Hartsfield-Jackson Atlanta International Airport

City of Atlanta

Department of Aviation

Office of Infrastructure Planning & Development

Concessions New Construction and Modifications

Design Standards

Civil Engineering

Design Standards Civil

Table of Contents

Design Standards Civil

1.0 Purpose

A. The purpose of this document is to provide the Concessionaire/Designer of Record with the Department of Aviation (DOA) Civil Engineering standard details and specifications to be used for any new construction and/or modification concessions project at the Airport.

2.0 General

A. All design work shall be performed in accordance with generally accepted professional principles and practices for civil engineering and in compliance with all applicable Federal, State, and City of Atlanta Codes, Guidelines, Standards, and Regulations and the following DOA Civil Engineering Standards and Specifications:

1. DOA Civil Design Standards (Attached)

   a. STD-01-301 Underdrain Details-Replacement Projects

   b. STD-01-400 In Pavement Manholes

   c. STD-01-700 Pavement Joint Details-Replacement Projects-1

   d. STD-01-701 Pavement Joint Details-Replacement Projects-2

   e. STD-03-300 Typical Grease Interceptor Installation (Top of Interceptor Flush with Pavement Surface Designed for Tug Loading) – Case 1

   f. STD-03-301 Typical Grease Interceptor Installation (Top of Interceptor Below Pavement, Designed for Tug Loading) - Case 2

   g. STD-03-302 Below Pavement Grease Interceptor Details (Interceptor Not Designed for Tug Loading) - Case 3

   h. STD-03-303 Utility Slab Detail for Interceptor Below Pavement

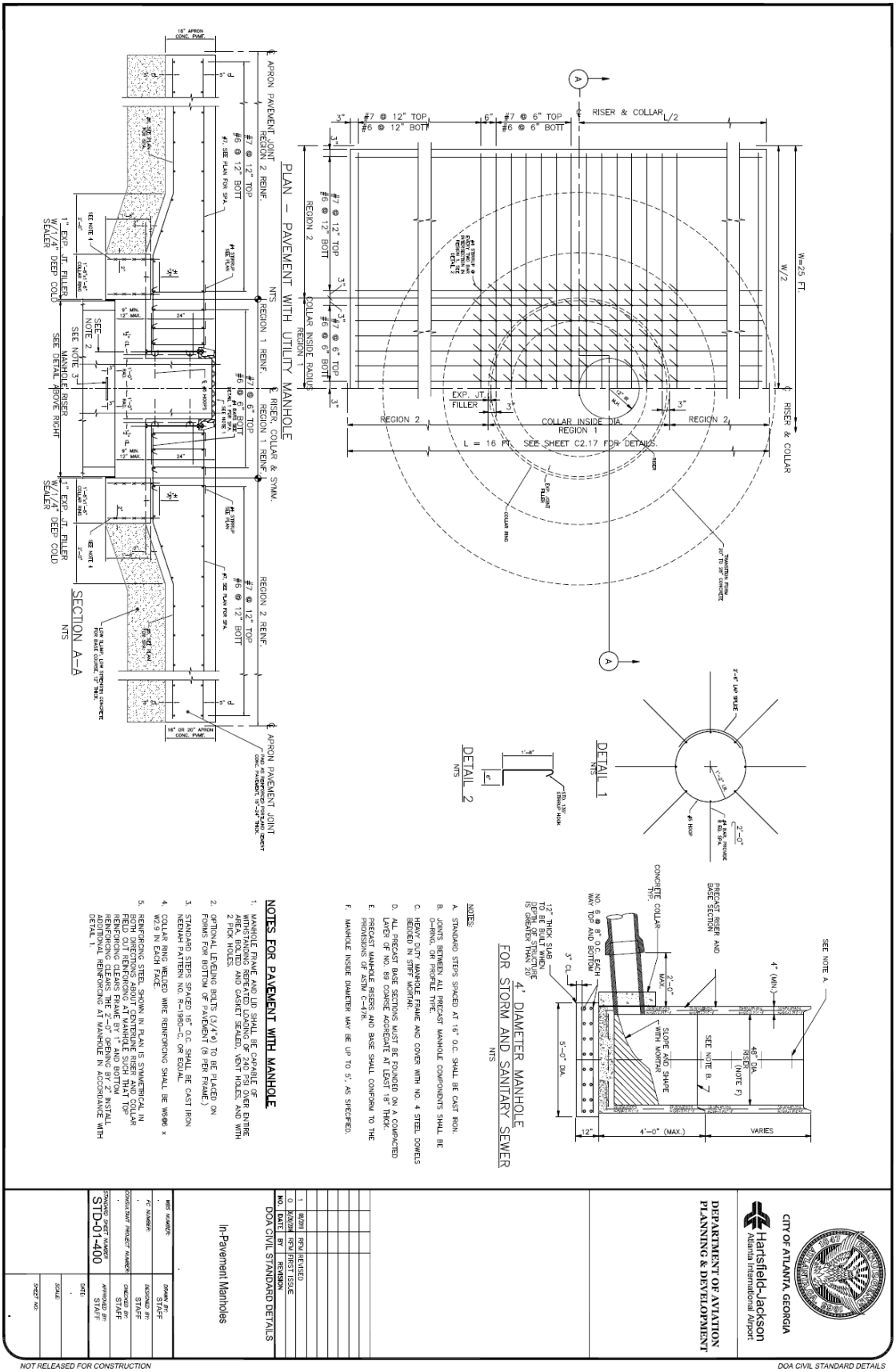
   i. STD-03-304 Additional Pavement Removal

   j. STD-03-404 Miscellaneous Pipe Details

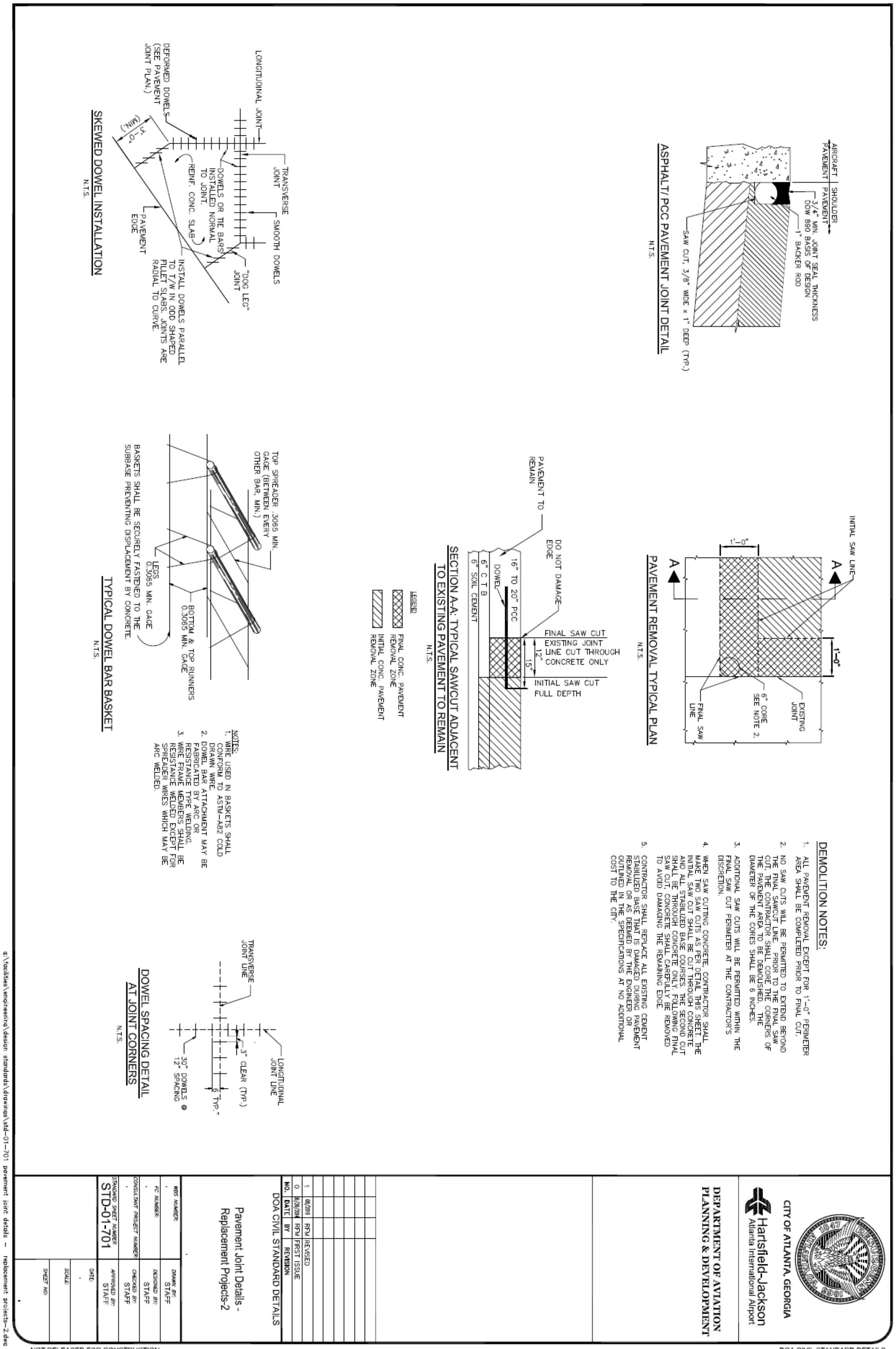
   k. STD-03-600 Bollard Detail

2. DOA Civil Design Specifications (Attached)
    a. Section 02085 Interceptors
    b. Section D-701 Pipe for Storm Drains.
    c. Section D-705 Pipe for Underdrains
    d. Section D-750 Sanitary Sewers
    e. Section D-751 Manholes, Catch Basins, and Inlets
    f. Section P-150 Removal of Pavements and Miscellaneous Items
    g. Section P-152 Excavation and Embankment
    h. Section P-209 Crushed Aggregate Base Course
    i. Section P-501 Portland Cement Concrete Pavement
    j. Section P-504 High Early Strength Cement Concrete Pavement
    k. Section P-605 Joint Sealing Filler
    l. Section P-610 Structural Portland Cement Concrete.pdf
    m. Section P-615 Site Concrete
    n. Section P-621 Pavement Markings and Marking Removal
    o. Section P-660 Concrete Filled Steel Guard Post

NOTES:
1. THE CONTRACTOR SHOULD BE AWARE THAT DUE TO THE DEPTH OF THE UNDERDRAINS, CERTAIN PREPARATIONS WILL BE NECESSARY BEFORE PCC IS PLACED, AS FOLLOWS:
A. THE CONNECTION SHOULD BE IN PLACE AND THE LOCATION SURVEYED.
B. THE CLEANOUT RISER SHOULD EXTEND TO 6" (MAX) BELOW THE SURFACE LEVEL OF SOIL CEMENT AND TEMPORARILY CAPPED TO PREVENT DEBRIS FROM ENTERING THE UNDERDRAIN SYSTEM.
2. ALL PAVEMENT AND GROUND AREA DISTURBED DURING INSTALLATION SHALL BE RESTORED TO ORIGINAL CONDITION BY THE CONTRACTOR.
3. SEE JOINT FILLER SPECIFICATION SECTION FOR SEALANT.
4. THE WORDS "UNDERDRAIN C.O." SHALL BE WELDED IN 1" LETTERS ONTO THE PLATE BY THE CONTRACTOR AFTER WELDING. PLATE SHALL BE HOT-DIPPED AND GALVANIZED.
5. CUT 9" DIAMETER HOLE IN THE BOTTOM OF CAN TO PROVIDE FOR CLEAN OUT RISER CONNECTION.
6. FOR INSTALLATION OF UNDERDRAIN CLEANOUT IN TYPICAL INSTALLATION FOR TYPE L-868 BASE IN CONCRETE PAVEMENT, REFER TO DETAILS OF ELECTRICAL DETAILS.
A. INSTALL L-868 BASE WITH 1/8" STEEL MUD PLATE, TEMPORARILY BOLTED ON IN PLACE OF THE ADAPTER PLATE.
B. IMMEDIATELY AFTER PAVING MACHINE PAVES OVER BASE, CONTRACTOR SHALL REMOVE LEAVING STEEL COVER IN PLACE.
C. DO NOT REUSE SHIPPING BOLTS FOR COVER INSTALLATION.
D. CONTRACTOR IS CAUTIONED TO OBSERVE THAT ALL SUBGRADE MATERIAL IS CEMENT STABILIZED. PROVISIONS MUST BE MADE FOR INSTALLATION HOLES IN CEMENT STABILIZED SUBBASE MATERIAL.
E. CONTRACTOR SHALL INSTALL AND FURNISH SUFFICIENT CONCRETE TO FILL AREA AROUND TOP OF L-868 BASE AFTER COVER INSTALLATION.
F. THE FOLLOWING TYPES OF BOLTS SHALL BE FURNISHED AND INSTALLED WITH EACH BASE:
a. SHIPPING BOLTS, 1/2" LONG DISPOSABLE
b. SETTING BOLTS, 1/8" MUD PLATE, THICKNESS OF 46" (DETERMINED BY CONTRACTOR)
c. STAINLESS STEEL FINISHING BOLTS, FOR SECURING COVER AND FINISHING RING, AS REQUIRED.
7. ALL ITEMS SHOWN FOR THE BASES SHALL BE FURNISHED AND INSTALLED. FINISHING RING SHALL BE FURNISHED AND INSTALLED TO RING THE COVER FIXTURE UP TO THE SPECIFIED ELEVATION.
8. CLEANOUTS SHALL BE AT LEAST 24" CLEAR OF THE NEAREST PCC JOINT LINE
PLAN
CONCRETE PAVEMENT JOINT
24" MIN CLEAR
INSTALL P-605 JOINT SEALANT
UNDERDRAIN CLEANOUT ELEVATION
(SHOWN FOR INSTALLATION IN CONCRETE)
N.T.S.
1-1/2" BLANK STL COVER SEE NOTE NO. 4.
12" DIAMETER, SIZE B, CLASS 1
TYPE L-868 BASE
FILL AREA BETWEEN UNDERDRAIN PIPE AND BASE WALL WITH NON-SHRINK GROUT
20" CAN HEIGHT
18"
6"
22"
PCC
EXISTING SOIL CEMENT
SEE NOTE 5
LOW SLUMP LOW STRENGTH CONCRETE
8" DIA CLEANOUT RISER
8" PERFORATED PVC PIPE
TEE CONNECTION FOR INLINE UNDERDRAINS. USE SCH. 40 PVC 90° ELBOW FOR CONNECTION AT END OF COLLECTOR.
TRANSVERSE UNDERDRAIN UNDER TAXIWAY
N.T.S.
NOTES:
1. THE CONTRACTOR SHALL USE #89 STONE FOR THE POROUS UNDERDRAIN BACKFILL
2. UNDERDRAIN INVERT ELEVATIONS SHALL MATCH EXISTING. EXISTING INVERTS ARE TYPICALLY 3'-10" BELOW TOP OF PCC PAVEMENT.
PCC PAVEMENT
EXISTING SOIL CEMENT
LOW SLUMP LOW STRENGTH CONCRETE
COURSE AGGREGATE UNDERDRAIN BACKFILL (#89 STONE)
6" DIA. PERFORATED UNDERDRAIN PIPE
18"
2" MIN.
6"
22"
DEPTH AS REQ'D TO TIE INTO EXISTING UNDERDRAINS AT A STRAIGHT-LINE GRADE (SEE NOTE 3)
UNDERDRAIN TIE-IN COUPLING
N.T.S.
EXISTING UNDER DRAIN TO REMAIN
6" SOIL CEMENT
6" CTB
16" PCC PAVEMENT
CONCRETE PAVEMENT TO REMAIN
PROPOSED CONCRETE PAVEMENT
DEMO EXISTING UNDERDRAIN, 12" FROM FACE OF PAVEMENT AND REPLACE WITH NEW UNDERDRAIN AS DIRECTED IN PLANS
22" PCC PAVEMENT
6" LOW SLUMP LOW STRENGTH CONCRETE (P-610)
UNDERDRAIN BACKFILL
PROPOSED UNDER DRAIN
6" CONCRETE COLLAR ALL AROUND
DETAILS ON THIS SHEET ARE INTENDED FOR USE IN PAVEMENT REPLACEMENT AND RETROFIT PROJECTS.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson
Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
NO. DATE BY REVISION
0 6/30/09 RPW FIRST ISSUE
1 8/2009 RPW REVISED
DOA CIVIL STANDARD DETAILS
Underdrain Details - Replacement Projects
WBS NUMBER: DRAWN BY: STAFF
FC NUMBER: DESIGNED BY: STAFF
CONSULTANT PROJECT NUMBER: CHECKED BY: STAFF
PROGRAM SHEET NUMBER: STD-01-301
APPROVED BY: STAFF
DATE:
SCALE:
SHEET NO:
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS
q:\cad\files\engineering\design standards\drawings\std-01-301 underdrain details - replacement projects.dwg


PLAN – PAVEMENT WITH UTILITY MANHOLE
NTS
SECTION A–A
NTS
DETAIL 1
NTS
DETAIL 2
NTS
4' DIAMETER MANHOLE FOR STORM AND SANITARY SEWER
NTS
NOTES FOR PAVEMENT WITH MANHOLE
DOA CIVIL STANDARD DETAILS
In-Pavement Manholes
STD-01-400
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS

LONGITUDINAL CONSTRUCTION JOINT
N.T.S.
TRANSVERSE CONSTRUCTION JOINT
N.T.S.
TRANSVERSE CONTRACTION JOINT
N.T.S.
THICKENED EDGE EXPANSION JOINT
N.T.S.
LONGITUDINAL OR TRANSVERSE JOINT AT EXISTING 16-INCH PAVEMENT
N.T.S.
DETAIL "A" LONGITUDINAL AND TRANSVERSE JOINT SEAL DETAIL
N.T.S.
EXPANSION JOINT SEAL DETAIL
DETAIL "B"
N.T.S.
EXISTING APRON SECTION
CPTC, NORTH AND SOUTH CARGO
N.T.S.
NOTES FOR DOWEL AND TIE BAR HOLE DRILLING AND INSTALLATION:
NOTES:
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson
Atlanta International Airport
DOA CIVIL STANDARD DETAILS
Pavement Joint Details - Replacement Projects-1
DOA CIVIL STANDARD DETAILS
STD-01-1700
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS


AIRCRAFT PAVEMENT
SHOULDER PAVEMENT
3/4" MIN. JOINT SEAL THICKNESS DOW 890 BASIS OF DESIGN
1" BACKER ROD
SAW CUT, 3/8" WIDE x 1" DEEP (TYP.)
ASPHALT/ PCC PAVEMENT JOINT DETAIL
N.T.S.
INITIAL SAW LINE
A
1'-0"
EXISTING JOINT
6" CORE SEE NOTE 2.
FINAL SAW LINE
PAVEMENT REMOVAL TYPICAL PLAN
N.T.S.
DEMOLITION NOTES:
1. ALL PAVEMENT REMOVAL EXCEPT FOR 1'-0" PERIMETER AREA SHALL BE COMPLETED PRIOR TO FINAL CUT.
2. NO SAW CUTS WILL BE PERMITTED TO EXTEND BEYOND THE FINAL SAWCUT LINE. PRIOR TO THE FINAL SAW CUT, THE CONTRACTOR SHALL CORE THE CORNERS OF THE PAVEMENT AREA TO BE DEMOLISHED. THE DIAMETER OF THE CORES SHALL BE 6 INCHES.
3. ADDITIONAL SAW CUTS WILL BE PERMITTED WITHIN THE FINAL SAW CUT PERIMETER AT THE CONTRACTOR'S DISCRETION.
4. WHEN SAW CUTTING CONCRETE, CONTRACTOR SHALL MAKE TWO SAW CUTS AS PER DETAIL THIS SHEET. THE INITIAL SAW CUT SHALL BE CUT THROUGH CONCRETE AND ALL STABILIZED BASE COURSES. THE SECOND CUT SHALL BE THROUGH CONCRETE ONLY. FOLLOWING FINAL SAW CUT, CONCRETE SHALL CAREFULLY BE REMOVED TO AVOID DAMAGING THE REMAINING EDGE.
5. CONTRACTOR SHALL REPLACE ALL EXISTING CEMENT STABILIZED BASE THAT IS DAMAGED DURING PAVEMENT REMOVAL OR AS DEEMED BY THE ENGINEER OR OUTLINED IN THE SPECIFICATIONS AT NO ADDITIONAL COST TO THE CITY.
PAVEMENT TO REMAIN
DO NOT DAMAGE EDGE
FINAL SAW CUT
EXISTING JOINT LINE CUT THROUGH CONCRETE ONLY
INITIAL SAW CUT FULL DEPTH
12"
15"
16" TO 20" PCC
DOWEL
6" C T B
6" SOIL CEMENT
SECTION A-A: TYPICAL SAWCUT ADJACENT TO EXISTING PAVEMENT TO REMAIN
N.T.S.
LEGEND
FINAL CONC. PAVEMENT REMOVAL ZONE
INITIAL CONC. PAVEMENT REMOVAL ZONE
TRANSVERSE JOINT
SMOOTH DOWELS
LONGITUDINAL JOINT
"DOG LEG" JOINT
DOWELS OR TIE BARS INSTALLED NORMAL TO JOINT.
REINF. CONC. SLAB
INSTALL DOWELS PARALLEL TO T/W IN ODD SHAPED FILLET SLABS. JOINTS ARE RADIAL TO CURVE.
DEFORMED DOWELS (SEE PAVEMENT JOINT PLAN.)
3'-0" (MIN.)
PAVEMENT EDGE
SKEWED DOWEL INSTALLATION
N.T.S.
TOP SPREADER .3065 MIN. GAGE (BETWEEN EVERY OTHER BAR, MIN.)
BOTTOM & TOP RUNNERS 0.3065 MIN. GAGE
LEGS 0.3065 MIN. GAGE
BASKETS SHALL BE SECURELY FASTENED TO THE SUBBASE PREVENTING DISPLACEMENT BY CONCRETE.
TYPICAL DOWEL BAR BASKET
N.T.S.
NOTES:
1. WIRE USED IN BASKETS SHALL CONFORM TO ASTM-A82 COLD DRAWN WIRE.
2. DOWEL BAR ATTACHMENT MAY BE FABRICATED BY ARC OR RESISTANCE TYPE WELDING.
3. WIRE FRAME MEMBERS SHALL BE RESISTANCE WELDED EXCEPT FOR SPREADER WIRES WHICH MAY BE ARC WELDED.
LONGITUDINAL JOINT LINE
TRANSVERSE JOINT LINE
3" CLEAR (TYP.)
6" TYP.
30" DOWELS @ 12" SPACING
DOWEL SPACING DETAIL AT JOINT CORNERS
N.T.S.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION PLANNING & DEVELOPMENT
1 RFM REVISED
0 RFM FIRST ISSUE
NO. DATE BY REVISION
DOA CIVIL STANDARD DETAILS
Pavement Joint Details - Replacement Projects-2
WBS NUMBER:
FC NUMBER:
CONSULTANT PROJECT NUMBER:
STANDARD SHEET NUMBER
STD-01-701
DRAWN BY: STAFF
DESIGNED BY: STAFF
CHECKED BY: STAFF
APPROVED BY: STAFF
DATE:
SCALE:
SHEET NO:
DOA CIVIL STANDARD DETAILS
NOT RELEASED FOR CONSTRUCTION
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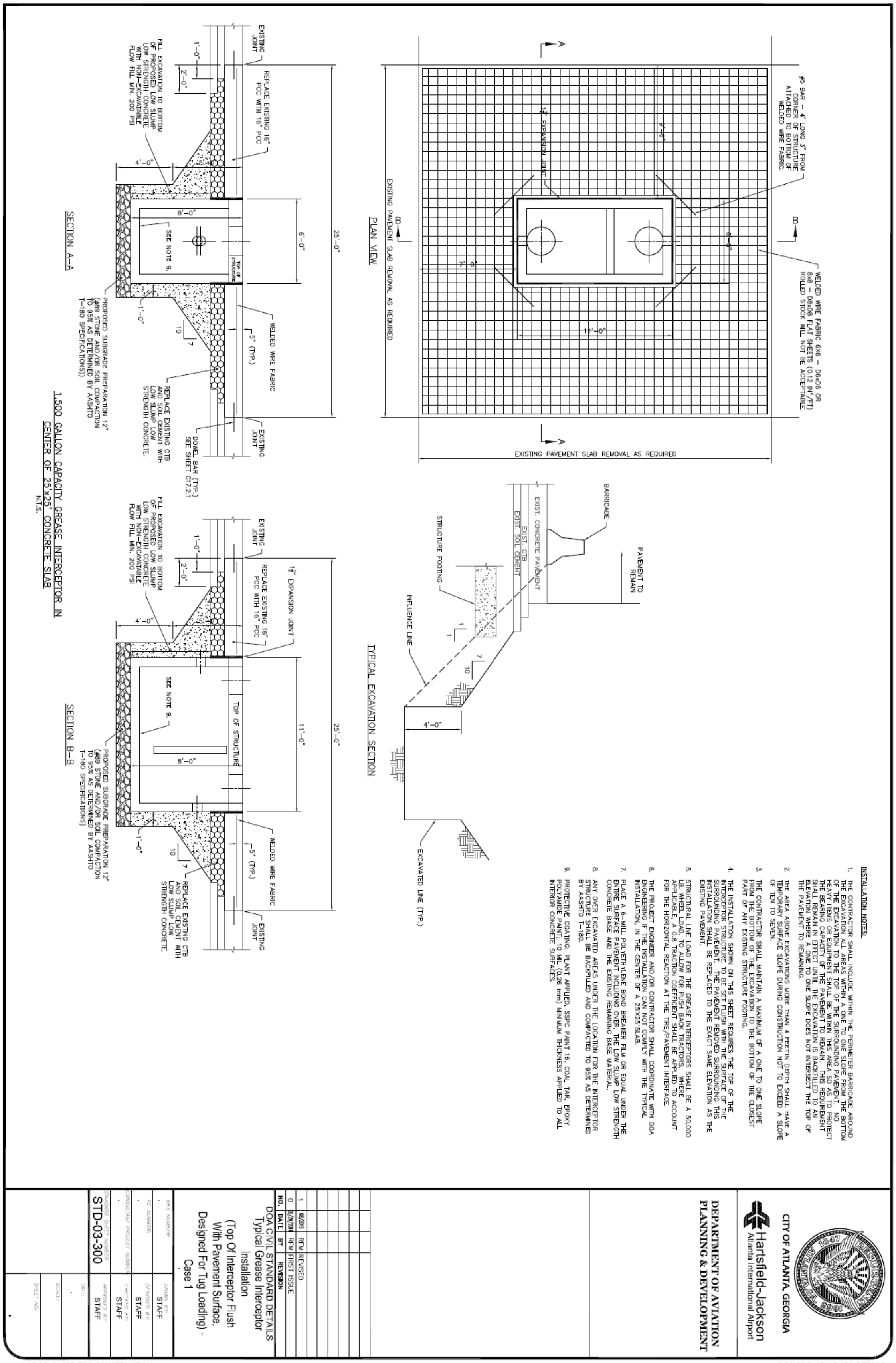
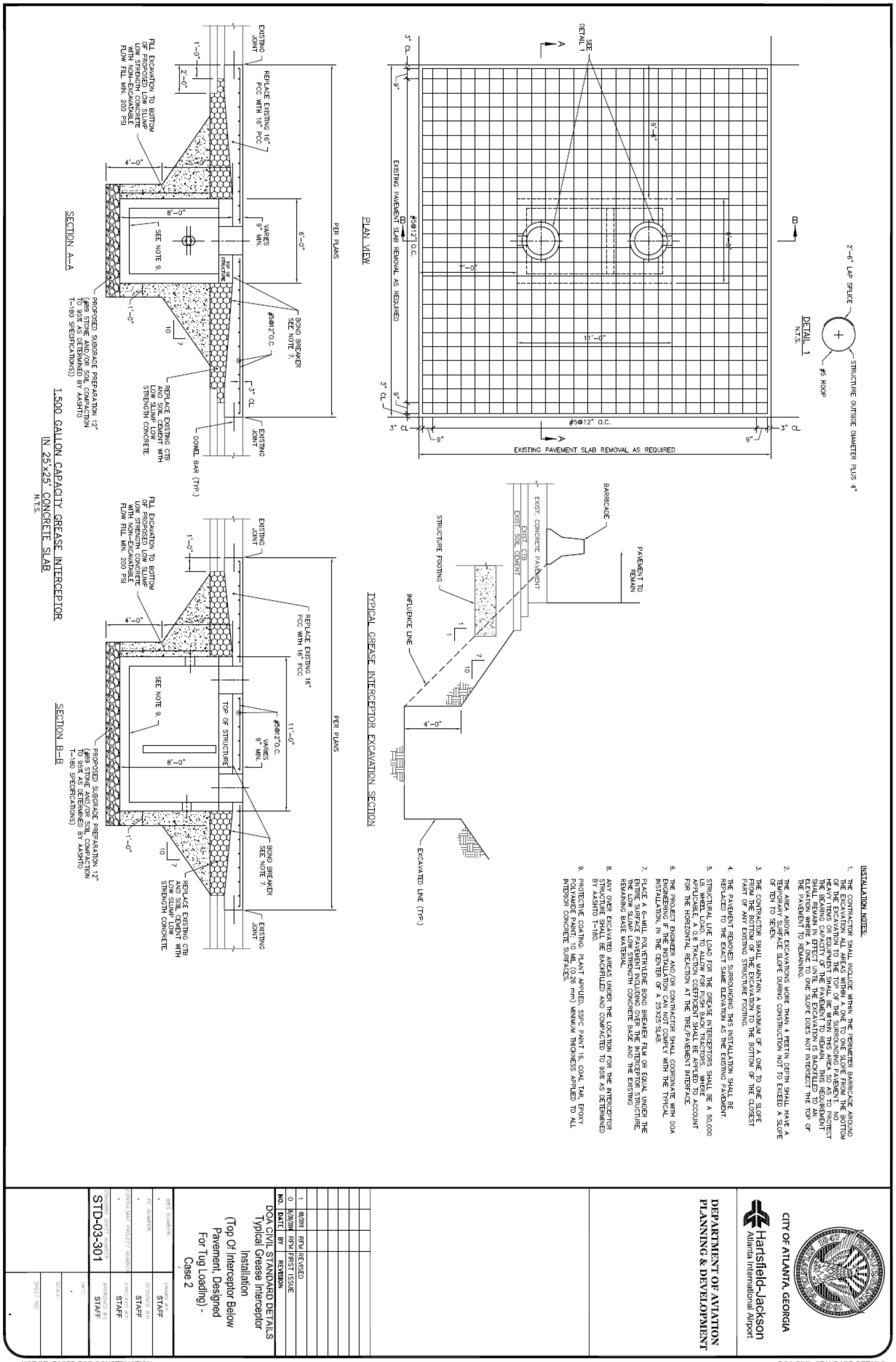
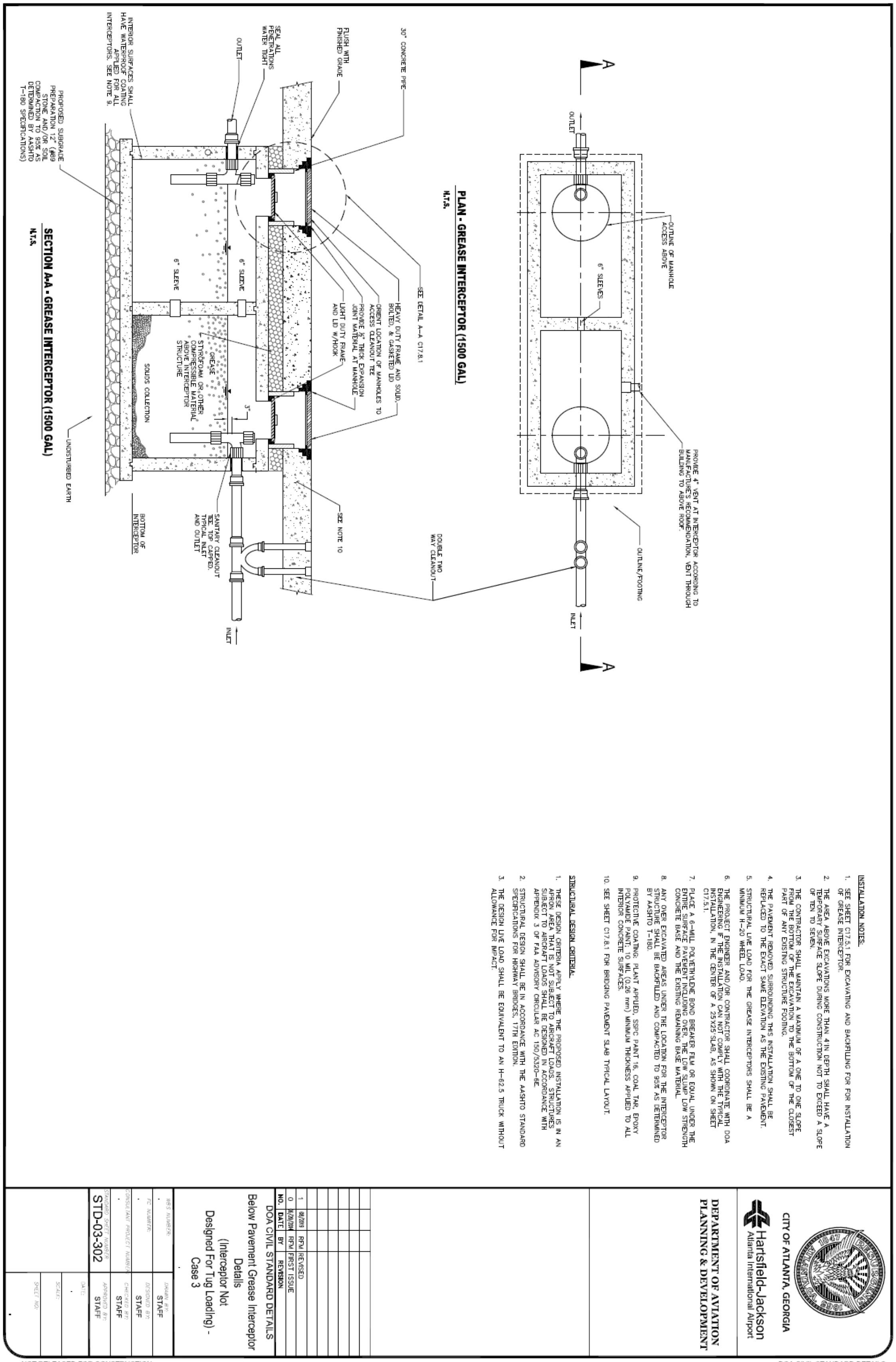
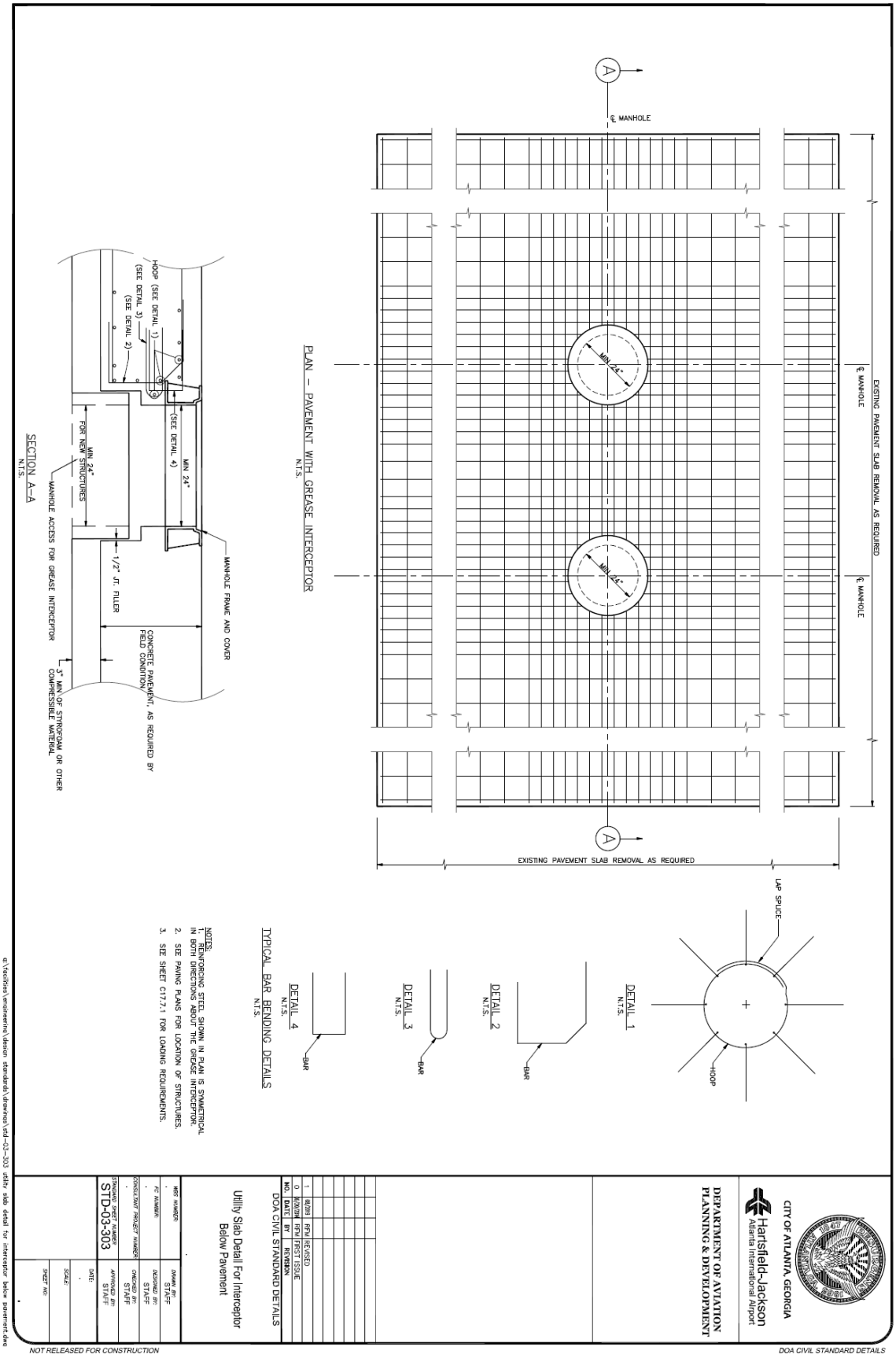

