



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

May 2018
Log No. _____

1. State Building Code to be Amended:

- International Building Code
- ICC ANSI A117.1 Accessibility Code
- International Existing Building Code
- International Residential Code
- International Fire Code
- Uniform Plumbing Code

- International Mechanical Code
- International Fuel Gas Code
- NFPA 54 National Fuel Gas Code
- NFPA 58 Liquefied Petroleum Gas Code
- Wildland Urban Interface Code

For the Washington State Energy Code, please see specialized [energy code forms](#)

Section(s): Modify Section 405.1, add new subsection 405.1.1
(e.g.: Section: R403.2)

Title: Repairs to structural concrete.
(e.g: Footings for wood foundations)

2. Proponent Name (Specific local government, organization or individual):

Proponent: American Concrete Institute

Title:

Date: 3-04-2022 (original on 2-07-2022)

3. Designated Contact Person:

Name: Kerry Sutton, PE

Title: ACI, Code Advocacy Engineer

Address: 38800 Country Club Drive, Farmington Hills, MI 48331

Office Phone: (248) 848-3161

Cell: (734) 673-2195

E-Mail address: Kerry.Sutton@concrete.org

4. Proposed Code Amendment. Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.

Clearly state if the proposal modifies an existing amendment or if a new amendment is needed. If the proposal modifies an **existing amendment**, show the modifications to the existing amendment by underlining all added language and striking through all deleted language. If a new amendment is needed, show the modifications to the **model code** by underlining all added language and striking through all deleted language.

Code(s) IEBC **Section(s)** 405.1

Enforceable code language must be used.

This is a proposed new amendment to add the following section.

Amend section to read as follows:

405.1 General. Structural *repairs* shall be in compliance with this section and Section 401.2.

405.1.1 Structural concrete repairs. Repair of structural concrete is permitted to comply in accordance with ACI 562 Section 1.7 is deemed to comply with section 405.1, except where Section 405.2.2, 405.2.3 or 405.2.4.1 requires compliance with Section 304.3.

Add new referenced standard to Chapter 16 as follows:

ACI		American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331
Standard reference number	Title	Referenced in code section number
<u>562-21</u>	<u><i>ACI CODE-562-21: Assessment, Repair, and Rehabilitation of Existing Concrete Structures – Code and Commentary</i></u>	<u>405.1.1</u>

5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed. Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

This proposed amendment adds ACI 562: *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*, to establish minimum requirements for the evaluation, design, construction, repair, and rehabilitation of concrete structural elements in buildings for various levels of desired performance as deemed appropriate for the project. This proposal is intended as a modification where the code is based on the 2021 edition of the ICC *International Existing Building Code*.

In addition to improved life safety, the requirements clearly define objectives and anticipated performance for the code official, owners, designers, contractors and installers. The proposed language is not exclusive as *Section 104.11 Alternative materials, design and methods of construction and equipment* of the 2021 edition of the ICC *International Existing Building Code* allows for alternative design and methods of construction. Citing this reference provides the building official a baseline for considering approval of design requirements and methods of construction. Further, the baseline is beneficial for product suppliers, owners, designers, contractors and most importantly the expectation of a reasonable level of safety for those residing in and working in the State of Washington.

SEE ATTACHMENT WHICH INCLUDES FULL DESCRIPTION OF PURPOSE, BENEFITS AND PROBLEMS ADDRESSED.

6. Specify what criteria this proposal meets. You may select more than one.

- The amendment is needed to address a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- The amendment is needed to address a specific state policy or statute.
- The amendment is needed for consistency with state or federal regulations.
- The amendment is needed to address a unique character of the state.
- The amendment corrects errors and omissions.

7. Is there an economic impact: Yes No

If no, state reason:

The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options.

