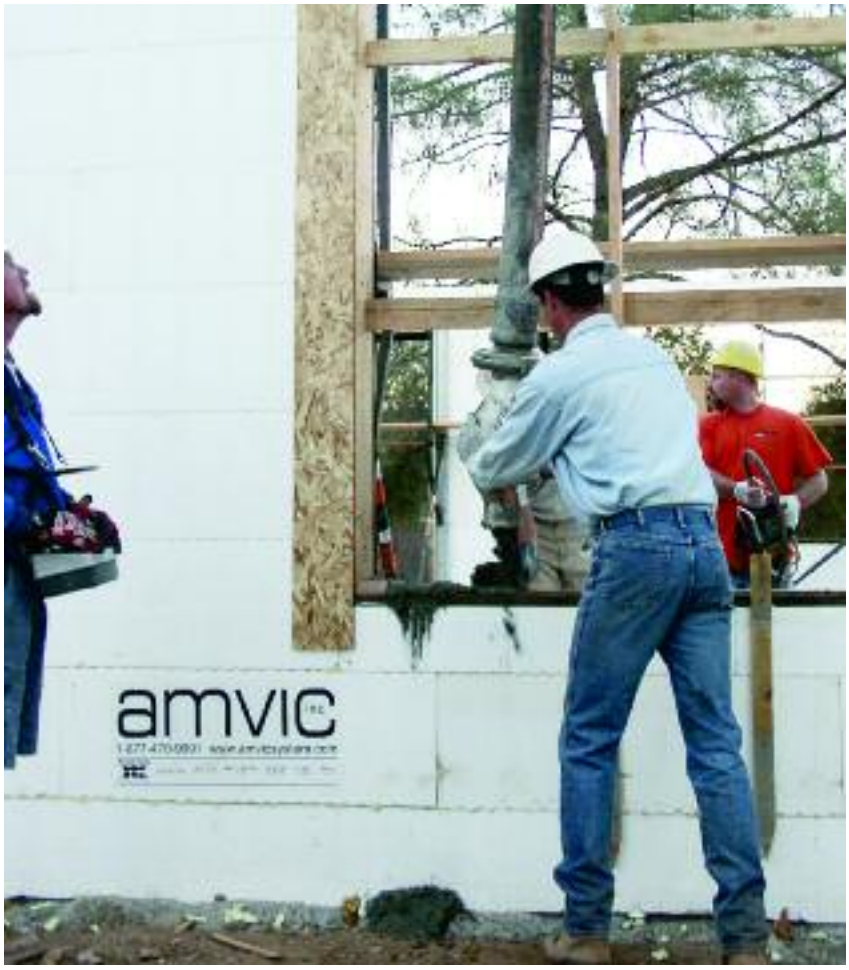

Figure 11.3 – Pouring concrete at window sills

2. Window and door bucks should not be completely filled on one side at one time. Fill both sides of the opening using a back-and-forth rhythm. Avoid spilling concrete into the window and door headers (also known as lintels).
3. Pour concrete normally into straight sections up to the required lift height.
4. As you fill the walls to a lintel, ensure a continuous pour along its entire length without creating any cold joints. Proper and adequate concrete **consolidation** in lintels is of paramount concern.

Tip

With a 2-3 inch (50 -76 mm) reducer on the pump hose, it frequently is possible to hold back the concrete briefly by placing your rubber-gloved hand over the end of the nozzle and quickly swinging the hose to the other side of the window or door.

Figure 11.4 – Using internal vibrator to consolidate concrete

5. Stop short of pouring concrete into a second corner by approximately 2 to 3 ft (0.6-0.9 m). Follow the recommendations given above for concrete placement in corner blocks.

11.7 – Quality Control

11.7.1 – Slump

It is recommended to perform a field slump test on the first batch of concrete that arrives on the jobsite. If the slump is too low or too high, then you can immediately inform the concrete supplier to adjust the concrete mix appropriately for the subsequent batches. This will also give a good feel for what the consistency of a proper concrete mix should be like with Amvic ICF.

If a special inspection is required by the local building code then an engineer will be on the jobsite and this test may become a requirement not an option.

Figure 11.5 – Performing the slump test in the field

11.7.2 – Compressive Strength

It is recommended to randomly retain fresh concrete into proper size cylinders. The cylinders will later be tested by a certified concrete laboratory for compressive strength at 28 days to ensure that concrete used on a specific jobsite meets the specified compressive strength by the local licensed engineer/building code requirements.

