

Definition

Cast-in-place concrete basements provide durable, high quality living space. At times, however, undesirable cracks occur. These cracks result from:

- Temperature and drying shrinkage cracks
- Settlement
- Other structural problems
- Cracks due to lack of joints or improper jointing practices

In concrete basement walls, some cracking is normal. Most builders or third party providers offer limited warranties for basements. A typical warranty will require repair only when cracks leak or exceed the following:

	<i>Crack Width</i>	<i>Vertical Displacement</i>
<i>Basement Walls</i>	<i>1/8" (3mm)</i>	-
<i>Basement Floors</i>	<i>3/16" (5mm)</i>	<i>1/8" (3mm)</i>
<i>Garage Slabs</i>	<i>1/4" (8mm)</i>	<i>1/4" (8mm)</i>

The National Association of Homebuilders requires repair or corrective action when cracks in basement walls allow exterior water to leak into the basement.

If the following practices are followed, cracking is minimized:

- Uniform soil is provided
- Concrete is placed at a moderate slump – up to 5", and excessive water not added at jobsite
- Proper construction practices are followed
- Control joints are provided every 20 to 30 feet
- Backfilling is done carefully and, if possible, waiting until the first floor is in place in cold weather
- Proper curing practices are followed

How to Construct Quality Basements

Since the performance of concrete basements is affected by climate conditions, unusual loads, materials quality, and workmanship, care should always be exercised in their design and construction. The following steps should be taken:

■ **Site conditions and excavation.** Soil investigation should be thorough enough to insure design and construction of foundations suited to the building site. Excavation should be to the level of the bottom of the footing. Soil or granular fill beneath the entire area of the basement should be well compacted by rolling, vibrating, or tamping. Footings must bear on undisturbed soil.

■ **Formwork and reinforcement.** All formwork must be constructed and braced so that it can withstand pressures of plastic concrete. Reinforcement is effective in controlling shrinkage cracks, and is especially beneficial where uneven side pressures against the walls may be expected.

■ **Joints.** Shrinkage and temperature cracking of basement walls can be controlled by means of properly located and formed joints. As a rule of thumb, in 8-foot high by 8-inch thick walls, vertical control joints should be provided at a spacing of about 30 times the wall thickness. These wall joints can be formed by nailing a 3/4" thick strip of wood, metal, plastic, or rubber, beveled from 3/4" to 1/2" in width, to the inside of both interior and exterior wall forms. Depth of the grooves should be at least 1/4 the wall thickness. After removal, the grooves should be packed with appropriate size backer rod, and caulked with a good quality elastomeric sealant. For large volume pours or with abrupt changes in wall thickness, bonded construction joints should be planned before construction. Construction joints may be horizontal or vertical. Wall reinforcement continues through a construction joint.

■ **Concrete.** In general, use concrete with a moderate slump up to 5 inches. Avoid re-tempering with water. Concrete with higher slump may be used, provided the mixture is specifically designed to produce the required strength without bleeding and/or segregation. Water-reducing admixtures can be used for this purpose. In areas where the weather is severe and walls may be exposed to moisture and freezing temperatures, air entrained concrete must be used. Maximize large aggregate (both size and quantity) in the mix. Avoid over-sanded mixes. High sand mixes typically lead to more bugholes at the form face surface.

■ **Placement and curing.** Place concrete in continuous operation to avoid cold joints. If concrete tends to bleed and segregate, a lower slump should be used and the concrete should be placed in the wall every 20 to 30 feet around the perimeter (do not require mix to flow further). Higher slump concrete that does not bleed or segregate will flow horizontally for long distances, and reduce the number of required points to access the forms. Curing should start immediately after finishing. Forms should be left in place five to seven days, or as long as possible. If forms are removed after one day, premature drying at the surface is likely, which can lead to additional cracking. In general, the application of a liquid membrane-forming curing compound or insulated curing blankets immediately after removal of forms will help prevent drying and will provide better surface durability. During cold weather, forms may be insulated or temporarily covered with insulating materials to conserve heat from hydration and avoid the use of an external source of heat. During hot, dry weather, forms should be covered. Walls must be cured with wet burlap or curing compound as soon as forms are removed.

■ **Waterproofing and drainage.** Spray or paint the exterior of walls with a damp proofing material or use waterproof membrane. Provide foundation drainage by installing drain tile around the exterior of the footing, then cover with clean, granular fill to a height of at least one foot prior to backfilling. Water should be drained to lower elevations suitable to receive storm water run off.

■ **Backfilling and final grading.** Backfilling should be done carefully to avoid damaging the walls. Brace the walls or, if possible, have the first floor in place before backfill. Keep heavy equipment at least eight feet away from walls. Place backfill in thin layers and with hand-operated equipment. Keep compaction equipment at least 12 inches from walls. Do not backfill with organic material, including topsoil. The finish grade should allow sufficient fall to drain surface water at least 10 feet way from the foundation.

■ **Crack repair.** In general, epoxy injection, dry-packing, or routing & sealing techniques can be used to repair stabilized cracks. Before repairing leaking cracks, drainage around the structure should be checked and corrected if necessary. Active cracks should be repaired based on professional advice.

References

Joints to Control Cracking Walls,
Concrete Technology Today, September 1984
Portland Cement Association

How to Control Basement Wall Cracks,
Concrete Technology Today, July 1995
Portland Cement Association

Preventing Wet Basements,
Concrete Technology Today, March 1996
Portland Cement Association