SEE ATTACHMENT WHICH INCLUDES FURTHER EXPLANATION OF NO ESTIMATED COST IMPACT

- a. **Life Cycle Cost.** Use the OFM Life Cycle Cost [Analysis tool](#) to estimate the life cycle cost of the proposal using one or more typical examples. Reference these [Instructions](#); use these [Inputs](#). Webinars on the tool can be found [Here](#) and [Here](#)). If the tool is used, submit a copy of the excel file with your proposal submission. If preferred, you may submit an alternate life cycle cost analysis.
- b. **Construction Cost.** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

\$Click here to enter text./square foot

(For residential projects, also provide \$Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

- c. **Code Enforcement.** List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

- d. *Small Business Impact.* Describe economic impacts to small businesses:
- e. *Housing Affordability.* Describe economic impacts on housing affordability:
- f. *Other.* Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

ATTACHMENT

Petition to Amend 2018 Washington State Existing Building Code

CHAPTER 4

REPAIRS

SECTION 405

STRUCTURAL

Section 405.1: Modify Section 405.1 as follows:

405.1 General. Structural *repairs* shall be in compliance with this section and Section 401.2.

405.1.1 Repair of structural concrete in accordance with ACI 562 Section 1.7 is deemed to comply with section 405.1, except where Section 405.2.2, 405.2.3 or 405.2.4.1 requires compliance with Section 304.3.

Add new referenced standard to Chapter 16 as follows:

ACI		American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331
Standard reference number	Title	Referenced in code section number
<u>562-21</u>	<u><i>ACI CODE-562-21: Assessment, Repair, and Rehabilitation of Existing Concrete Structures – Code and Commentary</i></u>	<u>405.1.1</u>

Background and rationale - This proposed amendment adds ACI 562: *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*, to establish minimum requirements for the evaluation, design, construction, repair, and rehabilitation of concrete structural elements in buildings for various levels of desired performance as deemed appropriate for the project. It is intended as a modification where the code is based on the 2021 edition of the ICC *International Existing Building Code*. In addition to improved life safety, the requirements clearly define objectives and anticipated project performance for the code official, owners, designers, contractors, and installers. While the proposed language is not mandatory, alternative means and methods remain permitted in accordance with Section 104.11 “Alternative materials, design methods of construction, and equipment.” This addition to the *Washington State Existing Building Code* is especially important as it includes references to standard specifications for materials used to repair concrete elements that are not addressed in the family of International Code Council Codes.

Consistent with the language in ACI Code 562, the proposed language clearly communicates that the use of 562 is not permitted where either the disproportionate earthquake damage (Section 405.2.2), substantial structural damage (Section 405.2.3) or lateral force-resisting elements (Section 405.2.4.1) provisions triggered strengthening. Such work would more appropriately be done using ASCE-41 or other similar resources.

Citing this reference provides the building official a baseline for considering approval of design requirements and methods of construction. Further, the baseline is beneficial for product suppliers, owners, designers, contractors and most importantly the expectation of a reasonable level of safety for those residing in and working in the State of Washington.

ACI 562 complements the *Washington State Existing Building Code* by providing specific direction on how to evaluate, design, and construct repairs to structural concrete and how to address the unique construction methods and problems associated with repair. This standard helps the designer assess the existing structure. The standard then provides the requirements that bridge the inconsistencies and gaps in acceptable criteria that occur from the two following situations that a designer must solve:

1. Repairing a structure according to the original building code used at the time it was built using today's construction methods and materials; or
2. Repairing a structure built according to an older building code but repaired according to the latest building code.

Benefits (Pros) – There are many benefits that ACI 562 provides for the designer, owner, contractor, materials providers, building code official and the citizens residing in and working in the State of Washington. A few of these benefits are:

- Provides a level of expectation of life safety to the public in buildings where repairs or rehabilitation is performed on concrete structural elements.
- Provides clearly defined, uniform requirements aimed at extending the service life of existing structures.
- Provides minimum requirements for efficiency, safety, and quality of concrete repair.
- Establishes clear responsibilities between owners, designers, and contractors.
- Provides building code officials with a means to evaluate rehabilitation designs.
- Provides specific repair requirements that often result in less costly repairs compared to repairs required to meet only new construction requirements.
- References standard specifications for materials used in concrete repairs that are not addressed in the code requirements for new construction such as fiber reinforced polymer (FRP) reinforcement and polymer concrete.

