



**INVITATION FOR BID (IFB) No. PAG-CIP-021-004  
REPAIR OF CONCRETE CRACKS & SPALLS AT PAG CFS BLDG.**

**AMENDMENT No. 1**

**Date: May 17, 2021**

**ALL BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS AMENDMENT ON AREA PROVIDED BELOW AND RETURN COPY TO PAG PROCUREMENT OFFICE:  
Fax: (671) 472-1439 or Email: Annie L.G. Sablan [algsablan@portofguam.com](mailto:algsablan@portofguam.com), Steven P. Muna [spmuna01@portofguam.com](mailto:spmuna01@portofguam.com) and Pia Castro [pacaastro@portofguam.com](mailto:pacaastro@portofguam.com).**

**NOTICE TO BIDDERS:** The IFB documents of the above referenced project are hereby **AMENDED TO INCLUDE** the following as part of IFB documents:

1. **AMEND TO CHANGE PAGE 82, IFB VOLUME 5 TITLE PAGE FROM:** "Volume 5 Scope of Work/Specification/Drawings";  
**TO NOW READ: Volume 5: Scope of Work and Drawings**
2. **CFS BUILDING REPAIR GUIDE DRAWINGS**

**\*\*\* END OF AMENDMENT No. 1, ALL OTHERS REMAIN THE SAME \*\*\***

Issued by:

  
**RORY J. RESPICIO**  
GENERAL MANAGER

**Acknowledgement Receipt**



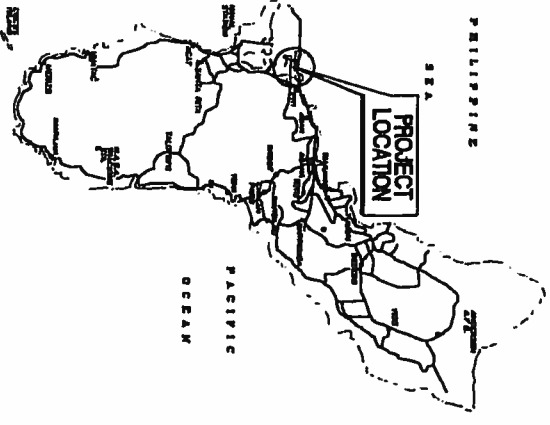

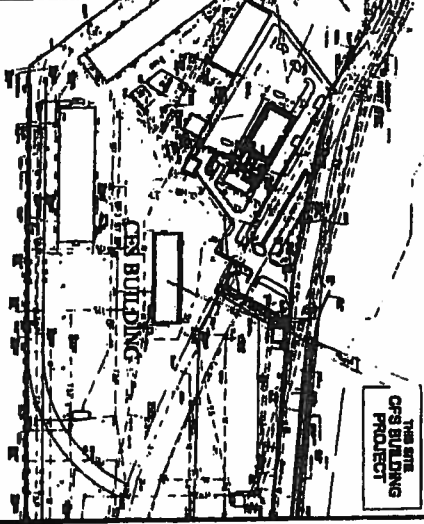
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AUTHORIZED SIGNATURE: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

DATE / TIME \_\_\_\_\_ / \_\_\_\_\_

# JOSE D. LEON GUERRERO COMMERCIAL PORT PORT AUTHORITY OF GUAM CFS BUILDING REPAIR GUIDE

<b>LOCATION MAP</b> 																						
<b>GENERAL NOTES</b>	<ol style="list-style-type: none"> <li>1. CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS.</li> <li>2. THE CONTRACTOR SHALL REMOVE TRASH AND DEBRIS FROM THE SITE DAILY. ALTERNATIVELY THE CONTRACTOR WILL ARRANGE FOR DEBRIS REMOVAL BY A LOCAL AREA SANITATION COMPANY AND WILL BE RESPONSIBLE FOR PAYMENT OF FEES.</li> <li>3. ALL WORK INCLUDING LABOR AND MATERIAS SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE.</li> <li>4. THE CONTRACTOR IS RESPONSIBLE FOR ALL FLOOR ROOF AND WALL PENETRATION FOR ELECTRICAL AND MECHANICAL WORK ALL SUCH OPENING SHALL BE PROTECTED. NO PENETRATIONS SHALL BE CUT WITHOUT PRIOR AUTHORIZATION BY PAG ENGINEERING.</li> </ol>																					
<b>INDEX OF DRAWINGS</b>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%; text-align: left;">SHEET NO.</th> <th style="width: 85%; text-align: left;">DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td>1 OF 5</td> <td>LOCATION MAP, SITE MAP, GENERAL NOTES</td> </tr> <tr> <td>2 OF 5</td> <td>INDEX DRAWING</td> </tr> <tr> <td>3 OF 5</td> <td>NOTES AND CRITERIA</td> </tr> <tr> <td>4 OF 5</td> <td>CONCRETE CRACKS AND SPALLS REPAIRS</td> </tr> <tr> <td>5 OF 5</td> <td>DETAILS AND REMOVAL GEOMETRY.</td> </tr> <tr> <td></td> <td>STEEL CLEANING AND REPAIR OF STEEL</td> </tr> <tr> <td></td> <td>REINFORCEMENT AND DETAILS</td> </tr> <tr> <td></td> <td>EPOXY INJECTION AND TYPICAL</td> </tr> <tr> <td></td> <td>CRACKS REPAIR</td> </tr> </tbody> </table>	SHEET NO.	DESCRIPTION	1 OF 5	LOCATION MAP, SITE MAP, GENERAL NOTES	2 OF 5	INDEX DRAWING	3 OF 5	NOTES AND CRITERIA	4 OF 5	CONCRETE CRACKS AND SPALLS REPAIRS	5 OF 5	DETAILS AND REMOVAL GEOMETRY.		STEEL CLEANING AND REPAIR OF STEEL		REINFORCEMENT AND DETAILS		EPOXY INJECTION AND TYPICAL		CRACKS REPAIR	
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<b>ISLAND OF GUAM</b> 																						
<b>SITE MAP</b> 																						

