GENERAL Building Services

TECHNICAL BULLETIN 1.0

UNBONDED TENDON REPAIR SERIES

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REPAIR OF DAMAGE AT LATERALLY DISPLACED TENDONS

This issue can arise when spalled or ruptured concrete is found to exist at a location where there is a lateral change in the direction of an unbonded tendon span. The tendons may have ruptured from the structure as the result of concrete spalling due to corrosion of embedded reinforcing steel, or because of insufficient hairpin reinforcement within the damaged area. While some may find it tempting to make the repair within the existing damaged area of the slab (and where the tendons are making the lateral directional change), this should be avoided for several reasons.

Structural considerations at laterally swept tendon locations

The standard vertical tendon profile as it runs along its length may be either higher or lower in the concrete depending on the bending or shear moments at a particular point. This profile is readily accommodated within the concrete member and is rarely cause for concern unless there are large sections of concrete that needs to be removed.

However, a tendons linear profile presents different challenges and are the subject of this discussion. When tendons are placed on a laterally diverted path, there are horizontal forces created in the concrete that must be recognized and accounted for prior to undertaking any repair of the damaged area.

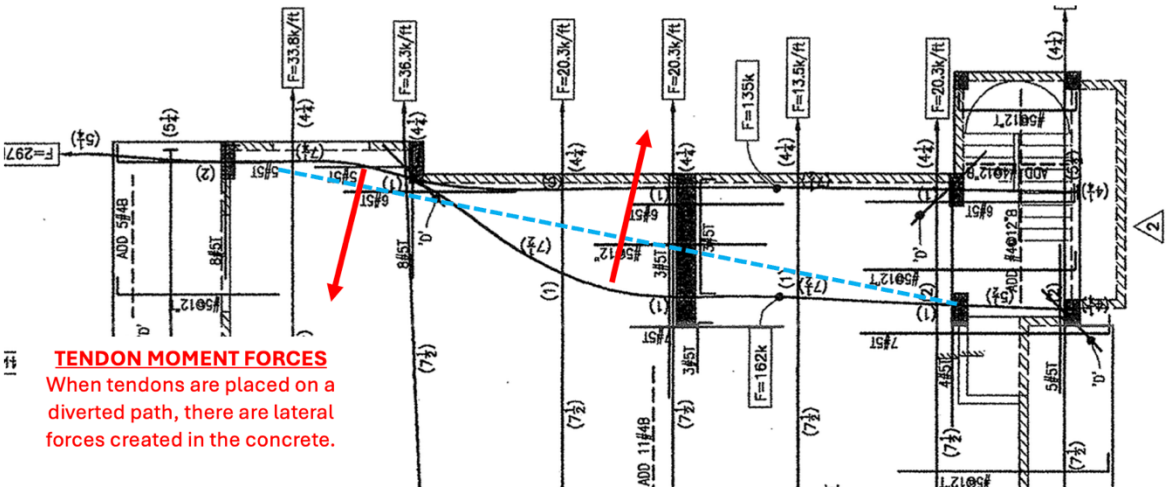

Image: Sketch showing lateral tendon force in slab structure.

Danger of inadequately reinforced tendons adjacent to damaged area

Prior to undertaking any repair efforts, it should be determined what post-tensioning exists within close proximity of the damaged area, and if these tendons lack proper hairpin reinforcement, as they too could rupture from the slab during the repair. A failure of this type can present a significant safety hazard to anyone close by, as well as a potential loss of post-tensioning that effects an entire tendon span. An examination of available structural and/or post-tension shop drawings can help identify the full extent of post-tensioning in the effected area. Additionally, it can be helpful to x-ray the areas around the damaged slab in order to confirm the existence and location of all post-tensioning and hairpin reinforcement that will play a factor in the repair.

