ROOFTOP SCREEN WALLS

Design and Construction Considerations

SEAC/RMSCA Steel Liaison Committee

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Executive Summary

Rooftop screen walls appear simple, however connections to the structure, load path, roofing penetrations, and designing for durability create complications. Field labor costs can rapidly escalate due to these complications. The design is often delayed until late in the process due to the coordination required from the many design team members and trades involved. There is currently no clear guidance in building codes for the design of screen walls, requiring a need for careful interpretation of code commentary and supplemental articles.

Early coordination among design and construction teams is important for alleviating some of the difficulties before construction begins. Screen wall construction requires adjustability to be included in the design.

Special consideration should be given to finishes and shapes used for both posts and girts for corrosion prevention and moisture control.

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Introduction

Rooftop screen walls are structurally supported architectural elements primarily meant to improve the overall appearance of a building by concealing rooftop equipment. The International Building Code defines a Mechanical Equipment Screen as “A rooftop structure, not covered by a roof, used to aesthetically conceal plumbing, electrical or mechanical equipment from view.” (IBC, 2024). The design is based on several factors, including wind and snow loads, roof equipment height, architectural aesthetics, and roof framing configuration.

Figure 1: An Example of a Rooftop Screen Wall

In the Rocky Mountain Region, roof screen wall height is dictated by the height of the mechanical equipment and sight lines. The Denver Zoning Code requires screen walls are designed by line of sight from the sidewalk opposite the building, see Figure 2 below. Taller roof screen walls are subjected to greater wind loads and may require kickers to brace the posts. Every post and kicker creates a structural connection point and a penetration in the roofing which can add risk for moisture infiltration.

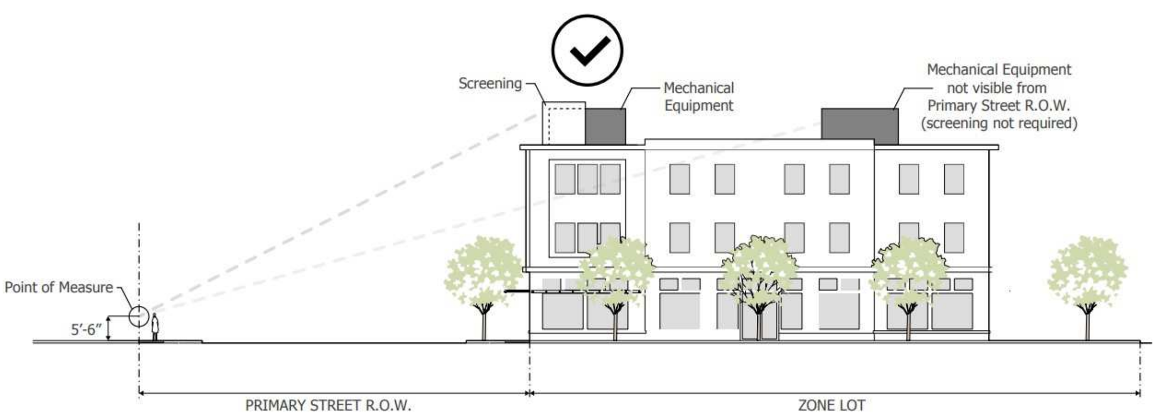

Figure 2: Denver Zoning Guidelines for Rooftop Screen Walls (Denver, 2010)

Building codes IBC, ASCE, and AISC do not have specific provisions for designing or constructing rooftop screen walls. ASCE commentary and supplemental articles provide some design assistance.

Successful screen wall design and construction requires coordination between design and construction teams. Unfortunately, screen wall design and details are often an afterthought to the primary building structure as the location and size of the rooftop equipment and screen are subject to change during design and construction.

Common Assemblies

A typical screen wall consists of two main systems: architectural cladding and structural frame.

Cladding

There are a wide variety of screen wall cladding assemblies utilized in the building industry, including metal deck, architectural metal panels, brick, concrete, and stucco. The most common cladding assemblies seen in the Rocky Mountain Region are metal deck and architectural metal panels. Design of the screen wall framing elements is part of the Structural Engineer of Record's (SEOR) scope of work. Some rooftop units include integral screen walls that attach directly to the equipment, which are delegated design items.

Structural Frame

The selection of a cladding assembly impacts several aspects of the structural frame design, including the configuration of structural supports, deflection criteria, and connection design. Two common screen wall framing configurations are discussed below: cantilevered screen walls and braced screen walls.

Cantilevered Screen Walls

Cantilevered screen walls are comprised of steel posts cantilevered off the roof structure, Figure 3. This can include continuous building columns that extend to the top of screen wall, acting as screen wall posts. Because cantilevered screen walls introduce moment into the supporting structure, they are typically used when the overall roof screen height extends less than ten feet above the supporting roof structure.

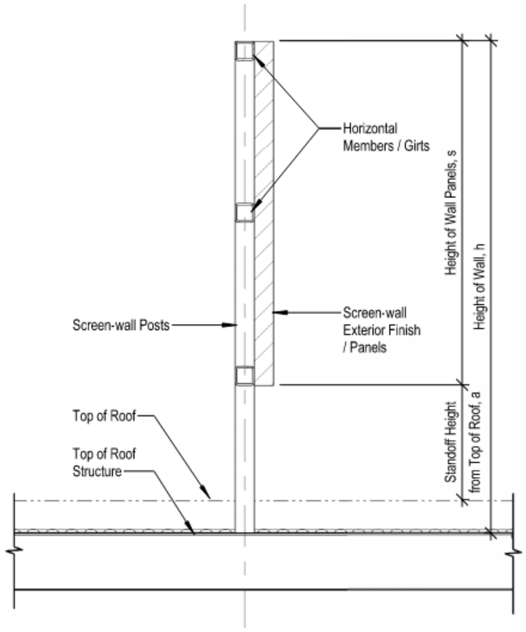

Figure 3: Cantilevered Screen Wall

Braced Screen Walls

Braced screen walls are built with steel posts using diagonal kickers bracing the posts, Figure 4. The post is designed as a pinned-pinned column with a short cantilever end above the top of the kicker. This system is predominantly used when the overall screen wall height above the roof structure exceeds ten feet, or when the supporting structure can resist a significant flexural load.