**NOTES:**

- GENERAL NOTES AND TYPICAL DETAILS SHALL APPLY TO ALL DRAWINGS UNLESS OTHERWISE SHOWN OR NOTES. FEATURES OF CONSTRUCTION SHOWN ARE TYPICAL AND SHALL APPLY GENERALLY THROUGHOUT FOR SIMILAR CONDITIONS.
- THE CONTRACTOR SHALL EXAMINE THE DRAWINGS AND SHALL NOTIFY THE PAG ENGINEERING OF ANY DISCREPANCIES HE MAY FIND BEFORE PROCEEDING WITH THE WORK DURING CONSTRUCTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE WORK AMONG THE VARIOUS TRADES AS NECESSARY TO AVOID CONFLICTS AND TO ENSURE THE INSTALLATION OF ALL WORK WITHIN THE AVAILABLE SPACE.
- ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST APPLICABLE STANDARDS OR SPECIFICATIONS.
- IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO PROVIDE ADEQUATE SHORING AND BRACING OF THE STRUCTURE FOR ALL LOADS THAT MAY BE IMPOSED DURING CONSTRUCTION.

**REINFORCED CONCRETE NOTES:**

- ALL CONCRETE SHALL DEVELOP A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 4000 PSI AT THE END OF 28 DAYS, IF NOT SOONER.
- ALL CONCRETE WORK SHALL CONFORM TO ACI 318-19 AS REFERRED IN THE DESIGN CRITERIA. PIPES OR DUCTS EXCEEDING ONE THIRD OF SLAB OR WALL THICKNESS SHALL NOT BE PLACED IN STRUCTURAL CONCRETE UNLESS SPECIFICALLY DETAILED. PIPES MAY PASS THROUGH STRUCTURAL CONCRETE IN SLEEVES BUT SHALL NOT BE EMBEDDED THEREIN.
- REINFORCING BARS SHALL BE SECURED IN PLACE BEFORE POURING. CONCRETE BAR PLACEMENT AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE RECOMMENDED ACI PRACTICE.
- IN GENERAL, THE LATEST EDITION OF "MANUAL OF STANDARD PRACTICE FOR DETAILING CONCRETE STRUCTURES," ACI 315-99 SHALL BE ADHERED TO, UNLESS SHOWN OTHERWISE.
- ALL INSERTS, ANCHOR BOLTS, PLATES, ETC. TO BE EMBEDDED IN CONCRETE SHALL BE HOT-DIPPED GALVANIZED UNLESS OTHERWISE NOTED.
- USE OF ADMIXTURE IS PERMITTED TO PRODUCE PROPER SLUMP AND WORKABILITY BUT SUBJECT TO ENGINEER'S APPROVAL. ADDITION OF WATER TO CONCRETE AT JOBSITE IS NOT ALLOWED.
- 48 HOURS PRIOR TO THE PLACEMENT OF ANY STRUCTURAL CONCRETE, THE CONTRACTOR SHALL NOTIFY THE ENGINEER SO AN INSPECTION CAN BE MADE ON ALL FORMS AND REINFORCING BARS.

**REINFORCED STEEL NOTES:**

- ALL REINFORCING BARS SHALL BE GRADE 60.
- REINFORCING BARS SHALL BE SPICED AS REQUIRED IN ACCORDANCE WITH ACI REQUIREMENTS.
- NO WELDING OF REBARS SHALL BE ALLOWED.
- IN GENERAL, BAR SPLICES SHALL BE MADE AT POINTS OF MINIMUM STRESS. SPLICES SHALL BE SECURELY WIRED TOGETHER, STAGGER SPLICES AT LEAST 24" WHENEVER POSSIBLE IN BEAMS AND SLABS. SPLICE TOPS BARS AT MIDSPAN, AND BOTTOM BARS NEAR SUPPORT FOR BEAMS AND TOP SLABS. IN CASE OF SLAB SPLICING SHALL ONLY BE MADE AS REQUIRED OF PERMITTED AS ALLOWED BY ACI CODE OR AS AUTHORIZED BY THE ENGINEER.
- ALL REINFORCING BENDS SHALL BE COLD BEND PER ACI 35 REQUIREMENTS.
- MINIMUM CONCRETE COVER FOR REINFORCING BARS SHALL BE AS FOLLOWS:  
 1 1/2" 1 1/2"  
 1 1/2" 1 1/2"  
 COLUMNS AND BEAMS

**ABBREVIATIONS:**

ACI	AMERICAN CONCRETE INSTITUTE
ARCS	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ARCHT	ARCHITECTURAL OR ARCHITECT
AMS	AMERICAN WELDING SOCIETY
BB	BOND BEAM
BLK	BLOCK
BOT	BOTTOM
BLDG	BUILDING
BP	BASE PLATE
BW	BOTH WAYS
C	CHANNEL
COMP	COMPACTED
CONC	CONCRETE
CMU	CONCRETE MASONRY UNIT
CONN	CONNECTION
CONT	CONTINUOUS
DECOR	DECORATIVE
D	DIAMETER
DIAM	DIAMETER
E	EXISTING
EF	EACH FACE
ETC	ETCETERA
EW	EACH WAY
ENCL	ENCLOSURE
EQUIP	EQUIPMENT
EXIST	EXISTING
EXP	EXPANSION
GR	GRADE
HGT	HEIGHT
HOR	HORIZONTAL
HSS	HOLLOW STRUCTURAL STEEL
JT	JOINT
KSI	KIPS PER INCH
L	LONG
LB	LINTEL BEAM
LIQ	LIQUID
MD	MAXIMUM DENSITY
MDD	MAXIMUM DRY DENSITY
MW	METRIC WIRE GAGE
MIN	MINIMUM
MPH	MILES PER HOUR
NGL	NATURAL GRADE LINE
NTS	NOT TO SCALE
O.C.	ON CENTER
OPG.	OPENING
PAG	PORT AUTHORITY OF GUAM
PCF	POUNDS PER CUBIC FEET
PNTD	PAINTED
PSF	POUNDS PER SQUARE FEET
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
PJF	PREFORMED JOINT FILLER
REBAR	REINFORCING BARS
RO.	ROUGH
SLRS	SEISMIC LOAD RESISTING SYSTEM
SIM	SIMILAR
SOG	SLAB ON GRADE
SS	STAINLESS STEEL
T	THICKNESS, THICK
T.O.	TOP OR
THK	THICK
THRU	THROUGH
TYP	TYPICAL
VERT	VERTICAL
W	WIDE FLANGE
WWF	WELDED WIRE FABRIC
W/	WITH

