

SECTION 32 13 13

CONCRETE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This Section includes provisions for constructing concrete base, concrete pavement, concrete parking strip, concrete bus pad, concrete gutter, concrete curb, concrete sidewalk and concrete curb ramps at the locations and to the dimensions shown on the Drawings, in accordance with the Project Manual and as directed by the City Representative.
- B. Preparation of subgrade to proper elevation, including excavating, backfilling, removal of existing pavement, existing gutter, existing curb, existing sidewalk, existing curb ramp, and compaction as required will be done as Incidental Work to the above mentioned new concrete work.
- C. Tree roots under pavement and sidewalk areas will be removed with a sharp edge instrument to a depth of 8 inches below finished grade as Incidental Work. Feeder roots greater than 2 inches in diameter will be checked by the Bureau of Urban Forestry. Call the 311 Customer Service, prior to removal by the Contractor.

1.2 REFERENCE

- A. DPW Standard Specifications (SSDPWSF), revised November, 2000.
- B. DPW Standard Plans, dated April, 2007.
- C. ACI 318-14 Building Code Requirements for Structural Concrete.
- D. 2015 Caltrans Standard Specifications
- E. 2015 Caltrans Revised Standard Specifications.

1.3 SPECIAL INSTRUCTIONS

- A. Notifications
 - 1. Underground Service Alert
 - a. Before commencing any excavation, the Contractor shall obtain an Underground Service Alert (USA) inquiry identification number by calling (800) 642-2444.
 - b. The Contractor shall allow four (4) calendar days after the identification number is obtained and before excavation work is started so that utility owners can be notified by the Contractor.
 - c. Identification numbers will not be given more than ten (10) calendar days prior to starting excavation work.
- B. Curb Ramps
 - 1. Curb ramps will be constructed in accordance with the details shown in the DPW Standard Plans.
 - 2. The Contractor shall investigate subsidewalk basement in sidewalk areas prior to saw cutting and excavation for curb ramps. If there is a subsidewalk basement and there is

sufficient cover to construct the curb ramp, saw cutting and excavation will proceed with care. If there is not sufficient cover to construct the curb ramp, the Contractor shall notify the City Representative and stop the construction of the curb ramp.

3. The Contractor shall notify the County Surveyor at (628) 271-2000 to report any monuments in danger of disturbance, destruction or removal. All City monuments are to be protected per State Land Surveyors Act and Section 01 71 33 – Protection of Adjacent Construction. The Contractor shall not disturb, destroy or remove any survey monuments without the approval from the County Surveyor. The Contractor shall salvage any monuments removed during construction and deliver these monuments to the Survey Department at 49 South Van Ness Avenue, Suite 300, San Francisco.
4. The Contractor shall complete the construction of curb ramps, sidewalk, curb and gutter within 72 hours from the commencement of excavation work, so as not to obstruct pedestrian traffic or travel thereon more than is reasonably necessary.

C. Broken Water Meter Boxes

1. Broken San Francisco Water Department (SFWD) meter boxes will be replaced before placing new sidewalk. Call SFWD at (415) 550-4945 to pick up the meter boxes free of charge.

D. Temporary Wearing Surface for Restored Concrete Base

1. After achieving the concrete base depth as shown on the plans or stated in the specifications, the Contractor may use temporary asphalt on the restored concrete base. The temporary asphalt concrete on the restored concrete base shall be removed by the Contractor before placing the final asphalt concrete wearing surface.
2. The final asphalt concrete wearing surface and restored base depths shall be as shown on the plans.
3. Installing temporary asphalt concrete surface on the concrete base areas will be considered as Incidental Work to the Concrete Base bid item. Refer to 01 55 26 - Traffic Control, Special Instructions for temporary ramp requirements.

E. California Code and Regulations

1. The Contractor shall comply with all Cal-OSHA Code requirements during this Contract – Article 37, Section 2946 “Provisions for Preventing Accidents Due to Proximity to Overhead Lines” and Article 37, Section 2947 “Warning Signs Required”.