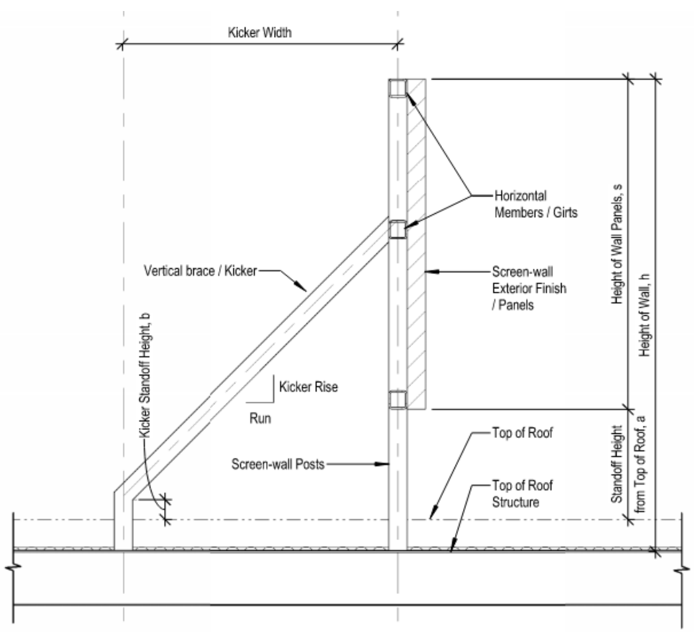

Figure 4: Braced Screen Wall

Compared to cantilevered screen walls, braced screen walls require greater horizontal clearances from the mechanical equipment/adjacent access paths, resulting in a larger overall footprint. Use of braced screen walls will also double the number of roofing system penetrations and increase the number of components for fabrication and erection.

Framing Members

For both cantilevered and braced screen walls, posts are the primary framing members and are commonly hollow structural steel (HSS) or wide-flange (WF) shapes. They are often designed to transfer loads from the screen wall to the supporting structure. Factors that may influence post shape selection include roof flashing details and material finishes; refer to the Constructability Considerations section for more information.

Girts spanning between posts are the secondary framing members, and a variety of profiles may be appropriate for these members such as channels, angles, or double-angles. Girt profiles should be selected to provide sufficient surface area for the cladding connections, to resist wind loads, and to avoid collecting water. For example, toe-down channels allow the cladding to be connected to the exterior flange or the web, are oriented with their strong axis parallel to the wind load applied to the screen, and allow water to freely drain off the web.

Post Shapes

HSS are a common structural shape used as primary frame members to frame screen walls. In addition to their efficient structural shape for biaxial loading, they are generally preferable from a water management perspective, as pre-formed roof flashings are generally fabricated to fit tube shapes. HSS typically have less surface area than open shapes, which can result in cost savings related to the application of a finish coating. But the steel fabricator and detailer have additional factors to consider with HSS members like vent holes for galvanizing, seal welds in lieu of bolted connections, drain holes to allow for the discharge of water, and plugs. WF sections offer more constructability for bolted connections in the field.

Horizontal Girt Shapes

The designer should weigh the benefits and drawbacks of various member shapes with consideration given to the finished screening material and its attachment. Given that the screen wall panels are typically connected to horizontal girts or other intermediate members, use of open sections such as channels or angles for the intermediate members may be preferred from a water management perspective. Open sections may also facilitate bolting of panels by another subcontractor without the need for shop-added connection material. If HSS sections are used where field connection installation is to be performed, the design will benefit from the use of shop welded connection tabs to the HSS allowing field bolting to be performed without the need for corrosion protection system repairs.

Coordination

Screen wall construction requires coordination across multiple disciplines during both design and construction. Key stakeholders include the Architect of Record (AOR), Structural Engineer of Record (SEOR), Mechanical Engineer of Record (MEOR), General Contractor (GC), steel detailer, steel erector, painter, and roofers.

During the design phase, the SEOR must collaborate with the AOR and MEOR to determine critical factors such as the height, location, and exterior finish of the screen wall. In the Rocky Mountain Region, the location, height, and cladding material of screen walls are typically determined by the AOR, but early structural input can optimize the placement of the screen wall and rooftop equipment. See Table 1 for a suggested Design Coordination Matrix outlining key design phase tasks.

Table 1: Design Coordination Matrix (for reference only)

Provides Information	Design Task/Information Needed	Needs Information		
		AOR	SEOR	MEOR
AOR	Height of the top of the screen wall, *h*		X	
	Location/extents of screen wall		X	
	Location of gates, if needed		X	
	Screen wall profile: Straight or mansard?		X	
	Screen wall panel type. Provide a cutsheet of the product specified.		X	
	Finishes: Paint or Galvanized?		X	
	Plenum space available		X	X
SEOR	Bottom of wall panels roof stand-off height, *a*	X		
	Location of screen wall framing members, i.e. posts & kickers	X		X
	Depth of roof structure supporting screen wall	X		X
MEOR	Roof Equipment sizes, locations and weights	X	X	
	Roof equipment clearance requirements	X	X	
	Roof equipment curb height	X	X	
	Clearance requirements within plenum space for ductwork	X	X	

A thorough understanding of the construction sequencing, adaptable design details, and direct coordination between designers and builders provides the best chance for a seamless execution.

In the Rocky Mountain Region, the steel fabricator is primarily responsible for understanding the design drawings to procure and fabricate the structural steel members that support the screen wall. Screen wall panels are generally metal deck or architectural metal panels. Steel erectors in this area are responsible for erecting the structural steel frame and metal deck if used as the panel. Architectural metal panels are installed by other trades.

Structural Layout Considerations

The AOR generally takes the lead for the layout with input from the SEOR and MEOR. The SEOR should inform the AOR of the key structural component locations early in the layout process so that the structure remains economical throughout design changes.

Post spacing is mainly determined by efficiency. The SEOR's goal should be to use the least number of posts possible to limit material and labor costs and roof penetrations. The locations and strength of the connecting structural roof components will impact the layout.