**REQUIRED REBAR LAP SPLICE LENGTHS**

BAR SIZE	MINIMUM LAP AND EMBEDMENT REQUIREMENTS (INCHES)		CMU		
	Fc = 3000 psi	Fc = 4000 PSI			
#3	TOP 21	OTHERS 16	TOP 19	OTHERS 14	24
#4	TOP 29	OTHERS 22	TOP 25	OTHERS 19	24
#5	TOP 36	OTHERS 27	TOP 32	OTHERS 24	24
#6	TOP 46	OTHERS 36	TOP 37	OTHERS 28	—
#7	TOP 50	OTHERS 38	TOP 43	OTHERS 33	—

## I. CONCRETE SPALLS

### A. CONCRETE REMOVAL

- 1 THE GENERAL PROCEDURE FOR PREPARING A SPALLED AREA FOR REPAIR SHALL BE
  - A. MARK OFF THE AREA TO BE REPAIRED USING STRAIGHT LINES BETWEEN CORNERS.
  - B. MAKE A NORMAL-TO-THE-SURFACE CUT ALONG THE MARKED BOUNDARY.
  - C. REMOVE ALL CONCRETE FROM WITHIN THE CUT PERIMETER TO A NEAR UNIFORM DEPTH.
  - D. SOUND THE REMAINING CONCRETE WITHIN THE REPAIR AREA FOR WEAKNESSES AND PERFORM REMOVAL AS NEEDED, AND
    - E. CLEAN ALL SURFACES WITHIN THE REPAIR AREA. THE MARKED AREA SHALL HAVE 90-DEGREE CORNERS WITH THE SIDES PARALLEL OR NORMAL TO THE DIRECTION OF THE REINFORCEMENT. THE MARKED BOUNDARIES FOR THE REPAIR AREA SHALL BE A MINIMUM OF 2 INCHES OUTSIDE THE PERIMETER OF THE SPALL. IF A NUMBER OF SPALLS ARE CLOSELY LOCATED TO EACH OTHER, THESE SPALLS SHALL BE INCLUDED IN A SINGLE AREA MARKED FOR REPAIR.
- 2 A NORMAL-TO-THE-SURFACE CUT ALONG THE MARKED BOUNDARY SHALL BE MADE WITH A DIAMOND BLADE SAW. HOWEVER, WHEN DIAMOND CUTTING IS NOT PRACTICAL, THE NORMAL EDGE CAN BE MADE WITH AN IMPACT HAMMER. THE DEPTH OF CUT SHALL BE A MINIMUM OF 1 INCH. CUT IS RECOMMENDED IN SITUATIONS WHERE THE DIAMOND SAW COULD CUT INTO THE REINFORCING STEEL DUE TO INADEQUATE CONCRETE COVER. THE BOUNDARY EDGE SHALL BE FORMED BY MEANS OF IMPACT HAMMERS.
- 3 CONCRETE SHALL BE REMOVED TO PRODUCE A NEAR UNIFORM DEPTH FOR THE REPAIR AREA. A FULL-DEPTH REPAIR MUST BE USED WHEN DOWNEY BARS ARE REACHED.
- 4 FULL-DEPTH REPAIRS REQUIRE THAT A FULL-DEPTH SAW CUT BE MADE AT THE BOUNDARIES.
- 5 IMPACT HAMMERS MAY BE APPLICABLE FOR SMALLER AND MODERATE AREAS OF REMOVAL. AND FOR AREAS OF LIMITED ACCESS. REMOVAL SHALL BEGIN AT THE INTERIOR OF THE REPAIR AREA AND PROGRESS TOWARD THE BOUNDARIES. REMOVAL SHALL BE PERFORMED USING 30-LB HAMMERS FOR THE INTERIOR AND 15-LB HAMMERS FOR AROUND REINFORCING AND NEAR BOUNDARY EDGES.
- 6 MECHANICAL MILLING (SINGLE DRUM, ROTARY CUTTER HEAD WITH THURSTEEN-CARBIDE BITS) IS APPLICABLE FOR LARGE AREAS WHERE THE CONCRETE COVER IS TO BE REMOVED. CARE MUST BE TAKEN TO AVOID CONTACT WITH THE REINFORCING STEEL AS BOTH THE REINFORCING AND THE CUTTER DRUM COULD BE DAMAGED. THE FRONT AND BACK EDGES OF REMOVAL SHALL BE ROUNDED AND THE OTHER TWO SIDES POSSIBLY FEATHERED. ROUNDED AND FEATHERED EDGES SHALL BE CUT TO FORM NORMAL-TO-THE-SURFACE BOUNDARIES.
- 7 AFTER REMOVAL, EXPOSED SURFACES SHALL BE VISUALLY INSPECTED AND SOUNDED FOR WEAKNESSES AND DELAMINATIONS IF FOUND.
- 8 CORROSION-INDUCED CRACKS SHALL BE TREATED AND REPAIR AS SPALLS.

