

“Structural Repairs to Conventionally Reinforced Concrete and Post Tensioned Members”

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Acqualina

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Sunny Isles Beach, FL 33160

One Miami Condominium

1778 Collins Ave.

Miami Beach, FL 33160

Ritz-Carlton Residences

Singer Island

2700 North Ocean Drive.

Singer Island, FL 33404

Luxuria

2500 S. Ocean Blvd.

Boca Raton, FL 33160



Reinforced Concrete Buildings

Design Requirements

Gravity
Loads

Wind
Loads

Seismic
Loads

Structural Framing
Systems

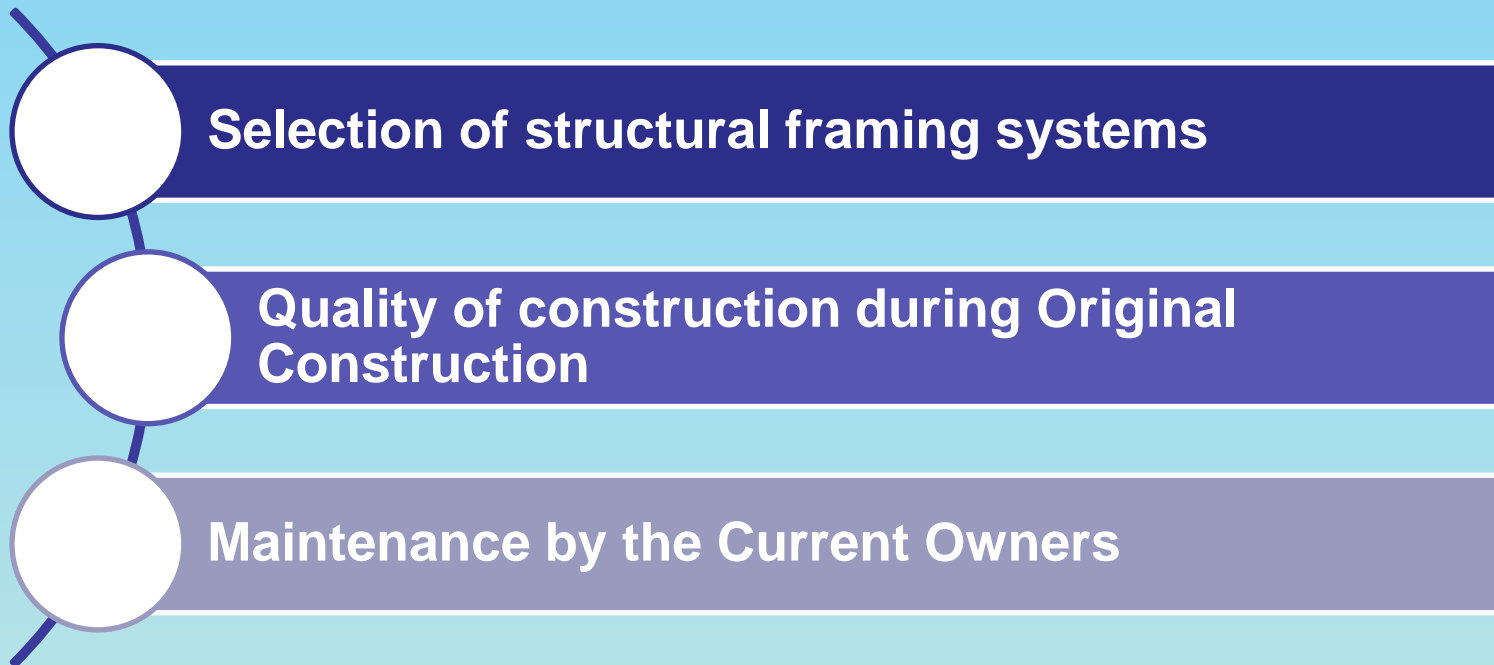
Reinforced Concrete Cast-in-place

Post-Tensioned Concrete

Pre-cast, Pre-stressed Concrete

Composite Concrete

LONGEVITY OF REINFORCED CONCRETE BUILDINGS



Federal Drug Enforcement Agency Building in Miami August 5, 1974



Federal Drug Enforcement Agency Building in Miami

August 5, 1974



**Do you know what
you are doing?**



LONGEVITY OF REINFORCED CONCRETE STRUCTURES

Minimize possibility of future failure of structural components of the older buildings and to be better prepared for hurricane and seismic events.



Proper Maintenance

Regular Periodic Inspections by qualified individuals.

Follow recommendations of the professionals.

Implementation of structural repairs in a timely manner

STRUCTURAL EVALUATION

The fundamental propose of the required inspections is to confirm in reasonable fashion that the building or structure under consideration is safe for continued use under the present occupancy

- **Visual Examination – Required of all exposed structural members.**
 - **Movement of the structure.**
 - **Deterioration.**
 - **Signs of structural distress**
 - **Signs of Foundation Settlement**
- **Testing – Not required unless its need is established by the inspector.**
 - **Concrete strength.**
 - **Size of the structural member.**
- **Evaluation**
 - **Statement to the effect – Safe or not safe.**



Typical High-rise
older building



Typical High-rise
older building



Typical High-rise
older building

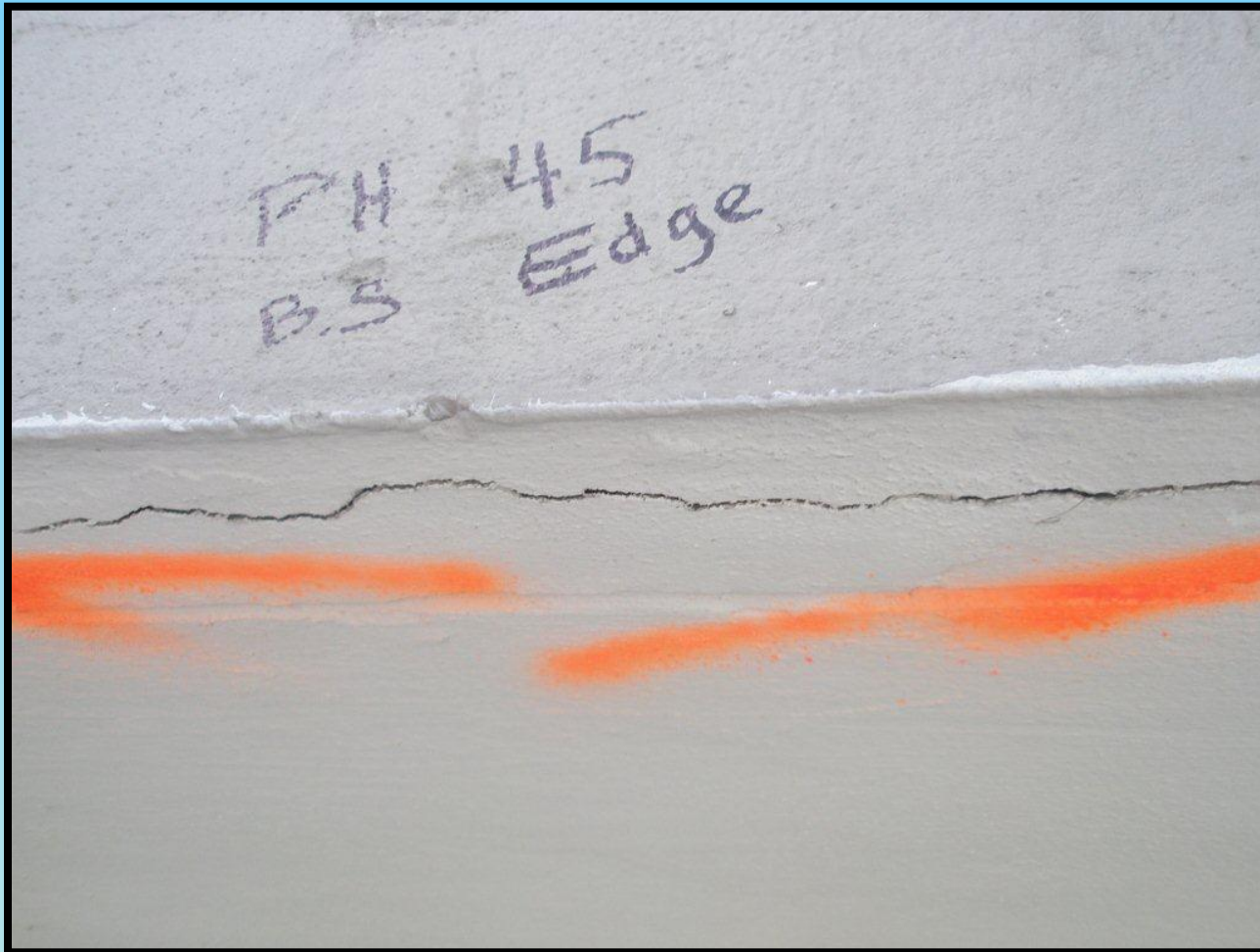
Repairs to Reinforced Concrete Building Components



Crack in reinforced concrete slab – Initial Symptom



Typical symptom of corroded rebar



Crack in reinforced concrete beam



Corroded reinforcing steel rebars with cracked and spalled concrete



Signs of structural distress in reinforced concrete beam



Corroded reinforcing steel rebars in reinforced concrete slab (TYP)



Corroded reinforcing steel rebars in main building column



Spalled concrete – Corroded Rebar



Water leaking through expansion joints



Main structural beam at expansion joint



Damage caused by water intrusion



Corroded reinforcing steel rebar in reinforced concrete beam



Cracks and spalled reinforced concrete beam



Crack in column, indicative of corroded reinforcing steel



Typical corroded reinforcing steel rebar ends



Corroded Rebars and Other Steel Inserts



Repairs to Reinforced Concrete Structural Members





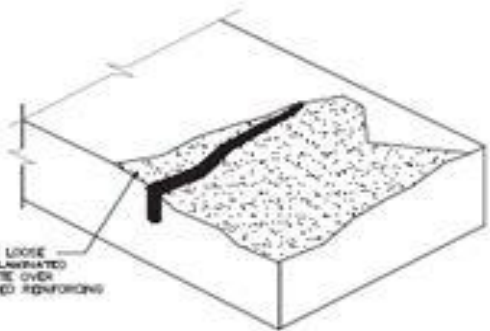
Repairs to Reinforced Concrete Slab



Repairs to Reinforced Concrete Slab

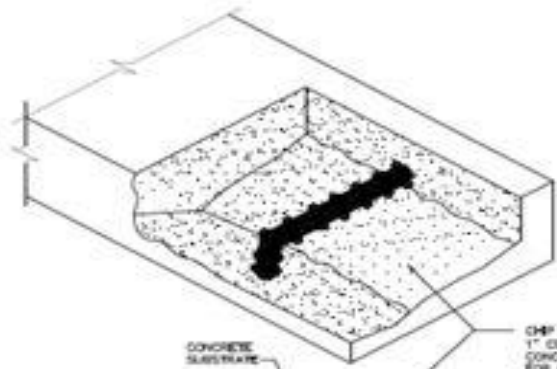


Repairs to Reinforced Concrete Slab

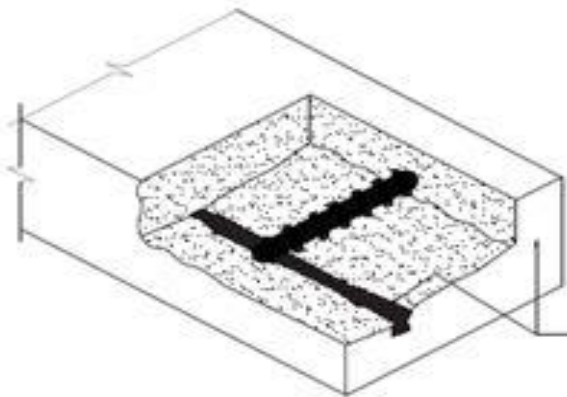


REMOVE LOOSE AND DELAMINATED CONCRETE OVER CORRODED REINFORCING STEEL.

EXISTING CORRODED STEEL

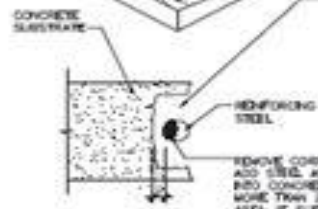


CHIP OFF EXISTING CONCRETE TO PROVIDE MINIMUM 1" CLEARANCE BETWEEN EXISTING BAR AND SURROUNDING CONCRETE. THIS UNDERCUTTING WILL PROVIDE CLEARANCE FOR BAR UNDERSIDE CLEANING AND FULL BAR CIRCUMFERENCE BONDING TO SURROUNDING CONCRETE. CONCRETE REMOVAL SHALL EXTEND ALONG THE BAR PERI-METER OF CORROSION, AND WHERE THE BAR IS PROPERLY BONDED TO SURROUNDING CONCRETE.



