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The Federal Highway Administration wants all bridges designed after 2007 to be done using LRFD...

LRFD, What is it?

By Ronald Thornton, PE

LRFD is a term that refers to a state-of-the-art method of bridge design and, whether we like it or not, is a term that is finding its way into the world of precast concrete design.

LRFD stands for "Load and Resistance Factor Design". It is a method first adopted by AASHTO in 1993 as a means to achieve a more uniform level of safety in bridge design. The method is based on the statistical reliability of a structure under various limit states. A limit state is defined as "the state beyond which a component ceases to satisfy the provisions for which it was designed".

The LRFD method, which bears some resemblance to traditional load factor design (LFD), is currently used primarily for bridges; however some states are specifying that it be used for culverts as well.

The AASHTO LRFD code defines four limit states including:

- Strength – For strength and stability.
- Service – Relates to stresses, deformations and cracking.
- Fatigue – Places restrictions on stress under repetitive live loads
- Extreme Events – Ensures the structural survival of a bridge during an event such as earthquake, vessel collision, flood, etc.

Each limit state must be checked under various combinations of permanent and transient loads. For instance, there are five load combinations for strength, three for service, two for extreme and one for fatigue.

One of the more significant and recognizable differences in the LRFD method over LFD is in the live load designation. HS20 no longer exists in the new code. The de-

sign load for LRFD is HL93 which includes a combination of a design truck (same as HS20 or design tandem) and a uniform lane load. This load is not intended to be scaleable. In other words, there is no HS25 equivalent but the resulting HL93 designs are often similar to HS25.

In addition to the live load designation there are also differences between methods in regard to load factors, capacity reduction (resistance) factors, dynamic load (impact) allowances, distribution methods and multiple presence factors.

New methods have been introduced in the LRFD code for concrete members including Modified Compression Field Theory for shear and Strut-and-Tie Model for deep flexural members. Equations for reinforced and prestressed sections are now combined into one.

As you can imagine, design calculations using LRFD can be quite tedious if done by hand. Fortunately, software is becoming more available to ease this burden. Unfortunately, new design software can be a fairly significant investment.

The Federal Highway Administration wants all bridges designed after 2007 to be done using LRFD. States are currently in various degrees of implementation and its use is going to be increasingly prevalent over the next few years. If you produce bridges or culverts, LRFD and HL93 are terms you will likely be seeing on plans and specifications, if you haven't already. How and when LRFD creeps its way into underground vaults and manholes remains to be seen.

Delta main office relocating

Delta Engineers will be moving its Binghamton office to a newly renovated building one block east of our current location. The office will close on Friday, Dec 16 for the move and will reopen again on Monday, Dec 19. Only the address will change. All phone numbers and e-mail addresses will remain the same. The new offices, at 184 Court Street, will provide ample space for anticipated growth in the Facilities, Transportation and Precast departments. Delta's Florida branch office, located in Tampa, continues to expand with a focus on land development bridge design.

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The Delta Advantage

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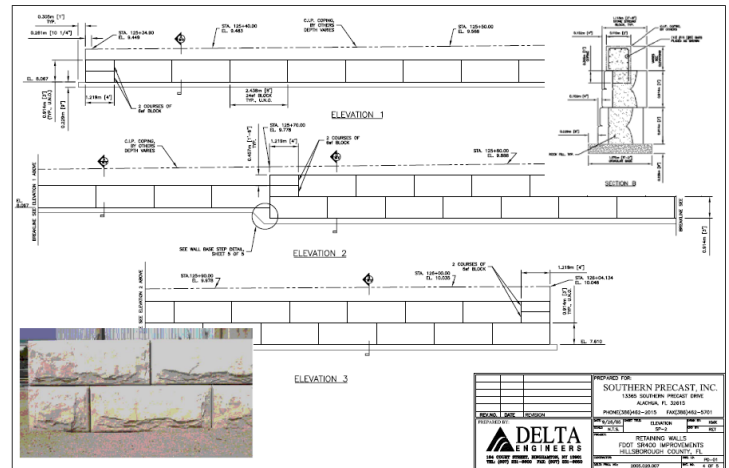
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Featured Project

SR400 I-4 Improvements – Hillsborough County, FL
Owner: Florida Department of Transportation
Produced by: Southern Precast, Inc., Alachua, FL
Specialty Design and Project Drawings- Delta Engineers



Send us your project photos to be featured here, if selected we will send you a Delta Engineers T-Shirt

This Stone Strong® modular precast retaining wall was proposed and accepted by FDOT as an alternate to an as-designed sheet pile wall with cast-in-place concrete fascia. The precast wall was much easier to construct and considerably more attractive than what was shown in the contract plans.