It is noteworthy that ACI has been publishing and making available guidance documents on evaluation and repair of concrete for more than five decades and still it is reported that more than 50% of all structural concrete repairs are found to fail in 20 years or less and 20% of repairs to structural concrete fail within 5 years. Recognizing this as putting the public at risk, ACI Committee 562 saw the need for and developed the *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* as an ACI standard intended for adoption in building codes. ACI continues to maintain and develop additional resources to support assessment, repairs, and rehabilitation of structural concrete in accordance with ACI 562. Among these are:

- [Concrete Repair Manual: Fourth Edition 2013](#)
- [ACI 563-18, Specifications for Repair of Structural Concrete in Buildings](#)
- [MNL-3\(20\) Guide to the Code for Assessment, Repair, and Rehabilitation of Existing Concrete Structures](#)

These resources are readily available to provide greater understanding of assessment, repair and rehabilitation of concrete structural elements. ACI MNL-3 provides case studies demonstrating the ease of use of ACI 562. Numerous technical notes, reports, guides, and specifications that provide background information and technical support are available through other organizations, such as American Society of Civil Engineers, British Research Establishment, Concrete Society, International Concrete Repair Institute, National Association of Corrosion Engineers, Post-Tensioning Institute, Society for Protective Coatings, and US Army Corps of Engineers. Many of these organizations' publications related to concrete repair can be found in the Concrete Repair Manual.

Challenges (Cons) – None. The building code official currently has the responsibility to approve the means and method of repair. This code change proposal establishes a baseline for the building official and all other parties involved.

Estimated impact on life safety - Spalling concrete and failure of connections and anchors pose a life safety threat to the public. This code will provide minimum requirements for assessment, repair, and rehabilitation of existing structural concrete buildings, members, systems and where applicable, nonbuilding structures, thus having a positive impact on satisfying the intent of the code.

Estimated impact on cost - The use of this referenced standard should in many cases reduce the cost of repair. Too often in the process of repair, there is insufficient information to determine acceptance criteria that is amicable to both the owner and the building code official. The result is the determination that the repair must meet the latest building code requirements for new construction. This standard increases the options available for repair and provides the acceptance criteria necessary to permit these options. A case study that illustrates this point: "ACI 562 has been referenced in expert reports for litigation cases, resulting in significantly reduced financial settlements. Denver-based J. R. Harris & Company recently used the code as a standard in several litigation reports assessing damages in existing concrete structures. As an approved consensus standard, according to American National Standards Institute (ANSI) procedures, ACI 562-13 has been accepted as the source standard to use for damage assessment and repair on individual projects by Greenwood Village and Pikes Peak Regional Building Departments in Colorado. Based on this acceptance, the consulting engineer was able to cite the code in their recommendation for structural remediation and determination of damages. In one case involving rehabilitation work on four buildings with faulty construction, J.R. Harris was able to reduce the repair costs from \$12 million to \$3 million, with a repair plan based on the lesser of the demand-capacity ratio based on either the original or current building code per ACI 562."

Resiliency – This proposal will increase Resiliency. Use of the ACI 562 standard helps ensure that repairs are properly performed and will satisfy an acceptable service life. Without minimum standards, repairs may not satisfy the intent of the code or the expectations of the owners or public. Proper evaluation and repairs will improve resiliency of the building. News coverage demonstrates the potential risk to life safety due to deteriorating concrete and inappropriate repairs. A [news investigation](#) of parking structures in the City of Pittsburgh, PA is an example of such coverage.

Sustainability - Reference of ACI 562 in the *Washington State Existing Building Code* will help improve the confidence of owners, builders, and developers regarding effective repairs, upgrades, and reuse of existing buildings in lieu of demolition and replacement. Typically, extending the life of existing buildings is substantially more sustainable than demolition and new construction. Adoption of ACI 562 by reference is needed to help facilitate efforts that conserve energy and resources while maintaining a minimum level of requirements to ensure reasonable levels of life safety, and welfare are afforded to the public.