INSTALLATION NOTES:
1. THE CONTRACTOR SHALL INCLUDE WITHIN THE PERIMETER BARRICADE AROUND THE EXCAVATION ALL AREAS WITHIN A ONE TO ONE SLOPE FROM THE BOTTOM OF THE EXCAVATION TO THE TOP OF THE SURROUNDING PAVEMENT. NO HEAVY ITEMS OR EQUIPMENT SHALL BE WITHIN THIS AREA SO AS TO PROTECT THE BEARING CAPACITY OF THE PAVEMENT TO REMAIN. THIS REQUIREMENT SHALL REMAIN IN EFFECT UNTIL THE EXCAVATION IS BACKFILLED TO AN ELEVATION WHERE A ONE TO ONE SLOPE DOES NOT INTERSECT THE TOP OF THE PAVEMENT TO REMAINING.
2. THE AREA ABOVE EXCAVATIONS MORE THAN 4 FEETIN DEPTH SHALL HAVE A TEMPORARY SURFACE SLOPE DURING CONSTRUCTION NOT TO EXCEED A SLOPE OF TEN TO SEVEN.
3. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM OF A ONE TO ONE SLOPE FROM THE BOTTOM OF THE EXCAVATION TO THE BOTTOM OF THE CLOSEST PART OF ANY EXISTING STRUCTURE FOOTING.
4. THE INSTALLATION SHOWN ON THIS SHEET REQUIRES THE TOP OF THE INTERCEPTOR STRUCTURE TO BE SET FLUSH WITH THE SURFACE OF THE SURROUNDING PAVEMENT. THE PAVEMENT REMOVED SURROUNDING THIS INSTALLATION SHALL BE REPLACED TO THE EXACT SAME ELEVATION AS THE EXISTING PAVEMENT.
5. STRUCTURAL LIVE LOAD FOR THE GREASE INTERCEPTORS SHALL BE A 50,000 LB. WHEEL LOAD, TO ALLOW FOR PUSH BACK TRACTORS. WHERE APPLICABLE, A 0.8 TRACTION COEFFICIENT SHALL BE APPLIED TO ACCOUNT FOR THE HORIZONTAL REACTION AT THE TIRE/PAVEMENT INTERFACE.
6. THE PROJECT ENGINEER AND/OR CONTRACTOR SHALL COORDINATE WITH DOA ENGINEERING IF THE INSTALLATION CAN NOT COMPLY WITH THE TYPICAL INSTALLATION, IN THE CENTER OF A 25'X25'SLAB.
7. PLACE A 6-MILL POLYETHYLENE BOND BREAKER FILM OR EQUAL UNDER THE ENTIRE SURFACE PAVEMENT INCLUDING OVER, THE LOW SLUMP LOW STRENGTH CONCRETE BASE AND THE EXISTING REMAINING BASE MATERIAL.
8. ANY OVER EXCAVATED AREAS UNDER THE LOCATION FOR THE INTERCEPTOR STRUCTURE SHALL BE BACKFILLED AND COMPACTED TO 95% AS DETERMINED BY AASHTO T-180.
9. PROTECTIVE COATING: PLANT APPLIED, SSPC PAINT 16, COAL TAR, EPOXY POLYAMIDE PAINT; 10 MIL (0.26 mm) MINIMUM THICKNESS APPLIED TO ALL INTERIOR CONCRETE SURFACES.
#5 BAR – 4' LONG 3" FROM CORNER OF STRUCTURE ATTACHED TO BOTTOM OF WELDED WIRE FABRIC.
WELDED WIRE FABRIC 6X6 – D6xD6 OR 8x8 – D8xD8 FLAT SHEETS (0.12 IN²/FT) ROLLED STOCK WILL NOT BE ACCEPTABLE.
1½" EXPANSION JOINT
EXISTING PAVEMENT SLAB REMOVAL AS REQUIRED
PLAN VIEW
PAVEMENT TO REMAIN
BARRICADE
EXIST. CONCRETE PAVEMENT
EXIST. CTB
EXIST. SOIL CEMENT
STRUCTURE FOOTING
INFLUENCE LINE
EXCAVATED LINE (TYP.)
TYPICAL EXCAVATION SECTION
EXISTING JOINT
REPLACE EXISTING 16" PCC WITH 16" PCC
WELDED WIRE FABRIC
5" (TYP.)
TOP OF STRUCTURE
DOWEL BAR (TYP.) SEE SHEET C17.2.1
SEE NOTE 9.
FILL EXCAVATION TO BOTTOM OF PROPOSED LOW SLUMP LOW STRENGTH CONCRETE WITH NON-EXCAVATABLE FLOW FILL MIN. 200 PSI
REPLACE EXISTING CTB AND SOIL CEMENT WITH LOW SLUMP LOW STRENGTH CONCRETE.
PROPOSED SUBGRADE PREPARATION 12" (#89 STONE AND/OR SOIL COMPACTION TO 95% AS DETERMINED BY AASHTO T-180 SPECIFICATIONS))
SECTION A–A
SECTION B–B
1,500 GALLON CAPACITY GREASE INTERCEPTOR IN CENTER OF 25'x25' CONCRETE SLAB
N.T.S.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION PLANNING & DEVELOPMENT
1 RFM REVISED
0 RFM FIRST ISSUE
NO. DATE BY REVISION
DOA CIVIL STANDARD DETAILS
Typical Grease Interceptor Installation (Top Of Interceptor Flush With Pavement Surface, Designed For Tug Loading) - Case 1
DRAWN BY: STAFF
DESIGNED BY: STAFF
CHECKED BY: STAFF
APPROVED BY: STAFF
STANDARD SHEET NUMBER STD-03-300
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS


DETAIL 1
N.T.S.
2'-6" LAP SPLICE
STRUCTURE OUTSIDE DIAMETER PLUS 4"
#5 HOOP
SEE DETAIL 1
EXISTING PAVEMENT SLAB REMOVAL AS REQUIRED
#5@12" O.C.
PLAN VIEW
PAVEMENT TO REMAIN
BARRICADE
EXIST. CONCRETE PAVEMENT
EXIST. CTB
EXIST. SOIL CEMENT
STRUCTURE FOOTING
INFLUENCE LINE
EXCAVATED LINE (TYP.)
TYPICAL GREASE INTERCEPTOR EXCAVATION SECTION
INSTALLATION NOTES:
1. THE CONTRACTOR SHALL INCLUDE WITHIN THE PERIMETER BARRICADE AROUND THE EXCAVATION ALL AREAS WITHIN A ONE TO ONE SLOPE FROM THE BOTTOM OF THE EXCAVATION TO THE TOP OF THE SURROUNDING PAVEMENT. NO HEAVY ITEMS OR EQUIPMENT SHALL BE WITHIN THIS AREA SO AS TO PROTECT THE BEARING CAPACITY OF THE PAVEMENT TO REMAIN. THIS REQUIREMENT SHALL REMAIN IN EFFECT UNTIL THE EXCAVATION IS BACKFILLED TO AN ELEVATION WHERE A ONE TO ONE SLOPE DOES NOT INTERSECT THE TOP OF THE PAVEMENT TO REMAINING.
2. THE AREA ABOVE EXCAVATIONS MORE THAN 4 FEETIN DEPTH SHALL HAVE A TEMPORARY SURFACE SLOPE DURING CONSTRUCTION NOT TO EXCEED A SLOPE OF TEN TO SEVEN.
3. THE CONTRACTOR SHALL MAINTAIN A MAXIMUM OF A ONE TO ONE SLOPE FROM THE BOTTOM OF THE EXCAVATION TO THE BOTTOM OF THE CLOSEST PART OF ANY EXISTING STRUCTURE FOOTING.
4. THE PAVEMENT REMOVED SURROUNDING THIS INSTALLATION SHALL BE REPLACED TO THE EXACT SAME ELEVATION AS THE EXISTING PAVEMENT.
5. STRUCTURAL LIVE LOAD FOR THE GREASE INTERCEPTORS SHALL BE A 50,000 LB. WHEEL LOAD, TO ALLOW FOR PUSH BACK TRACTORS. WHERE APPLICABLE, A 0.8 TRACTION COEFFICIENT SHALL BE APPLIED TO ACCOUNT FOR THE HORIZONTAL REACTION AT THE TIRE/PAVEMENT INTERFACE.
6. THE PROJECT ENGINEER AND/OR CONTRACTOR SHALL COORDINATE WITH DOA ENGINEERING IF THE INSTALLATION CAN NOT COMPLY WITH THE TYPICAL INSTALLATION, IN THE CENTER OF A 25'X25' SLAB.
7. PLACE A 6-MILL POLYETHYLENE BOND BREAKER FILM OR EQUAL UNDER THE ENTIRE SURFACE PAVEMENT INCLUDING OVER THE INTERCEPTOR STRUCTURE, THE LOW SLUMP LOW STRENGTH CONCRETE BASE AND THE EXISTING REMAINING BASE MATERIAL.
8. ANY OVER EXCAVATED AREAS UNDER THE LOCATION FOR THE INTERCEPTOR STRUCTURE SHALL BE BACKFILLED AND COMPACTED TO 95% AS DETERMINED BY AASHTO T-180.
9. PROTECTIVE COATING: PLANT APPLIED, SSPC PAINT 16, COAL TAR, EPOXY POLYAMIDE PAINT; 10 MIL (0.26 mm) MINIMUM THICKNESS APPLIED TO ALL INTERIOR CONCRETE SURFACES.
PER PLANS
EXISTING JOINT
REPLACE EXISTING 16" PCC WITH 16" PCC
BOND BREAKER SEE NOTE 7.
VARIES 9" MIN.
TOP OF STRUCTURE
DOWEL BAR (TYP.)
SEE NOTE 9.
FILL EXCAVATION TO BOTTOM OF PROPOSED LOW SLUMP LOW STRENGTH CONCRETE WITH NON-EXCAVATABLE FLOW FILL MIN. 200 PSI
REPLACE EXISTING CTB AND SOIL CEMENT WITH LOW SLUMP LOW STRENGTH CONCRETE.
PROPOSED SUBGRADE PREPARATION 12" (#89 STONE AND/OR SOIL COMPACTION TO 95% AS DETERMINED BY AASHTO T-180 SPECIFICATIONS)
SECTION A-A
SECTION B-B
1,500 GALLON CAPACITY GREASE INTERCEPTOR IN 25'x25' CONCRETE SLAB
N.T.S.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION PLANNING & DEVELOPMENT
1 08/2019 RFM REVISED
0 06/26/2014 RFM FIRST ISSUE
NO. DATE BY REVISION
DOA CIVIL STANDARD DETAILS
Typical Grease Interceptor Installation (Top Of Interceptor Below Pavement, Designed For Tug Loading) - Case 2
DRAWN BY: STAFF
DESIGNED BY: STAFF
CHECKED BY: STAFF
APPROVED BY: STAFF
STD-03-301
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS


PLAN - GREASE INTERCEPTOR (1500 GAL)
N.T.S.
SECTION A-A - GREASE INTERCEPTOR (1500 GAL)
N.T.S.
INSTALLATION NOTES:
STRUCTURAL DESIGN CRITERIA:
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION PLANNING & DEVELOPMENT
DOA CIVIL STANDARD DETAILS
Below Pavement Grease Interceptor Details (Interceptor Not Designed For Tug Loading) - Case 3
STD-03-302
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS


PLAN – PAVEMENT WITH GREASE INTERCEPTOR
N.T.S.
EXISTING PAVEMENT SLAB REMOVAL AS REQUIRED
℄ MANHOLE
MIN 24"
SECTION A–A
N.T.S.
HOOP (SEE DETAIL 1)
(SEE DETAIL 3)
(SEE DETAIL 2)
(SEE DETAIL 4)
MIN 24"
FOR NEW STRUCTURES
MANHOLE ACCESS FOR GREASE INTERCEPTOR
MANHOLE FRAME AND COVER
1/2" JT. FILLER
CONCRETE PAVEMENT, AS REQUIRED BY FIELD CONDITION
3" MIN OF STYROFOAM OR OTHER COMPRESSIBLE MATERIAL
TYPICAL BAR BENDING DETAILS
N.T.S.
DETAIL 1
N.T.S.
LAP SPLICE
HOOP
DETAIL 2
N.T.S.
BAR
DETAIL 3
N.T.S.
BAR
DETAIL 4
N.T.S.
BAR
NOTES:
1. REINFORCING STEEL SHOWN IN PLAN IS SYMMETRICAL IN BOTH DIRECTIONS ABOUT THE GREASE INTERCEPTOR.
2. SEE PAVING PLANS FOR LOCATION OF STRUCTURES.
3. SEE SHEET C17.7.1 FOR LOADING REQUIREMENTS.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson
Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
NO. DATE BY REVISION
1 00/00/0 RFVI REVISED
0 00/00/00 RFVI FIRST ISSUE
DOA CIVIL STANDARD DETAILS
Utility Slab Detail For Interceptor Below Pavement
MBE NUMBER:
PC NUMBER:
DRAWN BY: STAFF
DESIGNED BY: STAFF
CONSULTANT PROJECT NUMBER:
CHECKED BY: STAFF
STANDARD SHEET NUMBER: STD-03-303
APPROVED BY: STAFF
DATE:
SCALE:
SHEET NO:
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS
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NOTES:
1. SEE DOWEL SPACING DETAIL AT JOINT CORNERS DETAIL.
2. ONLY SAWCUTS MADE ALONG EXISTING JOINT LINES MAY BE OVERCUT. OTHER SAWCUTS WILL TERMINATE IN A 6" FULL DEPTH CORE TO PREVENT DAMAGE TO THE PAVEMENT TO BE RETAINED. SEE DETAIL.
3. DOWELS ALONG EXISTING JOINTS SHALL BE 1–1/2" X 30" SMOOTH DOWELS AT 12" NOMINAL SPACING. DOWELS THAT ARE ON SAWED FACES ONLY WILL BE #11 X 30" DEFORMED DOWELS AT 12" NOMINAL CENTERS. ALL DOWELS SHALL BE INSTALLED BY DRILLING AND EPOXYING.
4. CONTRACTOR SHALL LAY OUT REMOVAL AREA AS SPECIFIED IN THESE DOCUMENTS. PRIOR TO INITIATING REMOVAL, THE CONTRACTOR SHALL RECEIVE LAYOUT APPROVAL FROM THE ENGINEER.
5. SAWCUT AND REMOVE PAVEMENT CAREFULLY SO AS NOT TO DAMAGE/SPALL REMAINING CONCRETE EDGE. SAWCUTS MAY BE LEFT IN PLACE AHEAD OF REMOVAL OPERATION.
6. EXCAVATE SOIL TO THE REQUIRED DEPTH. REMOVE ALL DISTURBED MATERIAL UNTIL A FIRM FOUNDATION IS ACHIEVED.
7. INSTALL APPROPRIATE BEDDING AND UTILITY THEN BACKFILL TO REQUIRED DEPTH.
8. INSTALL DOWELS AND REBAR.
9. SAND BLAST THE SURFACE OF THE CONCRETE TO EXPOSE ROUGH AGGREGATE. COAT SAWCUT SURFACES WITH BONDING AGENT. EXISTING JOINT FACES DO NOT REQUIRE BONDING AGENT.
10. PLACE CONCRETE LEVEL WITH THE ADJACENT SURFACE. COMPLETELY CONSOLIDATE CONCRETE, FILL ALL VOIDS BY VIBRATING.

CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT

NO.	DATE	BY	REVISION

DOA CIVIL STANDARD DETAILS

Additional Pavement Removal

MSP NUMBER:	DRAWN BY: STAFF
FC NUMBER:	DESIGNED BY: STAFF
CONSULTANT PROJECT NUMBER:	CHECKED BY: STAFF
STANDARD SHEET NUMBER: STD-03-304	APPROVED BY: STAFF
	DATE:
	SCALE:
	SHEET NO:

NOT RELEASED FOR CONSTRUCTION

DOA CIVIL STANDARD DETAILS

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BUILDING COLUMN
BUILDING FOOTING
STAINLESS STEEL
PAVEMENT OR FLOOR SLAB
FOOTING INFLUENCE LINE SEE NOTE ABOVE
1
1
TYPICAL SECTION PIPE INSTALLATION AT FOOTINGS
N.T.S.
NOTE:
ANY EXCAVATION THAT PENETRATES A ONE TO ONE SLOPE FROM THE BOTTOM OF A FOOTING SHALL REQUIRE SHEETING AND BRACING TO PROTECT THE BEARING CAPACITY OF THE FOOTING.
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson
Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
NO. DATE BY REVISION
0 08/2011 RFM FIRST ISSUE
1 RFM REVISED
DOA CIVIL STANDARD DETAILS
Misc Pipe Details
WBS NUMBER:
FC NUMBER:
CONSULTANT PROJECT NUMBER:
STANDARD SHEET NUMBER:
STD-03-404
DRAWN BY: STAFF
DESIGNED BY: STAFF
CHECKED BY: STAFF
APPROVED BY: STAFF
DATE:
SCALE:
SHEET NO:
NOT RELEASED FOR CONSTRUCTION
DOA CIVIL STANDARD DETAILS
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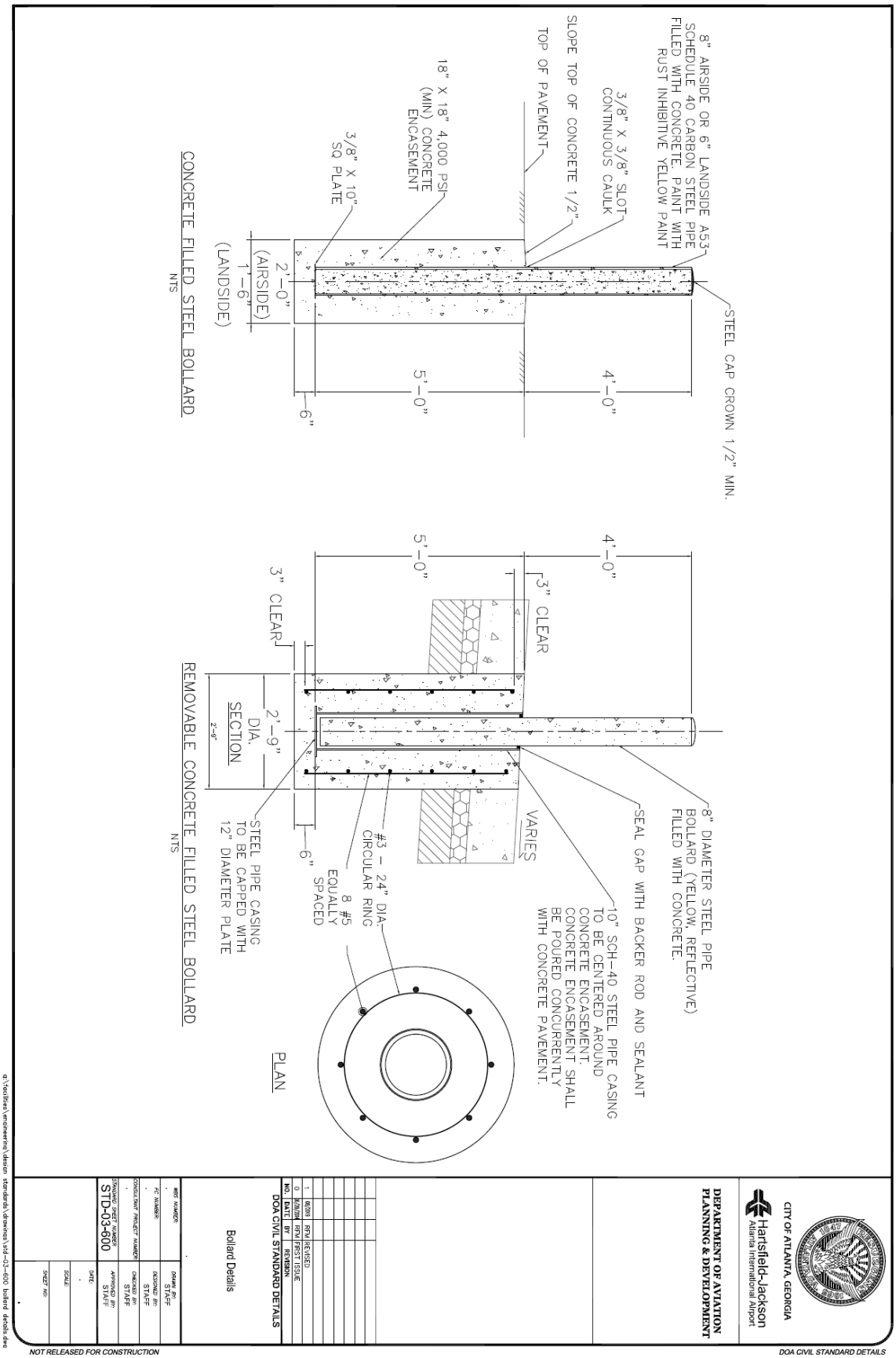
8" AIRSIDE OR 6" LANDSIDE A53 SCHEDULE 40 CARBON STEEL PIPE FILLED WITH CONCRETE. PAINT WITH RUST INHIBITIVE YELLOW PAINT
3/8" X 3/8" SLOT CONTINUOUS CAULK
SLOPE TOP OF CONCRETE 1/2"
TOP OF PAVEMENT
18" X 18" 4,000 PSI (MIN) CONCRETE ENCASEMENT
3/8" X 10" SQ PLATE
STEEL CAP CROWN 1/2" MIN.
2'-0" (AIRSIDE)
1'-6" (LANDSIDE)
6"
5'-0"
4'-0"
CONCRETE FILLED STEEL BOLLARD
NTS
8" DIAMETER STEEL PIPE BOLLARD (YELLOW, REFLECTIVE) FILLED WITH CONCRETE.
SEAL GAP WITH BACKER ROD AND SEALANT
10" SCH-40 STEEL PIPE CASING TO BE CENTERED AROUND CONCRETE ENCASEMENT. CONCRETE ENCASEMENT SHALL BE POURED CONCURRENTLY WITH CONCRETE PAVEMENT.
VARIES
#3 - 24" DIA. CIRCULAR RING
8 #5 EQUALLY SPACED
STEEL PIPE CASING TO BE CAPPED WITH 12" DIAMETER PLATE
2'-9" DIA. SECTION
3" CLEAR
PLAN
REMOVABLE CONCRETE FILLED STEEL BOLLARD
NTS
CITY OF ATLANTA, GEORGIA
Hartsfield-Jackson Atlanta International Airport
DEPARTMENT OF AVIATION
PLANNING & DEVELOPMENT
DOA CIVIL STANDARD DETAILS
Bollard Details
STD-03-600
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DOA CIVIL STANDARD DETAILS

SECTION 02085 INTERCEPTORS

1.0 PART 1 GENERAL

A. SUMMARY

1. This Section consists of grease interceptors located outside the building. The City of Atlanta Grease Management Ordinance Article V, Section 154-297 is hereby incorporated by reference.

B. ABBREVIATIONS

1. FRP: Fiberglass-reinforced plastic.
2. HDPE: High-density polyethylene plastic.
3. PE: Polyethylene plastic.
4. PP: Polypropylene plastic.

C. SUBMITTALS

1. Shop Drawings: For each type and size of cast-in-place-concrete interceptor indicated.
    a. Include materials of construction, dimensions, elevations, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.
    b. Include reports and calculations for design mixes of concrete.
2. Shop Drawings: For each type and size of precast concrete interceptor indicated.
    a. Include materials of construction, dimensions, elevations, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.
3. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
    a. Interceptors.
    b. Piping connections. Include size, location, and elevation of each.
    c. Interface with underground structures and utility services.

D. PROJECT CONDITIONS

1. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
    a. Notify ENGINEER no fewer than five (5) days in advance of proposed interruption of service.
    b. Do not proceed with interruption of sewer services without ENGINEER'S written permission.

c. PART 2 PRODUCTS

i. GREASE INTERCEPTORS

(1) Grease Interceptors: Cast-in-place-concrete or pre-cast concrete structure complying with requirements of City of Atlanta. Size should be 1500 gallon or as specified on the Drawings.

(2) Grease Interceptors: Construct bottom, sidewalls, and top of reinforced, cast-in- place concrete. Wall thickness and thickness of bottom slab to be designed according to Drawings. Include manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

(a) Concrete: Comply with ACI 318/318R, ACI 350R.

(i) Design Mix: 4000 psig (27.6 MPa) minimum, with 0.45 maximum water-to-cementitious materials ratio.

(ii) Portland Cement: ASTM C 150, Type II.

(iii) Fine Aggregate: ASTM C 33, sand.

(iv) Coarse Aggregate: ASTM C 33, crushed gravel.

(v) Water: Potable.

(vi) Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.

(vii) Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

(3) Grease Interceptors: Pre-cast concrete complying with ASTM C 913. Include rubber-gasketed joints, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

(a) Protective Coating: Plant-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all interior concrete surfaces.

(b) Structural Design Loads: Shall be as shown on drawings.

(c) Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into interceptor walls, for each pipe connection.

(d) Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches.

(e) Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.

(f) Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser with 4-inch- (100-mm-) minimum width flange and 26- inch- (660-mm-) diameter cover.

(i) Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise

indicated.

(ii) Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.

(iii) Include indented top design with lettering cast into cover, using wording equivalent to SANITARY SEWER.

(iv) Protective Coating: Foundry-applied, SSPC-Paint 16, coal-tar, epoxy-polyamide paint; 10-mil (0.26-mm) minimum thickness applied to all ferrous surfaces.

ii. MISCELLANEOUS MATERIALS

(1) Concrete Paint: SSPC-Paint 16, coal-tar, epoxy polyamide.

(2) Metal Paint: SSPC-Paint 16, coal-tar, epoxy polyamide.

(3) PE Film: ASTM D 4397, 0.10-inch (0.25-mm) thickness sheet.

d. PART 3 EXECUTION

E. EARTHWORK

1. Excavating, trenching, and backfilling are specified in D-701-Pipe For Storm Drains and D-751 Manholes, Catch Basins, and Inlets.

F. INSTALLATION

1. Install interceptor inlets and outlets at elevations indicated.

2. For cast in place concrete interceptors, refer to Section 500 and 511 of GDOT Standard Specifications for formwork, reinforcement, and structural concrete. Concrete strength shall be 5000 psi at 28 days

3. Install pre-cast concrete interceptors according to ASTM C 891. Set level and plumb.

4. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

5. Set tops of manhole frames and covers flush with finished surface in pavements.

6. Set tops of grating frames and grates flush with finished surface.

7. Clean and prepare concrete surfaces to be field painted. Remove loose efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

a. Cast-in-Place-Concrete Interceptors: All exterior, except bottom and all interiors.

b. Precast Concrete Interceptors: All interiors.