### B. SURFACE PREPARATION

- 1 PRIOR TO PREPARATION OF CONCRETE SURFACES, EXPOSED REINFORCING SHALL BE INSPECTED FOR PROPER EXPOSURE, CLEARANCE, CROSS-SECTIONAL AREA, AND LOCATION. REINFORCING BARS MUST BE FURTHER EXPOSED IF THE REMAINING CONCRETE IS DEBONDED FROM THE REINFORCING STEEL. REMOVAL MUST BE CONTINUED TO COMPLETELY EXPOSE THE BAR IF MORE THAN HALF OF A REINFORCING BAR PERIMETER HAS BEEN EXPOSED. FOR COMPLETELY EXPOSED REINFORCING BARS, A MINIMUM CLEARANCE OF 3/4 OR NOMINAL MAXIMUM SIZE AGGREGATE PLUS 1/4 INCH WHICHEVER IS GREATER, MUST BE PROVIDED BETWEEN THE REINFORCING BAR AND SURROUNDING CONCRETE. A STRUCTURAL ENGINEER SHALL BE CONSULTED IF THE CROSS-SECTIONAL AREA OF A BAR HAS BEEN REDUCED BY 25 PERCENT OR MORE OR IF TWO ADJACENT BARS HAVE BEEN REDUCED BY 20 PERCENT OR MORE. OUT-OF-PLANE AND LOOSE REINFORCING SHALL BE SECURED IN ITS DESIGN LOCATION.
- 2 THE GENERAL PROCEDURE IN PREPARING CONCRETE AND REINFORCING SURFACES FOR OPTIMUM BONDING IS TO SANDBLAST THE SURFACES AND THEN REMOVE DUST AND DEBRIS BY AIR BLASTING, LOW-PRESSURE WATER BLASTING, OR BRUSHING. IF THE DAMAGE WAS THE RESULT OF CORROSION, AN EPOXY COATING SHALL BE CONSIDERED TO PROTECT THE EXPOSED REINFORCING STEEL. FINAL INSPECTION OF THE PREPARED AREA AND REWORKING OF DEFICIENCIES SHALL BE COMPLETED JUST PRIOR TO BATCHING THE REPAIR MATERIAL.

### C. FORMWORK

1. IF REPAIRS ARE TO BE MADE TO VERTICAL OR OVERHEAD SURFACES AND A NON-SAG MATERIAL IS NOT TO BE USED, FORMWORK SHALL BE REQUIRED PRIOR TO INSTALLING FORMS. THE CONCRETE SURFACE MUST BE INSPECTED FOR ANY SURFACE CONTOURS THAT COULD RESULT IN AIR BEING TRAPPED DURING CONCRETE PLACEMENT OR PUMPING. IF FOUND, CONCRETE MUST BE REMOVED TO CHANGE THE CONTOUR, OR VENT TUBES MUST BE INSTALLED.
- 2 FORMWORK SHALL BE DESIGNED TO WITHSTAND A MINIMUM 14 PSI HYDROSTATIC PRESSURE. INSTALLED FORM ANCHORS SHALL BE TESTED FOR SLIPAGE VIA PRELOADING.
- 3 FORMWORK SHALL BE SECURED TO THE CONCRETE WITH EXPANSION ANCHORS OR STANDARD FORM TIES. PREPARED FOM GASKETS OR CAST-INPLACE FOM MAY BE REQUIRED TO PROVIDE A WATER-TIGHT SEAL BETWEEN THE CONCRETE AND FORM SURFACES.

### D. REPAIR MATERIALS

- 1 RESTRAINED CONTRACTION OF REPAIR MATERIALS, THE RESTRAINT BEING PROVIDED THROUGH BOND TO THE EXISTING CONCRETE SUBSTRATE, IS A MAJOR FACTOR THAT SIGNIFICANTLY INCREASES THE COMPLETENESS OF THE REPAIR. DURING SHRINKAGE AND THERMAL EXPANSIONS ARE THE PRIMARY CAUSES OF CONTRACTION, WHICH OFTEN RESULTS IN CRACKING OF THE REPAIR MATERIAL OR DEBONDING OF THE REPAIR THEREON. REPAIR MATERIALS MUST BE DIMENSIONALLY COMPATIBLE WITH THE EXISTING CONCRETE SUBSTRATE TO MINIMIZE THE POTENTIAL FOR CRACKING AND DEBONDING AS A RESULT OF RESTRAINED CONTRACTION.
- 2 THOSE MATERIAL PROPERTIES WHICH INFLUENCE DIMENSIONAL COMPATIBILITY INCLUDE SHRINKAGE, THERMAL COEFFICIENT OF EXPANSION, MODULUS OF ELASTICITY, BOND, AND CREEP.

### E. CONVENTIONAL CONCRETE

- 1 CONVENTIONAL CONCRETE SHALL NOT BE USED AS REPAIR MATERIAL, BUT ONLY FOR NEW CONCRETE FOOTING, WALLS, COLUMNS AND BEAMS.

