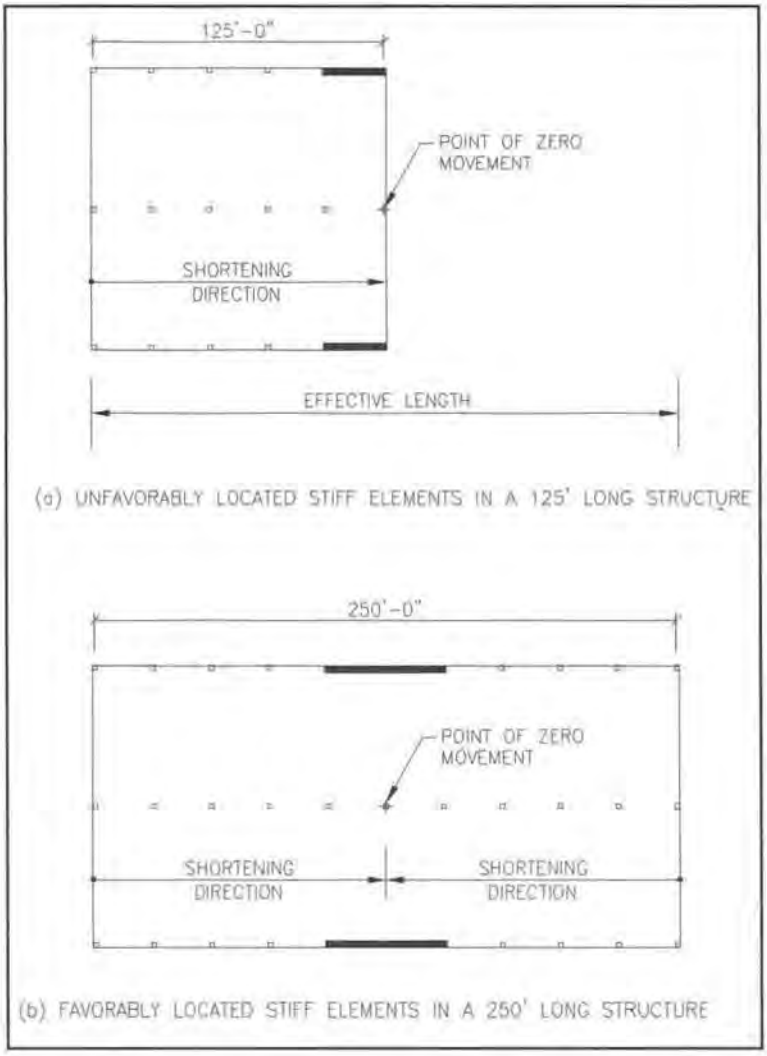
2.8.1.3 Closure Strips

Closure strips are temporary slab separations that allow different sections of the slab to move independently. The most important consideration for closure strips is that, in order to be effective in mitigating restraint cracks, they must remain open long enough for most of the slab shortening to have occurred. This is discussed in more detail in Section 2.8.4. If the construction schedule or other considerations will not allow a closure strip to remain open for the required time, an expansion joint should be used to create the structural separation. Note that closure strips are sometimes provided solely for construction convenience, i.e. to allow access for stressing. If this is the case, it does not matter when they are filled. Figure 4.2-11 shows reinforcing for a typical closure strip.

2.8.1.4 Expansion Joint and Closure strip Spacing Guidelines

Based on the performance of post-tensioned slabs, the following guidelines for closure strips and expansion joints are recommended:

- If the slab length is less than 250 feet, no closure strips or expansion joints are necessary.
- If the slab length is greater than 250 feet, but less than 325 feet, provide one centrally located closure strip.
- If the slab length is greater than 325 feet, provide one centrally located expansion joint.



These guidelines may need to be modified for locations with significant temperature changes. In addition, they assume that stiff elements such as shear walls are favorably located near points of zero expected movement. The plan location of stiff elements plays a very important role in the determination of expansion joint or closure strip spacing. As an example, the structure of Fig. 2.8-4(a) is only half as long as the structure of Fig. 2-8.4(b) but is equivalent when it comes to floor shortening effects. This simple illustration emphasizes the importance of favorably located stiff elements.

