SECTION 32 13 52
REINFORCED POST-TENSIONED CONCRETE COURT

APWA STANDARD SPECIFICATIONS ARE HEREBY AMENDED TO INCLUDE THE FOLLOWING:

PART 1 - GENERAL

1.1 SUMMARY

A. The contract work to be performed under this specification consists of furnishing all of the required labor, materials, equipment, implements, complements, parts and supplies in accordance with the specifications and drawings for the site preparation of and construction of post-tensioned concrete courts. Specifications not addressed in this Section shall follow APWA specifications.

B. The work shall be done in a thorough, workmanlike manner by contractors of the American Sports Builders Association (ASBA) and Post Tension Institute (PTI), and shall conform to their standards for tennis court construction. Contractor shall have a ASBA Certified Tennis Court Builder on staff and PTI Level 1 Unbonded Certified Field Technician on site. Proof of certification shall be required of successful bidder.

C. All steel tendon installation, concrete work and stressing of tendons shall be done by a single contractor (no part of the work may be subdivided between contractors). This provision intent is to provide continuity and one source responsibility for the integrity of the post-tensioned slabs.

D. Related Sections include the following:

1. Division 32 Section 32 13 60 “Pickleball Court Surfacing” for surface treatment.

2. Division 32 Section 32 40 01 “Site Furnishings” for pickleball nets and posts and basketball hoop.

E. Information in this section applies only to the construction of post-tensioned concrete slabs and foundations on grade. The engineer shall not be responsible for embedded hardware, anchor bolts, holdowns, post bases, etc., designed by others that do not meet the requirements of this specification. Items not specifically dimensioned on the plans such as posts, hold-downs, etc., shall be located according to approved plans and details.

1.2 QUALITY ASSURANCE

A. Contractor references for three similar successfully executed projects will be required. The contract work to be performed under this section consists of furnishing all required labor, materials, equipment, implements, parts and supplies necessary for, or appurtenant to, the construction of a five inch (5”) thick with thickened edges, post-tensioned concrete slab.

B. Bonding requirements shall be per City requirements.

1.3 SUBMITTALS

A. Submit engineered and stamped structural plans for post-tensioned courts to the Engineer for review and approval prior to construction.

B. Submit the following to the Engineer a minimum of 10 working days prior to installation:

1. Job Mix Formulas and source quality data for stone base and fine aggregate materials.
2. Dimensioned tendon layout locating tendons in horizontal plane.
3. Tendon profile locating centerline of prestress force at maximum 4 foot intervals with respect to bottom of post-tensioned element. Show chairs, chair heights, location of support steel, and other information regarding tendon support methods.
4. End anchorage details, including dynamic test data to verify fatigue properties are adequate to sustain maximum number and stress variations of loads anticipated during entire service life.
5. Jacking forces, initial and anchorage.
6. Required elongations, including narrative and details showing means of measuring elongations, tolerances for measurement.
7. Calculations verifying minimum tendon stress required to achieve minimum residual compressive force of 150 psi at center of slab.
8. Clearance requirements for stressing equipment.
9. Surfacing color samples.
10. Fencing materials.

1.4 GUARANTEE

A. The Contractor shall guarantee the work against defective materials or faulty workmanship for the period of one (1) year and that the colored surface will not wear through for a period of two (2) years from date of completion.

PART 2 - MATERIALS

2.1 STONE BASE MATERIAL

A. Use Class A or Class B Untreated Base Course meeting requirements of APWA 32 11 23.

2.2 FINE AGGREGATE MATERIAL

A. Use Fine Aggregate Material base consisting of 3/8” minus washed concrete sand meeting ASTM C33.

2.3 CONCRETE COMPRESSIVE STRENGTH

A. Use ready-mixed concrete designed, mixed and delivered according to APWA-Utah Chapter specifications for Class 4000 air-entrained concrete with a three to five inch (3-5”) slump.

2.4 POLYETHYLENE SHEETING

A. Use minimum 6 mil thick polyethylene sheeting meeting the requirements of ASTM E 1745.

2.5 TENSIONING CABLES AND ANCHORS

A. Post-tensioning strands and anchorages shall conform to the “PTI Guide Specifications for Post-tensioning Materials”.

B. The tensioning strands shall consist of one-half inch (1/2”) diameter, 7-wire, stress relieved strands, having a guaranteed ultimate tensile strength of 270,000 PSI (270 Kips). Strands shall conform to ASTM-416. Cables shall be fabricated to proper length for each slab, coated with a permanent rust preventative lubricant and encased in slip-age sheathing shall be repaired with tape prior to concrete placement. A maximum of six inches (6”) exposed strands is permitted at the dead-end anchor.

C. Anchorage for post-tensioning tendons shall be monostrand-type anchor system with current ICBO approval using a ductile iron casting of at least 2.25 inches by 4.5 inches of bearing. Pocket-formers shall be used on all stressing ends. The pocket-former shall provide adequate concrete coverage for the anchor as required by project details. Coating pocket-formers with oil or similar materials for ease of removal is acceptable. All dead end anchorages shall be shop fabricated, pre-seated wedges. Fabrication and manufacture of the unbonded system shall be in accordance with the guide specifications as outlined by the post-tensioning institute.