8. Install sheet PE film on earth where cast-in-place-concrete interceptors are to be built.

9. Clean and prepare metal surfaces to be field painted according to SSPC- PA 1. Paint the following metal surfaces according to SSPC-PA 1 and SSPC-Paint 16:

a. Metal Interceptors: All surfaces except baskets, screens, and strainers.

b. Plastic Interceptors: All metal surfaces except baskets, screens, and strainers.

c. Metal Manhole Frames and Covers: All surfaces.

d. Do not paint metal surfaces with factory-applied, corrosion-resistant coating.

10. Set interceptors level and plumb.

11. Set tops of metal interceptor covers flush with finished surface in pavements. Prepare and paint metal components, to be field painted, according to SSPC- Paint 16.

12. Repair and restore protective coatings to original condition.

G. CONNECTIONS

1. Drawings indicate general arrangement of piping, fittings, and specialties.

2. Make piping connections between interceptors and piping systems.

END OF SECTION

SECTION D-701 PIPE FOR STORM DRAINS

1.0 DESCRIPTION

A. This item shall consist of pipe of the types, classes, sizes and dimensions required on the plans, furnished and installed at the places designated on the plans and profiles, or by the Engineer, in accordance with these specifications and with the lines and grades given.

1. The item shall include the furnishing and installation of pipe in place, all excavation and backfill, furnishing and installing all trench bracing, all fittings required to complete the pipe drain as shown on the plans and the material for the making of all joints, including all connections to existing drainage pipe and structures

B. The Contractor shall submit detailed shop drawings for the pipe laying plan to the Engineer for approval. Include pipe strength class, joint lengths, and trench types.

C. This item shall also include all work associated with the protection of all trenches and excavations required to perform the work under all sections of the specifications, including procedures, inspections, reports, installations, modifications and all else required to complete the work.

2.0 MATERIALS

A. General

Materials shall meet the requirements shown on the plans and as specified below.

1. All reinforced pipe shall be strength Class IV unless noted otherwise on the plans. Pipe strength classes are referenced to ASTM C-76. Gaskets for joints shall be as specified in Article 02(e) of this section.

2. Reinforced concrete pipe shall be furnished in six-foot minimum laying lengths, except that two-foot spacer lengths shall be used as required to orient tee sections in the correct locations where these are specified on the plans. Two- foot sections shall also be used in making connections to drainage structures.

3. In addition to strength testing, all pipe and pipe joints on reinforced concrete pipe 48" diameter and smaller shall be certified as having been tested in accordance with ASTM Designation C-76 and C-443, respectively, for absorption and joint leakage. At least 1% of the pipe lengths and joints of each diameter from a given pipe run by a given manufacturer and not less than two pipe lengths or two joints of each diameter and run shall be so tested and certified. No runs of pipe failing to meet the absorption and leakage test requirements will be accepted.

4. Lift holes will be permitted on all concrete pipe. Lift holes shall be sealed with 5 Star Non-Shrink Grout conforming to ASTM C-827 for shrinkage; have reached its initial set time within 45 minutes of mixing and initial set conforming to ASTM C-191; and with minimum compressive strength of 2,000 psi in one day and 7,000 psi at 28 days conforming to ASTM C-109.

B. Pipe. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

- Reinforced Concrete Pipe ASTM C 76
- Standard Specification for Corrugated Steel Pipe, ASTM A 760 Metallic Coated for Sewers and Drains

- Standard Specification for Post-Applied Coatings, ASTM A 849 Paving's, and Linings for Corrugated Steel Sewer and
- Drainage Pipe

C. Concrete. All concrete shall conform to Class A as defined in Section 500 of the Georgia DOT Standard Specifications.

D. Mortar. Mortar for connections to other drainage structures shall be composed of one part, by volume, of Portland cement and 2 parts of mortar sand. The Portland cement shall conform to the requirements of AASHTO M-85, Type 1. The sand shall conform to the requirements of AASHTO M-45. Hydrated lime may be added to the mixture of sand and cement in an amount equal to 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C-6.

E. Rubber Gasket Joints. Rubber-type gaskets for concrete non-pressure pipe shall conform to the requirements of ASTM C-443.

1. Gaskets shall be "O" ring or profile type, Neoprene, fuel resistant.

2. All gaskets proposed as fuel resistant equals shall be tested for swelling in the presence of petroleum products in accordance with Federal Standard 601, Method 6001 and 6211. When the latter method is used with No. 3 oil for 70 hours at 212^0F, the swelling shall not exceed 100 percent by volume.

F. Pipe Fittings. Pipe fittings for reinforced concrete pipe shall be fabricated from standard lengths of reinforced concrete pipe of the specified class. All fabricated connections of the reinforcing steel cages shall be connected by welding. Pipe fittings shall be as follows:

1. Tees shall be furnished with groove-end on the branch of the tee.

2. Reducing Section shall be furnished with the groove-end on the smaller diameter end.

G. Bedding material for unstable trench excavation shall meet the requirements for No. 89 Coarse Aggregate Underdrain Backfill as specified in Section 800.2.01 of Georgia DOT Specifications for Construction of Transportation Systems.

3.0 CONSTRUCTION METHODS

A. Equipment. All equipment necessary and required for the proper construction of storm sewers and culverts shall be on the project, in first-class working condition and approved by the Engineer before construction is permitted to start.

The Contractor shall provide appropriate hoisting equipment to handle the pipe while unloading and placing it in its final position without damaging the pipe.

The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the pipe bed and the backfill, as specified.

B. Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under the pipe and of the backfill around the pipe but shall not be less than the external diameter of the pipe plus 6" on each side. The trench walls shall be approximately vertical below the top of the pipe, unless otherwise approved by the Engineer. The maximum allowable width of the trench shall not exceed 18" on each side of the pipe when placed, unless otherwise approved by the Engineer.

Where rock, hardpan, or other unyielding material is encountered at the bottom of pipe trench, such material shall be removed below the foundation grade for a depth of at least 12" or 1/2" for

each foot of fill over the top of the pipe, whichever is greater, but not more than 3/4 of the nominal diameter of the pipe. The material shall be removed across the full width of the trench and replaced with suitable granular material obtained from excavation within the project, compacted and shaped to fit the lower 1/4 of the pipe diameter.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil or from buried trash, rubble or garbage, the unstable soil or unsuitable material shall be removed and replaced with suitable granular material obtained from excavation for the full trench width. The limits of excavation of unstable material shall be as directed by the Engineer, but in no case will the required depth of excavation of unstable material below the bottom of the pipe exceed 1/2 the inside diameter of the pipe being installed, or 24" whichever is the lesser. All trash encountered at and below the pipe invert shall be removed and replaced. The Contractor shall dispose of trash, rubble and garbage removed from the trench outside Airport boundaries.

Excavated material that is neither required nor acceptable for backfill shall be disposed of by the Contractor as directed by the Engineer. Common excavation shall not be carried below the required depth; but when it is, the trench shall be backfilled at the Contractor's expense with material approved by the Engineer and compacted to a density of not less than 90% of the maximum dry density for the material as determined by AASHTO T-180. The excavation for pipes that are placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans. The bed for the pipe shall be so shaped that at least the lower quarter of the pipe circumference shall be in continuous contact with the bottom of the trench.

C. Trench and Excavation Protection. The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The Contractor shall submit an excavation plan, certifying that the excavation methods conform to all appropriate governing laws. The plan shall be prepared by a Professional Engineer registered in the State of Georgia.

The Contractor shall employ the services of a Professional Engineer registered in the State of Georgia to inspect the various trenches and excavations on the project on at least a weekly basis and certify as to meeting all the appropriate laws. A report will be promptly submitted to the Engineer detailing the results of the inspections. If problem areas are observed, the inspections shall be conducted daily until such time as the trenches and excavations meet all the appropriate governing laws. No work is to be accomplished until the problem areas are corrected.

If changes in the planned pipe gradients are directed by the Engineer, which result in trenching depths more than 12" greater or lesser than the planned trench depth, the increased or decreased cost of the work shall be provided for in a supplemental agreement. Changes of a lesser extent will be considered incidental to the contract, without lesser or additional compensation.

D. Bedding. The pipe bedding shall conform to the class specified on the plans. When no bedding class is specified or detailed on the plans, the requirements for Class C bedding shall apply.

1. Rigid Pipe

a. Class B or C Bedding shall consist of bedding the pipe in a granular foundation in accordance with details shown on the plans. The bed shall be shaped to fit the pipe and shall have recesses shaped to receive the bell of bell and spigot pipe.

b. Bedding details shown on the plans are an integral part of the pipe design, with respect to load bearing capacity of the various sizes and classes of pipe. The contractor has the option of constructing these beddings in accordance with the details shown on the plans or alternatively may produce his own designs for bedding and concrete pipe systems that will meet the D-load requirements of ASTM C-76, for the given fill heights and weights. If this second option is chosen, these designs are to be prepared, signed and sealed by a professional engineer registered in the state of Georgia, and submitted to the Owner for review and approval. Imperfect backfill will not be considered as an alternative to a conventional trench-type bedding and/or special design pipe.

2. Flexible Pipe

For flexible pipe, the bed shall be roughly shaped to fit the pipe and a bedding blanket of sand or fine granular material shall be provided as follows:

Pipe Corrugation Depth Inches	Minimum Bedding Inches Inches
½	1
1	2
2-1/2	2-1/2

3. PVC and Polyethylene Pipe. For PVC and polyethylene pipe, the bedding material shall consist of coarse sands and gravels with a maximum particle size of ¾ inch. For pipes installed under paved areas, no more than 12% of the material shall pass the #200 sieve. For all other areas, no more than 50% of the material shall pass the #200 sieve. The bedding shall have a thickness of at least 6 inches below the bottom of the pipe and extend up around the pipe for a depth of not less than 50% of its vertical outside diameter.

E. Laying and Installing Pipe.

1. Concrete Pipe. The Contractor shall provide the necessary mason's lines and supports to insure installation of the pipe to line and grade. The Contractor`s facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed.

a. The Engineer shall inspect all pipe before it is laid and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe.

b. The laying of the pipe in the finished trench shall be started at the lowest point and laid upgrade. When bell and spigot pipe is used, the bell shall be laid upgrade.

c. The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. The pipe shall be protected from water during placing and until the mortar in the joints has thoroughly set.

d. When bell and spigot pipes are used, spaces for the pipe bells shall be dug in the pipe subgrade to accommodate the bells. The spaces shall be deep enough to ensure that the bells do not bear the load of the pipe; they shall not be excessively wide in relation to the longitudinal direction of the trench. When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant-shaped bedding throughout its full length, exclusive of the bell, to support the entire load of the pipe.

e. Pipe shall not be laid on frozen ground.

f. When placing concrete pipe constructed with elliptical reinforcing, the pipe shall be oriented in accordance with the manufacturer`s markings of top or bottom.

g. The upgrade end of pipelines not terminating in a structure shall be plugged or capped as approved by the Engineer.

h. Pipe which is not true in alignment, or which shows any settlement after laying, shall be taken up and re-laid without extra compensation.

i. The Contractor shall provide, as may be necessary, for the temporary diversion of stream flow to permit the installation of the pipe under dry conditions.

j. The Contractor shall lay tee sections to set the tee risers at the location shown on the plans, using spacer length of pipe as required. A tolerance of 1.0` will be required in the plan location of the riser tee branch, measured along the pipe centerline, within areas to be paved.

k. The proposed storm sewer pipe alignments will pass under existing storm sewer lines, and other utilities as shown on the plans. The Contractor shall support in place those existing utilities, which must re- main in service during the construction process. At the Contractor`s option, existing storm sewers may be removed and replaced by the Contractor in lieu of supporting these facilities in place. The Contractor is advised that existing watermains will be required to always remain under pressure.

l. The Contractor shall replace in kind with new materials any pipe or other existing facility damaged because of his work or furnish any new fittings required to make the system whole.

2. Corrugated Metal Pipe. Corrugated steel pipe shall be laid with separate gasket sections jointed firmly together with 3/8 inch thick by 7-inch-wide Neoprene gasket and coupling bands conforming to Fed. Spec. WW-P-405, with outside laps of circumferential joints pointing upgrade, and with longitudinal laps on the sides.

a. Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a bed that is uniformly firm throughout its length. Any pipe which is not in true alignment, or which shows any undue settlement after being laid or is damaged, shall be taken up and re-laid without extra compensation.

b. The pipe shall be placed so that the element of the cylindrical pipe constituting the centerline of the paved section shall coincide with the flow line of the culvert or sewer. Sections of paved pipe shall be laid so that the flow line is smooth and continuous across joints.

c. All pipes shall be handled so as to prevent bruising, or breaking on the spelter coating or the bituminous coating. All spots on the pipe where the spelter or bituminous coating has been damaged or destroyed shall be painted with two coats of asphaltic paint or otherwise repaired in a satisfactory manner.

F. Joining Pipe.

1. Concrete Pipe. Concrete pipe may be either bell and spigot or tongue and groove. The method of joining pipe sections shall be such that the ends are fully entered, and the inner surfaces are reasonably flush and even.

Joints shall be made with rubber gaskets or plastic gaskets.

a. Rubber Gasket Joints

The gasket shall be installed in accordance with the manufacturer`s instructions.

b. Composition Gasket Joints

The gasket shall be installed in accordance with the manufacturer`s instructions.

i. Bell and Spigot Pipe. The first pipe shall be bedded to the established grade line, placing the bell end upstream. The interior surface of the bell shall be carefully cleaned with a wet brush, and the lower portion of the bell filled with mortar to such a depth as to bring the inner surfaces of the abutting pipe flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into the bell so that the sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar and a bead shall be formed around the joint with enough additional mortar. The cement mortar shall be protected from rapid drying from exposure to sun or wind by suitable covering such as damp burlap kept moist for at least 24 hours. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint should be wrapped or bandaged with cheesecloth to hold the mortar in place.

ii. Tongue and Groove Pipe. The first pipe shall be bedded carefully to the established grade line with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the second pipe. The grooved end of the first pipe shall be carefully cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned carefully with a wet brush and while in a horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall then be inserted in the grooved end of the first pipe until mortar is squeezed out on the interior and exterior surfaces. Sufficient mortar shall be used to completely fill the joint and to form a bead on the outside. The cement mortar shall be protected from rapid drying from exposure to sun or wind by suitable covering such as damp burlap kept moist for at least 24 hours. If the mortar is not sufficiently stiff to prevent appreciable slump before setting, an acceptable method shall be provided to hold the mortar in place.

2. Metal Pipe. Metal pipe shall be firmly joined by form fitting bands conforming to the requirements of ASTM A 760 for steel pipe and AASHTO M 196 for aluminum pipe.

3. PVC and Polyethylene Pipe. Fittings for PVC pipe shall conform to the requirements of ASTM D3034. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M252.

G. Backfilling. All trenches and excavations shall be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is directed. Pipes shall be inspected before any backfill is placed, and any found to be out of alignment, unduly settled, or damaged, shall be removed, re-laid or replaced at the Contractor`s expense.

Materials for backfill shall be fine, readily compactible soil or granular material selected from the excavation or an approved source. It shall not contain frozen lumps, stones that would be retained on a 2" sieve, chunks of highly plastic clay, or other objectionable material. Granular backfill material shall have not less than 95% passing a 1/2" sieve and not less than 95% retained on a No. 4 sieve.

When the top of the pipe is even with or below the top of the trench, backfill shall be compacted in layers, not exceeding 6" on both sides of the pipe and to an elevation of one foot above the top of the pipe or to natural ground level whichever is greater. Care shall be exercised to thoroughly compact the backfill material under the haunches of the pipe. Backfilling shall be done in a manner to avoid injurious top or side pressure on the pipe. Material shall be brought up evenly on both sides of the pipe. When the top of the pipe is above the top of the trench, the backfill shall be compacted in layers not exceeding 6" and shall be brought up evenly on both sides of the pipe to an elevation one foot above the top of the pipe. The width of backfill on each side of the pipe for the portion above the top of the trench shall be equal to twice the diameter of the pipe or 12 feet whichever is less.

For PVC and polyethylene pipe the backfill shall be placed in two stages; one to the top of the pipe and the other at least 12" over the top of the pipe. The backfill material shall meet the requirements as specified above.

All backfill shall be compacted to a density of not less than 90% of the maximum dry density as determined for the material by AASHTO Designation T-180. Density tests shall be taken, by the Owner's representative, at the frequency of one (1) per every other lift per 100 L.F. of trench or fraction thereof. The movement of construction machinery over a culvert shall be at the Contractor's risk. Any pipe damaged thereby shall be replaced at the expense of the Contractor.

H. Connections. Where the plans call for connections to existing or proposed structures, these connections shall be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

I. Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as ordered by the Engineer. Except for paved areas of the Airport, the Contractor shall restore all disturbed areas to their original condition.

1. After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clean and in good condition.

2. Performance of the work described in this section is not payable directly but shall be considered as subsidiary obligation of the Contractor covered under the contract unit price for the pipe.

3. The Contractor shall note that there is an existing drainage system constructed in this project. The proposed drainage system will be connected to this existing system. The Contractor and the Engineer will inspect the existing drainage system prior to the start of work and record its condition and again at the completion of the work to assure that the system is clean and operable. The Contractor will be required to always maintain the existing drainage system during construction, and clean and/or rehabilitate to its prior condition at no additional cost to the contract.

J. Inspection. Prior to final approval of the drainage system, the Engineer, accompanied by the Contractor`s representative, shall make a thorough inspection, by an appropriate method, of the entire installation. Any indication of defects in material or workmanship or obstruction to flow in the pipe system shall be further investigated and corrected. Defects due to the Contractor`s negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

4.0 METHOD OF MEASUREMENT

A. The length of pipe to be paid for shall be the number of linear feet of pipe in place, completed and approved. It shall be measured along the centerline of the pipe, from end to inside face of structure to the end or inside face of structure, whichever is applicable. The several types and sizes shall be measured under the appropriate item without distinction as to pipe strength class. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured. Pipe bends and flared end sections were called for on the plans or as directed by the city, will be counted for separate payment. Tees, wyes and eccentric pipe reducers will not be measured separately for payment and shall be included in the measurement in linear feet of the line of pipe in which they are installed.

B. The length of Class B or C Pipe Bedding to be paid for shall be the number of linear feet of pipe bedding, without regard to the pipe diameter, shaped, compacted and backfilled in accordance with these specifications and approved by the Engineer.

C. Trench and excavation protection will not be directly measured for payment.

D. Flared end sections of the various sizes and materials will each be counted for payment.

E. Grated outlet sections will each be counted for payment.

5.0 BASIS OF PAYMENT

A. Payment for storm sewer pipe, complete and installed as planned and/or directed, will be made at the contract unit price per linear foot for pipe, without distinction as to pipe strength class. If the contractor elects to utilize his own designs for concrete pipe, and or different beddings than those shown on the plans, those other designs will be paid for under the unit price items listed below for the various pipe diameters and bedding types. These prices shall be full compensation for furnishing all materials and for all preparation, excavation, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

1. No separate payment will be made for demolishing portions of walls of existing structures to make connection with new pipe.

2. Hauling and placement of excess material removed in the pipe trench excavation process and not used, as backfill will not be measured for payment under this item. Payment for this work will be made under the appropriate embankment item as specified.

3. No separate payment will be made for common trench excavation, or trench backfill, including select backfill. The cost of this work will be considered incidental to the construction of the storm sewer pipe.

4. No separate payment will be made for any sheeting, shoring, bracing, pumping and counter-floatation measures which are required during construction, whether or not such work is indicated on the plans.

5. No separate payment will be made for the cost of removing and abandoning existing storm sewers, existing manholes, existing inlets and other drainage structures. The costs of this work will be considered incidental to the storm sewer construction.

6. Separate payment will be made for constructing concrete pipe collars for the purpose of joining two pipes. This will be paid under the item for “Miscellaneous Concrete”

7. No separate payment will be made for the removal and replacement or support of existing utilities necessary during the construction of storm sewers. The cost of this work will be considered incidental to the construction of the storm sewer pipe.

8. No separate payment will be made for exceptional costs incurred by the Contractor in conforming to construction schedules established in the plans or for duplicated work required by these schedules. The cost of this work will be considered incidental to the storm sewer item.

9. No separate payment will be made for the removal and disposal of trash, rubble and garbage removed from the pipe trench, or for replacement backfill. All costs, therefor, shall be included in the prices bid for the pipe item.

10. No separate payment will be made for tees, reducers, or other fittings, except that bends and flared end sections will each be counted for payment.

11. Payment for Pipe Bedding completed and accepted will be made at the contract unit price per linear foot, which price shall be full compensation for furnishing and placing all material and for all labor, equipment, tools and incidentals necessary to complete the item.

12. Payment will be made at the contract lump sum price for Trench and Excavation Protection. This price shall be full compensation for furnishing and placing all material and for all labor, equipment, tools and incidentals necessary to complete the item. Partial payments shall be made as follows:

    a. Fifteen percent (15%) of the contract item will be paid when the complete excavation and protection plan is approved.

    b. Seventy-five percent (75%) of the contract item will be pro-rated on each partial payment in respect to the percent complete of all work on the contract, less allowances.

    c. The final ten percent (10%) will be paid when all work is complete, and all reports have been submitted.

    d. (d) Payment will be made under:

        - Item D-701-1- Storm Sewer, RCP, 18” Diameter - Per Linear Foot.
        - Item D-701-2- Storm Sewer, RCP, 24” Diameter - Per Linear Foot.
        - Item D-701-3- Storm Sewer, RCP, 30” Diameter - Per Linear Foot.
        - Item D-701-4- Storm Sewer, RCP, 36” Diameter - Per Linear Foot.
        - Item D-701-5- Storm Sewer, RCP, 42” Diameter - Per Linear Foot.
        - Item D-701-6- Concrete Flared End Section, 18” Diameter - Per Each.
        - Item D-701-7- Concrete Flared End Section, 24” Diameter - Per Each.
        - Item D-701-8- Concrete Flared End Section, 30” Diameter - Per Each.
        - Item D-701-9- Concrete Flared End Section, 36” Diameter - Per Each.
        - Item D-701-10- Concrete Flared End Section, 42” Diameter - Per Each.
        - Item D-701-11-Grated Outlet Structure – Per Each
        - Item D-701-12- Pipe Bedding, Type C - Per Linear Foot.
        - Item D-701-13- Trench and Excavation Protection- Per Lump Sum.

TESTING AND MATERIAL REQUIREMENTS

Test and Short Title	Material and Short Title
ASTM A 760	Standard Specification for Corrugated Steel Pipe, Metallic Coated for Sewers and Drains
ASTM A 849	Standard Specification for Post-Applied Coatings, Paving's, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM C 6	Hydrated Lime
AASHTO M 45	Sand
ASTM C 76	RC Pipe
ASTM C 443	Rubber Gasket
AASHTO M 85	Portland Cement
AASHTO M 157	Ready-Mix Concrete
AASHTO M 173	Joint Sealer
AASHTO M 198	Gaskets
AASHTO M 219	Aluminum Structural Plate
Fed. Std. 601	Gasket Swell
1/HH-G-156	Flexibility

Note: Others as required by referenced specifications.

1/ Federal Specifications

END OF SECTION

SECTION D-705 - PIPE FOR UNDERDRAINS

1.0 DESCRIPTION

A. This item shall consist of pipe for underdrains of the type, classes, sizes, and dimensions required on the plans, furnished and installed at the places designated on the plans, or by the Engineer, in accordance with these specifications and with the lines and grades given.

B. This item shall include the furnishing and installation of underdrain pipe in place, the cost of underdrain pipes, common excavation, pavement removal, furnishing and installing all trench bracings, all fittings required to complete the underdrains as shown on the plans, and the material for the making of all joints including all connections to existing drainage pipes and structures.

C. The bid price per linear foot of pipe shall include all backfill made with earth excavated from the immediate trench. Granular backfill, conforming to the requirements of Section 806, Aggregate for Drainage, of the Georgia Department of Transportation (GDOT) Standard Specifications Construction of Transportation Systems, shall meet the following specifications.

2.0 MATERIALS

A. Underdrain Backfill. Underdrain backfill shall meet the quality requirements of GDOT Standard Specifications Construction of Transportation Systems Section 800, Coarse Aggregate, with the gradation meeting the requirements of size 89.

The above material shall be used to replace material from the trench for perforated pipe and shall be paid for separately as specified herein. Gradations shall be obtained on samples of underdrain backfill prior to delivery to the job site. Additional gradations shall be obtained at the rate of one (1) per week for size No. 89 during the stockpiling and placement operations. The quality requirement tests described under section 800 shall be performed prior to the start of delivery to the job site.

B. General. Materials shall meet the requirements shown on the plans and as specified below.

1. Smooth-wall Perforated PVC Pipe, ASTM F758, Poly (vinyl chloride) Ribbed Drainpipe & Fittings, based on controlled inside diameter, ASTM F794, Poly (vinyl chloride) (PVC) corrugated sewer pipe with a smooth interior and fittings, ASTM F949, Poly (vinyl chloride) (PVC) Profile Drain Pipe and fittings based on controlled inside diameter AASHTO M30. All PVC pipe for under drains shall be Schedule 40

2. Fittings are not required to be leak-proof but must be tight enough to prevent intrusion of fine material. Fittings may snap or screw on. All fittings shall be of the composition and have the same physical properties as the tubing and shall not restrict flow. Fittings as a continuous part of the line shall be capable of passing the stretch resistance test in accordance with ASTM F-405, latest revision.

   Schedule 40 PVC pipe supplied as meeting this specification shall be marked with the manufacturer's identification symbol regularly at not more than 10 ft. intervals and in addition may be required to carry an approved symbol designating the manufacturer's assurance of compliance also at regular intervals along the pipe. Fittings shall bear the identification symbol of the manufacturer. Each bundle shall bear the date, month and year of manufacture.

3. All underdrain pipes backfill shall be AASHTO or ASTM No. 89 stone.

3.0 CONSTRUCTION METHODS

A. Equipment. All equipment necessary and required for the proper construction of pipe underdrains shall be on the project, in first class working condition, and approved by the Engineer before construction is permitted to start. The equipment shall be able to be set up to maintain line and grade control accurately without damaging the existing soil cement base. A standard backhoe will not be approved for this work

1. The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the pipe bed and backfill, as specified.

B. Excavation. The Contractor shall do all necessary excavation to the depth shown on the plans.

1. Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the Engineer. The excavation shall not be carried below the required depth; when this is done, the trench shall be backfilled at the Contractor's expense with material approved by the Engineer and compacted to the density of the surrounding earth material as determined by the AASHTO Compaction Control Tests AASHTO T-180. The laboratory compaction and field density shall be determined by methods described in Section P-152, "Excavation and Embankment".

2. In case the depth of cut is changed from that shown on the plans, the change shall not exceed 6" without a revision in the contract unit price per linear foot of pipe. However, if the depth of cut is changed more than 6", compensation or deduction of work involved, whether increased or decreased, shall be provided for in a supplemental agreement.

3. The minimum width of the trench at the top of the pipe, when placed, shall be a width which will permit the proper construction of joints and compaction of backfill around the pipe.

4. The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. Unless otherwise provided, the bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the backfill to at least 12" over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe.

5. The Contractor is cautioned to exercise extreme care, particularly in the areas immediately and adjacent to taxiway and runway edges, where lighting conduit runs continuously and under which the piping must pass. The Contractor is further cautioned to exercise care in the vicinity of FAA communication, power, and electronic circuits. Damages to these and any other underground utilities shall be repaired in accordance with "General Conditions, Section 22.11". All cost associated with these repairs shall be paid for by the Contractor.

C. Laying and Installing Pipe.

1. The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed.

2. The Engineer shall inspect all pipe before it is laid, and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe.

3. The laying of the pipe in the finished trench shall be started at the lowest point and laid upgrade. The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. Pipe shall not be laid on frozen ground or in a wet trench.

4. PVC pipe shall be installed in accordance with the requirements of ASTM D2321 or AASHTO standard specifications for Highway Bridges Section 30. Perforations shall meet the requirements of AASHTO M252 or M294 class 2, unless otherwise indicated on the plans.

D. Mortar. The mortar shall be of the desired consistency for making connections to other pipes or to structures. Mortar that is not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted.

E. Backfilling.

1. Earth. All trenches and excavations shall be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is provided. Backfill material shall be approved by the Engineer. Special care shall be taken in placing the backfill. Great care shall be used to obtain thorough compaction under the haunches and along the sides to the top of the pipe.

   a. The backfill shall be placed in loose layers not exceeding 6" in depth under and around the pipe and not exceeding 8" over the pipe. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Engineer, until the trench is filled and brought to the proper elevation. Backfilling shall be done in a manner to avoid injurious top or side pressures on the pipe.

   b. In embankments and for other areas, the backfill shall be compacted to 90% of the maximum density as determined by AASHTO T-180. The laboratory compaction and field density shall be determined by methods described in SECTION P-152, EXCAVATION AND EMBANKMENT. Density tests shall be taken at a frequency of one (1) per every other lift per 100 linear feet of trench for earth backfill.

2. Granular Material. When granular backfill is required, its placement in the trench and about the pipe shall be as shown on the plans. Special care shall be taken in placing the backfill. The granular backfill shall not contain a damaging amount of foreign matter, nor shall earth from the sides of the trench or from the windrow be allowed to filter into the backfill. The backfill shall be placed in loose layers not exceeding 6” in depth and compacted by hand and vibratory tampers to the requirements as given above. Backfilling shall be done in a manner to avoid injurious top or side pressure on the pipe. The granular backfill shall be made to the elevation of the trench, as shown on the plans.

   a. When perforated pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans.

   b. Whenever a granular subbase blanket course is to be used under pavements or which extends several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2” above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material which remains over the underdrain trench shall bb e removed and replaced.

The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench. The backfill shall be compacted in accordance with the applicable portions of Section D-701 Pipe for Storm Drains.

F. Connections. When the plans call for connections to existing or proposed structures, these connections shall be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

G. Flushing and/or Rodding. The flushing and/or rodding of underdrain pipe shall be accomplished in such a manner to reasonably assure that the underdrain longitudinal pipes and outlet pipes are not obstructed or blocked or discontinuous.

Sufficient water is to be injected into the system, overcoming the amount absorbed into the backfill aggregate, to reasonably indicate free flow. This can be observed by monitoring the time it takes to reach a monitoring point and the magnitude of flow. The reverse also will be monitored, i.e. the time it takes for the flow to abate.

If the lines appear to be blocked, obstructed, or discontinuous, based on the above monitoring, the Contractor is to rod the lines to determine the point of the problem.

An exploratory pit would then be dug at the perceived problem point and corrections made to the underdrains.

H. Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Engineer. Except for paved areas of the Airport, the Contractor shall restore all disturbed areas to their original condition.

1. After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

2. Performance of the work described in this section is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the underdrain.

4.0 METHODS OF MEASUREMENT

A. The length of pipe to be paid for shall be the number of linear feet of underdrain pipes in place, completed, and approved to be measured along the centerline of the pipe from end of pipe or inside face of structure to the end or inside face of structure, whichever is applicable. All fittings and appurtenances shall be included in the length as typical pipe sections in the pipe being measured.

B. The amount of low slump, low strength concrete as specified in P-501 shall not be measured separately as it is incidental to the work.

C. Underdrain cleanouts constructed and finished in-place will each be counted for payment.

D. Trench Rock Excavation will be measured per specification P-152.

5.0 BASIS OF PAYMENT

A. Payment will be made at the contract unit price per linear foot for each kind of pipe, type and size designated. These prices shall be full compensation for furnishing all materials and for all labor, equipment, tools and incidentals necessary to complete these items, including the excavation and removal of existing underdrain pipes, connections to existing drainage pipes and structures and drainage stone. The cost of underdrain outfall pipe, concrete encasement, concrete collars at manholes or inlets, shall also be included in the linear foot price bid for the non-perforated underdrain outlet pipe.

