

# curling (differential shrinkage)

## Definition

Nearly, all concrete floor slabs curl. Curling is the distortion of a slab into a curved shape by upward or downward bending of the edges. This distortion can lift the edges of the slab from the base leaving an unsupported corner. It is common when thin slabs are poured on top of older concrete. Sometimes, curling is evident at an early age. In other cases, slabs may curl over an extended period. Slabs on ground tend to curl more often than suspended slabs. Curling has always been a problem, but is more so today because of our higher strength concrete mixes and changed placement methods.

## Why do Concrete Slabs Curl?

Curling occurs when the upper portion of a slab tries to occupy a smaller volume than the lower portion. The change in volume can be due to temperature, moisture, shrinkage, and other variables, or combination of variables. Curling and shrinkage are closely related, and anything that effects shrinkage will have a like effect on curling. Factors which increase curling potential include:

1. Wide joint spacing
2. Gap graded aggregate
3. Thin slabs
4. High slump
5. Too many revolutions on the mixer
6. High placement temperatures
7. Small stone used when larger could have been in mix
8. Bleeding
9. High shrinkage potential aggregates
10. Chlorides
11. Some admixtures

## How to Minimize Curling

The primary factors controlling dimensional changes of concrete which lead to curling are: drying shrinkage, construction practices, moist or wet sub-grades, and day/night temperature cycles. The following will help minimize the potential for curling:

- Thicken slab, or at least edges of slab
- Use of synthetic, polypropylene fibers
- If placing over a vapor barrier, include a dry blotter between vapor barrier and concrete
- Use lowest strength concrete as possible (if abrasion resistance is needed, add mineral or metallic dry-shake to slab surface)
- Place at lowest possible slump, avoid retempering
- Shorten joint spacing – not more than 24 times floor thickness
- Use continuous reinforcing (or steel fibers)
- Do not place concrete at elevated temperatures
- Properly cure slab

## References

NRMCA, Concrete in Practice #11, Curling of Concrete Slabs

Concrete International, "Thou Shalt Not Curl Nor Crack....," January 1999

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"Slab Curling is Not a Game Played on Ice," (June 1982)