A Checklist for Industrial Floor Design

Use this information-gathering tool to get a better understanding of owner expectations and reduce the number of disputes after an industrial floor is completed.

BY BRUCE SUPRENANT, ROSS MARTIN, AND KIMBASHAM
Contractors are often asked to perform value engineering on floors. Unfortunately, they’re rarely given enough information to adequately perform this function, and may have to estimate original design loads or make guesses about the intended slab function. Sometimes the load capacity of the floor is calculated and used as a reference value to perform the value engineering.

True value engineering reduces the owner’s cost without sacrificing floor performance, but it’s difficult to value engineer a floor without collecting a substantial amount of information. Information-gathering starts with the owner, and will probably also require discussions with the architect, structural engineer, and geotechnical engineer. Although differing amounts of numerical data will be available, depending on the size of the project, other needed information such as owner expectations may be difficult to quantify. A checklist is a valuable tool for gathering both quantitative and qualitative information.

Using the information checklist

Using an information checklist to perform design-build or value engineering for industrial floors can help contractors build a completed floor that satisfies the owner. One benefit is similar to that resulting from use of a pre-pour checklist: the list provides a starting point for discussing the important aspects of the project. It makes all parties think about—and reach consensus on—risks, costs, and expectations.

We’ve found that using the checklist results in other benefits:
- It’s a tool for educating owners by alerting them to the costs and risks associated with choices they make when specifying a floor;
- It helps contractors to better understand the owner’s expectations and perceptions so they can suggest changes in the design and specifications that may be needed;
- By prompting discussion of the owner’s previous good and bad floor construction experiences, it helps contractors home in on the floor performance concerns that are most important to the owner; and
- It promotes discussion regarding the tradeoffs between first cost, maintenance, and life-cycle costing.

As you read the checklist, you’ll note several areas in which qualitative or partially quantitative information is requested. For instance, the section on serviceability requirements asks about acceptable surface features as a percentage of the total floor area. Such features might include trowel marks, trowel burns, footprints, surface peeling, blemishes, surface defects, or other irregularities that are often cosmetic and have little effect on floor performance. Discussing these with owners before the floor is built can help you better understand their expectations.

It’s useful to fill out the information checklist with the owner as a record of conversation, then provide the owner with a copy for his or her records. Also keep a copy for your project files. After the project is completed, the checklist serves as a method of protection if the owner changes the agreed-upon requirements and then believes that the floor doesn’t meet expectations.

Additional references

2. ACI Committee 360, “Design of Slabs on Grade (ACI 360R-92),” American Concrete Institute, Farmington Hills, Mich.
3. ACI Committee 302, “Guide for Concrete Floor and Slab Construction (ACI 302.1R-96),” American Concrete Institute, Farmington Hills, Mich.

Selected for reader interest by the editors.

Bruce Suprenant, FACI, PhD, is vice president of engineering and technical services for Baker Concrete Construction, Monroe, Ohio.

Ross Martin is materials engineer for Baker Concrete Construction, Monroe, Ohio. A longtime member of ACI, he serves on several committees including ACI 302, Construction of Concrete Floors.

Kim Basham, PhD, is structural engineer for Baker Concrete Construction, Monroe, Ohio. An ACI member, he specializes in construction techniques, concrete technology, and forensic and design engineering.
Industrial Floor Design Checklist

Project: ___________________________ Location: ___________________________

Owner: ___________________________ Engineer: ___________________________

Contact: __________________________ Contact: ___________________________

Phone: ____________________________ Phone: ____________________________

Fax: ______________________________ Fax: ______________________________

Email: ____________________________ Email: ____________________________

Building Data (attach architectural or structural plans or sketches)

Intended Floor Use and Function ____________________________________________

Total Area, sf _______ Warehouse Area, sf _______ Office Area, sf _______

Building Dimensions, ft _______________ Column Spacing, ft _____________

Owner Expectations

Prior Experience with Industrial Slabs ______________________________________

Prior Experience with Maintenance ________________________________________

List of Good Projects _____________________________________________________

List of Poor Projects _____________________________________________________

Slab Life Expectancy, years _______________________________________________

Anticipated Maintenance Level (circle one)       Low     Moderate     High

Maintenance Budget, $/year _______ Maintenance Performed by _____________

A/E Performance Requirements

Serviceability Requirements (circle all that apply)

