

THE BROWARD COUNTY LEAGUE OF CITIES'  
SCHOOL AND COMMUNITY PUBLIC SAFETY  
TASK FORCE

INITIAL REPORT AND RECOMMENDATIONS

June 4, 2018

Exhibit #17

## Memorandum

DATE: April 20, 2018  
TO: Jeffrey S. Moquin, Chief of Staff  
FROM: Robert F. Hamberger, Chief Building Official  
SUBJECT: **Perimeter Fencing Realignment for the BCPS District**

**Premise:** As a potential enhancement for school site security, the premise is to modify the standard height of perimeter chain link fencing from 6' above grade to 10' to 12' above grade with a rake to the outward or city property side.

**Conditions:** Several conditions must be considered: First, the configuration of the structures housing students and faculty to the site with the arrangement of the fencing for security. Secondly, the height of the fence with regarding to wind-load considerations imposed as a requirement of the 2017 Florida Building Code. And third, the direct cost impact of both the above conditions must be considered.

**Considerations:** There are 28 prototypical design projects throughout the District with some having as many as 17 schools and some as few as 2 or 3. Naturally, the plats vary from one school to another, but the overall layout plan of the school buildings as a plant are usually consistent. Given that there are 234 schools, centers and technical colleges, the prototypical design sites account for 159 schools and the unique school designs account for 75. Therefore, 28 prototypical plus 75 unique fence layouts totaling 103 site fencing designs will need to be reviewed.

*Consideration 1:* The configuration and essential design of schools vary widely and work in conjunction with the site fencing. The Donald Singer prototypical school is a model surrounded by tilt walls with clerestory windows designed high above the ground. The entrances to these schools are through metal doors in a high wall. The school is literally enclosed in concrete at the perimeter. This is a type of site where the site fencing can adjoin the perimeter corners of the building to protect adjacent play grounds and ball courts, but the design of the building is stout making unauthorized access difficult. Instead of running the fence along the entire perimeter of the property, the building could be used as a barrier. However, many of the high schools and technical centers due to the scale of the site with multiple buildings, athletic facilities, multiple parking lots and windows facing the bordering thoroughfares would require fencing at the perimeters (see attachments).

*Consideration 2:* The Florida Building Code invokes high velocity hurricane criteria once the height of a chain link fence becomes equal to or greater than 12' above grade. The cost-effective approach would be to design a fence 10' in height with a 2' section that has a 60-degree rake outward thereby remaining below the 12' high wind velocity elevation. Traffic gates would need to be linear and remain at below 12' in elevation as well.

*Consideration 3:* Since the fencing height has been limited to just under 12' to avoid increased costs that would be incurred due to high wind velocity measures, the cost factors still become dramatically increased. Additional costs to increase the height of the fence from 6' to 12' are incurred due to increased post size increases from 2 1/4" to 4", the concrete foundation for each post increases from 8' in diameter x 24" in depth to 18' in diameter x 42" in depth, the fence posts must reduce from 10' o/c to 8' o/c, the fabric doubles in square footage and all of the gate posts, bracing and tensioning increase in size and cost, inclusive of the splay braces for the rake at the top. The approximate cost would increase from \$18/lf for 6' high fencing, from \$21/lf for 8' high fencing, from \$23/lf for 10' high fencing to about \$98/lf for the 12' chain link w/o a rake top (all estimates acquired from PPO), but with an additional expenditure for demolition and removal of the existing fence lines. Consider the differential costs extended for 234 facilities, which cover 3,975 acres (obtained from FP&RE).

## SECTION 02830 (32 31 13)

### CHAIN LINK FENCES AND GATES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Fence framework, fabric, and accessories.
- B. Excavation for post bases and concrete foundations for posts.
- C. Concrete anchorage for posts.

##### 1.2 SECTION INCLUDES

- A. Section 01572-Construction Waste Management.

##### 1.3 SUBMITTALS

- A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware, and the following information:
  - 1. Recycled Content:
    - (a) Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    - (b) Indicate relative dollar value of recycled content product to total dollar value of product included in project.
    - (c) If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
    - (d) If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.
- C. Samples: Submit two samples of fence fabric, 12 inches x 12 inches in size illustrating construction and finish.
- D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation requirements.