The structural framing layout for the support of the screen wall panels is designed by the SEOR who must understand the span limitations of the selected screen material to provide adequate back-up support spacing. Design and specification of the fasteners used to attach the screen material to the structural supports should be delegated to the panel manufacturer, while the SEOR must provide the panel manufacturer with the design wind loading. The basis of design for the assumed panel and connection types should be specified by the SEOR. See Figure 4 for example of panel load table.

MR-36-EW
Galvalume

22 ga Ix: 0.597 in^4/ft
Sx: 0.337 in^3/ft

Load psf		Single Span (ft)	Double Span (ft)	Triple Span (ft)	Load psf		Single Span (ft)	Double Span (ft)	Triple Span (ft)
20	Stress	16'-5"	16'-5"	18'-4"	55	Stress	9'-11"	9'-11"	11'-1"
	Deflection	13'-9"	18'-7"	17'-1"		Deflection	9'-10"	13'-3"	12'-2"
25	Stress	14'-8"	14'-8"	16'-5"	60	Stress	9'-6"	9'-6"	10'-7"
	Deflection	12'-9"	17'-3"	15'-10"		Deflection	9'-7"	12'-11"	11'-10"
30	Stress	13'-5"	13'-5"	15'-0"	65	Stress	9'-1"	9'-1"	10'-2"
	Deflection	12'-0"	16'-3"	14'-11"		Deflection	9'-4"	12'-7"	11'-6"
35	Stress	12'-5"	12'-5"	13'-11"	70	Stress	8'-9"	8'-9"	9'-10"
	Deflection	11'-5"	15'-5"	14'-2"		Deflection	9'-1"	12'-3"	11'-3"
40	Stress	11'-7"	11'-7"	13'-0"	75	Stress	8'-6"	8'-6"	9'-6"
	Deflection	10'-11"	14'-9"	13'-7"		Deflection	8'-10"	12'-0"	11'-0"
45	Stress	10'-11"	10'-11"	12'-3"	80	Stress	8'-3"	8'-3"	9'-2"
	Deflection	10'-6"	14'-2"	13'-0"		Deflection	8'-8"	11'-8"	10'-9"
50	Stress	10'-5"	10'-5"	11'-7"	85	Stress	7'-12"	7'-12"	8'-11"
	Deflection	10'-2"	13'-8"	12'-7"		Deflection	8'-6"	11'-6"	10'-6"

Figure 5: Morin MR-36-EW 22ga Galvalume Load Table (Morin, 2025)

Post placement should be adapted to the roof framing plan. See Figure 6 for an example layout where roof framing members align with screen wall support frames.

An economical post spacing solution must consider:

- Roof screen height
- Magnitude of the applied loads to the roof framing components
- Cost effectiveness of the post shapes
- Using braces or not
- Common practice in the Rocky Mountain Region:
  - Approximately ten to twelve feet on center maximum spacing.

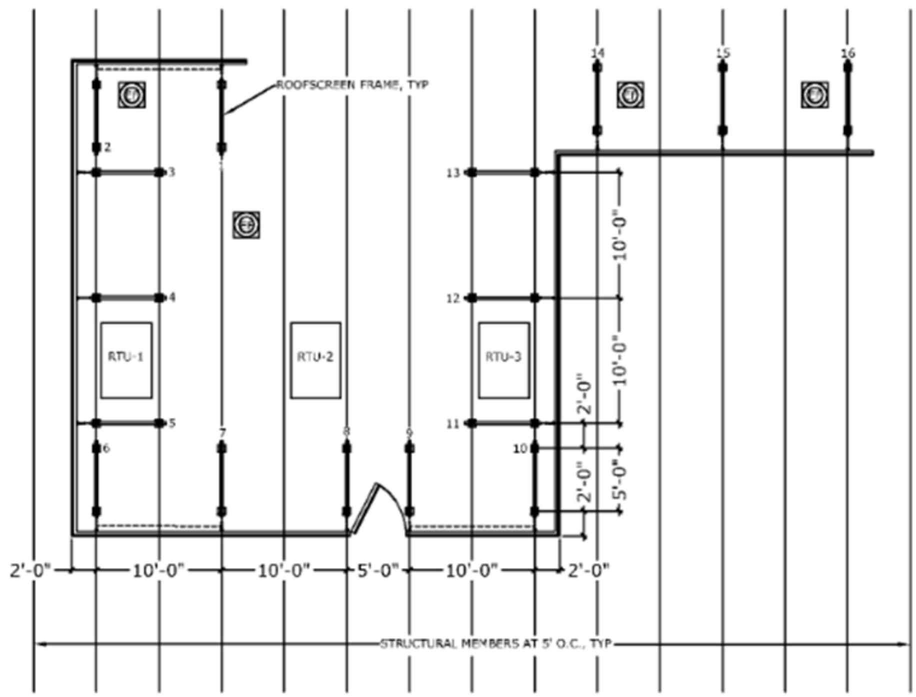

Figure 6: Example Layout - Screen Wall Support Frames Aligned with Roof Framing (RoofScreen)

Design Considerations

Structural Design

Codes & Guidelines

The below codes should be referenced for design assistance:

- ANSI/AISC 303 Code of Standard Practice for Steel Buildings and Bridges

- ASCE 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures,* American Society of Civil Engineers and Structural Engineering Institute
    - Unless otherwise noted, references to ASCE 7 are from the 2022 edition
- IBC International Building Code
- Local jurisdiction requirements

Wind Loads

Unless the wind tunnel procedure is used to determine the wind loads on screen walls, Chapter 29 of ASCE 7, *Wind Loads on Building Appurtenances and Other Structures: Main Wind Force Resisting System (Directional Procedure),* generally applies to the determination of wind loads on screen walls. While Chapter 29 does not directly address rooftop screen walls, the following text from the ASCE 7 Commentary section C29.4 provides some guidance on the recommended approach:

> Mechanical equipment screens are… defined as rooftop structures not covered by a roof and located away from the edge of the building roof, such that they are not considered parapets. Many configurations and types of screens are available ranging from solid walls to porous panels, which allow some air to flow through. Though the use of equipment screens is prevalent, little research is available to provide guidance for determining wind loads on screen walls and equipment behind screens. Accordingly, rooftop screens, equipment behind screens, and their supports and attachments to buildings should be designed for the full wind load determined in accordance with Section 29.4.1. Where substantiating data have been obtained using the Wind Tunnel Procedure (Chapter 31), design professionals may consider wind load reductions in the design of rooftop screens and equipment. For example, studies by Zuo et al. (2011) and Erwin et al. (2011) suggested that wind loads on some types of screen materials and equipment behind screens may be overestimated by the equations defined in Section 29.4.
>
> (ASCE 7, 2022)

The commentary would imply that the wind forces on screen walls located "away from the edge of the building roof" should be determined using the provisions for rooftop structures (ASCE 7-22 Section 29.4.1) and wind forces for screen walls located "near the edge of the building roof" are determined using the provisions for parapets. Additionally, screen walls are designed for full wind regardless of whether the panels are solid or porous, and full wind is also applied to rooftop equipment placed behind a rooftop screen wall regardless of shielding.

