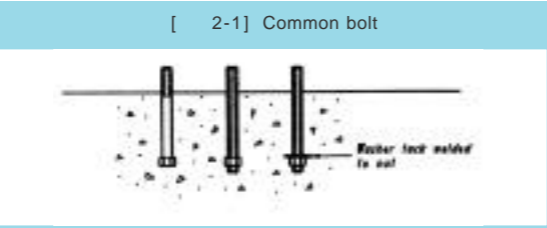
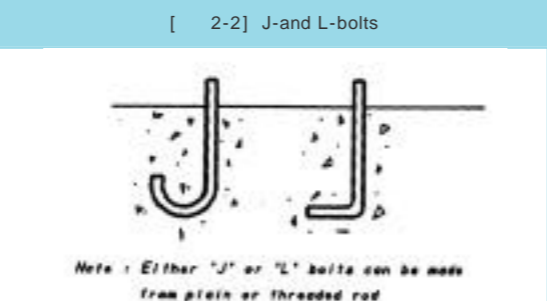
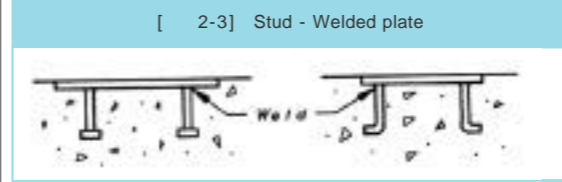


1.
 . 가 가
 (Cast-In-Place)
 가
 Installed) 가
 / 가
 Pull-Out
 가 가 가
 가
 가
 가
 가
 가
 가
 가

2.
 Cast-in-place
 System(가)
 Post-installed System(/
 Drill Hole)
 2-1. Cast-in-place System
 1) Common Bolt

 2) Hooked J or L Bolt


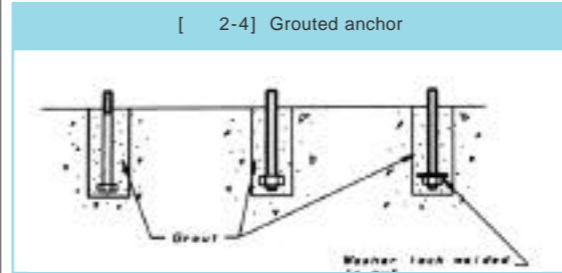
3) Stud Welded plate



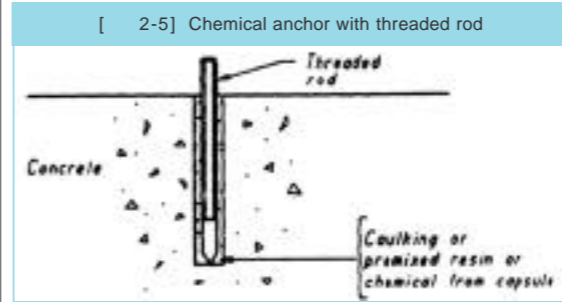
2-2. Post-installed system

2-2-1. Bonded Anchor

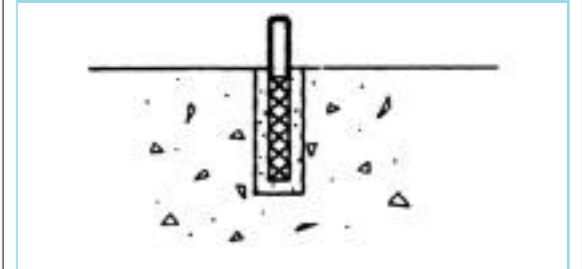
(1) Grouted Anchor
 Drilling Hole Headed/headless/threaded /
 Rod Cement-Sand Premixed Grout Grouting



(2) Chemical Anchor
 Chemical Anchor 3 Polyester, Vinylester Epoxy
 Threaded Rod Deformed Bar가



[2-6] Chemical anchor with deformed bar



Glass Capsule, Plastic Cartridge, Tube Bulk 가
 Glass Capsule Type Capsule Hole Anchor Rod 2가
 Plastic Cartridge Type Cartridge Nozzle , Hole
 Anchor Rod 가
 (Setting Time)
 30 0
 2-2-2. Expansion Anchor
 Pre-drilled Hole Anchor Nut
 (Torque Controlled Expansion Anchor, [2-7]) (Deformation Controlled Expansion Anchor, [2-8, 2-9])
 가 , Hole
 Under-cut Key가 (Under cut Anchor, [2-11])
 Anchor
 Expansion Pressure Hole Keying

