



Multi-strand Tendon Stressing

Question:

Can multi-strand tendons be stressed with a mono-jack?

Answer:

All multi-strand tendons have to be stressed using a multi-strand jack.

Multi-strand tendons consist of multiple bare strands within the PT ducts (steel or plastic). These ducts are initially placed in forms together with reinforcing stirrups-bars before casting.

Strands usually are installed either by pushing individual strands one-by-one or by pulling the strand bundle through the duct using a winch. The strands will not end up parallel and side-by-side with other strands in the duct, especially when the pushing method is utilized. When a pushing machine is used the strand is threaded not in a straight line but is entangled and twisted with the other strands forming a bundle.

The common tendon geometry has a profile with curvature/deviation along the length of the tendon. When tendons are stressed, the strand moves within the duct in the direction of stressing as it elongates. When curvatures exist in the duct, the strands will be concentrated in the area of the duct toward the inside wall of the duct in the curved portion. In a typical tendon, all strands will be pushing down against the duct at the high point and pushing up against the duct at the low point.

If individual strands were stressed with a mono-jack, they would be pinning down other strands against the duct in the curvature areas. This would increase the friction of those strands when they are stressed and when sufficient force is present, consequently strands would only elongate between the stressing jack and the first pinch point.

Stressing the tendons as a bundle with the multistrand jack eliminates this problem as all strands move at the same time.

Of course, there are also exceptions, such as the transverse tendons in bridge decks or the tendons in building slabs. These are typically 2-5 strand tendons in flat ducts. The duct dimensions do not allow strands to crisscross, the strands are typically pre-placed in the ducts, the tendons have minimum curvature, and they are typically short. In fact, most transverse tendon anchorage systems are designed to be stressed with mono-jack.

Another exception might be a multi-strand tendon that is straight with no curvature, as might be the case in external tendons.

AASHTO LRFD Bridge Construction Specifications, specifies that all strands in each tendon, except for those in flat ducts with no more than four strands, shall be stressed simultaneously with a multistrand jack.

However, only for the design engineer can determine if a deviation from the stressing procedure can be made and individual strands of a round/flat duct and curved multistrand tendon can be stressed with a mono-jack.