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| TITLE:<br>CONCRETE PATCHING                | ORIGINATOR<br><i>John Burnett</i>                               | REVIEWED BY:<br><i>CT. May</i><br>TUGCO QA | DATE<br>9-24-86<br>10/23/86 | DATE    |
| ** Major Rewrite**<br>No change bars added | APPROVED BY:<br><i>WE Baker</i><br>CONSTRUCTION PROJECT MANAGER | DATE<br>10-24-86                           | DATE                        |         |

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Reason for change  
Clarify craft re-  
quirements.

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| 1.0  | <u>INTRODUCTION</u>   |                     |          |                   |         |
| 1.1  | PURPOSE   |                     |          |                   |         |
| 1.1.1  | The purpose of this procedure is to prescribe an acceptable method of repairing concrete.   |                     |          |                   |         |
| 1.2  | SCOPE   |                     |          |                   |         |
| 1.2.1  | The scope of this procedure covers repair of Surface Defects, Defective Areas, Chipping Request Areas, Core Drill Request Areas, Abandoned Drill and Tie Holes in Containment Buildings, and other Category I Structures. |                     |          |                   |         |
| 1.3  | RESPONSIBILITY  |                     |          |                   |         |
| 1.3.1  | Concrete patching activities shall be performed under the direct supervision of the Concrete Department Superintendent within the guidelines set forth by this procedure.   |                     |          |                   |         |
| 1.4  | GENERAL DISCUSSION  |                     |          |                   |         |
| 1.4.1  | Patching of concrete involves a process that requires selection of a repair material based on the type of damage and repair material characteristics.   |                     |          |                   |         |
| 1.4.2  | This procedure covers the work required for patching concrete that construction will specifically perform to meet the requirements of Reference 9.1 to construct a Category I Structure.                                  |                     |          |                   |         |
| 1.4.3  | At the option of the Construction Project Manager, the patching of concrete in other structures may also be governed by this procedure.   |                     |          |                   |         |



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## 1.5 SPECIAL ITEMS AND OPERATIONS

### 1.5.1 Vendor products allowed for use with this procedure are:

|    | <u>Brand Names</u>   | <u>Product</u>   | <u>Manufacturer</u>     |
|----|----------------------|------------------|-------------------------|
| 1) | Gifford Hill Supreme | Non-Shrink Grout | Gifford-Hill & Co. Inc. |
| 2) | Masterflow 713       | Non-Shrink Grout | Masterbuilders, Inc.    |
| 3) | Embeco 636           | Non-Shrink Grout | Masterbuilders, Inc.    |
| 4) | Weldcrete            | Bonding Adhesive | Larsen Products Corp.   |
| 5) | Mirachem 100 & 250   | Cleaning Agents  | Mirachem Corp.          |
| 6) | Silpruf & CE 1300    | Sealants         | General Electric, Inc.  |

1.5.2 Water that has been tested and accepted per requirements of SS-9 Section 4.4 will be used for concrete patching. Water will be placed in designated areas under the direction of the Concrete Department Superintendent.

1.5.3 Cement and sand used for concrete repair shall be stored in clean, uncontaminated, water-tight storage hoppers and/or metal storage boxes. Storage hoppers and boxes for cement and sand shall be identified by signs which show: Type of material, controlling specification no., intended use, safety related (Q), etc.

## 1.6 DEFINITIONS OF TERMS

### 1.6.1 Dry-Pack

1.6.1.1 Dry-pack is the hand placement of a low-water content mortar followed by tamping or ramming the dry-pack into place, producing close contact between the dry-pack and the existing concrete.

### 1.6.2 Patching Mortar

1.6.2.1 Patching mortar requires the same proportions of sand and cement as dry-pack, but requires the use of additional water in the mix.

### 1.6.3 Cement Slurry

1.6.3.1 Used as a bonding adhesive between the existing surface and repair material consisting of cement and water.

### 1.6.4 Bonding Grout

Bonding grout is also used as a bonding adhesive between the existing surface and repair material. Bonding grout consist of cement, sand, and water.





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1.6.5 Pre-Wetting

1.6.5.1 Pre-wetting is another method used to obtain a bond between the existing concrete and the patching material, by keeping the existing concrete in a wet condition for a certain period of time.

2.0 PROCEDURE FOR REPAIRING CONCRETE

2.1 SURFACE DEFECTS

2.1.1 Surface defects are defined as honeycombs, minor air pockets, sand streaks, form fins, protrusions, scaling, spalling, etc., that can be chipped or abraded to sound concrete without exposing rebar.

2.1.2 Documentation Requirements

2.1.2.1 None.

2.2 DEFECTIVE CONCRETE

2.2.1 Concrete shall be determined defective when rebar is exposed.

2.2.2 Documentation Requirement

2.2.2.1 When rebar is exposed after form removal, chipping will not commence until a defective concrete work package has been prepared and issued from the Paper Flow Group.