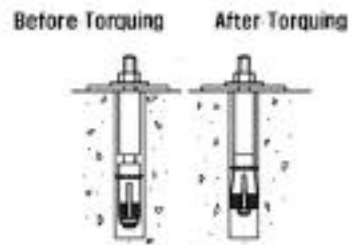
Friction

(1) Heavy duty, Torque Controlled sleeve Anchor

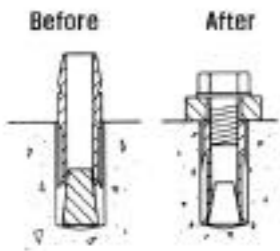
가 Thread Rod
Heavy Expansion Sleeve가

Expansion Sleeve Hole
Sleeve가
Keying Sleeve/Concrete

[2-7] Heavy - Duty, torque - controlled sleeve Anchor



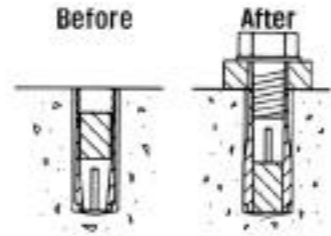
[2-8] Self - drilling anchor



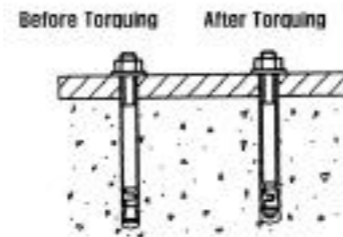
(2) Wedge Anchor

Wedge Anchor 가 Steel Stud
[2-10]. Steel Stud
가 Clip Wedge 가 Tapered
가 Nut가 Clip Wedge가
Tapered 가 Hole

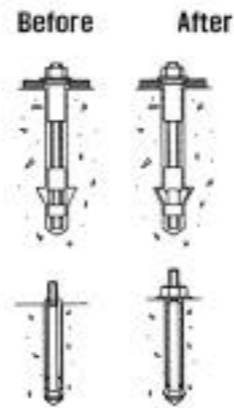
[2-9] Drop - in Anchor



[2-10] Wedge Anchor



[2-11] Undercut Anchor



(3) Undercut Anchor

가 Undercut Anchor가
[2-11] Under-cut Anchor Concrete
Drill Hole Undercut
Keying Bearing

Hole Expansion Force

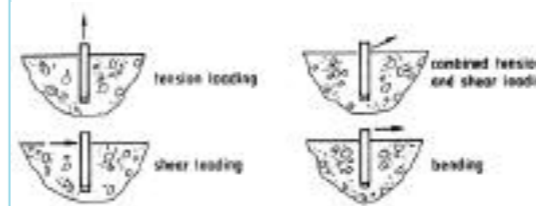
Drill Hole Undercut
가 Drilling
가 Tapered Expansion Plug가
Expansion Sleeve Undercut
Undercut Drill Hole

3.

3-1.

Anchorage

[3-1] Possible loading of anchors

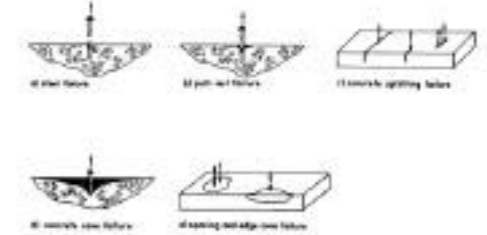


Transfer) (Shear (bending)
가

가
가
3-2.

5가
[3-2].
Steel Failure
Pull-out Failure
Concrete Splitting Failure
Concrete Cone Failure
Spacing and Edge Cone Failure

[3-2] Typical failure modes of anchors loaded in tension



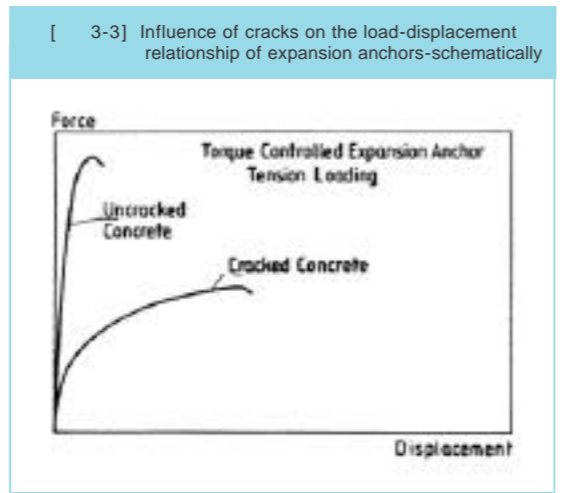
1) Steel Failure()
가
, Expansion Anchor
Headed/Undercut Anchor가

Anchor Slip
가 가

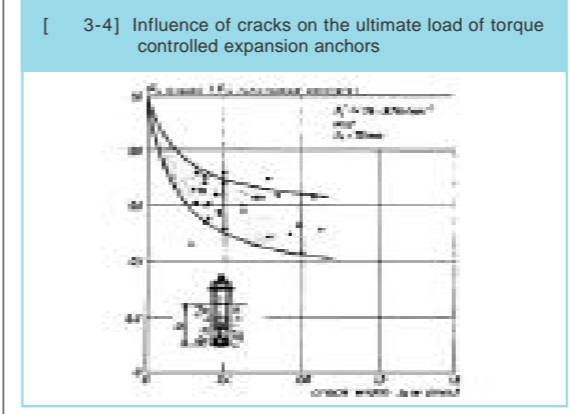
2) Cone Failure 가 Steel
Concrete Pull-
Out Cone Failure가 Full
Cone Strength 가