The commentary does not specifically state the boundaries for screen walls located "near the edge of the building roof" versus "away from the edge of the building roof." But in the *Structure Magazine* article "Wind Loads on Non-Building Structures," writer Emily Guglielmo, S.E., P.E. suggests this distinction can be determined using the components and cladding zones of Chapter 30 of ASCE 7-22. Screen walls located in interior zones (Zone 1' and 1) are defined as "away from the edge of the building roof," with wind forces determined using the provisions for rooftop structures. While screen walls located in corner and edge zones (Zones 2 and 3) are defined as "near the edge of the building roof", with wind forces determined using the provisions for parapets. Screen walls add to the overall building wind load, transferred into the MWFRS through the roof diaphragm (Guglielmo, 2018).

Figure 7 provides an example of the components & cladding roof wind zone map for a gable, sawtooth and multi-span gable with roof pitch ≤ 7 degrees and monoslope roofs with a roof pitch ≤ 3 degrees for heights ≤ 60ft & alternate design h < 90ft (ASCE 7, 2022).

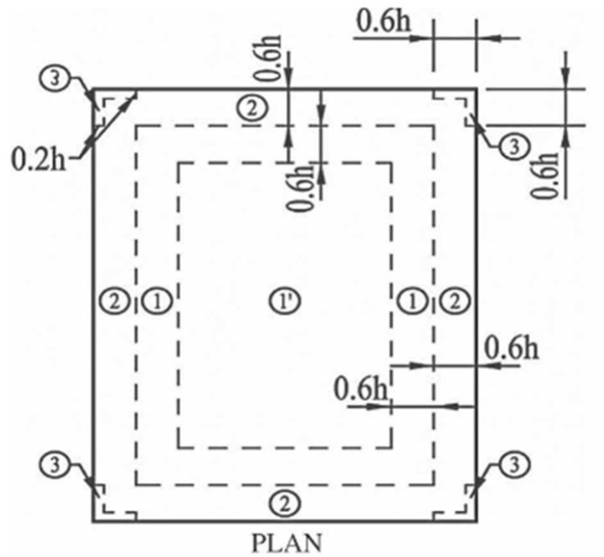

Figure 7: ASCE Wind Load Map (ASCE 7, 2022)

As mentioned in the ASCE 7 commentary, there is little research available to assist in determining wind loads applied to rooftop screen walls themselves and the rooftop equipment behind them, resulting in a recommendation that rooftop screen walls and rooftop equipment should be designed for full wind load. However, designers are allowed to consider wind load reductions in the design of rooftop screens and equipment if substantiating data is obtained using the Wind Tunnel Procedure prescribed in Chapter 31 (ASCE 7, 2022).

The Insurance Institute for Business & Home Safety (IBHS) Research Center and the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) are working on a two-part study on wind load applied to roof mounted equipment (RME) placed behind a screen wall and wind load applied directly to the screen wall. Although their investigation is still underway, ASHRAE & IBHS have published Research Project Report 1692-RP: Effects of Shielding on the Wind Loads on Roof-Mounted Equipment (2017). The report discusses various wind shielding effects with respect to the layout, size, configuration, and type of screen wall. Some key findings from the report include:

- Wind loads on the RME's can be meaningfully reduced by screen walls when the equipment height is smaller than the screen height, but that reduction is dependent on the configuration of the screen wall as well as their location on the roof.
- When effectively screened, RME loads can be as low as 45% of the ASCE 7-10 (2010) design loads.

- The type of screen panel (solid vs porous) does not appear to significantly affect the wind load on the RME.
- Wind loads for architectural screen walls are less than the lateral design coefficients provided by ASCE 7-10 (2010) for Roof Top Equipment wind loads.
    - The location on the roof does not appear to significantly change wind loads on architectural screens.

(ASHRAE & IBHS, 2017)

The findings presented in the ASHRAE report are consistent with ASCE's current recommendation that roof top screen walls be designed for the wind load, regardless of whether the panels are solid or porous.

Snow Loads

Although a screen wall design is unlikely to be controlled by snow loads, the layout of the screen wall can create snow drift conditions that impact the design of the primary roof structure. Where the screen wall is near the roof surface, snow drift should be considered in the design of the roof. According to ASCE 7-22 7.8, the bottom of the screen wall should be at least two feet above the balanced snow load to avoid additional drifting loads.

Seismic Loads

For screen walls with heavy cladding, such as precast concrete or brick, the weight of the screen material should be considered for seismic design.

Performance Requirements & Serviceability

Screen Wall Cladding Components

Like all structural elements, strength design is not the only consideration required for screen wall design. Screen walls must also be stiff enough to prevent noticeable deflections, but the allowable deflection of screen wall elements is not directly defined in the building code. Practically, the allowable deflection may be determined by the screen wall product. Brittle screen walls will require stiffer supports. While flexible screens, like metal deck, can accommodate larger deflections.

