The first point at the interior end of the left shear wall segment is determined as follows:

200 plf (3 ft) – 333 plf (3 ft) = - 400 lb (compression force)

The second point at the interior end of the right shear wall segment is determined as follows:

- 400 lb + 200 plf (9 ft) = 1,400 lb (tension force)

The collector load at the right-most end of the wall returns to zero as follows:

1,400 lb – 375 plf (8 ft) + 200 plf (8 ft) = 0 lb

Conclusion

The maximum theoretical collector tension force is 1,400 lb at the interior edge of the 8-foot shear wall segment. The analysis does not consider the contribution of the "unrestrained" wall portions that are not designated shear wall segments and that would serve to reduce the amount of tension (or compression) force developed in the collector. In addition, the load path assumed in the collector does not consider the system of connections and components that may share load with the collector (i.e., wall sheathing and connections, floor or roof construction above and their connections, etc.). Therefore, the collector load determined by assuming the top plate acts as an independent element can be considered very conservative depending on the wall-floor/roof construction conditions. Regardless, it is typical practice to design the collector (and any splices in the collector) to resist a tension force as calculated in this example. The maximum compressive force in the example collector is determined by reversing the loading direction and is equal in magnitude to the maximum tension force. Compressive forces are rarely a concern when at least a double top plate is used as a collector, particularly when the collector is braced against lateral buckling by attachment to other construction (as would be generally necessary to deliver the load to the collector from somewhere else in the building).

EXAMPLE 6.4 *Horizontal (Floor) Diaphragm Design*

Given

The example floor diaphragm and its loading and support conditions are shown in the figure below. The relevant dimensions and loads are as follows:

d	= 24 ft	
l	= 48 ft	
w	= 200 plf	(from wind or seismic lateral load)*

*Related to the diaphragm's tributary load area; see Chapter 3 and discussions in Chapter 6.

The shear walls are equally spaced and it is assumed that the diaphragm is flexible (i.e. experiences beam action) and that the shear wall supports are rigid. This assumption is not correct because the diaphragm may act as a "deep beam" and distribute loads to the shear wall by "arching" action rather than bending action. Also, the shear walls cannot be considered to be perfectly rigid or to exhibit equivalent stiffness except when designed exactly the same with the same interconnection stiffness and base support stiffness. Regardless, the assumptions made in this example are representative of typical practice.