The most economical joist size selected from the load tables published by the Steel Joist Institute was 22K5.

The secondary wall framing was limited to cold-formed Z girts, and a pair of intermediate wind columns was provided for girt support. These wind columns were placed on wall piers, and the columns were laterally supported at the top by a special roof bracing.

As discussed in Chap. 5, tilted open-web steel joists supporting standing-seam roofing generally require closely spaced joist bracing and cross-bridging. In addition, the joist seats and attachments must be designed to resist overturning by diaphragm forces. A note to that effect was added to the general notes relating to the pre-engineered building addition (Fig. 14.16).

The new intermediate frame was designed to support the existing Z purlins from one side and new open-web steel joists from another. The standard seat depth for open-web steel joists (2.5 in) would not match the existing purlins' depth, and a custom joist seat was required for this occasion (Fig. 14.17).

14.6.5 Foundation Design

The vertical load on the new interior frame columns was computed in a straightforward fashion, as a product of multiplying the tributary area by the design load. The tributary frame width was

$$\frac{34 + 24.5}{2} = 29.25 \text{ (ft)}$$

NOTES FOR PRE-ENGINEERED BUILDING ADDITION

1. SEE GENERAL STRUCTURAL NOTES ON DRAWING S001 FOR DESIGN STANDARDS AND LOADING.
2. INCLUDE IN THE DESIGN A MINIMUM COLLATERAL LOAD OF 5 P.S.F.
3. PROVIDE ADDITIONAL FRAMING FOR ROOF SUPPORTED MECHANICAL AND OTHER EQUIPMENT. PROVIDE ADDITIONAL BRACING (AND FRAMING IF NEEDED) AT EXISTING PURLINS SUBJECTED TO SUCH LOADING.
4. THE MAXIMUM ALLOWABLE VALUE OF LATERAL DRIFT UNDER ANY DESIGN LOAD COMBINATION SHALL NOT EXCEED H/200. SEPARATE THE DRYWALL PARTITIONS FROM THE BUILDING FRAMING BY A DISTANCE OF AT LEAST 2 INCHES.
5. PRIMARY FRAMING TYPE: SINGLE SPAN RIGID FRAME WITH PINNED COLUMN BASES (NO BENDING MOMENTS AT THE BASE).
6. SECONDARY FRAMING TYPE: BAR JOISTS OF SIZE AND SPACING SHOWN. PROVIDE CLOSELY SPACED JOIST BRACING AND CROSS–BRIDGING TO COMPENSATE FOR JOIST TILT (APPROX. 1:12) AND LACK OF BRACING PROVIDED BY ROOFING. DESIGN JOIST SEATS AND ATTACHMENTS FOR OVERTURNING BY DIAPHRAGM FORCES.
7. COLUMN BASE PLATE SIZES SHALL NOT EXCEED 12"x12". THE EDGE DISTANCE FOR ANCHOR BOLTS SHALL BE AT LEAST 7" FOR SIDEWALL COLUMNS, 6" FOR ENDWALL COLUMNS AND 4" FOR DOOR JAMBS. (MODIFY MANUFACTURER'S STANDARD BASE DETAILS AS REQUIRED TO ACCOMPLISH THIS.)

FIGURE 14.16 Notes for the pre-engineered building addition in the Case Study.

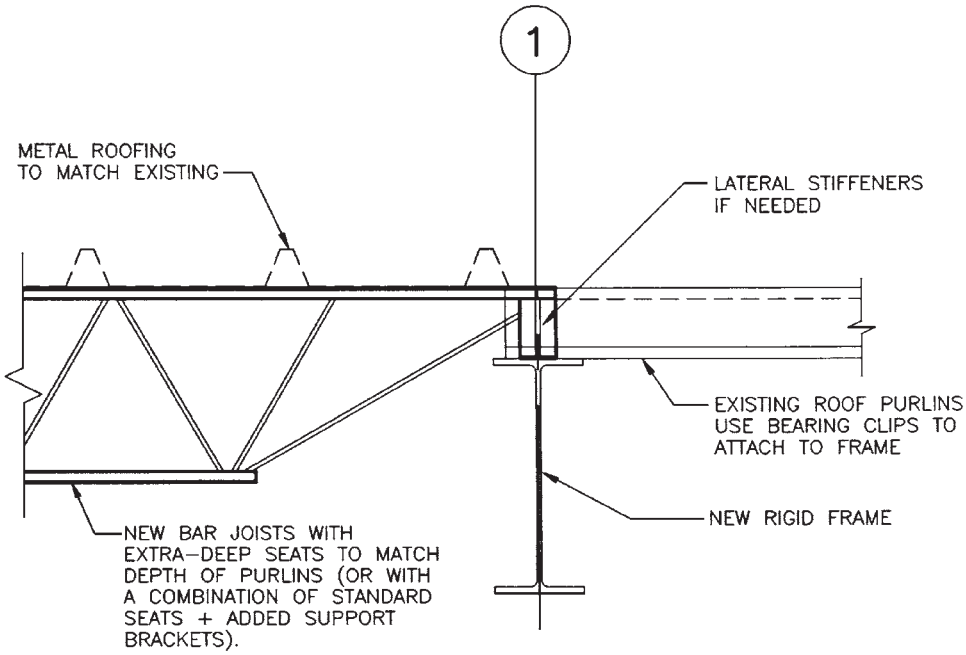

FIGURE 14.17 Section at new exterior frame in the Case Study.

The tributary area for a new interior column was

$$29.25 \times 30 = 877.5 \text{ ft}^2$$

The total vertical load on the column was, for a unit load of 40 psf,

$$\frac{877.5 \times 40}{1000} = 35.1 \text{ kip}$$

The required footing size was (35.1 kip)/4 ksf = 8.8 ft^2, so a 3-ft^2 footing could be used.

The horizontal frame reactions were estimated from the tables similar to those in Appendix D for a 60-ft span, eave height of 20 ft, tributary width of 29.25 ft, and the design loads listed above. The table values for 25-ft-wide bays were increased by a factor of 29.25/25 = 1.17.

The design value of horizontal frame reactions was determined to be 17 kip.

To resist the horizontal frame reactions and to engage the existing concrete walls to provide enough "ballast" against wind uplift, the new piers were doweled into the existing foundation walls (the former endwalls), so that the existing walls would serve as tie beams. The dowels were drilled into the mid-thickness of the 12-in wall. The design process for this task is described in a separate section below.

The design downward load on the two new middle endwall columns was

$$\frac{0.04 \text{ ksf} \times 20 \text{ ft} \times 34 \text{ ft}}{2} = 13.6 \text{ kip}$$

Similarly, the corner columns would be loaded with 13.6/2 = 6.8 kip. The footings for both middle and corner columns were nominal; their size (3 ft × 3 ft) was determined simply by providing a 6-in ledge around the piers.