F. MUNI Railway

1. If MUNI overhead wires are encountered, the overhead wires will be kept energized at all times. The overhead trolley wires carry a minimum of 600 Volts DC and have an 18 +/- feet clearance from the existing roadway. The Contractor shall adapt its methods and equipment to this condition, and take precautions against accidents and damage to the overhead wires and feeder cables when performing paving work and/or concrete work with overhead wires and feeders energized.

G. Local Access

1. The Contractor shall provide local access to garages by the end of each work shift by placing steel plate(s) over excavated area(s). It is the responsibility of the Contractor to notify residents of the Construction Schedule prior to any Work that may disrupt access to garages or other entrances and provide access during construction where as needed or requested by the City.

H. Spray Paint

1. Prior to the start of construction, the Contractor shall provide the City Representative with sufficient spray paint, at no cost to the City, for markings necessary for this Contract.

I. Limit Construction Activities

1. Excavation site may not exceed two (2) consecutive blocks at any time unless otherwise noted in traffic control or environmental management of excavated materials specifications.

J. Survey Control

1. Where roadway pavement reconstruction occurs, the Contractor is responsible for providing primary control, with control line and grades, from existing off site monument markers and lines. The Contractor shall maintain and preserve all lines, grades and benchmarks and provide for all other survey control work. The Contractor shall establish construction control line with hubs every 25 feet prior to construction work.
2. The Contractor shall replace or reestablish hubs missing or displaced during construction at no cost to the City.
3. The Contractor shall retain the services of a State of California registered Land Surveyor with a minimum of one year experience in engineering surveying and control procedure for public works construction, who will establish horizontal and vertical controls as needed by the Contractor.
4. The survey control work will be considered Incidental Work and no separate payment will be made.

K. Granite Curb

1. Granite curb shall only be replaced with concrete curb on curved sections and as part of the curb ramp construction. Existing granite curb in good condition shall be reset to new grade. If existing granite curb is damaged, contractor shall notify City Representative.
2. In the event granite curb is to be replaced with concrete curb, the Contractor shall remove them from the site as City property. All delivery must be initiated and authorized by City Representative. Only granite curb greater than 4 feet in length will be accepted. The granite curb will be neatly and securely placed on pallets so they can be moved about safely after delivery. The granite curb will be delivered, including off loading, to the Treasure Island Maintenance Yard at 701 14th Street at Avenue I, Treasure Island, or where directed by the City Representative within the City.
 - a. Contact Matthew Naclerio of the Bureau of Street and Sewer Repair at Matthew.Naclerio@sfdpw.org or (415) 695-2090.
 - b. Provide a minimum of 48 hour notice for delivery / cancellation via written notification with the following information:
 - Project Name
 - Project Number
 - City Representative Name
 - Contractor Contact Number
 - Estimated Delivery Quantity
3. The Contractor shall clean the granite curb of dirt, debris, and other construction material and exercise care in transporting the granite curb so as to minimize damage.
4. Salvage, hauling and delivery of existing granite curb to the designated areas from the site will be done as Incidental Work.

- a. Delivery is to be made between 8am to 3pm, Monday through Friday.
- b. During delivery, driver is to check in with the Yard Master for designated deliver location.
- c. Yard Master may reject mix and/or unclean load.
- d. Additional charges will be incurred for:
 - 1) Cleaning and Sorting, if Yard must double-handle load to sort, clean and stack delivery;
 - 2) Yard Opening and Operation during non-operation hours and unscheduled deliveries.

L. Cobblestones

1. In the event cobblestones are encountered in any street under construction, the Contractor shall remove them from the site as City property. All delivery must be initiated and authorized by City Representative. The cobblestones will be neatly and securely placed on pallets so they can be moved about safely after delivery. The cobblestones will be delivered, including off loading, to the Treasure Island Maintenance Yard at 701 14th Street at Avenue I, Treasure Island, or where directed by the City Representative within the City.
 - a. Contact Matthew Naclerio of the Bureau of Street and Sewer Repair at Matthew.Naclerio@sfdpw.org or (415) 695-2090.
 - b. Provide a minimum of 48 hour notice for delivery / cancellation via written notification with the following information:

Project Name
Project Number
City Representative Name
Contractor Contact Number
Estimated Delivery Quantity
2. The Contractor shall clean the cobblestones of dirt, debris, and other construction material and exercise care in transporting the cobblestones so as to minimize damage.
3. Salvage, hauling and delivery of existing cobblestones to the designated areas from the site will be done as Incidental Work.
 - a. Delivery is to be made between 8am to 3pm, Monday through Friday.
 - b. During delivery, driver is to check in with the Yard Master for designated deliver location.
 - c. Yard Master may reject mix and/or unclean load.
 - d. Additional charges will be incurred for:
 - 1) Cleaning and Sorting, if Yard must double-handle load to sort, clean and stack delivery;
 - 2) Yard Opening and Operation during non-operation hours and unscheduled deliveries.

M. Concrete Curing

1. Comply with all specification requirements found in the Contract Documents, including those found in the DPW Standard Specifications.

2. The Contractor shall protect all concrete work from mechanical injury (including, but not limited to, mechanical injury from non-project persons tampering with the fresh concrete) until thoroughly set and the strength thereof is sufficient to prevent damage. At a minimum, Contractor shall assign its own personnel, at no additional cost to the City, to monitor finished concrete work until it has cured and cannot be damaged.

1.4 SUBMITTALS

- A. The Contractor shall submit concrete mix design(s) for all intended applications in accordance with project specifications, DPW Standard Specifications Section 800.01, and ACI 318.
- B. The Contractor shall submit manufacturer's literature, specifications, applications and installations for color pigment to be used in curb ramps for the Engineer's approval: L.M Scofield "C-24 Charcoal Gray", QC Integral Colors "IC-3 Ash Gray", Solomon Colors "Charcoal Gray 920", or approved equal.
- C. Mill Test Reports
 1. Certified mill test reports (tensile and bending), for each heat or melt of steel, showing physical and chemical analyses, shall be submitted to the City Representative for review and approval before the material delivery to the job site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Concrete Batching: A concrete batching ticket specifying mix design information shall accompany all concrete deliveries and shall be subject to verification by City Representative.
- B. Dowel bars shall be shipped and stored with dowel bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings.
- C. Dowel bars shall be stored off the ground and be protected from moisture. Keep free from soil, oil, or other injurious contaminants. All steel, which cannot be properly identified, will be rejected, and shall be immediately removed from the job site.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Portland Cement: In accordance with the requirements of Section 800.02 of the DPW Standard Specifications. The Contractor may substitute supplementary cementitious materials such as fly ash or natural pozzolan; silica fume; or ground granulated blast furnace slag (GGBFS) such that the total amount of portland cement shall not be less than 40% by weight of the total amount of cementitious material. The minimum amount of portland cement shall not be less than 225 pounds per cubic yard. Supplementary cementitious materials can be used in all concrete products with the exception of concrete base.
 1. If fly ash or natural pozzolan is used, the total amount of fly ash or natural pozzolan shall not exceed 30% by weight of the total amount of cementitious material.
 - a. Fly ash shall conform to AASHTO M 295, Class F. The available alkali, as sodium oxide equivalent, shall not exceed 1.5% when determined in conformance with ASTM C311 or the total alkali, as sodium oxide equivalent, shall not exceed 5% when determined in conformance with AASHTO T105.

