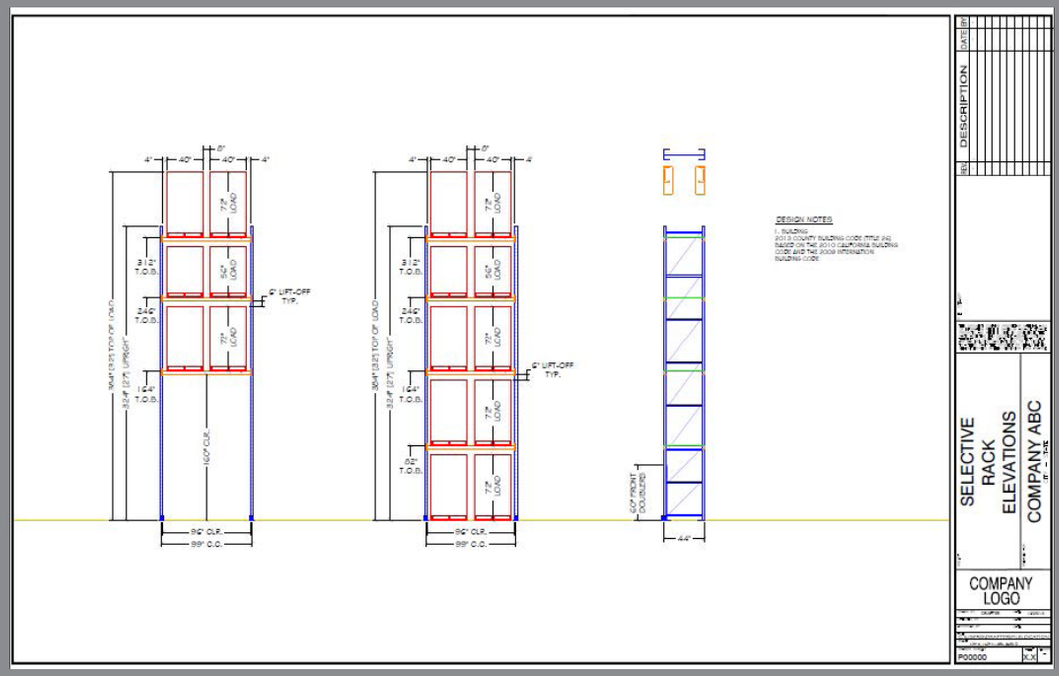
Engineering / Maintaining Documentation

Drawings and Maintaining Proper Documentation:

If the existing LARC drawings are not available, new LARC drawings showing the load capacity of the repaired system must be created. The Supervising Engineer should approve such drawings before repairs are begun. LARC drawings should provide clear information defining the repair or replacement, as well as, configurations of bays or sections affected by the repair or replacement.

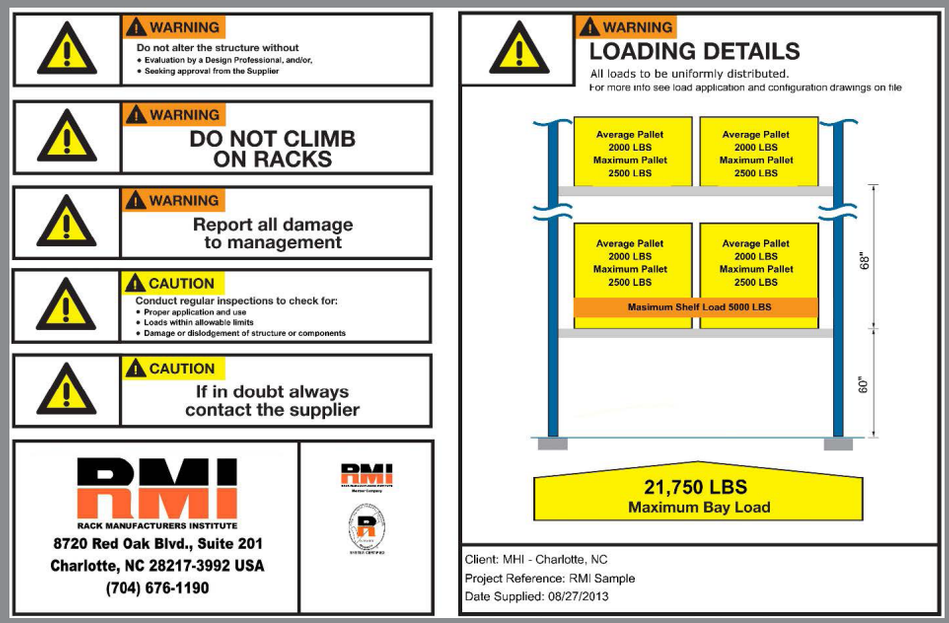
Notice should be conspicuously depicted on LARC drawings showing that the Supervising Engineer is to evaluate any deviations from the drawings and that any deviation may impair the safety of the rack system. (RMI/ANSI MH 16.1 [1], Section 1.4.5).



