

Section 38 – Concrete Removal, Repair and Replacement

Black text – from standard FAA spec	Blue text – additions to FAA standard spec
Strikeout text – deletions from FAA standard spec	Red text – notes to the Engineer/won't appear in spec

**I. GENERAL**

**A. DESCRIPTION – THIS SECTION COVERS**

1. Repair of new pavement found to be damaged or defective.
  - a) In lieu of removal and replacement as required by Section 37-Portland Cement Concrete Pavement
  - b) Repair attempt only if approved by the Engineer.
    - (1) If repair acceptable,
      - (a) no separate payment will be made for repairs
      - (b) payment will be made for repaired pavement under Sections
        - (i) Section 37 – Portland Cement Concrete Pavement
        - (ii) this section
          - (a) with penalties applied
      - (2) If unacceptable, remove and replace entire slab
2. Full slab removal for:
  - a) new slabs
    - (1) no payment will be made
  - b) existing slabs
    - (1) payment will be made under Section 14-Removals
3. Engineer not required to accept attempt to repair new damaged or defective pavement
  - a) Such approval will not be withheld arbitrarily
4. All work to be done in accordance with the plans and specifications.

**B. IDENTIFICATION**

1. Contractor, in company of Engineer, will identify defects
  - a) Mark for repair
2. Areas marked shall be at sole discretion of Engineer

**II. MATERIALS**

**A. ELASTOMERIC CONCRETE**

1. General
  - a) Fluid base with reinforcing agents
  - b) mix in 5 minutes or less
  - c) flows readily
  - d) strongly adheres to concrete
  - e) requires no external application of heat
2. Properties
  - a) “DelPatch” or approved equal
    - (1) must conform to Table 1:

TABLE 1 – ELASTOMERIC CONCRETE PROPERTIES		
Properties	Requirement	Test Method
Tensile Strength	600 psi, min	ASTM D 412 (Mod)
Elongation at break	25 %, min	ASTM D 412 (Mod)
Hardness, Type D Durometer	50 pts, min	ASTM D2240
<u>Compression-Deflection Properties</u>		
Stress (psi) 5% Deflection	800 min/1400 max	D 695
Resilience, 5% Deflection	95 min	D 695 (Mod)

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TABLE 1 – ELASTOMERIC CONCRETE PROPERTIES		
Properties	Requirement	Test Method
Impact Ball Drop @ -20°F	>10 ft	D 3029 (Mod)
Adhesion to Concrete (psi)		
Dry Bond	400 min	
Wet Bond	250 min	

3. Application
    - a) weigh and mix per manufacturer’s recommendations
    - b) place in layers up to finished grade
      - (1) within 4 minutes of initial mixing
    - c) cure 2 hours minimum before opening to traffic
  4. [OPTIONAL: Manufacturer’s Representative]
    - a) If requested by Engineer, manufacturer’s rep shall be present during initial stages of placement
      - (1) to ensure that material is properly applied.]
- B. HIGH MOLECULAR WEIGHT METHYLMETHACRYLATE (HWHM)
1. 4R by 3 M, or
  2. T70X by Transpo, or
  3. approved equal
- C. EPOXY RESIN
1. Conform to ASTM C881, of type and grade specified
    - a) Type III
      - (1) Grade
        - (a) as specified herein
        - (b) contingent upon particular use
    - b) Type IV
      - (1) Grade
        - (a) as specified herein
        - (b) contingent upon particular use
- D. OTHER MATERIALS
1. Conform to like materials from Section 37 – Portland Cement Concrete Pavement

**III. TESTING AND QUALITY CONTROL**

1. As required in Section 37 – Portland Cement Concrete Pavement
2. Cost to be borne by Contractor

**IV. CONSTRUCTION METHODS**

- A. REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS
1. General
    - a) new slabs to be removed, replaced or repaired:
      - (1) broken
      - (2) containing cracks
      - (3) at Contractor’s expense
    - b) spalls along joints
      - (1) repair as specified herein
    - c) removal of partial slabs not permitted
    - d) removal and replacement shall be
      - (1) full depth
      - (2) full width
      - (3) limit of removal normal to
        - (a) paving lane
        - (b) original transverse joint