##### 1.4 QUALITY ASSURANCE

- A. References:
  - 1. ASTM A53-Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
  - 2. ASTM A123-Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. ASTM A392-Standard Specification for Zinc Coated Steel Chain-Link Fence Fabric.
  - 4. ASTM A641-Zinc coated (Galvanized) Carbon Steel Wire.
  - 5. ASTM C94-Ready-mixed Concrete.
  - 6. ASTM F567-Standard Practice of Installation of Chain-Link Fence.

7. ASTM F668-Poly (Vinyl Chloride) (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric.
  8. ASTM F900 Standard Specification for Industrial & Commercial Swing gates.
  9. ASTM F1083-Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- B. Manufacturer: Company specializing in commercial quality chain link fencing with minimum 3 years experience.
- C. Perform work complying with provisions of ASTM F567, and as specified in this section.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with the specified requirements, provide products by one of the following manufacturers:
1. Stephens Pipe & Steel, LLC.
  2. Master-Halco.
  3. Merchants Metals a Division of MMI Products, Inc.
- B. Substitutions:
1. Will be considered by the A/E and Owner when submitted per requirements of Division-0, Division-1, and Section 01630-Product Substitution Procedures.

### **2.2 MATERIALS**

- A. All chain link fabric, posts, accessories, fittings, and hardware products shall contain recycled content.

### **2.3 CHAIN LINK FENCE**

- A. Fabric:
1. Wire: No. 9 gage (.148 inch diameter), 2-inch mesh galvanized fabric with knuckled selvages top and bottom.
    - (a) Wire at Site Perimeter Fences: No. 11 gage (.120 inch diameter), 2 inch galvanized mesh fabric with knuckled selvages top and bottom.
    - (b) Wire at Baseball Backstops: No. 6 gage (.192 inch diameter), 2 inch galvanized mesh fabric with knuckled selvages top and bottom.
  2. Galvanized Base Coating: Under provisions of ASTM A641.71a, 1.2 ounces/square foot.
  3. Fusion-Bonded Vinyl Coating: Where vinyl coated fencing is specified or indicated on the Drawings it shall be fusion-bonded type, comply with ASTM F668, Standard Industrial, Class 2B, with thickness of vinyl coating between 0.006 and 0.010 inches. Core wire to be 6 or 9 gage galvanized in accordance with ASTM A641. Color: Black
    - (a) Fence System Color: When vinyl coated fabric is used, the remainder of the fence system (such as posts, rails, braces, frames, wires, caps, gates, gate hardware, accessories, etc.) shall receive polyester powder coating, with the color to match the chain-link fabric.

- B. Bottom Tension Wire: 6 gage (.192 inch diameter), attached to fence fabric with hog rings at 24 inches on center. Tension wire and hog rings: Finish shall match fabric.
- C. Posts, top rails, braces, and gate frames: Schedule 40, type E or S, grade B galvanized pipe per ASTM A53, sizes as follows:
1. Line Posts (maximum spacing 10 feet), End or Corner Posts (Braces to be provided at both) as listed in the table below:

Fence height	Line posts:	End or corner posts:
4 ft	2" nominal diameter (2 3/8" O.D.)	2 1/2" nominal diameter (2 7/8" O.D.)
6 ft	2" nominal diameter (2 3/8" O.D.)	2 1/2" nominal diameter (2 7/8" O.D.)
8 ft	3" nominal diameter (3 1/2" O.D.)	3 1/2" nominal diameter (4" O.D.)
10 ft	3 1/2" nominal diameter (4" O.D.)	6" nominal diameter (6 5/8" O.D.)
12 ft	6" nominal diameter (6 5/8" O.D.)	6" nominal diameter (6 5/8" O.D.)