B. No separate payment shall be made for the 6-inch concrete caps of low slump, low strength concrete.

C. Payment for underdrain cleanouts shall be made for each cleanout installed and accepted in-place These prices shall be full compensation for furnishing all materials and for all labor, equipment, tools and incidentals necessary to complete these items

D. Payment for the underdrain pipe aggregate backfill shall be made per cubic yard placed and accepted.

E. Payment for Trench Rock Excavation, if required, will be per item P-152-3.

Payment will be made under:

Item D-705-1 8” Perforated Underdrain Pipe – Per Linear Foot

Item D-705-2 8” Non-Perforated Underdrain Outlet Pipe, Concrete Encased – Per Linear Foot

Item D-705-3 6” Perforated PVC Pipe – Per Linear Foot

Item D-705-4 Underdrain Cleanout – Per Each

Item D-705-5 Coarse Aggregate Backfill, #89 Stone– Per Cubic Yard

TESTING AND MATERIAL REQUIREMENTS

Test and short title	Material and short title
AASHTO T-180 -- Density	AASHTO M-85--Portland Cement
AASHTO T-27 – Gradation	AASHTO M-45--Sand
	ASTM C-6--Hydrated Lime ASTM D-1248—Joints
	ASTM D-3034--PVC Pipe & Fittings ASTM F-758--PVC Pipe
	ASTM F-949--PVC Pipe

END OF SECTION D-705

a. SECTION D-750 - SANITARY SEWERS

1.0 DESCRIPTION

A. This work shall include the construction of sanitary sewer pipes of the types, classes and sizes required on the contract documents, furnished and installed as designated on the contract documents, or as directed by the Engineer.

2.0 SUBMITTALS

A. Shop Drawings: For the following:

1. Manholes: include plan, elevations, sections, details, frames and covers.

2. Sewer Pipe: include manufacturer's cut sheet and certification.

B. Coordination Drawings: Show pipe size, locations, and elevations. Show other piping in same trench and clearance from sewage system piping. Indicate interface and spatial relationship between manholes, piping and proximate structures.

C. Field-Quality Control test reports. Infiltration test results.

3.0 MATERIALS

A. Ductile iron pipe shall meet the requirements of AWWA C-151. The pipe shall be cement-enamel lined in accordance with AWWA C-104 and coated outside in accordance with Section 51-8.1 of AWWA C-151. Push-on type rubber gaskets shall be used for gravity pipe and restrained joints will be used for force mains. All pipes shall be strength Class 51 pipe, unless otherwise noted on the Contract Drawings.

B. Reinforced concrete pipe shall be furnished in eight-foot maximum laying sections' and shall have the strength or Class as indicated on the plans. The pipe shall be lined with two coats of epoxy coating. Dry fill coating thickness will be seven to eight mils per coat. Two coats will be required: preferably one red and the second in gray. No additional payment will be made for epoxy coating; all cost thereof will be considered incidental to the type of pipe.

C. All pipe and pipe joints on reinforced concrete pipe 48" diameter and smaller shall be certified as having been tested in accordance with ASTM Designation C-76 and C-443, respectively, for absorption and joint leakage. At least 1% of the pipe lengths and joints of each diameter from a given pipe run by a given manufacturer and not less than two pipe lengths or two joints of each diameter and run shall be so tested and certified. No runs of pipe failing to meet the absorption and leakage test requirements will be accepted. Lift holes will be permitted on all concrete pipe. Lift holes shall be sealed with 5 Star Non-Shrink Grout conforming to ASTM C-827 for shrinkage; have reached its initial set time within 45 minutes of mixing and initial set conforming to ASTM C-191; and with minimum compressive strength of 2,000 psi in one day and 7,000 psi at 28 days conforming to ASTM C-109.

D. PVC pipe furnished for force main and pressure gravity sewer shall be smooth- wall solid pipe, ASTM F758 Schedule 40.

E. Gaskets for both ductile iron pipe and reinforced concrete pipe shall be "O" ring type and approved, fuel resistant Neoprene "N". All gaskets proposed as fuel resistant equals shall conform to the requirements of ASTM C-443 and shall be tested for swelling in the presence of petroleum products in accordance with Federal Standard 601, Method 6001 and 6211. When the latter method is used No. 3 oil for 70 hours at 212°F, the swelling shall not exceed 100% by

volume.

F. Manholes shall be as specified in Section D-751, “Manholes, Catch Basins and Inlets.”

G. Concrete for concrete encasement of sanitary sewers shall meet the requirements in Section “P-610 Structural Portland Cement Concrete”. Concrete shall have a minimum compressive strength of 3,000 PSI at 28 days.

4.0 CONSTRUCTION

A. Sanitary sewer pipe shall be constructed in accordance with Section D-701, "Pipe for Storm Sewers and Culverts", of these specifications. Sanitary facilities shall be tested:

1. For infiltration in accordance with Section 660.3.06 “Quality Acceptance” of the Georgia Department of Transportation (DOT) Standard Specifications Construction of Transportation Systems.

2. For water tightness with low-pressure air test. The Contractor shall furnish all necessary equipment and materials for testing including but not limited to pressure gauges, plugs, pumps, bulkheads, miscellaneous piping, etc.

   a. The Contractor shall isolate the test section with required plugs, bulkheads, etc.

   b. The Contractor shall pressurize the test section to 3.5 psi greater than the average backpressure of groundwater around the sewer (add 0.43 psi to test pressure for each vertical foot that the groundwater is about the groundwater is above the top of the pipe).

   c. Allow 3 minutes for the pressure to stabilize.

   d. The pressure shall not decrease more than 0.5 psi during the periods shown below:

Pipe Diameter (inches)	Time/100ft of Pipe
8	1 min – 12 sec.
10	1 min – 30 sec.
12	1 min – 48 sec.
14	2 min – 48 sec.
15	2 min – 0 sec.
16	2 min – 6 sec.
18	2 min - 12 sec.
20	2 min – 48 sec

B. The Contractor will be required to maintain flow in existing sanitary sewers during construction. Blockage of any line or discharge of any line into adjacent drainage facilities will not be permitted. There will be no additional compensation for the maintenance of flow and all costs thereof will be considered incidental to the pipe.

C. Where noted on the plans, the Contractor shall plug existing sanitary sewer pipe with concrete. Concrete plugs shall extend into the pipe a distance equal to the pipe diameter.

D. All trench excavation through rock shall be extended at least one foot below the outside of the pipe in all directions and then backfilled with approved granular material to form the pipe bedding.

E. Where noted on the contract plans, the Contractor shall remove or abandon existing manholes by demolishing or removing the top of the structure to five feet below finished grade and backfilling with approved material, once the floor of the structure has been made pervious by

drilled holes, as directed by the Engineer. No additional compensation will be made for this work, and all costs will be considered incidental to the pipe.

F. Concrete encasement shall be placed in the trench around sanitary sewer pipe where indicated in the plans. The concrete encasement shall be in accordance with the detail in the plans

5.0 METHOD OF MEASUREMENT

A. The length of pipe to be paid for shall be the number of linear feet of pipe in place completed and approved. It shall be measured along the centerline of the pipe from end to inside face of structure to the end or inside face of structure, whichever is applicable. The several types and sizes shall be measured under the appropriate item without distinction as to pipe strength class. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

B. The length of Type “B” and “C” Pipe Bedding and Concrete Encasement to be paid for shall be the number of linear feet of pipe bedding or concrete encasement, without regard to the pipe diameter, shaped, compacted and backfilled in accordance with these specifications and approved by the City.

C. Trench and Excavation Protection shall be included in the contract lump sum price bid for contract Item Trench and Excavation Protection in “Pipe for Storm Drains,” Section D-701. Trench Rock Excavation, if required, will be included in “Excavation and Embankment,” Section P-152.

D. Each manhole complete, in place and accepted will be counted for payment.

6.0 BASIS OF PAYMENT

A. Payment for sanitary sewer pipe, complete and installed as planned and/or directed, will be made at the contract unit price per linear foot for pipe, without distinction as to pipe strength class. These prices shall be full compensation for furnishing all materials and for all preparation, excavation, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

1. No separate payment will be made for connection of new pipe as indicated on the drawings to existing sanitary sewer system (pipe, manhole, etc.). This work shall be considered incidental to the sanitary sewer construction.

2. Hauling and placement of excess material removed in the pipe trench excavation process and not used as backfill will not be measured for payment under this item. Payment for this work will be made under the appropriate embankment item as specified in “Excavation and Embankment,” Section P-152.

3. No separate payment will be made for common trench excavation, or trench backfill, including select backfill. The cost of this work will be considered incidental to the construction of the sanitary sewer pipe.

4. No separate payment will be made for any sheeting, shoring, bracing, pumping and counter-floatation measures which are required during construction, whether or not such work is indicated on the plans, other than as specified under the term “Trench and Excavation Protection” in “Pipe for Storm Drains,” Section D-701.

5. Payment will be made for the cost of removing and abandoning existing sanitary sewers, existing manholes, as specified by Section P-150, “Removal of Pavements and Miscellaneous Items”.

6. Separate payment will be made for constructing concrete pipe collars for the purpose of joining two pipes. This will be paid under the item for “Miscellaneous Concrete” in

"Manholes, Cath Basins, and Inlets," Section D-751.

7. No separate payment will be made for the removal and replacement or support of existing utilities necessary during the construction of sanitary sewers. The cost of this work will be considered incidental to the construction of the sanitary sewer pipe.

8. No separate payment will be made for exceptional costs incurred by the Contractor in conforming to construction schedules established in the plans or for duplicated work required by these schedules. The cost of this work will be considered incidental to the sanitary sewer item.

9. No separate payment will be made for the removal and disposal of trash, rubble and garbage removed from the pipe trench, or for replacement backfill. All costs therefor, shall be included in the prices bid for the pipe item.

10. No separate payment will be made for tees, reducers, or other fittings.

B. Payment for Pipe Bedding completed and accepted will be made at the contract unit price per linear foot, which price shall be full compensation for furnishing and placing all material and for all labor, equipment, tools and incidentals necessary to complete the item.

C. Each manhole of the various types, complete, in-place, and accepted shall be paid for at the contract price bid per each. Such prices and payments shall be full compensation for furnishing all materials, fittings, and other appurtenances called for on the plans for all preparation, excavation, and placing of materials, and for all labor, equipment, tools and incidentals necessary to complete the structures.

Payment will be made under:

Item D-750-1–Sanitary Sewer, 42" RCP, Gravity -Per Linear Foot

Item D-750-2-Sanitary Sewer 6" Diameter DIP, Gravity – Per Linear Foo
Item D-750-3-Sanitary Sewer, 12" Diameter DIP-Per Linear Foot
Item D-750-4-Sanitary Sewer, 8" Diameter DIP, CL 56-Per Linear Foot
Item D-750-5–Type "C" Bedding for Sanitary Sewers-Per Linear Foot
Item D-750-6-Type "B" Bedding for Sanitary Sewers-Per Linear Foot
Item D-750-7- Concrete Encasement for Sanitary Sewers-Per Linear Foot
Item D-750-8- 6' Diameter Sanitary Sewer Manhole-Per Each.
Item D-750-9- Adjust Existing Sanitary Manhole to Grade-Per Each.
Item D-750-10-4' Diameter Sanitary Sewer Manhole Over Existing Sanitary Sewer-Per Each
Item D-750-11-Sanitary Sewer Cleanout – Per Each

TESTING AND MATERIAL REQUIREMENTS

Test and Short Title	Material and Short
Title ASTM C 6	Hydrated Lime
AASHTO M 45	Sand
ASTM C 76	RC Pipe
ASTM C 443	Rubber Gasket
AASHTO M 85	Portland Cement
AASHTO M 157	Reddy-Mix Concrete
AASHTO M 173	Joint Sealer
AASHTO M 198	Gaskets
AASHTO M 219	Aluminum Structural Plate
1/HH-P-117	Oakum
Fed. Std. 601	Gasket Swell
1/HH-G-156	Flexibility

Note: Others as required by referenced specifications.

1/ Federal Specifications

END OF SECTION D-750

SECTION D-751 MANHOLES, CATCH BASINS AND INLETS

1.0 DESCRIPTION

A. This work shall include construction of new manholes, inlets, headwalls, trench drains, miscellaneous drainage structures, adjusting inlets to grade, and other incidental concrete structures constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

B. This section shall also include the repair of trench drains at locations shown in the plans.

C. This section shall include plain or reinforced concrete for miscellaneous structures, constructed in accordance with the specification at the specified locations and conforming to the lines, grades and dimensions shown on the plans or required by the Engineer.

D. All reinforced concrete structures partly or wholly precast, covered by these specifications shall be constructed in accordance with the shop drawings, approved by the Engineer, in advance of the work. Shop drawings shall indicate the location of all joints and the size, shape and orientation of all the pipe openings. Bar schedule for all reinforcing steel shall be submitted with the shop drawings. Shop drawings shall be submitted with all parts of the structure and hardware indicated – multiple submittals for the appurtenant parts of a single structure will be cause for rejection of the entire submittal.

2.0 MATERIALS

A. Mortar. The mortar for brick masonry and similar work shall be composed of one part of Portland cement and two parts of mortar sand, by volume. The Portland cement shall conform to the requirements of AASHTO M-85. The sand shall conform to the requirements of AASHTO M-45. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C-6. The water shall be clean and free of deleterious amounts of acids, alkali's, and organic material. If the work is of questionable quality, it shall be tested in accordance with AASHTO T-26.

B. Concrete. Joints between storm sewer pipes and manholes shall be made with formed and poured collars.

The top and bottom slabs and other portions of the various drainage structures to be constructed of reinforced concrete shall conform to the applicable requirements of Section 500, Section 833, and Section 441 of the Georgia Department of Transportation Standard Specifications. Unless otherwise noted on the contract documents, these elements may be cast in place or precast, at the Contractor's option. All concrete shall be Class A unless otherwise specified on the plans.

Reinforcing steel shall conform to ASTM A-615, Grade 60, and shall conform to the applicable requirements of Section 511 of the Georgia Department of Georgia Standard Specifications.

C. Manholes.

1. Precast concrete manhole risers shall conform to the requirements of ASTM C-478, unless noted otherwise on the plans.

2. Precast circular wall sections of manholes shall conform to the requirements of ASTM C-

478, unless noted otherwise on the plans.

3. All manhole covers shall be furnished with four cover hold-down bolts, rubber gaskets, and a single pick hole on the cover periphery which does not extend beyond the seating flange of the frame. Frames shall be furnished with anchor bolts, as shown on the contract documents. All frames and covers shall be cast iron, as shown on the contract drawings.

4. Rubber Gasket Joints shall conform to the requirements of C-433.

   a. Gasket shall be “O”- ring or profile type, Neoprene, fuel resistant.

   b. All gaskets proposed as fuel resistant equals shall be tested for swelling in the presence of petroleum products in accordance with Federal Standard 601, Method 6001 and 6211. When the latter method is used with No. 3 oil for 70 hours at 212° F., the swelling shall not exceed 100% by volume.

5. All castings shall be thoroughly cleaned and given two coats of approved bituminous paint. After fabrication, structural steel units shall be galvanized to meet the requirements of AASHTO M-111.

6. The steps or ladder bars shall be gray or malleable cast iron.

7. Bedding for precast base sections shall conform to the requirements for coarse aggregate No. 89, Georgia DOT Standard Specifications.

3.0 CONSTRUCTION METHODS

A. Unclassified Excavation.

1. The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations shown on the plans or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.

2. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When poured concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.

3. All precast base sections must be founded on a compacted layer of Georgia DOT No. 89 coarse aggregate at least 18" thick.

4. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.

5. Unless otherwise provided, the Contractor shall remove bracing, sheathing, or shoring involved in the construction of this item after the completion of the structure. Removal shall be affected in a manner, which will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.

6. After each excavation is completed, the Contractor shall notify the Engineer to that effect; and concrete or reinforcing steel shall be placed after the Engineer has approved the depth of the excavation and the character of the foundation material.

B. Concrete Structures. Concrete structures shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. The construction shall conform to the requirements of section 500, Class A Concrete, of the Georgia DOT Standard Specifications.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward toward the outlet.

Adjusting existing manholes and inlets shall consist of removing and replacing the casting, removing portions of the existing walls, and/or constructing new structure walls as necessary to lower an existing structure to grade. Also included under this item is the raising of an existing structure to grade.

C. Precast Concrete Structures. Precast concrete structures shall be constructed on prepared aggregate bases and shall conform to the dimensions and locations shown on the contract documents. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily and all joining and connections shall be cemented with mortar. The top of the upper precast concrete pipe member shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required.

Provisions shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow.

D. Inlet and Outlet Pipes. Inlet and outlet pipes shall extend through the walls of the structures for a sufficient distance beyond the outside to allow for connections but shall be cut off flush with the wall on the inside surface, unless otherwise directed. For concrete or brick structures, the mortar shall be placed around these pipes so as to form a tight, neat connection. For precast structures, joints between storm sewer pipes and structure walls shall be formed concrete collars, placed exterior of the structure, which completely fill and seal the annular void between the pipe and the structure wall.

E. Placement and Treatment of Castings, Frames, and Fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans, or as directed by the Engineer, and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry shall be brought true to line and grade and shall present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans, or as directed and approved by the Engineer. All units shall be set firm and secure.

After the frames and fittings have been set in final position and the concrete or mortar has been allowed to harden for seven days, then the grates or covers shall be placed and fastened down.

F. Installation of Steps. The steps shall be installed as indicated on the plans, or as directed by the Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least seven days. After this period has elapsed, the steps shall be cleaned and painted, unless they have been galvanized. When steps are required with precast concrete pipe structures, they shall be cast into the sides of the pipe at the time the pipe sections are manufactured, or set in place after the structure is erected, by drilling holes in the concrete and cementing the steps in place.

In lieu of steps, prefabricated ladders may be installed. In the case of brick or concrete structures, the ladder shall be held in place by grouting and supports in drilled holes. In the case of metal structures, the ladder shall be secured by welding the top support and grouting the bottom support into drilled holes in the foundation, or as directed.

G. Backfilling.

1. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8" in loose depth and compacted to a density of not less than 90% of the maximum dry-density for the material as determined by AASHTO T-180. Density tests shall be taken at the frequency of one per every other lift per manhole, inlet, junction chamber, or drainage structure, as appropriate. Each layer shall be deposited all around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans, or as directed by the Engineer.

2. Backfilling shall not be placed against any structure until the Engineer gives per- mission. In the case of concrete, such permission shall not be given until the concrete has been in place seven days, or until tests made by the laboratory under supervision of the Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

3. Backfill placed around concrete culverts shall be deposited on both sides at the same time and to approximately the same elevation. Care shall be taken to prevent any wedging action against the structure and all slopes bounding or within the area to be backfilled shall be stepped or serrated to prevent wedge action.

4. Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the structure involved.

H. Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Engineer. The Contractor shall restore all disturbed areas to their original condition. After all work is complete, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

4.0 METHOD OF MEASUREMENT

A. Each manhole, junction chamber and inlet complete, in place and accepted will be counted for payment.

B. Each manhole and inlet adjustment complete, in place and accepted will be counted for payment.

C. Miscellaneous concrete for collars, aprons, pipe plugs and other purposes will be measured by the cubic yard, complete, in place and accepted.

D. No measurement or allowance shall be made for forms, falsework, cofferdams, pumping, bracing, expansion joints or material, water stops or utility sleeves.

5.0 BASIS OF PAYMENT

A. Each manhole, inlet, manhole adjustment, and inlet adjustment of the various types, complete, in-place, and accepted shall be paid for at the contract price bid per each. Such prices and payments shall be full compensation for furnishing all materials, fittings, and other appurtenances called for on the plans for all preparation, excavation, and placing of materials, and for all labor, equipment, tools and incidentals necessary to complete the structures.

B. No separate payment will be made for breaking and connecting into manholes for storm sewers. This work shall be considered incidental to the storm sewer construction.

C. No additional payment will be made for sheeting, shoring, bracing, pumping, dewatering, and any counter-floatation measures, which may be required during construction.

D. Payment will be made at the contract unit price per cubic yard for concrete for miscellaneous concrete. These prices shall be full compensation for furnishing all materials, for all preparation, excavation, and placing of materials, and for all labor, equipment, tools, and incidentals necessary to complete the structure. No separate payment will be made for reinforcing steel.

E. Payment will be made under:

Item D-751-1 – 4’ Dia. Manhole – Per Each.

Item D-751-2 - Adjust Existing Manhole to Grade – Per Each.

END OF SECTION D-751

SECTION P-150 - REMOVAL OF PAVEMENTS AND MISCELLANEOUS ITEMS

1.0 DESCRIPTION

A. This section consists of the breaking up and removal of pavements of all types, guardrail, and fencing in the areas indicated on the plans or as directed by the Engineer. The actual limits of pavement and fence removal shall be approved by the Engineer prior to the start of removal operations.

B. The contractor shall accomplish the demolition and disposal in accordance with all local, state, and federal regulations and laws in regard to hazardous or toxic materials and shall obtain any permits required to accomplish the work.

2.0 CONSTRUCTION

A. Pavement removal shall consist of saw cutting, breaking up and removal, if required, of all bituminous and concrete pavements, curbs, guardrail, and base courses as indicated on the plans. The horizontal limits of these removals shall be surveyed and saw cut prior to removal, unless otherwise agreed to by the Engineer.

B. Temporary chain link fences shall be erected before existing chain link fences and gates with or without barbed wire are removed.

3.0 METHOD OF MEASUREMENT

A. The area of pavement removal including curb and gutter (if required) to be measured for payment will be actual square yardage required to be removed for purposes so directed by the Engineer. Pavement removed outside these limits will not be measured for payment.

B. Removal of existing chain link fence and gates with or without barbed wire regardless of height will be the actual linear footage of fence removed and disposed of as directed by the Engineer.

4.0 BASIS OF PAYMENT

A. Payment shall be made at the contract unit price for pavement removal of all sections and types. This price shall be full compensation for breaking up of all designated pavements and for all broken materials removed and hauled to a designated area, or off airport, and for all labor, equipment and incidentals necessary to complete the item.

B. Payment shall be made at the contract unit price for removal of existing fence. The price shall be full compensation for removal, disposal off airport property, and for all labor, equipment and incidentals necessary to complete the item.

C. Payment will be made under:

Item P-150-1-Removal of Pavements– Per Square Yard. Item P-150-2-Demolition of Existing Fence – Per Linear Foot.

END OF SECTION

SECTION P-152 EXCAVATION AND EMBANKMENT

1.0 DESCRIPTION

A. This section consists of furnishing borrow, excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct embankments and other facilities in accordance with these specifications and in conformity with the lines and grades established by the Engineer as shown on the plans.

B. All suitable materials taken from excavation of any contract item shall be used in the formation of the embankment, subgrade, and for backfilling as indicated on the plans, or as directed by the Engineer.

1. When on-site material is not sufficient to construct the embankment, the Contractor shall furnish material from his own off-Airport borrow site(s). In general, the borrow material supplied shall be of such soil type and gradation that the material has the capacity of being tested in accordance with AASHTO T-180 and meets the stability requirements as specified under Section P-152, 02), g), 11).

C. Classifications:

1. All material that is excavated and used for embankment shall be classified as "In-Place Embankment", “Borrow Excavation”, "On Site Excavation", "Backfill", “Rock Excavation or as “Trench Rock Excavation”.

2. In-Place Embankment shall include onsite excavation and offsite borrow excavation, hauling, manipulation, placement, grading, and compaction of all materials necessary to construct embankments as set forth on the plans and in these specifications.

3. Borrow Excavation shall consist of material approved by the Engineer and furnished by the Contractor from the Contractor’s off Airport borrow site(s).

4. Backfill shall include the excavation of unsuitable material, obtaining suitable replacement, hauling, placing and compaction of suitable material required to replace any unsuitable material which has been removed and disposed of. Unsuitable material may be placed on the finished slopes of the embankment when approved by the Engineer and deemed able to support vegetation. Deleterious materials such as wood, rubber, metal, paper, drywall, plastic, trash and other similar materials shall be disposed of off Airport property in a legal manner at no additional cost to the City.

5. Unsuitable material shall include stripping and other materials that will not meet the compaction requirements for In-Place Embankment. Organic composition will generally be considered the basis for designating a material unsuitable. Excess moisture content will not be considered a basis for designating a material unsuitable. If there is any dispute over the suitability of materials, the Engineer's opinion shall be final. Removal of unsuitable material will be as specified per Section P-152, 01), (c), 4).

6. The existing ground line shall be that surface which is defined by cross sections taken after all stripping and clearing and grubbing, and removal of pavement operations have been completed.

7. Trench Rock Excavation shall include rock in the various pipe and utility trenches. The Contractor shall expose and determine the extent of rock in trenches. The rock removal shall be accomplished at such time to not damage or disturb completed work.

8. Rock Excavation shall include all solid rock embedded in deposits, in unstratified mass, and conglomerate deposits which are so firmly cemented they present all characteristics of solid rock, and which cannot be moved without drilling or blasting. This classification includes rock removed for the construction of underground structures such as manholes and vaults.

9. Excess Embankment shall include materials remaining after embankments are complete and excavation has been completed to the grades shown on the plans.

10. Selective Grading shall include the excavation, hauling, placement, and compaction including subgrade preparation, of all materials required to construct the areas as directed by the Engineer to final grades.

2.0 CONSTRUCTION METHODS

A. General. The rough excavation shall be carried to the necessary depth to obtain the specified depth of subgrade densification. Should the Contractor, through negligence or other fault, excavate below the designated lines and grades, the excavation shall be replaced with approved materials, in an approved manner and condition, at the Contractor's expense. The Engineer shall have complete control over the excavation, moving, placing, and disposition of all material and shall determine the suitability of material to be placed in embankments. All material determined unsuitable shall be disposed of off airport property or as directed by the Engineer. Topsoil shall be utilized as directed in Section P-152, 02), (f) contained hereinafter.

1. Before beginning excavation, grading, and embankment operations in any area, the area shall have all sediment control devices in place, be completely cleared and grubbed or stripped of all vegetation and approved by the Engineer to proceed.

2. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for any excavated material which is used for purposes other than those designated

3. Those areas outside of the pavement areas in which the top layer of soil material becomes compacted, due to hauling or to any other activity of the Contractor, shall be scarified and disced to a depth of 4 inches, as directed, to loosen and pulverize the soil. All materials that would be deleterious to the establishment of grass shall not be incorporated into the top 4 to 6 inches of areas to be grassed. The Contractor shall remove any such material prior to commencement of the grassing operation.

4. If it is necessary to interrupt existing surface drainage, sewers or underdrainage, conduits, utilities, or similar underground structures, or parts thereof, the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide temporary services. When such facilities are encountered, the Contractor shall notify the utility owner as provided for elsewhere in these specifications, who shall arrange for their removal, if necessary. The Contractor shall, at its own expense, satisfactorily repair all damage to such facilities or structures which may result from any of his operations during the period of the contract.

B. Excavation.

Excavation shall be performed as indicated on the contract plans to the lines, grades, and elevation shown, or as directed by the Engineer, and shall be made so that the requirements for formation of embankments can be followed. All unsuitable material encountered within the limits indicated shall be removed and disposed of as directed by the Engineer. During the process of excavation, the grade shall be maintained so that it will always be well drained. When

directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the work.

1. If, at the time of excavation, it is not possible to place any material in its proper section of the permanent construction, it shall be stockpiled in approved areas for later use. Any stockpiling or re-hauling of material will be done at no additional cost to the city.

2. After all indicated areas have been excavated to the line, grades, and elevations shown, the Contractor shall follow the requirements of Section P-152, 02), (j) as contained hereinafter.

3. The Contractor shall excavate to the limits as indicated and/or implied on the plans. Widening or narrowing of the section and raising or lowering of the grade to avoid haul will not be permitted. The City reserves the right to make minor adjustments or revisions in lines or grades, if found necessary, as the work progresses due to discrepancies in the plans or to obtain satisfactory construction.

4. The disposition of existing structures and utilities shall be as indicated on the drawings, and as specified in other sections of these specifications.

5. In cut areas, the existing ground shall be compacted to a minimum depth of six (6) inches and to a density of not less than 90% of the maximum density, at optimum moisture, as determined by AASHTO T-180 except as modified in Section P-152, 02), (j). Any unsuitable materials encountered shall be removed and paid for as specified herein.

6. No payment or measurement for payment will be made for suitable materials removed, manipulated, and replaced to obtain density. Any removal, manipulation, aeration, replacement, and re-compaction of suitable materials necessary to obtain the required density shall be considered incidental to the excavation and embankment operations and shall be performed by the Contractor at no additional cost to the project.

7. Stones or rock fragments larger than 2 inches in their greatest dimension will not be permitted in the top 6 inches of a pavement subgrade

8. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Engineer.

9. Blasting, when necessary, will be permitted only when proper precautions are taken for the protection and safety of all persons, the work, and the property. All damage done to the work or property shall be repaired at the Contractor's expense. All operations of the Contractor in connection with transportation, storage, and use of explosives shall be approved by the Engineer. Any approval given will not relieve the Contractor of his responsibility in blasting operations. If any portion of the Work is over excavated by blasting, that portion will be restored to the plan elevations by filling with suitable material by the Contractor at no additional cost to the City.

10. Blasting for trench rock excavation shall be controlled by limiting particle velocity to 1"- 2" per second at nearby structures. The use of a recording seismograph will be required for all detonations. The use of electrical detonation will not be allowed.

11. No measurement of trench rock excavation will be made until the Contractor demonstrates to the satisfaction of the Engineer that the material encountered must be drilled and blasted. Contractor must demonstrate that a crawler tractor having a minimum Flywheel Horsepower rating of 440 at 2100 RPM, or approved equal, and equipped with a single

tooth ripper compatible with this type and size equipment will not penetrate the material. The specifications of the equipment used by the Contractor for this purpose shall be submitted to the Engineer for approval.

C. Borrow Excavation

Borrow excavation shall consist of the excavation, loading and hauling of material from the Contractor's off Airport borrow area(s). The Contractor shall be totally responsible for paying for and obtaining all permits and meeting all requirements of all Local, State, and Federal Authorities for excavating borrow and hauling the material to the construction site. All cost associated with obtaining and supplying the borrow material shall be included in the cubic yard unit cost of "In-Place Embankment".

1. The borrow excavation shall be handled and placed as specified in these specifications for excavation and embankment.

2. In general, the borrow material supplied shall be of such soil type and gradation that the material has the capability of being tested in accordance with AASHTO T-180 and meets the stability requirements as specified under Section P-152, (02), (g), (11).

3. To maintain the construction schedule, an appropriate portion of the Contactor's borrow material shall consist of a granular type of material that can be placed and compacted during wet conditions.

D. Ditch Excavation.

1. Ditch excavation shall consist of excavating the drainage ditches to the templates, lines, and grades shown on the plans or as directed by the Engineer. The work shall be performed in proper sequence with the other construction. The location of all ditches shall be established on the ground. All satisfactory materials shall be placed in the taxiway or roadway embankments; all unsatisfactory materials shall be disposed of off Airport Property. The Engineer shall decide whether material from a given location is satisfactory. All necessary handwork shall be performed to secure a finish true to line, elevation, and cross-section, as designated.

2. Ditches constructed on the project shall be maintained to the required cross-section and shall be kept free of silt, debris, or obstructions until the project is accepted. Seeding and mulching of the slopes shall be done as soon as practical after the completion of the excavation. All work shall be in accordance with the Georgia Soil and Water Conservation Commission's *Manual for Erosion and Sediment Control in Georgia.*

3. No separate payment shall be made for ditch excavation. Payment for all excavated material shall be made at the contract unit price for "In-Place Embankment", "Backfill", or "Rock Excavation", whichever the case may be.

E. Embankment areas shall be stripped or cleared and grubbed and existing pavement broken up and removed before existing cross sections are taken. Existing ground cross sections shall be taken before construction of the embankment will be permitted to start.

1. Immediately prior to the placing of the fill materials, the entire area upon which the embankment is to be placed, except where limited by rock, shall be scarified and broken by means of a disc harrow or plow, or other approved equipment, to a depth of 6 inches. Scarifying shall be done approximately parallel to the axis of the fill. All roots, debris, large stones, or objectionable material that would cause interference with the compaction of the foundation or fill shall be removed from the area and disposed of as directed by the

Engineer. A thin layer (approximately 3 inches) of the fill material shall be spread over the scarified foundation and the whole area compacted as required in the specifications.

2. Where embankments are to be placed on existing slopes steeper than 3-to-1, horizontal benches shall be constructed. The benches shall be of a width sufficient to allow the placement of a maximum of three lifts of compacted embankment material between successive benches.

3. No direct payment shall be made for the ditch excavation performed under this section. The necessary clearing and grubbing, removal of pavement and the yardage removed will be paid for under the respective items of work as provided for elsewhere within the contract documents.