An example LARC Drawing.
***Note that design loads and beam elevations are clearly identified**

Load Capacity Plaque:

As outlined in RMI/ANSI MH 16.1 [1], Section 1.4.2, the Owner is responsible to ensure that load capacity plaques are conspicuously displayed in one or more prominent locations. If there are any changes to the rack configuration, the capacity plaques must be updated and reinstalled.



An Example of an RMI Load Plaque

Technical Requirements:

The Supervising Engineer shall review the maximum loading capabilities of the system with the Owner Operator. If appropriate, the Supervising Engineer should determine all external loading requirements of the rack structure, including product load, wind load, snow load, rain on snow surcharge, snow drifting, seismic load and dead and live load from structures supported by the storage rack and more. The necessary strength and stiffness of the members and connections shall be determined by structural analysis for the appropriate load combinations (ASD or LRFD, as required by RMI/ANSI MH 16.1 [1] Section 2.1 or 2.2, respectively.

The components affected, by the repair or replacement, shall meet all the material and design requirements of the RMI/ANSI MH 16.1 Specification [1] and Commentary, which details component design requirements. The following information in this guideline is for some components that are not mentioned in the RMI/ANSI MH 16.1 Specification [1], but is important and unique to the repair of storage racks.

When testing is required, representative samples of specific components from the existing system being repaired shall be used with the new repair component in a procedure that is approved and overseen by the Supervising Engineer. This testing may be done in any facility acceptable to the Supervising Engineer, and the testing records shall be maintained by the Supervising Engineer.

Column:

Column Splice:

If it is necessary to repair a column segment with a new section, a splice may be used to join the two components. The continuity of the load path across this splice joint is critical to the structural integrity of the repair.

The column splice must meet the loading requirements of the applicable loading combinations in RMI/ANSI MH 16.1 [1] Section 2.1 or Section 2.2. The splice connection shall be evaluated for the following factors including, but not limited to: column axial force, flexural buckling, torsional buckling, flexural-torsional buckling, column axial slip resistance, the column bending strength, the column bending stiffness.

Column:

Column Baseplate

A column baseplate may have to be repaired with a new plate because the column must be re-anchored and old hole locations are no longer available. The bending stiffness of the base joint may be critical to the success of the repair.

The column base plate must be shown to meet the loading requirements of the applicable loading combinations in RMI/ANSI MH 16.1 [1] Section 2.1 or Section 2.2. The base connection shall be evaluated for the following factors including, but not limited to: the column downward axial force, the column uplift, the base joint bending strength and the base joint bending stiffness.

If replacement anchors cannot be located in the same place relative to the column, a new location must be designed and tested. Replacement anchors shall be located in the same hole or not less than 3 times the larger anchor diameter from existing anchor holes whether the holes are empty or contain the remnants of old anchors. If existing anchor holes are filled with “dry-pack mortar” and the mortar has set for not fewer than 7 days, replacement anchors shall be placed not less than 1.5 times the diameter of the largest anchor from existing holes.

When welding new base plates onto existing frames, field welding risks discussed in Appendix 1 of the RMI Rack Repair Guidelines should be carefully considered.

Bracing Continuity:

Original frame bracing generally provides a continuous load path to the supports. Repair of that bracing must be shown to establish a satisfactory replacement of the original load path.

The design of the repaired bracing system with an evaluation of the repair kit and the existing structure must ensure that stability and force requirements meet RMI/ANSI MH 16.1 [1], Section 2.4. Frame bracing and its connections to the column must be shown to have the necessary strength and stiffness to support the column axial and bending load. All frame bracing that is replaced or repaired, must be capable of carrying this load.

Bracing Continuity (Continued):

Considerations must be given to compression bracing members that have discontinuities or splices.

Shelf Beams:

Shelf Connection

The shelf beam-to-column connector of conventional racking is the primary joint that stabilizes the storage rack columns in the down-aisle direction. These connections vary widely from manufacturer to manufacturer. Each original equipment manufacturer has tested its connector with its column in accordance with RMI/ANSI MH 16.1 [1].

If a shelf must be replaced, the Supervising Engineer shall obtain (or develop through testing) the beam-to column test results that are for the specific combination being used, and shall incorporate that data into the design of the repair solution.

Lateral Bracing Beam

Beams (particularly open sections) that are bent about their major axis are subject to lateral buckling of the compression flange. If the replacement beams are open sections, the design shall account for this buckling, or adequately brace the compression flange.