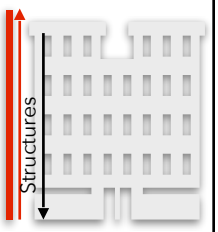
SE INSIGHTS
FOR MASONRY DESIGN

Support Strategies for Masonry Veneers: Shelf Angles, Movement Joints, and Structural Considerations

To estimate differential defections, compare:

- Brick veneer movement:
  - + ▵ brick moisture growth
  - + / - ▵ brick temperature
  - - ▵ compression from self-



Differential Movement Example

What Are the Options for Supporting Masonry Veneers?

Masonry veneers are commonly used in building facades for their aesthetic appeal and durability. Proper support of these veneers is crucial for accommodating vertical (gravity) and lateral (wind or seismic) loads. The TMS 402-16 code outlines various methods for supporting masonry veneers, either through prescriptive requirements or alternative analyses. This article reviews the available support options, particularly for systems with flexible backup materials like wood or metal studs, and discusses considerations for rigid backup systems.

According to Section 12.2 of TMS 402-16, the support options for masonry veneers can follow prescriptive guidelines or be determined through alternative analysis. The choice between these approaches depends on the type of backup system used and the specific characteristics of the building, such as height and structural flexibility.

Veneer Support with Flexible Backup Systems

For structures utilizing flexible backup materials (e.g., wood or metal stud walls), the following options are available for supporting masonry veneers:

1. Shelf Angles with Horizontal Movement Joints:

As specified in TMS 402, Section 12.2.2.6.1, shelf angles should be used to create horizontal movement joints at intervals of 30 feet and at each floor level above that, or at 38 feet for gable ends. This configuration accommodates differential movement between the veneer and the backup system, reducing the risk of cracking due to thermal expansion, moisture changes, or structural deflections.

2. Alternative Analysis for Eliminating Shelf Angles:

Section 12.2.1 of TMS 402 permits alternative analyses to eliminate the need for shelf angles. This approach involves evaluating the differential movement between the veneer and the backup system and may require the use of flexible veneer connectors for the upper portions of the wall. Such connectors allow for movement while maintaining the integrity of the veneer system.

3. Reduced Shelf Angle Frequency:

Under the same section (12.2.1), an alternative analysis can justify reducing the frequency of shelf angles, such as placing them every second or third floor. In these cases, standard veneer connectors may still be used, but the connections between the shelf angles and the backup system need to be more robust to handle increased loads.

4. Structural Masonry Veneer:

For walls constructed with structural masonry (e.g., 4-12 inch hollow clay units or 6-inch or greater concrete masonry units), shelf angles may not be required. Instead, horizontal supports can be provided as needed based on the design requirements. This approach can simplify the construction process for taller buildings.

When using rigid backup systems such as structural masonry or concrete walls, the need for shelf angles is less critical. However, for buildings over 50 feet in height, FORSE Consulting and the International Masonry Institute (IMI) recommend analyzing potential veneer movement to ensure adequate support and prevent excessive stresses. Even with rigid backup systems, differential movements due to temperature changes, moisture variations, and structural loads must be accounted for.

Estimating Differential Movement

Differential movement between the veneer and the backup structure is influenced by several factors:

- Brick Veneer Movement: Includes thermal expansion, moisture growth, and compression due to self-weight.

- Structural Movement: Includes deflections due to gravity loads (particularly significant in stud construction) and lateral forces from wind or seismic events.

- Veneer Anchors: Must be designed to accommodate the differential movement by allowing for relative motion without compromising the structural or aesthetic performance of the veneer.

Practical Recommendations

For designers and engineers working on masonry veneer projects, consider the following practices:

1. Use Prescriptive Requirements for Standard Applications: When working with common building types and heights, follow the prescriptive guidelines in TMS 402-16 for ease of compliance and design efficiency.

2. Perform Alternative Analysis for Unique Conditions: For projects with unconventional heights, materials, or environmental conditions, consider conducting an alternative analysis to optimize the support strategy and potentially reduce construction costs.

3. Specify Movement Joints and Anchors Appropriately: Ensure that movement joints are located based on calculated differential movement and that anchors can accommodate expected displacements.

4. Consider Structural Masonry for Simplification: Where appropriate, use structural masonry veneers to eliminate the need for shelf angles and movement joints, especially in high-rise applications.

Conclusion

Supporting masonry veneers involves selecting an appropriate strategy based on the type of backup system and building characteristics. For flexible systems, shelf angles and movement joints are typically required, while rigid systems may allow for reduced use of these elements. Understanding differential movement and using alternative analyses can help optimize veneer support, ensuring safety and durability across various applications.

References

TMS 402-16, "Building Code Requirements for Masonry Structures"
FORSE Consulting, "Insights for Masonry Design"
International Masonry Institute, "Best Practices for Masonry Veneer Support"