F. Stripping shall include the removal of all vegetation and organic matter from areas not cleared and grubbed. Grass shall be removed to a depth of approximately 3 inches. No stripping will be required in areas that have been cleared and grubbed. All material excavated during the stripping operation shall be stockpiled at the work site and is to be distributed over the finished grading of the side slopes and infields. The Contractor is to take this into account during the excavation and embankment operations. Payment for stripping operations is included in the pay item for “In-Place Embankment”.

G. Formation of Embankments. Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section.

1. The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankment shall be spread in successive layers as specified.

2. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.

3. The material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform-moisture content of within ±3 points of optimum moisture throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall always be available. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

4. Rolling operations shall be continued until the embankments for the roadways are compacted to not less than 90 % of the maximum density, at moisture content within ±3 points of optimum, as determined by AASHTO T-180 except as modified in Section P-152, 02), (j). Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers.

5. During construction of the embankment, the Contractor shall always route his equipment,

both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

6. In the construction of embankments, starting layers shall be placed in the deepest portion of the fill and the outer areas of the fill to form a surface parallel to the finished grade lines. This surface shall drain away from the terminal/concourse building site and the MSE walls towards the location of the proposed apron drainage systems. The layers shall be constructed approximately parallel to the finished grade line and the drainage systems constructed as the embankment placement progresses.

7. Stone or fragmentary rock larger than 2 inches in their greatest dimension will not be allowed in the top 4 feet of the embankment. All fill material placed in the top 4 feet of the embankment shall be capable of being tested in accordance with AASHTO T-180. If the Contractor proposes to use fill material below 4 feet of the top of the embankment that cannot be tested in accordance with AASHTO T-180 due to the size and amount of rock, the Contractor shall obtain approval from the Engineer prior to the placement of the material. To obtain the approval from the Engineer, the Contractor shall submit a plan for approval that describes the soil/rock mix fill material proposed to be used, including the type and gradation of the material, and how this material shall be brought up in layers to fill voids with the finer materials to form a dense, compacted mass of low compressibility. If the plan is approved, the Contractor shall then be required to demonstrate to the satisfaction of the Engineer in a test section the ability to consolidate and compact the embankment with a suitable mix of rock and finer material before proceeding with the use of this material. Rock or boulders from the project site shall not be disposed of outside of the excavation or embankment areas, except at places and in the manner designated by the Engineer. Rock may be incorporated into the embankment provided that the larger sections are well separated, and soil is worked and blended with the rock. No rock or broken pavement materials larger than 6 inches shall be placed in the embankments within ten feet (10') of the toe of slope or the slope face.

8. Material available in this stockpile on site is mixed dirt and rock, with a particle size of 4 inches and less. This material may not be used above an elevation 4' below finished subgrade, unless the contractor can successfully segregate the larger particles to produce a mix that will meet the requirements of paragraph 7 above.

9. When rock, from on the Airport project site, is of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment in layers as approved by the Engineer. The Contractor shall demonstrate to the Engineer in a test section the ability to consolidate and compact this material to the satisfaction of the Engineer before proceeding with use of this material. These lifts shall not be constructed above an elevation 4 feet below the finished subgrade.

10. Frozen material shall not be placed in the embankment, nor shall embankment be placed upon frozen material.

11. The Contractor shall be responsible for the stability of all embankments made under this contract and shall conduct all testing required at each borrow source and at the embankment to determine the angle of internal friction and the cohesion soil strength based on the ninety percent (90%) modified density within ±3 points of optimum moisture content as determined by AASHTO T-180 specification. Higher densities may be required on some soils to increase the soil strength in order to meet the stability requirements for

the embankments. Borrow source material shall conform to the safe zone combination illustrated in the chart shown in Appendix 1 (P-152).

12. Following site demolition, prior to placement of embankment, the exposed ground surface shall be densified by rolling with a large, vibratory roller (CAT-CB564D or similar) making at least 2 complete passes in two perpendicular directions. Following densification, the site shall be proof rolled under the observation of the geotechnical engineer. Proof rolling shall be conducted with a fully loaded, tandem axle dump truck or similar pneumatic tired vehicle of about 30 tons gross weight. The purpose of proof rolling will be to detect weak or soft surficial zones that may require additional treatment prior to placement of embankment.

    No embankment shall be placed until the required stripping, pavement removal, or unsuitable material removal, whichever the case may be, has been completed and the Contractor has taken cross-sections as directed by the Engineer.

H. Selective Grading Selective grading shall consist of fine grading of areas where the existing ground is generally within +/- two feet of the grades shown in the plans or as directed by the Engineer. Cut areas shall meet the requirements specified under Section P-152, 02), (b) Excavation. Embankment areas shall meet the requirements specified under Section P-152, 02), (g) Formation of Embankments. The exact limits of selective grading shall be established by the Engineer with the Contractor in the field prior to any operations by the Contractor in the areas designated.

I. Equipment. The Contractor, unless otherwise specified, may use any type of earth-moving, compaction, and watering equipment he may desire or has at his disposal, provided the equipment is in a satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the Contractor and as approved by the Engineer in accordance with the total calendar days or working days bid for the construction. The Contractor shall furnish, operate, and maintain such equipment as is necessary to control uniform density, layers, section, and smoothness of grade.

J. Preparation and Protection of the Top of the Subgrade.

1. When completed, the subgrade shall be true to the lines, grades, and cross-sections shown on the plans or as directed by the Engineer. After all drains, structures, ducts, and other underground appurtenances, except transverse and longitudinal underdrains along the edges or under the pavement have been completed, the subgrade shall be compacted to the depths and densities specified herein.

    Preparation of subgrade for all areas where pavement is to be placed under this contract shall be scarified and compacted for a depth of 24 inches below soil cement level, to a density of not less than 95% of the maximum density, at optimum moisture, as determined by AASHTO T-180. Payment for this work is to be included in the contract unit price for "Preparation of Subgrade".

2. After grading operations are complete, all loose stones larger than two (2) inches in their greatest dimension shall be removed from the surface of all proposed graded paving areas and disposed of as directed by the Engineer.

3. When all manipulation and shaping is complete, the subgrade is to be proof rolled by completely covering it twice (two passes) with a pneumatic tired roller weighing at least fifty (50) tons with four (4) tires of equal bearing pressure and 90 pounds per square inch of tire pressure. Any irregularities or depressions that develop under proof rolling shall be corrected by loosening the material at these places and adding, removing, or replacing

material until the surface is smooth and uniform. Any portion of the area that is inaccessible to a roller shall be compacted with mechanical tampers. The material shall be sprinkled with water during compaction operations as directed by the Engineer.

Earthwork constructed under this contract and scheduled for paving under future contracts shall be proof rolled as specified above. There shall be no specific payment for this work and the cost thereof included in the unit price bid for “In-place Embankment”.

Payment for proof rolling and correcting irregularities shall be included in the contract unit price for "Preparation of Subgrade", for earthwork constructed under this or previous contracts, and scheduled for paving under this contract.

4. At all times, the top of the subgrade shall be kept in such condition that it will drain readily and effectively. The Contractor shall take all precautions necessary to protect the subgrade from damage. This includes limiting of hauling over the finished subgrade to that which is essential for construction purposes. All ruts or rough places that develop in a completed subgrade shall be smoothed and recompacted. No subbase, base, surface course, or pavement shall be placed on the subgrade until the subgrade has been approved by the Engineer.

K. Haul. No payment will be made separately or directly for haul on any part of the work. All hauling will be considered a necessary and incidental part of the work, and its cost shall be considered by the Contractor and included in the contract unit price for the pay items of work involved.

L. Tolerances. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 16 foot straightedge applied parallel and at right angles to the center-line, it shall not show any deviation in excess of 1/2 inch, or shall not be more than 0.04 foot from true grade as established by grade hubs or pins. Any deviation more than these amounts shall be corrected by loosening, adding, or removing materials, reshaping, and recompacting.

On all other areas outside the pavement, base or subbase limits, the surface shall be of such smoothness that it will not vary more than 0.10 of a foot from true grade as established by grade hubs. Any deviation more than this amount shall be corrected by loosening, adding or removing materials, and reshaping.

M. Testing. Compaction tests will be made for each 500 s.y. on each layer of each area of embankment or backfill and each 200 s.y. of each area on finished subgrade. Sufficient soil classification tests shall be made each 200 s.y. to accurately determine the classification of the top two feet of finished subgrade. Elevations of finished grades of the subgrade under the pavement area shall be checked to ensure proper thickness and grades of base and surface to be placed thereon.

N. Testing Procedures. The maximum density shall be determined by the appropriate method shown below:

1. Where all of the material passes a No. 4 sieve, use AASHTO T-180, Method A (or B).

2. Where the material contains particles larger than a No. 4 sieve, use AASHTO T-180, Method C (or D).

3. Where the material contains particles larger than 3/4 inch, follow the replacement procedure given in the note under Method C of AASHTO T-180.

The field density shall be determined in accordance with AASHTO T-191, ASTM D-1556, ASTM D-2937 or ASTM D-2922. ASTM D-2922 may be used if a minimum of every tenth test is run in accordance with AASHTO T-191, ASTM D-1556 or ASTM D-2937, for calibration. AASHTO T-224 shall determine the correction for coarse particles in the soil compaction tests.

The field moisture content shall be determined in accordance with AASHTO T-217, or ASTM D-2216.

3.0 METHOD OF MEASUREMENT

A. The quantity of "In-Place Embankment" to be paid for shall be the number of cubic yards measured in their final position. Fill settlement, if any, will not be measured for payment. Quantities for monthly estimates may be computed with equipment of Contractor's choosing. The final quantity shall be computed by the average end area method using existing ground cross-sections taken after the area has been prepared for placement of embankment and final cross-sections taken by the Contractor after the material has been placed and compacted.

B. No specific measurement for payment will be made for Excavation, other than the rock items listed below.

C. The quantity of "Backfill" to be paid for shall be the number of cubic yards measured in their final position. The quantity shall be computed by the average end area method using cross-sections taken by the Contractor after any unsuitable material has been removed and final cross-sections taken by the Contractor upon completion of backfill operations.

D. The quantity of "Preparation of Subgrade" to be paid for shall be the number of square yards measured in its final position as shown on the typical section on the plans.

E. No specific measurement for payment will be made for "Borrow Excavation".

F. The quantity of Rock or Trench Rock Excavation authorized and accepted by the Engineer to be paid for shall be the number of cubic yards measured. The quantity shall be computed by the average end area method using cross-sections taken before excavation of rock starts and after it is finished. The area used for calculations shall not exceed the neat line pay limits shown on the plans, where applicable. The measurement will include over-breakage unless caused by the negligence of the Contractor. Measurement will be made as "Trench Rock Excavation" for rock removed from pipe or utility trenches and as "Rock Excavation" for various structures such as manholes or vaults.

G. The quality of excess embankment to be authorized for payment shall be based on documented truck counts, after the Engineer and Contractor have agreed upon a volume of cubic yards per truck.

4.0 BASIS OF PAYMENT

A. Payment shall be made at the contract unit price per cubic yard for "In-Place Embankment". This price shall be full compensation for all borrow material supplied, on site excavation, loading and hauling to various site locations and the formation and compaction of embankments, preparations and completions of ditches and dikes, and for furnishing all materials, labor, equipment, tools and incidentals necessary to complete the item.

B. No payment shall be made for "On Site Excavation". The cost of this work shall be included in the unit price for "In-Place Embankment".

C. Payment shall be made at the contract unit price per cubic yard for "Backfill". This price shall be full compensation for excavation of unsuitable material, obtaining suitable material, hauling, and placing of backfill and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

D. Payment shall be made at the contract unit price per square yard for "Preparation of Subgrade". This price shall be full compensation for compacting, shaping, and proof rolling the subgrade, removing unsuitable material, and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

E. Payment shall be made at the contract unit price per cubic yard for "Trench Rock Excavation". This price shall be full compensation for blasting, excavation, loading and hauling to the final location and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

F. Payments shall be made at the contract unit price per cubic yard for "Rock Excavation". This price shall be full compensation for blasting, excavation, loading and hauling to the final location and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

G. Payment shall be made at the contract unit price per cubic yard for excess embankment. This price shall be full compensation for loading, hauling and delivery to the recycled materials jobsite.

H. Payment will be made under:

Item P-152-1 In-Place Embankment - Per Cubic Yard.

Item P-152-2 Backfill - Per Cubic Yard.

Item P-152-3 Preparation of Subgrade - Per Square Yard.

Item P-152-4 Trench Rock Excavation - Per Cubic Yard.

Item P-152-5 Rock Excavation - Per Cubic Yard.

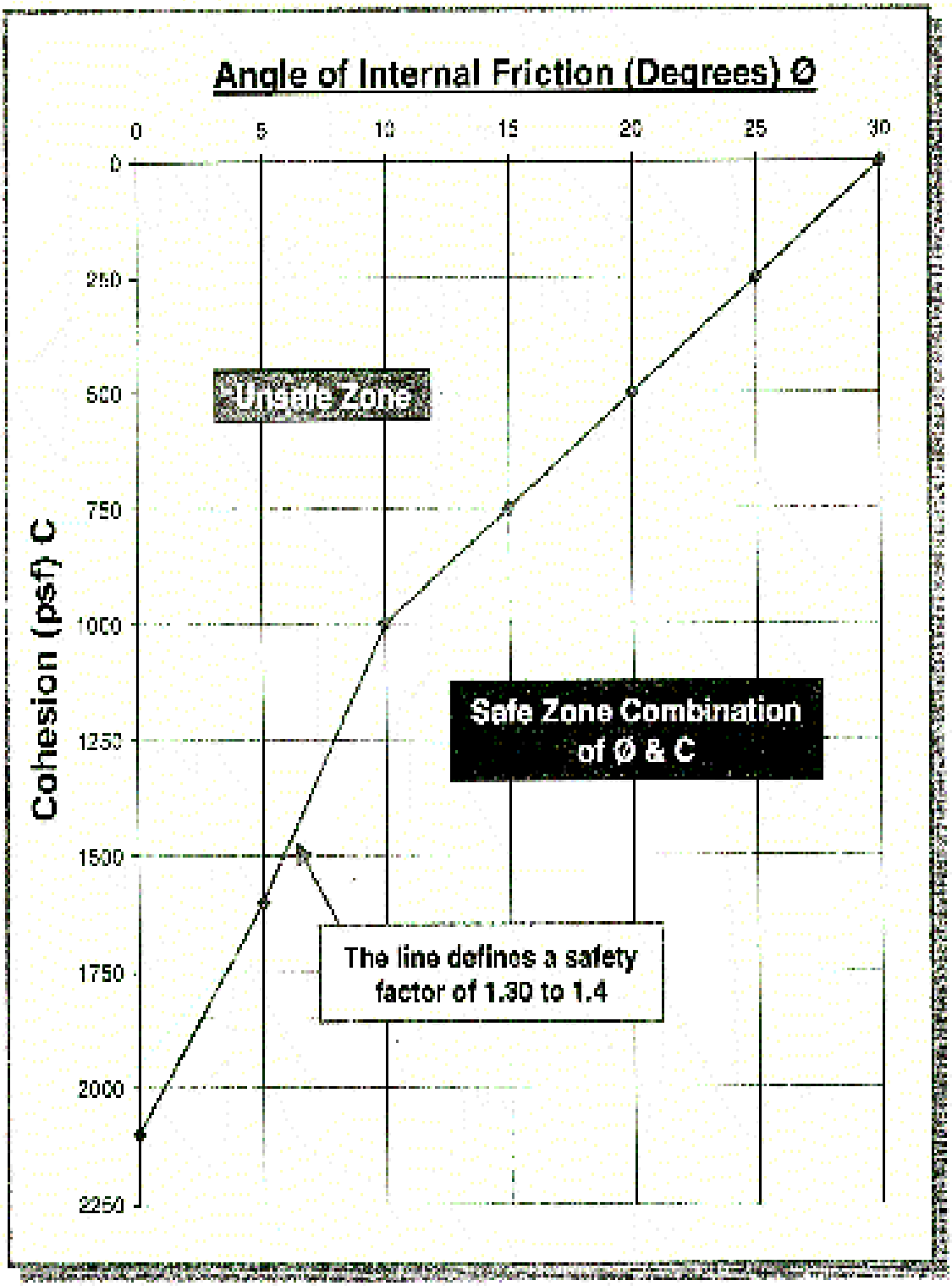
Item P-152-6 Excess Embankment - Per Cubic Yard

TESTING AND MATERIAL REQUIREMENTS

Testing and short title	Material and short title
AASHTO T-180	Moisture Density Relation
None	None
AASHTO T-191, ASTM D-1556, D-2937 or D-2922, AASHTO T-224	Field Density
AASHTO T-217 or ASTM D-2216	Moisture Content

END OF SECTION P-152

Appendix 1


Angle of Internal Friction (Degrees) Ø
0
5
10
15
20
25
30
Cohesion (psf) C
0
250
500
750
1000
1250
1500
1750
2000
2250
Unsafe Zone
Safe Zone Combination of Ø & C
The line defines a safety factor of 1.30 to 1.4

SECTION P-209 - CRUSHED AGGREGATE BASE COURSE

1.0 DESCRIPTION

A. This item consists of a base course composed of crushed aggregates or recycled concrete base constructed on a prepared surface in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.

B. This item includes constructing a surface course composed of crushed aggregate base material on a prepared surface in accordance with these specifications and in conformity to the dimensions and typical cross sections shown on the plans.

2.0 MATERIALS

A. Aggregates shall consist of clean, sound, durable particles of crushed stone or crushed gravel and shall be free from coatings of clay, silt, vegetable matter, and other objectionable materials and shall contain no clay balls. Fine aggregate passing the No. 4 sieve shall consist of fines from the operation of crushing the coarse aggregate. If necessary, fine aggregate may be added to produce the correct gradation. The fine aggregate shall be produced by crushing stone or gravel that meet the requirements for wear and soundness specified for coarse aggregate.

The crushed aggregate portion which is retained on the No. 4 sieve shall contain not more than 15 percent, by weight, of flat and/or elongated pieces exceeding a ratio of 5:1 between maximum and minimum dimensions as tested in accordance with ASTM D 4791, and shall have at least 90 percent by weight of particles with at least two fractured faces and 100 percent with at least one fractured face. The area of each face shall be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures shall be at least 30 degrees to count as two fractured faces.

The percentage of wear shall not be greater than 45 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss shall not exceed 12 percent, after 5 cycles, when tested in accordance with ASTM C 88.

The fraction passing the No. 40 sieve shall have a liquid limit no greater than 25 and a plasticity index of not more than 4 when tested in accordance with ASTM D 4318. The fine aggregate shall have a minimum sand equivalent value of 35 when tested in accordance with ASTM D 2419.

1. Aggregates for preliminary testing shall be furnished by the Contractor prior to the start of production. Except as otherwise specified, all tests for initial aggregate submittals necessary to determine compliance with the specification requirements will be made by the Engineer at no expense to the Contractor.

   Samples of aggregates shall be furnished by the Contractor at the start of production and at intervals during production. The sampling points and intervals will be designated by the Engineer. The samples will be the basis of approval of specific lots of aggregates from the standpoint of the quality requirements of this section.

   In lieu of testing, the Engineer may accept certified state test results indicating that the aggregate meets specification requirements.

Samples of aggregates to check gradation shall be taken by the Engineer at least once daily. Sampling shall be in accordance with ASTM D 75, and testing shall be in accordance with ASTM C 136 and C 117.

2. The gradation (job mix) of the final mixture shall fall within the design range indicated in Table 1, when tested in accordance with ASTM C 117 and C 136. The final gradation shall be continuously well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on an adjacent sieve or vice versa.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Size	Design Range Percentage by Weight Passing Sieves	Job Mix Tolerances Percent
2 in (50.0 mm)	100	0
1-1/2 (37.0 mm)	95-100	+/- 5
1 in (25.0 mm)	70-95	+/- 8
3/4 in (19.0 mm)	55-85	+/- 8
No. 4 (4.75 mm)	30-60	+/- 8
No. 30 (0.60 mm)	12-30	+/- 5
No. 200 (0.075 mm)	0-8	+/- 3

The job mix tolerances in Table 1 shall be applied to the job mix gradation to establish a job control grading band. The full tolerance still will apply if application of the tolerances results in a job control grading band outside the design range.

The fraction of the final mixture that passes the No. 200 sieve shall not exceed 60 percent of the fraction passing the No. 30 sieve.

B. If used to construct the base course, Recycled Concrete Base materials shall meet the requirements of Section 815.2.03 Recycled Concrete Base, of the Georgia Department of Transportation Special Provision 815 – Graded Aggregate and all other sections referenced therein.

3.0 CONSTRUCTION METHODS

A. The underlying surface shall be checked and accepted by the Engineer before placing and spreading operations are started. Any ruts or soft yielding places caused by improper drainage conditions, hauling, or any other cause shall be corrected at the Contractor's expense before the base course is placed thereon. Material shall not be placed on frozen surfaces.

1. Weather Limitations. Do not construct base course when atmospheric temperature is below 35 degrees F or when rainfall or other weather conditions detrimentally affect the quality of the finished course.

B. The aggregate shall be uniformly blended during crushing operations or mixed in a plant. The plant shall blend and mix the materials to meet the specifications and to secure the proper moisture content for compaction. Delivery, storage, placement, and rolling procedures shall not cause damage, segregation, or contamination to the blended and mixed materials.

C. The crushed aggregate base material or crushed aggregate surface course material shall be placed on the moistened underlying surface in layers of uniform thickness with a mechanical spreader.

The maximum depth of a compacted layer shall be 8 inches. If the total depth of the compacted material is more than 8 inches, it shall be constructed in two or more layers. In multi-layer construction, the base course shall be placed in approximately equal-depth layers.

The previously constructed layer shall be cleaned of loose and foreign material prior to placing the next layer. The surface of the compacted material shall be kept moist until covered with the next layer.

D. Immediately upon completion of the spreading operations, the crushed aggregate shall be compacted full depth to not less than 100 percent maximum density as determined by ASTM D 1557. The number, type, and weight of rollers shall be sufficient to compact the material to the required density.

The moisture content of the material during placing operations shall not be below, nor more than 1-1/2 percentage points above, the optimum moisture content as determined by the ASTM method specified for determining maximum density.

E. The surface of the aggregate base course shall be finished by blading or with automated equipment especially designed for this purpose.

In no case will the addition of thin layers of material be added to the top layer of base course to meet grade. If the elevation of the top layer is 1/2 inch or more below grade, the top layer of base shall be scarified to a depth of at least 3 inches, new material added, and the layer shall be blended and recompacted to bring it to grade. If the finished surface is above plan grade, it shall be cut back to grade and rerolled.

F. The finished surface shall not vary more than 3/8 inch when tested with a 16-foot straightedge applied parallel with and, when practical, at right angles to the centerline. Any deviation more than this amount shall be corrected by the Contractor at the Contractor's expense.

G. The base course or surface course shall be maintained in a condition that will meet all specification requirements until the work is accepted. Equipment used in the construction of an adjoining section may be routed over completed portions of the base course, provided no damage results and provided that the equipment is routed over the full width of the base course to avoid rutting or uneven compaction.

4.0 METHOD OF MEASUREMENT

A. The quantity of crushed aggregate base course, composed of crushed aggregate or recycled concrete base course, to be paid for will be determined by measurement of the number of cubic yards of material constructed and accepted by the Engineer as complying with the plans and specifications.

B. The quantity of crushed aggregate surface course to be paid for will be determined by measurement of the number of cubic yards of material constructed and accepted by the Engineer as complying with the plans and specifications.

5.0 BASIS OF PAYMENT

A. Payment shall be made at the contract unit price per cubic yard for either crushed aggregate base course or recycled concrete base, under Item P-209-1. Crushed aggregate surface course will be paid for at the contract unit price per cubic yard under Item P-209-2. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

B. Payment will be made under:

Item P-209-1	Crushed Aggregate Base Course - Per Cubic Yard
Item P-209-2	Crushed Aggregate Surface Course - Per Cubic Yard

TESTING REQUIREMENTS

ASTM C 88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 117 Materials Finer than 75-micron (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 Sieve Analysis of Fine and Coarse Aggregate

ASTM D 75 Sampling Aggregates

ASTM D 422 Particle-Size Analysis of Soils

ASTM D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 k N-m/m^3)

ASTM D 1556 Density and Unit Weight of Soil in Place by the Sand - Cone Method

ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft- lbf/ft^3 (2,700 kN-m/m^3))

ASTM D 1883 CBR (California Bearing Ratio) of Laboratory-Compacted Soils

ASTM D 2167 Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2419 Sand Equivalent Value of Soils and Fine Aggregate

ASTM D 2922 Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 3665 Random Sampling of Construction Materials

ASTM D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D 4791 Flat Particles, Elongated Particles, or Flat and Elongated Particles In Coarse Aggregate

END OF SECTION

SECTION P-501 PORTLAND CEMENT CONCRETE PAVEMENT

1.0 DESCRIPTION

A. This work shall consist of pavements composed of Portland Cement Concrete, with or without reinforcements as specified, constructed on a prepared subgrade or subbase course in accordance with these specifications and shall conform to the thickness and typical cross sections shown on the plans and with lines and grades established by the Contractor.

B. This section shall also include the replacement of damaged and/or deficient soil cement stabilized base course, and capping of underdrain trenches with low slump, low strength concrete. Mix design and placement methods shall be in general accordance with the requirements of this section.

2.0 MATERIALS

All aggregates shall be sourced from producers on the most recent Georgia Department of Transportation Office of Materials and Research Qualified Products List. Gradation will be performed at the frequency of one per day for each material for each day of the stockpiling or production.

All aggregates, including sand and stone, for use in concrete shall be tested for alkali-aggregate reaction in accordance with either ASTM C1260 or ASTM C1293. Expansions less than 0.08% at 14 days in the caustic soak solution in ASTM C1260 or less than 0.04% at one year in ASTM C1293 shall indicate that the aggregate is considered non-deleteriously reactive. Aggregates at or above these limits shall be considered potentially deleteriously reactive.

Use of aggregates at or above these limits (i.e., aggregates that are potentially deleteriously reactive) shall require testing of the proposed concrete mix design to demonstrate control of deleterious expansion from ASR. The tests to demonstrate control of the mix shall be either a modified version of ASTM C1260 or ASTM C1293. The modification is that any mineral admixtures in the mix design shall be included in the cementitious portion of the batch of materials to be tested, and at the same weight percentages as designed for use in the concrete mixture being evaluated. Expansions less than 0.08% at 28 days in the caustic soak solution in the modified ASTM C1260 or less than 0.04% at two years in the modified ASTM C1293 shall be indicative of control of deleterious expansions from ASR (Alkali-Silica Reaction).

Aggregates shall also be tested for alkali-carbonate reaction in accordance with the criteria stated in ASTM C33. Aggregates shown to be alkali-carbonate reactive shall not be used.

A. Fine Aggregate. Fine aggregate for concrete shall be natural sand and shall conform to the requirements of ASTM C33 and AASHTO M-6 and shall meet the gradation requirements of Table I.

TABLE I

Gradation For Fine Aggregate

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieve
3/8 Inch	100
No. 4	95-100
No. 16	45-80
No. 30	25-55
No. 50	10-30
No. 100	2-10

B. Coarse Aggregate. Coarse aggregate for concrete shall conform to the requirements of ASTM C33 and AASHTO M80. Coarse aggregate shall be furnished in the two separate sizes as shown in Table II. The coarse aggregate shall show no more than 47% wear when tested in accordance with ASTM C131 and/or ASTM C535.

TABLE II

Gradations From 1-1/2 Inch to No. 4

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves (AASHTO T-27)						
	2"	1-l/2"	1"	3/4"	3/8"	No. 4	No. 8
1-1/2" to 3/4"	100	90-100	20-55	0-15	0-5	-	-
3/4" to No. 4	-	-	100	90-100	10-55	0-10	0-5

C. Cement. The cement used shall be Portland cement conforming to one of the following specifications:

Portland Cement ..... ASTM C150, Type I or Type II

Cement supplied for use in concrete shall be of the low alkali type, the total alkali content to be less than 0.40%.

If for any reason cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

A minimum of five and one-half (5½) bags of Portland cement, at 94#/bag, per cubic yard of concrete shall be used in the mix.

D. Pre-molded Joint Filler. Pre-molded joint filler for expansion joints shall conform to the requirements of AASHTO M 213 and shall be punched to admit the dowels were called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Engineer.

E. Joint Sealer. The joint sealer for the joints in the concrete pavement shall be as specified in

Section P-605 Joint Sealing Filler.

F. Dowel and Tie Bars. Dowel and tie bars shall conform to the requirements of AASHTO M 31 or AASHTO M 42, except that rail steel shall not be used for tie bars that are to be bent or re-straightened during construction. Tie bars shall be deformed bars. Dowel bars shall be plain round bars of the size specified and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site, one-half of the length of each dowel bar shall be painted with one coat of paint.

G. Water. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. Water will be tested in accordance with and shall meet the suggested requirements of AASHTO T-26. Water known to be of potable quality may be used without testing. Where the source of water is relatively shallow, the intake shall be so enclosed as to exclude silt, mud, grass, or other foreign materials.

H. Cover Materials For Curing. Curing materials shall be liquid membrane-forming compounds for curing concrete and shall conform to ASTM C 309, Type 2, Class B. Apply at the rate of no more than 125 square feet per 1 gallon.

I. Admixtures. The use of any material added to the concrete mix shall be approved by the Engineer. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below for the admixtures for which approvals are desired. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests will be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

Pozzolanic admixtures shall be fly ash meeting the requirements of ASTM C-350 or raw or calcined natural pozzolans meeting the requirements of ASTM C-402.

Air-entraining admixtures shall meet the requirements of AASHTO M 154 or ASTM C-260. Concrete to be tested for approval shall be made with the cement and aggregate to be used in the work and shall contain an air content of 4% to 6% by volume of the concrete mixture, as determined by ASTM C-231.

Water-reducing, set-controlling mixture shall meet the requirements of ASTM C-494, Type A, water-reducing or Type D, water-reducing and retarding and shall be added to all mixes. Type A shall be added when temperatures are below 65°F., and Type D when temperatures are above 65°F. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions. The water-reducing, set-controlling and retarding admixtures shall not contain calcium chloride or chloride containing compounds as a functional ingredient.

J. Fly Ash. Fly ash shall be used as an additive in concrete to promote workability and plasticity. Fly ash shall be used as a partial replacement for portland cement in concrete in accordance with the following:

1. The quantity of fly ash in the mix shall be 25% of the weight of total cementitious material (i.e., Portland cement plus fly ash).

2. The fly ash shall conform to ASTM C-618, Type F, except that the loss on ignition shall not exceed 3%. The fly ash should have a maximum of 1.5% available alkali and a maximum 6% CaO.

3. Separate facilities must be provided for the fly ash such that it will be stored in the same fashion as cement and batched and weighed to the same degree of accuracy as required for cement. The same scales may be used for weighing both cement and fly ash provided they are handled as a separate operation.

4. The Contractor shall assume full responsibility for obtaining concrete having the minimum strength requirements set forth in the specifications.

K. Steel Reinforcement. Deformed welded wire fabric conforming to the requirements of AASHTO M-55 or M-221 shall be used where specified on the plans.

3.0 CONSTRUCTION METHODS

A. Equipment. Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition. The equipment shall be at the job site sufficiently before the start of construction operation for examination and approval.

1. Batching Plant and Equipment.

a. General. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If bulk cement is used, a bin, hopper, and separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation.

b. Bins and Hoppers. Bins with adequate separate compartments for fine aggregate and for each required size of coarse aggregate shall be provided in the batching plant. Each compartment shall discharge efficiently and freely into the weighting hopper. Means of control shall be provided so that, as the quantity desired in the weighing hopper is approached, the material may be added slowly and shut off with precision. A port or other opening for removing an overload of any one of the several materials from the hopper shall be provided. Weighing hoppers shall be constructed to eliminate accumulations of tare materials and to discharge fully.

c. An automatic recording device capable of recording all of the individual ingredients of the mix shall be installed at the point of manufacture of the concrete.

d. Scales. The scales for weighing aggregates and cement shall be of either the or the spring less dial type. They shall be accurate within 0.5% throughout their range of use. When beam-type scales are used, provision, such as "tell-tale" dial, shall be made for indicating to the operator that the required load in the weighing hopper is being approached.