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- e) determination of full depth cracks
  - (1) by the Engineer by full depth cores
  - (2) 4" diameter cores
    - (a) drilled by Contractor
    - (b) Contractor fill with well-consolidated concrete mix
    - (c) bonded with epoxy resin
      - (i) ASTM C881, Type V
    - (d) at Contractor's expense
- 2. Shrinkage Cracks
  - a) Definition
    - (1) less than 4 inches in depth
    - (2) Severity
      - (a) Low Severity
        - (i) isolated hairline cracks
        - (ii)  $\leq 1/16$  inch wide
      - (b) Medium Severity
        - (i)  $1/16$  inch to  $1/8$  inch wide
      - (c) High Severity
        - (i)  $>1/8$  inch wide
  - b) Repair
    - (1) low severity shrinkage cracks
      - (a) fill with High Molecular Weight Methymethacrylate (HMWM) filler
      - (b) apply per manufacturer's recommendations
    - (2) medium severity shrinkage cracks
      - (a) clean
      - (b) pressure inject with epoxy resin
        - (i) Type IV, Grade 1
        - (ii) use approved procedures
      - (c) insure that crack is not widened during injection
      - (d) injection shall be done in the presence of Engineer
    - (3) high severity shrinkage cracks
      - (a) remove and replace slab
  - c) cracks deeper than 4 inches to be repaired per IV.A.3 or IV.A.4
- 3. Slabs With Full Depth ( $> 4$  inches) Cracks Through Interior Areas
  - a) Definition Interior Area:
    - (1) more than 6 inches from either transverse or longitudinal joint
  - b) Remove and replace full slab
    - (1) at Contractor's expense
- 4. Slabs with Full Depth ( $> 4$  inches) Cracks Close To And Parallel With Joints
  - (1)
  - (2) essentially parallel to original joint
  - (3) within 6 inches of original joint
    - (a) if  $> 6$  inches treat as interior joint crack per IV.A.3.
  - b) Repair
    - (1) Full depth crack – original joint not opened
      - (a) saw and seal crack
        - (i) rout with equipment especially designed to follow random cracks
        - (ii) form reservoir
          - (a) depth:  $3/4$  inch (+/-  $1/16$  inch)
          - (b) width:  $5/8$  inch (+/-  $1/8$  inch)

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- (iii) replace/ modify equipment/procedures
            - (a) if raveling occur
            - (b) if spalling occurs
          - (iv) seal with joint sealant specified, or
            - (a) per Sections
              - (i) 37 – Portland Cement Concrete
              - (ii) 42 – Joint Sealing Filler
            - (b) as directed by Engineer
        - (b) Fill original joint
          - (i) if original joint reservoir has been sawcut
            - (a) fill reservoir and lower sawcut with
              - (i) epoxy resin Type IV, Grade 2
              - (ii) thoroughly tool into void
              - (iii) using approved procedures
          - (ii) if only lower sawcut has been completed
            - (a) clean
            - (b) pressure inject
              - (i) epoxy resin Type IV, Grade 1
              - (ii) using approved procedures
          - (iii) if filler material used to form original joint
            - (a) completely saw out filler material
            - (b) pressure inject
              - (i) epoxy resin Type IV, Grade 1
              - (ii) using approved procedures
        - (c) Parallel crack runs part way across slab, then intersects original joint
          - (i) treat cracked portion per IV.A.4.b.1
          - (ii) treat original joint portion as originally designed
      - (2) Full depth crack – original joint also cracked
        - (a) remove and replace entire slab
          - (i) applies if any portion of joint is in this condition
5. Removal and Replacement of Full Slabs
  - a) If no dowels present
    - (1) sawcut all edges full depth
      - (a) with concrete saw
      - (b) perpendicular to slab surface
  - b) If dowels present
    - (1) sawcut full depth
      - (a) just beyond edge of dowels
    - (2) then sawcut on the joint line
      - (a) within 1 inch of depth of dowel
  - c) Further divide slab by sawcutting
    - (1) full depth
    - (2) at appropriate locations
    - (3) do additional sawcuts as necessary to provide for vertical lift out of pieces
      - (a) using approved equipment to attachment to slab pieces
  - d) carefully break up and remove concrete along joint line
    - (1) use light, hand-held jackhammers
      - (a) 30 lb or less, or
      - (b) other approved equipment
  - e) Prevent damage to dowels and concrete to remain
    - (1) trim joint faces below dowels

