

VISCMA

INSTALLING SEISMIC / WIND LOAD RATED ROOF CURBS TO COMPLY WITH CURRENT BUILDING CODES

For both curb and installation compliance with the Seismic & Wind Load Requirements
of the International Building Code

Initial Release: June 2009

Background Information

The International Building Code (IBC) was originally prepared in 1997 by five drafting subcommittees appointed by the International Code Council (ICC) and consisting of representatives of Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI). The intent was to draft a comprehensive set of regulations for building systems consistent with and inclusive of the scope of the existing model codes.

All 50 states and the District of Columbia have since adopted the IBC as their governing building code. The IBC requires nonstructural building components to be permanently attached to their supporting structure and installed to withstand all loads created by wind and/or seismic forces. This requirement applies to both the rooftop unit and its supporting roof curb.

In the year 2000, the IBC was self contained with seismic and wind loads defined within chapter 16. The 2003 & 2006 editions remove specific wording and defers to the American Society of Civil Engineers Standard 7 (ASCE7), “Minimum Design Loads for Buildings and Other Structures” as the design manual for these loads and additionally changed the building classifications. ASCE7 provides the methodology for calculating all loads that the rooftop unit, its curb and the supporting structure must be able to withstand.

Purpose

This document is to provide engineered recommendations for the installation of seismic and wind restrained roof curbs. The intent of the governing codes, namely the International Building Code, was foremost in the selection of these recommendations. The details are provided for the engineering community to have a reference with which to validate their inclusion on structural drawings, and for field inspection of the installations.

Curb Requirements and the Calculation Process

Regardless of code year, the IBC and ASCE7 require that “component attachments shall be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.” The process by which

attachments from rooftop units to roof curbs and roof curbs-to-the-building structure are designed can be summarized in three steps. In all instances, a licensed Professional Engineer (P.E.) in responsible charge shall certify that the proposed installation and curb complies with the IBC requirements.

- 1) *Determine which version of the code is applicable for their particular project.*

This information is typically provided in the project's Structural or Architectural drawings for the project under "Design or Structural Loads". The IBC's first edition made its debut in the year 2000 and is revised every three years. Clarification of the applicable code year is therefore essential. The assigned P.E. must also be aware of any project requirements that are more stringent than those listed in the building code or the additional requirements for all associated components that are part of the building code. These may include business continuity, higher wind or seismic design loads for critical facilities as specified by the project engineer.

- 2) *Determine the wind/seismic load design forces that the rooftop equipment, its curb and the supporting structure are all required to withstand.*

The IBC, ASCE7 and project contract documents are used to determine applicable forces and their direction. These forces result in various components in the load path being placed in tension, shear and moment. The governing force is the wind or seismic loading that produces the greater combination of the shear, tension and moment. In some areas of the US where it is not intuitively clear which load is greater, the P.E. should perform both calculations and specify all hardware and attachments accordingly.

- 3) *Determine the requirements for attachment of the unit to the roof curb, the roof curb to structure and the curb design.*

Once the design load on the rooftop equipment is calculated, the P.E. performs an analysis to ensure that this load is safely transmitted through the roof curb and its attachment points at the building structure. The roof top unit attachment to its supporting curb, the passage and path of those forces to the curbs attachment points to structure and the structure itself must all be designed and manufactured with the ability to safely transfer these forces and function as a single component.