2.6 REINFORCING STEEL

A. Use epoxy coated reinforcement steel, meeting material requirements of and placed according to APWA-Utah Chapter specification 03 20 00.

2.7 FENCING MATERIAL

A. Height of fence shall be 6’-0”, or 4’-0” as specified on drawings.

B. Fence fabric shall be nine (9) gauge core, eight (8) gauge finish fused and bonded, 2” black resin clad mesh fabric with poly-vinyl chloride coating, minimum wall thickness of .015 inches over a galvanized substrate. The base metal shall have a minimum breaking strength of five hundred fifty (550) pounds and a zinc coat weight of 0.1503 pounds per square foot of un-coated wire surface. Zinc coating per ASTM A 392 requirements. Top and bottom selvage of the fabric shall be knuckled.

C. Pipe used for fence framework shall be cold rolled and electric-resistance-welded from steel conforming to ASTM A-569 and hot dip galvanized to ASTM A-525 G-90 zinc weight both inside and outside the pipe. The outside then receives a conversion coating and fusion bonded black polyester powder coating. The application of the coating will consist of three (3.0) mils of cured thermosetting polyester powder coating applied over zinc phosphate pre-treatment of galvanized steel.

D. All line, terminal and gate posts shall be two and seven eighths inch outside diameter (2-7/8” O.D.) with a wall thickness of eleven gauge (11 Ga.) and minimum yield strength of fifty thousand pounds per square inch (55,000 PSI).

E. Top rail(s) shall be one and five eight inch outside diameter (1-5/8" O.D.) pipe with a wall thickness of thirteen gauge (13 Ga.) and a minimum yield strength of fifty five thousand pounds per square inch (55,000 PSI) and provided with seven inch (7") long expansion sleeve couplings.

F. Construct gate frames with one and five-eighth inches outside diameter (1-5/8" O.D.) rail material with welded corners. Provide fabric filler same as used in fence and use heavy duty galvanized hardware with lockable latches. Gates to be powder coated to match the color of the fence after welding.

G. Fence accessories:

1. Fabric ties: Eleven gauge (11 Ga.) galvanized steel tie wire to fasten fabric to framework. Tension wire shall be attached to fabric bottom with heavy galvanized hog rings.
2. Tension Wire: Galvanized-Two (2) strands of twelve and one half (12.5) gauge steel wire twisted together. Vinyl Coated – One (1) strand of eight gauge (8 Ga.) with a six gauge (6 Ga.) finish.
3. Tension Bands: Beveled edge type with nuts and bolts.
4. Line Post Tops: Heavy galvanized cast from eye top fitting.
5. Terminal Post Tops: Heavily galvanized iron tops of rounded type construction.
6. Coating: All accessories to receive black polyester powder coating.

PART 3- EXECUTION

3.1 SUBGRADE

A. The area will be graded to the required depth to accommodate the base and concrete thickness and provide a uniform one percent (1%) slope at plus or minus one tenth of a foot (+0.1') in one plane. Scarify and compact top 8 inches of subgrade to ninety percent (90%) of standard density (AASHTO T-99) at optimum moisture. Grade subgrade material to within one-half inch (1/2") accuracy.

B. Alert the Owner of any "soft spots" or structures that could affect the stability of the slab.

C. The site preparation will be done so as to provide positive drainage away from the play courts where drainage requirements are not addressed by plans.

3.2 STONE BASE

A. Place with automatic laser-regulated equipment capable of providing a true plane to plus or minus one-quarter inch (+1/4"). Place in one layer and compact to ninety five percent (95%) of standard density (AASHTO T-99) at optimum moisture. Grade stone base material to within one-quarter inch (1/4") accuracy.

3.3 FINE GRADE BASE

Place with automatic laser-regulated equipment capable of providing a true plane to plus or minus one-quarter inch (+1/4”). Place in one layer and compact to ninety five percent (95%) of standard density (AASHTO T-99) at optimum moisture. Grade fine grade base material to within one-quarter inch (1/4”) accuracy.

3.4 POLYETHYLENE SHEETING

A. Install two layers of polyethylene sheeting with upper layer laid in direction 90 degrees from lower layer. Overlap edges a minimum of 6 inches and tape edges. Replace sheeting damaged or dislodged during construction.

3.5 FORMING

A. Forms shall be accurately set to the lines and to plus or minus one-quarter inch (+1/4”) of finished grades indicated on drawings and be securely staked to prevent settlement of movement during placement of concrete. Forms shall remain until concrete has taken final set.

3.6 TENSIONING CABLES AND ANCHORS

A. All cables shall be supported on chairs and loosely tied two inches (2”) high at all intersections (too tightly tied, tendon friction will increase when tensioning) to prevent vertical and horizontal movement during concrete placement. Strands shall be placed as engineered. See drawing details for cable spacing.