A device on the weighing beams shall clearly indicate critical position. Poises shall be designed to be locked in any position and to prevent unauthorized change. The weight beam and "tell-tale" device shall be in full view of the operator while charging the hopper, and they shall have convenient access to all controls.

Scales shall be inspected and sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten 50-pound weights for frequent testing of all scales.

2. Mixers

a. General. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

A device, accurate within 3% and satisfactory to the Engineer, shall be provided at the mixer for determining the amount of air-entraining agent that is added to each batch requiring such admixture.

Mixers shall be examined daily for the accumulation of hard concrete or mortar and the wear of blades.

b. Mixers at construction sites. Mixing shall be in an approved mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warning device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, providing that each batch is mixed 90 seconds. The mixers shall be cleaned at suitable intervals. The pickup and throwover blades in the drum(s) shall be repaired or replaced when they are worn down 3/4 inch or more. The Contractor shall have available at the job site a copy of the manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth, or provide permanent marks on blades to show points of 3/4 inch wear from new conditions. Drilled holes of 1/4 inch diameter near each end and at the midpoint of each blade are recommended.

c. Central plant mixers. Mixers for central plant mixing (plant mixer, revolving drum type mixer, single opening revolving truncated drum mixer, and a revolving drum charging at one end and discharging at the other end) shall have attached thereto, in a prominent place by the manufacturer, a metal plate or plates on which is plainly marked the various uses for which the equipment is designed, the normal capacity (in cubic feet) of the drum or container in terms of the volume of mixed concrete, and the speed of rotation of the mixing drum or blades. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed. The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer.

The mixers shall be cleaned at suitable intervals. They shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or to wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch or more. The Contractor shall provide the Engineer with a copy of the manufacturer's design showing dimensions and arrangement of blades in reference to original height and depth.

d. Truck Mixers and Truck Agitators. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central mixed concrete, shall conform to the requirements of AASHTO M 157.

e. Non-agitator Trucks. Non-agitating hauling equipment shall conform to the requirements of AASHTO M 157.

3. Finishing Equipment.

a. Finishing machine. The finishing machine shall be self-propelled and equipped with at least two oscillating type transverse screeds.

b. Vibrators. Vibrators, for full width vibration of concrete paving slabs, may be either the surface pan type or the internal type with either immersed tube or multiple spuds. They may be attached to the spreader or the finishing machine, or they may be mounted on a separate carriage. They shall not come in contact with the joint, load transfer devices, subgrade, or side forms. The frequency of the surface vibrators shall be not less than 3,500 impulses per minute and the frequency of the internal type shall be not less than 5,000 impulses per minute for tube vibrators and not less than 7,000 impulses per minute for spud vibrators.

When spud internal vibrators are used adjacent to forms, they shall have a frequency of not less than 3,500 impulses per minute.

4. Concrete Saw. When sawing of joints is elected or specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be always maintained at the site of the work during sawing operations.

The Contractor shall provide adequate artificial lighting facilities for night sawing. All this equipment shall always be on the job both before and during concrete placement. Immediately after the initial sawing, the Contractor shall flush out the slurry in the joint with water and install a backer rod slightly larger in diameter than the width of the saw cut, at the bottom of the saw cut. The length of the backer rod shall be extended approximately 6" beyond the slab edge for future overlap of the adjacent slab.

5. Forms. Straight side forms shall be made of metal having a thickness of not less than 7/32” and shall be furnished in sections of not less than 10 feet in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than two-thirds the height of the form. Forms with battered top surfaces, and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than ¼ inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting.

B. Form Setting. Forms shall be set sufficiently in advance of the concrete placement. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10-foot section. A pin shall be placed at each side of every joint. Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/4 inch at any point.

Excessive settlement or springing of forms under the finishing machine will not be tolerated. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

C. Conditioning of Underlying Course. Ruts or depressions caused by hauling or usage of other equipment shall be filled, as they develop, with suitable material to the satisfaction of the Engineer. A multiple-pin template weighing not less than 1,000 pounds (per 20-foot machine) or other approved template shall be provided and operated on the forms immediately in advance of the placing of the concrete. If the mixer is operated upon the grade, the template shall be operated between the mixer and the spreader; in any case, it shall be propelled only by hand and plates shall be adjustable so that they may be set and maintained at the correct contour of the underlying course. The adjustment and operation of the template shall be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material shall be removed. If the grade is found to be below the true elevation, the depressions shall be filled with approved material and thoroughly compacted to the proper cross section by rolling or tamping with a hand tamp.

1. The template shall be maintained in accurate adjustment, always by the Contractor, and should be checked daily.

2. The work described under the foregoing paragraphs does not contemplate a regular sub-grading operation, but rather a final accurate check of the underlying course.

D. Handling, Measuring and Batching Materials. The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be built up in layers of not more than 3 feet in thickness. Each layer shall be completely in place before beginning the next, which shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different gradings shall not be stockpiled together.

1. Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner to secure the specified grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. In case the aggregates contain high or nonuniform moisture content, storage or stockpile periods in excess of 12 hours may be required by the Engineer.

2. The fine aggregate and each size of coarse aggregate shall be separately weighed into hoppers in the respective amounts set by the job mix. Cement shall be measured by the sack or by weight. Separate scales and hoppers, with a device to indicate positively the complete discharge of the batch of cement into the batch box or container, shall be used for weighing the cement. Ninety-four pounds of bulk cement shall be considered one sack. Batches involving fractional sacks shall not be allowed, except when bulk cement is used.

3. When mixing is at the site of the work, aggregates shall be transported from the batching plant to the mixer in batch boxes, vehicle bodies, or other containers of adequate capacity and construction to properly carry the volume required. Partitions separating batches shall be adequate and effective to prevent spilling from one compartment to another while in transit or while being dumped. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper or transporting container or into the

batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance of the actual presence in each batch of the entire cement content specified.

4. Bulk cement shall be transported to the mixer in tight compartments capable of carrying the full amount of cement required for the batch, or if permitted, between the fine and coarse aggregate. When cement is placed in contact with the aggregates, batches may be rejected unless mixed 1-1/2 hours of such contact. Cement in original shipping packages may be transported on top of the aggregates, each batch containing the number of sacks required by the job mix.

5. Batches shall be delivered to the mixer separately and intact. Each batch shall be dumped into the mixer without loss of cement, and when more than one batch is carried on the truck, it shall be dumped without spilling of material from one batch compartment into another. Batching shall be conducted so that the results in the weights of each material required will be within a tolerance of 1% for cement and 2% for aggregates.

6. Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within ±1% of required amounts. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. The measuring tank shall be equipped with an outside tap and valve to provide checking of the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

   Methods and equipment for adding air-entraining agent or other admixtures to the batch, when required, shall be approved by the Engineer. All admixtures shall be measured into the mixer with an accuracy of ±3%.

E. Proportions.

1. At least thirty (30) days prior to the start of concrete paving operations and after approval of all material to be used in the concrete, the Contractor shall submit the proportions of the material to produce the specified flexural strength of 650 psi at 28 days and 735 psi at 90 days. During the mix design process, additional beams shall be made to determine the strength at 24 hours, 36 hours and 48 hours. The Contractor shall submit for approval the job mix formula, at his expense, to the Engineer at least thirty (30) days prior to construction. The proportioning shall be approved in writing by the Engineer to the Contractor. Should a change in sources of materials be made, or if different sources of materials are to be used, proportions for these materials shall also be approved in writing by the Engineer before said materials are incorporated into the mix. The approved mix shall be a workable concrete designed for a two and a half (2-1/2) inches slump, with two (2) inches as the minimum and three (3) inches as the maximum allowable in any specimen and an air content of 4% to 6%.

2. The mix design for the low slump, low strength concrete shall follow the general requirements of this section. The concrete shall be designed for a 1" to 2" slump, 5% to 7% air content and a 7-day compressive strength of 2000 psi. The low slump concrete shall also be used for capping the underdrain trenches, duct banks, and conduit trenches in the base materials.

   The mix design procedure shall include testing for gradation, specific gravity, fineness modulus, dry rodded unit weight, abrasion, compressive and tensile strengths of cement, slump, air, yield, strength, time of set, shrinkage, and statistical analysis. Sufficient beams shall be cast during the mix design process to adequately determine the strengths at 3 days,

7 days, 14 days, 28 days, and 90 days to ensure compliance with the requirements of the contract documents.

During construction, the Contractor shall make at least seven (7) beams for each 200 cubic yards, or fraction thereof, placed. Each individual three (3), seven (7) twenty-eight (28) day flexural strength test, consisting of the average of two (2) beam breaks, shall represent that amount of concrete each side of the test location midway to the adjacent test locations or to end of lane, whichever is applicable. The quantity of concrete represented by each test shall be as near as practical to the specified frequency. Beams shall be tested at three (3) and seven (7) twenty-eight (28) and ninety (90) days. The flexural strength average of any four (4) consecutive strength tests, tested at the end of twenty-eight (28) days, shall have an average flexural strength equal to or greater than the specified flexural strength. When an individual 28-day test falls below 650 psi, the Contractor will be required to core the test location and have tests conducted in accordance to ASTM C496, at no additional cost to the City. The Contractor shall be responsible for establishing the relationship between flexural strength and the splitting tensile strength to the satisfaction of the Engineer. When the test specimens fail to conform to the requirements for strength, the Engineer shall have the right to order changes in the concrete sufficient to increase the strength to meet these requirements.

In order to monitor quality control the Contractor shall make test beams and the Contractor shall provide the concrete and adequate facilities for sampling, making, (including the beam molds), storing, curing, and breaking the beams in accordance with the ASTM specifications, at facilities set up by the Contractor at the worksite. Complete records shall be maintained on a daily basis, showing the location, age, test results, standard deviation, consecutive four (4) average, remarks and other data necessary to monitor quality control.

Should any portion of the concrete pavement fail to meet the requirement of the average four (4) consecutive twenty-eight (28) day flexural strength tests, the following shall apply:

a. Twenty-eight (28) day strengths shall be adjusted for any variation from design strengths in proportion to the square of the thickness as follows:

b. **fs** adjusted = $\frac{t^2 \text{ actual}}{t2 \text{ design}}$ X **fs** actual

Where: t_{actual} = actual pavement thickness

t_{design} = design thickness

fs_{actual} = actual 28-day flexural strength

$fs_{adjusted}$ = adjusted 28-day flexural strength

c. If the concrete pavements fail to meet the strength tests after adjustment for thickness, the unit price shall be adjusted for that quantity of concrete as defined by the 200 cubic yards, or 500 cubic yards represented by the beam specimens.

TABLE III

Adjusted Deficiency in Flexure Strength-PSI		Proportional Part of Contract Price Allowed	
4.0	650 psi and above	**5.0**	100%
6.0	649 psi to 645 psi	**7.0**	90%
8.0	644 psi to 640 psi	**9.0**	80%
10.0	639 psi to 635 psi	**11.0**	70%
12.0	634 psi to 630 psi	**13.0**	60%
14.0	629 psi to 625 psi	**15.0**	50%

Any adjusted deficiency below 625 psi shall be removed or, if approved by the Engineer, may be left in place without payment.

F. Mixing Concrete. The concrete may be mixed at the work site in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements of AASHTO M-157.

1. When mixed at work site or in a central mixing plant, the mixing time shall be not less than 50 seconds nor more than 90 seconds. Four seconds shall be added to the specified mixing time if timing starts the instant the skip reaches its maximum raised position. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

2. The mixer shall be operated at the drum speed as shown on the manufacturer's nameplate on the approved mixer. Any concrete mixed less than the specified time shall be discarded by the Contractor at his expense. The volume of concrete mixed per batch shall not exceed the standard rating plate on the mixer, except that an overload up to 10% above the mixer's nominal capacity may be permitted, provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

3. The batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

4. Mixed concrete from the central-mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks having special bodies. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor 60 minutes when the concrete is hauled in truck mixers or truck agitators.

5. Retempering concrete by adding water will not be permitted. Concrete that is not within the specified slump limits at the time of placement shall not be used. Admixtures for increasing the workability or for accelerating the set will be permitted only when specifically specified for in the contract.

G. Limitations of Mixing. No concrete shall be mixed, placed or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

1. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat

reaches 40°F., and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F.

2. When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might injure the materials. Unless otherwise authorized, the temperature of the mixed concrete shall be not less than 50°F., and not more than 80°F., at the time of placement in the forms.

3. If the air temperature is 35°F., or less at the time of placing concrete, the Engineer may require the water and/or the aggregates to be heated to not less than 70°F., nor more than 150°F. Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete.

4. Sufficient cold weather protection shall be provided to cover and protect the freshly placed concrete for a period of a minimum of five (5) days.

5. Placement of concrete during hot weather shall be controlled by various means to maintain the concrete temperature at the time of placement in the forms to 85°F.

   The temperature of the various materials and the final concrete may require the use of several simultaneous cooling methods including covering the aggregate stockpiles, sprinkling the aggregates, chilled water, substituting crushed ice for a portion of the mixing water, and/or any other method to maintain the temperature of the concrete at the time of placement to a maximum of 85^{o} F.

H. Placing Concrete. The concrete shall be deposited on the thoroughly moistened grade in such a manner as to require as little rehandling as possible. Unless truck mixers, truck agitators, or non-agitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

1. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 15 seconds in any one location.

2. Concrete shall be deposited as near to expansion and contraction joints as possible, without disturbing them but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

3. When concrete is placed on low-slump low-strength concrete subbase, a bond breaker, approved by the Engineer, shall be used.

4. Should any concrete materials fall on or be worked into the surface of a completed slab, they shall be removed immediately by approved methods.

I. Strike-Off of Concrete and Placement of Reinforcement. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement, or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

1. Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond.

2. Reinforcing steel with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable AASHTO specification requirement.

3. The Contractor shall, at his option, either place pavement reinforcing manually in the plane shown on the plans and then place the final lift or they may set the reinforcing into place using mechanical equipment to be approved by the Engineer prior to its use, after the placement of the concrete.

4. Mechanical equipment to place the pavement reinforcing after the placement of concrete shall be capable of positioning the pavement reinforcing at the required depth in the wet concrete without damaging the edges and finished surface of the concrete pavement. The Contractor shall use a finishing machine, equipped with side forms, to correct and refinish the surface of the concrete pavement to provide a smooth riding surface in accordance with the requirements of the specifications.

J. Joints.

1. General. Longitudinal and transverse joints shall be constructed as indicated on the plans and in accordance with these requirements. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Joints shall not vary more than 1/4 inch from true line or from their designated position. The vertical surface of the pavements adjacent to all expansion joints shall be finished to a true plane and edged to a radius of 1/4 inch, or as shown on the plans. The surface across the joints shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of 1/8 inch shall be corrected before the concrete has hardened. Transverse joints shall be at right angles to the centerline of the pavement and shall extend the full width of the slab. The transverse joints in succeeding lanes shall be placed in the line with similar joints in the first lane. In the case of widening existing pavements, transverse joints shall be placed in line with similar joints in the existing pavement. All transverse contraction joints shall be saw cut to the depths and widths shown in the plans.

   a. Deformed Dowel Bars. Deformed dowel bars of the dimensions and spacings as shown on the plans shall be installed principally in longitudinal construction joints as shown on the plans. The dowel bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals of 12 inches, unless otherwise specified. They shall be held in position parallel to the pavement surface and midway between the

surfaces of the slab.

When deformed dowel bars extend into an unpaved lane, they shall be drilled and epoxy grouted into the poured lane as hereinafter specified, un- less threaded bolt or other assembled deformed dowel bars are specified. These bars shall not be painted, greased, or enclosed in sleeves.

b. Smooth Dowel Bars. Smooth dowel bars or other load-transfer units of an approved type shall be placed across transverse, longitudinal, or other joints in the manner as specified on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. When the dowels for longitudinal construction joints extend into an unpaved lane, they shall be drilled and epoxy grouted into the poured lane as hereinafter specified. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. The portion of each dowel painted with rust preventative paint, as required under Paragraph 02(f) hereinbefore, shall be thoroughly coated with Asphalt MC-70, or an approved lubricant, to prevent the concrete from binding to that portion of the dowel. In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by a mechanical device approved by the Engineers.

2. Installation. If the paving mixer is operated from an adjacent lane, any joint materials required shall be set immediately after the final testing of the grade. If the paving mixer is operated from the lane being poured, the materials shall be set immediately after the mixer moves forward to permit as much time as possible for proper installation. All joint materials required shall be put in place on the completed and accepted grade. The materials and joint position shall be either at right angles or parallel to the centerline of the pavement, except for fillets or irregular sections. The top of an assembled joint device shall be set at the proper distance below the pavement surface and the elevation shall be checked. Such devices shall be set to the required position and line and shall be securely held in place by stakes or other means during the pouring and finishing of the concrete. The pre-molded joint material shall be placed and held in a vertical position; if constructed in sections there shall be no offsets between adjacent units. Dowel bars shall be checked for exact position and alignment as soon as the joint device is staked in place, and the device shall be tested to determine whether it is firmly supported. Any joint installation not firmly and securely supported shall be reset.

   a. When joints in concrete pavements are sawed, the joints shall be cut at the time and in the manner approved by the Engineer. The equipment used shall be as described in paragraph 03(a) 4).

   b. The circular cutter shall be capable of cutting a groove in a straight line; the circular cutter shall produce a slot at least 1/8 inch wide. When shown on the plans or required by the specifications, the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved beveling to provide adequate space joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

3. Longitudinal Joints.

   a. Construction. Longitudinal construction joints necessary for lane construction shall be formed against suitable forms made of steel. Wooden forms may be used under special

conditions, when approved by the Engineer. The construction joints shall be a butt-type joint with smooth dowel bars or deformed tie-bars, as indicated on the plans. The dowels for this type of joint shall be painted and greased. The edges of the joint shall be finished with a grooving tool or edging tool and a space or slot shall be formed along the joint of the dimensions, as indicated, to receive the joint sealing material. Provisions shall be made for the installation of tie bars as noted on the plans.

b. Contraction or Weakened-plane Type. The longitudinal groove formed or sawed in the top of the slab shall be installed where indicated on the drawings. The groove shall be formed in the plastic concrete with suitable tools or material to obtain the width and depth specified, or it shall be sawed with approved equipment in the hardened concrete to the dimensions required. When the groove is formed in plastic concrete, it shall be true to line with not more than 1/4-inch variation in 10 feet; it shall be uniform in width and depth; and the sides of the groove shall be finished evenly and smoothly with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The sawed groove shall be straight and of uniform width and depth. In either case, the groove shall be clean cut so that spalling will be avoided at intersections with transverse joints. Tie bars shall be installed across those joints, as shown on the plans.

c. Expansion. Longitudinal expansion joints shall be installed where designated on the plans. These shall be of a butt type without load-transfer devices and shall include a pre-molded expansion material. The thickness of the concrete at these joints shall be increased by at least 25% of the normal pavement thickness to the nearest inch but not less than 2 inches. This increase shall slope to normal thickness in not less than 10 feet from the joint unless otherwise indicated on the plans or to the nearest joint such as a groove joint. The pre-molded filler, of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface.

A metal or wooden cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the pre-molded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. The width of the joint shall be corrected for temperature, nominal width shown on the plans to be at 68°F.

4. Transverse Joints.

a. Expansion. Transverse expansion joints shall be installed at the locations and spacing as shown on the plans. The joints shall be installed at right angles to the centerline and perpendicular to the surface of the pavement. The joints shall be so installed and finished to insure complete separation of the slabs.

Expansion joints shall be of a pre-molded type conforming to these specifications and with the plans and shall be the full width of the pavement strip.

All concrete shall be cleaned from the top of the joint material. Before the pavement is opened to traffic this space shall be swept clean and filled with approved joint sealing material.

The filler shall be placed on the side of the installing plate nearest the mixer. The top edge of the filler shall be protected by a metal channel cap of at least 10-gauge material. The installing device may be designed with this cap self-contained.

All devices used for the installation of expansion joints shall be approved by the Engineer. They shall be easily removable without disturbing the concrete and held in proper transverse and vertical alignment. Immediately after forms are removed, any concrete bridging the joint space at the ends shall be removed for the full width and depth of the joint.

When specified, expansion joints shall be equipped with dowels of the dimensions and at the spacing and location indicated on the plans. The dowels shall be firmly supported in place and accurately aligned parallel to the subgrade and the centerline of the pavement by means of a dowel assembly which will remain in the pavement and will ensure that the dowels are not displaced during construction.

Other types of load-transfer devices may be used, when approved by the Engineer. The width of the joint shall be corrected for temperature, nominal width shown on the plans to be at 68°F.

b. Contraction. Transverse contraction joints, weakened-plane joints, or both, shall be installed at the locations and spacing as shown on the plans. These joints will be installed by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened in the same manner as specified in paragraph 03)(j)3)ii).

Dowel bar assembly shall be installed when required, as shown on the plans.

c. Construction. Transverse construction joints shall be installed in accordance with the details on the plans and ordinarily are only needed when it is necessary to suspend the work for more than 30 minutes. The construction joint shall be located at a planned contraction or expansion joint. The fresh concrete shall be removed back to the previously spaced regular joint.

d. Construction of Connection Between New and Existing Pavement. The Contractor shall hand excavate, using extreme care, to the dimensions shown in the plans, adjacent to the edges of all existing pavements to prevent any damage to the existing pavement.

The connection between the new and existing pavements shall be constructed as shown on the plans.

Any damage to the existing pavement caused by the Contractor's operations shall be repaired by him, to the satisfaction of the Engineer at no cost to the Owner.

K. Final Strike-Off, Consolidation and Finishing.

1. Sequence. The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straight edging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations generally will not be permitted. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.

2. Finishing at Joints.

a. The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in paragraph 03(h).

b. After the concrete has been placed and vibrated adjacent to the joints as required in paragraph 03(h), the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints causes segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the front screed is approximately 8 inches from the joint. Segregated concrete shall be removed from the front of and off the joint; the front screed shall be lifted and set directly on top of the joint and the forward motion of the finishing machine shall be resumed.

When the second screed is close enough to permit the excess mortar in front of it to flow over the joint, it shall be lifted and carried over the joint. Thereafter, the finishing machine may be run over the joint without lifting the screeds, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

3. Machine Finishing.

a. A belt finish or burlap drag will be acceptable on the taxiway and roadway pavements. The final elevations of all pavements shall not vary more than one fourth (1/4) inch from the finished grade elevations.

b. Vibratory Method. When vibration is specified, vibrators for full-width vibration of concrete paving slabs shall meet the requirement specified in paragraph 03)(a)3) ii). If uniform and satisfactory density of the concrete is not obtained by the vibratory method at joints, along forms, at structures, and throughout the pavement, the Contractor will be required to furnish equipment and methods which will produce pavement conforming to the specifications.

When in operation, the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.

4. Hand Finishing. Unless otherwise specified, hand finishing methods will not be permitted, except under the following conditions:

a. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade.

b. Narrow widths or areas or irregular dimensions where operation of the mechanical equipment is impractical may be finished by hand methods.

c. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete when reinforcement is used.

d. The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable material, shod with metal.

e. Consolidation shall be attained using a suitable vibrator or other approved equipment.

5. Floating. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, using one of the following methods, as specified or permitted:

   a. Hand Method. The hand-operated longitudinal float shall be not less than 12 feet in length and 6 inches in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion, while held in a floating position parallel to the road centerline and passing gradually from one side of the pavement to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the side forms on each pass.

   b. Mechanical Method. The mechanical longitudinal float shall be approved by the Engineer, and it shall be in good working condition. The tracks from which the float operates shall be accurately adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustments of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward speed shall be adjusted so that the float will lap the distance specified by the Engineer on each transverse trip. The float shall pass over each pavement at least two times, but excessive operation over a given area will not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.

   c. Alternative Mechanical Method. As an alternative to paragraph 03(k)5)ii., Contractor may use a machine composed of a cutting and smoothing float(s) suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with, the side forms.

      If necessary, following one of the preceding methods of floating, long handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike-off and consolidation are done by hand, and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a straightedge 10 feet or more in length. Successive drags shall be lapped one-half the length of the blade.

6. Straight-Edge Testing and Surface Correction. After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 16-foot straightedge. For this purpose, the Contractor shall furnish and use an accurate 16-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one half the length of the straightedge. Any depressions shall be immediately filled with freshly mixed concrete, struck-off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface correction shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section.

7. Final Finish. Taxiways, roadways and other pavements may be finished with either a belt finish, or a burlap drag finish.

   a. Belt Finish. If the surface texture is to be a belt finish, when straight edging is completed and water sheen has practically disappeared and just before the concrete becomes non-plastic, the surface shall be belted with a 2-ply canvas belt not less than 8 inches wide and at least 3 feet longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the centerline and with a rapid advance parallel to the centerline.

   b. Drag Finish. If the surface texture is to be a drag finish, a drag shall be used; it shall consist of a seamless strip of damp burlap and it shall produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement. For pavement 16 feet or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap at least 3 feet wide is in contact with the full width of pavement surface while the drag is used. The drag shall consist of not less than two layers of burlap with the bottom layer approximately 6 inches wider than the upper layer. The drag shall be maintained in such a condition that the resultant surface is of uniform appearance and reasonably free from grooves over 1/16 inch in depth. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

8. Edging at Forms and Joints. After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to the radius required by the plans. A well-defined and continuous radius shall be produced and a smooth, dense, mortar finish obtained. The surface of the slab shall not be unduly disturbed by tilting of the tool during use.

   At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by brooming the surface. In doing this, the rounding of the edge shall not be disturbed. All concrete on top of the joint filler shall be completely removed.

   All joints shall be tested with a straightedge before the concrete has set, and correction shall be made if one side of the joint is higher than the other or if they are higher or lower than the adjacent slabs.

L. Surface Test. The Contractor shall also have a 16' rolling straightedge on the work to check the completed pavement. Surface deviations more than 1/4 inch in 16 feet in any direction will require correction by planning. Deviations exceeding ½" shall be cause for removal and replacement.

   Any area or section so removed shall not be less than 10 feet in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

M. Curing. Immediately after the finishing operations have been completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured in accordance with one of the following methods. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period.

1. Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall.

   Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon to not more than 125 square feet. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by effective mechanical means. Hand spraying of off widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed.

   The curing shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound.

   Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

2. Curing in Cold Weather. When the average daily temperature is below 40°F., curing shall consist of covering the newly laid pavement with a protective curing authorized by the Engineer, which shall be retained in place as determined by the Engineer. Admixture for curing or temperature control may be used only when authorized by the Engineer.

   When concrete is being placed and the air temperature may be expected to drop below 30°F., a sufficient supply of suitable blanketing material shall be provided along the work. Any time the temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to prevent freezing of the concrete. The period such protection shall be maintained shall be determined by the Engineer. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the Contractor's expense.

N. Removing Forms. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except where auxiliary forms are used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in paragraph (m) above. Major honeycombed areas shall be considered as defective work and shall be removed and replaced. Any area or section so removed shall be not less than 10 feet in length, nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

O. Sealing Joints. The joints in the pavement shall be sealed in accordance with Section P-605 of these specifications.

P. Protection of Pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, or crossovers, etc.

   The plans or special provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Q. Loading on new concrete. The pavement shall attain a strength of 450 psi for dowel drilling equipment on the new concrete, 500 psi for paving equipment on the new pavement and 650 psi for opening to air traffic. The strength shall be determined based on the actual strength adjusted for the ratio of the design thickness compared to the actual thickness based on the pavement design.

R. Opening to Traffic. The Engineer shall decide when the pavement shall be opened to traffic, based on flexural strength testing. The pavement shall not be opened to traffic for at least 3 days after the concrete has been placed. Prior to opening, the pavement shall be cleaned.

S. Surface Tolerances. Extreme care must be exercised in all phases of the operation to assure that the pavement will pass the specified tolerances. The following tolerances are applicable:

1. Lateral deviation from established alignment of the pavement edge shall not exceed plus or minus 0.10 foot in any lane.

2. Vertical deviation from established grade shall not exceed plus or minus 0.04 foot at any point.

3. Surface smoothness deviations shall not exceed 1/4" from a 16-foot straightedge placed in any direction, including placement along and spanning any pavement joint or edge, and in addition shall not exceed the requirements as stated in 03)(L).

4. To stay within the above tolerances, the Contractor must control the tolerances on all phases of construction preceding the placement of pavement and is cautioned that additive deviations may result in the removal and replacement of out of tolerance construction and/or price adjustments for deficient construction in accordance with the specifications as stated herein.

T. Tolerance of Pavement Thickness. The thickness of the pavement shall be determined by average caliper measurement of cores taken and tested in accordance with AASHTO T-148 and by edge measurements taken prior to placement of adjacent lanes. Cores shall be taken by the Contractor at the frequency of one per 250 feet per lane per section to verify pavement thickness and concrete consolidation. The Contractor shall patch the core holes in a manner approved by the Engineer.

Should any portion of the concrete pavement fail to meet the requirements of the thickness, the following shall apply:

1. The twenty-eight (28) day strengths for the area of thickness deficiency shall be adjusted in proportion to the square of the thickness.

$$f_{sadjusted} = \frac{t^2_{actual}}{t^2_{design}} \times f_{sactual}$$

Where: t_{actual} = actual pavement thickness

t_{design} = pavement design thickness shown on plans

$f_{sactual}$ = actual 28-day flexural strength

$f_{sadjusted}$ = adjusted 28-day flexural strength

2. If $f_{sadjusted}$ is less than 650 psi, the unit price shall be adjusted in accordance with Table III in Article 03(e), Item ii.

4.0 METHOD OF MEASUREMENT

A. The yardage to be paid for shall be the total area of each depth of pavement, measured in square yards, in-place, completed and accepted less any deductions hereinbefore required for deficient strength or thickness. Thickened slabs will be measured separately.

B. The quantity of low-slump low-strength concrete, to be paid for shall be the total volume measured in cubic yards, in-place, completed and accepted less any deductions hereinbefore required for deficient strength or thickness. Measurements will be made at all locations where the low-slump, low-strength concrete is used to cap underdrain and utility trenches in existing stabilized base course and shoulders, as a new base course for pavement widening and base course reconstruction, and for any replacement of untreated subgrade soil. Measurement will not be made for the use of the low-slump low-strength concrete used by the contractor to repair damage to existing base course and subgrade.

5.0 BASIS OF PAYMENT

A. General. The accepted quantities of concrete pavement will be paid for at the contract unit price per square yard, after any adjustments required for deficient strength or thickness, which price and payment shall be full compensation for all mix designs, for furnishing and placing all materials, including any dowels and steel reinforcement.

B. No additional payment over the unit contract bid price shall be made for any pavement which has an average thickness in excess of that shown on the plans or for strengths in excess of that specified.

Adjustments in the payment will be made for smoothness, in accordance with sections 03)(l) and ii).

C. Payment for low-slump, low-strength concrete for base or base replacement shall be paid at the contract unit price per cubic yard which price and payment shall be full compensation for mix design, for furnishing and placing all materials and incidentals.

D. Payment for low-slump, low-strength concrete placed in underdrain or duct banks shall be included in the unit price bid for those items.

Payment will be made under:

Item P-501-1	Non- Reinforced Portland Cement Concrete Airfield Pavement, 16" Thick - Per Square Yard.
Item P-501-2	Reinforced Portland Cement Concrete Airfield Pavement, 16" Thick - Per Square Yard.
Item P-501-3	Non-Reinforced Thickened Edge Portland Cement Concrete Airfield Pavement, 16” – 20” Thick – Per Square Yard
Item P-501-4	Reinforced Thickened Edge Portland Cement Concrete Airfield Pavement, 16” – 20” Thick – Per Square Yard
Item P-501-5	Low-Slump Low-Strength Concrete – Per Cubic Yard

TESTING AND MATERIAL REQUIREMENTS

Test and short title	Material and short title
AASHTO T-26 -- Water	AASHTO M 6 -- Fine Aggregate
AASHTO T-23 -- Test Specimens	AASHTO M 80 -- Coarse Aggregate
AASHTO T-97 -- Flexural Strength	AASHTO M 85 -- Portland Cement Concrete
AASHTO T-119 -- Slump	AASHTO M 154 -- Air-entrained PC
AASHTO T-152 -- Air (Aggregate)	AASHTO M 151 -- Slag PC
AASHTO T-121 -- Yield	ASHTO M 90 -- Joint Filler
AASHTO T-84 and T-85 Absorption and Specific Gravity	AASHTO M 153 -- Joint Filler
AASHTO T-148 – Cores	AASHTO M 213 -- Joint Filler
ASTM T-173 -- Air (Slag)	AASHTO M 55 -- Wire
ASTM C1260 – ASR	AASHTO M 137 -- Bars
ASTM C1293 – ASR	AASHTO M 54 -- Bars
ASTM C-496 Splitting Tensile Strength	AASHTO M 31 – Bars
	AASHTO M 42 – Bars
	AASHTO M 73 -- Mats
	AASHTO M 139 -- Paper
	ASHTO M 171 -- Polyethylene
	AASHTO M 182 -- Burlap
	AASHTO M 148 -- Membrane
	ASTM C 618 -- Fly Ash
	ASTM C 402 -- Pozzolans
	ASTM C 260 -- Air-entraining
	STM C 494 -- Water Reducing
	ASHTO M 157 -- Ready Mix
	Fed. Spec. TT-C-800 – Membrane

Note: Others as required by referenced specifications.