### F. NON-SHRINK GROUT

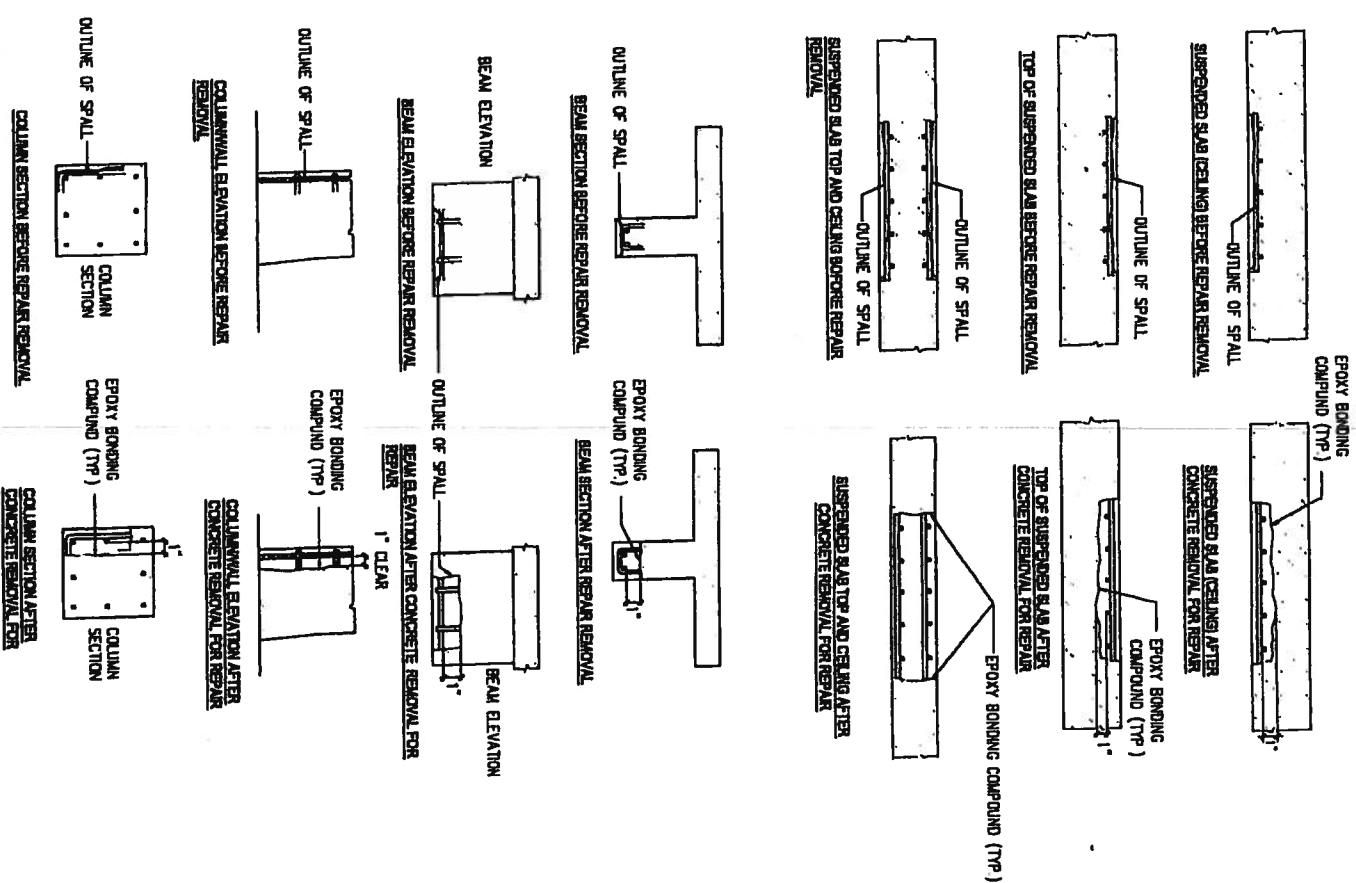
- 1 NON-SHRINK GROUT SHALL BE DEFINED AS A HIGH STRENGTH MORTAR OR GROUT WHICH DOES NOT SHRINK IN THE PLASTIC STATE, IS DIMENSIONALLY STABLE IN THE HARDENED STATE, AND BOND PERMANENTLY TO A CLEAN METAL AND CONCRETE SUBSTRATE.
- 2 GROUT SHALL BE NON-METALLIC, NON-CORROSIVE, CEMENT-BASED GROUT CONFORMING TO ASTM C1107 AND CRD-C821.
- 3 SHRINKAGE AT 28 DAYS: NONE(0.00 SHRINKAGE WHEN TESTED IN ACCORDANCE WITH ASTM C827 MODIFIED PROCEDURE). NO SHRINKAGE AFTER HARDENING (0.00 WHEN TESTED IN ACCORDANCE WITH CRD-C821).
- 4 COMPRESSIVE STRENGTH, MINIMUM AT 28 DAYS: 5,000 PSI SHRINKAGE AT 28 DAYS
- 5 PROVIDE NONSAG THIXOTROPY OR FLOWABILITY AS NECESSARY FOR PARTICULAR APPLICATION.
- 6 NON-SHRINK GROUT MAY BE USED FOR MAKING SHALLOW REPAIRS UP TO 2 INCHES DEEP FOR REPAIRS OF GREATER DEPTH, THE CONCRETE MORTAR MUST BE PLACED IN LIFTS AFTER PLACEMENT AND FINISHING. CONCRETES SHALL BE COVERED PROMPTLY WITH A SINGLE LAYER OF CLEAN, WET BURLAP TOPPED WITH PREFERABLY WHITE SHEET OF POLYETHYLENE FILM. THE SURFACE SHALL BE WET CURED FOR 24 HR AND DRY CURED FOR 72 HR BEFORE VEHICULAR TRAFFIC IS PERMITTED ON THE REPAIR SURFACE.

### G. BONDING AGENT

- 1 THE CEMENTITIOUS BONDING GROUTS MUST BE WORKED INTO THE SURFACES WITH A STIFF BRUSH OR BRUSH. THE GROUTS SHALL NOT BE ALLOWED TO DRY MORE THAN 10 MIN BEFORE THE REPAIR MATERIAL IS PLACED. IF ALLOWED TO DRY, THE GROUT MUST BE REMOVED AND THE SURFACES PREPARED. REMOVAL OF GROUT IS TYPICALLY ACCOMPLISHED BY LOW-PRESSURE WATER BLASTING FOLLOWED BY SANDBLASTING. EPOXY AND OTHER POLYMER BONDING AGENTS ARE AVAILABLE FOR CELESTIAL CONCRETES AND MORTARS. IF ONE OF THESE PRODUCTS IS SELECTED, THE MANUFACTURER'S RECOMMENDATIONS MUST BE FOLLOWED FOR POLYMER CONCRETES AND MORTARS. THE BONDING AGENT RECOMMENDED BY THE MANUFACTURER MUST BE USED AND APPLICATION INSTRUCTIONS FOLLOWED.
- 2 BONDING COMPOUND SHALL CONFORM TO ASTM C881, TYPE V, EPOXY-BASED BONDING AGENT.
- 3 BONDING COMPOUND SHALL BE APPLIED IN SUCH A MANNER THAT SURFACES ARE COATED WITH NO MORE THAN 0.4 MILLIMETERS OF FILM THICKNESS.

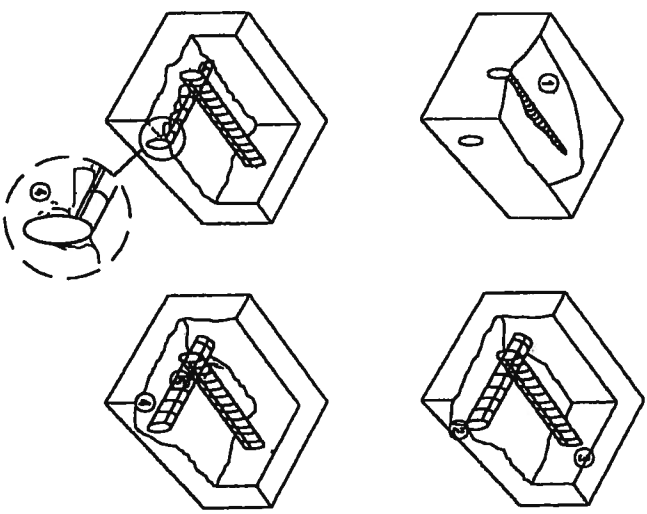
### H. REMOVAL GEOMETRY

- 1 BEFORE STARTING REMOVALS, REVIEW EFFECT OF REMOVALS ON STRUCTURAL INTEGRITY. PROVIDE SHOWING OF MEMBER AS NECESSARY. PARTICULAR CARE SHALL BE EXERCISED AT SLAB BEAM CONNECTIONS TO COLUMNS.