Floor flatness, F_f 25 30 35 40 45 50 Other _____________

Floor levelness, F_l 15 20 25 30 35 40 Other _____________

Surface hard-trowel finish Light Moderate Burnished

Aggregate hardener: No Mineral Metallic Other _____________

Delayed topping: No Mineral Metallic Other _____________

Acceptable surface features, % of area 1 2 3 4 5 Other _____________

Acceptable color variations_______________________________________________

Popouts: Maximum acceptable number of popouts per sq yd _________________

Repairs permitted: Yes No Comments _________________________________

Will any slab area have a surface covering?    Yes    No       If yes, attach data sheets.

Durability Requirements (circle appropriate exposure level)

Freeze-thaw None Low Moderate Severe Unknown

Sulfate attack None Low Moderate Severe Unknown

Alkali-silica reaction None Low Moderate Severe Unknown

Abrasion None Low Moderate Severe Unknown

Chemical attack None Low Moderate Severe Unknown
**Loading and Design Information**

### Vehicle Axle Loads

- **Payload Capacity** ____________ (lb.)
- **Vehicle Weight** ______________ (lb.)
- **Axle** □ Single Wheel □ Dual Wheel
- **Wheel Spacing WS** ____________ (in.)
- **Dual Wheel Spacing SD** ____________ (in.)

### Rack and Post Loads

- **Total load on a section of rack** ____________ (lb.)
- **Post load** ____________ (lb.)
- **Wheel’s Tire Width** ____________ (in.)
- **Wheel Contact Area** ____________ (sq.in.)

### Uniform Loads with Aisle

- **Axis Width** ____________ (in.)
- **Uniform Load on Slab** ____________ (psf)

### Wall Loads

- **Wall Loading** ____________ (kips)

### Column Concentrated Loads

- **Total Design Load at Column Base** ____________ (lb.)
- **Base plate size (area)** ____________ (sq. in.)
- **Slab Thickness at Column** ____________ (in.)

### Other Loading Information

- **Rack and post height, ft** ____________
- **Rack or posts supporting structures** ____________
- **Anticipated daily forklift repetitions**
  - 25  50  75  100  200  Other ____________
- **Column, wall or rack loads within 3 ft of joint?**
  - Yes  No
Slab Design Options  (cross out unacceptable options)

Type A, plain concrete slab

Type B, slab with shrinkage control reinforcement

Type C, shrinkage-compensating concrete

Type D, post-tensioned slab

Type E, lightly reinforced slab

Type F, structurally reinforced slab

Type G, fiber-enhanced concrete slab

**Tolerances**

Elevation of top of slab: ± ¾ inch Other ________
Elevation of finished subbase: ± 1 inch Other ________
Thickness: ± 3/8 inch ± ½ inch Other ________

**Soils Information**

Soils report available? Yes No If yes, attach soils report.
A stable wet weather-working base? Yes No Other ________
Anticipated slab support k-value? Estimated ______ Measured ______
Soil sulfate content a concern? Yes No If yes, attach sulfate content tests.
Radon gas a concern? Yes No
Soils Engineer: ______________________________________________________
Contact Name: _________________________ Phone: _________________________
Fax: ________________________________ Email: ____________________________
Concrete Information

Have mix proportions been proposed? Yes No If yes, attach mix proportions.
Modulus of rupture measured for proposed mix? Yes No If yes, attach data.
Shrinkage data available for proposed mix? Yes No If yes, attach data.
Ready Mix Supplier: ________________________________ Phone: ____________________
Fax: ________________________________ Email: ____________________
May the concrete proportions be improved? Yes No
Contact person to discuss improvements: ________________________________
Company ______________________ Phone: ____________________

