

FLOOR LOADING GUIDELINES

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Introduction

A high-density mobile storage system consists of shelving mounted on mobile carriages that roll on fixed tracks so that multiple rows of shelving can be accessed by only one aisle. Since high-density mobile storage units significantly increase the available storage capacity when compared to traditional static filing systems, floor loading may increase beyond that of normal floor design live load.

This handbook is to be utilized by the architects and engineers who will determine the ability of the floor system to safely support Spacefile's high-density mobile storage units. Spacefile International Corp and its engineers will not determine if our high-density mobile storage systems can be installed on a particular floor due to the fact that this is the responsibility of the architect and structural engineers of record. This handbook contains example calculations, diagrams, and charts to aid the architects and engineers of record in determining the suitability of the floor system for our high-density mobile storage units. Should a floor loading issue arise, Spacefile International Corp will provide suggestions and alternatives in order to assist in the successful resolution of the floor loading issues.

When placing a high-density mobile storage system on a structural floor composed of slabs, beams, and girders, the architect or engineer of record should consider the entire structural floor assembly. Most high-density mobile storage systems are relatively small and can be installed on structural floors without retrofitting the existing structure. For existing buildings, additional structural support, if required, will be more economical if the support beams are installed above the slab. For buildings being designed or built, the addition of beams under the tracks and beams and girder reinforcement, if required, should occur below the floor.

The structural floor system has to be reviewed for both stress and deflection due to the fact that a high-density mobile storage system is very sensitive to floor deflection. The wheels will move by gravity if the floor deflects significantly after the system is loaded. To eliminate "drifting" – the unwanted movement of the carriages – it is important for the design professional to use realistic loads in order to determine floor deflection. This handbook will address the multiple aspects of the design so that the high-density mobile storage system can successfully be placed on a structural slab.



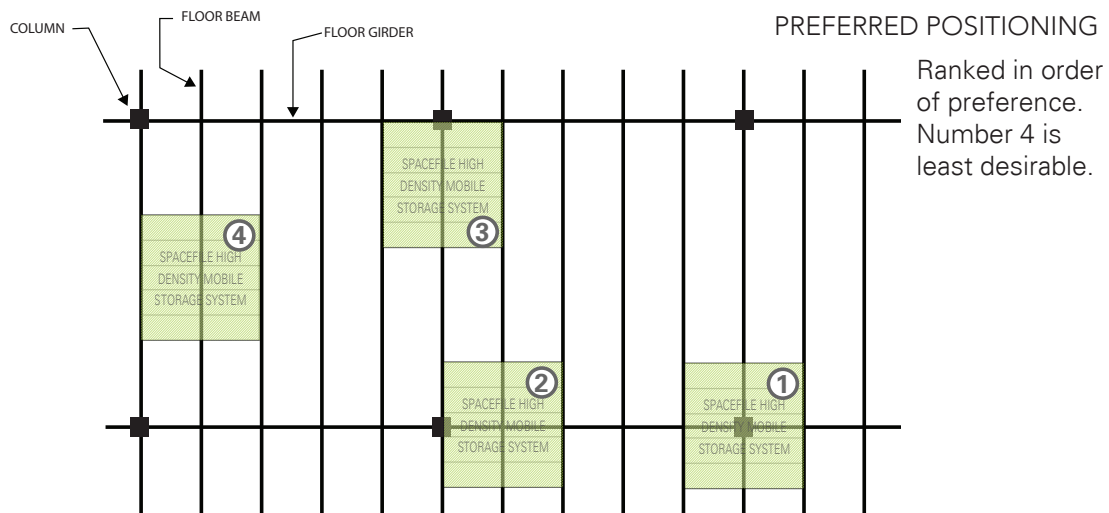
Floor Loads

Continuous tracks support the entire weight of the high-density mobile storage unit which are then in turn supported by the structure. At the rail locations, the load transfers into a line load and therefore the use of average load per square foot or an alternative uniform load may yield flawed results. For design purposes, no live load occurs between the tracks of the high-density mobile storage system. Since a high-density mobile storage unit is a real load, shear stresses and floor deflection for concrete flat plates should be reviewed. An uniform live load may be appropriate when a high-density mobile storage unit is located on a flat concrete slab or flat plate, or other heavily designed concrete floor systems.

The consideration of an "open aisle" within the high-density mobile storage unit, a realistic live load is to place a 200 lbs human in front of each shelving upright. For example, equivalent open aisle live load is measured by $200\text{lbs} \div 3\text{ft.} \times 3\text{ft.} = 22\text{lbs/sq. ft.}$

Positioning

The preferred positioning of a high-density mobile storage unit is directly on top or adjacent to girder or beams adjacent to a column. The ideal location of a high-density mobile storage unit is placed where the load can be shared by 2 girders as well as near the ends of the floor beams. Should this positioning not be possible, the following position is recommended. Position the high-density mobile storage system so the load is on a single girder and near the ends of the floor beams. The least best place to position the high-density mobile storage system is between two girders and in the middle of the floor beams; this position will induce the maximum bending stress and deflection of the floor beams.

