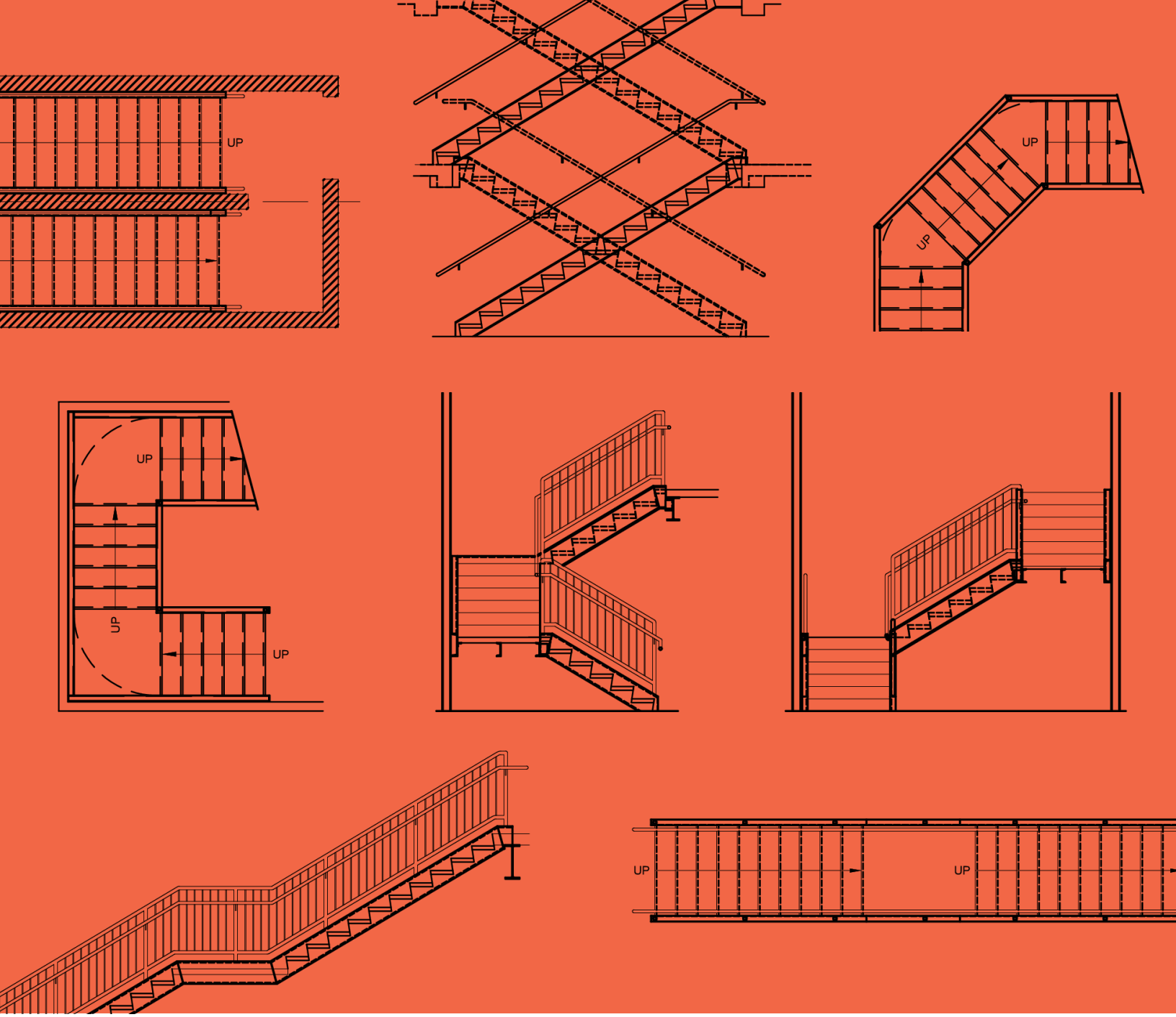

Design Guide 34

Steel-Framed Stairway Design

Smarter. Stronger. Steel.

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American Institute of Steel Construction

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Preface

This Design Guide provides guidance for the design and layout of steel elements for steel-framed stairways, guards, handrail, and related components. Background information regarding stairways, code requirements, design methods, and design examples are presented. The goal of this Design Guide is to provide sufficient information for a structural engineer to complete the design of a steel-framed stairway or provide adequate guidance to delegate this work to another engineer or stair designer.

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Purpose

This Design Guide was written in an effort to resolve common issues that occur during the planning, design, detailing, fabrication, erection and construction process related to steel stairways. Part of this effort involves providing guidance for structural engineers to apply engineering mechanics to the design of stair elements while conforming to industry standards.