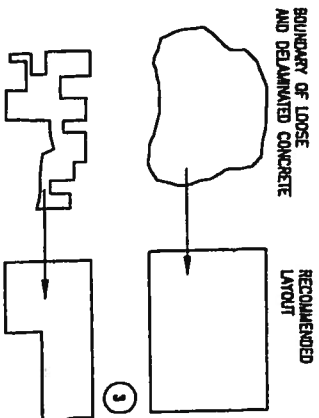
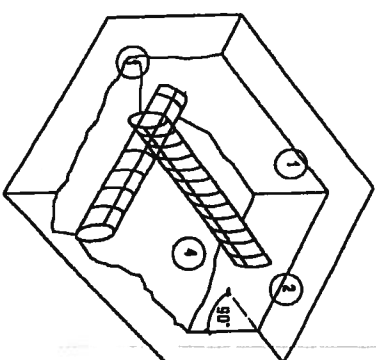
### I. EXPOSING AND UNDERCUTTING OF REINFORCING STEEL

- A. THESE DETAILS ARE APPLICABLE TO HORIZONTAL, VERTICAL, AND OVERHEAD LOCATIONS. THEY ARE ALSO APPLICABLE TO REMOVAL BY HYDRO-DEMOLITION, HYDRO-BLASTING, AND ELECTRIC, PNEUMATIC OR HYDRAULIC IMPACT BREAKERS.
- 1 REMOVE LOOSE OR DELAMINATED CONCRETE ABOVE CORRODED REINFORCING STEEL.
  - 2 ONCE MINOR REMOVALS ARE MADE, PROCEED WITH THE UNDERCUTTING OF ALL EXPOSED CORRODED BARS. UNDERCUTTING WILL PROVIDE CLEARANCE FOR UNDER BAR CLEANING AND FILL. BAR CIRCUMFERENCE BONDING TO SURROUNDING CONCRETE, AND WILL SECURE THE REPAIR STRUCTURALLY. PROVIDE MINIMUM 3/4 INCH (19 mm) CLEARANCE BETWEEN EXPOSED BARS AND SURROUNDING CONCRETE OR 1/4 INCH (6 mm) LARGER THAN LARGEST AGGREGATE IN REPAIR MATERIAL, WHICHEVER IS GREATER.
  - 3 CONCRETE REMOVALS SHALL EXTEND ALONG THE BARS TO LOCATIONS ALONG THE BAR FREE OF BOND INHERENT CORROSION, AND WHERE THE BAR IS WELL BONDED TO SURROUNDING CONCRETE.
  - 4 IF NON-CORRODED REINFORCING STEEL IS EXPOSED DURING THE UNDERCUTTING PROCESS, CARE SHALL BE TAKEN NOT TO DAMAGE THE BAR'S BOND TO SURROUNDING CONCRETE. IF BOND BETWEEN BAR AND CONCRETE IS BROKEN, UNDERCUTTING OF THE BAR SHALL BE REQUIRED.
  - 5 ANY REINFORCEMENT WHICH IS LOOSE SHALL BE SECURED IN PLACE BY TIEING TO OTHER SECURED BARS OR BY OTHER APPROVED METHODS.



### III. EDGE AND SURFACE CONDITIONING OF CONCRETE (FOR REBARS WITHOUT CORROSION)

- 1 REMOVE DELAMINATED CONCRETE, UNDERCUT REINFORCING STEEL (REFER TO "EXPOSING AND UNDERCUTTING OF REINFORCING STEEL" ON PAGE 23), REMOVE ADDITIONAL CONCRETE AS REQUIRED TO PROVIDE MINIMUM REQUIRED THICKNESS OF REPAIR MATERIAL.
- 2 AT THE EDGE LOCATIONS, PROVIDE RIGHT ANGLE CUTS TO THE CONCRETE SURFACE WITH EITHER OF THE FOLLOWING METHODS.
  - SANDIT (1/2" (13 mm) OR LESS AS REQUIRED TO AVOID CUTTING REINFORCING STEEL.
  - USE POWER EQUIPMENT SUCH AS HYDRODEMOLITION OR IMPACT BREAKERS AVOID FEATHER EDGES.
- 3 REPAIR CONFIGURATIONS SHALL BE KEPT AS SIMPLE AS POSSIBLE, PREFERABLY WITH SQUARED CORNERS.
- 4 AFTER REMOVALS AND EDGE CONDITIONING ARE COMPLETE, REMOVE BOND WEARING MATERIALS (DRIT, CONCRETE SLURRY, LOOSELY BONDED AGGREGATES) BY ABRASIVE BLASTING OR HIGH PRESSURE WATERBLASTING WITH OR WITHOUT ABRASIVE. CHECK THE CONCRETE SURFACES AFTER CLEANING TO INSURE THAT ADDITIONAL DELAMINATIONS ARE NOT PRESENT.
- 5 IF HYDRODEMOLITION IS USED, CEMENT AND PARTICULATE SLURRY MUST BE REMOVED FROM THE PREPARED SURFACES BEFORE SLURRY HANDERS.