END OF SECTION P-501

SECTION P-504- HIGH EARLY STRENGTH CEMENT CONCRETE PAVEMENT

1.0 DESCRIPTION

1. This work shall consist of pavement composed of a quick setting high early strength concrete, with or without reinforcement, constructed on re-compacted base course, after removal of the existing pavement. The work shall comply with applicable sections of the 501 Specifications referenced herein, and shall conform to the lines, grades, thickness and typical cross sections shown on the drawings.

2.0 QUALITY CONTROL

Quality Control shall be as specified in Special Conditions Section SC-15 and in Section P-501- Portland Cement Concrete Pavement, with the addition of the following:

If the concrete is produced at the paving site with a mobile batching-mixing plant, the equipment shall be capable of producing the specified concrete mix to the standards of quality and uniformity that would be required for production by a permanent or portable batch plant. Specifically, the equipment shall be capable of consistent production to the concrete uniformity requirements of Table A1.1 in ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing. Compliance with these requirements shall be demonstrated by quality control testing of the mix produced by each equipment unit proposed for use on the project. A qualified independent laboratory, at the Contractor's expense shall perform the testing. The test results and a certification by the laboratory that the equipment meets the above stated requirements shall be submitted and approved by the Engineer before the start of full pavement production will be authorized. If the equipment compliance documentation is not previously submitted and approved, the required testing shall be accomplished during the Mix Design Development and Test Section process.

3.0 MATERIALS

A. Fine Aggregate

Fine Aggregate for concrete shall conform to the requirements of ASTM C33 and shall meet the requirements of Table 1, as specified in Section P-501 - Portland Cement Concrete Pavement.

B. Coarse Aggregate

As specified in Section P-501 - Portland Cement Concrete Pavement.

C. Cement

Cement shall be one of the following:

1. Portland Cement conforming to the requirements of ASTM C150, Type I, Type II, or Type III.
2. "Rapid Set C-150 Cement" as manufactured by the CTS Cement Manufacturing Company, or an approved equal.
3. A combination of the above.

All cement of a particular type shall be the product of one manufacturer. If, for any reason, cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

The cement listed above shall be capable of producing a quick setting high early strength concrete with the following properties:

a. Development of flexural strength in excess of 500 psi not later than 4 hours from the time water is added to the mix.

b. The mix setting shall accommodate a placing and finishing time of 45 minutes, plus or minus 15 minutes.

If the Contractor proposes to use a cement other than Rapid-Set C-150 cement, information relating to the proposed cement shall be submitted indicating the use of the material under (5) separate contracts for the previous (5) years.

A. Admixtures

As specified in Section P-501 - Portland Cement Concrete Pavement.

B. Water

As specified in Section P-501 - Portland Cement Concrete Pavement.

C. Steel Reinforcement and Tie Bars

Steel reinforcement shall meet the requirements of Section P-501 - Portland Cement Concrete Pavement.

D. Pre-molded Joint Filler

As specified in Section P-501 - Portland Cement Concrete Pavement.

E. Joint Sealer

The sealer for joints in the concrete pavement shall meet the requirements of Section P-605 - Joint Sealing Filler.

F. Cover Material for Curing

Curing materials and methods shall conform to the recommendations of the curing material manufacturer and the cement manufacturer, and Section P-501 - Portland Cement Concrete Pavement.

4.0 MIX DESIGN

A. General

As specified in Section P-501 - Portland Cement Concrete Pavement, with the exception of the following:

1. A mix design shall be developed to allow for the construction of 12.5 to 50 x 25-foot slabs per nightly work shift specified in the phasing plans. The mix design shall meet the criteria specified in 4) Mix Design (b) Strength and Proportions.

2. Several quick setting high early strength concrete mix designs, utilizing RAPID-SET Cement as manufactured by CTS Cement Company, were developed, that met the above criteria, and were used on airfield pavement projects at Hartsfield Atlanta International Airport in 1997, 2001 and 2004. Information on the concrete mix designs used is available from the CTS Cement Company; telephone # 1-800-929-3030.

3. The previous project experience with quick setting concrete mix designs showed variability in the set time of the concrete mix and the cement material used. The Contractor shall develop a mix design and quality control program to allow adjustment in the procedures so the concrete mix that is used consistently meets the criteria specified at no cost to the Owner.

B. Strength and Proportions

As specified in Section P-501 - Portland Cement Concrete Pavement, except for the following:

1. A mix design shall be developed by the Contractor to meet the following properties:

   a. The concrete mix shall achieve a minimum flexural strength of 500 psi within 4 hours of the time water is added to the mix and shall achieve a minimum flexural of 750 psi in 28 days.

   b. The concrete placed each night must attain the 500-psi flexural strength each morning when the pavement is opened to traffic.

   c. The concrete mix shall have a set time of a minimum of 30 minutes beyond the time established by the Contractor's procedure to batch, transport, and place the mix takes a set and no further surface finishing can be accomplished.

      The proportions of the concrete mix shall be as developed by the Contractor to meet the specified criteria. There is no specified minimum cement content, slump, water/cement ratio or restriction on admixtures. The entrained air content shall be 4.5% plus or minus 1.0 percent.

   d. The mix shall have a minimum durability factor of 95 when tested in accordance with ASTM C666.

C. Cementitious Materials

Fly ash and silica fume may be used in the mix. Ground blast-furnace slag shall not be used.

D. Admixtures

As specified in Section P-501 - Portland Cement Concrete Pavement, with the exception of the following:

Air Entraining: The average air content shall be 4.5 percent, plus or minus 1.0 percent, and the mix shall have a durability factor of 95 or more when tested in accordance with ASTM C-666. The durability factor shall be determined by a test of the actual concrete mix to be used on the project.

E. Mix Design Development

The Contractor shall develop a mix design that meets the criteria specified in section 4) Mix Design. The process shall include the development of a minimum of three trial batches with decreasing water/cement ratios.

The batches shall use the intended raw materials to be used for the project, including cement, fine and coarse aggregates as well as chemical and mineral admixtures. The trial batch mixtures shall maintain the same fine aggregate/coarse aggregate ratios as well as the same proportions of intended admixtures, only the water/cement ratio shall be varied. The testing of the trial batches shall, at a minimum, include flexural strength, temperature development, air content and slump. Flexural beam tests and temperature development specimens shall be prepared in

accordance with ASTM C31, except that specimens shall be surrounded with insulative blankets for minimum of 5 hours following addition of water to the mix. The mix design to be submitted for use on the project shall be required only on the trial batches. Freeze-thaw durability testing shall be required only on the specific mix design intended for use on the project.

F. Flexural Strength Testing

The average of a minimum of two flexural strength test results shall be completed at 4 hours, 5 hours, 6 hours, 8 hours, 24 hours, 7 days and 28 days for each of the three trial batches. The results shall be plotted on a flexural strength versus water/cement ratio.

G. Temperature Development

The trial batches shall be monitored for development of temperature from the time the water is added to the mix until an age of 5 hours at 15 minutes intervals. The temperature of the water and other materials and the ambient temperature at the time of batching shall be recorded. The time at which the mix takes a set shall be recorded along with the corresponding temperature of the mix. The temperature shall be taken with a thermometer accurate to within 0.5 °F. The thermometer shall remain inserted in the curing sample throughout the period of testing. The temperature data shall be plotted for each trial batch, with temperature on the vertical scale and time on the horizontal. The set time of the mix shall be identified for each batch.

H. Freeze-Thaw Durability

The mix intended for use on the project shall be tested for durability in accordance with ASTM C666.

I. Mix Design Submittal

The mix design submittal shall include the following minimum information:

1. Type(s) of cement.
2. Water/cement ratio.
3. Slump.
4. Air Entrainment percentage.
5. Flexural strength test results at 4, 5, 6, 8 and 24 hours, 7 days and 28 days.
6. Results of durability test in accordance with ASTM C666.
7. Temperature development of mix and set time.
8. Plant/lab mix certification of proportion of materials.
9. Fine and coarse aggregate supplier, pit location, graduation, fineness modulus, tested wear, specific gravity, absorption capacity and moisture content.
10. Manufacturer’s name, catalog information for the cement(s) and admixtures used, including ASTM certification information.
11. Certification of Testing Laboratory designing the mix.

J. Tentative Mix Design Approval

a. When a mix design meeting all the specified criteria and documentation requirements have been met and approved by the Engineer, the mix design may be given tentative approval. Tentative approval may be granted prior to the receipt of the 28-day strength

tests, if 750-psi flexural strength has been demonstrated at an earlier test period.

K. Full Mix Design Approval

Full approval of the mix design will be granted when the following requirement has been met:

1. Acceptable results from the 28-day strength.

5.0 CONSTRUCTION METHODS

A. Equipment

As specified in Section P-501 - Portland Cement Concrete Pavement, with the following exceptions and additions:

1. Backup Equipment: For pavement removal and replacement under night working conditions, the Contractor shall provide backup units for each item of equipment that is essential to the timely completion of each night's work. The backup equipment shall be itemized and submitted for review and approval prior to the placement of any pavements.

2. If the concrete is produced at the paving site with a mobile batching-mixing plant, the equipment shall meet the requirements specified in Section 2 Quality Control. Inspection of each equipment unit for calibration and effective operation shall occur at least once during every night of production and for every 40 cubic yards of concrete produced.

B. Form Setting

The concrete shall be placed and formed in accordance with the following:

1. Against the sides of previously placed concrete slabs, or against other existing slabs or structures which will remain: Unless the slabs are separated by expansion joint material, the sides of the adjacent concrete shall be sprayed with a debonding agent, approved by the Engineer, that will prevent bonding at the face of the joint. The prevention of bonding is critical to the prevention of cracking in the newly placed concrete.

C. Conditioning of Underlying Surface, for Side-Form and Fill-In Slab Construction.

The base shall be well moistened with water, without saturating, immediately ahead of concrete placement to prevent loss of moisture from the concrete. The elevations of the finished base course shall be properly recorded at sufficient locations (grid pattern not exceeding five feet spacing) in each slab in order to establish the depth of the new concrete slab.

D. Handling, Measuring and Batching Material

As specified in Section P-501 - Portland Cement Concrete Pavement.

E. Mixing Concrete

As specified in Section P-501 - Portland Cement Concrete Pavement.

F. Limitations of Mixing and Placing

As specified in Section P-501 - Portland Cement Concrete Pavement, with the following exceptions and additions:

1. Portable Lighting Units sufficient for control and observation of the work shall be in position at the concrete placement site prior to mixing concrete each night. In addition, adequate lighting shall be provided at the batch plant to facilitate quality control and safe operations.

2. Concrete shall be mixed only in quantities, which are required for immediate use and can be placed and finished prior to final setting of the concrete.

3. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature reaches 40°F and shall not be resumed until an ascending air temperature reaches 35°F.

4. To compensate for cool temperatures and to enhance early concrete curing and strength gain, the Engineer may require the water and/or aggregates to be heated to not less than 70°F nor more than 150°F.

G. Placing Concrete

As specified in Section P-501 - Portland Cement Concrete Pavement, with the following exceptions and additions:

1. Slip forming is not an appropriate method for placement of the concrete covered by these specifications.

2. The Contractor shall use all means necessary to protect concrete materials before, during and after installation and to protect the installed work and materials of all other trades such that final conditions will be as specified. In the event of damage, immediately make all repairs and replacements necessary to the satisfaction and approval of the Engineer and at no additional cost to the Owner.

3. The concrete shall be deposited on the moistened base in a manner, which requires as little rehandling as possible. Unless truck mixers, truck agitators, or non-agitating hauling equipment is equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread to prevent segregation of the materials. Necessary hand spreading shall be done with shovels - not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots coated with foreign substances.

4. Concrete shall be thoroughly consolidated against and along the faces of all adjacent slabs and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the base or adjacent slabs. In no case shall a vibrator be operated longer than 15 seconds in any one location, nor shall they be used to move concrete. The contractor shall demonstrate that the method of vibration he chooses to use will properly consolidate the concrete and shall not build up excessive slurry on the surface.

H. Strike-Off of Concrete and Placement of Reinforcement

As specified in Section P-501 - Portland Cement Concrete Pavement.

I. Joints

As specified in Section P-501 - Portland Cement Concrete Pavement, excluding provisions for slip-form construction, which is not applicable. Prior to placing the new concrete, the existing concrete faces shall be sprayed with an approved debonding agent to prevent bond of new concrete to the existing concrete.

J. Final Strike-Off, Consolidating and Finishing

As specified in Section P-501 - Portland Cement Concrete Pavement.

K. Surface Texture

As specified in Section P-501 - Portland Cement Concrete Pavement.

L. Surface Testing

As specified in Section P-501 - Portland Cement Concrete Pavement.

M. Curing

The initial method of curing, to begin immediately after the finishing and set of the pavement surface, shall be water curing. The entire surface shall be inundated for at least 2 hours, or until the concrete cools.

After the minimum water-curing period and before opening the pavement to traffic, an impervious curing membrane shall be applied as specified in Section P-501 - Portland Cement Concrete Pavement.

N. Sealing Joints

As specified in Section P-605 - Joint Sealing Filler.

O. Protection of Pavement

P. As specified in Section P-501 - Portland Cement Concrete Pavement.

Opening to Traffic

The Engineer shall decide when the pavement will be opened to traffic. The flexural strength of the permanent concrete required for opening the pavement to normal airport traffic (vehicles and aircraft) is 500 psi, based on testing in accordance with ASTM C78.

In addition to the above requirements, all equipment, materials and debris shall be removed and the pavement in the immediate work area shall be cleaned by the Contractor to the satisfaction of the Engineer prior to each pavement opening.

6.0 MATERIAL ACCEPTANCE

A. Acceptance Sampling and Testing

Concrete samples shall be furnished by the Contractor and shall be taken in the field to determine the consistency, air content and strength of the concrete. Flexural test beams shall be made each night that the concrete is placed. The specimens shall be made in accordance with ASTM C31. Each group of test beams shall be molded from the same batch of concrete and shall consist of a sufficient number of specimens to provide at least two flexural strength tests at each of the test ages specified below. However, at the start of paving operations and when the aggregate source, aggregate characteristics, or mix design is changed, additional groups of test beams may be required and testing of beams at various hourly ages may be required, until the Engineer is satisfied that the concrete mixture being used complies with the strength requirements of these specifications, for the actual nightly placement schedule.

1. The time scheduled for opening the pavement to normal airport traffic (aircraft and vehicles) each morning is 0800 hours. For purposes of the following discussion “batching” means the time that water is added as the final ingredient to the concrete mix. The test reports for all beams shall record the age of the concrete, from the batching to the time of testing.

2. Test ages for the nightly concrete placement shall be the following:

   a. If concrete batching ends later than 4 hours prior to scheduled pavement opening, beams made from concrete that is placed in the last slab constructed each night shall be tested at or slightly before the scheduled time for pavement opening, to insure that the required strength has been attained. Tests made at that time shall be the OPENING TIME tests used in the computation of pay factors.

   b. If concrete batching ends earlier than 4 hours prior to scheduled pavement opening, one set of beams shall be tested at an age of 4 hours from batching. These tests shall be continued only to the extent determined necessary by the Engineer to evaluate the performance of the specified 4-hour mix design requirement. They shall be used as the OPENING TIME tests only if the 4-hour age coincides with the scheduled opening time.

   c. If concrete batching ends earlier than 4 hours prior to scheduled pavement opening, beams made from concrete that is placed in the last slab constructed each night shall be tested at or slightly before the scheduled time for pavement opening, to insure that the required strength has been attained. Tests made at that time shall be the OPENING TIME tests used in the computation of pay factors.

   d. Initially, beams shall be tested at ages of 4 hours, 8 hours and 24 hours. When the consistency of the Contractor's paving operations, placement completion time and concrete strength gain has been demonstrated to the satisfaction of the Engineer, some or all of the testing at these ages may be terminated.

   e. Beams from each night of work shall be tested at an age of 28 days, for the duration of the project. These tests shall be the 28-DAY tests used in the computation of pay factors.

3. The flexural strength of the concrete shall meet the following requirements:

   a. For each night of placement, the average strength of the concrete tested shall not be less than 500 psi at the time the pavement is scheduled for opening to normal airport traffic.

   b. For each night of placement, the average strength of the concrete tested at an age of 28 days shall not be less than 750 psi.

4. Specimens, which are obviously defective, shall not be considered in the determination of strength. The specimens with the least imperfections shall be used for the earlier tests.

5. When the satisfactory relationship between the 24 hour and 28 day strengths has been established and approved, the 24-hour results may be used as an indication of the 28-day strengths, for purposes of interim acceptance and progress payments. However, final acceptance and payment will be based only on the OPENING TIME and 28 DAY strengths, with the following exception: If the OPENING TIME strength of any lot of concrete is 650 psi or more, the pay factor from that lot shall be 1.0, regardless of the 28 DAY strength.

6. Final acceptance and payment, each night's production, regardless of quantity, shall be considered as one lot. Except as provided above, the pay factor for each lost shall be established on the basis of both the OPENING TIME and the 28 DAY-strength test results, according to the following formulas and tables:

PAY FACTOR = (0.3 x OPENING TIME FACTOR)+

(0.7 X 28 DAY FACTOR)

TABLE 1: OPENING TIME FACTOR

Flexural Strength	Factor
500 psi min.	1.00
490 to 499 psi	.90
480 to 489 psi	.80
470 to 479 psi	.70
460 to 469 psi	.60
450 to 459 psi	.50
Below 450 psi	.00

TABLE 2: 28 DAY FACTOR

Flexural Strength	Factor
750 psi min.	1.00
740 to 749 psi	.90
720 to 739 psi	.70
700 to 719 psi	.50
650 to 699 psi	.30
Below 650 psi	.00

a. If the average OPENING TIME strength for any lot is below 500 psi, concrete placement shall be suspended until the deficiency is investigated and corrections acceptable to the Engineer are made. The corrections which the Engineer shall have the right to require include additional test strips using the current mix, changes to the mix, and establishing an earlier nightly time deadline for final batching and placement of concrete.

b. Closure of the pavement beyond the scheduled opening time of 0800 hours due to concrete strength deficiencies or other concrete deficiencies, will subject the Contractor to liquidated damages as specified in the Contract.

c. If the average OPENING TIME strength for any lot is less than 400 psi, the Contractor shall remove and replace the concrete at his own expense.

d. If the average 28-DAY strength for any lot is less than 650 psi, regardless of the OPENING TIME strength, the Contractor shall remove and replace the concrete at his own expense.

B. Acceptance Criteria

1. Flexural Strength

Acceptance based on flexural strength shall be as specified in Section 6) Material Acceptance (a) Acceptance Sampling and Testing.

2. Thickness

Cores shall be made to determine thickness and consolidation. No deductions will be made for deficient thickness unless the pavement elevations, as determined by survey, are not within the specification requirements.

7.0 METHOD OF MEASUREMENT

A. The quantity for “High Early Strength Cement Concrete Pavement” to be measured for payment shall be the number of square yards of pavement in place, completed and accepted, including mix design development and pavement constructed as part of test sections.

8.0 BASIS OF PAYMENT

A. The accepted quantity of “High Early Strength Cement Concrete Pavement (including mix design development and test sections) will be paid for at the contract unit price per square yard, which price and payment shall be full compensation for furnishing required lighting and other equipment, placing all materials, steel reinforcement, joint sawing, curing and surface texturing, provided, however, that for any pavement found deficient in flexural strength, price adjustment shall be made as specified in Section 6) Material Acceptance. Payment adjustments based on pavement thickness shall be made from tolerance pavements as per Section 6) Material Acceptance.

B. No additional payment over the unit contract bid price shall be made for pavement which has an average thickness more than that shown on the plans or for strengths in excess of that specified.

C. Price Adjustment

The pay factor for each lot shall be determined as specified in Section 6) Material Acceptance (a) Acceptance Sampling and Testing. If the pay factor for a lot of concrete is less than 1.0, payment for the material in that lot shall be made at a reduced price, arrived at by multiplying the contract price per square yard by the appropriate pay factor.

D. Payment will be made under:

Item P-504-1 High Early Strength Cement Concrete Pavement, 16” Thick Per Square Yard

TEST REQUIREMENTS

As specified in Section P-501 - Portland Cement Concrete Pavement.

MATERIAL REQUIREMENTS

As specified in Section P-501 - Portland Cement Concrete Pavement.

END OF SECTION P-504

SECTION P-605 JOINT SEALING FILLER

1.0 DESCRIPTION

A. This section shall consist of providing and installing resilient and adhesive joint sealing filler capable of effectively sealing joints and cracks in pavements and structures and around the various electrical items embedded in the pavement.

B. This section includes routing and sealing pavement cracks as directed by the Engineer.

C. It is the intent of this specification to provide a superior sealed joint, considerably in excess of normal industry standards.

2.0 MATERIALS

A. The joint sealing material for concrete pavement joints shall conform to the requirements of Table I.

1. Cold Applied Sealant for Joints.

(a) TABLE 1 - SILICONE SEALANT REQUIREMENT

Test Method	Test	Material Requirement
As Supplied		
ASTM D 2202	Flow, maximum	0.2
ASTM D-1475	Specific Gravity	1.450 - 1.515
ASTM C 1183 (Type S)	Extrusion Rate, mL/minute, minimum	50
ASTM C 679	Tack-Free Time, minutes	35 – 75
Upon Complete Cure		
ASTM D 2240	Durometer[1], Shore A, points	15 - 25
ASTM D 412, Die C	Modulus, at 150% Elongation[1], psi (k Pa), maximum	45 (310)
ASTM D 412, Die C	Elongation[1], minimum	1200
ASTM D 5329[2] (Section 9, (Modified)	Adhesion to Concrete, minimum % elongation	500

Performance

ASTM C 719 Movement, 10 cycles at

100/-50 % ..... No failure

ASTM C 793 Accelerated Weathering,

@ 5,000 hours .....No cracks, blisters or bond loss

1-Sample cured 7 days at 77 ± 2 F (25 ± 1 C) and 50 ± 5% relative humidity. Proper joint design and proper joint preparation are necessary for maximum performance.

2-Tested on random samples at least on a Quarterly basis. The Engineer shall have additional tests performed in accordance with ASTM C-719 on random samples taken from material supplied to the work. Material not passing the testing shall be removed and replaced at the contractor's cost.

B. The joint sealing material for the concrete and asphalt joint interfaces shall conform to the requirements of Table II. This material may also be used to seal around light base cans in Portland cement concrete pavements.

TABLE 2 - SL SELF- LEVELING SILICONE SEALANT REQUIREMENT

Test Method	Test	Material Requirement
As Supplied		
ASTM D 1475	Specific Gravity	1.26 – 1.34
ASTM C 1183	Extrusion Rate,	
(Type S)	mL/minute, minimum	50
CTM 0098	Skin Over Time,	
	minutes, maximum	60
CTM 0208	Non-Volatile Content, minimum	96
Upon Complete Cure		
ASTM D 412,	Elongation[1], % minimum	1400
Die C, Modified		
ASTM D 5329	Joint Modulus at 50% elongation[1],	

(Section 9 Modified)	psi (kPa), maximum	7 (49)
	Joint Modulus at 100% Elongation[1], psi (kPa), maximum	8 (56)
	Joint Modulus at 150% Elongation [1], psi (kPa), maximum	9 (62)
ASTM D-5329 (Section 9, modified)	Adhesion to Asphalt/Concrete [1], elongation	600 min

Performance

ASTM C 719	Movement, 10 cycles at + 100/-50 %	No failure
ASTM C 793	Accelerated Weathering, at 5,000 hours	No cracks, blisters ,or bond loss

1 Sample cured 7 days at 77 ± 2 F (25 ± 1 C) and 50 ± 5% relative humidity. Proper joint design and proper joint preparation are necessary for maximum performance.

2 Tested on random samples at least on a Quarterly basis. The Engineer shall have additional tests performed in accordance with ASTM C-719 on random samples taken from material supplied to the work. Material not passing the testing shall be removed and replaced at the contractor's cost.

3.0 PREFORMED BACKUP RODS

Preformed backup rods, as shown on the plans and as recommended and approved by the sealant manufacturer, shall be used with cold applied sealants to control the depth of the sealant, to achieve the desired shape factor, to support the sealant against indentation and sag, and shall be a non-moisture absorbing resilient material. Backup materials shall be compatible with the sealant, shall not adhere to the sealant, shall be compressible without extruding the sealant, and shall recover to maintain contact with the joint faces when the joint is open.

Samples of all materials which the Contractor proposes for use and copies of the sealant manufacturer’s recommendations for mixing and installation shall be submitted to the Engineer for approval at least thirty (30) days prior to use.

An appropriate primer, compatible with the seal and either manufactured by or approved by the sealant manufacturer shall be used with the sealant.

Each lot or batch of sealing material shall be delivered to the job-site in the manufacturer’s original sealed container. Each container shall be labeled to include the following:

1. Name of Material.
2. Manufacturer's Name.
3. Manufacturer's Lot Number.

4. Shelf Life.
5. Mixing Instructions.
6. Storage Instructions.

4.0 CONSTRUCTION METHODS

A. Time of Application. The joints shall be sealed immediately following the curing period or as soon thereafter as weather conditions permit, and before the pavement is opened to traffic, including construction traffic. At the time of application of the sealing compound, the atmospheric and pavement temperature shall be above 50^{O}F and the weather shall not be rainy or foggy. The temperature requirements may be waived only when so directed by the Engineer.

At a temperature of 75^{O}F. (24^{O}C) and 50% relative humidity, the sealant will cure to a tack-free surface in about one hour. At a temperature of 40^{O}F. (4^{O}C) the tack-free time will be about 2-3 hours.

B. Equipment. All equipment necessary for the proper construction of this work shall be on the project in first class working condition. The equipment shall be as recommended by the manufacturer of the filler and approved by the Engineer before construction is permitted to start. Air compressors shall be equipped with suitable traps capable of removing all free water and oil from the compressed air and shall be capable of furnishing air with a pressure greater than 90 psi.

C. Preparation of Joints. Immediately after final saw cutting and beveling is complete, the resulting cement slurry, laitance, curing compound and other foreign material shall be completely removed from the joint by water blasting. After cleaning is complete the joint shall be blown out with compressed air. When the surfaces are clean and dry, and just prior to placement of the backer rod and sealant, the joint shall be sand blasted with two passes, i.e., one pass on each bond face, then compressed air shall be used to blow out the joint and remove all residual dust.

Preparation for concrete pavement crack routing and sealing shall be by properly routing the crack to be slightly lower than the existing crack to ensure proper adhesion to the sidewalls. The cracks should be routed out to provide a minimum sealant reservoir 3/8” wide with a minimum depth of 3/8”. The contractor shall use a specialized crack router that is designed to automatically follow the crack. Thickness and depth below the pavement surface shall be as specified for joint sealant. The cracks should be free of dirt, dust, and moisture and be frost-free.

D. Installation of Sealants. Joints and cracks shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer before sealing is allowed. Sealants shall be installed in accordance with the manufacturer’s recommendations and the following requirements:

1. Cold Applied Sealants. A backer rod shall be installed as shown on the plans and the primer shall be applied in the correct sequence in accordance with the sealant manufacturer's instructions, prior to placement of the joint sealer. The sealant shall be applied in a continuous operation, with an approved mechanical device that will force the sealant to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement and shall adhere to the concrete and be free of voids.

   The sealant shall then be tooled, with an appropriate tool, to produce a slightly concave surface approximately 1/4" below the pavement surface for roadways, 3/8" below the surface for aprons and taxiways and 1/2" below the surface of runways. The sealant shall have a minimum thickness of 3/8". Tooling shall be accomplished before a skin forms on the surface, usually within 10 minutes of application.

The sealant shall be tooled in both directions to ensure a void-free installation. Sealant which does not bond to the concrete surface of the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost. Before sealing the joints, the Contractor shall demonstrate that the equipment and procedures for preparing, mixing, and placing the sealant will produce a satisfactory joint seal. This shall include the preparation of two small batches and the application of the resulting material.

2. A manufacturer's representative(s) is to conduct the demonstration(s), train the Contractor's personnel, and ensure the installation procedures are in accordance with the manufacturer's directions prior to the start of the sealing operations. The representative(s) shall visit the job-site at least four (4) times during the sealing operation for each type of sealant, and after the sealing is complete, is to conduct a general inspection of the work and perform more extensive inspections and/or testing on a random basis to reasonably assure that the construction is in accordance with the manufacturer's recommended construction methods and procedures. A report outlining the findings is to be submitted at the completion of the inspection.

3. To ensure that the superior workmanship is achieved throughout the contract, the Contractor shall be required to construct a test section per crew on a portion of the contract site prior to commencing the contract work in order to evaluate workmanship of each of the Contractor's crews. If the test sites are completed to the satisfaction of the Engineer, the Contractor shall then receive notice to proceed with the approved crews with the remainder of the Contract work.

   However, to maintain an acceptable level of productivity, the Contractor shall be required to maintain the same crew members per crew who performed work in the test area together throughout the duration of the contract. If any personnel changes are anticipated by the Contractor, either reducing the work force or changing specific individuals, the Engineer is to be notified. If, at any point during the construction period after a personnel change has been made, the Engineer believes the workmanship has diminished, the crew shall be ordered to halt all construction operations. The Contractor shall then be required to reinstate the original work crew or set-up with the Engineer to perform in another test area to re-qualify the new crew.

   A new test area will then be developed by the Engineer. Upon a successful evaluation of the new test area, the evaluated crew may proceed with the contract construction.

4. The Contractor shall be required to perform test cores on portions of the newly installed joint seals at intervals outlined below. The cores shall be analyzed by the Engineer to evaluate the Contractor's workmanship. If the cores indicate unacceptable workmanship, the Contractor will be required to replace the sealant to the last acceptable core.

   If deemed necessary by the Engineer, additional test cores will be required to determine the limits of defective work. Any additional cores shall be taken by the Contractor at no additional cost to the Owner.

   a. At expansion joints, the Contractor will perform a test core every 100 feet per crew.

   b. At longitudinal and transverse joints, the Contractor will perform a test core every 100 feet per crew.

      If the test results indicate satisfactory work is obtained by a crew on a continuous basis, the Engineer may reduce the number of cores required from the original amount of 100 feet for that crew. The specific intervals increasing or decreasing the number of cores, is at the Engineer's discretion.

5.0 TEST CORE

As stated above, the resealed joints are to be tested at specific intervals. The size of the test cores shall be as follows:

A. Transverse and longitudinal joints in general shall require a 1-1/2 inch diameter core. The actual core size will be based on the minimum core required to include the portion of the joint between the top edges of the beveled edge to a depth of 1/2 inch below the backer rod (see detail on Plans).

B. The expansion joint in general shall require a 2-1/2 inch to a 5 inch core drilled to a depth of at least 2 inches below the backer rod. The actual core size will be based on a minimum core size required to include the portion of joint between the top of the beveled edges (see detail on Plans).

C. The cores for the completed joint seal shall not be taken until after the seal has cured for 14 to 28 days as recommended by the seal manufacturer.

D. The Contractor shall patch the core holes by preparing the core hole in the same manner as for seal placement. A short section of backer rod shall be coiled in the hole prior to sealant placement. After sealant placement the material shall be tooled to ensure bonding to the entire surface.

E. Warranty. The sealant shall be warranted for repair and/or replacement for all defects in materials and workmanship by both the Contractor and the Sealant Manufacturer for a period of five (5) years.

6.0 METHOD OF MEASUREMENT

A. Joint sealing material for contraction, construction, longitudinal, and asphalt/concrete interface shall be measured by the linear foot of sealant in place, complete, and accepted.