IF SOME NON-CORRODED REINFORCING STEEL IS EXPOSED DURING THE CONCRETE CHIPPING PROCESS, CARE SHALL BE TAKEN NOT TO DAMAGE THE BOND TO SURROUNDING CONCRETE. IF BOND BETWEEN BAR AND CONCRETE IS BROKEN, UNDERCUTTING OF THE BAR SHALL BE REQUIRED.

CLEANING THE BACKSIDE OF CORRODED BARS



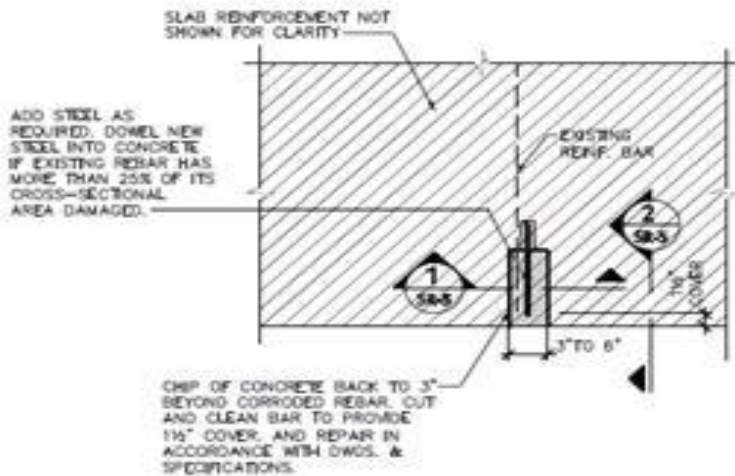
REMOVE CORRODED/DEFORMED STEEL, ADD STEEL AS REQUIRED. SOURCE NEW STEEL INTO CONCRETE IF EXISTING REPAIR HAS LOST MORE THAN 25% OF ITS CROSS-SECTIONAL AREA. IF SUFFICIENT SPACE IS AVAILABLE, CONTRACTOR MAY SPlice A NEW BAR. MIN. SPlice LENGTH TO BE 30 INCHES.

CORRODED REINFORCING BAR REPAIR DETAIL

SEE

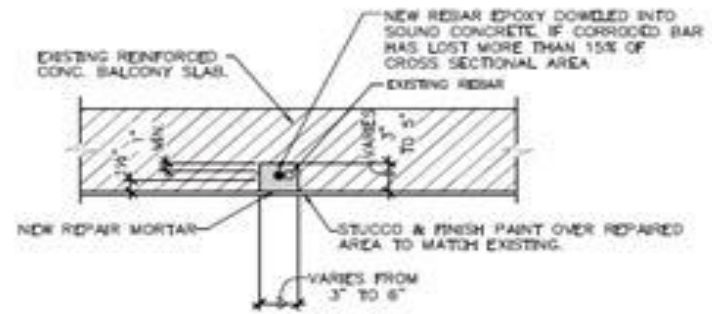


It's in the details!



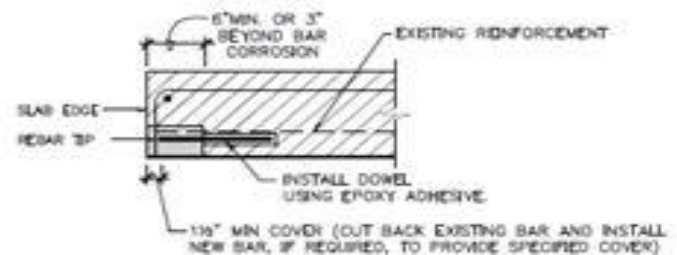
PLAN VIEW

SC: 1" = 1'-0"



SECTION

SC: 1" = 1'-0"



SECTION

SC: 1" = 1'-0"

CORRODED REBAR TIP REPAIR DETAIL

SC: 1" = 1'-0"



It's in the details!

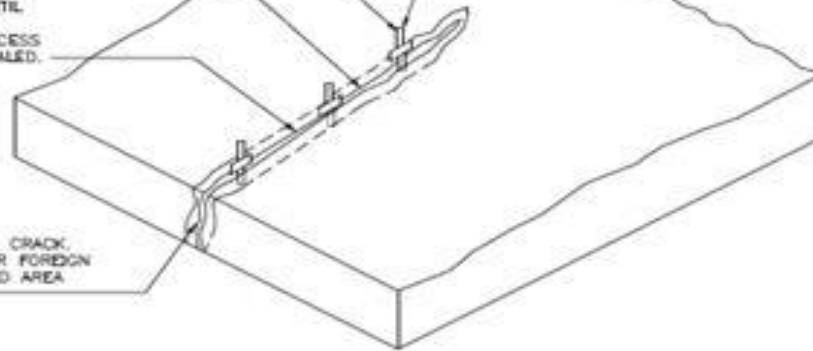
⑤ AFTER THE INJECTED EPOXY HAS HARDENED, THE PORTS SHALL BE REMOVED, AND BOTH SIDES OF THE CONCRETE SURFACE SHALL BE GRIND TO MATCH EXISTING STUCCO, FINISH AND PAINT TO MATCH ADJACENT EXISTING SURFACES. EXPOSED CONCRETE SURFACE SHALL BE COATED WITH SIKATOP SEAL-107.

③ SEAL THE PORTS AND SURFACE BETWEEN, TOP AND BOTTOM WITH SIKADUR 31, 48-MOD GEL, CAPABLE OF WITHSTANDING THE INTERNAL PRESSURE.

④ AFTER THE EPOXY ADHESIVE SEAL HAS CURED, SIKADUR 35 HI-MOD LV EPOXY MUST BE PUMPED INTO THE LOWEST PORT WITH AUTOMATED INJECTION EQUIPMENT. A SLOW STURDY PRESSURE IS TO BE MAINTAINED UNTIL THE EPOXY REACHES THE NEXT HIGHER PORT. THE LOWER PORT SHALL THEN BE CLOSED AND THE PROCESS IS TO BE REPEATED UNTIL THE ENTIRE CRACK IS SEALED.

① CLEAN THE CONCRETE SURFACE AND CRACK. USE PRESSURED WATER OR SANDBLASTING TO CLEAN CRACK. REMOVE ALL DUST LAIVANCE, GREASE AND ANY OTHER FOREIGN AND DISINTEGRATED MATERIAL. SURFACE AND CRACKED AREA ARE TO BE DRY AND CLEAN PRIOR TO SEALING.

② INSERT ONE WAY POLYETHYLENE VALVE INJECTION PORTS. THE SPACING OF THE INJECTION PORTS SHALL NOT BE GREATER THAN THE DEPTH OF THE STRUCTURAL MEMBER BEING REPAIR AND NO MORE THAN 12 INCHES IN ANY CASE.



NOTES:

1- SEE TYPICAL REPAIR DETAILS ON SR DRAWINGS AND CONTRACT SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

2- EPOXY INJECTION TO BE DONE BY QUALIFIED APPLICATOR WITH MINIMUM OF 5 YEARS EXPERIENCE AND CERTIFIED AS QUALIFIED BY THE MANUFACTURER.

REINFORCED CONCRETE SLAB, BEAM OR COLUMN SEAL CRACKS BY PRESSURE EPOXY INJECTION

N.T.S.



It's in the details!

CHP CONCRETE AT A 90° ANGLE AND
APPLY BONDING AGENT

CHP CONCRETE AND PATCH

REMOVE ALL TOP SURFACE FLOORING,
FINISHES AND CONCRETE ON SLAB
REQUIRING FULL DEPTH REPAIRS AND
APPLY BONDING AGENT TO SIDES OF
THE TOTAL REPAIRED AREA AS PER
MANUFACTURER'S RECOMMENDATIONS.



ADD STEEL AS REQUIRED.
DOWEL NEW STEEL INTO CONCRETE IF
EXISTING REBAR HAS MORE THAN 20%
OF ITS CROSS SECTIONAL AREA DAMAGED.
DOWEL BY UTILIZING HILTI HY 150 EPOXY
SYSTEM. MIN. EMBEDMENT OF REINFORCEMENT
TO BE 8". THE QUANTITY AND SIZE OF NEW
REINFORCEMENT & DOWELS TO MATCH EXISTING.

REPLACE EXISTING FINISH
AND PAINT TO MATCH EXISTING

FULL DEPTH SLAB REPAIR DETAIL

N.T.S.

TWO LAYERS OF REINFORCING MAY BE PRESENT



It's in the details!

CHIP CONCRETE AND PATCH WITH APPROVED REPAIR MORTAR

ADD NEW REBAR AS REQUIRED. SEE REPAIR NOTES ON DWG. SR-1

MIN 1" CLEARANCE REQUIRED.

CHIP CONCRETE AT A 90° ANGLE AND APPLY BONDING AGENT TO CONCRETE SURFACE AND EXPOSED REINFORCING STEEL.

UP TO 4"



DO NOT DAMAGE CONCRETE BELOW

IF LESS THAN 2 1/2" FULL DEPTH REPAIR IS REQUIRED

SECTION

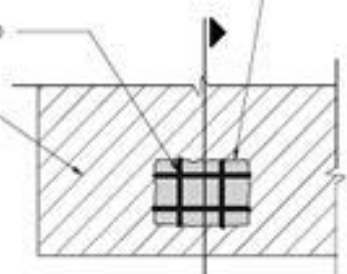
N.T.S.

1
SR-6

CHIP OFF SPALLED OR HOLLOW SOUNDING CONCRETE TO VERTICAL AND HORIZONTAL SURFACES. IF EXISTING REBAR HAS LOST 20% OR MORE OF ITS CROSS-SECTIONAL AREA, REPLACE WITH NEW BAR OF SAME SIZE. IF NEW BAR IS TO BE PROVIDED, MINIMUM SPLICE LENGTH SHALL BE IN ACCORDANCE WITH ACI 318-05. REPOSITION EXISTING AND NEW STEEL TO ACHIEVE 1 1/4 INCH CONCRETE COVER. CLEAN EXISTING BAR WITH POWERED WIRE BRUSH TO SILVER STEEL SURFACE. COAT REBARS AND EXISTING CONCRETE WITH BONDING AGENT. REPLACE CHIPPED-OFF CONCRETE WITH REPAIR MORTAR AND FINISH TO MATCH ADJACENT AREAS.

CHIP MINIMUM 1 INCH ALL AROUND THE REBAR

TOP SURFACE OF REINFORCED CONCRETE SLAB.



1
SR-6

PARTIAL DEPTH REPAIR PLAN

PARTIAL DEPTH SLAB REPAIR DETAIL

N.T.S.

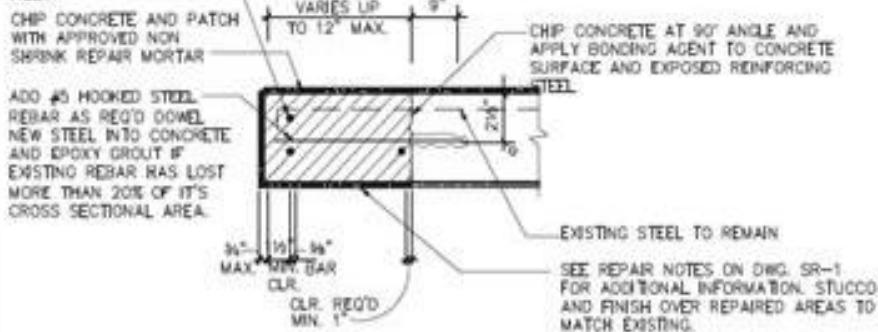
B
SR-6

It's in the details!

NOTES:

1. IF THE UNDERSIDE OF THE SLAB AT EDGE IS DAMAGED, THEN THE FULL DEPTH REPAIR AS ILLUSTRATED SHALL BE UTILIZED TO REPAIR THE DAMAGED SLAB EDGE. ENGINEER WILL MAKE THE DECISION IN THE FIELD.
2. GPR SLAB EDGE PRIOR TO CHIPPING.
3. LOCK OFF POST TENSION TENDONS PRIOR TO CHIPPING.

EXISTING AND/OR NEW #5 CONT. BAR WITH MINIMUM 1 1/4" COVER. PROVIDE MIN. 3/4" CLEARANCE WITH THE EXISTING ALUMINUM POST. PROVIDE MAXIMUM CLEAR DISTANCE ALLOWED FOR THE REINFORCING STEEL WHILE MAINTAINING THE REQUIRED CLEAR COVER FROM THE EDGE OF THE SLAB. NOTIFY ENGINEER IMMEDIATELY IN WRITING OF ANY DISCREPANCIES FOUND IN THE FIELD.

