Concrete Anchoring – Mechanical Anchors vs Chemical Anchors

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One of the main criteria in a structural design between steel and concrete involves the choice of which type of anchoring system an engineer will choose. The system he chooses has to satisfy at least some, if not all the following; load transfer (static, cyclic, fatigue), ease and speed of installation, cost, durability (including corrosion protection), aesthetics (including finish), fire resistance etc.

Structures are becoming more complex and demand new ways to anchor. Historically, a myriad of different types of mechanical anchors have been used which are still useful today. But since the 1970's, there has been an increase in the types and numbers of chemical anchors produced in the market. Chemical anchors have been developed to cater for use in both non-cracked and cracked concrete. In simple terms, cracked concrete refers to cross-sections of concrete that are subjected to tensile stresses whereas areas subjected to compression zones are generally non-cracked. Although not actually true, it would be safe to assume that most zones in a suspended slab are cracked.

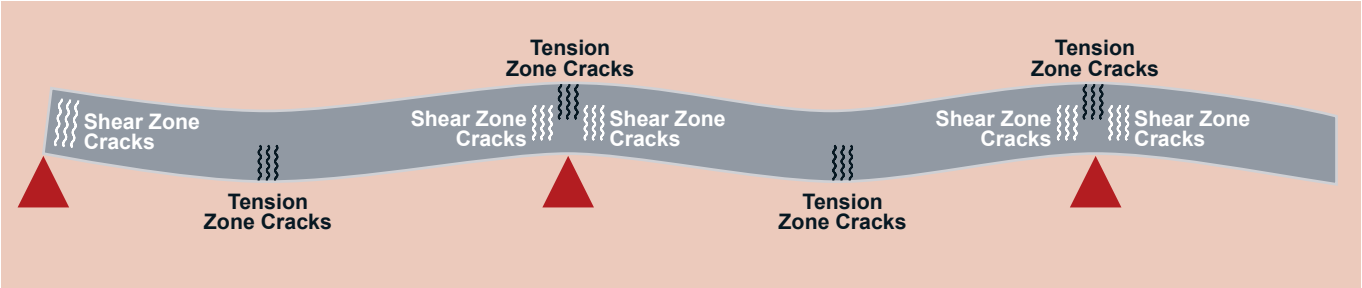
Stronger adhesives have been developed and can be used to cater for more sophisticated anchor requirements.

Below is a table showing general comparison of different anchor types and some of their suitability. A more rigorous method is to use software, like Mungo Design*, to assist the designer in the most appropriate and efficient choice of anchor to use in the design process.

REFERENCES

1. AEFAC Technical Note, *"CRACKED VERSUS NON-CRACKED CONCRETE"*, www.aefac.org.au

Typical Crack Zones



Cracked concrete refers to concrete that may experience cracking passing through the plane of the anchor at some time after installation of the system. Cracked concrete does not refer to the state of the concrete at the time of installation and post-installed anchors are not currently designed for installation in existing cracks.

Non-cracked concrete is concrete that has been demonstrated via stress analysis to remain crack-free in the vicinity of the anchor throughout the design life under all design load considerations.

Mechanical Anchors

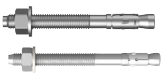
Expansion
Throughbolts, stud anchors, shield anchors, sleeve anchors, drop in anchors

TYGABOLT®

MTBMSGM

MTH16PM

CLAWBOLT



MAW58YCM

MAW16PCM

Friction, Shear Resistance
Nylon frame plugs

mungo

MUNMBSS0

MUNMBRKR

MUNMQLSR

Non-Expansion
Undercut anchor, self-tapping screws, concrete screws

Keying – Bearing, Undercut, Triaxle stresses

XBOLT®

MXHMSGM

MXCMSGM

MXEMSYM

MVXMSZIM

MXKMSGM

TX-CON®

MTXTRCP

MTXTRHL

Chemical Anchors

Capsule (Glass or foil capsule system) **and Injection** (Vinylester Urethane, Pure Epoxy, Polyester, Epoxy-Acrylate)

Adhesion, Shear Resistance and Triaxle stresses after curing.

mungo

MVA Capsule
MUCMVA00

MIT-Hybrid
MUCMTHYB1710094

MIT600RE
MUCMT6001710010

MIT-SE
MUCMTSEP1710026

Advantage	Disadvantage	Advantage	Disadvantage	Advantage	Disadvantage
Cheap, Fast Installation	Weaker then chemical anchors	Cheap, Fast Installation	Weaker then chemical anchors	Stronger then mechanical anchors	Expensive
Suitable for temporary and short term applications	Induce compression stresses	Suitable for temporary and short term applications		Does not induce compression stresses during installation	Requires setting equipment
Effective for concrete installation (within minimum edge distance)	Not suitable for hollow wall/block applications	Effective for concrete installation (within minimum edge distance)	Not suitable for hollow wall/block applications	Can bond with irregularly shaped drill holes and can transfer loads along the full length of the bond	Requires more installation time
Easy installation and less sensitive to poor installation methods		Easy installation and less sensitive to poor installation methods		Stronger anchorage in masonry materials	Sensitive to poor hole cleaning (although spin type capsules are less sensitive because the resin mixes with remaining dust)
Can be immediately loaded		Can be immediately loaded		Can be used for restrictive sections of concrete	Time required for curing and can be atmospherically temperature dependant
Throughbolts and sleeve anchors can be fixed through clearance holes in the fixture		Low stresses induced during installation		Can be used in cracked and non-cracked concrete	Overhead installation can be difficult
Suitable for overhead installations		Easily removed and can sometimes be re-used if they have wear indicators gauging their suitability		Suitable for hollow wall/ block applications with a sleeve	Require larger clearance holes in fixtures

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