Construction, Control and Isolation Joints

Construction
Specify construction joint layout? No Yes _______________
Place limits on the minimum or maximum placement area? No Yes
Construction joint sawed and sealed? Yes No
Preference for load transfer?
_____ None (butt joint)
_____ Round dowels _____ Square dowels with isolation material on sides
_____ Keyed
_____ Diamond plate
_____ Tie bars
_____ Other (describe) ___________________________________________

Contraction
Maximum joint spacing: 15 feet_____ at half-column____ at columns_____ Other_____
Joint to be made by: Sawcut _____ Insert _____ Tool_____
Depth of joints: ¼ slab_____ 1/3 slab_____ Other_____
Nominal width of joints: 1/8”_____ ¼”_____ Other_____
Are joints to be filled: Yes No Are joints to be sealed: Yes No
What filler __________ or sealer _________ do you prefer? Attach data sheets.
How long after slab installation may joints be sealed? (weeks) 1__ 4__ 16__ Other__
Preference for load transfer?
_____ Nothing (Aggregate Interlock)
_____ Round dowels _____ Square dowels with isolation material on sides
_____ Diamond plate
_____ Reinforcement, with 50% (every other bar) cut at joints
_____ Other

Isolation
What full-depth isolation material do you prefer at joints?
Polyethylene sheet_____ Hardboard_____ Foam_____ Bituminous_____ Other _____
Thickness of isolation material: Less than 1/8”_____ ¼”_____ ½”_____ 1”_____ Other _____

Construction Loads

What construction loads will be applied? (check all that apply)
_____ Ready mix trucks _____ Crane (list size) _____ Lifts (size) _____ Other
How long after a slab is poured must construction resume? 1 3 7 14 28 days (circle one)
How will unfilled joints be protected during construction? ______________________
### Crack and Curl Management

#### Drying Shrinkage Crack Expectations

- Anticipated lineal feet of crack between joints:
  - 0
  - 10
  - 20
  - 30
  - 40
  - Other

- Anticipated panel cracking: percent of panels
  - 0
  - 5
  - 10
  - 20
  - Other

- Crack width a concern?  No  Yes
- Maximum unrepaired crack width: ___________

- If the crack width exceeds that stated above, what repair procedure do you prefer?
  - a) rout and seal
  - b) penetrating sealer
  - c) epoxy injection

#### Drying Shrinkage Crack Control

- Preferred methods to limit the movement of drying shrinkage cracks that may occur between joints?
  - Nothing
  - Deformed bars: 1 layer 2 layers
  - Welded wire fabric: 1 layer 2 layers
  - Amount of steel: 0.15% 0.30% 0.50% Other
  - Post-tensioned cables: diameter spacing strength
  - Steel fibers, pcy 1.0 1.5 Other
  - Other: describe

#### Plastic Shrinkage Crack Control

- Preferred methods to limit plastic shrinkage cracks?
  - Nothing
  - Evaporation retarder
  - Fog mist of water
  - Synthetic fibers, pcy 1.0 1.5 Other
  - Other: describe

#### Curling Expectations

- Anticipated maximum corner curling: 0 1/8” ¼” 3/8” ½” Other

- Anticipated curled corners: (% at each level) < 1/8” 1/8” to 3/8” > 3/8”

- Joints located under storage and away from traffic areas?  Yes  No
- Maximum unrepaired curl in inches: ___________

- If the curl exceeds that stated above, which repair method do you prefer?
  - a) grind
  - b) underseal
  - c) underseal and grind

#### Control of Curling

- Preferred methods to limit curling?
  - Nothing
  - Reinforcement: ¾% 1% 1¼% Other
  - Steel fibers, pcy 50 70 Other
  - Post-tensioning: diameter spacing strength
  - Shrinkage-compensating concrete
  - Other

#### Vapor Retarder Placement

- Is a vapor retarder/barrier to be used under the slab?  Yes  No
- Preferred location: Directly under slab Under subbase Other

#### Job Conditions Anticipated During Slab Installation

- Anticipated start: 
- Anticipated completion: 
- Roof and walls functioning and building at operating environment:  Yes  No
- Roof installed but NOT watertight:  Yes  No
- Installation in open:  Yes  No
- Anticipated relative humidity: during pours finished structure
- Anticipated temperature: during pours finished structure