

# Expansion Joint Curve/Valley Intersection on Metal Roofing:

## A CASE STUDY

By Christopher A. Payne, RRC, CDT

In February of 2016, NB Handy Company was contacted by the roofing contractor installing the metal roofing assembly on the Academic Instruction Building of the U.S. Naval Facilities Engineering Command at Camp Johnson, a satellite camp of the Marine Corps base at Camp Lejeune in Jacksonville, NC (see the project information in the adjacent box). The assembly for the main roof of this project included the following:

- 1½-in., 20-gauge, type “B” metal roof decking
- ½-in. glass mat gypsum sheathing, meeting ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, with a flame spread = 0 and a smoke spread = 0
- Two layers of 3-in. manufacturer-approved polyisocyanurate roof insulation board (R-30.6) with joints in the

successive layer, staggered a minimum of 6 in. from the preceding layer in both directions

- ⅝-in. glass mat gypsum sheathing, secured with insulation fasteners and 3-in.-diameter insulation plates installed in a fastening pattern allowing for five square drive fasteners and 3-in.-diameter plates

P-003 Staff NCO Academy Facilities

Academic Instruction Building

Naval Facilities Engineering Command – Mid-Atlantic

United States Marine Corps Base

Camp Johnson, North Carolina

Project #15BCX-010

per 4- x 8-ft. sheet. Cover board and insulation securement utilized #14 13- x 10-in. DP1 pancake-head carbon steel epoxy-coated fasteners.

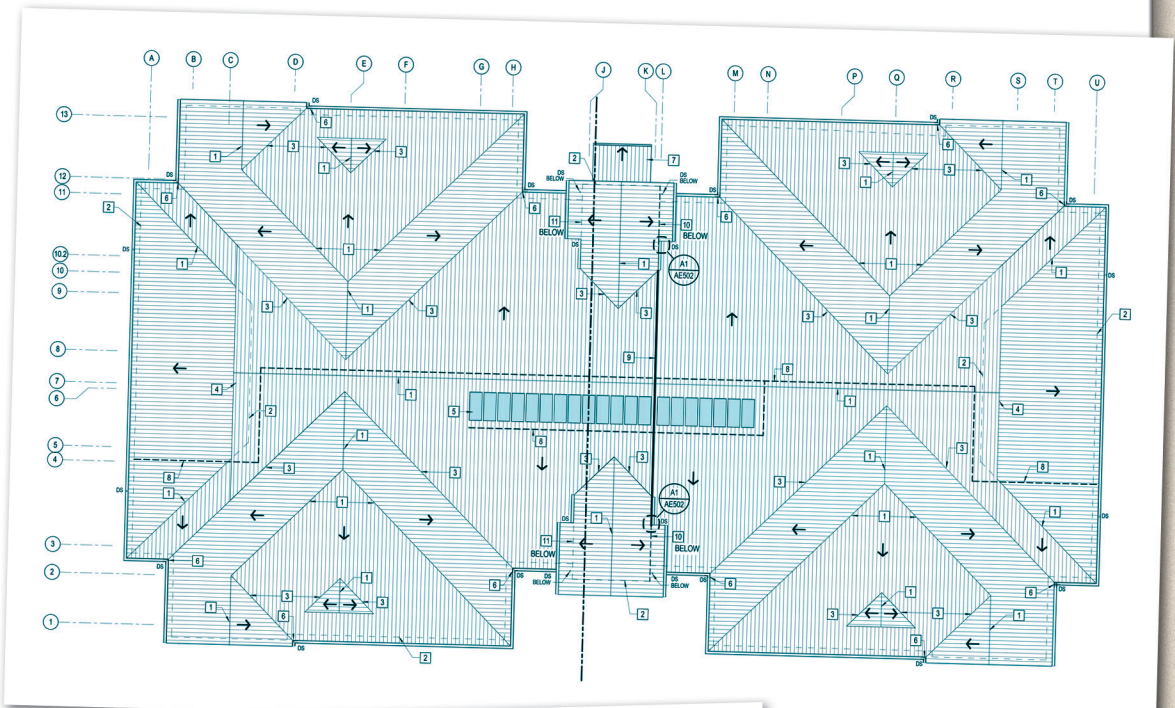


Figure 1 – Roof plan (expansion joint curb runs just right of center, parallel to the main roof slope).