2.2.2.2 When rebar is exposed while chipping a surface defect to sound concrete, chipping shall cease until a defective concrete work package has been prepared and issued from Paper Flow Group.

2.3 CHIPPING REQUEST

2.3.1 The chipping request shall contain detailed instructions from engineering to craft including exact location and size of area requiring chipping, reason for chipping, and comments if required.

2.3.2 Documentation Requirement

2.3.2.1 A concrete chipping request work package shall be issued from Paper Flow Group.

2.4 CORE DRILL REQUEST

2.4.1 The core drill request shall have detailed instructions to craft giving exact location and size of area requiring chipping. When



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chipping for core drill, chip 1" around outside layer of rebar and expose second layer so that Field Engineering can prepare a more accurate drawing of rebar location for Civil Engineering.

2.4.2 Documentation Requirement

2.4.2.1 A Core Drill Request Work Package shall be issued from the Paper Flow Group.

3.0 SURFACE PREPARATION

3.1 CHIPPING OR ABRADING REQUIREMENTS

3.1.1 Surface Defects

3.1.1.1 Surface defects shall be removed down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted.

3.1.2 Defective Concrete

3.1.2.1 After obtaining required documentation per Section 2.2.2.1 or 2.2.2.2 of this procedure, defective area shall be chipped to sound concrete maintaining a minimum of 1" clearance around outside layer of exposed rebar. The edges of chipped area shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted.

3.1.3 Chipping Request

3.1.3.1 After obtaining required documentation per Section 2.3.1 of this procedure, chip area per engineering instructions. If rebar is exposed while chipping, use the same criteria as detailed in Section 3.1.2.1 of this procedure.

3.1.4 Core Drill Request

3.1.4.1 After obtaining required documentation per Section 2.4.1 of this procedure, chip area as required per core drill request. Unless otherwise detailed on the core drill request, chip area to the second layer of rebar. Chip 1" around outside layer of rebar. The edges of chipped area shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted.

3.2 CLEANLINESS REQUIREMENTS

3.2.1 Concrete surfaces to be repaired shall be thoroughly cleaned to remove dust, laitance, oil, grease, and other foreign matter. Mirachem 100 or 250 may be used as a cleaning aid in preparation



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of repair area prior to placement of repair material. Areas where either of the subject products are utilized must be thoroughly rinsed prior to placement in order to remove residue and to neutralize Mirachem 250. Final cleaning shall be done immediately before placement of bonding material.

### 3.3 PREPLACEMENT PREPARATION

3.3.1 Depending on existing conditions and method of repair, pre-placement preparation shall consist of pre-wetting, predampening, or application of cement slurry/bonding grout or adhesive.

#### 3.3.1.1 Pre-dampening

3.1.1.1.1 The existing concrete shall be thoroughly drenched with water until saturated. Immediately prior to placement of repair material, remove standing water leaving concrete damp.

#### 3.3.1.2 Pre-wetting

3.3.1.2.1 The existing concrete shall be maintained in a wet condition for the period of time as specified below:

- 1) Gifford Hill Supreme - 18 hours minimum
- 2) Embeco 636 - 12 hours minimum
- 3) Masterflow 713 - 12 hours minimum

#### 3.3.1.3 Concrete Adhesives (Cement Slurry, Bonding Grout, & Weldcrete)

3.3.1.3.1 Cement Slurry consists of water and cement mixed to the consistency of cream. The mix must be well brushed into the surface and placed so that the hydration of the slurry and the repair material occurs simultaneously.

3.3.1.3.2 Bonding Grout consists of 1 part cement to 1 part passing #30 mesh sieve sand mixed with water to the consistency of thick cream. It must be well brushed into the surface and placed so that the hydration of the bonding grout and repair material occurs simultaneously. It is not recommended for use in shallow surface defect repairs.

3.3.1.3.3 Weldcrete may be applied using a brush, roller, or spray to form a continuous blue film over entire surface. Allow Weldcrete to dry one hour before placement of repair material. Placement must be made within 10 days after application of Weldcrete. If not, Weldcrete must be reapplied. If Weldcrete becomes inadvertently wet with water and you can identify it by its blue appearance after removing standing water, you may proceed and place the repair material.