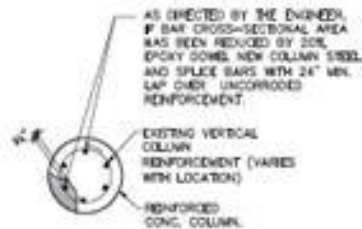
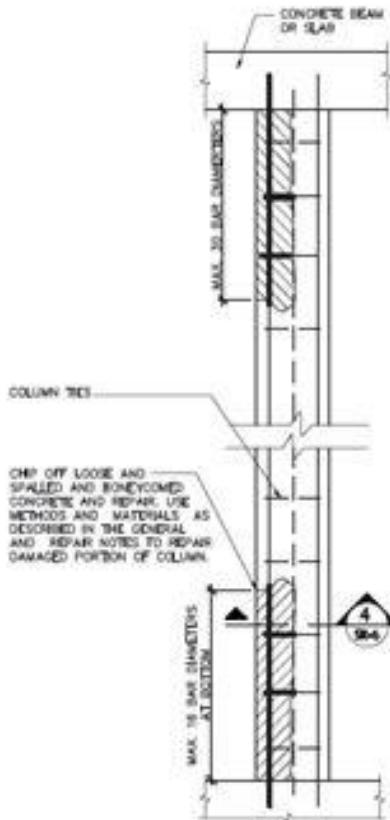


SLAB EDGE REPAIR DETAIL

N.T.S.



It's in the details!



CONCRETE COLUMN SECTION 4
N.T.S. SR-6

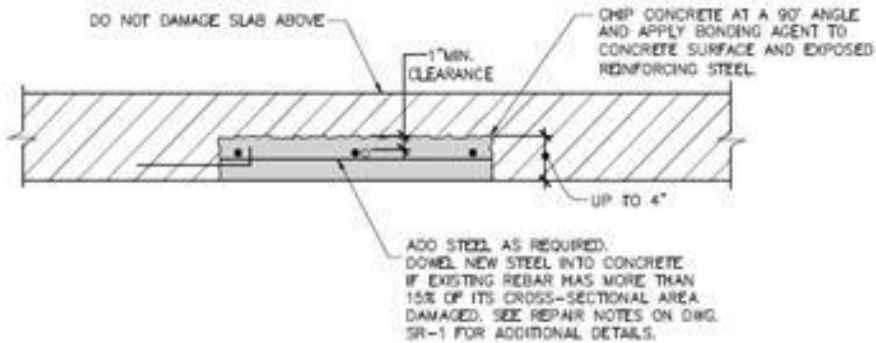
NOTES:

1. ONLY THE SMALLER OF TWO BARS OR NOT MORE THAN 1/4 OF PERIMETER OF A COLUMN SHALL BE REPAIRED AT ONE TIME. NEW REPAIR MORTAR SHALL BE CURED FOR AT LEAST 5 DAYS PRIOR TO THE START OF THE REPAIR OF THE NEXT TWO BARS OF THE SAME COLUMN. CONTRACTOR SHALL NOTIFY ENGINEER OF COLUMN TO BE REPAIRED AT LEAST 48 HOURS PRIOR TO THE START OF THE REPAIR WORK. ALL REPAIRS TO FOLLOW SEQUENCE OF CONSTRUCTION AS ILLUSTRATED IN THESE DRAWINGS.
2. SEE GENERAL AND REPAIR NOTES FOR MORE INFORMATION ON METHODS AND MATERIALS TO BE USED.
3. COLUMNS AND LOCATIONS TO BE REPAIRED SHALL BE POINTED OUT BY THE ENGINEER IN THE FIELD.
4. SIZES AND TYPES OF COLUMNS CONTAINED WITHIN THE CONDOMINIUM BUILDING VARY WITH LOCATION. TYPES AND SIZES OF COLUMNS SHOWN IN THE CONTRACT DOCUMENTS ARE TO ILLUSTRATE REPAIR METHODS ONLY. EACH COLUMN LOADING CONDITION AND CONFIGURATION OF REINFORCING STEEL VARIES DEPENDENT UPON LOCATION. CONTRACTOR TO FIELD VERIFY EACH CONDITION PRIOR TO THE START OF THE WORK ON THAT PARTICULAR COLUMN OR OTHER STRUCTURAL MEMBER SUPPORTED BY THAT COLUMN.
5. CONTRACTOR TO CHASE CORRODED STEEL UNTIL A MIN OF 6" OF CORROSION FREE STEEL IS FOUND BUT DO NOT EXPOSE MORE BAR LENGTH THAN SHOWN IN THE DETAIL.

**PARTIAL ELEVATION
PARTIAL REPAIR DETAIL**

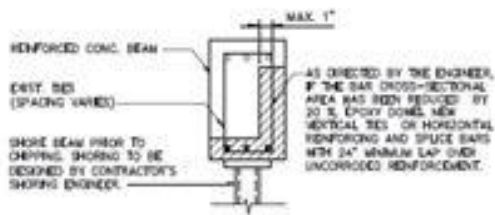
CONCRETE COLUMN REPAIR DETAIL C
N.T.S. SR-6

It's in the details!



PARTIAL DEPTH CEILING REPAIR DETAIL (H)
N.T.S. SR-6

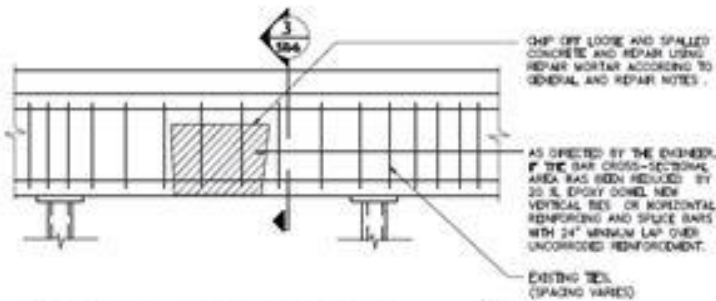
It's in the details!



CONCRETE BEAM CROSS - SECTION **3**
S.R.-6
N.T.S.

NOTES:

1. ONLY A LIMITED PORTION OF THE BEAM SHALL BE REPAIRED AT ONE TIME, AS ALLOWED BY THE ENGINEER. REPLACED CONCRETE SHALL BE CURED FOR AT LEAST 3 DAYS PRIOR TO THE START OF REPAIR OF THE NEXT CORNER OR SECTION OF THE SAME BEAM. CONTRACTOR SHALL NOTIFY ENGINEER OF AREAS TO BE REPAIRED AT LEAST 48 HOURS PRIOR TO START OF THE REPAIR.
2. HEAVY DUTY SHORING IS REQUIRED TO SUPPORT THE STRUCTURE BEING SUPPORTED BY THE REINFORCED CONCRETE BEAMS. SHORING SHALL BE DESIGNED TO SUPPORT THE LOADS OF ALL FLOORS ABOVE IF MORE THAN 1/3 OF THE BEAM'S CROSS-SECTIONAL AREA IS TO BE CHIPPED OFF. CONTRACTOR TO SUBMIT SHORING DRAWINGS AND CALCULATIONS FOR REVIEW AND APPROVAL. SHORING CALCULATIONS AND DRAWINGS ARE TO BE SIGNED AND SEALED BY AN ENGINEER REGISTERED IN THE STATE OF FLORIDA.
3. SEE REPAIR NOTES FOR ADDITIONAL INFORMATION ON METHODS AND MATERIALS TO BE USED.



CONCRETE BEAM REPAIR DETAIL **G**
S.R.-6
N.T.S.

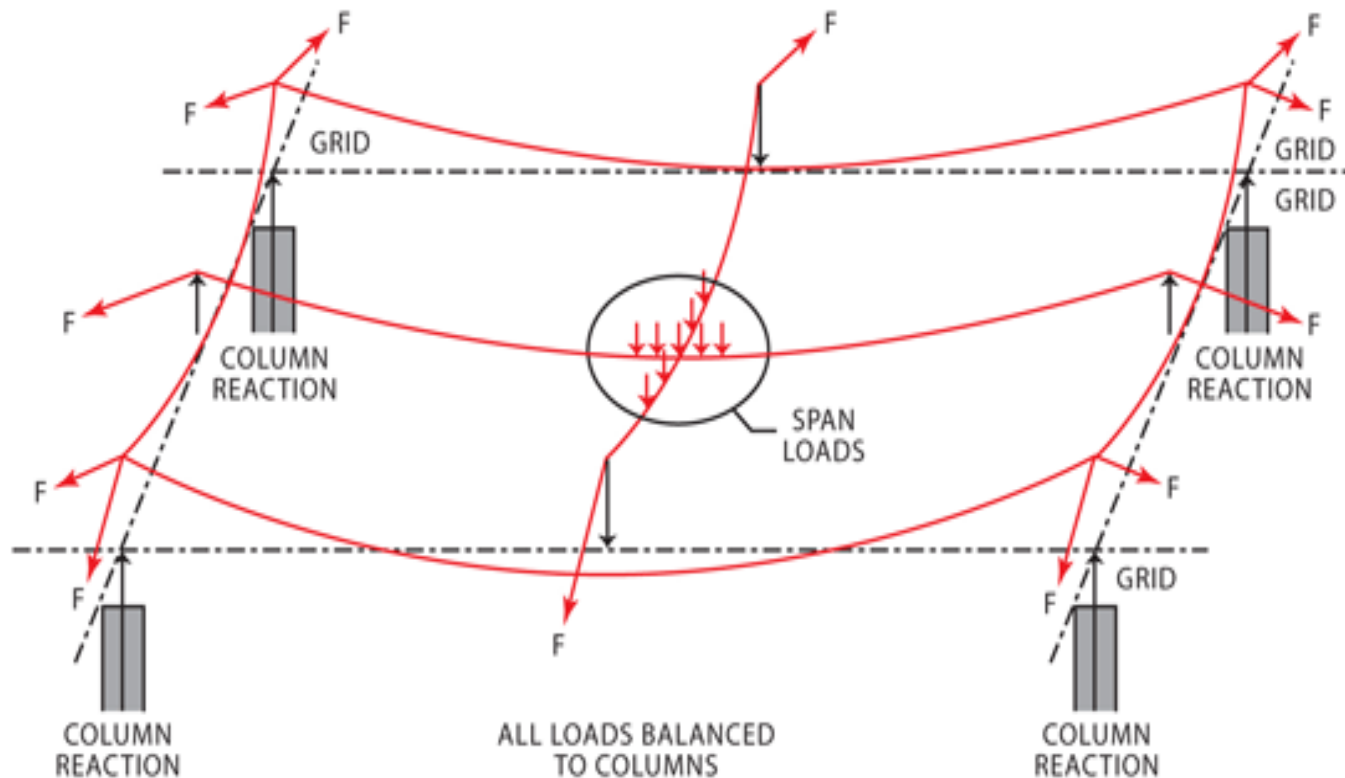
It's in the details!