Excerpt from the *Morin Exposed Series Metal Wall System Installation Guide* explaining deflection limits:

> Building codes in most cases do not set limits on the deflection of wall cladding; therefore this item is overlooked in the design of wall panel systems. Usually these codes limit the deflection to structural members only if other materials supported are sensitive to great movement and/or cracking. Deflection should be calculated if there is concern for drainage

or the possibility of a clearance problem with secondary structural members. The Southern Building Code and BOCA limit deflection to L/180 while the Aluminum Association sets the limit at L/60. However, the designer should always check the local codes for the limits that they should set and these limits should be included in the project specifications. Uniform loading changes the wall panel products section properties as the panel distorts, (i.e., panels become more rigid under positive loads and more flexible under negative loads). (Morin, 2025)

A good rule of thumb is to follow IBC 2024 Table 1604.3 deflection limitations for both allowable vertical gravity load deflection and allowable horizontal deflection and rotation. Use two times the allowable lateral deflection based on the screen wall panel material type for horizontal deflection and rotation.

Screen Wall Connections to Open Web Steel Joists

The joist manufacturer must consider any screen wall loading during joist design, so it is necessary for the SEOR to provide all load magnitudes, connection locations on the top and bottom chord, and attachment methods.

If the screen wall post is directly attached to the joist, it is important to attach the screen wall post to both the top and bottom chords of the joist. Attaching the post to only one chord and specifying a local moment is not feasible.

When posts are connected directly to joists a bracing configuration will need to be designed that resolves the loads into vertical and horizontal (axial) components. Since steel joists cannot carry any out-of-plane loading, any such loads must be accounted for with bracing designed by the SEOR to transfer these forces into the steel deck while keeping the joist completely out of the load path for these forces. Joist chord angles are not a reliable load path for transferring out-of-plane loads to the deck due to the gap between the chords (even at a panel point). Additionally, the adequacy of the deck attachment at the bracing location is unknown. Therefore, all bracing should be attached to the post and the deck, and not to the joist.

One solution is to install a channel, or similar, underneath the "high hat" of the decking, to be attached using mechanical fasteners with a pattern designed by the SEOR. This member could be installed at the time the deck is laid, once the joist has been erected, and run into adjacent joist spaces "over top" of the joists. This would facilitate the use of as many deck attachments as necessary. Diagonal braces could then be run in both "adjacent" jois spaces from the bottom screen wall post to this member and attached at each end. This would enable the vertical portion of the load from the angle brace to be transferred from the post as a concentrated load to the bottom chord of the joist, and the horizontal component to be transferred into the deck diaphragm.

The most direct design is to add wide-flange header beams between the roof joists and beneath the screen wall posts, Figure 8. When the screen wall is parallel to the joist span, a single wide flange beam can support a cantilevered screen wall post.

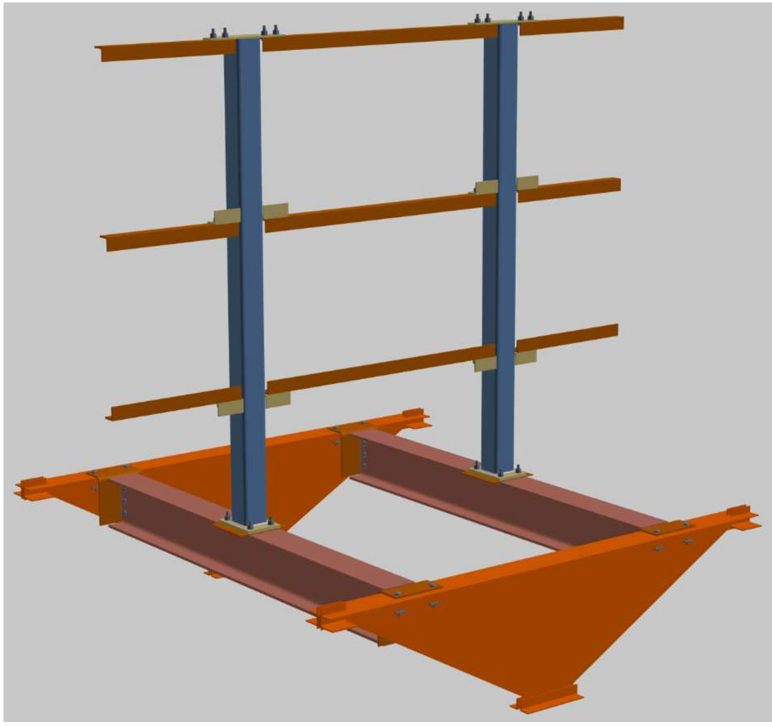

Figure 8: Header Beams Supporting Screen Wall Posts Parallel to Joist Span

When the screen wall is perpendicular to the joist span, a three-member wide flange beam frame can be added to support a screen wall post. For example, refer to Figure 9.

Figure 9: Header Beam Frame Supporting Screen Wall Posts Perpendicular to Joist Span

Tolerances

The allowable out-of-plumb tolerances for screen wall erection are primarily determined by the type of screen specified by the AOR. As noted in the design section, there is not much guidance in the codes for the design of rooftop screen walls.

The framing configuration and details used to define the support of screen walls impact how they are installed as well as what tolerances are required.

Sources of tolerances that need to be considered include deflection, rotation, and curvature of the supporting primary structure, tolerances of these supporting members, and tolerances of the screen wall components (posts, horizontal members, panels, etc. as applicable). The designer should be aware that relatively small changes in rotation of the supporting structure can translate to large tip deflections at the top of cantilevered elements.

For more information on how tolerances impact constructability, refer to the SEAC/RMSCA Steel Committee Constructability Considerations whitepaper (2019).

