Hot Springs, Arkansas Office

Merry Christmas & Happy New Year from All of Us!

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The Barn Raiser

Mid-South Engineering Company

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Concrete Cracking

By: Jason Tankersley, E.I.

It is important to understand that cracking in concrete does not directly imply a structural failure or the imminence of failure in the slab. Most cracks seen in concrete are cosmetic cracks from shrinkage while curing (drying) and these thermal stresses cannot be prevented; but through proper joint layout, slab design, and workmanship they can be controlled leading towards an aesthetically pleasing concrete design.

Cracks will form when shrinkage occurs in restrained concrete to provide relief of the tensile stresses. This type of crack is controlled through temperature steel and control joints (Restraint can come from grade beams, subgrade surface irregularities, or friction between slab and subgrade). Temperature steel has the purpose of holding the crack together and control joints provide a more desirable look than the irregular natural cracks of the concrete. There are some key considerations when determining a jointing layout. As a rule of thumb, maximum joint spacing should be no more than 36 times the thickness of the slab and panels should try to be kept square without having the length exceeding 1.5 times the width. Control joints should be placed where a reentrant corner occurs as well as additional rebar placed at a 45 degree angle to the reentrant foundation, perpendicular to the crack. There is a set ratio of temperature steel reinforcement to concrete area in ACI-318 for all types of construction circumstances. It is imperative to stay as close to this ratio as possible; if the ratio is lower, then the probability of having larger cracks increases. However, if the ratio is higher than recommended by ACI, then the probability for having more frequent hairline cracks increases because the rebar is the mechanism that restrains the concrete from shrinking.

Proper curing techniques should be implemented to minimize drying shrinkage, as mentioned previously, thereby reducing visible cracks. The most practical and widely used method of curing is applying a membrane-forming curing compound over fresh concrete. The most effective method to cure concrete would be a wet covering typically employing burlap fabric or water spray. Alternative methods for wet covering include: a 2” bed of earth, sand, or sawdust (sawdust cannot contain tannic acid).

Special provisions have to be implemented when forming concrete in hot weather. This is due to a higher rate of evaporation at the surface of the concrete that does not occur in the middle of the slab. High winds can increase this effect. The wet center of the slab will act as a form of restraint to the top layer while it dries and shrinks causing the formation of surface cracks as relief. This could also lead to curling where the edge of the slab lifts upward. There are also special provisions for cold weather and those vary based upon the climates.

Summary of Steps to Control Cracks

- Joint Design
- Reinforcement Ratio
- Lower Water Content
- Proper Curing
- Special Provisions in Hot Weather
- Special Provisions in Cold Weather

“The Barn” built in the 1930’s to house Welsh ponies, serves as Mid-South’s offices.

What is all this Talk about the Energy Code?

By: Karen Griffin, Registered Architect

For most industrial plants there is an enormous amount of energy expended to operate the machinery at the site compared to the energy used by the conditioned support buildings needed for personnel. Management of the entire plant's energy usage can be critical to profits for the business and upgrading to more efficient processing can be an extremely important decision, evaluating life cycle costing with energy usage. So why should we be so concerned about the small amount of energy used in our occupied buildings within the plant compared to the whole? Simply put, it's what our government is asking us to do!

The Federal Government has an energy conserving agenda in place as well as a goal to become more energy dependent from the rest of the world. The individual states are mandating more current energy codes to become in effect. The local jurisdictions' job, whether it is a city or county government, is to adopt and enforce the mandates of the state. In fact, if a permit is issued for new building construction, most states now require the cities and counties to record that the builder has certified that the proposed building will comply with the energy code in effect. So, indeed, it is the job of the designers and the builder to be responsible in creating an energy efficient building which will ultimately help keep the client's energy costs down.

Codes are complicated and the energy code is no exception. There are set-down rules, but you have various paths to meet the code. Then there are lots of exceptions to the rules. Then there are gobs of choices in materials and building products on the market to help create the all important sealed building envelope, which by the way, is the secret weapon used to meet the energy code. Phew, this can be overwhelming, so let's look at a "nutshell" break-down of the more current energy codes to help us all understand this.

