

## Complete preparation, including accounting for all factors prior to the pour, goes a long way in preventing costly foundation failures.

**A RECENT REPORT BY GCUBE**, a prominent renewable energy industry insurance provider, listed the top five categories of wind project insurance claims in 2012: blades, gearboxes, generators, transformers and foundations. Of these, average foundation claims were far higher than other claim types. An average claim for blade damage or failure was \$240,000; average gearbox claims came in at \$380,000. Foundation claims averaged \$1,300,000 and rose to \$2,500,000 in exceptional circumstances. Accordingly, contractors should closely examine their foundation construction procedures to guard against foundation failures.

Avoiding foundation defects depends on complete preparation for each pour. Here are some good ways to be prepared:

### BACKUPS FOR EVERYTHING

Foundation concrete must be placed in continuous pours. Most designs for spreading footing foundations allow cold joints only between the pedestal and base. Accordingly, the contractor must have backup equipment available in the event of a failure of critical equipment. This includes pump trucks, generators, finishing equipment, heaters, and any other equipment necessary to insure the integrity of the foundation. If critical equipment fails, the contractor is running against the clock to get the pour back on track before the concrete is unsuitable to pour. A typical life of a load is 90 minutes. Haul distances take up a portion of this time, so backup equipment must be on-site and available.

### READY-MIX/BATCH PLANT AVAILABILITY

Whether the contractor is using a ready-mix plant or a batch plant, the facility must be able to keep up with the pour rate needed for the project. Otherwise, pours may be interrupted. A pour rate of 120 cubic yards-per-hour is not unusual, and many ready-mix plants may be unable to meet this schedule. If possible, a backup ready-mix plant should be available, and each facility should have generators available to power the plant in the event of a loss of grid power.

### BACKUP MATERIAL

The ready mix facility (or batch plant) must have adequate material on hand to support all pours. The aggregate used for foundations is more than likely not going to be the aggregate typically stocked by the ready mix plant. Any substitutions may greatly affect concrete strength and suitability, and contractors should require (and verify) an adequate stored quantity of aggregate.

### WEATHER

Weather is a concern for every pour. The contractor must be confident that the pour can be completed once it starts. Any interruption because of weather can result in serious impacts the integrity of the foundation pour. Accurate daily weather prediction is essential.

Hot Weather Temperature Control—Temperature control as concrete is poured is critical for proper curing. If the concrete is too hot, it can dry out and cure too fast, resulting in a higher possibility for defects. Some ways to control excessive concrete temperatures include:

- Irrigate aggregate piles with cold water pipes and pull aggregate from the interior of the piles.
- Spray rebar with cold water immediately prior to the pour to help reduce the interior foundation temperature.
- Upon pour completion, immediately place cure and seal and cover the foundation with plastic.
- Place ice in the concrete mix at the plant. While expensive, this helps lower concrete temperatures prior to the pour.
- Use chilled water in the concrete mix.

Cold Weather Temperature Control—In cold weather, the object is to prevent cold temperatures from hindering the concrete from developing the proper strength. Contractors need to be concerned when average daily temperatures are below 40° F and the air temperature is not greater than 50° F for more than half a day. The foundation must be kept warm enough to prevent the water in the concrete from freezing, which can result in preventing hydration and dramatically affecting concrete strength and long-term structural integrity. Contractors can take a number of measures to avoid deficiencies caused by low temperatures, including:

- Insure material (aggregate, sand, cement) is not frozen. Do not wash aggregate in cold weather.
- Run material through heaters prior to mixing.
- Keep materials in large piles and take from the interior.
- Pre-heat all rebar.
- Blow hot air on the covered pour and the completed, covered foundation.
- Use hot water in the concrete mix at the plant.
- Use insulated blankets (measurable R-value) over the completed foundation.

### TESTING

An often overlooked measure is to cure test cylinders in the same environment as foundation pour to insure test result accuracy. ↘