2. If silica fume is used, the total amount of silica fume shall not exceed 10% by weight of the total amount of cementitious material.
 - a. Silica fume shall conform to AASHTO M307 with reduction in mortar expansion of 80% minimum using the cement from the proposed mix design.
3. If ground granulated blast furnace slag is used, the total amount of GGBFS shall not exceed 50% by weight of the total amount of cementations material.
 - a. GGBFS shall conform to AASHTO M302, grade 100 or grade 120.
- B. Aggregate: In accordance with the requirements of Sections 800.03, 800.04, 800.05 and 800.06 of the DPW Standard Specifications. The Contractor shall substitute recycled concrete for a portion of the virgin aggregate in an amount no less than fifteen percent (15%) of the total dry aggregate mass. The recycled concrete material will meet or exceed the specified requirements. When recycled material is used for concrete base, exposed concrete applications such as gutter, curb, sidewalk and curb ramp, the Sodium Sulfate Soundness Test (ASTM C88) is waived. Recycled concrete material will not be allowed in structural concrete or decorative concrete with an exposed aggregate finish.
- C. Concrete Curb Ramps: Color pigment will be extra high strength, non-floating, dispersible, non-glare, permanent and unaffected by sunlight. It will be composed of extremely fine sub-micron particle size and will not create the loss of concrete strength.
- D. Concrete Cast-In-Place Detectable Warning Tiles: In accordance with the requirements of Section 32 17 34 – Concrete Detectable Warning Tiles.
- E. Dowel Bars: Dowel bars shall be deformed.
 1. Dowel bars shall conform to ASTM A615 or ASTM A1035, Grade 60, unless otherwise indicated.
- F. Accessories
 1. Tie wire: Minimum 16 gage black annealed wire.
 2. Supports and spacers: Provide spacers, chairs, bolsters, and other devices to support and secure the dowel bars in place. Supports for dowel bars on ground, aggregate base or sand over vapor barrier shall be precast concrete blocks of sufficient strength, size and spacing to support the bars in proper locations.

2.2 MIXES

- A. Concrete Mix Design Requirements:

Proportioning for concrete mix designs shall be in accordance with ACI 318-14 Section 26.4- Concrete Materials and Mixture Requirements. Maximum allowed concrete slump shall be 4.5 inches and the maximum allowed water-cementitious materials ratio shall be 0.5 (except for concrete bus pad mix design as noted below).

 1. **Concrete Base:** Concrete base shall have a minimum compressive strength of 5,000 psi at 28 days. Performance admixtures to accelerate the setting of the concrete shall be used per manufacturer's recommendation. Concrete base mix design shall be in accordance with requirements of Section 800 of the DPW Standard Specifications.
 2. **Concrete Bus Pad:** Concrete for bus pad shall have a minimum compressive strength of 6,000 psi at 28 days. The maximum allowed water-cementitious material ratio shall be 0.40. Concrete bus pad mix design shall be in accordance with Standard Plan 96,607 Revision 2 and Section 800 of the DPW Standard Specifications. Traffic shall not be

allowed on the concrete bus pad until concrete compressive strength exceeds 2,500 psi. Cure concrete bus pad for 7 days minimum, during such time, traffic shall not be allowed on concrete bus pad, unless otherwise approved by City Representative. Also, following admixture requirements shall be met:

- a. Admixtures shall be compatible and contain no chlorides, sulfides, or nitrides.
 - b. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
 - c. Admixtures for use in producing flowing concrete shall conform to ASTM C 1017.
- B. Returned plastic concrete (RPC) may be incorporated into new minor (concrete curb, gutter, sidewalk and curb ramp) concrete mixes per Caltrans Revised Specification Section 90-9 in an amount not exceeding 15 percent per Section 90-9.02A.
- C. **Concrete Pavement, Concrete Parking Strip:** In accordance with the requirements of Sections 210.04, 800.08 and 800.11 of the DPW Standard Specifications.
- D. **Concrete Curb:** In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.
- E. **Combined Concrete Curb and Gutter:** In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.
- F. **Concrete Sidewalk:** In accordance with the requirements of Sections 204.01 and 800.11 of the DPW Standard Specifications. Also, following admixture requirements shall be met:
1. Admixtures shall be compatible and contain no chlorides, sulfides, or nitrides.
 2. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
 3. Admixtures for use in producing flowing concrete shall conform to ASTM C 1017.
- G. **Curb Ramps**
1. Curb Portion of Work: In accordance with the requirements of Sections 202.06 and 800.11 of the DPW Standard Specifications.
 2. Sidewalk Portion of Work: In accordance with the requirements of Sections 204.01 and 800.11 of the DPW Standard Specifications.
 3. Curb Ramp Color: To obtain the approved permanent dark visual color contrast of 70 percent between the ramp and the adjacent sidewalk, use one of the following approved manufacturers and color types, or approved equal:
 - a. L.M. Scofield "C-24 Charcoal Gray".
 - b. QC Integral Colors "IC-3 Ash Gray".
 - c. Solomon Colors "Charcoal Gray 920".