If a special inspection is required by the local building code then an engineer will be on the jobsite. Taking random samples of concrete for compressive strength testing becomes a requirement and not an option.

Figure 11.6 – Random sampling of concrete for compressive strength testing at 28 days

11.8 – Concrete Consolidation

11.8.1- What is Consolidation

Consolidation is the process of compacting freshly poured concrete. Concrete ***MUST*** be consolidated to:

1. Eliminate stone pockets, honey-comb, and entrapped air.
2. Mold concrete within the forms and around embedded items.
3. Ensure reinforcing steel is properly embedded and bonded to the concrete paste.

11.8.2 – Methods of Consolidation

The concrete industry has accepted 2 types of concrete consolidation – internal and external.

Internal Consolidation

1. Mechanically using a proper size immersion type concrete vibrator (also known as poker or spud vibrators). This is the most preferred method for adequate consolidation.
2. Manually using steel rods and "rodding" the concrete. This is not a practical method for use with Amvic ICF and does not provide adequate consolidation of the concrete.

Important Note!

Ensure that you use the proper size concrete vibrator for adequate concrete consolidation. Using hand rodding to consolidate concrete in Amvic ICF walls should be AVOIDED.

External Consolidation

This method involves attaching a mechanical vibrating device to the outside of the Amvic ICF forms. Although this method may be acceptable, it is not as effective as internal mechanical vibration.

Important Note!

Tapping on the outside of the forms is not an acceptable method of consolidating concrete in Amvic ICF.

11.9 – Using Concrete Vibrators

11.9.1 – Recommended Specifications

Vibrators consist of a vibrating head connected to a driving motor by a flexible shaft. Inside the head, an unbalanced weight connected to the shaft rotates at high speed, causing the head to revolve in a circular orbit. The motor can be powered by electricity, gasoline, or air. The vibrating head is usually cylindrical with a diameter ranging from $^{3}/_{4}$ to 7 inches (20 to 180 mm). The dimensions of the vibrator head as well as its frequency and amplitude in conjunction with the workability of the mixture affect the performance of a vibrator.

Figure 11.7 – Immersion type concrete vibrator with gasoline engine

The table below provides the recommended specifications for concrete vibrators used with Amvic ICF.

Value	4 & 6 inch ICF	8 & 10 inch ICF
Maximum vibrator head diameter	1 inch (25 mm)	1.25 inch (38 mm)
Frequency (vibrations per minute)	10000 vpm	9000 vpm
Minimum Radius of Action	4 inch (100 mm)	6 inch (152 mm)
Insertion on center spacing	6 inch (152 mm)	9 inch (228 mm)
Centrifugal Force	220 lbs (100 Kg) 2 - 4 cu.yds / hr	500 lbs (225 Kg) 2 to 5 cu.yds / hr
Compaction rate	(1.5 - 3 m^3 / hr)	(1.5 to 3.8 cu. m^3 / hr)

Table 11.3 – Recommended immersion type concrete vibrator specifications for use with Amvic ICF

11.9.2 – Guidelines for Concrete Consolidation

Recommended Practices:

- Consolidation ***MUST*** be done immediately after fresh concrete is poured and before it sets.
- Completely immerse vibrator head in concrete during consolidation.
- Insert vibrator vertically and let it sink as **quickly** as possible under its own weight to the desired depth.

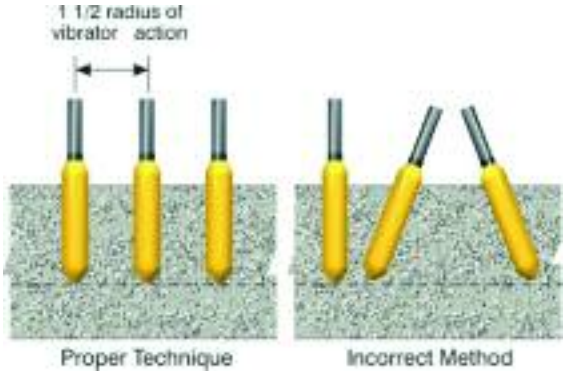

Figure 11.8 – Vibrator head placement

- Hold the vibrator 5 to 15 seconds then **slowly** lift up, approximately 3 inches/sec (76 mm/sec) staying behind the trapped air's upward movement.
- Move vibrator and re-insert at a distance 1.5 times the radius of action as shown in diagram below.