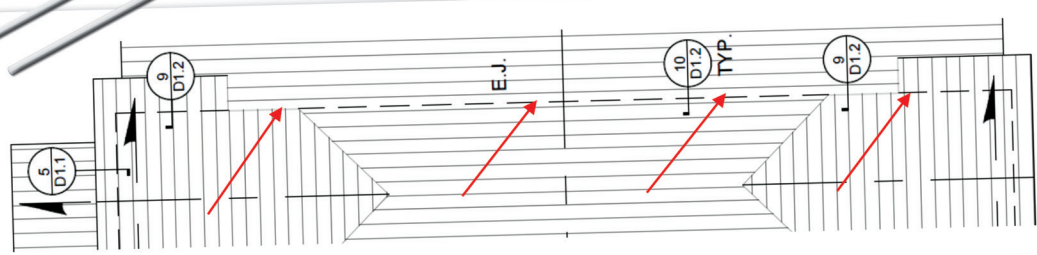


Figure 2 – Expansion joint curb (noted as segmented line and delineated by red arrows).

Figure 4 – Section through expansion joint curb at side wall.

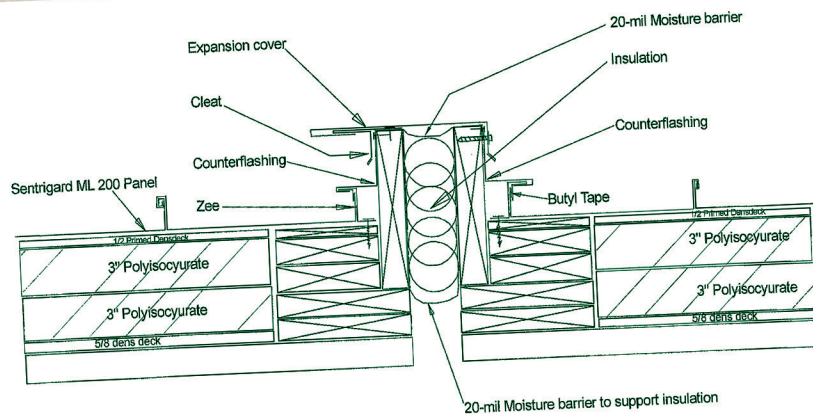
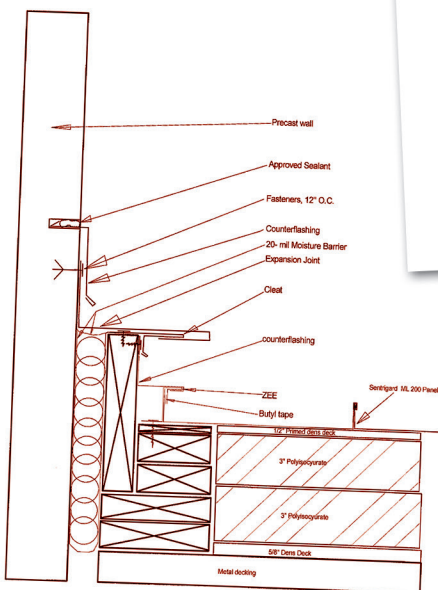


Figure 3 – Section through expansion joint curb.