Suggested Methods for Alleviating Tolerances:

- Locate screen wall posts on framing members near points of support, such as load-bearing walls and columns.
    - This mitigates movement of the supporting structure
- Using framing schemes that do not rely upon rigid connections to the supporting structure, such as providing ample wall returns
- Use of ballasted screen wall systems that can be installed and adjusted after roofing, mechanical equipment, and other permanent loads are installed
- Locate screen walls in such a way that the observer cannot easily observe plumbness or alignment
- Layer the screen wall components such that one component hides another
- Include adjustability in the design for field adjustments during installation

Suggested Methods of Providing Adjustability:

- Use of oversized holes or slots
    - This may necessitate the use of slip critical bolts
- Use of field welding.
    - Note that the sequence of construction should be considered to alleviate potential damage from welding to nearby materials such as roofing or glazing
    - Also consider the effects on the finish – finishes may need to be held back from the welding surfaces, and finishes may need to be touched up after welding is complete

- Use of mechanical connections, such as self-tapping screws
- Use of end plate connections with filler plates, shims or leveling nuts
- If using a concrete slab on metal deck, consider an assembly with a kicker and post-installed anchors (with filler plates)
    - This provides horizontal and vertical adjustability at both attachment points

For example, refer to Figure 10, which depicts a conceptual screen wall detail including:

- Stub post bolted to the beam
- End plate post connection with oversized holes
- Note allowing for shims at the end plate
- Adequate clearance of end plate above roofing
- Hot dipped galvanized for corrosion resistance
- Bolted horizontal screen wall support members

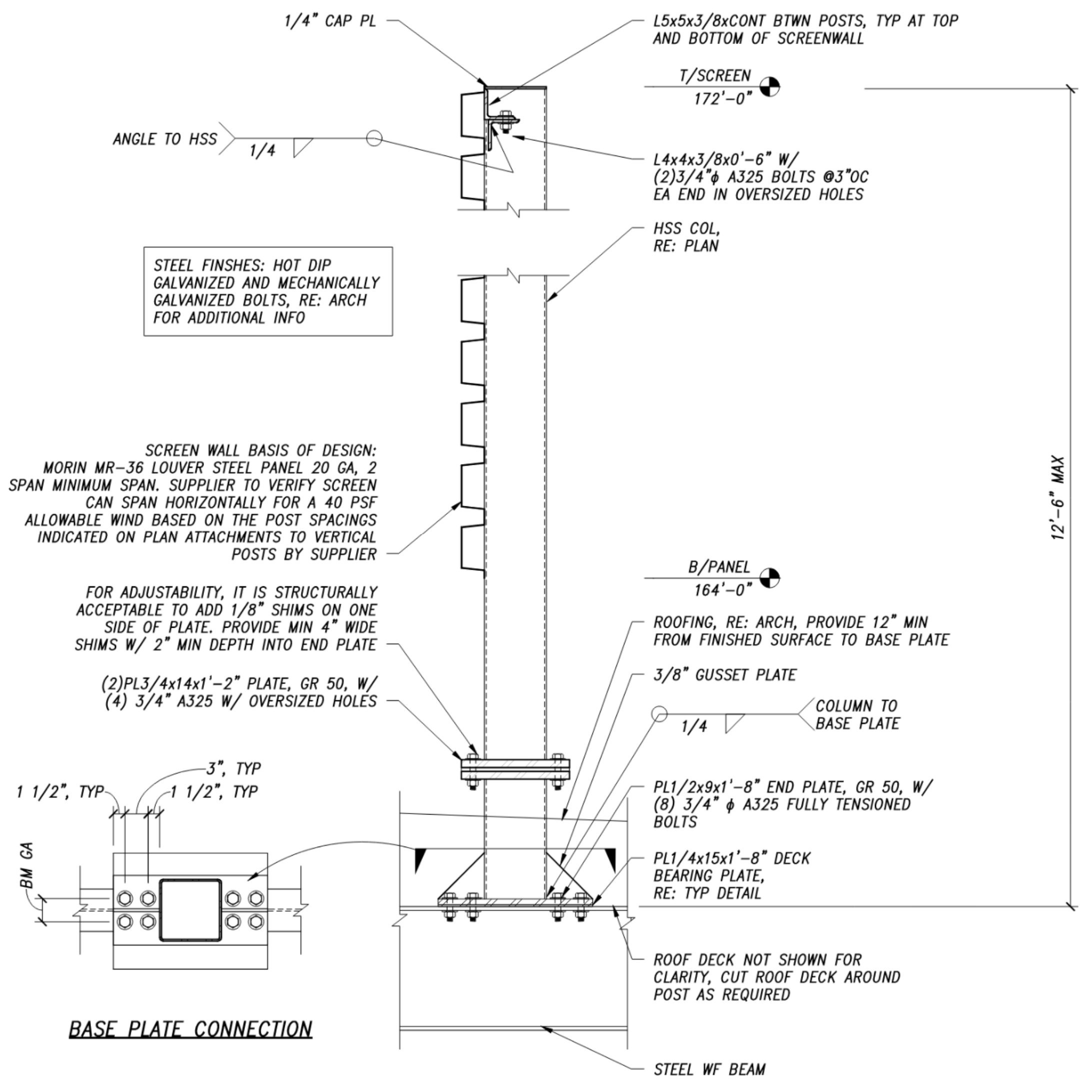

Figure 10: Conceptual Detail

Constructability Considerations

Sequence

The expected installation sequencing of metal roof deck and dead loads should play a key role in detailing screen wall post bases. Typically, metal deck is installed as shortly after the main structural frame as feasible to create a safe working surface. However, this can create difficulties installing connections below deck like common screen wall post connections. Temporarily removing deck to complete these connections can create fall hazards and schedule complications.

Where possible, the SEOR should consider extending building columns above the roof elevation to act as screen wall posts. Where building columns cannot be used in this manner, consider using stub posts shop-welded to beams. Posts can then be field bolted to the stub post. This configuration creates an opportunity to use a thermal break, transition material finishes, or transition between material sections. See Figure 11 for an example.

