

# structural design

## Scaffolding... A Designer's Guide

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Mobile scaffold towers with tie-ins properly attached to the structure through the brick veneer.

### Design Criteria and Specifications for Scaffolding

If there are limitations imposed by the project, it is important that the scaffolding requirements are clearly identified in the Construction Documents or addressed at a pre-bid meeting. These could have a significant impact on the cost of the project. On some projects, this may be as minor as identifying possible locations for the lateral tie-ins of ground supported scaffolding.

*“...potential loading conditions of scaffolding should be reviewed...”*

However, on projects where scaffolding will be supported directly on portions of the building being renovated, the potential loading conditions of scaffolding should be reviewed during the design phase to verify that they can be safely installed. This will require someone with a general knowledge of scaffolding to develop potential loading conditions so the Design Professional can determine the effects on the building. If it is determined that there are load restrictions on certain portions of a building with respect to the temporary scaffolding loads, these conditions should be indicated in the Construction Documents so the scaffolding can be properly bid.

On most restoration projects there is a need for scaffolding to access portions of the building or structure to perform the required work. Usually, the Construction Documents prepared by the Design Professional clearly identify the required repair and renovation work to be completed; however, performance specifications for the scaffolding are often overlooked.

The primary responsibility for the scaffolding design and installation rests with the Contractor and their scaffolding supplier. However, there are specific issues that the Design Professional should review. These issues can affect the structure as well as the safety of the scaffolding itself.

Some of the general requirements of scaffolding from the Design Professional's point of view should include:

- Design Criteria and Specifications for Scaffolding.
- Scaffolding Submittal Review.
- Scaffolding Concerns during Construction.
- Follow-up after Construction.

*“...there are specific issues that the Design Professional should review.”*

In most cases, the scaffolding limitations can be provided in a Performance Specification. As a minimum, the Construction Documents or Scaffolding Specifications should provide the following information:

- The length of the contract. This could limit the type of scaffolding to be used, whether it is a hung scaffold system or an erected scaffold tower.
- Expected loads that may be placed on the scaffolding, and the number of working levels that will be required for tower scaffolding. During restoration work, it may be required to remove portions of the buildings facade and these loads may need to be placed on the scaffolding.
- Scaffolding tie-in requirements and any limitations that may be present on the building.
- Design loads at all scaffolding attachment and bearing points onto the building.
- Identify any known buried structures where potential scaffolding may be placed. In many older urban locations, there may be vaults below the sidewalk in front of the building.

Placement of tall scaffold towers on these areas could be of concern.

- Existing structure limitations where scaffolding could be supported directly on portions of the building. Based upon the Design Professional's analysis of the building, these limitations may begin as maximum load capacities, maximum number of planked levels, or maximum allowable scaffold leg loads. If there are areas of the building which cannot support the scaffolding loads, these areas should be clearly indicated.

- Limitations on enclosing the scaffolding. When plastic sheeting or other material is provided as potential weather protection on a scaffolding system, this can increase the loads transmitted to the lateral tie-ins and other supporting members. If these potential loads are too high, it should be indicated that the scaffolding is not to be enclosed.

- Load restrictions for roof supported outrigger beams that may be used for suspended scaffold or boatswain chairs. With the use of outrigger beams, a counterweight is usually incorporated on the beam to counterbalance the suspended loads. The roof must be capable of

supporting these loads, as well as the concentrated point load at the outrigger pivot point. That usually is at the parapet or edge of the roof. The parapet integrity is also important if parapet clamps are used.

- Lifeline attachment points for personnel using suspended scaffolding. (Each should be capable of supporting 5000 pounds per person.)

- Soil bearing requirements for ground-supported scaffolding.

- Qualification requirements of the scaffolding designer and installer. In some locations there may be local codes which dictate that the scaffolding be designed by a Professional Engineer.

## Scaffolding Submittal Review

Before construction starts, submittals for the proposed scaffolding should be provided by the Contractor for review. This should be mandatory before scaffolding installation begins. Submittals should include all tie-in and

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special support conditions, as well as attachment point loads. In most cases, the scaffolding will be designed by an Engineer retained by the scaffolding company or Contractor. This Engineer will be responsible

## Definitions

**Boatswains Chair:** A single-point adjustable suspension scaffold consisting of a seat that supports a single person.

**Lifeline:** A flexible line that connects a personal harness to an anchorage point on the building forming a fall protection system.