2. Gate Posts: As scheduled below (see 2.2.E).
  3. Top Rails: 1-1/4 inch nominal diameter (1-5/8 inch O.D. - 2.27 lbs/foot).
  4. Mid Rails: 1-1/4 inch nominal diameter (1-5/8 inch O.D. - 2.27 lbs/foot).
  5. Bottom Rails: 1-1/4 inch nominal diameter (1-5/8 inch O.D. - 2.27 lbs/foot).
  6. Braces: 1-1/4 inch nominal diameter (1-5/8 inch O.D. - 2.27 lbs/foot).
  7. Fences greater than 12 feet in height (and their foundations) shall be designed by a Florida Licensed Professional Engineer in accordance with the provisions of the Florida Building Code. Provide an Engineered Shop Drawing and/or supporting calculations.
- D. Gate Frames: ASTM F900, for fabrication only, use 1-1/2 inch nominal, 1-7/8 inch O.D. schedule 40 galvanized pipe with welded corner connections and welded diagonal 1-1/4 inch nominal diameter (1-5/8 inch O.D.) pipe bracing. Paint all welds with galvanic paint, 2 coats.
- E. Gate Posts for swing gates:
1. Use pipes of nominal sizes as listed on table below for each fence height and gate leaf width:

Fence height	Gate leaf width:	Gate post (Schedule 40, type E or S, grade B galvanized pipe - ASTM A53):
4 ft or 6 ft	up to 6ft wide (inclusive)	2 1/2" nominal diameter (2 7/8" O.D.)
4 ft or 6 ft	over 6ft to 12ft wide (inclusive)	3" nominal diameter (3 1/2" O.D.)
4 ft or 6 ft	over 12ft to 18ft wide (inclusive)	3 1/2" nominal diameter (4" O.D.)
8 ft	up to 12ft wide (inclusive)	3 1/2" nominal diameter (4" O.D.)
8 ft	over 12ft to 18ft wide (inclusive)	6" nominal diameter (6 5/8" O.D.)
10ft or 12ft	up to 18ft wide (inclusive)	6" nominal diameter (6 5/8" O.D.)

- F. Fabric Connections:
1. Securely fasten fabric to all terminal posts with 3/16 inch x 5/8-inch tension bars and beveled edge 11-gage tension bands.
  2. Number of tension bands: One band less than the height of the fabric in feet for each tension bar.
  3. Fasten all fabric to intermediate posts with vinyl coated 9-gage galvanized wires not to exceed 12 inches apart. Fasten tie wire to fence fabric with 1-1/2 inch full turns minimum.

- 4. Tie fabric to top rail with 9-gage galvanized wire not to exceed 24 inches apart. Fasten tie wires to fabric with 1-1/2 inch full turns minimum.
- 5. Fasten bottom edge of fabric to bottom tension wire using hog rings at intervals not to exceed 24 inches on center.
- 6. Aluminum ties are not acceptable.

G. Braces:

- 1. Securely fastened to posts by 11 gage pressed steel beveled bands and malleable fittings, then securely trussed from the line post to base of terminal post with a 3/8 inch truss rod and tightener.
- 2. Braces are required only in heights of 6 feet and higher.
- 3. Brace pipe: the same as top rail and installed midway between the top rail and the ground and extend from the terminal post to the first adjacent line post.
- 4. Truss bracing: Provided in panels adjoining all end, corner and gate posts.

H. Intermediate Post Tops: Malleable iron with no points on top.

I. Hinges: Malleable iron, hot dipped galvanized:

- 1. Heavy 90 degrees Industrial Box Hinge, with 180 degree offset adaptor.

J. Latches: Malleable iron, hot dipped galvanized

- 1. Industrial Fork Latch combined with back latch attached.

K. Gate Holdbacks w/ Duck Bill: One per each gate leaf.

L. Fence and Gate Height: As shown on drawing. Gates to be same height as fence.

2.4 CONCRETE FOR POST SETTING: ASTM C94; normal Portland cement, 3,000 psi strength at 28 days, 4 inch slump.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

A. Post Installation:

- 1. Provide posts for fencing along lines indicated. Space posts evenly, maximum 10 feet on center, carefully aligned and plumb in every direction.
- 2. Post Setting: Extend post to six inches from foundation bottom. Extend foundation to 2 inch below finish grade. Trowel crown and slope foundation away from post.
- 3. Coordinate with Project Consultant concerning any obstacles or obstructions in line of fencing.
- 4. At foundations that will be located under a concrete slab, provide sleeves for future fence foundations, if fence will be installed after the concrete slab.