Repairs to Post-Tensioned Concrete Building Components

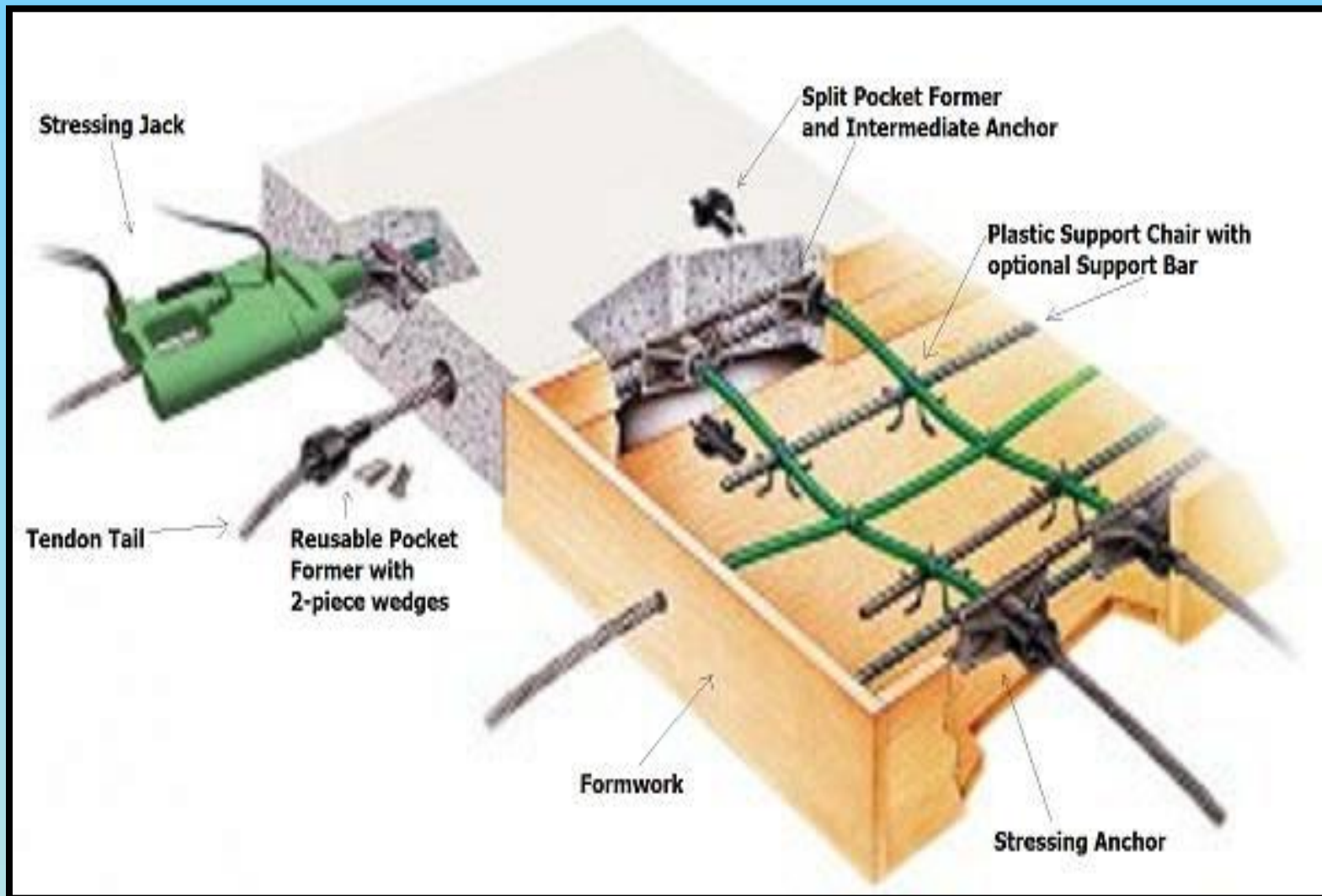


Two Way Load Balancing

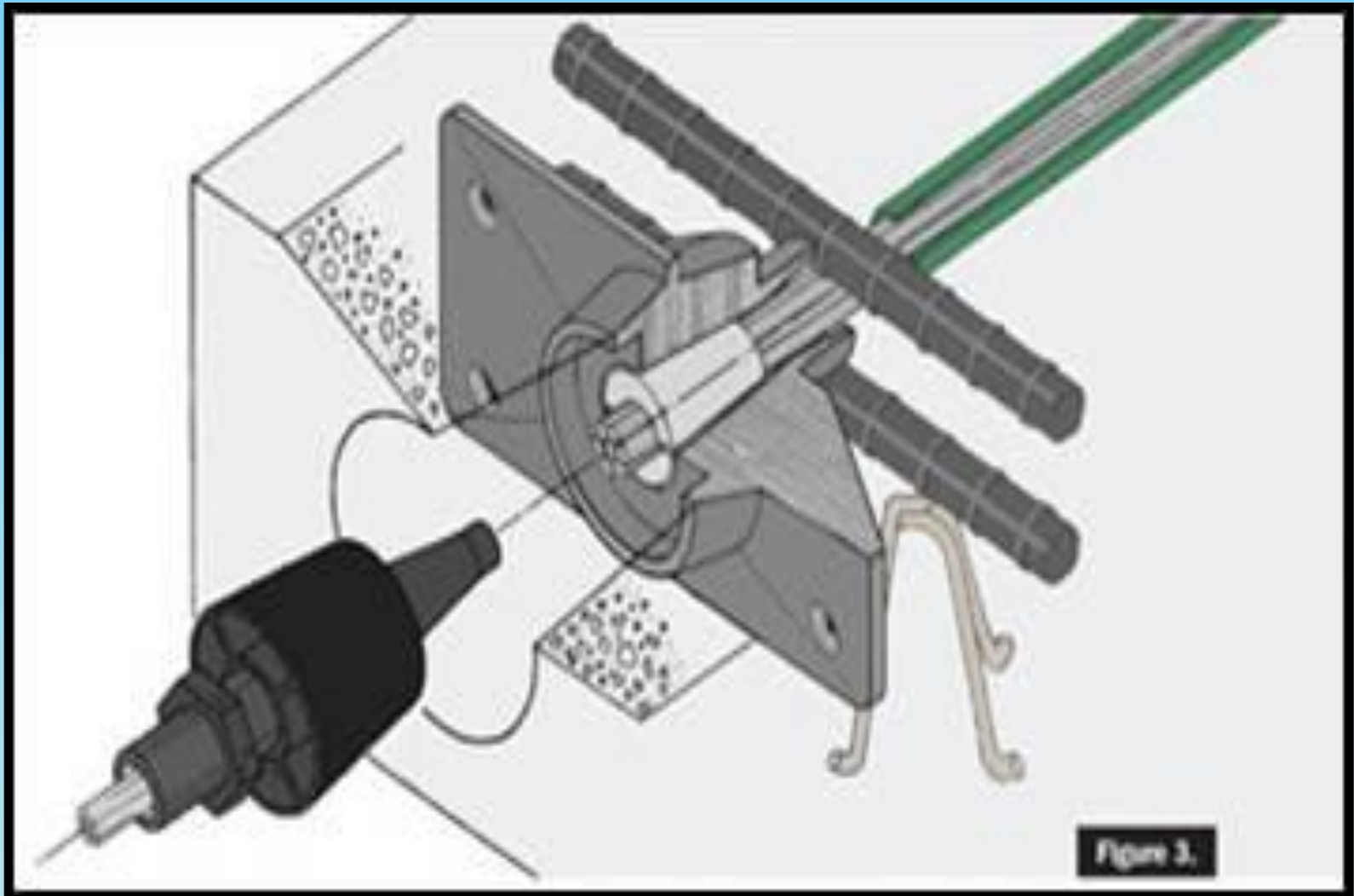
TWO WAY LOAD BALANCING



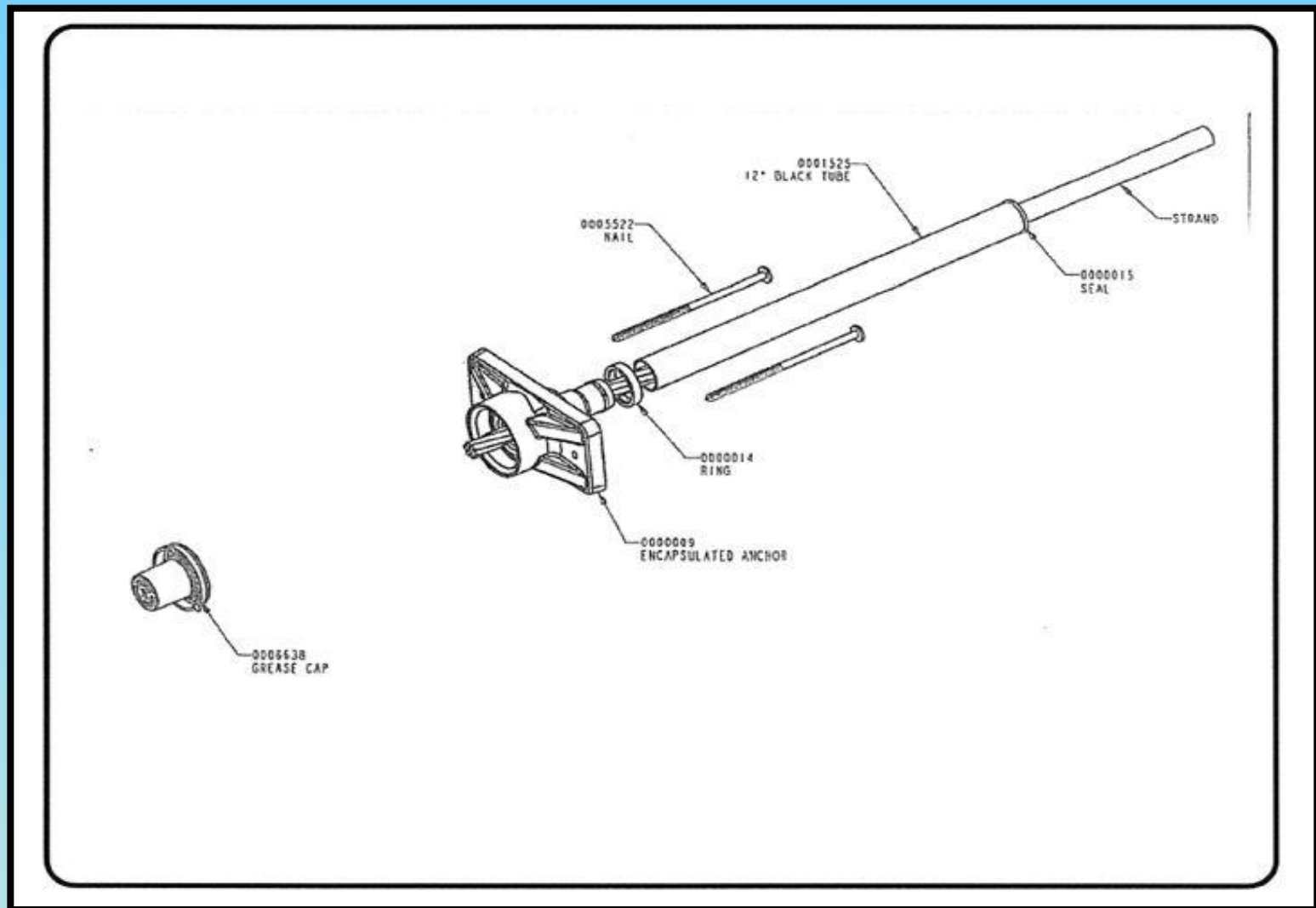
Post-Tension Slab



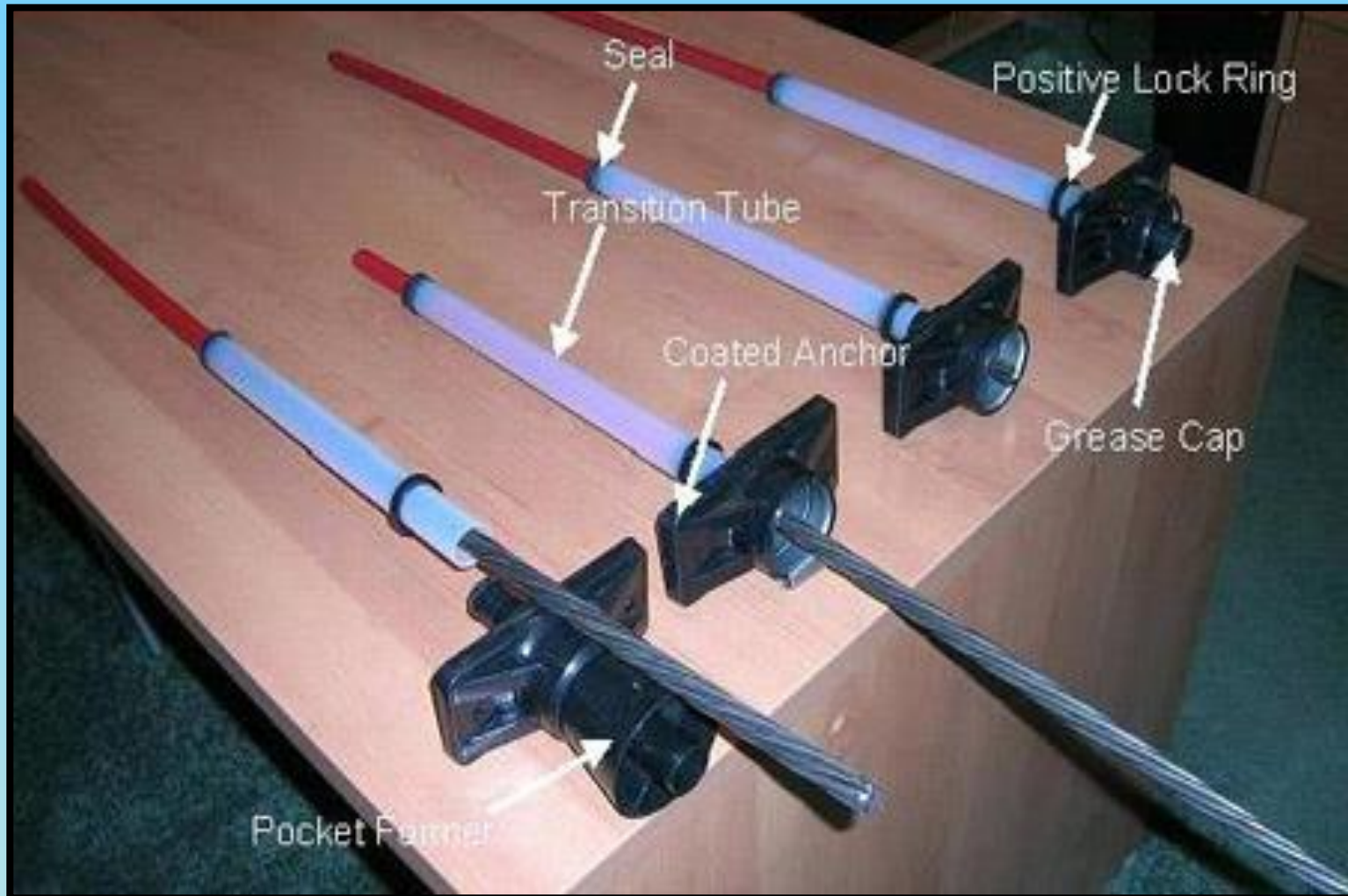
Post Tension Anchorage Assembly



Standard PosiLock Stressing End



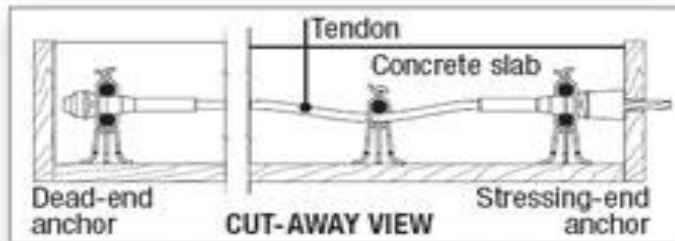
