Guide for Tolerance Compatibility in Concrete Construction

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This guide lists industry-standard tolerances and presents recommendations for mitigating tolerance conflicts related to embedded items, elevator cores and hoistways, openings in slabs and walls, manufactured couplers and splicing systems for reinforcing bars, stairs, cladding systems, infill wall systems, surface accessibility components, finish floor coverings, and expansion joints. Evaluating tolerance compatibility can be challenging due to the variety of materials, products, and elements that interface with, or connect to, concrete construction. Failure to accommodate these various tolerances could have a significant impact on construction quality, cost, and schedules. Architects and engineers can use these guide recommendations to accommodate individual material, product, and element tolerances at their interface with concrete construction. Contractors can use these guide recommendations to mitigate tolerance conflicts during the construction phase.

The materials, processes, quality control measures, and inspections described in this document should be tested, monitored, or performed as applicable only by individuals holding the appropriate ACI Certifications or equivalent.

Keywords: construction; embedded items; foundation; reinforced concrete; specification; tolerance; tolerance compatibility.

CONTENTS

CHAPTER 1—INTRODUCTION AND SCOPE, p. 2
1.1—Introduction, p. 2
1.2—Scope, p. 2
1.3—Unit conversions, p. 2

CHAPTER 2—DEFINITIONS, p. 2
2.1—Definitions, p. 2

CHAPTER 3—TOLERANCE COORDINATION AND RESPONSIBILITY, p. 3
3.1—Tolerance coordination meetings, p. 3
3.2—Responsibilities, p. 3
3.3—Review and approval, p. 4
3.4—Measurements, p. 4

CHAPTER 4—CREATING TOLERANCE COMPATIBILITY, p. 5
4.1—Steps toward tolerance compatibility, p. 5
4.2—More restrictive tolerances, p. 5
4.3—Tolerance limit considerations, p. 6
4.4—Coordinating architectural layouts with structural framing, p. 8
4.5—Communicating information, p. 11

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CHAPTER 5—TOLERANCES AND METHODS OF ACCOMMODATING TOLERANCES, p. 11
5.2—Elevator cores and hoistways, p. 16
5.3—Openings in slabs and walls, p. 17
5.4—Manufactured couplers and splicing systems for reinforcing bars, p. 22
5.5—Cast-in-place stairs, p. 23
5.6—Cladding systems, p. 24
5.7—Infill wall systems, p. 37
5.8—Surface accessibility, p. 41
5.9—Finish floor coverings, p. 43
5.10—Expansion joints, p. 44

CHAPTER 6—REFERENCES, p. 45
Cited references, p. 46

CHAPTER 1—INTRODUCTION AND SCOPE

1.1—Introduction

Evaluating tolerance compatibility at the interface between concrete and other building systems is challenging because materials, products, and elements that connect to the concrete often have tolerances that differ from those for concrete. Coordinating these different tolerances early in the project reduces problems that can impact quality, cost, and schedule during construction.

Architects and engineers can use the recommendations in this guide to accommodate individual material, product, and element tolerances at their interface with concrete construction. Contractors can use the recommendations in this guide to mitigate tolerance conflicts during the construction phase. To assist the architect, engineer, and contractor, this guide lists industry-standard tolerances and presents recommendations for mitigating tolerance conflicts related to embedded items, elevator cores and hoistways, openings in slabs and walls, manufactured couplers and splicing systems for reinforcing bars, stairs, cladding systems, infill wall systems, surface accessibility components, finish floor coverings, and expansion joints. This guide does not list all concrete or industry tolerances or all potential tolerance conflicts.

1.2—Scope

Tolerances for concrete construction from ACI 117 and other industry standards developed by trade and standards-writing organizations are discussed. Tolerances and suggested methods of mitigating tolerance conflicts for common concrete construction procedures and typical construction materials that interface with or connect to concrete elements are described. This guide is not intended to apply to special structures, such as nuclear reactors and containment vessels, bins, prestressed circular structures, thin shell structures, and single-family residential construction. Construction projects may require tolerances that are less or more stringent than contained in this guide.

1.3—Unit conversions

Hard conversions are used throughout this guide. Where individual trade or standards-writing organizations have established a specific SI equivalent to inch-pound units, the value determined by the organization is used. The equivalent SI units for the same inch-pound unit from different sources could be different. Use the units and tolerances specified in the construction documents. If the drawings are in one system of measurement and the tolerances are in another, a soft conversion is acceptable but should not exceed the published tolerance.

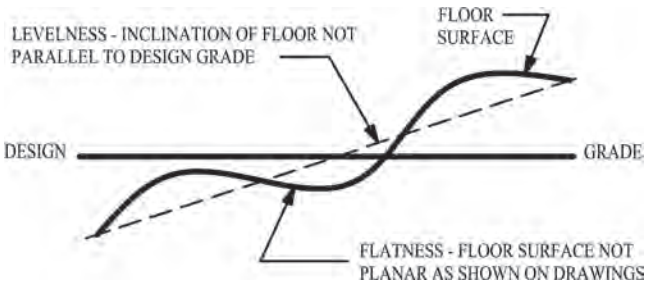

Fig. 2.1—Flatness and levelness.

CHAPTER 2—DEFINITIONS

2.1—Definitions

ACI provides a comprehensive list of definitions through an online resource, "ACI Concrete Terminology," http://www.concrete.org/Tools/ConcreteTerminology.aspx. Definitions provided herein complement that resource.

anchor bolt—Refer to ACI Concrete Terminology. See **rod, anchor**.

assembly tolerance—overall tolerance for the assembly of components.

bearing devices—shop-attached base and bearing plates; loose base and bearing plates; and leveling devices, such as leveling plates, leveling nuts and washers, and leveling screws.

component tolerance—permitted deviation for a single component.

curtain wall—cladding system installed on the exterior of the primary building structure and carrying no loads other than its self-weight, wind, or seismic loads.

datum—ideal geometric point, line, or plane used to define the location or orientation of a constructed work.

envelope tolerance—boundary defining the permitted deviation for any accumulation of tolerances on a feature, component, or assembly.

erection tolerance—permitted deviation in the orientation or location of a component resulting from its erection or installation.

fabrication tolerance—permitted deviation from the specified dimensions or shape for a manufactured product.

feature—geometric aspect of an element, such as a surface, edge, line, centerline, median plane, corner, or center point.

flatness—deviation of a surface from a plane. (Fig. 2.1)

levelness—deviation of a line or surface from a horizontal line or surface. (Fig. 2.1)

location tolerance—permitted deviation in position relative to a datum.