PART 3 – EXECUTION

3.1 PREPARATION

- A. Preparation and Compaction of Subgrade: In accordance with the requirements of Section 200 of the DPW Standard Specifications.
1. Concrete Base: In accordance with the requirements of Section 207 of the DPW

Standard Specifications.

2. Concrete Pavement, Concrete Parking Strip and Concrete Bus Pad: In accordance with the requirements of Section 210 of the DPW Standard Specifications.
 3. Concrete Curb: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
 4. Combined Concrete Curb and Gutter: In accordance with the requirements of Section 203 of the DPW Standard Specifications.
 5. Concrete Sidewalk: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
 6. Concrete Curb Ramps
 - a. Curb Portion of Work: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
 - b. Sidewalk Portion of Work: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
- B. Preparation of subgrade to proper grade, excavating, backfilling and compacting will be considered as Incidental Work to the applicable bid items where excavation is required to perform the Work.
- C. Asphalt shaving or grindings will not be used as fill material.
- D. Saw cutting and removal of concrete base, concrete pavement, concrete parking strip, concrete gutter, concrete curb, concrete sidewalk and concrete curb ramps to construct and/or reconstruct curb ramps, and to remove existing curb ramps will be considered as Incidental Work to the applicable bid items where removal of the said items are required to perform the Work.

3.2 INSTALLATION

- A. Concrete Installation (All Applications): The Contractor shall install concrete in accordance with proportioning, mixing, transporting, and placing requirements identified in DPW Standard Specification Sections 800.13 and 800.14.
- B. Concrete Base
1. Concrete Base: In accordance with the requirements of Section 207 of the DPW Standard Specifications.
 2. Placing Concrete: In accordance with the requirements of Section 207.05 of the DPW Standard Specifications.
 3. Construction Joints: In accordance with the requirements of Section 207.06 of the DPW Standard Specifications.
 4. Dummy Joints: In accordance with the requirements of Section 207.07 of the DPW Standard Specifications.
 5. Protection and Curing: In accordance with the requirements of Section 207.08 of the DPW Standard Specifications.
- C. Concrete Pavement and Concrete Parking Strip
1. Concrete Pavement and Concrete Parking Strip: In accordance with the requirements of Section 210 of the DPW Standard Specifications, except that the thickness for concrete pavement and concrete parking strip will be 8 inches unless otherwise noted.

2. Placing Concrete: In accordance with the requirements of Section 210.05 of the DPW Standard Specifications.
 3. Construction Joints: In accordance with the requirements of Section 210.07 of the DPW Standard Specifications.
 4. Dummy Joints: In accordance with the requirements of Section 210.08 of the DPW Standard Specifications.
 5. Protection and Curing: In accordance with the requirements of Section 210.09 of the DPW Standard Specifications.
- D. Concrete Bus Pad
1. Placing Concrete: In accordance with the requirements of Section 210.05 of the DPW Standard Specifications.
 2. Construction Joints: In accordance with the requirements of Standard Plan 96,607 Revision 2.
 3. Protection and Curing: In accordance with the requirements of Section 800.16 and Standard Plan 96,607, Revision 2.
 4. Dowel Bars: In accordance with the requirements of Standard Plan 96,607, Revision 2.
 - a. Dowel bars shall be secured firmly in position. Use No. 16-gauge black annealed wire at each steel intersection. Use precast mortar blocks, metal chairs, spacers, metal hangers, supporting wires, and other approved devices to set steel in position with sufficient strength to resist crushing under full load and to prevent displacement during concrete placing operations.
 - b. Precast Concrete Blocks: Precast concrete blocks shall not be less than 3 inches square with embedded wires and shall have at least the same 28-day compressive strength as the surrounding concrete. Space concrete blocks no less than 1'-6" and no more than 3 feet apart.
 - c. Minimum concrete cover for dowel bars and minimum clear bar spacing shall be as specified on standard plan, but in no case shall be less than values specified in ACI 318.
 - d. Placing bars on layers of fresh concrete as the work progresses, or adjusting bars during the concrete placement, will not be permitted.
 - e. Dowel Bars Around Opening: Whenever conduit, piping, sleeves, boxes or other embedded items interfere with the proper placement of dowel bars as detailed, the Contractor shall submit to the City Representative the proposed dowel bar adjustment for review.
 - f. Inspection: No concrete shall be deposited until the Contractor's Testing Agency has inspected the dowel bar placement and the Engineer has been given 24 hours advanced notice to perform their own inspection and has given permission to place concrete.
- E. Concrete Curb
1. Concrete Curb: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
 2. Placing Concrete: In accordance with the requirements of Section 202.07 of the DPW Standard Specifications.
 3. Construction Joints: In accordance with the requirements of Section 202.08 of the DPW Standard Specifications.

