

Technical News Bulletin

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Investigation and Design Requirements for Repairs to Existing Structures

Introduction

Repairs to existing structures shall be based on a documented understanding of the existing condition, the cause and extent of deterioration or damage, and the required performance of the completed repair. Prescribing a repair without adequate investigation may conceal unresolved deficiencies, transfer distress to adjacent components, compromise the load path, or result in premature failure. The following article establishes minimum standards for investigation, evaluation, design, construction, inspection, and acceptance of structural repairs.

Existing Condition Assessment

Before developing repairs, the design professional shall review available record drawings, previous repair documents, inspection reports, calculations, and relevant maintenance history. Historical documents shall be used for reference only and should not be considered accurate until verified. A field investigation shall verify existing construction and document deterioration or distress, including cracking, spalling, corrosion, section loss, deformation, water intrusion, settlement, impact damage, and undocumented modifications.

The investigation shall extend beyond visibly damaged areas when concealed or progressive deterioration may exist. Appropriate methods may include visual inspection, probing, sounding, ground-penetrating radar, concrete coring, weld examination, material sampling, test pits, selective demolition, and laboratory testing. Verified conditions shall be distinguished from assumptions, and inaccessible areas and investigation limitations shall be documented.

The scope and methodology of the condition assessment should be established using recognized structural assessment standards and the applicable existing-building code. ASCE Manual of Practice No. 158, Structural Condition Assessment of Existing Buildings, should be used for planning and executing the assessment, selecting appropriate investigation and testing methods, evaluating findings, and documenting conclusions. Similarly, ACI 562 provides minimum requirements for assessment, repair, rehabilitation, and quality assurance of existing structural concrete.

Root Cause and Extent of Damage

The design professional shall determine the cause or contributing causes of the damage. Potential causes include overloading, corrosion, moisture intrusion, inadequate drainage, material degradation, settlement, impact, vibration, construction defects, incompatible materials, design errors, or a combination of these conditions.

Repairs shall address both the observed damage and its underlying cause. Where the cause cannot be conclusively determined, the documents shall identify assumptions, remaining uncertainties, required supplemental investigation or monitoring, and procedures for addressing differing field conditions.

Structural Evaluation and Repair Design

The affected structural system and relevant load path shall be evaluated using verified dimensions, material properties, reinforcement, member sizes, connections, support conditions, loads, and boundary conditions. The evaluation should consider remaining capacity, serviceability, stability, load redistribution, and the effects of material removal or temporary supports.

Repair documents shall define repair and demolition limits, materials, surface preparation, reinforcement, anchors, connections, corrosion protection, curing, sequencing, tolerances, and acceptance criteria. Post-installed anchors shall be designed and installed in accordance with approved evaluation reports. Before drilling or coring existing concrete, locate reinforcing steel and embedded utilities using GPR or another approved nondestructive method. Repairs shall also be evaluated for compliance with the applicable provisions of IEBC Chapter 4, Repairs, including requirements governing repair materials, structural repairs, and the extent to which existing structural elements may remain in service.

Relevance to the NIH Bethesda Campus

For projects on the NIH Bethesda Campus in Bethesda, Maryland, repair planning should also consider the operational constraints of occupied and mission-critical facilities. The design professional shall coordinate the investigation, temporary conditions, repair sequencing, access, noise, vibration, dust, utility interruptions, and other



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construction impacts with the NIH project team and affected facility stakeholders, as applicable.

The work shall comply with the applicable building code, referenced standards, the NIH *Design Requirements Manual (DRM)*, and project-specific requirements.

Temporary Conditions, Inspection, and Acceptance

The design shall address conditions during demolition and repair, including temporary shoring, bracing, unloading, access restrictions, construction loads, and sequencing where required to maintain structural stability. Temporary works affecting structural stability shall be designed by a qualified professional engineer. Structural components shall not be cut, drilled, removed, or modified without authorization from the Engineer of Record.

Repair documents shall establish required inspection, testing, and acceptance criteria, including special inspections where applicable. Repairs shall not be considered complete until the required inspections and tests are documented, deficiencies are corrected, and significant field changes are incorporated into record information provided to the stakeholders.

References

1. National Institutes of Health (NIH), Office of Research Facilities (ORF). NIH Design Requirements Manual (DRM)
2. International Code Council (ICC). International Existing Building Code (IEBC), Chapter 4 - Repairs
3. American Society of Civil Engineers (ASCE). ASCE Manual of Practice No. 158, Structural Condition Assessment of Existing Buildings (2024)
4. American Concrete Institute (ACI). ACI 562, Assessment, Repair, and Rehabilitation of Existing Concrete Structures
5. American Concrete Institute (ACI). ACI 563, Specifications for Repair of Structural Concrete in Buildings