The other part of this effort is to create better lines of communication and coordination between each project team member. The level of information, details and requirements for stairways can vary significantly from project to project. The following is a list of some of the more common items that should be reviewed and considered related to stairway design:

(1) Adequate stairway shaft dimensions

Determining an accurate opening size for stairways is critical early in the design development process. This Design Guide provides sizing recommendations in Section 3.4.4. These recommendations provide member suggestions, egress requirements and connection considerations to determine the preliminary opening size.

Adjustment and flexibility can also be provided in the design to accommodate changes to the stair layout or construction tolerances. Designers should provide stair connections that allow for adjustment through the use of slotted holes or adjustable bearing details. Refer to Figure 6-3 for the use of an extended plate detail with horizontal slotted holes that allow for adjustment during steel erection. This Design Guide provides several connection options in Chapter 6.

Designers can also provide a concrete slab edge angle detail that allows for adjustment by the detailer when the stair detailing is underway. Refer to Figure 6-8 for a detail that provides adjustment during detailing. Similarly the detailer, fabricator and erector can provide flexibility at opening locations by shipping the concrete slab edge angle as a loose piece to be field welded to the perimeter beams. This allows for minor adjustments without having to remove or modify fabricated steel. Final stair opening sizes should be coordinated with project team members.

Completing a field survey or creating an accurate set of as-built drawings will help to avoid field modifications. This can be especially important in existing structures or when stairs will connect to concrete or masonry construction. This Design Guide provides information regarding tolerances for different construction materials in Section 8.1.

Items to take into consideration when allocating stairway shafts in floors:

- Code requirements for egress width
- Tread width and depth
- Rise per tread
- Landing dimensions
- Space required between stair runs
- Space allocated for handrail and guards
- Space allocated for stair connections to header beam or support steel
- Allowance for the member width of stringer and landing members
- Structural support for the stair

(2) Code requirements for stairways, handrail and guards

Code requirements for a stair dictate the functional aspects of layout and design. It is imperative that accurate dimensions and clear requirements be provided by the architect to ensure the proper layout of a stairway can be achieved. Chapter 3 of this Design Guide provides an overview of various code requirements. These requirements should always be verified with the architect for each project.

For projects using delegated design submittals for structural engineering of stairways, code requirements should be confirmed with the architect before detailing work begins. The architect should review stair shop drawings for aesthetic elements and code requirements and then provide approval when all criteria are met. Adequate time for the review process should be included. Chapter 9 of this Design Guide provides additional information related to delegated design.

(3) Quality of design documents and information

The design documents should clearly show the work that is to be performed and should give sufficient dimensions and guidance to accurately convey the design intent for the work to be constructed. Designers

should carefully review design documents and project specifications to ensure that there is consistency throughout.

Typical details and standard notes are often provided for stairways and guards. This level of information often leads to conflicts between the design documents and project specifications. It also leads to unnecessary delays and confusion that need to be resolved through a formal request for information process. Designers need to take care to provide accurate information throughout their design documents or defer all aspects of the design to another party. Appendix A of this Design Guide provides checklists that can help to ensure that designers have provided adequate information in their design documents.

Project team members should coordinate architectural requirements with the Architect to ensure that structural requirements can be met while maintaining aesthetic expectations. These requirements will vary based on the stair type and stair class. This Design Guide covers general stair information in Chapter 2. Additional guidance and recommendations for member types with advantages and disadvantages for each type can also be found in Chapter 4, Chapter 5 and Chapter 7.

(4) Coordination of structural support with stairway support

An often overlooked aspect of stairway design is the requirement for structural support of the stair stringers and landings. Many times, stairs are shown pictorially on drawings without consideration of how they can be supported by the main structure. Each intermediate landing must have some sort of structural support with at least two support points. It is most desirable to have the intermediate landing supported at each of its four corners. To accomplish this, the main building structural members must be present either at the level of the landing or at a location that will permit the landing to be hung from the structure above or supported from below.

Stair runs also require the same consideration. With a fully supported landing, the stair run can be supported by the intermediate landing and the lower or upper floor framing. A review of Chapter 3 of this Design Guide will aid designers in the framing layout to provide adequate support for stairways.

(5) Contractual aspects of deferred submittals, delegated design, and design-build projects

Careful thought and consideration should be put into any portion of work that is part of a deferred submittal, delegated design, or a design-build process. Each of these options has different expectations, requirements and liability. Designers should clarify their scope of work and expectations for project submittals before entering into a contract. Contractual guidance is outside of the scope of this Design Guide.

Working with the project team to overcome and resolve the issues presented here can help to avoid potential problems related to the design and construction of stairs. Structural engineers, detailers, fabricators and erectors can utilize this Design Guide along with years of experience to continue providing steel solutions for everything from simple egress stairs to unique feature stairs.