4. Finishing: In accordance with the requirements of Section 202.09 of the DPW Standard Specifications.
 5. Protection and Curing: In accordance with the requirements of Section 202.10 of the DPW Standard Specifications.
 6. Repair and Replacement: In accordance with the requirements of Section 202.12 of the DPW Standard Specifications.
 7. Painting: In accordance with the requirements of Section 202.13 of the DPW Standard Specifications.
- F. Combined Concrete Curb and Gutter
1. Concrete Curb and Gutter: In accordance with the requirements of Section 203 of the DPW Standard Specifications.
 2. Placing Concrete: In accordance with the requirements of Section 202.07 of the DPW Standard Specifications.
 3. Construction Joints: In accordance with the requirements of Sections 210.07 and 210.08 of the DPW Standard Specifications.
 4. Finishing: In accordance with the requirements of Section 202.09 of the DPW Standard Specifications.
 5. Protection and Curing: In accordance with the requirements of Section 202.10 of the DPW Standard Specifications.
 6. Repair and Replacement: In accordance with the requirements of Section 202.12 of the DPW Standard Specifications.
 7. Painting: In accordance with the requirements of Section 202.13 of the DPW Standard Specifications.
- G. Concrete Sidewalk
1. Concrete Sidewalk: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
 2. Placing Concrete: In accordance with the requirements of Section 204.05 of the DPW Standard Specifications.
 3. Joints: In accordance with the requirements of Section 204.07 of the DPW Standard Specifications and Standard Plan 87,173.
 4. Reinforced Steel Bars: In accordance with the requirements of Standard Plan 96,608.
 5. Finishing: In accordance with the requirements of Section 204.06 of the DPW Standard Specifications.
 6. Protection and Curing: In accordance with the requirements of Section 204.09 of the DPW Standard Specifications.
 7. Sidewalk will not be constructed monolithic with curb.
 8. Street Names: In accordance with the requirements of Section 204.08 of the DPW Standard Specifications.
 9. Installation of Reinforced Steel Bars at re-entrant corners on a diagonal: In accordance with the requirements of Standard Plan 96,608.

H. Concrete Curb Ramps

1. Curb Portion of Work: In accordance with the requirements of Section 202 of the DPW Standard Specifications.
2. Sidewalk Portion of Work: In accordance with the requirements of Section 204 of the DPW Standard Specifications.
3. All curb ramps will be poured separately from any adjacent construction such as, gutter, curb or sidewalk.
4. Curb ramps will be constructed in accordance with the requirements of the DPW Standard Plans.

3.3 FIELD QUALITY CONTROL

- A. The Contractor shall perform water tests to satisfactorily demonstrate the proper drainage of the constructed curb and gutter, including curb and gutter at constructed curb ramps. The Contractor shall flush with water approximately 50 feet of the upstream end of each curb and gutter, including curb and gutter at curb ramps, for 2 minutes with a minimum flow rate of 0.02 cubic feet per second or approximately 20 gallons equivalence. After 5 minutes, the City Representative and the Contractor shall make visual inspection of the gutter to demonstrate proper drainage and no ponding. All water tests will be considered Incidental Work.
- B. The Contractor shall make corrections necessary to demonstrate proper drainage with no ponding, and no separate payment will be made. The Contractor's correction method will be approved by the City. The City's approval does not release the Contractor from the successful execution of the remedy and the requirement to demonstrate proper drainage of the constructed curb and gutter work, including curb and gutter at constructed curb ramps.

END OF SECTION