Code to follow:

For non-residential buildings, most states have adopted ASHRAE 90.1-2007 and/or the 2009 IECC and some states are using even more current energy codes. ASHRAE is the Energy Standard for Buildings except Low-Rise Residential Buildings developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers. IECC is the International Energy Conservation Code developed by the International Code Council. The Arkansas Energy Office will adopt both of these on January 1, 2013. Before beginning a project, the specific code must be verified for the project jurisdiction, because they do vary slightly, usually by State.

Three Compliance methods:

Prescriptive Path allows the designer to follow set rules, for example, R-value of ceiling/roof, wall, floor, and foundation insulation, U-factors for fenestrations, solar heat gain coefficient for glazing, infiltration and air sealing rates, mechanical ventilation rates, lighting efficiency.

Performance Path allows the designer to upgrade some areas and compensate other areas, resulting in a system analysis approach to meet the code. Although, not all energy code requirements are flexible. The Arkansas Energy Office encourages "the use of innovative approaches and techniques to achieve effective utilization of energy".

Above-Code Programs deemed to comply if approved by code official or jurisdiction, may use a chosen building rating program such as LEED.

Affected Design Areas:

The main categories are energy efficient building envelope, HVAC, service water-heating, electrical distribution, illumination systems.

Code enforced for these buildings:

Existing installations for the most part, are not required to be upgraded.

Additions to existing buildings are required to meet the code as it relates to new construction only.

Renovations to buildings are required to meet the code if more than 25% of gross floor area or volume of entire building is to be rebuilt.

Compliance tools:

The following are examples of software available:

COMcheck (free software from www.energycodes.gov)

EnergyPlus free energy modeling software from the U.S. department of Energy

Numerous mechanical equipment suppliers offer free analysis software such as Trace™ 700 by Trane

VisualDOE® by Architectural Energy Corporation

Inspection, Verification, and Monitoring:

Work that must comply with the energy code is subject to *inspection* by code officials or State energy office agents within a two year period from completion and may be required to bring the building into compliance if it fails. *Verification* varies by State , by the energy code enforced, and by building type such as a State owned/operated facility or even a residence in some areas. This may require blower door testing during construction and after completion to prove the building's air tightness. *Monitoring* requirement are not currently the norm, but more programs are now being developed and quickly becoming available, such as one offered through LEED. This may require separate metering, and may be tied into Federal tax credit programs. EPA's ENERGY STAR partnership offers an energy management program that helps in measuring current energy performance, setting goals, and tracking savings.

Other points of interest:

- State owned/funded buildings and Educational buildings have higher energy efficiency requirements in many states.
- Some states offer exemptions for separated buildings with very low energy usage, unconditioned buildings, buildings and structures that are exclusively heated with renewable fuels.
- Energy Code requirements vary with occupancy type (factory, business, warehouse, educational, etc.) and construction type (mass, metal building, metal frame, wood frame, other) and climate zone.
- One of today's highest energy standard is Passive House, a popular European energy standard which is working towards bringing a building to 'zero' energy with a performance characteristic of equal to or greater than 120kWh/m^2/year.
- Manufacturers are offering many rebates for using their energy efficient products, Energy companies and State governments are offering incentives, and Federal tax credits are available in many different areas of energy efficiency. This usually involves a good bit of work to get this "free" money and there are specialized companies offering their services to track and collect the data and paperwork required for submittals.
- The government based ENERGY STAR program offers certification for businesses and industrial plants resulting in cost savings and opportunities to market your company as environmentally responsible.

The "green" movement which includes energy efficiency is not perfect, but it is here now and is a solid start toward helping create more comfortable working environments, improved indoor air quality, and helping use our energy resources in a more responsible way. It may increase project budgets initially, but cost savings must also be considered over time. Engineers, architects, builders, and project owners have the responsibility and the resources today to pave the way to a better future for the world! It also appears the ENERGY STAR program is something that industrial facilities need to look into more closely.