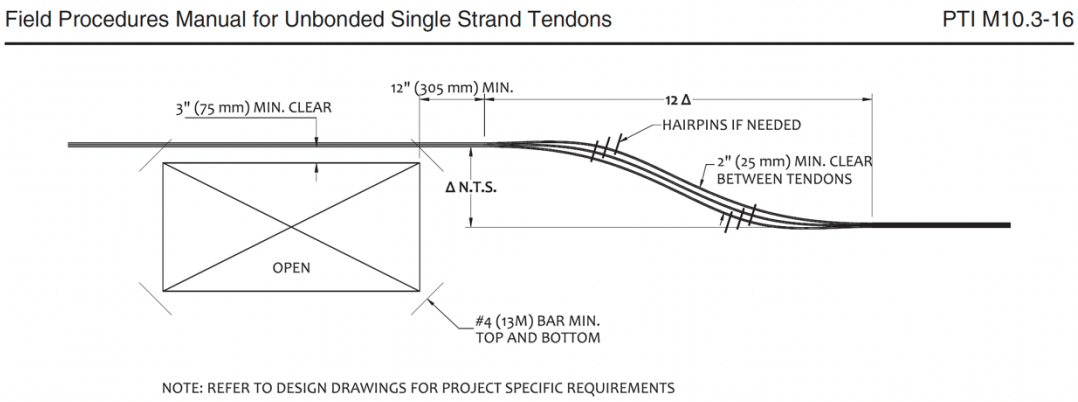

Fig. 4-6 —Typical detail of tendons deviating around an opening and tendon sweeps.

Image source: PTI M10.3-16 "Field Procedures Manual for Unbonded Single Strand Tendons".

Splice Coupler placement within a lateral tendon sweep

An issue that should be avoided is the installation of splice couplers at a location that places high bending stress on the hardware. These parts are designed to handle high tension loads that run in a straight unidirectional manner through the part. When they are subjected to off-center excentric tension loads, it can overstress the hardware and result in a sudden and catastrophic failure of the splice coupler. It is strongly recommended to avoid the installation of splices within an area of lateral tendon displacement. Instead, they should be located where the tendons have returned to a straight configuration.

Photo: Installation of these splice couplers within the tendon sweep places an excentric load on the hardware.

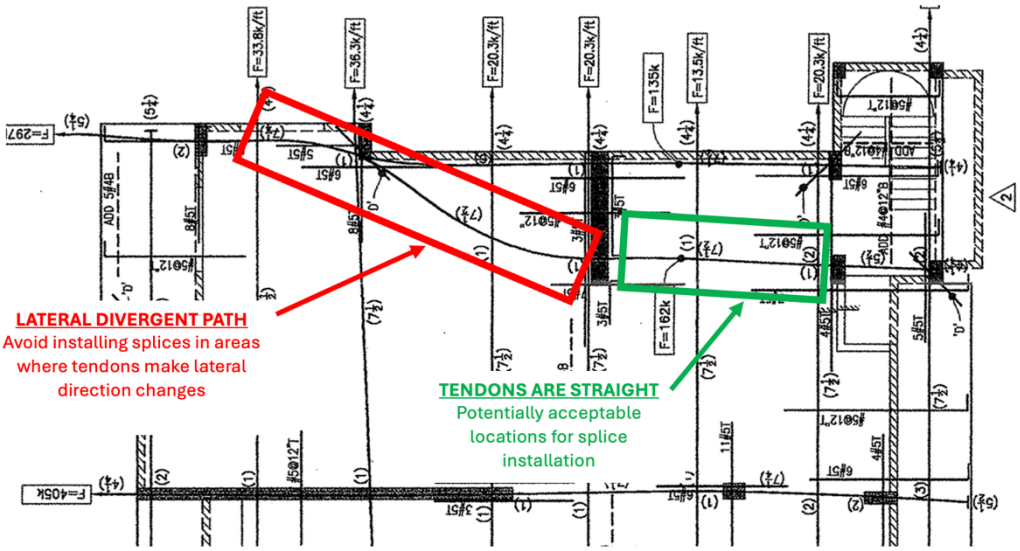

Image: Sketch shows locations to avoid when installing splice couplers.

Conclusion

Damage located within a lateral sweep of the tendons can be very challenging and should be approached with the utmost of due diligence and consideration. These repairs can evolve into complex and costly projects once the full extent of the concrete damage, tendon damage, mild steel reinforcement deficiencies, and repair alternatives are taken into consideration. Overlooking the underlying nature of the damage and rushing into a quick repair can threaten the safety of the technicians involved in the repair, as well as the structural integrity of the building.

Repair of Damage at Laterally Displaced Tendons

For more information:

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