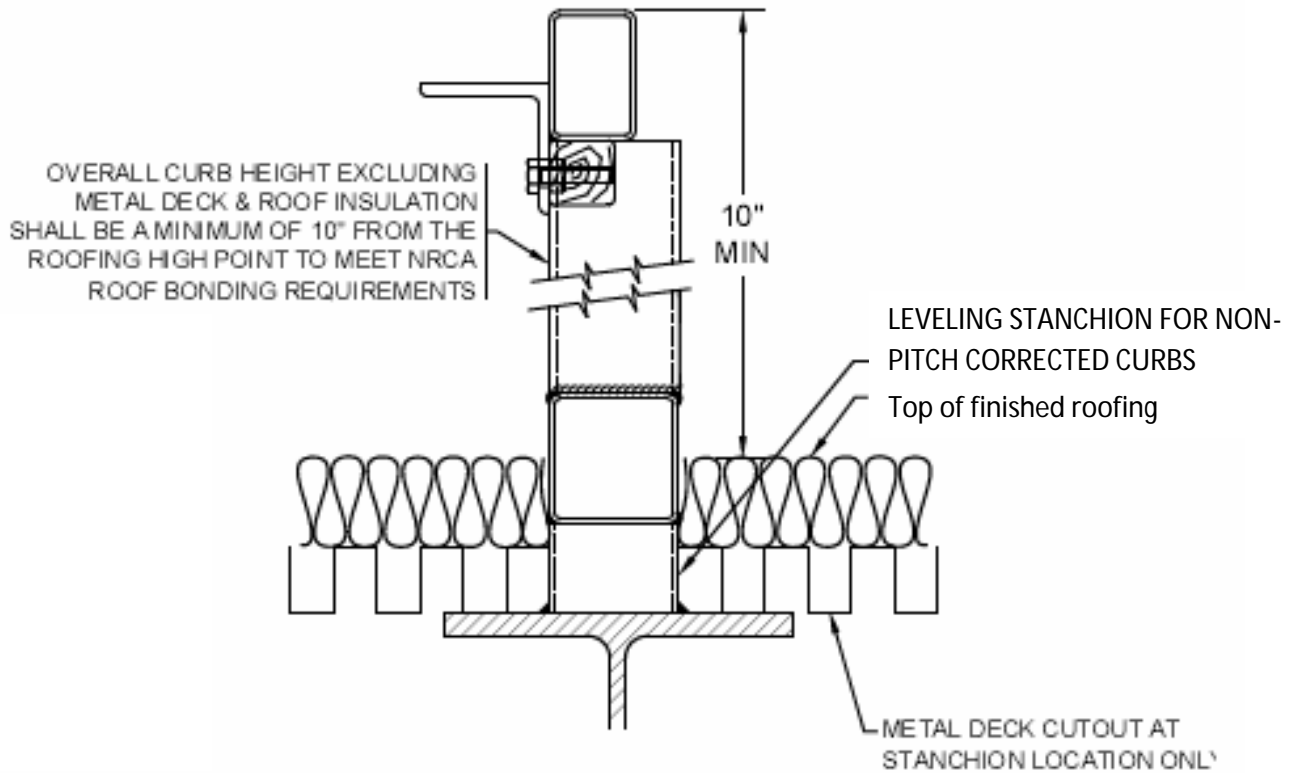
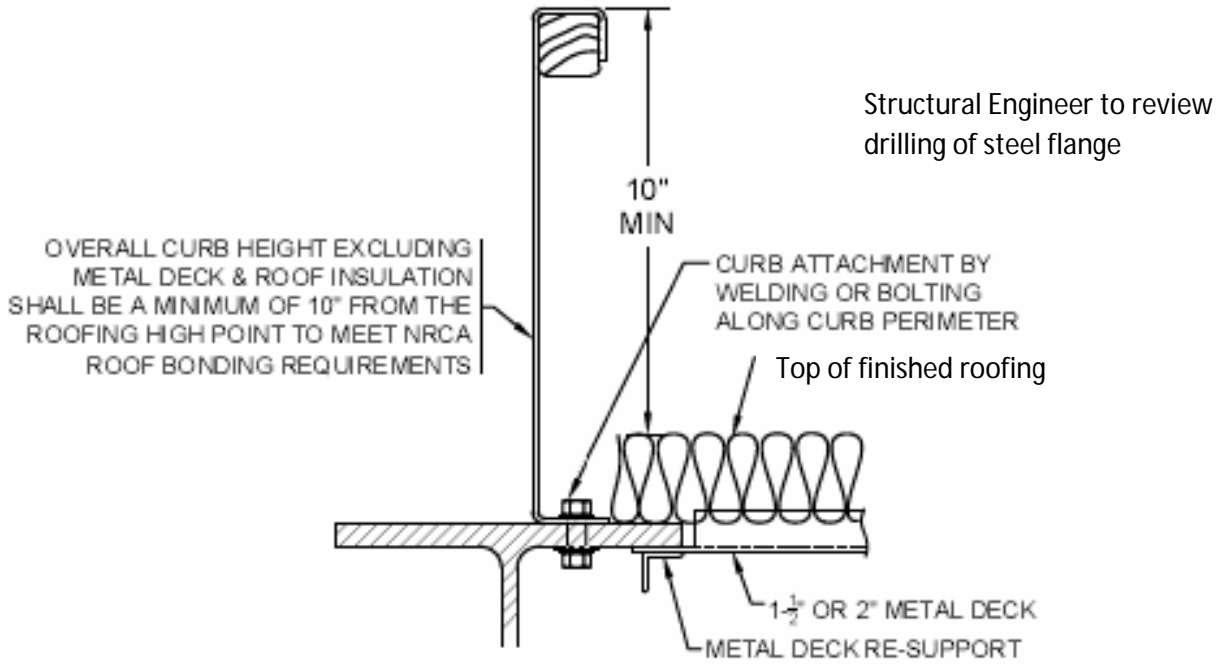
The Professional Engineer's calculation package must include the reactions and their locations acting on the building's structure to ensure that the project's structural engineer is aware of those loads and has designed the supporting structure appropriately.