Typical Encapsulated Anchor Assembly



Typical Steel Wedges

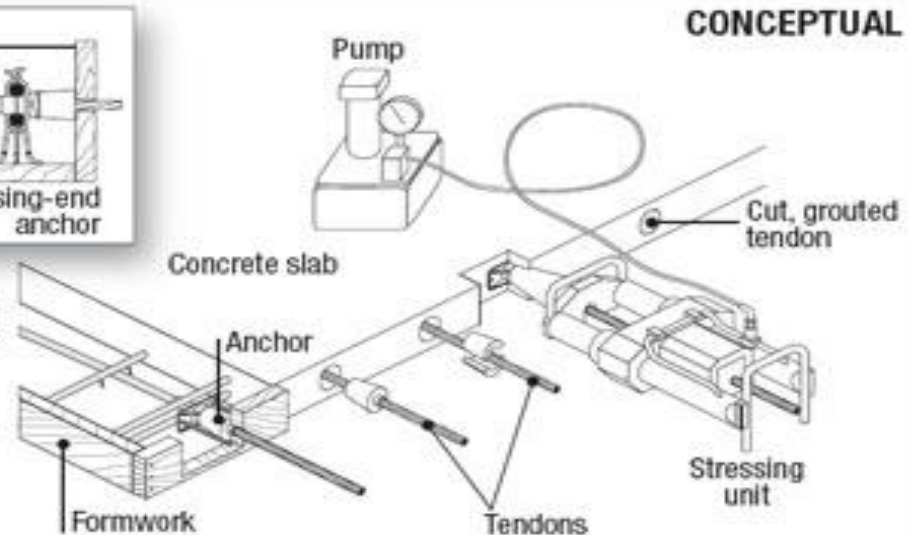


Stressing Tendons with Hydraulic Jack

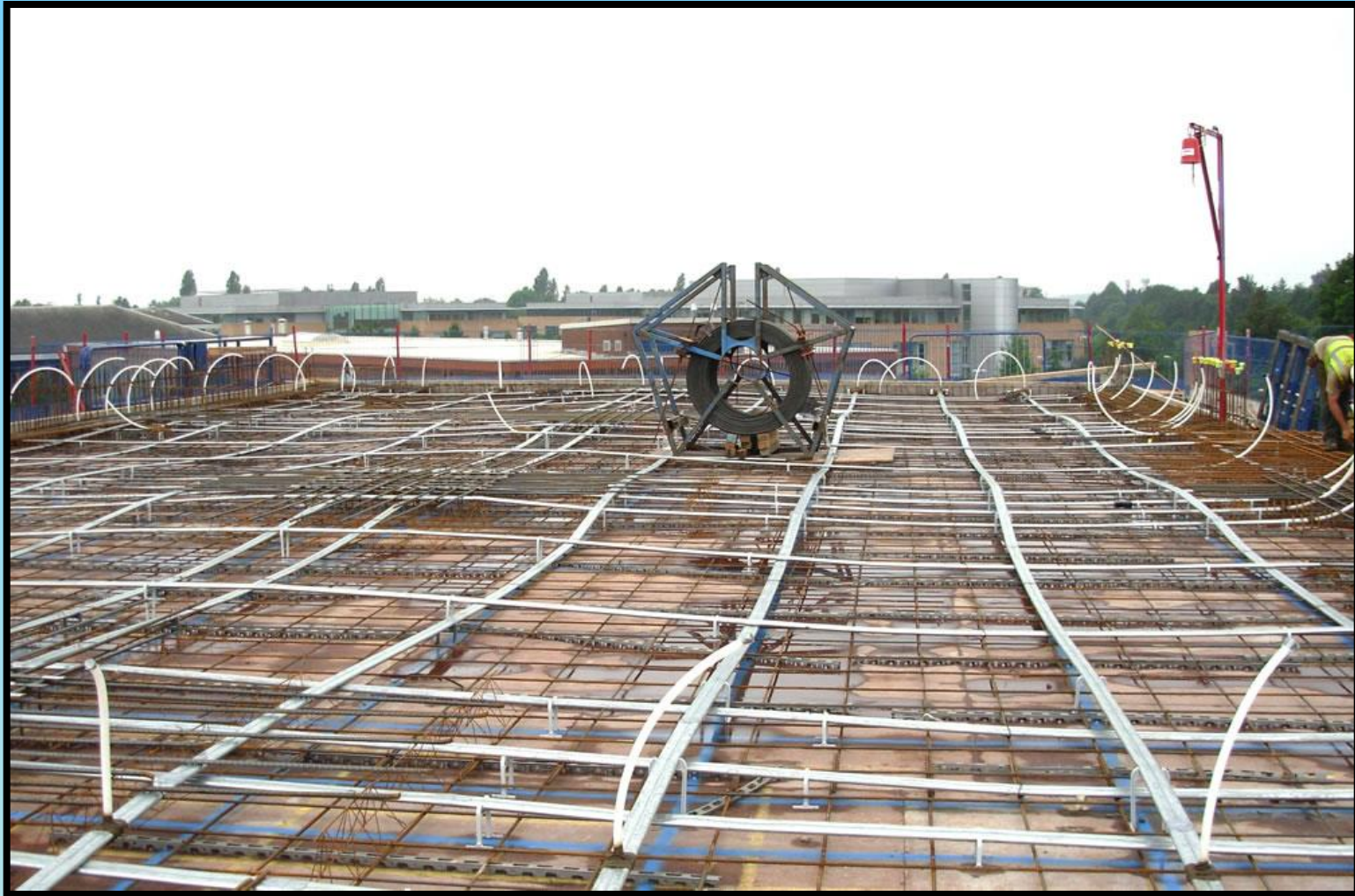


POST-TENSIONED SLAB The steps to post-tensioning are as follows: Place the tendons and nail anchors to the formwork, cast the concrete slab, remove the formwork, stress and anchor the tendons, then cut and grout the tendons with non-shrink grout.