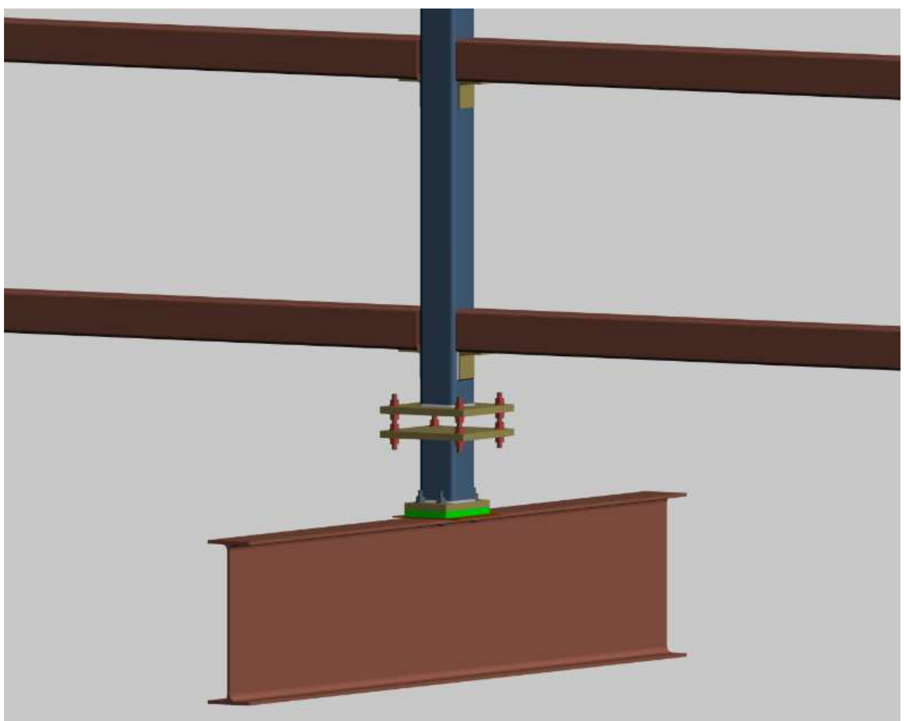

Figure 11: Example of a Shop Attached Stub Post for a Screen Wall Connection

If the roof system includes a significant dead load the designer should detail the base of the posts to permit installation of the screen wall after the permanent load has been installed to allow the dead load deflection to occur prior to screen wall installation. Where this is not possible, adjustability methods should be included in the design to allow erectors to re-plumb the screen wall after the dead load has been placed. Note that detailing to provide this adjustability may require heightened splice elevations so that the connection is still accessible after the dead load is in place.

Consideration should also be made for any details requiring field welding. In the Rocky Mountain Region, the screen wall structural steel components will be galvanized or painted. Where coating systems are shop applied, field welding of connections may require localized removal of those coatings in the field before welding can be performed. This also requires surface preparation and system repair in the field after welding has been completed, which does not provide a consistent appearance.

Designing connections to incorporate shop welding and field bolting reduces the need to perform field repairs to coatings and may reduce the risk of damage from welding after roofing installation.

Adjustability

All screen wall connections should allow for adjustability to account for conditions such as roof slope, cambered roof support members, field tolerances, and roof framing members which are not aligned with the screen wall supports. Adjustability is also desired to allow for re-plumbing the posts after nearby dead loads have been installed.

Steel construction generally proceeds with a raising gang performing the main structural steel installation, followed by a deck and detailing crew, and finally the installation of miscellaneous steel. The deck installation is a key step in this process and roof screen posts can interfere with the efficiency. Additional steel may be required to support the deck near the post. If a tall post is installed first, and is not located at a deck seam, the deck will be field cut and fished over the post, impacting crew efficiency.

Installing the screen wall posts after the deck is in place is an option, but involves field cutting openings, and additional field welding. This can also interrupt schedule flow.

Stub posts can be used to alleviate these deck install sequencing problems. Installing a stub post allows faster and simpler deck installation prior to post installation. Stub posts can also improve flashing details via the use of rectangular or round tubes while retaining an open shape above. Field welding the stub posts to the supporting structure allows the metal deck to be installed first. Shop welding the stub posts reduces field labor, but the deck will need to be field cut to fit over the stub posts. Figure 12 shows how stub posts can be used.

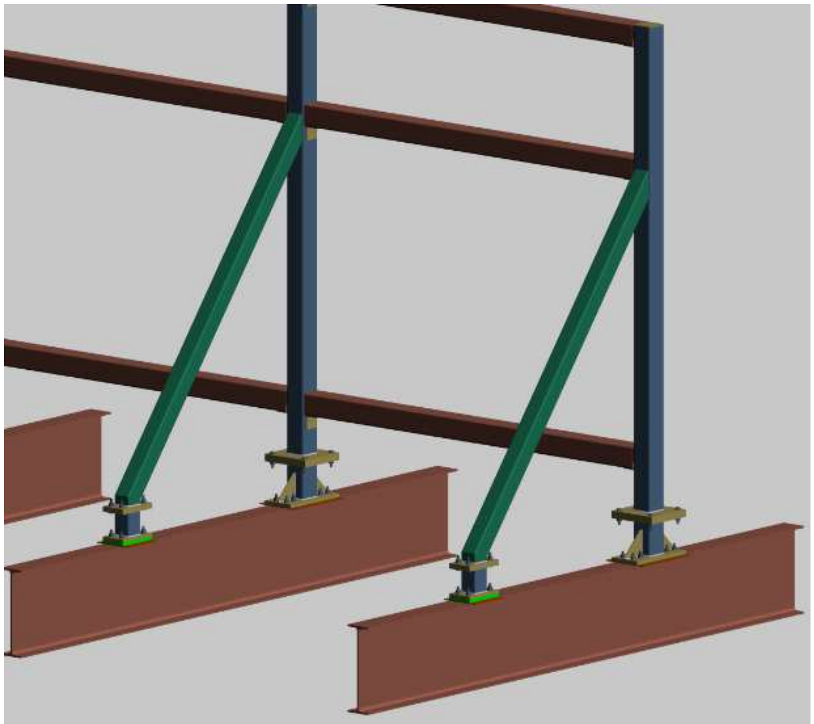

Figure 12: Example of End Plates Used on a Braced Screen Wall

End plates, also seen in Figure 12, are a common connection type used to attach screen wall posts to supporting structure – either with or without the use of stub posts. End plates also provide an opportunity to add thermal breaks where required. When detailing end plate connections consider the use of shims or filler plates that allow the erector to plumb the screen wall posts. Ideally, these are located so they are still accessible after the roof dead load is completely installed for future re-plumbing of the screen wall wind posts.

Additional consideration is required for sloped roofs so the adjusting elements also allow for vertical adjustment in addition to perpendicular adjustment. For cambered beams, additional adjustments may be required to account for that camber, and the sequence of screen wall installation versus dead load installation.

