

SKIPPED FLOORS

DO ALL FLOORS NEED TO BE TIED OFF?

There are several continuous tiedown systems available that offer solutions to resist the high overturning forces inherent in multi-storey light frame structures. Typically these systems fall into one of two categories: those that call for every floor to be tied off and those where floors are skipped.

A skipped floor system restrains two or more floors with a single restraint point to provide overturning resistance. An all floors tied-off system differs in that it establishes overturning restraint at every floor.

Although a skipped floor system and an all floors tied-off system initially appear to be similar, there are some significant differences in load path and performance that could potentially compromise the integrity of a structure. Skipping floors is not recommended, and familiarization with potential issues is strongly encouraged when choosing a tiedown system.

ISSUES TO CONSIDER WITH SKIPPED FLOOR SYSTEMS:

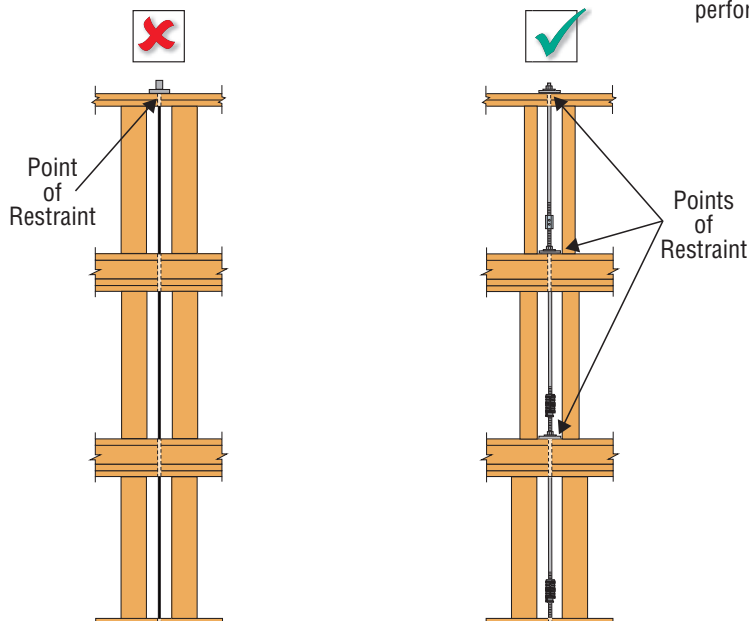
INCREASE IN COMPONENT SIZES – In a skipped floor system, the overturning forces transfer up the building until a restraint is reached. As a result, all elements at the restrained point have to resist uplift forces for any non-restrained stories below. This results in increased lumber, threaded rod, and bearing plate sizes. In a tied-off system, the incremental uplift at each level is transferred directly into the tiedown system at that level.

DRIFT – A skipped-floors system that is properly designed to resist demand loads may not be sufficient to satisfy drift requirements. Test results indicate that skipping floors has the potential to substantially increase inter-storey drift. Even if drift analysis is not required in your area, it is a critical element to multi-storey design.

REDUNDANCY – Even when appropriately designed, structural elements can perform unexpectedly during major seismic and high wind events. In a skipped floor system, multiple floors rely on a single component for their performance. If that element fails, the entire uplift resistance for all non-restrained floors below may be compromised. However, with an all floors tied-off system, the lower floors do not rely on the stability of the upper floors for their performance.

SHRINKAGE – In tiedown systems wood shrinkage creates gaps at the restraint points. When a floor does not have a restraint, this gap will transfer up to the next restraint point, resulting in a larger space between the nut and bearing plate. This additional space will result in increased horizontal drift. In addition, it is recommended that shrinkage is compensated for at every level.

CONSTRUCTION STABILITY – A functioning shearwall needs to have holdowns installed to properly perform. A system where all floors are tied off requires no additional shoring or bracing during construction because the structure is restrained at each level once the system is installed. In a skipped-floor system, the designer or builder may want to consider requiring a temporary bracing method during construction until the skipped floor system is completely installed. This temporary bracing can help prevent collapse or any damage that might occur during a seismic or wind event. In a tied-off system, all holdowns are installed as the structure is built ensuring that the shearwalls will perform as designed if an event occurs during construction.



SKIPPED FLOOR SYSTEM:

A single point of restraint for multiple levels

ALL FLOORS TIED-OFF SYSTEM:

Overturning restraint provided at each level

To learn more about skipped floor vs. tied-off systems and Simpson Strong-Tie® ATS testing, visit www.strongtie.com/skip.