B. Crack routing and sealing shall be measured by the linear foot of sealant in place, complete, and accepted.

C. Expansion joint replacement shall be measured by the linear foot of expansion joint in place, complete, and accepted. This shall include specially fabricated sections of expansion joint material as may be required.

7.0 BASIS OF PAYMENT

A. Payment for joint sealing material shall be made at the contract unit price per linear foot. The price shall be full compensation for all joint preparation, furnishing all materials including backer rod, expansion filler, and sealant, delivery, placing of the material, for test coring, and for all labor, equipment, tools, and incidentals necessary to complete the item.

B. Payment for crack routing and sealing shall be made at the contract unit price per linear foot. The price shall be full compensation for all crack preparation, furnishing all materials including backer rod and sealant, delivery, placing of the material, for test coring, and for all labor, equipment, tools, and incidentals necessary to complete the item.

C. Payment for expansion joint replacement shall be made at the contract unit price per linear foot. The price shall be full compensation for all joint preparation, removal of existing expansion joint material, furnishing all materials, special fabrication as necessary, delivery, placing of the material, locating reinforcing steel, and for all labor, equipment, tools, and incidentals necessary to complete the item.

D. Payment will be made under:

Item P-605-1 Cold Applied Sealant, Contraction, Construction and Longitudinal Joints - Per Linear Foot.

Item P-605-2 Cold Applied Sealant, Expansion Joints - Per Linear Foot.

Item P-605-3 Cold Applied Sealant, Asphalt – Concrete Joint Interface - Per Linear Foot. Item P-605-4 Crack Routing and Sealing - Per Linear Foot.

TESTING AND MATERIAL REQUIREMENTS

Test and Short Title	
MIL-S-8802	Flow, Extrusion Rate, Tack-Free Time, Adhesion
ASTM D-1475	Specific Gravity
ASTM D-2240	Durometer
ASTM D-412,	Die C Modulus, Elongation
ASTM C-719	Movement
ASTM D-793	Accelerated Weathering
ASTM D-2202	Flow or Sag
AASHTO T-132	Bond to Concrete

END OF SECTION P-605

SECTION P-610 - STRUCTURAL PORTLAND CEMENT CONCRETE

The requirements of Section 500 of the State of Georgia, Standard Specifications shall apply with the following modifications and additions:

1.0 DESCRIPTION OF WORK

This section consists of the manufacture and utilization of Portland Cement Concrete in the construction of drainage structures and underdrain outlet pipes, electrical manholes and handholes, sign bases and light bases, and electrical duct banks.

2.0 CLASSES AND USE OF CONCRETE

Cast-in-place foundations and related structures shall have a minimum compressive strength of 4000 psi and shall be designated as Class 4000 Concrete.

3.0 QUALITY CONTROL OF CONCRETE:

A. Proportioning: The Contractor shall be responsible for designing the proportions of Portland Cement, fine aggregates, coarse aggregate, water and admixture, which will produce a workable concrete mix meeting all of the following limiting criteria for the concrete specified:

Class	Minimum Cement Content Per Cubic Yard	Slump	Minimum Compressive Strength 7 Days	28 Days
4000	6.5 bags*	3" ± 1"	2800 psi	4000 psi

*94 lbs. cement per bag

B. Since the cement content necessary for a given mix to produce certain strength requirements is also dependent on the type and gradation of the aggregates actually used. The Contractor shall use whatever amount of cement is required to comply with all the provisions specified herein, and all costs or such compliance and materials required shall be understood to be included in the price bid for the various concrete items in the proposal.

C. The slump shall be determined in accordance with ASTM Test Method C143. The consistency of the concrete shall be such as to be easily workable and to permit proper finishing. The plastic concrete, when deposited, shall not flow but shall remain in a conical pile. There shall be a minimum of segregation and surplus water during the process of handling and finishing.

D. Admixtures: Air-entraining agents conforming to the requirements of the Standard Specifications shall be added to each concrete batch in such amount as to secure between 4% and 6% air entrained in the plastic concrete. Consideration shall be given to the amount of any air entrainment that may be incidentally afforded whenever a water reducing retarder agent is used.

1. The concrete producer shall insure compliance with the manufacturer's recommendations for the method of dispensing the admixtures, with particular attention to possible undesirable chemical reaction between products when mixed in concentrated form. The following listed admixtures shall be used in all concrete:

   a. A water reducing agent (ASTM C494 Type A) shall be added to the concrete when the ambient temperature is below 65^0F, and a water reducing retarder (ASTM C494 Type D) shall be added to the concrete at temperatures above 65^0F., as directed by the Engineer.

The manufacturer of the mixture shall submit in writing to the Prime Contractor for submission to the Engineer, special recommendations for quantities of the mix to be used under various temperatures and job conditions to assure that the concrete can be maintained at a uniform consistency prior to and during placing. The mix is to have sufficient workability between lifts to prevent the occurrence of lift lines with the specified placement and consolidation techniques, and as approved by the Engineer.

b. The addition of the superplasticizer, if deemed necessary, to the concrete mix shall be metered to assure proper dosage; the superplasticizer shall be added to the concrete only at the job site, and immediately prior to its placement in the forms.

The Contractor will be required to run trial batches prior to concrete construction to determine the proper dosage of the superplasticizer and/or the water-reducing-retarding admixture. A slump-loss curve acceptable to the Contractor as well as other test results must be submitted to the Engineer for approval. The Contractor shall advise the Engineer not less than 48 hours prior to any trial batches so that the Engineer may witness the trial batches. Changing the dosage of the superplasticizer at the job site will not be permitted without prior approval of the Engineer. This approval or rejection will be made at the job site on a case-by-case basis.

The maximum slump permitted for the superplasticizer concrete shall be eight (8) inches. Calcium chloride or other admixtures containing calcium chloride shall not be used.

c. The water reducing retarder agent proposed for use shall have a proven performance record in large construction projects for at least five years, as evidenced by letters from owners of structures attesting to satisfactory quality and durability of the concrete structures cited, submitted to the Engineer when approval of the agent is requested.

The agent may be in liquid or powder form and may be either a) a calcium, sodium, potassium or ammonium salt of lignosulfonic acid, or b) a hydroxylated carbolic acid or its salt.

Concrete containing this agent is hereinafter referred to as the "test concrete", and concrete with the same materials but without the agent is hereinafter referred to as the "referenced concrete". Both test and reference concretes shall be prepared at an ambient temperature of 70^0F. The cement and aggregates for the test and reference concretes shall be the same as those to be used in the project.

Test concrete containing the agent in an amount sufficient to cause an increase of 50% and 60% in the initial setting time (ASTM Test Method C403) over the initial setting time of the reference concrete at an ambient temperature of 70^0F, and having the same cement content and slump (AASHTO Test Method T119) as the reference concrete, shall exhibit the following properties when compared to such reference concrete.

E. The water content in the test concrete shall be decreased by at least 5% from that of the reference concrete.

F. The longitudinal linear measurement of the drying shrinkage (AASHTO Test Method T160) of the test concrete at the age of 28 days, after 14 days of initial moist curing, shall be decreased by at least 5% from that of the reference concrete.

G. The compressive strength (AASHTO Test Method T22) of the test concrete shall be increased by at least 10% at the ages of 3, 7, and 28 days, from that of the reference concrete.

Concrete strengths shall be calculated on the average results of at least five 6 inch diameter by 12 inch high cylinders for compressive tests, at each age of test, prepared in accordance with

AASHTO Test Method T126. Drying shrinkage shall be calculated on the average results of at least 3" x 3" x 16" specimens prepared in accordance with AASHTO Test Method T160.

The Contractor shall submit to the Engineer actual test data from an approved laboratory evidencing that the above requirements have been met.

The Contractor shall submit to the Engineer a certificate written by the manufacturer of the proposed water reducing retarder agent stating that the agent to be furnished for the project is identical in composition with the agent that was used for the acceptance tests. The samples of the agent necessary for the acceptance tests shall be selected at random from stockpiled supplies.

H. Laboratory Mix Design:

Concrete mixes shall be designed by the Contractor on the basis of approved ingredients which the Contractor intends to use for this project and all trial batches shall be made using such materials. Trial mixes designed by the Contractor shall be tested for complete conformance to these Specifications by an approved laboratory engaged by the Contractor and at his own expense. All materials for the trail batches shall be furnished by the Contractor and the batches prepared either by him or by his laboratory, also at his own expense. After the Contractor has designed satisfactory mixes, and his laboratory has tested for compressive strength at least four concrete cylinders (for each mix) from each of three separate trial batches using that mix (2 cylinders for each age per batch), he shall furnish the Engineer the mix data, the results of the cylinder tests, the yield as determined by ASTM Test Method C138, and all necessary ingredients for producing approximately 5 cubic feet of concrete. In establishing the amount of each ingredient to be used in the design mixes, the cement and aggregate proportions shall be given by weight for measuring and batching purposes; water and admixture shall be given by weight or volume, as appropriate or convenient. The Engineer may then check the mixes for conformance to specifications and observe various other characteristics of the plastic concrete, such as workability, cohesiveness, finishing, setting time, etc. All such check testing will be done at the Owner`s expense. If any of the requirements are not met, the mixes design will be rejected, and the Contractor shall furnish a new design and materials until satisfactory results are produced. Then each design mix shall be checked as prescribed above for a new mix whenever the source of cement, coarse aggregate, fine aggregate or any other ingredient changes.

Upon acceptance of a design mix found satisfactory to the Engineer, the mix proportions shall be used without change for all concrete structures under the class of concrete in this contract, unless necessary modifications are subsequently approved by the Engineer. Corrections necessitated by variations in the moisture content of the aggregates shall be made by the Contractor as required.

4.0 CONCRETE MANUFACTURING

An automatic recording device capable of recording all of the individual ingredients of the mixes shall be installed at the point of manufacture of the concrete.

5.0 PRODUCTION AND PLACEMENT CAPACITY REQUIREMENTS

The requirements of Section 500.06 of the GDOT Standard Specifications shall apply.

6.0 FORMS

A. The requirements of this Article in the Standard Specifications shall apply except that the formwork shall also conform to the following:

1. Prepare and submit shop drawings to the Engineer for review.

2. Forms shall be designed with adequate strength to withstand pumping pressures and to permit ramming of concrete to fill all possible voids. All hinges shall be drilled for the hinge pins to insure better alignment of the forms.

3. Forms shall be provided with ample openings through which the concrete may be placed, worked and inspected as it moves into place.

4. Forms shall be metal type forms or plywood forms constructed to fit exactly the shapes required. The material used shall be of such thickness that the forms will remain true to shape. All bolts and rivet heads shall be countersunk. Clamps, pins and other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Forms which do not present a smooth surface or do not line up properly shall not be used.

5. Care shall be exercised to keep forms free from rust and grease and other foreign matter. Forms which, in the opinion of the Engineer are unsatisfactory, shall not be used.

7.0 REMOVAL OF FALSEWORK AND FORMS

Forms shall not be removed without approval of the Engineer, and all removal shall be accomplished In a manner which will prevent injury to the concrete. Forms shall be removed only after the concrete has attained sufficient strength to support itself without damage.

8.0 APPLICATION OF EXTERNAL LOADS TO CONCRETE

A. Backfilling around underground structures shall not be performed until the compressive strength of the concrete has reached its design strength evidenced by concrete cylinders taken from the pour and tested in accordance with these specifications, unless authorized by the Engineer.

B. In order that the Engineer can maintain a record of the strength gain of all concrete placed, and to enable the Contractor and the Engineer to determine the times for the removal of the forms and the application of external loads, the Engineer shall make 6" x 12" concrete test cylinders for determining strengths and other properties of the concrete, molds and equipment therefore, shall tag and identify the cylinders, shall cure the test specimens in the same manner as the concrete in the construction being sampled, and shall deliver them to his laboratory for testing. These cylinders shall be prepared in accordance with the requirements of ASTM Specification C31 and tested in accordance with AASHTO Test Method T22.

C. In general, and unless otherwise required, six test cylinders shall be made from each continuous pour of concrete. Two cylinders of each set of six will be tested to determine when the concrete reaches the stresses for the removal of the forms, two at 7 days and two at 28 days. The cost of taking concrete samples, furnishing molds and equipment, preparing, curing and testing the cylinders shall be at the expense of the Contractor.

D. If, during the course of construction, a 7-day concrete cylinder breaks at a compressive strength lower than that specified hereinbefore for that age, the Engineer reserves the right to order the Contractor to immediately core the portion of the concrete construction represented by that cylinder for testing purposes. The coring shall be made of the size and at the locations ordered by the Engineer. Coring and filling core holes with concrete and core testing shall be done at the Contractor`s expense. If the results of the core tests indicate that, in the sole opinion of the

Engineer, the expected rate of strength gain is not sufficient to produce a satisfactory strength at 28 days, the portion of the concrete construction represented by the core, as delineated by the Engineer, shall be removed and disposed of, at the Contractor`s expense, and that portion replaced with new construction. If the results of the core tests indicate that a satisfactory 28-day strength may yet be realized, possible rejection of the concrete in question will be deferred until the 28-day cylinders are tested. If a 28-day cylinder breaks at a strength below the required value, the Engineer reserves the right to immediately reject the concrete represented by the cylinder, ordering such construction removed and replaced within designated limits, or he may permit the Contractor to perform additional coring. If additional coring is permitted, the Engineer will either accept or reject the concrete represented on the basis of the 28-day core tests and all previous tests. The Engineer`s decision in these cases shall be final and conclusive.

E. In the event that, during the course of construction, and following satisfactory 7 day cylinder tests, a 28 day concrete cylinder breaks at a compressive strength lower than that specified hereinbefore for that age, the Engineer reserves the right to immediately reject the concrete represented by the cylinder, ordering such construction removed and replaced within designated limits, or he may permit the Contractor to perform coring wherever ordered. If coring is permitted, the Engineer will either accept or reject the concrete represented on the basis of the 28-day core tests and all previous tests. Coring and filling core holes with concrete and core testing shall be done at the Contractor`s expense. The Engineer`s decision in these cases shall be final and conclusive.

9.0 CONCRETE HANDLING AND PLACING

A. Before placing concrete, care shall be taken to ensure that all required embedded items are firmly and securely fastened in place, as shown on the plans or approved by the Engineer. All embedded items shall be thoroughly cleaned and free from oil and other foreign matter such as loose coating of rust, paint, scale and the like. Concrete shall be placed continuously in the forms in layers of such thickness as may be directed by the Engineer. Each layer shall be placed and compacted before the preceding batch has taken initial set. Tapping or other external vibration of forms will not be permitted without specific permission of the Engineer. Each layer shall be so compacted as to avoid the formation of a construction joint with a preceding layer which has not taken initial set. When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. Where directed by the Engineer, such surfaces shall be cut with an air and water jet at the proper stage of surface hardening or shall be thoroughly cleaned with a stiff wire brush or other satisfactory tool and a stream of water or air, or both, under pressure, if necessary, to remove all laitance of undesirable surface accumulations. If surfaces are not cleaned at the proper time or in the proper manner, sandblasting may be required to produce the required surface. Work shall not be halted except at construction joints shown on the plans or the approved shop drawings. Immediately after the work of placing concrete is halted, all accumulations of mortar splashed upon the reinforcement and surfaces of the forms shall be removed before the concrete takes its initial set. Care shall be taken when leaning reinforcing steel to prevent damage to or breakage of the concrete steel bond. Concrete that has attained its initial set or has contained its mix-water for more than 60 minutes shall not be placed in the work. Placing will not be permitted when, in the opinion of the Engineer, limitations of facilities furnished by the Contractor prevent proper finishing and curing of the concrete. No concrete shall be placed by compressed air.

B. Any concrete which is found to be defective, before the final completion and acceptance of the work, shall be removed, disposed of and the structure properly rebuilt, or if damaged during such time shall be properly repaired or replaced, as required to the satisfaction of the Engineer, at no cost to the Owner.

C. Chutes and Troughs: Where steep slopes are required, chutes either shall be equipped with baffle boards or shall be in short lengths that reverse the direction or movement. Concrete shall not be allowed to drop freely more than 5 feet in unexposed work nor more than 3 feet in exposed work; where greater drops are required, a tremie or other approved methods shall be employed. The discharge of the tremies shall be controlled so that the concrete may be effectively compacted into horizontal layers not more than 12 inches thick, and the spacing of the tremies shall be such that segregation does not occur. Care shall be taken to fill each part of the form by depositing the concrete in as near the final position as possible. The coarse aggregate shall be worked back from the forms and around the reinforcement without displacing the bars. After initial set of the concrete, the forms shall not be jarred, and no strain shall be placed on the ends of projecting reinforcement.

D. Pump Placement. Where the concrete is conveyed and placed by pumping, the plant and equipment used shall be subject to approval by the Engineer. Operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. The position of the discharge end of the line shall be as near the final position of the concrete as possible. The discharge lines shall be horizontal, inclined upwards or vertical from the machine. When placing is completed, concrete to be used which is remaining in the pipelines shall be ejected without contamination of concrete or separation of ingredients. After each operation, debris and flushing water shall be washed away from the structures.

E. Pumps used to convey concrete shall be of a suitable kind and size to adequately handle the volumes of the concrete to be conveyed. The use of aluminum components that might come in contact, during pumping or conveying, with fresh concrete will not be permitted.

F. Vibrating: Unless otherwise directed, concrete shall be compacted with suitable high speed mechanical vibrators. Vibrators shall not be used to push concrete into position.

The vibration at any point shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Vibrators shall not penetrate previously placed layers more than 2 inches to consolidate the layers and to prevent over vibration of the previously vibrated layer.

G. Water stops shall be installed at the location shown on the plans.

10.0 CONCRETE SURFACE FINISHES

Finish shall be Type I, Type II, Type III, or Type IV as specified in the Standard Specifications.

11.0 COLD WEATHER CONCRETING

The requirements of Section 500.14 of the Standard Specifications shall apply.

12.0 HOT WEATHER CONCRETING

The requirements of Section 500.15 of the GDOT Standard Specifications shall apply.

13.0 TOLERANCES

Permissible construction tolerances shall conform to the requirements specified in the Standard Specification. The Contractor shall be responsible for setting and maintaining forms sufficiently within the tolerances specified. Concrete work that exceeds the tolerance limits specified shall be remedied or removed and replaced or corrected at the expense of the Contractor.

14.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Measurement will not be made for structural Portland cement concrete used in the construction of drainage and electrical items.

B. Payment will not be made for structural Portland cement concrete under this specification. Compensation for structural Portland cement concrete, when used for the construction of drainage and electrical items will be included as a part of the respective items.

TESTING AND MATERIAL REQUIREMENTS

Testing and Short Title	Material and Short Title	
AASHTO T-27-Gradation	AASHTO M-80	- Aggregate
AASHTO T-96-Abrasion	AASHTO M-6	- Aggregate
AASHTO T-26-Water	AASHTO M-85	- Portland Cement
AASHTO T-121-Yield AASHTO T-84-Absorption	AASHTO M-134	- Air-Entrained Portland Cement
AASHTO T-85-Absorption	ASTM C-350	- Fly Ash
AASHTO T-152-Air Content	ASTM C-402	- Pozzolans
AASHTO T-23-Cylinders	AASHTO M-154	- Air-Entrained
AASHTO T-22-Compressive Test		- Additives
	ASTM C-494	- Retarder
AASHTO T-119-Slump		
AASHTO M-33-Joint Material		
	ASHTO M-90	- Joint Material
ASTM C-31-Test Specimens	AASHTO M-153	- Joint Material
AASHTO M-213		-Joint Material
	AASHTO M-18	- Joint Material
	AASHTO M-73	- Cotton Mats
	AASHTO M-139	- Paper
	AASHTO M-171	- Polyethylene
	AASHTO M-182	- Burlap
	AASHTO M-148	- Membrane
	ASTM C-618	- Fly Ash

END OF SECTION P-610

SECTION P-615 SITE CONCRETE

1.0 DESCRIPTION

A. This section shall consist of constructing concrete curb and gutter, sidewalks, paved ditches and miscellaneous site work concrete in accordance with the lines, grades and dimensions shown on the plans or as required by the Engineer.

2.0 MATERIALS

A. Concrete and other required materials shall conform to the requirements of Article 441.2 of the Georgia Department of Transportation's Standard Specifications. Modify the concrete to use a minimum compressive strength of 3000 PSI at 28 days.

3.0 CONSTRUCTION METHODS

A. These items shall be constructed in accordance with the requirements of the applicable portions of Article 441.3 of the Georgia Department of Transportation's Standard Specifications.

B. The compaction and testing requirements for the subgrade materials under these items shall be the same as the requirements for subgrades under paved areas in Section P- 152, Excavation and Embankment.

C. Parking bumper blocks shall be installed at the locations and in accordance with details shown on the plans.

4.0 METHOD OF MEASUREMENT

A. Concrete curb and gutter will be measured per linear feet of curb and gutter, completed in- place and accepted.

B. Excavation and backfill will not be measured for payment.

C. Ditch paving will be measured by the cubic yard, complete, in place and accepted.

D. Concrete traffic island and sidewalk paving will be measured by the square yard, complete, in place and accepted.

E. Concrete bumper blocks will each be counted for payment, completed and accepted.

5.0 BASIS OF PAYMENT

A. Payment will be made at the Contract unit price per linear foot for curb and gutter, complete in-place. These prices shall be full compensation for furnishing all materials, preparations and placing of the materials and for all labor, equipment, tools, and incidentals necessary to complete this item.

B. Payment will be made at the Contract unit price per cubic yard of ditch and sidewalk paving, complete in-place. These prices shall be full compensation for furnishing all materials, preparations and placing of the materials and for all labor, equipment, tools, and incidentals necessary to complete this item. Steel reinforcing bars or mats will not be paid separately.

C. Payment will be made at the contract unit price per square yard for traffic islands, complete in place, including steel where required.

D. Payment will be made at the contract unit price for concrete bumper blocks, including rebar, installation, and for all labor, tools, equipment and incidentals necessary to complete the item.

E. Payment will be made under:

Item P-615-1 - Concrete Curb and Gutter - Per Linear Foot

Item P-615-2 - Concrete Ditch Paving - Per Cubic Yard

Item P-615-3 - Concrete Sidewalk - Per Square Yard

Item P-615-4 - Concrete Island Paving - Per Square Yard

Item P-615-5 - Concrete Bumper Blocks - Per Each

END OF SECTION P-615

SECTION P-621 - PAVEMENT MARKINGS AND MARKING REMOVAL

1.0 DESCRIPTION

This section shall consist of the preparation and painting of markings and stripes, and the removal of existing markings, on the surface of Runway, Taxiways, Aprons and Roadways applied in accordance with these specifications and at the locations shown on the plans, or as directed by the City.

2.0 MATERIALS

A. Materials Acceptance. The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for material acceptance, or the Engineer may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the Engineer upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers for inspection by the Engineer. Material shall not be loaded into the equipment until inspected by the Engineer.

B. Paint. Paint shall be Waterborne meeting the requirements of Federal Specification TT-P- 1952E, Type II, furnished in White – 37925, Yellow – 33538 or 33655, Red – 31136, and Black – 37038, in accordance with Federal Standard No. 595. Pink shall be made using one part Red – 31136 to two parts White – 37925.

C. Reflective Media. This feature will be provided by the addition of glass spheres to the surface of the pigmented binder. Glass spheres shall meet the requirements of Federal Specification TT-B-1325D, Type III Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

D. Water. Water to be used by high-pressure water equipment for removing pavement markings shall be obtained by the Contractor from a potable source.

E. Chemicals. The use of chemicals for removing pavement markings will not be permitted.

3.0 CONSTRUCTION METHODS

A. Weather Limitations. The painting shall be performed only when the existing surface is dry and clean, when the atmospheric temperature is at least 45°F and rising, when the pavement surface temperature is at least 5°F above the dew point, and when the weather is not excessively windy, dusty, or foggy. The suitability of the weather will be determined by the city.

Do not perform work when the atmospheric temperature is below 40 degrees F or when the pavement is covered with snow or ice.

Markings shall not be applied when the wind speed exceeds 10 knots unless windscreens are used to shroud the material guns.

B. Equipment. All equipment for the work shall be approved by the City and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

1. The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed to apply markings of uniform cross sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein. When needed, a dispenser shall be furnished which is properly designed for attachment to the mechanical marker and suitable for dispensing the required quantity of

reflective media. The equipment shall be capable of applying markings from 6 to 36 inches in a single pass with uniform coverage and capable of applying two colors simultaneously without applying glass beads to the black markings.

2. Suitable adjustments shall be provided on the sprayer(s) of a single machine or by furnishing additional equipment for painting the width required.

C. Removal Methods. Pavement markings shall be removed from indicated areas by methods acceptable to the Engineer, such as sandblasting, water blasting, or bead blasting, that cause negligible damage to existing pavements, surface texture, joint sealants, or other airfield appurtenances as determined by the City. The method for protecting existing joint sealants during marking removal shall be submitted to the Engineer for approval prior to beginning work on this item. The Contractor shall repair at his expense any damage to the pavement, surface texture, sealant, or appurtenances caused by the removal work. Methods to repair damages shall be acceptable to the City.

1. Contractor shall be aware that existing paint to be removed may contain lead. Safety precautions shall be taken for environmental concerns. Contractor shall test the area prior to submitting a bid for this condition.

2. Any removal method that causes objectionable dust, contaminated water runoff, or other such hazard or nuisance shall be controlled by means approved by the City that eliminate such causes of objection, or its use will not be allowed.

D. Preparation of Surfaces. Immediately before application of the paint, the existing surface shall be dry and entirely free from dirt, grease, oil, acids, laitance, existing paint, or other foreign matter which would reduce the bond between the coat of paint and the pavement. The surface shall be thoroughly cleaned by water blasting as required to remove all dirt, laitance and loose materials. After the cleaning operations, vacuuming or other City- approved cleaning methods shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

1. During blasting, dust and debris will be controlled and contained by vacuums or other approved processes.

2. Obliterating pavement markings by masking with paint, bituminous material, surface treatments or other cover material will not be an acceptable removal method.

3. Paint shall not be applied to new Portland cement concrete pavement until the concrete in the areas to be painted is clean of curing material and/or removal of existing markings. Sandblasting or high-pressure water shall be used to remove curing material and laitance from the concrete surfaces.

E. Layouts and Alignment. Suitable layouts and lines of proposed stripes shall be spotted in advance of the paint application. Control points shall be spaced at such intervals as will insure accurate location of all markings. All stripes shall be accurately surveyed, and layout accomplished well in advance of painting and shall be approved by the City prior to applying paint.

1. The Contractor shall provide an experienced technician to supervise the location, alignment, layout, dimensions and application of the paint.

F. Application. Markings shall be applied at the locations and to the dimensions and spacing indicated on the plans or as specified. Paint shall not be applied until the layouts, indicated alignment and the condition of the existing surface have been approved by the City. Pavement shall be dry to the satisfaction of the City prior to application of paint.

1. The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the pavement with the marking machine at its original consistency without the addition of thinner. The paint shall be applied uniformly by suitable equipment at the following rates:

Pavement Type	Paint Application Rate
Portland Cement Concrete	115 Square Feet per Gallon Freshly
Seal coated Asphalt Concrete	75 Square Feet per Gallon Other
Asphalt Concrete	115 Square Feet per Gallon

2. The reflective media shall be distributed to the surface of the pigmented binder immediately after application and imbedded at the rate and depth as required to provide adhesion and reflection. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Type III glass beads shall be applied at the rate of 10 pounds per gallon of paint for white and yellow markings. Type III glass beads shall not be used for red, pink, or black markings.

   Red and pink markings shall utilize Type I, gradation A glass beads. Type I, gradation A glass beads shall be applied at the rate of 5 pounds per gallon of paint for red or pink markings.

3. All painting shall be performed to the satisfaction of the City by competent and experienced equipment operators, laborers, and artisans in a neat and workmanlike manner. The edges of the markings shall not deviate from a straight line more than ½ in 50 feet and marking dimensions and spacings shall be within the following tolerances

Dimension and Spacing	Tolerance
36 inches	+/- ½ inch
Greater than 36 inches to 6 feet	+/- 1 inch
Greater than 6 feet to 60 feet	+/- 2 inches
Greater than 60 feet	+/- 3 inches

4. A period of 7 days shall elapse between placement of a bituminous surface course or seal coat and application of the paint. Upon application to properly prepared surfaces after curing, the paint shall not bleed excessively, blister, peel, curl, or discolor.

5. New concrete pavement shall be allowed to cure for 7 days before removing curing compound and installing permanent markings.

6. The Contractor shall furnish certified test reports for the materials shipped to the project. These reports shall not be interpreted as a basis for final acceptance. The City shall be notified upon arrival of a shipment of paint to the job site for inspecting and sampling of the materials. The Contractor shall make an accurate accounting of the paint materials used in the accepted work. All emptied containers shall be returned to the storage area for checking by the Engineer. The containers shall not be removed from the airport or destroyed until authorized by the Engineer.

G. Protection. After application of the paint, all markings shall be protected while the paint is drying. The fresh paint shall be protected from injury or damage of any kind. The Contractor shall be directly responsible and shall erect or place suitable warning signs, flags or barricades,

and protective screens or coverings as required. All surfaces shall be protected from disfiguration by spatter, splashes, spillage, drippings of paint or other materials. Contractor's failure to protect fresh paint shall result in repainting at contractor's expense.

H. Cleanup. The Contractor shall remove from the site all debris, waste, and by-products generated by the surface preparation and application operations to the satisfaction of the Engineer. Loose or unadhered reflective media shall be removed from the site to the satisfaction of the Engineer. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations.

I. Defective Workmanship or Material. When any material not conforming to the requirements of the specifications or plans has been delivered to the project or incorporated in the work, or any work performed is of inferior quality, such material or work shall be considered defective and shall be corrected as directed by the City, at the expense of the Contractor. Any area of paint that chips or peels or wears excessively in respect to the overall work shall be repainted within the warranty period. Any areas that do not have a continuous uniform coverage of beads will need to be remarked at the Contractor's expense.

4.0 METHOD OF MEASUREMENT

A. The payment for pavement striping and marking removal shall be the number of square feet of paint removed.

B. The quantity of pavement striping and marking, shall be paid by the number of square feet of paint applied in accordance with the specifications and accepted by the City.

5.0 BASIS OF PAYMENT

A. Payment shall be made at the Contract unit price per square foot for striping or marking removal. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools and incidentals necessary to complete the item.

B. Payment shall be made at the Contract unit price per square foot for pavement striping, and marking, including the surface prep prior to paint application, paint and the reflective media. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools and incidentals necessary to complete the item.

C. Payment will be made under:

Item P-621-1 Pavement Striping and Marking Removal – Per Square Foot.

Item P-621-2 Pavement Striping and Marking – Per Square Foot.

TESTING AND MATERIAL REQUIREMENTS

Test and short title	Material and short title
TT-B-1325C1	Beads (Glass Spheres) Retro-reflective
TT-P-1952E1	Paint, Traffic and Airfield Marking, Waterborne
Federal STD 595	Colors used in Government Procurement

END OF SECTION P-621

SECTION P-660 CONCRETE FILLED STEEL GUARD POSTS

1.0 DESCRIPTION

A. This item shall consist of constructing concrete filled steel guard posts. This item shall be constructed in accordance with this specification, or as required by the Engineer.

2.0 MATERIALS

A. Concrete and other required materials shall conform to the requirements of Article 441.02 of the Georgia Department of Transportation's Standard Specifications.

B. Structural steel (plates, etc.) for guard posts shall meet the requirements of ASTM A36-75. Steel pipe shall conform to the requirements of ASTM A53 Schedule 40.

3.0 CONSTRUCTION METHODS

A. This item shall be constructed in accordance with the requirements of the applicable portions of Article 441.03 of the Georgia Department of Transportation's Standard Specifications.

B. The compaction and testing requirements for the subgrade materials under these items shall be the same as the requirements for the roads where this item is required.

C. The contractor shall cast three (3) 12" x 6" cylinders for each concrete pour, one cylinder tested at 7 days and 2 at 28 days. Slump and air test shall also be made for each sample.

4.0 METHOD OF MEASUREMENT

A. Guard posts will be measured by each post completed in-place and accepted.

B. Excavation and backfill will not be measured for payment.

5.0 BASIS OF PAYMENT

A. Payment will be made at the contract unit price per each guard post, completed in-place and accepted. This price shall be full compensation for furnishing and placing all materials necessary and for all labor, equipment, tools, and incidentals necessary to complete the item.

B. Payment will be made under:

Item P-660-1 - Concrete Filled Steel Guard Post - Per Each.

END OF SECTION