STRUCTURAL CONDITION ASSESSMENTS

Structural condition assessments for buildings and facilities are performed for various reasons. The most common reason being damaged or deteriorated conditions noted by facility owners, managers, and users, including the general public. Often structural damage may not be obvious or evident, but there is concern of possible damage following an unexpected impact (ex. vehicle or forklift) or over-load (large snow loading) situation. Also, a change in building occupancy, such as from warehouse to office space usage, is another common reason to perform a structural condition assessment.

Typical examples of damaged and deteriorated conditions are corrosion (rust), cracks, spalls, delamination, discoloration, efflorescence, fractured welds and bolts, and excessive deflection or displacement.

The typical steps taken during structural condition assessments are as follows:

1. Preliminary assessment
2. Site visit
3. Visual and sounding surveys
4. Documentation of damaged and distressed conditions
5. Non-destructive testing
6. Material sampling and testing
7. Analysis
8. The development of a report to document work performed, conclusions, recommendations, and budget cost estimates for repair

The preliminary assessment can include conversations with facility users and managers and the review of any available documents, including original drawings and design criteria, geotechnical reports, and structural calculations. The next critical step is to perform a site visit to visually observe damaged and deteriorated conditions. Observations of adjacent areas, which can potentially impact the primary area of concern, are also taken at this time. During the site visit, the existing condition of the building is documented to note discrepancies (or modifications) to the original design intent and the condition of structural components which may have deteriorated over time due to exposure to harsh environments.

Non-destructive testing (NDT), limited destructive testing, or a combination of both are often performed in support of the structural condition assessment. Non-destructive testing may include visual observations, sounding with chains and hammers, scanning with ground penetrating radar (GPR), or radiography (x-ray) to locate embedded items in concrete or masonry construction, ultrasonic testing (UT) for steel components, or other techniques.

Limited destructive testing or selective demolition/exploration sampling and testing may include:

- Core sampling for compressive strength testing, which can be an indicator of the existing quality of a concrete material
- Sampling and testing of a concrete material to determine its modulus of elasticity (MoE); the MoE is a critical factor in the serviceability of a concrete structure, including the calculation of deflections
- Depth of carbonation sampling and testing to determine the ability of a concrete material to provide corrosion resistance for embedded reinforcing steel
- Chloride-ion content sampling and testing of concrete to determine the amount of chlorides (salts) that have penetrated into a concrete material and can increase the rate of the corrosion of embedded reinforcing steel
- Petrographic analysis of concrete to determine the water-cement ratio, air content, aggregate type and gradation, and other physical and chemical properties of the concrete
- Selective chipping and cutting of concrete and masonry to expose, observe and measure the configuration and condition of embedded items
- Extraction and testing of masonry prisms to determine compressive strength characteristics
- The excavation of test pits to access, observe and test the condition of foundations and/or subgrades
- Mechanical testing and chemical analysis of obtained samples of steel to determine material properties

In addition to the assessment of structural conditions other factors such as, the presence of hazardous materials, the interaction of structural and non-structural components, and historic preservation issues, must be considered.

Critical requirements for a successful structural assessment are the experience, expertise, and engineering judgment of the professionals who perform the work. Also, a published document by the Structural Engineering Institute (SEI) of the American Society of Civil Engineers (ASCE) titled, "Guideline for Structural Condition Assessment of Existing Buildings (document 11-99)," is a valuable resource.

We hope this "Lessons Learned" will be helpful should you have a need for a structural condition assessment.

Respectfully,

ECS Corporate Services, LLC