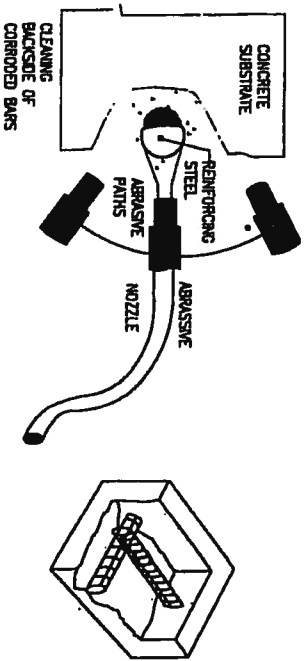


1 UNDERCUTTING DETAIL (PLAN)  
8-12 SCALE  
NOT TO SCALE

### II. CLEANING AND REPAIR OF REINFORCING STEEL

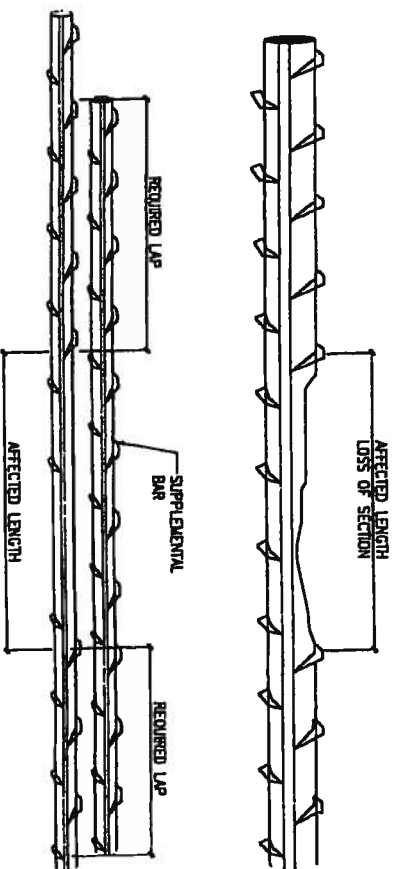
#### CLEANING OF REINFORCING STEEL

- A. ALL HEAVY COULON AND SCALE SHALL BE REMOVED FROM THE BAR AS NECESSARY TO PROVIDE MINIMUM BOND OF REPLACEMENT MATERIAL. OIL FREE ABRASIVE BLAST IS THE PREFERRED METHOD. A TIGHTLY BONDED LIGHT MIST BUILD-UP ON THE SURFACE IS USUALLY NOT DETRIMENTAL TO BOND, UNLESS A PROTECTIVE COATING IS BEING APPLIED TO THE BAR SURFACE. IN WHICH CASE THE COATING MANUFACTURER'S RECOMMENDATIONS FOR SURFACE PREPARATION SHALL BE FOLLOWED.

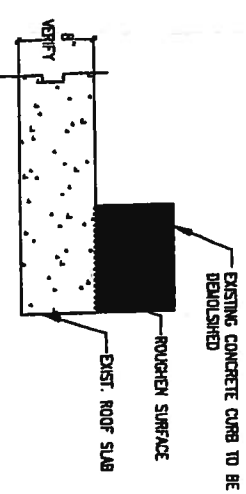


### IV. REPAIR OF REINFORCING STEEL DUE TO LOSS SECTION

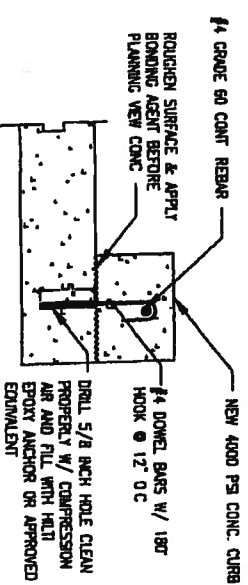
- 1 IF REINFORCING STEEL HAS LOST SIGNIFICANT CROSS SECTION, A STRUCTURAL ENGINEER SHOULD BE CONSULTED. IF REPAIRS ARE REQUIRED TO THE REINFORCING STEEL, ONE OF THE FOLLOWING REPAIR METHODS SHOULD BE USED.
  - A COMPLETE BAR REPLACEMENT, OR
  - ADDITION OF SUPPLEMENTAL BAR OVER AFFECTED SECTION.
- 2 NEW BARS MAY BE MECHANICALLY SPLICED TO OLD BARS OR PLACED PARALLEL TO AND APPROXIMATELY 1/2 IN. (13mm) FROM EXISTING BARS. LAP LENGTHS SHALL BE DETERMINED IN ACCORDANCE WITH ACI 318, ALSO REFER TO CRS AND AASHTO MANUAL.



### V. EXISTING CONCRETE CURB REPAIR



#### EXISTING CURB BEFORE REPAIR

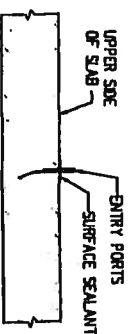
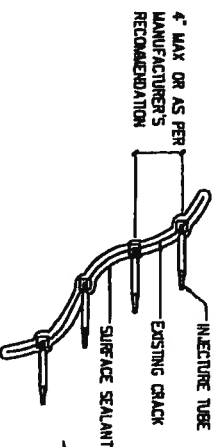


#### EXISTING CURB AFTER REPAIR

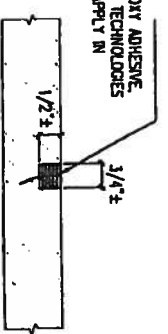
## II. EPOXY INJECTION:

1. CLEAN THE CRACKS THE FIRST STEP IS TO CLEAN CRACKS THAT HAVE BEEN CONTAMINATED. OIL, GREASE, DIRT, OR FINE PARTICLES OF CONCRETE PREVENT EPOXY PENETRATION AND BONDING. PREPARATION SHALL BE REMOVED BY FLUSHING WITH WATER OR SOME OTHER SPECIALLY EFFECTIVE SOLVENT. THE SOLVENT IS THEN BLOWN OUT USING COMPRESSED AIR OR VACUATE. TIME IS PROVIDED FOR AIR-DRYING.
2. SEAL THE SURFACE CRACKS SHALL BE SEALED TO KEEP THE EPOXY FROM LEAKING OUT BEFORE IT HAS CURED. WHERE THE CRACK FACE CANNOT BE REACHED, BUT WHERE THERE IS BUCKLE, OR WHERE A SLAB-ON-GRADE IS BEING REPAIRED, THE BACKFILL MATERIAL OR SURFACE MATERIAL IS CUT IN AND A SURFACE SEAL CAN BE SEALED BY BRUSHING AN EPOXY ALONG THE SURFACE OF THE CRACK AND ALLOWING IT TO HARDEN. IF EXTREMELY HIGH INJECTION PRESSURES ARE NEEDED, THE CRACK SHALL BE CUT OUT TO A DEPTH OF 1/2 IN. AND WIDTH OF ABOUT 3/4 IN. IN A SQUARE-SHAPE, FILLED WITH AN EPOXY, AND STRUCK OFF FLUSH WITH THE SURFACE. IF A PERMANENT GLOSSY APPEARANCE ALONG THE CRACK IS DESIRABLE AND IF HIGH INJECTION PRESSURE IS NOT REQUIRED, A STRIPPABLE PLASTIC MAY BE APPLIED ALONG THE CRACK, WHEN THE JOB IS COMPLETED, THE DRY FILLER CAN BE STRIPPED AWAY TO EXPOSE THE GLOSS-FREE SURFACE.
3. INSTALL THE ENTRY PORTS. THREE METHODS ARE IN GENERAL USE:
  - A. DRILLED HOLES-FITTINGS INSERTED. HISTORICALLY, THIS METHOD WAS THE FIRST TO BE USED, AND IS OFTEN USED IN CONNECTION WITH SQUARE-GROOVING OF THE CRACKS. THE METHOD INVOLVES DRILLING A HOLE INTO THE CRACK, APPROXIMATELY 3/4 IN. IN DIAMETER AND 1/2 TO 1 INCH BELOW THE AREA OF THE SQUARE-GROOVED SECTION, INTO WHICH A FITTING SUCH AS A PIPE NIPPLE OR THE VALVE STEEL IS BOUNDED WITH AN EPOXY ADHESIVE. A VACUUM CHECK AND BIT ARE USEFUL IN PREVENTING THE CRACKS FROM BEING FLOODED WITH DRILLING DUST.
  - B. ROUNDED FLUSH FITTING WHEN THE CRACKS ARE NOT V-GROOVED, A METHOD FREQUENTLY USED TO PROMOTE AN ENTRY POINT IS TO BOND A FITTING FLUSH WITH THE CONCRETE FACE OVER THE CRACK. THIS FLUSH FITTING HAS A HAT-LIKE CROSS SECTION WITH AN OPENING AT THE TOP FOR THE ADHESIVE TO ENTER.
4. MIX THE EPOXY. THIS IS DONE EITHER BY BATCH OR CONTINUOUS METHODS. IN BATCH MIXING, THE ADHESIVE COMPONENTS ARE PREMIXED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS. USUALLY WITH THE USE OF A MECHANICAL STIRNER, LIKE A PLANT MIXING PADDLE ONE MUST BE TAKEN TO MIX ONLY THE AMOUNT OF ADHESIVE THAT CAN BE USED PRIOR TO COMMENCEMENT OF SETTING OF THE MATERIAL. WHEN THE ADHESIVE MATERIAL BEGINS TO GEL, ITS FLOW CHARACTERISTICS BEGIN TO CHANGE, AND PRESSURE INJECTION BECOMES MORE AND MORE DIFFICULT. IN THE CONTINUOUS MIXING SYSTEM, THE TWO LIQUID ADHESIVE COMPONENTS PASS THROUGH METERING AND DIRMING PUMPS PRIOR TO PASSING THROUGH AN AUTOMATIC MIXING HEAD. THE CONTINUOUS MIXING SYSTEM ALLOWS THE USE OF FAST-SETTING ADHESIVES THAT HAVE A SHORT WORKING LIFE.
5. INJECT THE EPOXY.
  - A. HYDRAULIC PUMPS, PUMP PRESSURE POTS, OR AIR-ACTUATED CALIBRATING GUNS CAN BE USED. THE PRESSURE USED FOR INJECTION MUST BE CAREFULLY SELECTED. INCREASED PRESSURE OFTEN DOES LITTLE TO ACCELERATE THE RATE OF INJECTION. IN FACT, THE USE OF EXCESSIVE PRESSURE CAN PROPAGATE THE EXISTING CRACKS, CAUSING ADDITIONAL DAMAGE.
  - B. IF THE CRACK IS VERTICAL, THE INJECTION PROCESS SHALL BEGIN WITH PUMPING EPOXY INTO THE ENTRY POINT AT THE LOWEST ELEVATION UNTIL THE EPOXY LEVEL REACHES THE ENTRY POINT ABOVE THE LOWER INJECTION POINT. THE PROCESS IS THEN REPEATED AT SUCCESSIVELY HIGHER POINTS UNTIL THE CRACK HAS BEEN COMPLETELY FILLED AND ALL PORTS HAVE BEEN CAPPED.
  - C. FOR HORIZONTAL CRACKS, INJECTION SHALL PROCEED FROM ONE END OF THE CRACK TO THE OTHER IN THE SAME MANNER THE CRACK IS FULL IF THE PRESSURE CAN BE MAINTAINED. IF THE PRESSURE CANNOT BE MAINTAINED, THE EPOXY IS STILL FLOWING INTO UNFILLED PORTIONS OR LEAKING OUT OF THE CRACK.
  - D. REMOVE THE SURFACE SEAL. AFTER THE INJECTED EPOXY HAS CURED, THE SURFACE SEAL SHALL BE REMOVED BY GRINDING OR OTHER MEANS, AS APPROPRIATE. FITTINGS AND HOLES AT ENTRY POINTS SHALL BE PAINTED WITH AN EPOXY PATCHING COMPOUND.

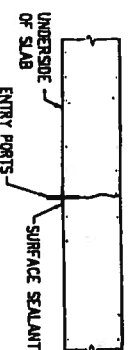
### ISOMETRIC



UPPER SLAB CRACK



TYPICAL CRACK REPAIR (ALTERNATE CRACK REPAIR FOR UPPER SLAB CRACK ONLY)



FULL PENETRATION CRACK

1 TYPICAL CRACK REPAIR DETAIL  
S-5 SCALE: NOT TO SCALE