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- (a) reduce
        - (i) abrupt offset to < ½ inch in all directions
        - (ii) gradual offset to < 1 inch
        - (iii) when tested in horizontal direction
          - (a) using 12-ft straightedge
    - f) Do not use mechanical impact breakers
      - (1) except for handheld per IV.A.5 d.
    - g) If underbreak occurs along any edge
      - (1) between 1-1/2 inch and 4 inches
        - (a) repair as directed by Engineer before replacing slab
          - (i) use procedures similar to spall repair
            - (a) modified as necessary
      - (2) greater than 4 inches
        - (a) remove and replace slab containing underbreak
    - h) Dowels or tie bars
      - (1) Where no dowels exist on damaged edge
        - (a) install dowels of similar size and spacing per project plans
          - (i) drill holes
          - (ii) install dowels with epoxy grouting
            - (a) per Section 37 – Portland Cement Concrete Pavement
      - (2) Damaged existing dowels or tie bars
        - (a) cut off flush with joint face
      - (3) Protruding dowels
        - (a) paint and lightly oil
      - (4) All four edges of new slab shall contain dowels
    - i) Placement of concrete
      - (1) as originally specified per Section 37 – Portland Cement Concrete Pavement
        - (a) underlying course
          - (i) shape, scarify, and recompact underlying unbound course
        - (b) joint faces
          - (i) clean all four joint faces of loose material
          - (ii) coat with double application of membrane forming curing compound
            - (a) prevent contact with dowels or tie bars
        - (c) joints
          - (i) seal per original construction plans
            - (a) Section 37 – Portland Cement Concrete Pavement
            - (b) Section 42 – Joint Sealing Filler
6. Repairing Spalls Along Joints
  - a) Establish limits of repair
    - (1) by sounding concrete with steel rod
      - (a) drop from height of 4-6 inches
      - (b) dull sound => unsound concrete
      - (c) ringing sound=> sound concrete
    - (2) repair boundary shall be at least 3 inches outside unsound concrete
  - b) Make vertical sawcut
    - (1) Cut rounded corners of repair with approximately 4-inch diameter coring equipment

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- (a) at least  $\pm 3$  inches outside spalled area
    - (b) to depth of at least 2 inches
  - (2) connect with straight sawcut lines
    - (a) connecting corner tangents
    - (b) to depth of at least 2 inches
  - (3) chip out concrete between sawcut and joint
    - (a) at least  $\frac{1}{2}$  inch into visually sound concrete
- c) Clean and prepare cavity
  - (1) high pressure water jets and
  - (2) compressed air
  - (3) prime coat contact surfaces
    - (a) except joint face
    - (b) epoxy resin Type III, Grade 1
    - (c) apply thin coat
      - (i) scrub into surface with stiff-bristle brush
      - (ii) avoid pooling of epoxy
  - (4) to abutting joint faces apply
    - (a) approved bond breaker, or
    - (b) joint insert
- d) Preparation of filler
  - (1) portland cement materials
    - (a) proportion, mix, place, consolidate and cure as directed
  - (2) epoxy resin mortars
    - (a) use Type III, Grade 1
    - (b) proportion, mix, place, consolidate and cure
      - (i) as recommended by manufacturer
      - (ii) as approved by the Engineer
- e) Fill cavity
  - (1) low slump cement-based filler, or
    - (a) concrete, or
    - (b) mortar
  - (2) epoxy resin-based filler
    - (a) concrete (elastomeric concrete), or
    - (b) mortar
  - (3) appropriate material based on size of spall
    - (a)  $> 0.5$  cu. ft
      - (i) use concrete
    - (b)  $0.1 - 0.5$  cu ft
      - (i) use mortar
    - (c)  $< 0.1$  cu ft
      - (i) use epoxy resin mortar, or
      - (ii) use epoxy resin Type III
  - (4) Epoxy Resin materials
    - (a) place in layers  $\leq 2$  inches thick
    - (b) time interval for placement of subsequent layers
      - (i) such that temperature does not exceed 140 deg F at any time
  - (5) Consolidate concrete or mortar
    - (a) use mechanical vibrators or hand tampers
  - (6) Remove excess materials from surrounding surfaces before it hardens
- f) Complete joint
  - (1) sawcut reservoir

