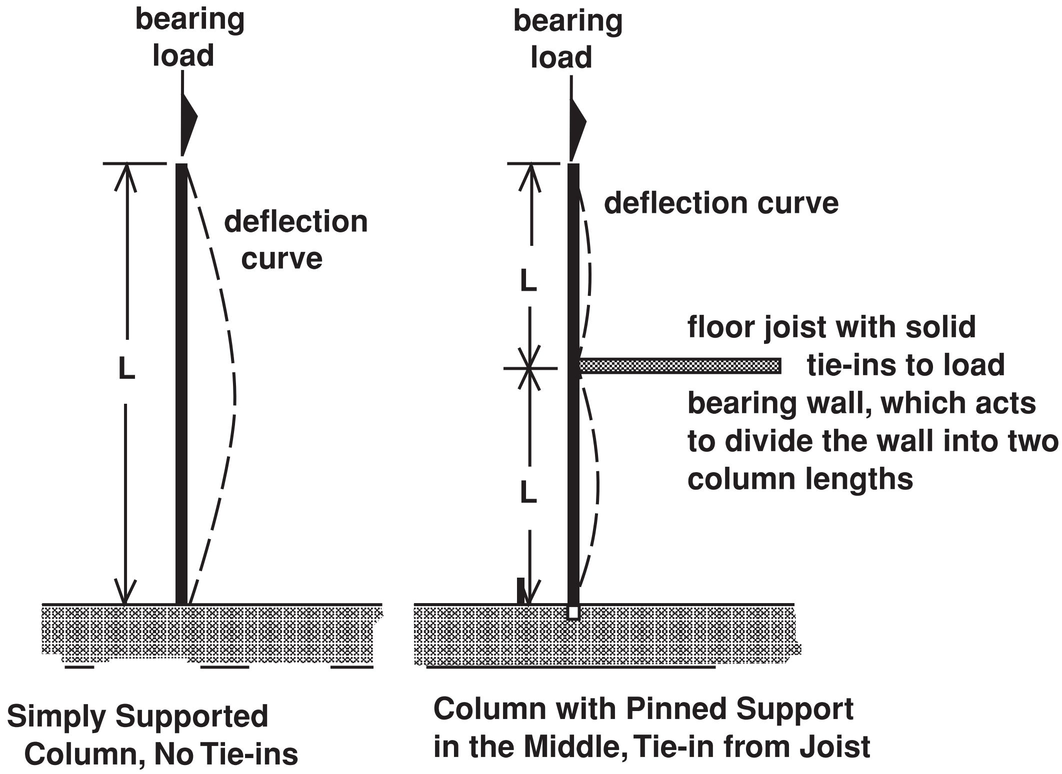

Figure 5.4 Effect of joist tie-ins.

When one end of a column is rounded, and the other end is fixed, C = 2. When the column is pivoted at both ends, C = 1. When both ends are fixed, C = 4. When one end is fixed and the other free, C = 1/4.

Thus, with no effective tie-ins, the wall can be modeled as a column of length "L," with a free end and a fixed end. However, if there is a rigid tie-in in the middle of the wall, the lower portion becomes a column with a fixed end and a pivoted end, and the upper portion of the wall becomes a column with a free end and a pivoted end. The effective tie-in afforded by the joist not only shortens the length of the column, which reduces the critical stress point, but also improves the end conditions, which further reduces the critical stress point.

With respect to the bottom of the wall being assumed to be a fixed end, some care should be made when applying this assumption. Often when water leakage is sufficient, water will run down the wall and pool at the base of the wall. If significant damage has occurred at the bottom, it should be considered a rounded end condition.

Thus, when water leakage from the roof has both leached significant amounts of calcium hydroxide from the mortar and caused rot in the bearing boxes, the combined structural effects can very pronounced. The effective value for Young's modulus is reduced, the overall length of the wall as a column can be doubled, and the applicable factors for column end conditions are lowered.

5.7 Restoration Efforts

Some of the buildings that fit the category under discussion have become icons of the city or town in which they were constructed. Because they were built when the town was first established, they have historical and sentimental value to the residents. Unfortunately, the repair of such buildings is neither easy nor cheap.

If the damage to the wall is localized and confined to a small area, repairs may entail removal of the stone or brick in the leached areas with complete resetting with a modern cement based mortar. Since removal of such brick or stone may leave a large hole in the load-bearing wall, such repairs may require significant structural shoring. To do this safely requires the expertise of experienced rehabilitation contractors.

Sometimes when such water damage is finally discovered in a turn-of-the-century building, leaching of the mortar has progressed to the point where entire sections of load-bearing walls are affected and are at risk. Simple tuck-pointing repairs or remortaring *in situ* are the usual first attempts to deal with such damage because they are the cheapest option. While these efforts can temporarily hide the damage, they can not reverse it. In fact, such repairs often will not even be cosmetically effective for long because the new mortar will not be able to adhere to the crumbling old mortar.

Meaningful structural repair and salvage of the wall in such cases requires more than superficial tuck pointing. It may require more resources than are available, or at least more than the owners are willing to spend. This creates the following dilemma: the building is too sentimentally significant to the town to be torn down, but costs too much to be properly fixed by the owners. Because of the indecision that results, the building usually sits for a long time, decays more, and is eventually razed when decay is obvious and collapse is imminent.

Further Information and References

Formulas for Stress and Strain, by Raymond Roark, 2nd ed., McGraw-Hill, New York, p. 300. For more detailed information please see Further Information and References in the back of the book.

Mechanical Engineer's Pocket Book, by William Kent, 9th ed., John Wiley & Sons, New York, 1915, p. 372, "Strength of Lime and Cement Mortar," and p. 370, "The