B. Install tendons and anchors at locations shown on plans. Locate Interior tendons (away from edge of slab or opening) at the approximate location dimensioned on plans. Tendons may be moved laterally, up to a maximum of 12 inches from given dimensions to avoid embeds, blockouts, etc. (see Detail A4). Tendon locations not dimensioned on plans shall be placed at approximately equal spaces between dimensioned control points.

C. All tendon overlaps shall be centered in depth in concrete slab unless noted otherwise.

D. Secure all tendons at each intersection with the appropriate chair or Dobie blocks. Vertical tendon dimensions shall vary not more than 1/8" from the dimensions shown on the drawings. Plastic chairs which provide saddle or side clips for the tendons need only be tied at every third tendon intersection. Dobie block or other chairs which allow tendons to move laterally shall be tied at each tendon intersection. Tie all tendon intersections at the perimeter of the slab.

E. Remove plastic tendon sheathing within 3 inches of back of anchor. Secure the dead end and stressing end anchors to the form boards with nails. Provide proper concrete coverage per project details.

3.7 REINFORCEMENT BAR

A. Install rebar at locations shown on plans. Use minimum of 30x diameter overlap for rebar.

B. Placement of mild steel reinforcement shall be coordinated with placement of post-tensioning tendons, proper tendon placement has priority.

C. All reinforcing shall be bent cold. Bars shall not be un-bent and re-bent. Field bending of rebar shall not be allowed unless specifically noted and approved by Engineer.

3.8 CONCRETE PLACEMENT

A. Concrete contractor shall ensure that workmen exercise great care so as not to disturb locations of tendons during concrete placement.

B. Place each slab in one (1) continuous operation. Place slab with a mechanical screed or laser screed capable of providing a surface to + ¼" in 10' at a 1% slope. No tooled, cold/construction or sawed joints are allowed.

C. Do not add water to surface of concrete before or during finishing operations. Use of an evaporation retarder in accordance with manufacturer recommendations is acceptable. Do not use evaporation retarder as a finishing aid.

D. Provide a medium-broom finish for final surface texture.

E. Finish surface shall not have a water-holding area greater than 1/8" deep. Demonstrate surface flatness by Floor Flatness test or by flooding the court with water and allowing it to drain for one hour on a 70-degree or warmer day.

3.9 CONCRETE CURING

A. Moist cure the concrete slab for between seven (7) and ten (10) days by covering it with burlap, a polyethylene sheet or other curing paper. Liquid curing agents are not acceptable.

3.10 TENDON STRESSING

A. Notify Engineer of stressing schedule a minimum of 3 working days prior to beginning stressing to allow engineer to schedule inspection to measure or verify elongations.

B. Partial stressing the day after concrete placement is recommended stressing to reduce shrinkage cracks. Apply partial (25% of all total force) tendon stressing as early as possible when the concrete strength obtains 1700 psi.

C. Apply full tendon stressing [stress each tendon to a maximum of eighty percent (80%) ultimate breaking strength, and anchored a minimum of 29 kips] after

concrete reaches 3,000 psi. Maximum temporary jacking force shall not exceed 33 kips.

D. All tendons shall be stressed by means of a hydraulic jack equipped with a recently calibrated (within 60 days) pressure gauge. Each jack shall be accompanied by a current certified calibration chart. Tendon stressing operator shall maintain rigid control of gauge pressure readings and elongation measurements. Measured elongation shall correspond to the calculated elongation by plus or minus 10%. Any discrepancies in tendon elongation or stressing operations shall be reported to the engineer before cutting the stressing ends.

E. On tendons 25 feet in length or less, gauge pressure governs over elongation. Tendons exceeding 100’-0” shall be stressed from both ends.

F. Do not stand behind the jack during stressing operations.

G. Upon completion of stressing and receipt of written approval by the engineer, cut off cable ends, coat stressing assemblies with an approved rust preventive material, and grout cone holes flush with edge of slab. Use non-shrink grout.

3.11 FENCING

A. Workmanship: The complete fence shall be plumb, both in line and transverse to the fence, straight and rigid with fabric tightly stretched and held firmly in place. Details of construction not specified shall be performed in keeping with standard good fencing practices. Bottom of chain link shall hang one-half (1/2) inch from tennis surface.

B. Posts: Space all posts not more than eight feet (8’) apart and set in concrete twenty (2) inches deep and not less than ten (10) inches in diameter.

C. Rails: Set top and bottom of rails as nearly parallel to finish grade as possible and at the specified height of fence.

D. Fabric Ties: Provide a minimum of six (6) ties for each ten (10) feet of rail and one (1) tie to each foot of post height. Ties to tension wire shall be made with heavy galvanized hog rings at six (6) per ten (10) feet of tension wire.

E. Tension Bands: Provide one (1) fastener for each one foot (1’) of fabric height (minimum of eight (8) bands for ten (10), three (3) bands for forty three (43) inches).

F. Gates: Gates shall swing easily and hang true and close into the plane of the fence.

END OF SECTION