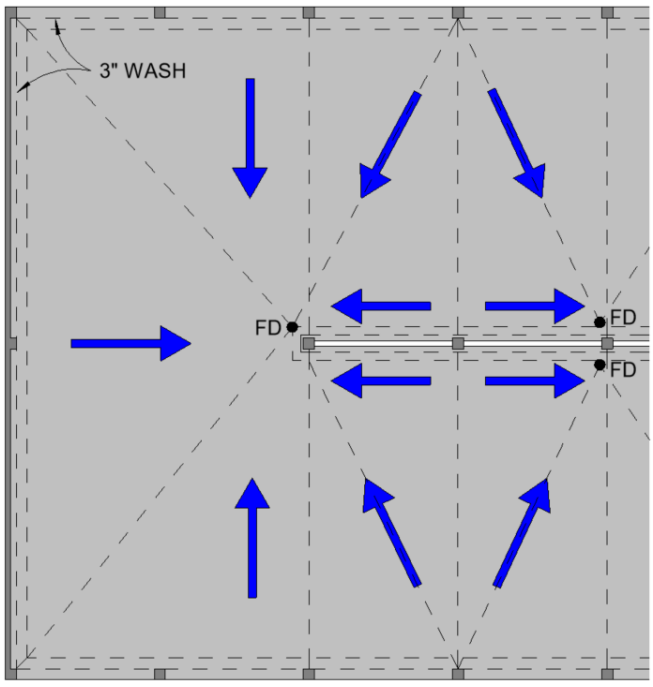
Design Tip: Slopes and Drainage

Considerations for ramp and drainage slopes that will improve constructability and the garage structure's aesthetic longevity.

With cast-in-place concrete designs, you can form ramps and floors to provide optimal drainage. Efficient drainage manages fluid and water runoff that could damage vehicle finishes or discolor/decay the concrete over time. Consider the following:

- To drain rain and snowmelt internally, provide an additional 3 inches on the top side as a concrete buildup "wash" at all exterior and interior ramp edges. This prevents fluids from spilling over the perimeter edge.
- Create drainage elevation slopes to drain locations, and locate the drains near interior columns. Non-ramp slabs can be warped 2% within a bay between the long span beams to encourage surface flow to the drain. A good solution is to locate a low column point every other bay to a nearby drain.
- When drains are located mid-bay, constructability is drastically reduced. This is because the steel beamform is straight from column to column and not "kinked."
- Locate drains at the bottom of the ramps to collect surface flow.
- If drains are to be cast into the slab, select a low-profile drain embedment that does not extend below the slab soffit.
- Ensure drain locations and drainage elevation changes are consistent from floor to floor. Otherwise, they can compromise the required clearance and reduce construction tolerances.
- Post-tensioned (PT) concrete beams should be formed with a project's standard-sized steel beamform for constructability. Because these forms are not easily cambered, designs should not require camber. When fully tensioned, however, a crown may result above the cast elevation and can impact insufficient drainage slopes.
- Garage ramp slopes should be consistent throughout the project. Ramp slopes require steel beamforms to modify the beamside heights to remain vertical and align with gravity for the structural loads. This is accomplished by adjusting a beamside buildup for the higher beamside. The lowest side of the concrete beam is considered the effective design depth of the beam. Although the buildup can be modified during construction form reuse, the process reduces constructability and can be prone to field errors. It's best to utilize this design solution sparingly.
- Locations where top-of-slab ramp slopes begin or end should be considered without modifying the effective design depth of the beam. It is recommended to start or end a ramp slope above the side of the beam facing the ramp.
- If ramp slopes on multiple floors are not identical (location or degree of slope) from the level below, double-check the clearance at the ramps' beginning and end locations. Often, the minimum clearance is unknowingly compromised.
- For greater ramp slopes, focus on the ramp beginning or end locations. The transition from a ramp to a level parking area can cause auto clearance difficulty with lower-profile sports cars. If the ramp slope cannot be reduced, use two ramping slope transitions on subsequent bays. Keep the slope changes above the highest beamside.



Slope the slab to interior drains and provide a 3-inch wash around all edges.