State and Local References – Several jurisdictions already addressed the need for these requirements. ACI

562 is already being used in several jurisdictions:

City of Los Angeles, California: The Structural Engineers Association of Southern California (SEAOSC) has produced a guide entitled [*Design Guide Vol. 1, City of Los Angeles Mandatory Earthquake Hazardous Reduction In Existing Non-Ductile Concrete Buildings \(NDC\)*](#) which references extensively ACI 562 in Chapter 3 - Structural Analysis and Evaluation Process, and Chapter 4 – Retrofit Design Process.

Florida: Language references ACI 562 in the [*2020 Florida Building, Code 7th Edition*](#): 301.3.4 Concrete evaluation and design procedures. Evaluation and design of structural concrete in compliance with ACI 562 shall be permitted.

Exception: ACI 562 shall not be used to comply with provisions of this code for seismic evaluation and design procedures.

Hawaii: Hawaii was the first state to adopt ACI 562 by reference. [*Section 3401.6*](#) Alternate compliance (see page 27), of the HAWAII STATE BUILDING CODE allows the use of ACI 562 as a supplement to the International Existing Building Code. This became effective on January 1, 2018:

New York City: The New York City Buildings Department issued [*BUILDINGS BULLETIN 2015- 017*](#) in December 2017 Conditions of Acceptance for Fiber Reinforced Cementitious Matrix strengthening systems. FRCM shall comply with the NYC Construction Codes and the applicable provisions for Design which reference ACI 562.

North Carolina: Per [*Section 606.1.1*](#), approved amendment to the 2018 NC Existing Building Code, permits the use of ACI 562 for structural repairs.

Ohio: The Ohio Board of Building Standards Ohio adopted rule changes identified as [*Amendments Group 95*](#). Included in this group is: 3401.6 Concrete evaluation and design procedures. Evaluation and design of structural concrete repairs and rehabilitation shall be in compliance with Chapter 34 and ACI 562.

Letters of Support (included as attachments):

ICRI
A. Taylor



CONCRETE REPAIR
Restore | Repurpose | Renew

January 6, 2022

State of Washington
State Building Code Council
1500 Jefferson Street SE
Olympia, Washington 98504

RE: Support for Adoption by Reference of ACI 562
In the Washington State Building Code
Proposal #442, EB 502.1.1-18

State Building Code Council Members:

I am writing this letter as President of the International Concrete Repair Institute (ICRI) in support of approval of adoption by reference of ACI 562-21 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* into the *Washington State Building Code* as presented in the code change proposal submitted by the American Concrete Institute (ACI).

ICRI is the only non-profit organization that is dedicated solely to the repair of concrete structures. ICRI has over 2500 members and 39 local chapters across the United States and Canada, with a local chapter in the state of Washington.

For the past 33 years, ICRI has developed and promoted best practices for concrete repair and has developed consensus document guidelines for the repair of deteriorated concrete structures. These guidelines have been published and used to result in more durable concrete repairs. It has been proven that poor performance of concrete repairs is a serious issue in the industry, and improvements are needed in concrete repair practices. Several studies indicate that **less than 50%** of concrete repairs perform satisfactorily, posing a significant danger to the health, safety and welfare of the public. This is a tremendous burden on owners, municipalities and the economy.

As a repair industry professional and the President of an organization that represents contractors, design professionals and material manufacturers that are involved in the repair of existing concrete buildings, both I and ICRI as an organization recognize the need for standards that will help design professionals and contractors improve the design, implementation and performance of concrete repairs.

The ACI 562-21 code provides minimal requirements for assessment, design and construction, and implementation of repairs and rehabilitation, including quality assurance requirements, for structural concrete **in service**. ACI 562 encourages evaluation of the structure, and a better evaluated structure is potentially less risky to repair. ACI 562 also requires consideration of durability in design, likely leading to better repair performance and less premature repair failure.