- Full coverage of manufacturer-approved, high-temperature, self-adhesive, polymer-modified-bituminous underlayment applied directly to existing prepared roof deck cover board surfaces
- 2-in., mechanical-lock, standing-seam metal roofing system assembly, complete with manufacturer-approved flashing and sheet metal details at all perimeter and penetration locations. All panels fabricated from prefinished 22-gauge Galvalume® architectural sheet metal material, with trim fabricated from prefinished 24-gauge Galvalume®.
  - Note: The metal roofing panels were formed on the job site in continuous lengths and were not to be swedged or have end laps. Fasteners must not penetrate the metal roof panels, except at the peak, where it was necessary to pin the panels beneath the peak closure and flashings as shown on the shop drawings.
- Metal roofing clips installed in a fastening pattern as determined by site-specific engineering to meet specified wind uplift criteria, as well as current International Building Code (ASCE 07-05) and local regulatory agency requirements. All metal



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*Figure 5 – Expansion joint valley intersection prior to panel and flashing installation.*

roofing clips and bearing plates manufactured from galvanized steel and supplied by the manufacturer.

- Minimum 18-gauge galvanized steel backup plates installed at all hip, ridge, and valley locations

The issue at hand on this project was a large expansion joint curb that extend-

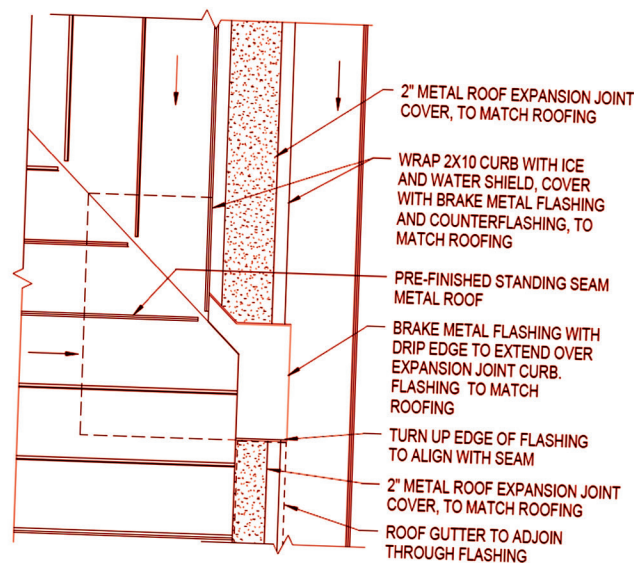
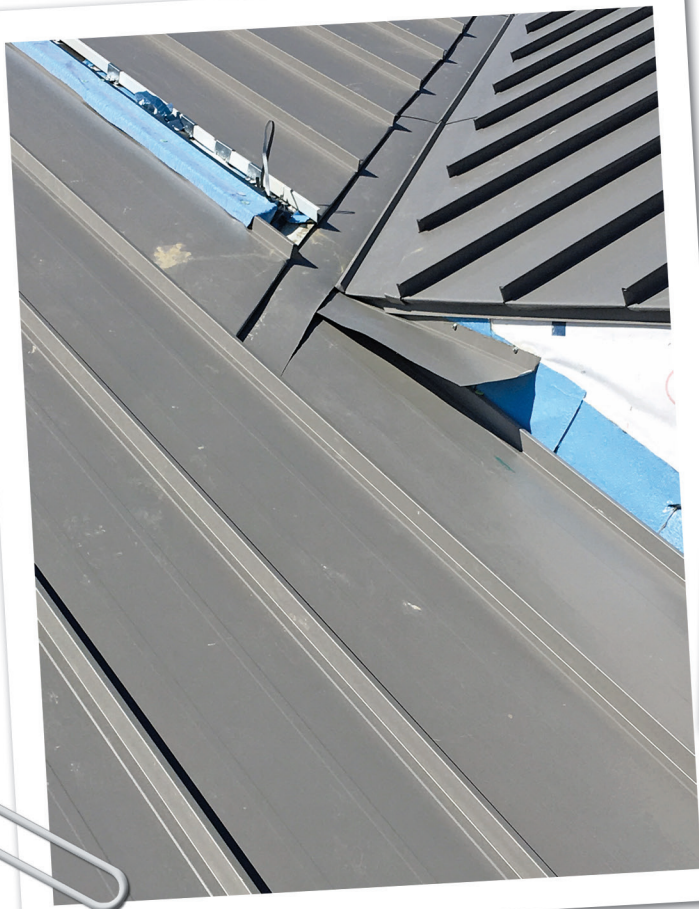
ed across the roof, parallel to the panels of the main roof slope, but also intersecting two dormer valley flashings and sidewalls. The roof plan may be viewed in *Figure 1*. A close-up section of the expansion joint curb may be seen in *Figure 2*. The expansion joint intersection with the dormer valley occurred in two places on opposite sides of the building, both mirror images of one another. The project architect made an attempt to conceptualize the expansion joint flashing above and below the valley flashing, but struggled with how to deal with the actual transition of the expansion joint curb to the valley, then into the sidewall expansion joint and flashing on the wall below the valley. *Figures 3 and 4*