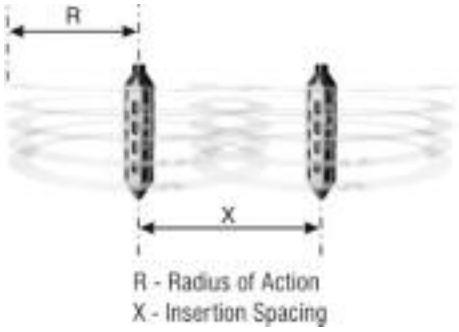

Figure 11.9 – Radius of action of concrete vibrator

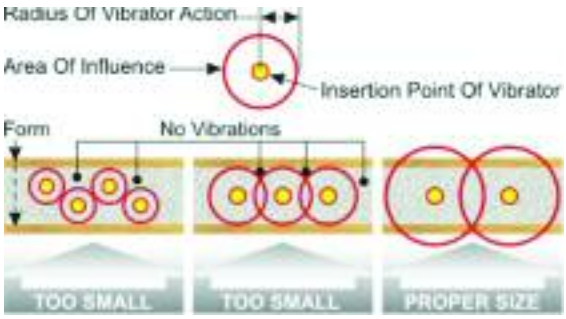

Figure 11.10 – Insert vibrator head at 1.5 times radius of action

- Allow the vibrator to penetrate 6 inches (152 mm) into the previous layer to ensure proper bond and eliminate cold joints.
- Pour concrete into the walls in lifts of 3-4 ft (915 – 1.2 m) per hour. For proper consolidation, each of the lifts should be poured in layers of the same thickness as the vibrator head length minus depth of penetration into previous layer, typically 6 inches (152 mm).
- Stop vibration when the surface becomes shiny and there are no more breaking air bubbles.

Practices to Avoid:

- Do not use the vibrator to move concrete laterally. This causes segregation.
- The vibrator head should not touch the sides of the ICF forms. It should only be in contact with concrete.
- Do not immerse the vibrator head down the same path more than once.
- Do not run the vibrator in air for more than 15 seconds. This will cause overheating.
- Avoid sticking the vibrator head into the top of a concrete heap. To flatten a concrete heap, insert the head around the perimeter. Do this carefully to avoid segregation.

Tip

- *Ensure the vibrator flexible shaft has enough length to match the wall height being poured.*
- *Make sure there are enough workers for placing and consolidating concrete during the pour. A two-man crew should be handling the concrete vibrator and immediately following the person working the pump hose as each layer is poured.*

11.10 – Finishing the Concrete Pour

If a second storey will be constructed above the height being poured, stop filling the top course of block at least 2 inches below the block top. Vibrate it thoroughly but leave it rough so that the next pour will have a good mechanical bonding surface. An excellent bond will develop by leaving the concrete unfinished.

If this is the final course of block that will be poured, then the concrete should be troweled down smoothly, (recommend the use of a laser level at this point) and anchor bolts should be put into the wet concrete after finishing. We recommend you wet set the anchor bolts into the screeded top of the wall, and install the mudsill after the concrete has set. Mudsills or top plates can either be installed to be full width and extend all of the way to the surface of the blocks (13 inch or 11 inch) or it can be recessed *within* the block cavity so that the EPS foam extends unbroken to the rafter tails.

Tip

It gets very busy towards the end of the pour. Mark anchor bolt locations on the sides of the form before the pour and place them on the scaffolds near where they will be installed.

11.11 – After the Pour: Recheck Wall Straightness and Adjust

After pouring is complete, immediately check the corners again for plumb and the wall for straightness. There is a short window in which the bracing system can push and move the wall. If realignment is required adjust the bracing to do so. Have 3 to 4 spare braces ready in the event you need to quickly install an additional adjustable brace to push the wall in an area that you didn't expect.

11.12 – Preparing for a Blow-out

In the unlikely event of a blow-out, prepare a kit which contains the following:

- A few pieces of OSB or plywood, 24 by 24 inches (600 x 600 mm) or so.
- A container of sheetrock screws.
- A fully charged electric driver drill.
- A portable ladder sufficient to reach whatever height is involved.

Before all pours, brief the crew on how to handle a blow-out. If a blow-out occurs, the ground man should:

- Wave off the pump and vibrator.
- If the foam has only bulged and not separated from the webs, install a piece of form support at the location. Use an extra brace for that purpose.
- If the EPS is broken, remove it, clean out concrete and reinsert the broken piece of EPS so that it is flush with the wall.
- Install one or more pieces of OSB with *multiple* screws into intact webs or bucks on either side of the failure location.