**Outrigger Beam:** A structural member that extends out and away from the building to support a suspended scaffold.

**Parapet Clamp:** A device used to attach a suspended load of lifeline to a parapet.

**Stand-off:** A horizontal strut to transmit both tension and compression forces to maintain the scaffolding upright.

**Suspended scaffold:** A scaffold suspended by ropes or other non-rigid means from an overhead structure.



*Scaffold stand-off going through the stone veneer attaching to the structure back-up system.*

for the scaffolding components and general safety issues of the scaffolding system. However, depending on the requirements of the performance specifications for the project, the Engineer and Contractor may or may not have reviewed the actual connections of the scaffolding to the building and the impact of the loads on the building components themselves. In either case, these connections and loads must also be reviewed by the Design Professional responsible for the project.

The Design Professional's responsibility is to review the scaffolding submittals to verify that the loads imposed on the building by the scaffolding are acceptable, and will not overload any component of the building. The scaffolding erection drawings should clearly indicate the method of attachment of the scaffolding and the design loads at each point where the scaffolding is in contact with the building. These items will allow the Design Professional to assess their impact.

For scaffolding towers including motorized scaffold tower units that are completely ground supported, the only connection to the building may be stand-offs which are used for lateral stability. These connections will impose tension and compression forces into the building. All too often, these connections are made into a masonry veneer on the building and not to a structural component. In most cases the veneer is an architectural finish and is not capable of

safely supporting the imposed loads from the scaffold. These connections must be reviewed to verify that the loads are properly transferred and resisted by an adequate structural component and not an architectural finish.

*“...revised scaffolding  
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reassessed.”*

## Scaffolding Concerns during Construction

During the course of construction and renovation operations, scaffolding may need to be reworked or connections temporarily removed because there may be removals of veneers or architectural finishes. These conditions should be addressed on the original scaffolding submittals, if they are known. However, conditions may arise which are unforeseen and revised scaffolding connections and support conditions must be reassessed. The appropriate tie-in and support of the scaffolding must be maintained at all times, and coordination of removals and proper scaffolding support must be continually evaluated during the project by the Contractor and the Design Professional.

In areas where snow may be encountered, these loads must also be addressed with the scaffolding design if the construction is occurring during periods when snow may be expected.

The snow loads on the scaffolding planked levels may be greater than the general construction loading. This increase in total leg loads on the scaffolding is important if the scaffolding is supported directly on portions of the building. Roofs that support snow loads and are also being used to temporarily support scaffolding must be evaluated.

If a project starts during the summer and is unexpectedly extended into winter, the scaffolding and support conditions should be reevaluated. The Design Professional must be aware of these conditions, and in some cases, the scaffolding may need to be removed and construction operations suspended until weather permits.

## Follow-up after Construction

Once construction and renovation operations have been completed and dismantling of scaffolding is underway, there may be areas on the building which may need to be patched or restored to their original conditions where



*Scaffold tower legs supported directly on roof with cribbing to distribute loads over the roof.*

scaffolding was temporarily connected. Special sequencing of work may be required as the scaffolding is removed to allow the scaffolding to be properly tied-in and supported while these operations are completed. These conditions should be reviewed by the Design Professional to verify that the loadings on the building that may occur during these operations are acceptable.

**“Review the potential effects of the scaffolding early in the design phase...”**


## Conclusion

Scaffolding is a tool that is often needed to perform work on many renovation projects. Although the scaffolding itself is generally the responsibility of the Contractor, the Design Professional for the building must be aware of the potential problems of the temporary loads applied by the scaffolding. Review the potential effects of the scaffolding early in the design phase providing the appropriate design criteria for the scaffolding, and also perform reviews of the scaffolding erection drawings for their impact on the building.


Scaffolding may be modified during construction operations as work progresses, and loading conditions may change. The Design Professional should continue to monitor these changes to verify that the structural components of the building are not compromised for the integrity of the building as well as for the safety of the scaffolding system. If these general procedures are followed, they will reduce the chance of delays in construction, there will be increased safety with regard to the use of scaffolding, and they can be a key component to a successful project outcome.

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