Detailed Drawings

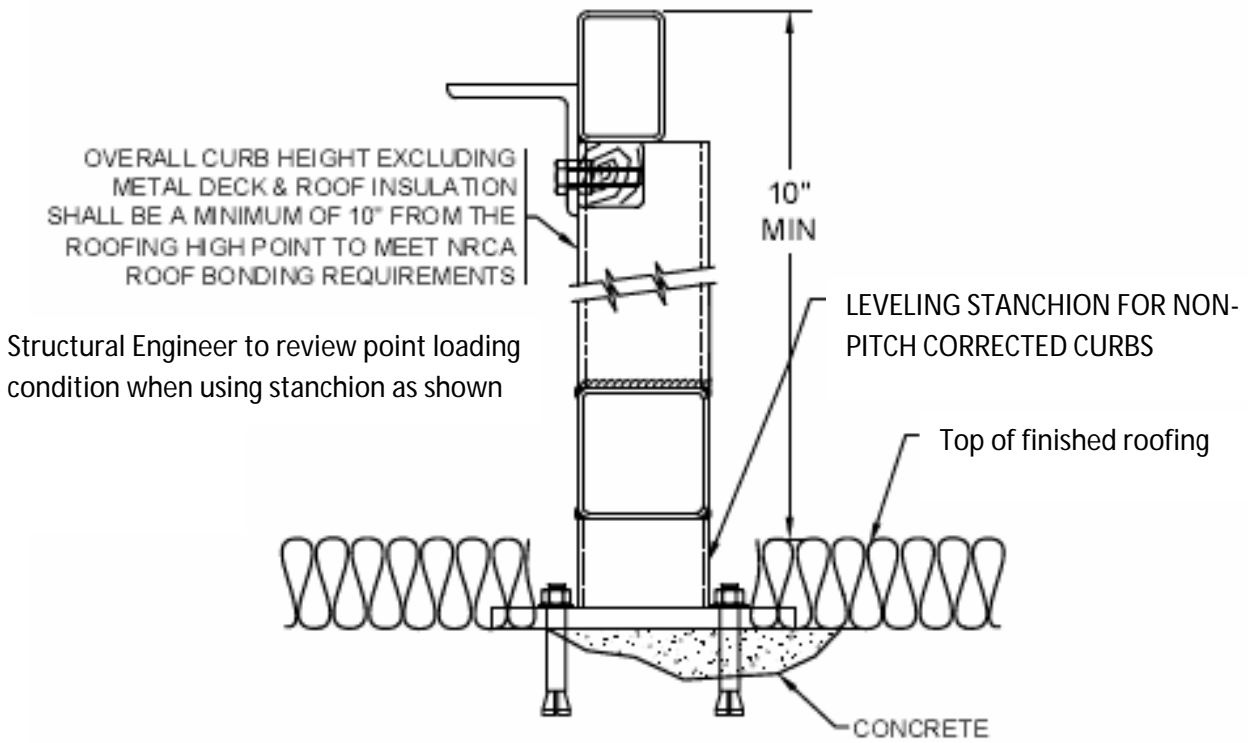
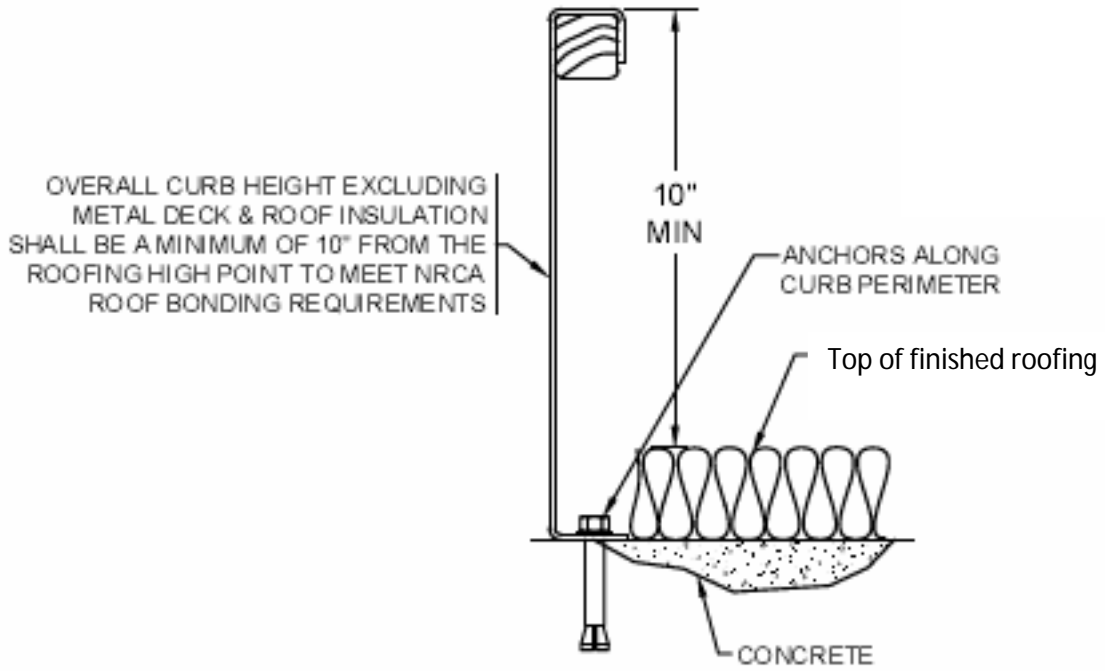
The following details can be used as typical roof curb installation methods for insulated or non-insulated, vibration isolated or non-isolated roof curbs installed on structural steel or concrete decks. Additional information is available in FEMA 412, "Installing Seismic Restraints For Mechanical Equipment".

Note that bolt size, anchor embedment, anchor depth and weld length will be determined by the calculations performed by the manufacturer's Professional Engineer using the relevant design forces referred to in the process described above. As described above, the installation methods shown below do not in turn make the unit capable of carrying the applied seismic loads.