Material Finishes

The finish selection for the screen wall system will impact cost, schedule, aesthetics, and maintenance frequency. Common finishes for rooftop screen wall components include hot-dip galvanizing (HDG), powder coating, painting, or a duplex system, which employs both HDG and coating. Because rooftop screen walls are exposed to precipitation and ultraviolet radiation (UV), the selected finish should provide long-term corrosion resistance and UV protection.

Corrosion Protection

Zinc is commonly incorporated in steel coatings to provide cathodic protection, where the zinc acts as a sacrificial barrier for the steel and corrodes before the steel. HDG is performed by immersing members into a bath of molten zinc, which leaves a thin layer of zinc on the exposed steel surfaces. Painting may incorporate a zinc-rich primer applied directly to the steel to provide cathodic protection. Duplex coatings consist of powder coating or painting over galvanized surfaces, providing redundancy so if the topcoat deteriorates or is damaged, the galvanizing still provides corrosion resistance.

UV Protection

Rooftop screen wall systems are not usually sheltered or shaded, so the screen wall component finishes selected should not degrade when subjected to long term UV exposure. This is especially important in the Rocky Mountain Region due to high altitude and increased solar exposure. While HDG oxidizes in exterior applications, it generally does not degrade due to UV exposure, where other coatings can. Many powder coating and paint systems incorporate a polyurethane topcoat for UV resistance. Epoxy coatings should not be exposed to UV without a polyurethane or other UV stable topcoat.

Application

HDG and powder coatings cannot be applied in the field, while some paint systems can be field applied. However, paint systems should be applied under environmental conditions permitted by the manufacturer, which generally limit temperature, relative humidity, and precipitation exposure during application. Depending on the location, time of year, and exposure of the screen wall, field surface preparation and paint application may be impractical. Additionally, some coatings may not be field-applied based on the governing jurisdiction's VOC limitations.

Repairs

Whether the finish is shop- or field-applied, repairs to the finish will likely be required during construction. Each finish discussed above can be field-repaired, though the repair material may not be applied in the same manner as the shop-applied finish. Repairs to HDG and powder coated finishes are typically spray applied, while repairs to paint systems may generally be applied in the same manner as the initial application.

Aesthetics

HDG generally leaves a consistent appearance but may appear rough and cannot be customized. Powder coating and painting, whether applied directly to steel or as part of a duplex system, offer more color and gloss options. Because repairs to galvanized or powder coated surfaces are applied in a method other than the original shop application, repairs to these finishes are more likely to be visually apparent than in paint systems.

Cost

For the owner of a building, the cost of a screen wall is primarily in materials, fabrication, and erection. While designers are often focused on minimizing material weights and costs, the fabrication and erection costs can also be significant where there are additional pieces, field welds, or heavy members.

Roof Penetrations

Every penetration through the roofing system poses a threat of water infiltration if the flashing at that penetration is not thoughtfully designed, correctly installed, or regularly maintained. While the flashing detail for roof penetrations is typically designed by the AOR, the SEOR may play a role in reducing the likelihood of water infiltration through roofing penetrations in a number of ways.

The SEOR may direct the structural design towards maximizing post spacing to minimize the total number of roof penetrations. Early coordination with the AOR can lead to an overall reduction of the footprint and perimeter of the screen wall, which also reduces the number of roof penetrations.

Flashing at Post Penetration

Flashing at roof penetrations is often accomplished by using pre-formed boot flashings, which are typically composed of the same material as the roof membrane. Most pre-formed boot flashings fit a variety of square or round tube sizes, making square or round tubes a practical profile for screen wall posts that will penetrate the roofing system. The boot flashings are adhered or heat welded to the roof membrane and sealed at the top termination against the penetration. If the penetration is round, a clamping ring may also be used at the top termination as an extra precaution. Note that while pre-formed boot flashings are not rigid, they are typically intended to be installed around vertical tube penetrations, so angled tube kickers may require liquid flashing. Likewise, liquid flashing may be implemented if profiles such as wide flange sections or angles penetrate the roofing, though liquid flashing may not be compatible with paint systems used on the structural frame members.

Provide Sufficient Flashing Height

Changes in profile of the post or connections to the post should be at a height above the roof that allows proper installation of flashing components. Depending on the flashing details, eight to twelve inches will likely accommodate the flashing.

Design Watertight Connections

While tube sections are practical from a flashing perspective, they pose a connection problem for both design and field teams. Bolt holes or vent holes in HSS used during galvanizing can introduce an avenue for water to penetrate the roof system. Welded connections to HSS do not create openings that would allow water infiltration into the tube but should still be designed with consideration for water management. Aside from welding for structural purposes, skyward facing joints between steel members should be welded to prevent water from collecting between the steel members, which could cause corrosion, separation, or deformation of the members. Utilizing clip angles or plates welded to tube posts may allow bolted connections to be implemented for constructability purposes without creating additional openings in hollow sections. Consider using open sections like WF for posts where water retention is a concern.

Inclusion of thermal breaks should also be discussed with the AOR. Each post creates a thermal bridge that reduces the efficiency of the building envelope unless mitigated, Figure 13 for example. For more information on thermal breaks in steel construction, refer to the SEAC/RMSCA Steel Committee Thermal Breaks in Structural Steel whitepaper (2023).

Figure 13: Thermal Breaks at Screen Wall Base

Conclusion

Rooftop screen walls are often afterthoughts on projects, causing coordination, design, and installation difficulties. Current building codes do not provide much design assistance, but with careful interpretation of ASCE 7 commentary and wind load requirements, roof screens can be designed with ease. Successful screen wall design and construction requires early coordination and consideration for constructability. Designers should balance efficient structural design with a coordinated layout that minimizes the total number of roof penetrations. Structural sections should be selected to minimize moisture retention and to facilitate integration with the roofing and flashing systems.

Detailing of the screen wall structure should include reasonable construction tolerances required when screen wall posts are supported by deflected and often sloped roof framing members. Providing adjustable connections is important to allow for proper installation. Designers should prioritize bolted connections that allow for shims and oversized holes for adjustment. Although hot dipped galvanized tube sections are common for screen wall posts, designers may consider the use of open sections or other coating options to reduce the costs of screen walls.

For such a simple component of the building, there are many different approaches that may be best for any given project. Early coordination with design and construction teams will set the project up for success and reduce the difficulties of screen wall construction.

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