The concrete repair industry utilizes many unique repair strategies. The Code provides latitude and flexibility to the licensed design professional to prepare a design to address the specific issues encountered on an existing building while still meeting the requirements of ACI 562. The ACI 562 code will serve to unify and strengthen concrete evaluation, repair, and rehabilitation projects while accommodating the diverse and unique repair strategies and materials used in the repair industry, making existing structures safer. All of these goals are consistent with the mission of ICRI.

In examining the cost of concrete repairs, the greatest cost to the owner is having to remove and replace previous repairs to a structure due to premature repair failure. I believe the adoption of the ACI 562-19 code has the potential to significantly reduce the long-term life cycle cost of maintaining a structure. I also believe it will provide safer structures with minimal impact on initial cost of repairs.

Any standard that improves the quality of the completed repair work will be a welcome addition to the building code and the concrete repair industry. Use of ACI 562 also contributes to increased sustainability, increasing the probability that a concrete structure will be restored rather than demolished and replaced.

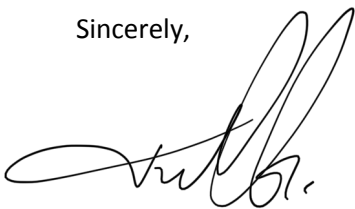
Many leaders in the repair industry support the ACI 562 code and other states, including Hawaii, Ohio , Florida, and North Carolina and jurisdictions have already adopted it. This code complements the *Washington State Building Code* by providing specific direction on how to evaluate and design concrete repairs and how to address the unique construction methods and issues associated with repair. In addition, ACI 562 provides building code officials with a means to evaluate rehabilitation designs.

On behalf of the Board of Directors and members of ICRI, I recommend and hope that the State of Washington will also realize the benefit of this code and adopt code change proposal into the Washington State Building Code.

If you have any questions regarding my comments or would like to discuss my viewpoints in more detail, please feel free to contact me at your convenience.

Thank you in advance for your time and consideration of this recommendation for support of the proposed building code change.

Sincerely,

A handwritten signature in black ink, appearing to read 'John McDougall', written in a cursive style.

John McDougall, CCSRT
2022 ICRI President
919-500-2232
johnmcdougall27540@gmail.com



February 4, 2022

Washington State Building Code Council
1500 Jefferson Street Southeast
Olympia, WA 98501

Subject: Washington State Building Code Amendments
American Concrete Institute, ACI 562-21, *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures*

Dear Councilmembers:

I am writing to express my support for a proposal that the American Concrete Institute (ACI) has submitted to amend the 2018 Washington State Existing Building Code. This amendment would add ACI 562-21 *Code Requirements for Assessment, Repair, and Rehabilitation of Existing Concrete Structures* as a reference standard in Section 405.1.

First, a little about my background. I have been a practicing consulting engineer in Washington State for 25 years, I am past chair of the Structural Engineers Association of Washington (SEAW) Earthquake Engineering Committee, and I am a long-time member of ASCE 7 and ASCE 41 code committees. Since 2008, I have been a voting member of the ACI Building Code committee (ACI 318), and I am currently chair of the main code committee for development of ACI 318-25.

ACI codes and standards are developed through a rigorous standardization process approved by the American National Standards Institute (ANSI). I am particularly proud of ACI's commitment to completeness and accuracy in the development of codes and standards. Through my work with the ACI 318 building code committee, I am familiar with the extensive coordination that takes place during the development of ACI technical documents. This coordination is managed by ACI engineering staff and the ACI Technical Activities Committee.

Consequently, there is a close interrelationship between the ACI 318 code for design of *new* buildings and the ACI 562 code for evaluation and retrofit of *existing* buildings. This is why it is important to amend the 2018 Washington State Existing Building Code so that it refers to the ACI 562 code for existing buildings. The two codes have been coordinated so that they work hand-in-hand. Since the Washington State Building Code already refers to the ACI 318 code for new buildings, it should also refer to the companion code, ACI 562, for existing buildings.

I am happy to answer any of the Council's questions. I can be reached at andrew.taylor@kpff.com.

Sincerely,

A handwritten signature in black ink, appearing to read 'Andrew W. Taylor'.

Andrew W. Taylor, PhD, SE, FACI
Technical Director

AWT:heh

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