Fig. 2.8-4 Effect that Stiff Element Location has on Effective Floor Slab Length

2.8.1.5 Structural Isolation

Released connections are an effective means of crack mitigation when favorable layout of supporting structural elements, or provision of expansion joints and closure strips, cannot be adequately implemented. Released connections are those in which a joint is detailed and constructed to permit limited movement of the slab relative to its support. Released connections may be used in conjunction with closure strips and structural joints. In most practical applications, released connections are temporary, meaning that after a predetermined amount of slab shortening occurs, the connection is fixed and the slab is rigidly tied to the support. As with closure strips, released connections must remain free for an appropriate amount of time in order to be effective.

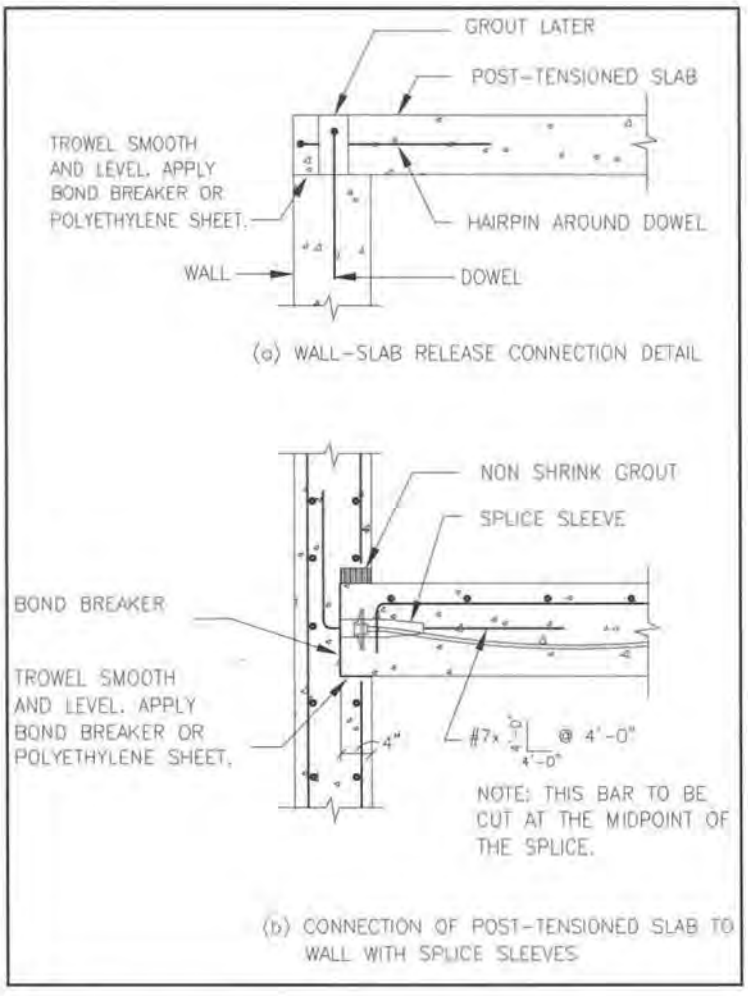


Figure 2.8-5 shows some examples of typical released connections that have been used successfully in practice. The performance of released connections is highly dependent on the thought given to how the detail will actually work and the workmanship and quality of the construction. Slippage materials such as polyethylene should be used to reduce contact friction along released connections.

Fig. 2.8-5 Temporary Release Details

2.8.1.6 Restraint Cracks and Ultimate Strength

Work done by Aalami et al[16] indicates that rotation at regions of maximum moment partially closes the gaps created by restraint cracking in flexural compression zones. Upon partial closure of these gaps, a horizontal compression force develops. This is beneficial to the ultimate strength of the slab or beam since it virtually eliminates the axial tensile force due to restraint. Restraint cracks in post-tensioned members thus do not significantly affect the ultimate strength of a section and or its factor of safety against failure. In order to properly assess the ultimate strength of unbonded post-tensioned members, boundary conditions in the plane of the member need to be taken into account. Pure sectional considerations are not adequate.