Failure Cone
 Headed Expansion
 45° Expansion Anchor
 50mm) 60° (ld
 150mm) 45° (ld
 가 가
 Cone Strength가
 Headed Anchor
 Side(edge) Cone Failure
 Tie
 3) Pull-Out(Slip)
 Steel Cone
 Failure Expansion Force
 Expansion Anchor Slip 가
 Wedge Hole
 (Hole Oversizing) Slip
 Failure 가 6D(D)
 Bonded/Adhesive
 Slip
 Failure Load Sliding Surface
 Expansion Sleeve Wedge Hole,
 4) Splitting Failure of Concrete
 Concrete 가
 가 , 가
 Expansion Force가

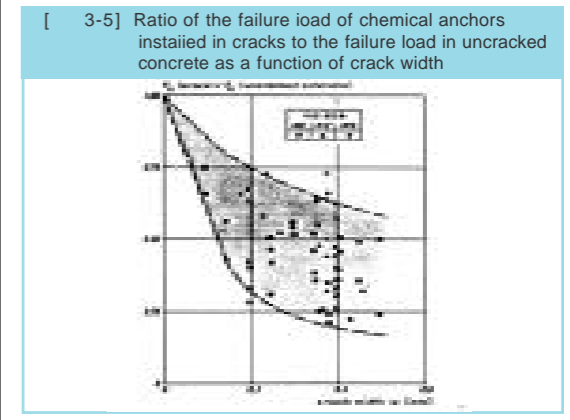
. Failure Load
 Cone Failure Load . Deformation
 Controlled Expansion Anchor
 Torque Controlled Expansion
 Undercut 가
 Splitting Crack
 가 Drop-In Self-Drilling
 가 Torque Controlled Expansion
 Torque Controlled Expansion
 Spreading Force가
 3-2.
 RC (, Slab)



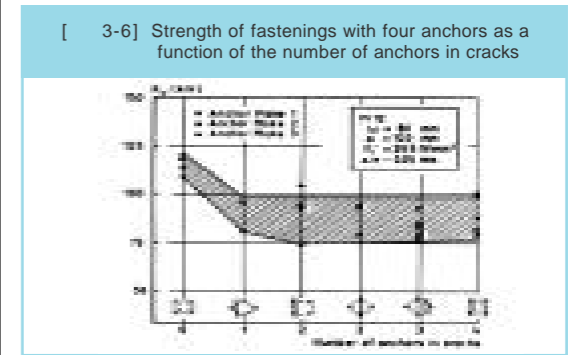
1) Torque Controlled Expansion Anchor
 Torque Controlled Expansion
 0.4mm
 Heavy-Duty Torque Controlled Sleeve Anchor
 Concrete Cone Pull-Out
 Headed Anchor Under Cut
 가 가 [3-4].
 Torque Controlled Expansion Anchor가



2) Grouted Anchor(Grouted Cement Based/Chemical-Based Mortar)
 Grouted Grout Grouted
 [3-5].
 가 . [3-5] . 20%



3) ()
 가
 30%
 Cone
 Pull-Out
 가 1 가
 [3-6].



4)

가

4. /

1)

가Saltwater Deicing

Salt 가

가

[3-7] 가

Torque Controlled Expansion Anchor

가 가

Stress Corrosion Failure 가

가 120,000psi

(Unloaded)

Pull-

(8,400kg/cm)

Stress

Out Load

25%

Corrosion Failure 가

Chloride

가

가

Chloride

Stress Corrosion

가

Coating System

Coating

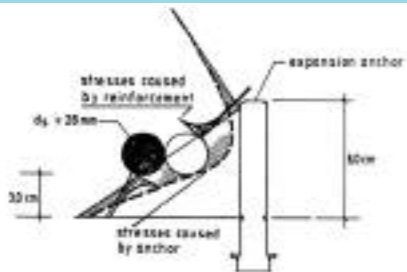
2)

(Segregation)

가

(

[3-7] Anchors in the region of an overlap splice(cross section). Overlapping of stresses caused by the bars and by the anchor



ASTM A325 가

Zinc Coating

가

Baseplate

가 Baseplate

가

()

가

가 2

Rigid

가 Rigid

가Flexible

Prying Force

가

가Flexible

Error 가 가

3)

Redundancy()

가

Inspection

Post-Installed

Inspection

Block-Out

Drilled Hole

Setting

Inspector Block-Out Hole

Drill Hole

Hole (Bit Guide)

Rotary Drill(Carbide Tip

Diamond Studded

Bit)

Jack Hammer

Hole

Field Problems

가

가

Chipping

가

가

가

가

(Slip)

Slip

Slip

가