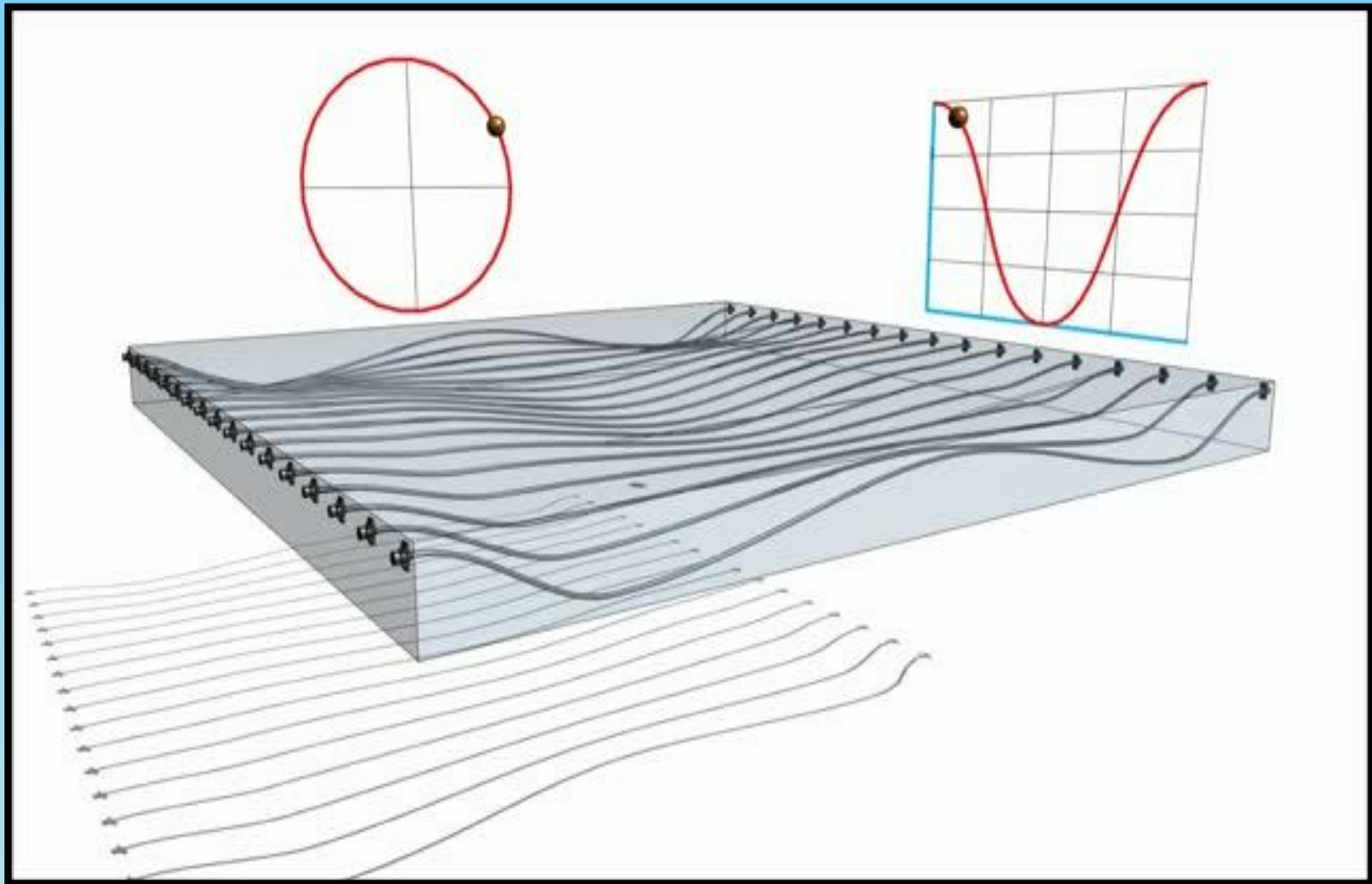
SOURCE: POST-TENSIONING INSTITUTE



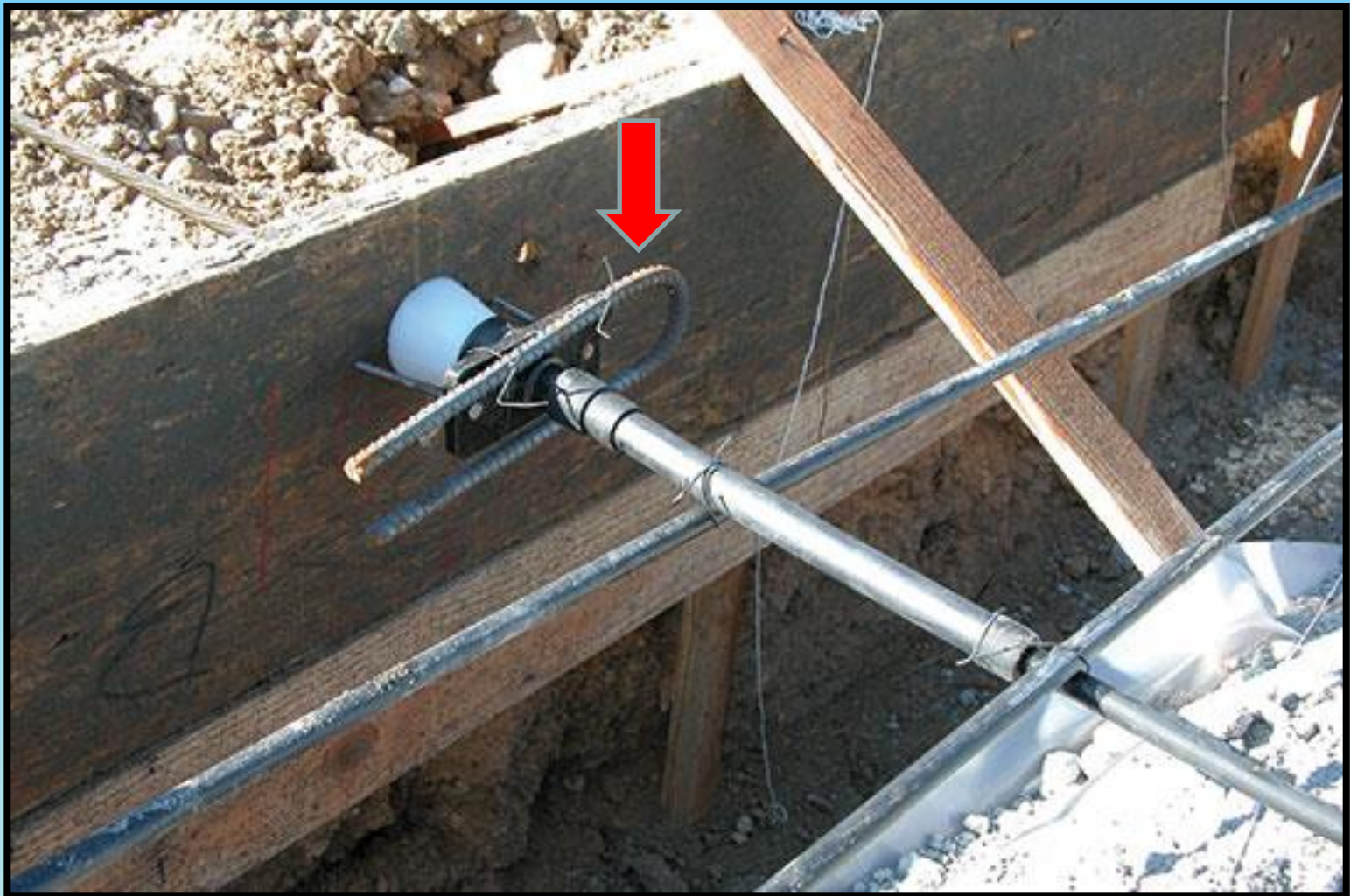
Typical Tendons Layout



Typical PT Slab Layout



Back-up Bars



Post-Tensioned Transfer Slab



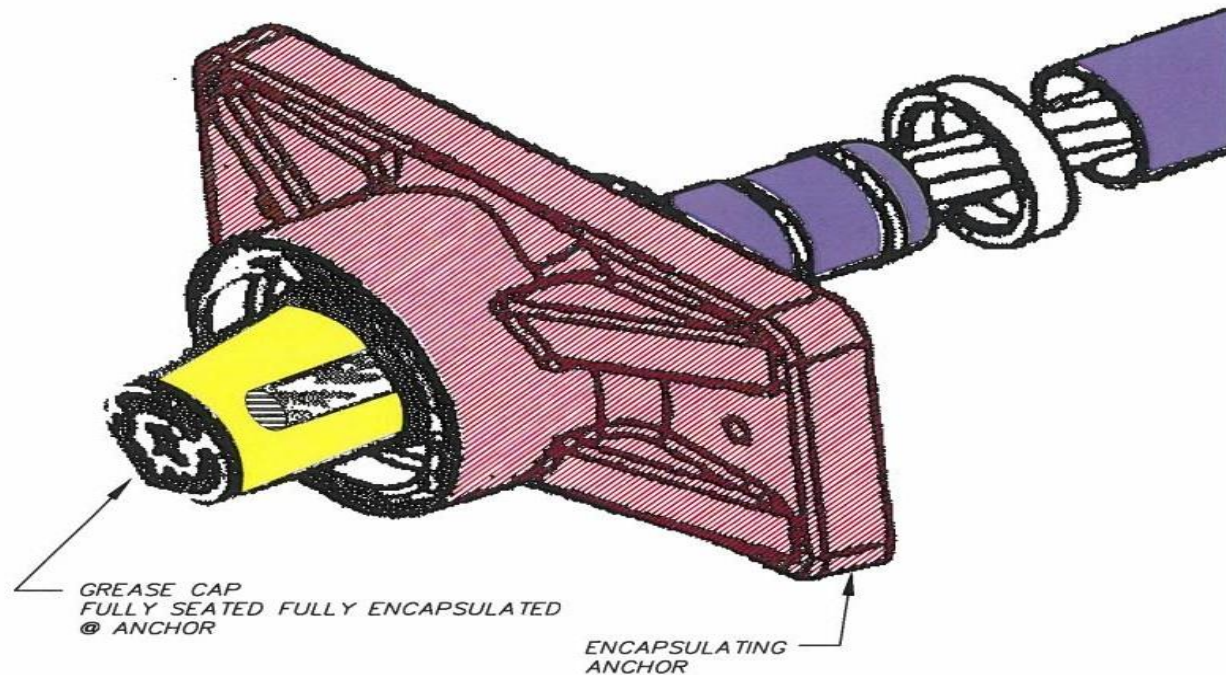
Tendons prior to stressing



Stressing Hydraulic Jack

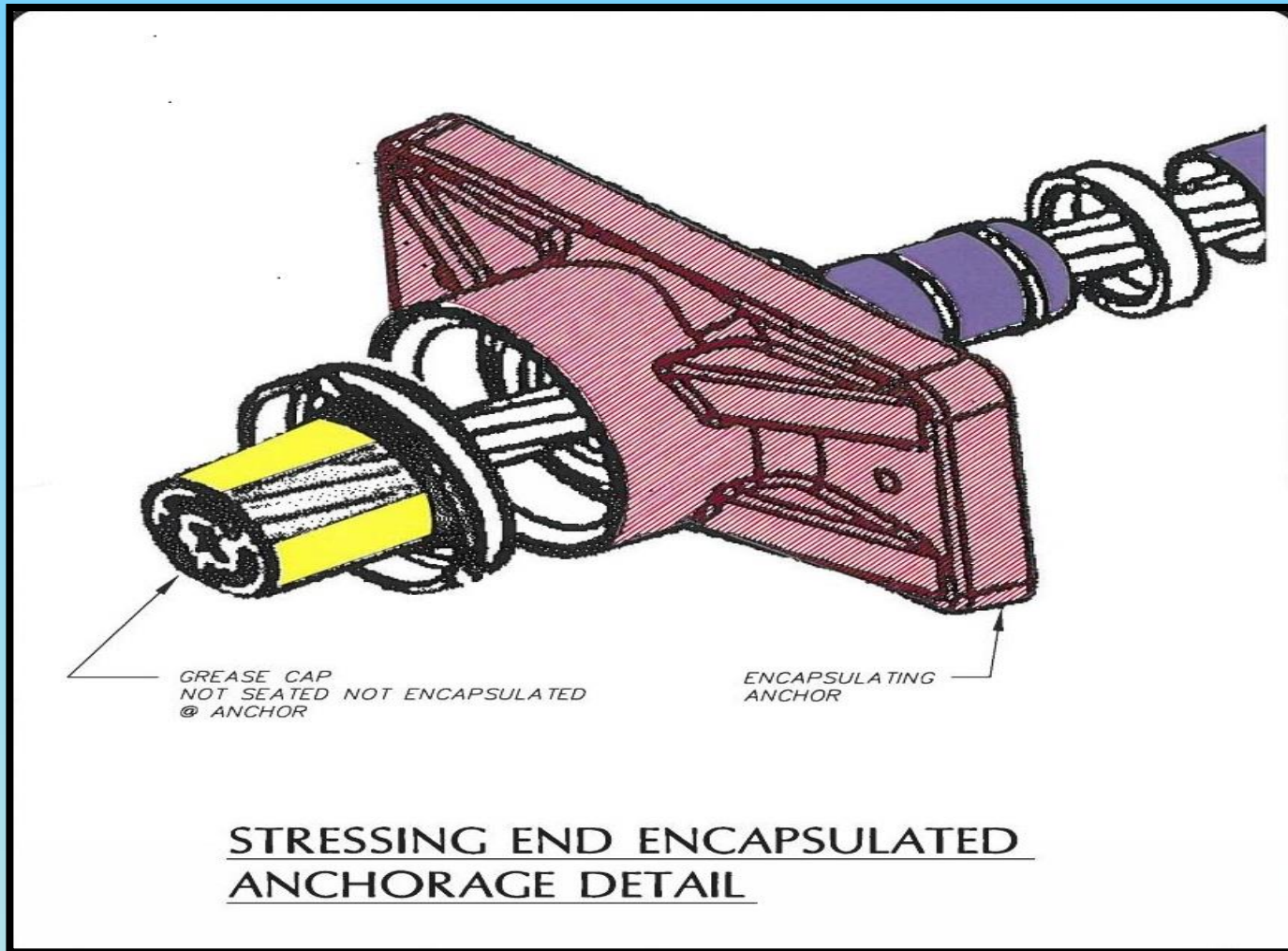


Properly Seated Plastic Cap



STRESSING END ENCAPSULATED ANCHORAGE DETAIL

Improperly Seated Plastic Cap

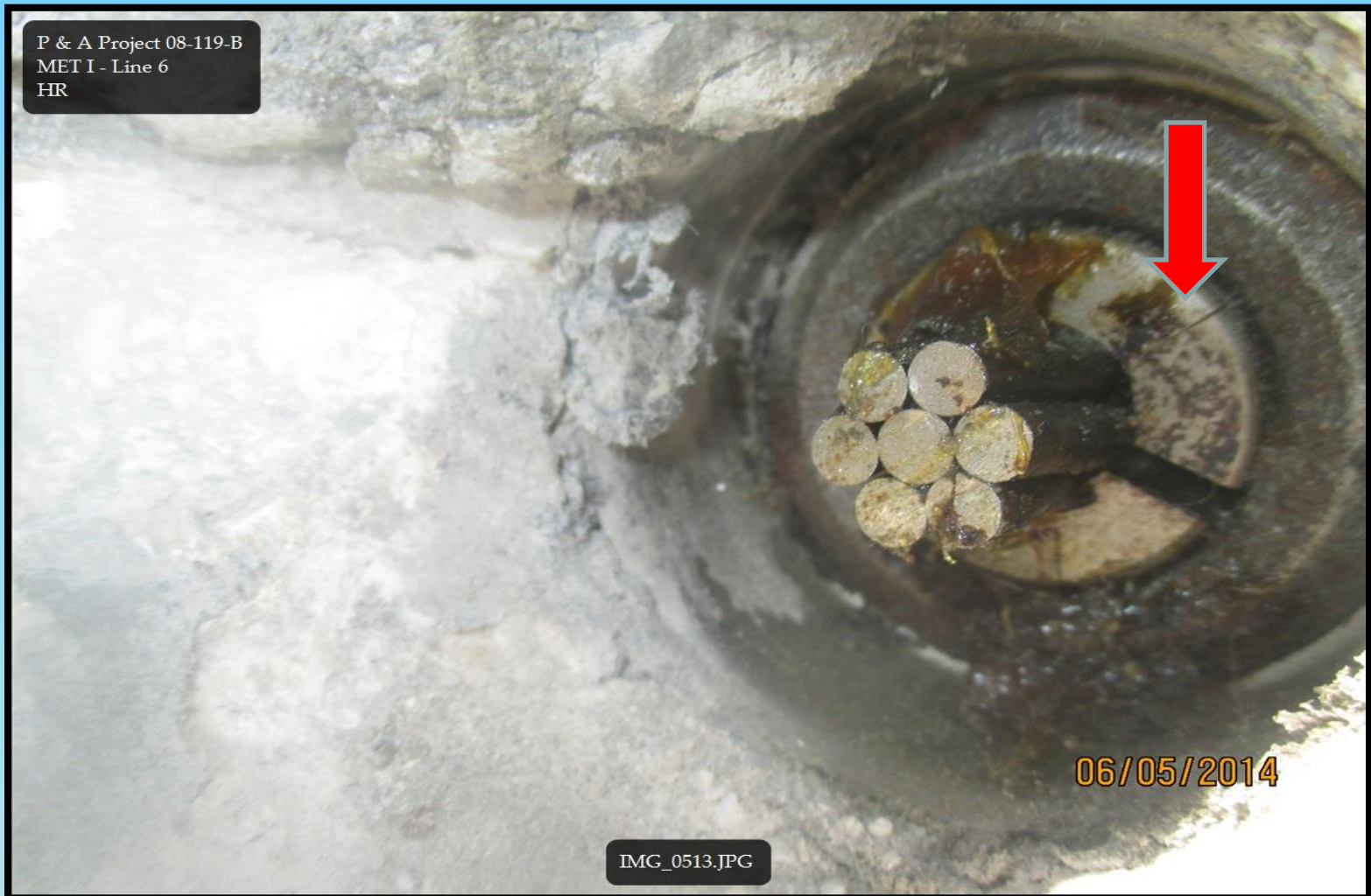


Improperly installed plastic cap –
Tail length too long



Cracked Wedges

P & A Project 08-119-B
MET I - Line 6
HR



06/05/2014

IMG_0513.JPG

Use Qualified Individuals



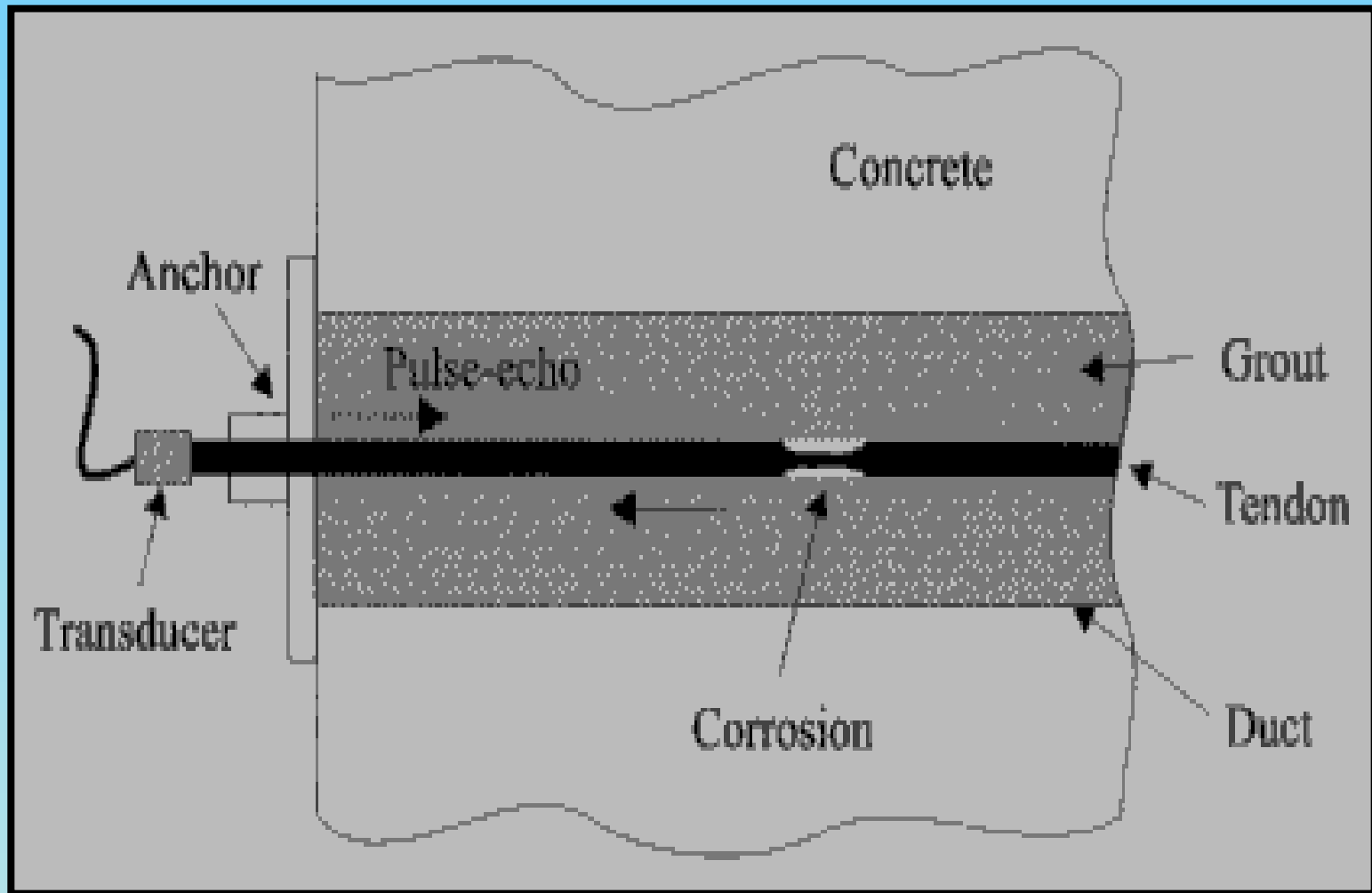
TRAINING AND CERTIFICATION OF FIELD PERSONNEL FOR UNBONDED POST-TENSIONING

LEVEL 1 - FIELD FUNDAMENTALS



pti POST-TENSIONING
INSTITUTE®

Corrosion of PT Tendons



Corroded reinforcing steel and post-tensioned anchor



Corroded Post-tensioned tendon anchor and reinforcing steel rebars



2013.06.18

Corroded reinforcing steel rebar and Post-Tensioned tendon



Corroded Post-Tensioned Tendon



Damaged Post-Tensioned Tendons



Corroded Post-Tensioned Tendon's Anchorage Assembly



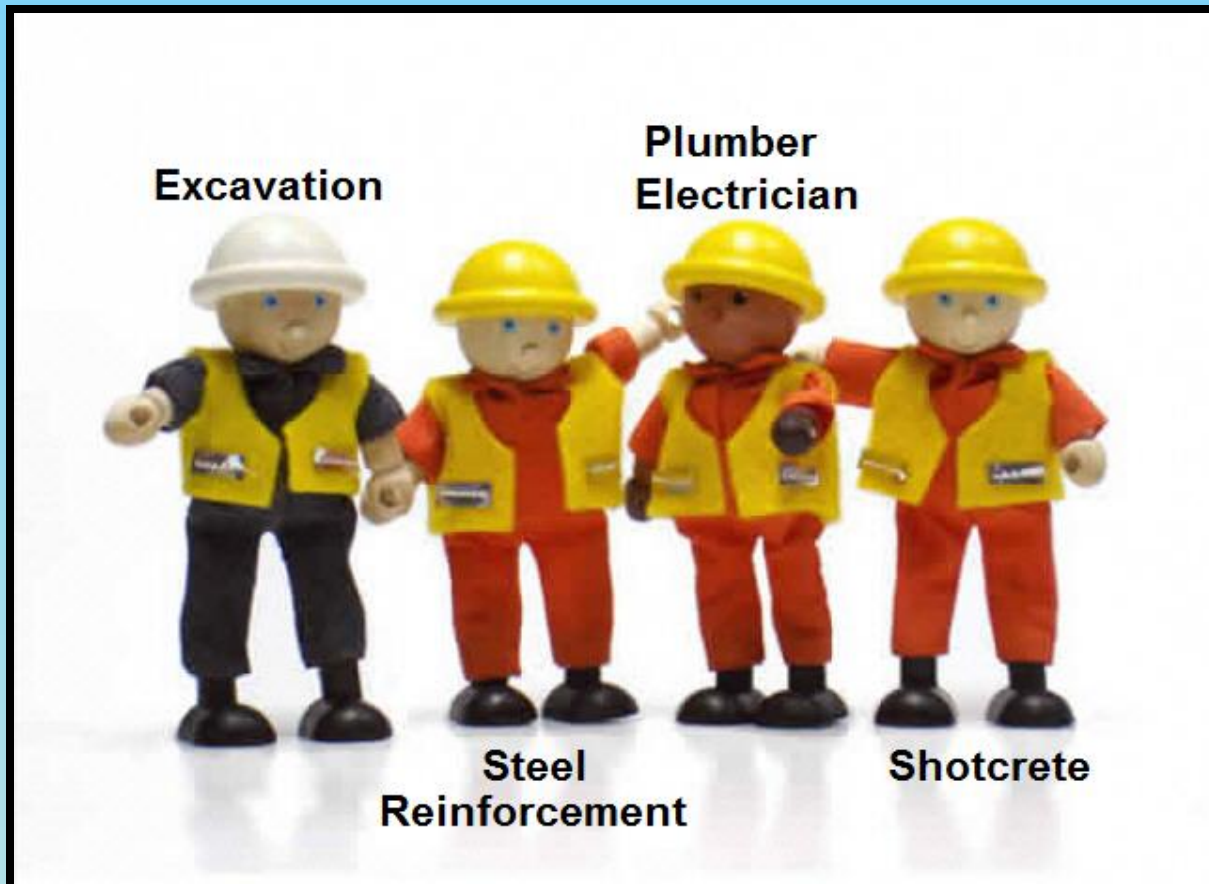
Corroded Post-Tensioned Tendon Anchorage Assembly



Corroded and Broken Post-Tensioned Tendons



Repairs to Post-Tensioned Structural Members



Concrete Chipping