B. Adjust hardware for smooth operation and lubricate where necessary.

C. Foundation Size

- 1. Concrete foundation size for line or terminal posts shall comply with the following table based on fence height:

Fence height	footing dimensions (inches)	
	diameter	depth

4 ft or 6 ft	12	30
8 ft	18	36
10 ft	21	42
12 ft	24	42

Note: Fences greater than 12 feet in height (and their foundations) shall be designed by a Florida Licensed Professional Engineer in accordance with the provisions of the Florida Building Code. Provide an Engineered Shop Drawing and/or supporting calculations.

2. Concrete foundation size for gate posts shall comply with the following based on Gate Leaf width and maximum allowable height:

Fence height	Gate leaf widths	footing dimensions (inches)	
		diameter	depth
4 ft or 6ft	up to 6ft wide (inclusive)	12	30
4 ft or 6ft	over 6ft to 18ft wide (inclusive)	18	36
8 ft	up to 6ft wide (inclusive)	18	36
8 ft	over 6ft to 12ft wide (inclusive)	21	42
8 ft	over 12ft to 18ft wide (inclusive)	24	42
10 ft	up to 6ft wide (inclusive)	21	42
10 ft	over 6ft to 12ft wide (inclusive)	24	42
10 ft	over 12ft to 18ft wide (inclusive)	27	48
12 ft	up to 6ft wide (inclusive)	24	42
12 ft	over 6ft to 12ft wide (inclusive)	27	48
12 ft	over 12ft to 18ft wide (inclusive)	30	54

Note: A Florida Licensed Professional Engineer shall design gates, gate posts and their foundations with a leaf width and height outside these parameters. Design shall be in accordance with the provisions of the Florida Building Code. Provide an Engineered Shop Drawing and/or Supporting Calculations.

- D. Top and Bottom Rail:
  1. Provide continuous top rail through line posts.
  2. Rigidly connect top rail to all end, corner, and gate posts.
  3. Level site: Install top rail level. Varying ground slopes: Install top rail with continuous even gradient from corner to corner. Roller coaster installation: Not permitted.
  4. Provide bottom rail at bus barriers.
  
- E. Mid Rail:
  1. At 8 feet high and over fences provide mid rails.
  
- F. Chain Link Fabric:
  1. Install with fabric top flush to top rail with bottom of fabric 1 inch (+/- 1/2 inches) above finished grade.
  2. Stretch fabric tightly to eliminate sags and buckles.
  3. Refer to paragraph 2.2 above for fabric fastening.
  
- G. Gates:
  1. Fabricate and install gates to prevent sagging conditions.
  2. Install gates square, level, and plumb.
  3. Install ground-set items in concrete for anchorage.



4. Permanently fasten hasp and staple combination for locking gates and hold open feature in place.
- H. Bottom Tension Wire
1. Install bottom tension wire and mechanically tension for very tight installation.
  2. Use tension bands for attachment of tension wire to end and corner posts at each straight run of fence.

**END OF SECTION**

2223.5.4 Fastenings shall be by bolting, welding or other approved fastening device that provides a resistance to lateral movement as required by rational analysis or by test, but not less than 400 pounds per lineal foot (5838 N/m).

2223.6 Permitting. Reserved.

2223.7 Fabrication and erection.

2223.7.1 Reserved.

2223.7.2 Temporary bracing shall be provided during erection and shall remain in place until all structural frames, purlins, girts, flange braces, cable or rod bracing and sheets used as diaphragms have been installed.

2223.8 Roof sheets, wall sheets, roof panels and wall panels.

2223.8.1 Reserved.

2223.8.2 The fusion welding of structural members and structural sheets defined in Section 2222.4 and less than 22 gauge (0.0299 inch nominal) in thickness shall have minimum of  $\frac{5}{8}$  inch (17 mm) diameter welds through weld washers not less than 14-gauge in thickness and 1 inch (25 mm) in diameter, contoured if necessary to provide continuous contact, or an equivalent device.

2223.8.3 Clip-mounted standing-seam roof sheets shall not be used as diaphragms nor shall they be considered as adequate lateral bracing of the flange of the secondary member to which they are attached unless one or both of these features are designed into the sheathing system and the manufacturer can certify by testing and/or analysis that such capabilities exist and are appropriately defined.

2223.8.4 Structural standing-seam roof sheets shall be a minimum of 24 gauge [0.0239 inch (0.6 mm) nominal] in thickness.

