Shear Walls Under Gravity Load

While shear walls are primarily a lateral force resisting system they also carry gravity loads including their self-weight. Gravity loads typically produce axial loads as the main force components for walls. However, asymmetric gravity loading and frames could produce shears and bending moments of significant magnitude in shear walls. This is due to the diaphragm action in most typical shear wall buildings. Any differential vertical displacement in a shear wall system causes the diaphragm to displace in the vertical and rotational direction resulting in re-distribution of both vertical and horizontal loads. The net lateral load under gravity load will, of course, remain zero.

First take the case of a single wall, 10' wide with 2 levels of 10' in height, but with no rigid diaphragm. At one corner, a vertical load of 10 kips is applied at each level. The resulting overturning moment is equal to 10k x 5' eccentricity = 50k'. Since there are no other elements connected to this free body (and since the wall element is not meshed into smaller parts), the net shear at the base is zero.

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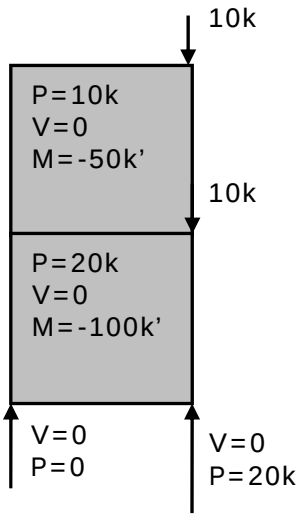
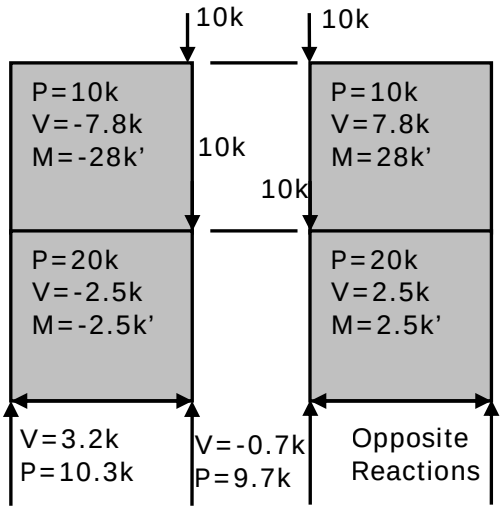


Isolated Wall with Eccentric Load

Now consider two identical walls connected by a rigid diaphragm (or a stiff beam). The presence of the diaphragm inhibits the lateral deformation and internal shear forces can now occur. The wall moments are reduced by this effect, but the shear forces can be significant. The forces and reactions in the opposing walls counteract each other, so there is still no net shear (only the left wall reactions are depicted here). It is also of note, that when walls are meshed the relative corner reactions will change.



Paired Walls with Eccentric Loads