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| 4.0  | <u>METHODS OF REPAIR</u>  |          |                   |         |
| 4.1  | SURFACE DEFECTS   |          |                   |         |
| 4.1.1  | Surface Defects shall be repaired by use of the following:  |          |                   |         |
|  | 1.) Patching Mortar<br>2.) Dry-Pack (Regular or Gifford Hill Supreme)<br>3.) Commercial Non-Shrink Grout  |          |                   |         |
| 4.2  | DEFECTIVE CONCRETE  |          |                   |         |
| 4.2.1  | Defective Concrete Repairs shall be repaired by use of the following:   |          |                   |         |
|  | 1.) Dry-Pack (Regular or Gifford Hill Supreme), if area does not exceed 6" in depth or 1 cubic foot.<br>2.) Commercial Non-Shrink Grout<br>3.) Batch Plant Concrete<br>4.) Batch Plant Mortar   |          |                   |         |
| 4.3  | CHIPPING REQUEST  |          |                   |         |
| 4.3.1  | Chipping Request Repairs shall be repaired by use of the following:   |          |                   |         |
|  | 1.) Dry-Pack (Regular or Gifford Hill Supreme), if area does not exceed 6" in depth or 1 cubic foot.<br>2.) Commercial Non-Shrink Grout<br>3.) Batch Plant Concrete<br>4.) Batch Plant Mortar   |          |                   |         |
| 4.4  | CORE DRILL REQUEST  |          |                   |         |
| 4.4.1  | Core Drill Request Repairs shall be repaired by use of the following:   |          |                   |         |
|  | 1.) Commercial Non-Shrink Grout<br>2.) Batch Plant Concrete<br>3.) Batch Plant Mortar   |          |                   |         |
| 5.0  | <u>MIXING</u>   |          |                   |         |
| 5.1  | PATCHING MORTAR   |          |                   |         |
| 5.1.1  | Patching Mortar shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of 1 part cement, or richer, to 2½ parts sand, not to exceed a 1 to 1 mix. The quantity of mixing water shall be not more than necessary for handling and placing. The |          |                   |         |



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patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

5.2. DRY-PACK

5.2.1 Dry-Pack shall consist of a mixture (by volume) of 1 part cement, or richer, to  $2\frac{1}{2}$  parts of sand, not to exceed a 1 to 1 mix. Only enough water shall be used to provide mix that will stick together on being molded into a ball by slight pressure of the hands and will not exude water, but will leave the hands damp. The proper amount of mixing water and the proper consistency shall be that which produces a filling which is at the point of becoming rubbery when the material is solidly packed. Any less water will not make a sound, solid pack; any more water will result in excessive shrinkage and a loose repair. Discard dry-pack material which has achieved initial set. Do not retemper.

5.3 GIFFORD HILL SUPREME DRY-PACK

5.3.1 Gifford Hill Supreme dry contents shall be thoroughly mixed prior to using for dry-pack because of possible segregation during shipment. Use the same amount of water as mentioned in Dry-Pack method Section 5.2.1 to achieve the same consistency. Discard dry-pack material which has achieved initial set. Do not retemper.

5.4 COMMERCIAL NON-SHRINK GROUT

5.4.1 Have all necessary tools and materials as near work area as possible to permit rapid and continuous placement of grout. For accurate mixing to the desired consistency, a marked water pail is required.

5.4.2 Use a clean 5 gallon bucket or suitable container for mixing.

5.4.3 Add the premeasured water to the larger container.

5.4.4 Slowly add grout material into the container while continuing to mix with a suitable paddle device chucked in a  $\frac{1}{2}$ " electric drill. The main requirement is that the grout be completely blended and free of lumps.

5.4.5 Use caution when mixing material with electric drill as continuous high speed mixing could overwork the grouting material and cause segregation.





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5.4.6 To achieve the desired consistency with each brand of commercial Non-Shrink grout, use the following guidelines:

- |                         |                                   |
|-------------------------|-----------------------------------|
| 1) Plastic Consistency: | Required Amount of Water per Bag: |
| a) Gifford Hill Supreme | 1.25 gallon                       |
| b) Embeco 636           | 0.85 to 1.02 gallon               |
| c) Masterflow 713       | 0.96 to 1.08 gallon               |
| 2. Flowable Consistency |                                   |
| a) Gifford Hill Supreme | 1.38 gallon                       |
| b) Embeco 636           | 1.1 to 1.2 gallon                 |
| c) Masterflow 713       | 1.14 to 1.26 gallon               |
| 3. Fluid Consistency    |                                   |
| a) Gifford Hill Supreme | 1.5 gallon                        |
| b) Embeco 636           | 1.26 gallon                       |
| c) Masterflow 713       | 1.32 gallon                       |

#### 5.5 BATCH PLANT CONCRETE

5.5.1 Concrete received from the batch plant shall be made of the same materials and of approximately the same proportions as used in the original concrete. Civil Engineering shall make the determination as to design mix I.D. when they sign the concrete pour card.

#### 5.6 BATCH PLANT MORTAR

5.6.1 Batch plant mortar replacement may be used for chipped areas considered impractical to dry-pack, non-shrink grout, or repair with concrete. Generally, these areas will be too wide to dry-pack, too big to non-shrink grout, or too shallow for concrete placement. Mortar shall have approximately the same proportions of cement and sand as used for the concrete placed in the structure being repaired.