2223.8.5 Direct screw attached roof and wall sheets may be used as diaphragms provided the sheets are a minimum of 24 gauge [0.0239 inch (0.6 mm) nominal] in thickness. Additionally, these sheets shall be considered to laterally brace the flange of the secondary member to which they are attached.

2223.8.6 See Section 2222 for additional requirements for roof sheets, wall sheets, roof panels and wall panels.

2223.9 Roof purlins and wall girts.

2223.9.1 Adequate bracing shall be provided to the compression flanges of secondary members with special attention to those members subject to uplift or outward pressures where no roof or wall sheets are attached to provide such bracing. Sag rods shall not be considered bracing when located in the neutral axis of the web of the secondary members.

2223.9.2 Roof purlins and wall girts shall be laterally braced in addition to relying on deck and panel diaphragm action.

2223.9.3 The ends and bearing points of secondary members shall be designed to carry 100 percent of dead, live and collateral loads superimposed on them by wind.

2223.9.4 Upward or outward forces of wind are to be calculated without live and collateral loads. When downward or inward forces caused by wind are involved, the dead forces plus collateral load forces must be combined but the roof live load may be omitted.

2223.10 Individual structural members.

2223.10.1 Cables and rods shall not be used as lateral bracing in habitable structures. Lateral bracing, when used, shall have a slenderness ratio of 300 or less, unless restricted by any other section of this code.

2223.10.2 Reserved.

2223.10.3 All doors shall be anchored as part of the frame in the closed position.

2223.10.4 See Section 2222 for additional requirements for metal building systems and components.

2223.11 Inspection. Reserved.

#### SECTION 2224 HIGH-VELOCITY HURRICANE ZONES— CHAIN LINK FENCES

2224.1 Chain link fences in excess of 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones).

2224.2 Chain link fences less than 12 feet (3.7 m) in height shall be designed according to the loads specified in Chapter 16 (High-Velocity Hurricane Zones) or may be constructed to meet the minimum requirements specified in Table 2224.

TABLE 2224  
CHAIN LINK FENCE MINIMUM REQUIREMENTS

Fence Height (ft)	Terminal Post Dimensions (o.d. x wall thickness) (in inches)	Line Post Dimensions (o.d. x wall thickness) (in inches)	Terminal Post Concrete Foundation Size (diameter x depth) (in inches)	Line Post Concrete Foundation Size (diameter x depth) (in inches)
Up to 4	$2 \frac{3}{8} \times 0.042$	$1 \frac{5}{8} \times 0.047$	10 x 24	8 x 24
Over 4 to 5	$2 \frac{3}{8} \times 0.042$	$1 \frac{7}{8} \times 0.055$	10 x 24	8 x 24
Over 5 to 6	$2 \frac{3}{8} \times 0.042$	$1 \frac{7}{8} \times 0.065$	10 x 24	8 x 24
Over 6 to 8	$2 \frac{3}{8} \times 0.110$	$2 \frac{3}{8} \times 0.095$	10 x 36	10 x 36
Over 8 to 10	$2 \frac{7}{8} \times 0.110$	$2 \frac{3}{8} \times 0.130$	12 x 40	10 x 40
Over 10 to 12	$2 \frac{7}{8} \times 0.160$	$2 \frac{7}{8} \times 0.120$	12 x 42	12 x 42

For SI: 1 inch = 25.4 mm.

NOTES:

1. This table is applicable only to fences with unrestricted airflow.
2. Fabric: 12 $\frac{1}{2}$  gauge minimum.
3. Tension bands: Use one less than the height of the fence in feet evenly spaced.
4. Fabric ties: Must be minimum the same gauge of the fabric.
5. Fabric tie spacing on the top rail: Five ties between posts, evenly spaced.
6. Fabric tie spacing on line posts: One less than height of the fence in feet, evenly spaced.
7. Either top rail or top tension wire shall be used.
8. Braces must be used at terminal posts if top tension wire is used instead of top rail.
9. Post spacing: 10 foot (3 m) on center maximum.
10. Posts shall be embedded to within 6 inches (152 mm) from the bottom of the foundation.
11. In order to follow the contour of the land, the bottom of the fence may clear the contour of the ground by up to 5 inches (127 mm) without increasing table values to the next higher limit.