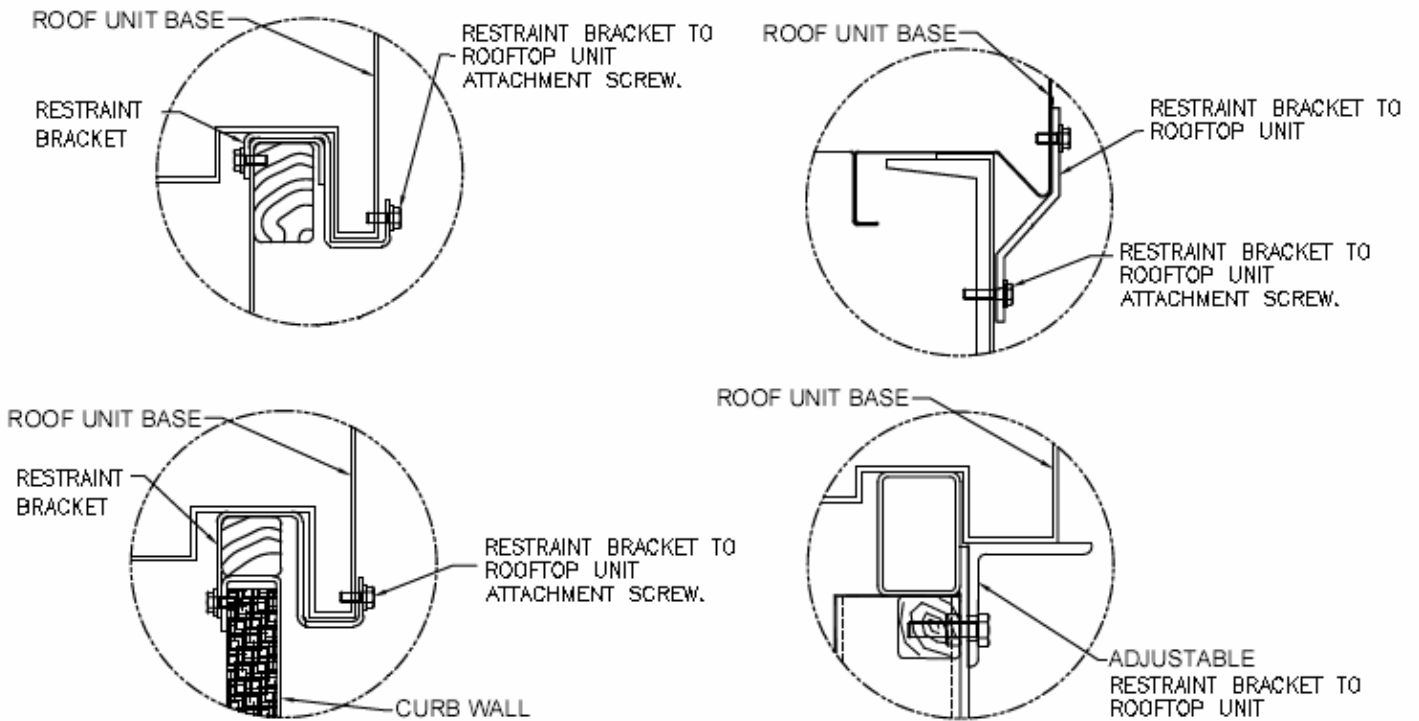
ROOF CURB TO BUILDING STRUCTURE RESTRAINT DETAILS



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OPTIONAL RESTRAINT DETAILS



ROOFTOP UNIT MUST HAVE POSITIVE ATTACHMENT TO CURB AND CURB MUST HAVE POSITIVE ATTACHMENT TO BUILDING STRUCTURE. OPTIONS FOR PROVIDING THIS POSITIVE ATTACHMENT INCLUDE USE OF RESTRAINT BRACKETS, DIRECT BOLTING OR WELDING AS DETERMINED BY THE RESPONSIBLE ENGINEER IN CHARGE.