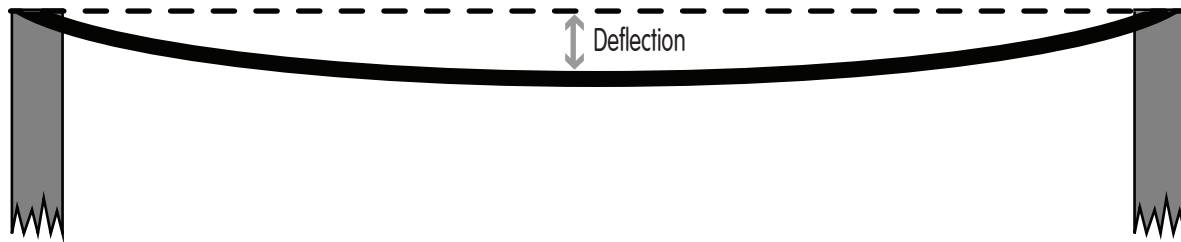


Track Orientation

The ideal track position is perpendicular to the floor beams unless the floor beams are spaced 6 feet or less, then the ideal position is directly over the floor beams. Should the tracks be placed perpendicular to the beams, secondary framing may be required, especially if the floor is structurally inadequate to support the line loads. Spacefile International Corp is able to place the tracks at any spacing to a maximum of 72 inches to place the track directly over a girder or floor beam potentially eliminating the need for a track support beam.

Deflections

Floor deflection only occurs once the system has been loaded. All framed floor systems are privy to deflection when a load is applied to the flooring system. The amount of deflection varies depending on the load applied. It is the responsibility of the designer to minimize floor deflection to prevent the unwanted movement of the carriages. Buildings with larger than average bays could have enough deflection to hinder the movement, or generate unwanted movement of the high-density mobile system carriages. While every precaution should be taken to prevent the drifting of high-density mobile carriages, some structures have long span beams and girders that are too flexible to prevent carriage drifting.



Spacefile has developed a few solutions to prevent drifting when deflection is too great.

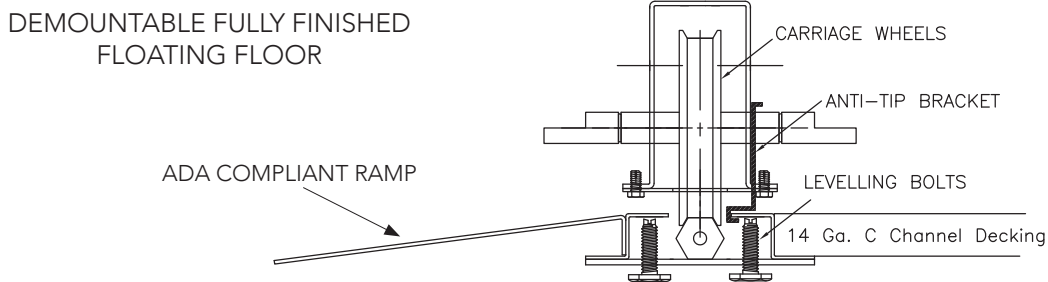
1. **Brakes:** adjustable friction brakes can be installed on wheels to prevent drifting. The brakes will make a mechanical assist or manual system harder to move since the operator must overcome the friction of the brake as well as move of the carriage.
2. **Electric Drive Systems:** Since our electric systems have automatic braking systems, the same braking system will prevent drift. This solution may be a more cost effective solution when compared with retrofitting the structure.
3. **Stepping/cambering:** When deflection can be predicted, the tracks can be raised to compensate the deflection however this must be done carefully and uniformly to ensure the proper movement of the carriages. Carriages should be operational with or without media. Our demountable fully finished floor comes standard with leveling bolts to help compensate for deflection and other uneven floor surfaces.

Seismic Activity

Building codes require all building components, such as high-density mobile storage systems, be designed to resist the code-required seismic forces in areas where seismic activity may occur. Spacefile's anti-tip mechanisms, internal bracing, and attachments meet all code requirements for seismic activity.

ADA Compliance

ADA requires that all office environments must be completely accessible to those with disabilities. Spacefile has multiple track options that satisfy ADA requirements. Our demountable fully finished floating floor, pictured below, utilizes our standard ADA compliant ramps with a ratio of 1:12. Our inlaid track is completely level with the floor and is laid into the ground. Our low profile aluminum 3-piece track features a small rise which is compliant with ADA standards.



Media Weights

Spacefile International Corp has compiled some approximate common media weights to help assist architects and engineers to determine track loads. For storage of other media an estimate should be acquired.

	lbs/inch	lbs/foot	lbs/ 36" Section
Letter Size Documents	2	24	70
Medical Records	2	24	70
Legal Size Documents	2 ½	30	90
X-Ray Film with Jackets	8	96	280
Printouts in binders	3 ½	42	125
Books	1 ¼	15	45

Static Shelving

Static shelving can occur in close relation to a high-density mobile storage unit. When checking the floor structure for adequate support usually uses an equivalent uniform load approach since the shelving bears directly on the floor. A typical static system has one or two people per aisle, for a design load criteria. The total load of the static shelving system should include all walls, equipment and other items within or contiguous to the static system. The floor area will include both interior and exterior access to aisles.