

Elevator design is a multidisciplinary coordination effort in which raising key structural coordination questions early can minimize future changes. This checklist provides a basis for key items to coordinate with the architect and elevator consultant during the design phase of a project.

The Checklist is divided into 4 Sections:

- A. Elevator Geometry and Clearances
- B. Elevator Design Loads
- C. Elevator Structural Analysis
- D. Elevator Structural Drawings and Detailing

Ideally, there is an opportunity to coordinate with an elevator consultant and the architect during the design phase. At this time, the elevator consultant provides approximate loads, and defines appropriate speed, capacity, and quantity of elevators based upon planned building use, anticipated traffic, and budget. During the construction phase, the final elevator contractor is awarded and elevator shop drawings are submitted for approval. It is common at this point for the structural engineer to find differences in final elevator geometry or loading from that assumed in design, which can result in minor to major modifications in the structure.

For this reason, close coordination with the elevator consultant and architect during design, as well as providing flexibility in the structure where possible, can mitigate potential structural changes during construction. It is prudent to reflect as many design assumptions as possible in the design documents so as to effectively convey deviations discovered in shop drawings, and notify the project team of potential structural changes required to accommodate the final elevator design.

Note that the checklist that follows is primarily based on a steel elevator braced frame with concrete foundation system, but can be applied to masonry or concrete shear wall systems as well.

Importantly, this checklist is intended to serve as an overall starting point for your design coordination efforts. Please customize as required to meet the needs of your specific project. Do you have additional items to include as part of this checklist? We welcome your feedback! Please email Cathleen Jacinto at <u>Cathleen.Jacinto@LearnWithSEU.com.</u>

<u>Helpful Link:</u> <u>ANSI / ASME A17.1 - 2007 Safety Code for Elevators and Escalators</u> – For Purchase



A. Elevator Geometry and Clearances

- Determine elevator type selected by the owner and/or architect. There are three main elevator types – traction with a machine room, machine-room-less (MRL) traction, and hydraulic. Further discussion can be found in the article <u>"Elevator</u> <u>Types"</u> from Archtoolbox.*
- 2. What is the required minimum elevator pit depth?
- 3. What are horizontal clearances within elevator hoistway in both directions?
 - a. Double check that structural elements (steel members, piers, foundation wall, etc) remain outside of horizontal clearances. Any horizontal ledges typically in excess of 4" within the hatch will need to be canted.
 - b. If steel columns bear on a foundation pier integral with a foundation wall system, confirm that the column base plate and pier do not encroach into the required elevator clearance.
 - c. If you are utilizing steel angle or channel vertical braces, indicate flange orientation and ensure the flanges do not encroach into the interior elevator shaft clearance nor conflict with exterior wall cladding.
- 4. What is the minimum vertical clearance (i.e. overrun height) above the top floor?
- 5. In a traction elevator with an overhead machine room, will the building employ a structural slab or will machine beams be used to support elevator equipment? For a machine beam arrangement, closely coordinate the machine beam(s) connection to the base structure with the elevator contractor, as location is critical.
- 6. Confirm machine room location, if any.
- 7. What is the vertical clearance required for the machine room?
- 8. Provide support for vertical elevator guiderails (elevator contractor typically provides elevator guiderails). Request maximum span for elevator rails from elevator consultant. Typically, rails cannot vertically span more than 12 to 14 feet. Intermediate supports may be needed where floor-to-floor height exceeds guiderail max span.
- 9. Provide elevator divider beams, if required, and coordinate locations with elevator consultant.
- 10. Provide a hoist beam above elevator shaft for equipment transport, if required. Oftentimes, elevator equipment is hoisted into place via the beam. The hoist beam will reduce installation time and provides a means for equipment removal should it become necessary. The elevator consultant should provide its location, imposed loading, and elevation.

