

AGENDA

Techniques, Materials, and Design Considerations
for Strengthening/Repair of Existing Concrete Structures

PULLMAN

Although the analysis and upgrade of concrete structures is somewhat of a “scientific art” that has been practiced for many years, it has evolved into a complex process that requires a blend of engineering, material science and constructability perspectives. Strengthening projects may utilize traditional materials such as conventional cement-based and steel materials as well as advanced composite materials (FRPs) that are commonly used for aerospace applications. The techniques used to design and install these materials for upgrade applications are not common to the engineering and general construction industry which can also make strengthening projects even more challenging and complex than new construction.

There are many factors that create the need for strengthening. They include construction errors, increase in live loads, new code requirements, low concrete strength, voids created during concrete placement, cutting new penetrations, overloading and prevention of progressive collapse from blast loads. This presentation will describe the different design strategies, installation techniques, materials and QC concepts used for upgrading concrete structures.

THE ABOVE WILL BE ILLUSTRATED THROUGH CASE STUDIES, RELATED TO THE FOLLOWING:

Factors Affecting the Capacity of Reinforced Concrete

- Adaptive reuse-change in use
- Overloading
- Missing, misplaced, or damaged reinforcement
- Repair of elements with dimensional issues (too deep, excessive deflection)
- Cutting new small or large penetrations that affect existing reinforcement
- Low strength concrete

Strengthening with Externally Bonded FRP Systems

- Typical FRP forms-sheet and rod
- Installation techniques and QA/QC
- Design concepts per ACI 440 2R-08
- FRP limitations - both strengthening limits and fire rating limitations

Conventional Strengthening Techniques for Cases Where FRP Is Not Viable

- External and internal post-tensioning
- Section enlargement and bonded overlays
- Supplemental steel supports and span shortening



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