Chipping of Concrete



Splicing of Tendons



Splicing of Tendons



Splicing of Tendons



Splicing of Tendons



Splicing of Tendons

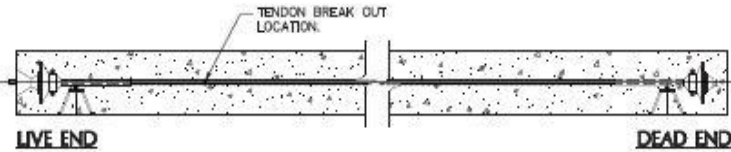


Splicing of Tendons



Splicing of Tendons

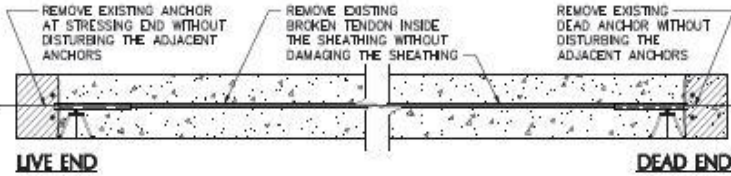




EXISTING POST TENSION TENDON CONDITION

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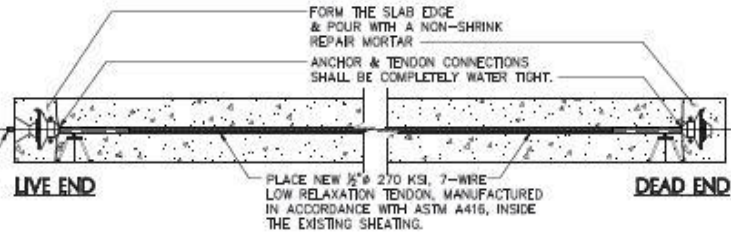
A
SR-8



TENDON & ANCHOR REMOVAL DETAIL

N.T.S.

B
SR-8



TENDON ANCHOR INSTALLATION DETAIL

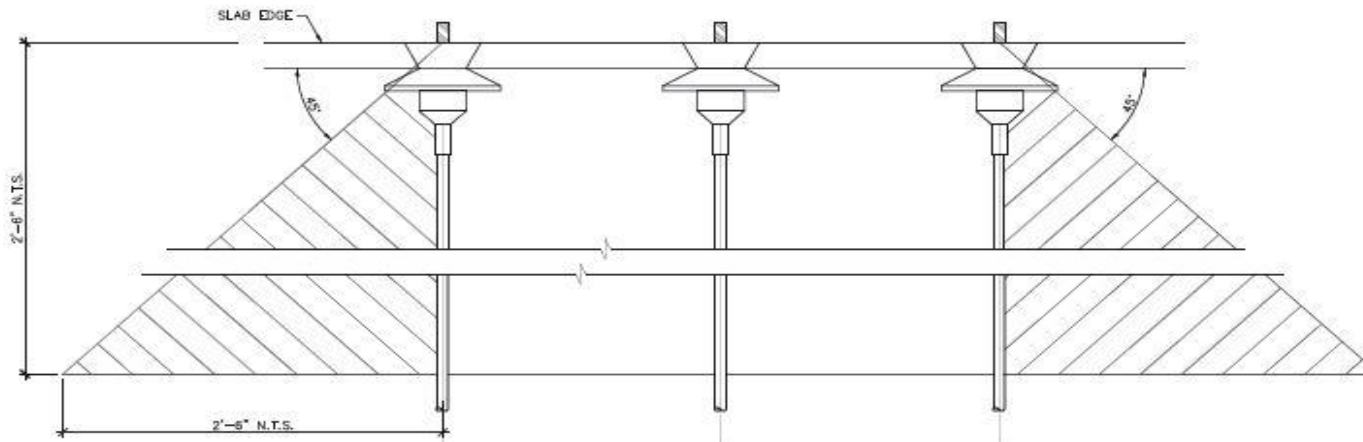
N.T.S.

C
SR-8

- PROVIDE NEW ANCHOR AT THE STRESSING END AS MANUFACTURED/SUPLIED BY SUNCOAST POST-TENSIONING OR APPROVED EQUAL TO MATCH EXISTING
- PROVIDE NEW DEAD-END ANCHOR BY SUNCOAST POST-TENSIONING OR APPROVED EQUAL TO MATCH EXISTING
- STRESS THE TENDON TO REQUIRED FORCE, AS PROVIDED BY ENGINEER.
- INFORMATION REGARDING EXPECTED ELONGATION WILL BE PROVIDED BY SPECIALTY ENGINEER. MEASURED ELONGATION SHALL BE WITHIN 5% OF THE EXPECTED ELONGATION.
- AFTER STRESSING CUT THE EXCESS TENDON TO 1/4 TO 3/4 INCH FROM THE WEDGES.
- ENCAPSULATE THE ANCHOR WITH A GREASE CAP IN A WATER TIGHT MANNER.
- FILL THE GROMMET HOLE WITH NON-SHRINK, NON-METALLIC GROUT.
- APPLY STUCCO OVER THE REPAIRED AREAS & PAINT TO MATCH ADJACENT AREAS.
- ALL WORK MUST BE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS & FLORIDA BUILDING CODE 2007.
- SEE POST TENSION REPAIR NOTES FOR ADDITIONAL DETAILS.