^{*}The "Elevator Types" article can be found at:

http://www.archtoolbox.com/materials-systems/vertical-circulation/elevatortypes.html



B. Elevator Design Loads

Request the following design loads to assume from the elevator consultant:

- 1. Do design loads include factor of safety for impact?
- 2. Are there seismic requirements for the geographic area?
- 3. Elevator Pit Load Magnitudes and Locations
 - a. Confirm application of pit loads with the elevator consultant to confirm which loads are to be applied independently and concurrently.
 - b. Confirm if an uplift reaction is to be considered at the elevator pit floor. Generally, there are no uplift conditions at the pit unless a 'basement set' traction machine arrangement is employed. In this condition, the machine anchorage to structure imposes significant uplift loading to structure. The machine in this arrangement will be located immediately adjacent to the hoistway rather than overhead. Machines may be tied to the structure by embedded anchorages for concrete foundations.
 - c. If concentrated loads are provided, what is the area of load application?
- 4. Elevator Guiderail Load Magnitude, Directionality, and Locations
 - a. Guiderail loads can be applied in the downward direction and two lateral directions.
 - b. Determine location for the downward guiderail load. Confirm with consultant if this load is only applied at the base of the guiderail, not at each horizontal support. If the guiderail is to apply a downward load only at the base, ensure that movement is allowed at each connection to horizontal support in shop drawings (i.e. that the rail is allowed to vertically slip and not induce load onto the intermediate supports).
- 5. Elevator Sheave Beam Loads
 - a. Apply elevator loads to longest-span beam on each level, and assign same size to all 4 beams to allow for flexibility when the final elevator consultant is chosen.
 - b. For MRL (machine-room less) elevators, request if high loads are required at the top of the elevator.
- 6. Machine Room loading
 - a. Refer to the Live Load required in governing building code.
 - b. Request actual elevator equipment weight and size from the elevator contractor.
 - c. Choose the governing loading.
- 7. Hoist Beam loading, if a hoist beam is to be shown on design drawings



C. Elevator Structural Analysis

- 1. Are members supporting elevator loads designed per current ANSI/ASME codes with respect to deflection and strength?
 - a. Vertical deflection of supports for machinery or sheave beams, and guiderail supports are not to exceed L/1666 per ASME A17.1, 2007 Part 2.9.5. Confirm with current code and your governing building code.
 - b. Guiderail supports (beams or walls) shall be capable of resisting the horizontal forces imposed by guiderail loads with total deflection not to exceed 1/8" at point of support per 2007 ASME A17.1 Part 2.23.5.2. Confirm with current code and your governing building code.



D. Elevator Structural Drawings and Detailing

- 1. Coordinate with architect where vertical bracing can be placed to coordinate with door openings. Coordinate beam depth above door openings to meet clearance requirements.
- 2. Coordinate exterior wall details with the architects.
 - a. For a steel elevator frame, if space permits, try to avoid sandwiching the exterior wall within the structural elevator frame to avoid complications with vertical bracing details.
- 3. Machine rooms must typically be a fire rated enclosure. Ensure machine room slab construction and thickness are consistent with fire rating requirements.
- 4. Slab penetrations may be required for rope drops or pipes. Consider adding notes to drawings that penetrations are to be coordinated with elevator contractor prior to slab pour to avoid coring.
- 5. How will elevator sheave beams connect into base structure beams? Confirm top of steel elevations coordinate with elevator sheave beams.
- 6. Check that the elevator sill support detail coordinated with the architectural drawings and elevator specification.
- 7. In overhead machine rooms, coordinate the top of machine beam elevations or steel blocking beam elevations are flush with the top of finished slab. This will ensure that the machine equipment bears directly on steel and can be appropriately isolated as required. Note that blocking beams are steel beams provided above machine beams typically supplied by the elevator contractor.
- 8. Coordinate sump pit size and location with architectural and MEP disciplines. Provide detail for sump pit support.
- 9. Are pit stairs required? Pits deeper than 4'-0" may require stairs.
- 10. Indicate any dropped footing elevations, where appropriate.
- 11. Is there a slab connected to the concrete or CMU shaft wall? Some contractors opt to pour the slab after the CMU or concrete shaft wall is erected. Consider slab dowels or couplers.
- 12. Are architectural drawings referenced?
- 13. It is prudent to show assumed elevator loading and locations on construction documents. When elevator contractor is hired and you receive shop drawings, it will be easier to provide comments for any deviations from design loading and potential structural changes required to accommodate changes.