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- (a) equipment and methods per Section 37 – Portland Cement Concrete, or
        - (b) as for routed cracks Section IV.A.4.b.1.a
      - (2) clean reservoir
      - (3) seal reservoir per Sections 37 and 42
    - g) If spall depth exceeds ½ slab thickness
      - (1) remove and replace slab
- B. REMOVAL AND REPAIR OF EXISTING CONCRETE PAVEMENT
  - 1. General
    - a) control all operations to prevent damage to remaining
      - (1) adjacent slabs
      - (2) underlying courses
    - b) make all sawcuts perpendicular to slab surface
  - 2. Removal of Existing Pavement Slab
    - a) remove per IV.A.5
  - 3. Edge Repair
    - a) General
      - (1) protect existing concrete at all times
      - (2) if damage cause by Contractor operations
        - (a) repair at Contractor’s expense
      - (3) if damage pre-existing
        - (a) payment will be by bid item herein, or
        - (b) will be considered incidental
    - b) Spall Repair
      - (1) Repair of pre-existing spalls
        - (a) where indicated on the plans
        - (b) where directed by Engineer
        - (c) using procedures in IV.A.6
    - c) Underbreak Repair
      - (1) Repair all underbreak
      - (2) Procedures
        - (a) remove delaminated and loose material
        - (b) recompact underlying material without addition of new material
        - (c) thoroughly moisten underlying material
        - (d) completely fill void with paving concrete
        - (e) completely consolidate concrete
        - (f) produce even joint face from top to bottom
        - (g) coat with curing compound
        - (i) in amount approved by the Engineer
    - d) Underlying Material
      - (1) protect from damage or disturbance during slab removal operations
      - (2) shape as shown on drawings or as directed by Engineer
      - (3) provide adequate material outside joint line to prevent sloughing from under pavement to remain
      - (4) If disturbed
        - (a) remove and replace with concrete per IV.B.3.c.

## V. ACCEPTANCE

- A. Acceptance of repaired pavement at sole discretion of the Engineer

## VI. PENALTY

- A. Repaired deficiencies will increase maintenance costs to Owner.
- B. Contractor will be assessed penalty of \$500 for each spall repaired.

**VII. SUBMITTAL REQUIREMENTS**

- A. ELASTOMERIC CONCRETE
- B. HWHM
- C. EPOXY RESIN
- D. OTHER REPAIR MATERIALS

**VIII. METHOD OF MEASUREMENT**

- A. Unless otherwise specified, no measurement for payment for work under this section.
- B. Accepted pavement will be measured and paid under section 37 – portland cement concrete pavement.
- C. Engineer not obligated to accept request to repair damaged or defective pavement
  - 1. Removal and replacement may be required.
- D. All work under this Section done at Contractor's expense.
- E. See penalty charges for spall or slab repairs in VI.
- F. Slab removal as part of demolition operations to be measured and paid under Section 14 – Removals.
- G. [OPTIONAL: Repair of pre-existing concrete spalls in existing concrete will be measured for payment by the cubic foot of repaired spalls, as measured after the cavity has been cleaned and approved by the Engineer.]

**IX. BASIS OF PAYMENT**

- A. PAID AT CONTRACT UNIT PRICE UNDER ITEM NUMBER
  - 1. [OPTIONAL: 38.1 Concrete Spall Repair of Existing Pavement – per cu ft
  - 2. Is full compensation for all materials, labor, equipment, tools and incidentals.
  - 3. No separate payment for work in areas of night or limited-time construction area.]

**X. END OF SECTION**