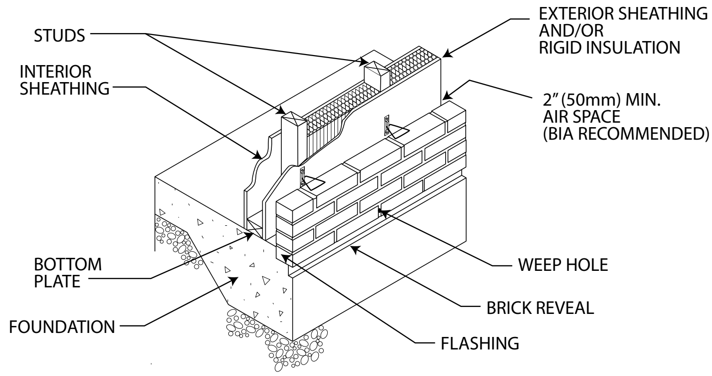
Deflection Limits for Wood Studs Backing Brick Veneer

By Harold O. Sprague, P.E.

Serviceability issues like deflection limits are fairly subjective. While codes may prescribe certain minimums for elements like brittle finishes, do these minimums actually accomplish their intended purpose? This article deals with deflection limits for wood studs backing brick veneer. Code provisions and research are examined to determine if these limits are appropriate.



Codes and Research

What is the maximum deflection limit of wood studs that back-up brick veneer? International Building Code (IBC) Table 1604.3 gives a limit of L/240 for "brittle finishes" in exterior walls and interior partitions. Furthermore, footnote "f" states the wind load is permitted to be taken as 0.70 of the components & cladding (C&C) wind load for the purpose of determining deflection limits. For wood-frame, deflections are typically calculated assuming bare studs (i.e. no sheathing contribution to stiffness).

Other promulgated deflection limits for brick veneer include L/360 by steel stud manufacturers, L/600 according to the Brick Industry Association (BIA), and L/720 based on Canadian Research.

Interestingly, BIA guidance from *Technical Note 28B* limits the lateral deflection of steel studs to L/600 for "service" wind loads: "Therefore, to obtain sufficient backing stiffness, the allowable out-of-plane deflection of the studs due to service level loads should be restricted to L/600." But BIA does not define "service level loads."

For wind the IBC and *Minimum Design Loads for Buildings and Other Structures*, ASCE 7, requires calculating the variable "p" that is defined as the "design" wind pressure and is the 50-year mean recurrence interval (MRI). Serviceability is discussed in ASCE 7 Section C6.5.5. The general consensus is that service level winds are 10-year MRI winds and are about 75% of the pressure calculated from "design" 50 year MRI winds. This is consistent with the IBC 0.70 factor on C&C wind loads.

If the above logic is considered valid, the L/600 BIA limit at a "service" 10-year MRI wind would be about the same as a L/400 at a 50-year MRI "design" wind load (inferring L/600 for a 10-year service). It is conservative to use the 50-year MRI for L/600, but that also increases the cost. If "service level wind loads" without a qualifier means code based wind loads without load factors applied, it would mean a 50-year wind load as written.

But, the issue of "serviceability" is much more subjective. A deflection limit of L/720 makes more sense for vertical deflection of lintels than for out-of-plane deflection of masonry walls, due to greater wall flexibility in the out-of-plane direction. It would be better to have deflection limits defined for full code "service level wind loads," than define it for a lesser wind frequency, even if the lesser wind frequency is part of the basis for the defined limit. This just keeps requirements more "user friendly."

Is L/600 too stringent for out-of-plane bending for a serviceability issue? Canadian research titled *Technics Steel Stud / Brick Veneer Walls*, by Trestain and Rousseau drew from earlier McMaster University studies. The McMaster studies actually constructed veneer stud walls and tested with wind pressure and simulated rain.

The result was that there was no increased system vulnerability due to excessive leakage from flexural cracking. The L/720, L/600, or L/360 deflection limits do not eliminate flexural cracking. The deflection limit is intended to reduce the flexural cracking size. But as the McMaster study indicated, the size of the flexural cracking did not increase system vulnerability.

What did have a more significant effect on the system were elements to: 1) control and manage moisture that enters through the brick from rain and dew point, and 2) provide corrosion resistance. The Technics research did recommend L/720 for the full wind load, but as stated earlier, actually provided evidence that crack width was not an issue for system performance.

It is interesting to note that the latest Canadian code for masonry has reduced the deflection limit for flexible structural backing systems to L/360, providing the veneer is not used as part of the moisture management system. In earlier codes, a deflection limit of L/720 plus tie deflection was specified when the veneer was being used to limit water penetration. Additionally, an air barrier membrane to deal with any moisture that makes its way through the veneer is required.

Conclusion

Deflection limits for wood studs that back-up brick veneer are subjective. The IBC prescribes a minimum of L/240 for brittle finishes. Research showed that tighter deflection limits do not eliminate flexural cracking; however, the size of flexural cracking does not increase system vulnerability to moisture intrusion. More significant elements for moisture control were managing moisture from rain and dew point, and corrosion resistance.▪

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