It's in the details!

It's in the details!



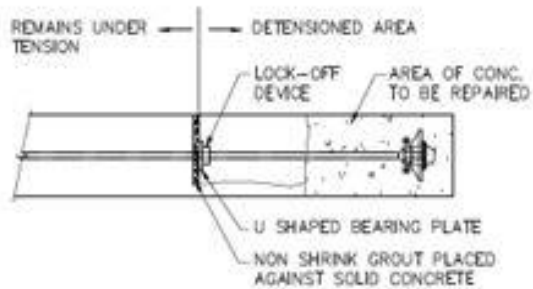
NOTES :

1. NO AREA OF CONCRETE SHALL BE REMOVED IN THE "V" SHAPED ZONE FOR 2'-6" IN BOTH DIRECTIONS.
2. DO NOT EXPOSE MORE THAN THREE TENDONS PAST THE "V" SHAPED ZONE.
3. IF REPAIRS ARE REQUIRED IN THE "V" SHAPED ZONE TENDONS SHALL BE LOCKED OFF PRIOR TO REPAIRS.
4. SEE POST TENSION REPAIR NOTES FOR ADDITIONAL DETAILS.

AREA OF RESTRICTED CONCRETE REMOVAL - DETAIL

SC: 3" = 1'-0"





NOTE :

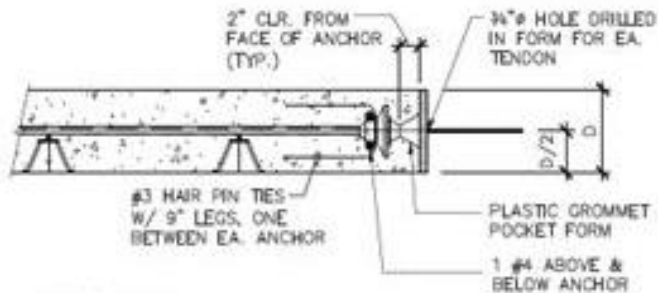
1. PROVIDE A LOCK OFF DEVICE AT LOCATION IDENTIFIED BY ENGINEER IN FIELD.
2. AFTER THE REPAIRS ARE COMPLETED, AND THE REPAIR MORTAR HAS GAINED ALLOWABLE STRENGTH, PROVIDE TENDON SPLICE COUPLER & STRESS TO ACHIEVE REQUIRED FORCE AND REMOVE LOCK-OFF DEVICE.
3. DURING THE REPAIRS LEAVE A PORTION OF SLAB SUFFICIENT TO RECEIVE TENSION SPLICE COUPLER.
4. SEE POST TENSION REPAIR NOTES FOR ADDITIONAL DETAILS.

POST TENSION LOCK-OFF DEVICE DETAIL

N.T.S.



It's in the details!



NOTES :

1. REMOVE PLASTIC CAP FROM GROMMET, POCKET.
2. LOCK OFF TENDON AT LOCATION IDENTIFIED BY ENGINEER IN FIELD.
3. REMOVE EXISTING ANCHOR AND INSTALL NEW ANCHOR.
4. PROVIDE TENDON WITH SPLICE COUPLER AND STRESS THE TENDON.
5. STRESS THE TENDON.
6. USE HYDRAULIC SHEARS OR GRINDERS TO TRIM EXCESS TENDON TO W" TO W" FROM THE WEDGES.
7. PROVIDE PLASTIC CAP WITH GREASE ON TOP OF ANCHOR ASSEMBLY.
8. ENCAPSULATE THE ANCHOR WITH A GREASE CAP IN A WATER TIGHT MANNER.
9. FILL THE GROMMET HOLE WITH NON-SHRINK, NON-METALLIC GROUT.
10. APPLY STUCCO OVER THE REPAIRED AREAS & PAINT TO MATCH ADJACENT AREAS.
11. ALL WORK MUST BE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS & FLORIDA BUILDING CODE 2007.
12. SEE POST TENSION REPAIR NOTES STRESSING END ENCAPSULATION SYSTEM FOR ADDITIONAL DETAILS.

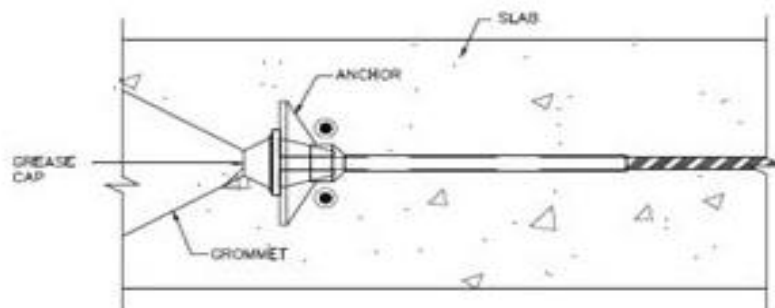
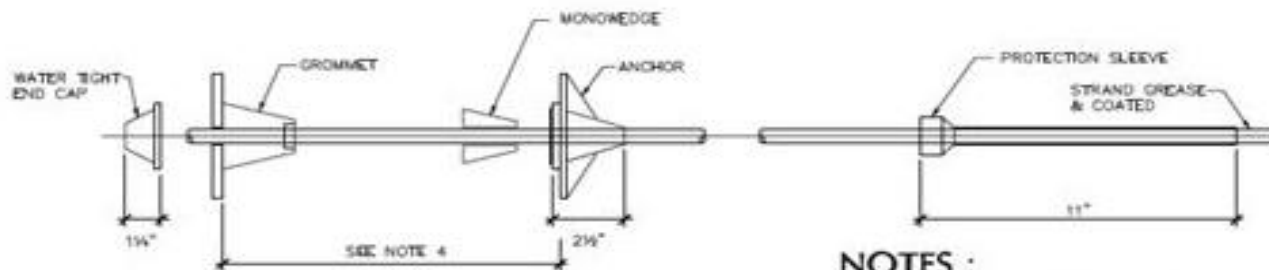
TYPICAL POST TENSION ANCHOR REPLACEMENT DETAIL

SC: 1" = 1'-0"



It's in the details!

It's in the details!



NOTES :

1. INSTALL GROMMET FLUSH WITH THE EDGE OF SLAB AND ANCHOR FACE.
2. SLIDE SLEEVE TIGHT AGAINST ANCHOR. BE SURE NO BARE STRAND IS EXPOSED. TAPE IF NECESSARY.
3. AFTER POURING, AT TIME OF STRESSING, REMOVE GROMMET AND INSERT WEDGES IN THE ANCHOR.
4. AFTER STRESSING, CUT STRAND TO WITHIN $W''-W''$ FROM WEDGES.
5. PROVIDE PLASTIC CAP WITH GREASE ON TOP OF ANCHOR ASSEMBLY.
6. PATCH STRESSING POCKET AFTER WRITTEN AUTHORIZATION IS OBTAINED FROM THE ENGINEER BY UTILIZING NON SHRINK, NON METALLIC GROUT.
7. SEE POST TENSION REPAIR NOTES FOR ADDITIONAL DETAILS.

STRESSING END ENCAPSULATION SYSTEM

SD: 3" - 1'-0"





Reinforced Concrete High-Rise

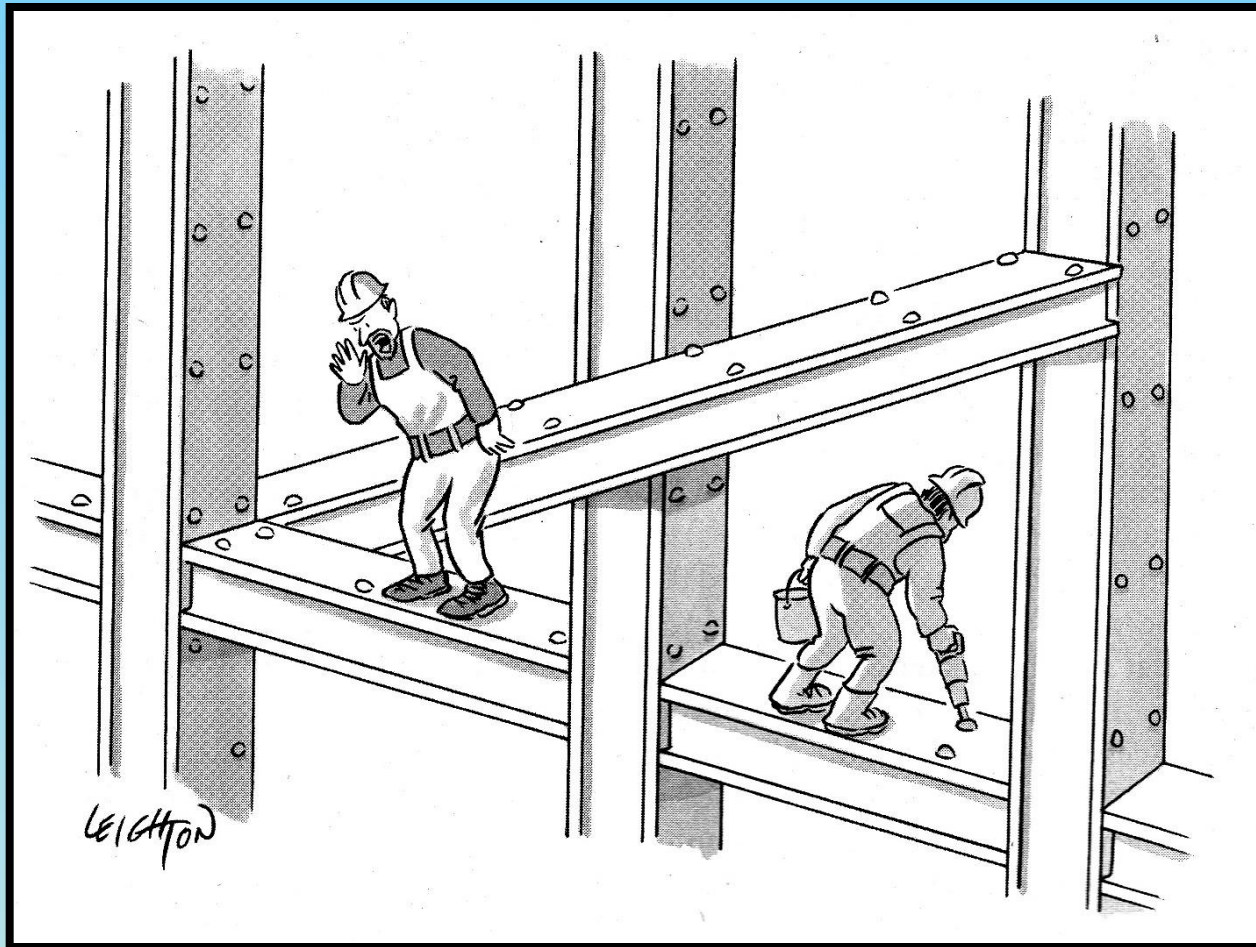
Typical structural repairs to High-Rise Building using swing stage



Typical repair of High-Rise Building using swing stage



Do Not Make Mistakes



Concrete Repair Steps and Effects

- **Removal of damaged Concrete by Chipping**
 - Follow Engineer of Record's direction
 - Extent of concrete chipping – Limits of Corrosion
 - Follow ICRI Recommendations – Vertical and horizontal surface

- **Reinforcing steel rebars cleaning**
 - Sand blast
 - Powered wire brush

- **Coating of concrete surface and steel rebars with rust inhibitor and bonding agent**

Placement of the Repair Mortar

Selection of repair mortar

Repair Material adhesion (Bond) with substrate

Mechanical Bond

- Roughen substrate – sandblasting, shot blasting, scarifying, water blasting & jetting and hammer chipped surfaces
- Open cavities of substrate – Interface texture
- Capillary absorption
- Substrate moisture condition – Optimal Moisture contents only

Chemical Bond Bonding Agent

Properties of Repair Material

Mechanical Bond

- Early age strength and bond durability
- Shrinkage compensated – Non Shrink repair mortar
- Workability, compaction and consolidation
- Horizontal, vertical and overhead repairs

Concrete Repairs - Steps and Effects

- **Hardened repair material**
 - **Directly influence the bond strength**
 - **Development of stresses due to shrinkage**
 - **Elastic modulus, Thermal coefficient, Creep, Permeability**
 - **Concrete carbonation**

- **Substrate Temperature**
 - **At the time of repair mortar placement has significant effect on shear strength**

- **Curing of repaired areas.**



- ← P&A has approximately 35 employees with 26 professionals consisting of Architects and Engineers
- ← In-house Architectural, Electrical, Mechanical, Civil, Structural Engineering Departments
- ← Vast experience in Structural Repairs, Investigators, Code Compliance Experience, Intimate knowledge of building codes past and present

With P&A you get years of experience of working on High-Rise and Low-Rise

NO LEARNING CURVE!