#### 6.0 PLACEMENT

##### 6.1 PATCHING MORTAR

6.1.1 When the cement slurry or bonding grout begins to lose its water sheen or after weldcrete has dried (1 hour minimum), the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface to permit initial shrinkage, it shall be left undisturbed for at least 1 hour before being finally finished.



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6.2 DRY-PACK (REGULAR OR GIFFORD HILL SUPREME)

6.2.1 To insure proper consolidation dry-pack should be placed in small workable layers. Each layer should be thoroughly compacted over the entire surface using a blunt stick or hammer. There need be no time delays between layers. Surface appearance may be improved by a few light strokes with a rag or sponge float.

6.3 NON-SHRINK GROUT

6.3.1 Placement and compaction of grout should be continuous until completed. Place the grout quickly to avoid the undesirable effects of overworking which may cause segregation, bleeding, and change in the initial set. Do not use vibrators in the grout at any time. Vibration from near-by machines or equipment can be transmitted into the foundation of the structure being grouted. If vibrating machines or equipment are being used nearby, have them turned off until grout takes initial set.

6.3.2 Flowable or fluid grout may be placed by bucket, pumping or other suitable means that will completely fill the space.

6.3.3 When pumping material through a mortar pump, it is necessary to keep a continual flow of grouting material in the pump. If a breakdown should occur, the pump and lines should be immediately cleaned to insure that the grout does not set up in the pump or line.

6.3.4 Special care should be taken to avoid excessive air entrapment by use of vent holes, vent tubes, strapping, etc.

6.4 BATCH PLANT CONCRETE AND MORTAR

6.4.1 Concrete and mortar received from the batch plant shall be placed in accordance with Reference 9.6

7.0 CURING

7.1 PROCEDURE

7.1.1 The repair material shall be protected immediately after placement from premature drying, excessively hot or cold temperatures, mechanical injury, and shall be maintained with minimal moisture loss at relative constant temperature. Refer to Reference 9.7 for approved methods of curing.



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8.0 TIE HOLES AND ABANDONNED DRILLED HOLES

8.1 PROCEDURE

8.1.1 After being cleaned and thoroughly dampened, tie holes and abandoned drill holes shall be filled solid with patching mortar, Gifford Hill Supreme Non-shrink Grout, or dry-pack (regular or Gifford Hill Supreme).

8.1.1.1 Patching mortar shall be mixed in accordance with Section 5.1.

8.1.1.2 Gifford Hill Supreme shall be mixed in accordance with Section 5.3.1 or Section 5.4 of this procedure.

8.1.1.3 Dry-pack shall be mixed in accordance with Section 5.2.1 of this procedure.

8.1.2 Abandoned overhead holes originally drilled for hilti expansion bolts, which will be completely covered by the base (support) plates or angles of attached fixtures and which are farther than 4 bolt diameters (center to center) from an active hilti bolt, may be filled with "Spilpruf" water-proofing sealant or "GE 1300", both manufactured by General Electric, Inc.

NOTE: The use of "Sealpruf" or "GE 1300" does not apply to level 4 and 5 radiation zones, unless approved by the responsible engineer.

8.1.3 Curing of abandoned drill hole patches is not required. The surface area and depth of anchor holes are minor and shrinkage is not considered detrimental. Tie holes shall be cured in accordance with Reference 9.7.

9.0 REFERENCES

9.1 G&H Specification 2323-SS-9, Rev. 5 Concrete

9.2 Gifford Hill Supreme Non-Shrink Grout Data Sheet from Gifford-Hill & Co., Inc.

9.3 Embeco 636 - Non-Shrink Grout Data Sheet from Master Builders Co.

9.4 Masterflow 713 - Non-Shrink Grout Data Sheet from Master Builders Co.





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- 9.5 Weldcrete Data Sheet from Larsen Products Corporation
- 9.6 CCP-11 - "Concrete Placement"
- 9.7 CCP-13 - "Concrete Curing"
- 9.8 American Concrete Institute Manual of Concrete Practice,  
1972, Part 2, "Specifications for Structural Concrete  
for Buildings, (ACI 301-72)".
- 9.9 Mirachem 100 & 250 Data Sheet from the Mirachem Corporation



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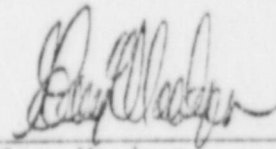
TO: Pam Parker  
FROM: Gary Maedgen  
SUBJECT: CCP-12, Revision 5 Errata

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December 31, 1986

CCP-12, Revision 5 was issued with a word processing error in that the heading for Paragraph 1.6.3 "Cement Slurry" was inadvertently omitted.

Please replace page 3 in all control copies with the attached corrected page 3.



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Gary Maedgen  
Staff Engineering  
Construction Procedures  
and Reports

CC: H.A. Hutchinson  
ARMS