show the details in the shop drawings.

When it came to the actual valley intersection with the expansion joint curb, it was necessary to allow for expansion and contraction of the sheet metal flashing in six different directions, yet keep the flashing system weathertight. *Figure 5* shows the intersection. *Figure 6* illustrates the first attempt of the roofing contractor to flash the condition, while *Figure 7* was the architectural detail from the original plans and specifications. This detail was the same as saying, “Roofers: Figure this out because we don’t know how to do it.”

After submitting a request for information (RFI) to the architectural design team on this project, the latter came up with the architectural renderings in *Figures 8A and 8B*.

While these renderings are nice, they in no way provide any clarity as to how to install the sheet metal flashings at this transition. The standing seam roof panels above the valley on the main roof area are nearly 70 ft. long. Installing a dam on the top side of the valley, at the termination of the expansion joint curb, would create a “dead” valley, with a tremendous amount of water flowing across the transition in a heavy rain event. Additionally, it is virtually impossible to install a 36-in.-girth gutter in such a manner that it might extend all the



**EXPANSION JOINT FLASHING**  
 1 1/2" = 1'-0"  
 AE103 **A1**

*Figure 7 – Architectural detail of expansion joint flashing from original plans and specifications.*

*Figure 6 – Temporary expansion joint; temporary valley flashing.*





Figure 10 – Completed expansion joint/valley intersection (north side).

this problem would have been to move the building expansion joint and subsequent curb over at least 24 in. away from the valley. Unfortunately, the transition was never even thought about or discussed until the building was constructed and it was too late. Figures 10 and 11 show the successful integration of the standing seam roofing and flashing materials as they were ultimately constructed and installed.


Architectural standing seam metal roofing systems are traditionally unforgiving, and some flashing details present challenging situations. We were able to come together and find some common ground to form a successful weathertight flashing solution. All parties—from the initial project conception to the design team and the construction team—learned some valuable lessons from this case study. Most importantly, we would encourage design professionals to engage an RCI registered professional to be a part of the design team when dealing with the complexities of the building envelope. 

Figure 11 – Completed expansion joint/valley intersection (south side).



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*career with a roofing and sheet metal contracting company in 1984. In 1997, Payne founded Carolina Roofing Concepts Inc., practicing as a professional roof consultant. He joined NB Handy in 2003.*

## OSHA RAISES FINES

The U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has raised its fines for the first time in 25 years. The new fines took effect in August and represent a 78% increase in the maximum fines. The legislation also gives OSHA the authority to raise fines annually with inflation. The new penalty structure is shown below:

Violation	Current Maximum Penalty	New Maximum Penalty
<ul style="list-style-type: none"> <li>• Serious</li> <li>• Other than serious</li> <li>• Posting requirements</li> </ul>	\$7,000 per violation	\$12,471 per violation
<ul style="list-style-type: none"> <li>• Failure to abate</li> </ul>	\$7,000/day	\$12,471/day
<ul style="list-style-type: none"> <li>• Willful or repeated</li> </ul>	\$70,000/violation	\$124,709/violation
<ul style="list-style-type: none"> <li>• Criminal (willfully causing employee's death)</li> </ul>	\$250,000/death; 6 mo. prison; \$500,000 penalty for corporations	\$250,000/death; 6 mo. prison; \$500,000 penalty for corporations