



RECOMMENDED PRACTICE

American Public Transportation Association
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APTA Transit Infrastructure
Security
Work Group

Ornamental Fencing Systems to Control Access at Transit Facilities

Abstract: This *Recommended Practice* provides guidance for ornamental fencing systems to control access at revenue and nonrevenue transit facilities.

Keywords: access control, assessment, crime prevention through environmental design (CPTED), gate, landscaping, lighting, ornamental fencing systems, security, threat and vulnerability analysis

Summary: Ornamental fencing systems are components of access control systems. They define boundaries, channel access and egress, provide visual barriers, support security and safety, and deter and delay intrusion and trespassing. Many styles of ornamental fences are available to the public transportation industry. If aesthetics are a priority, ornamental fencing systems may be designed with a low-profile appearance through reduced height, or the incorporation of colors, environmental coatings, or lattice style inserts while maintaining anti-scaling capabilities. Ornamental fencing should be integrated with other security measures, including CPTED, lighting, barriers, etc., to optimize protection and complement security solutions. Ornamental fencing systems can also be used with protective vehicle barriers, but both should blend with area aesthetics and adhere to local ordinances.

Scope and purpose: This document supplements the *Recommended Practice* “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities,” which should be reviewed and considered when researching and developing fencing system practices for transit agencies. This document establishes recommended practices for the design, installation and maintenance of ornamental fencing systems to control access to areas under the jurisdiction and control of a transit operating agency. These recommended practices should be considered as components of a “systems approach” to achieving security related objectives. APTA recommends the use of this *Recommended Practice* by any entity, public or private, who regulates, inspects, designs, specifies, builds, maintains and/or operates public transportation facilities

This Recommended Practice represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system’s operations. In those cases, the government regulations take precedence over this standard. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit agencies, may be either more or less restrictive than those given in this document.



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1. Stakeholder considerations

Ornamental fencing systems should be designed to meet the needs of each specific application (i.e., parking, walkways, internal or underground areas) for revenue and nonrevenue facilities. To the extent possible, installation of ornamental fencing systems should serve a clear purpose, be conducive to or at least not interfere with transit operations, and present a minimal and manageable financial and maintenance burden. Additional information about incorporating fencing systems with barricade systems is located in “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities,” and should be reviewed

1.1 Risk assessment considerations

Transit agencies should formally evaluate risk and use systemwide and asset-specific risk assessments as guides in determining effective placement of chain link, mesh and woven metal fencing systems to optimize security. This standard is intended to be incorporated with the application of anti-personnel fencing and not anti-vehicle fencing. For additional information, see the APTA *Recommended Practice* on risk assessment.

1.2 CPTED considerations

Transit agencies should complete a CPTED survey of the proposed fencing system installation site to identify exposures and recommend enhancements that can be employed as crime prevention or other security measures. For additional information, see the APTA *Recommended Practice* on CPTED.


1.3 Site considerations

Transit agencies should identify installation, operations and maintenance factors when evaluating existing or planning new ornamental fencing systems. For additional information, see the APTA *Recommended Practice* “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities.”

2. Ornamental fencing systems

Ornamental fencing materials, construction, installation methods and designs are significant factors to determining fencing system selection. The most commonly used type of ornamental fencing employed in the transit system environment is described in [Table 1](#).

TABLE 1
Fencing System Type, Description and Use

Fencing Type	Description	Potential Uses
<p>Metal or aluminum alloy fencing</p> 	<ul style="list-style-type: none"> • Pickets vary based on application. • Posts are set in concrete, usually 10 ft. (3.05 m) on-center apart. • Height varies based on application, but can range from 4 to 12 ft. (1.21 to 3.65 m). • Pickets can be extended, shaped and curved for use and top guard. • Top guard treatments (e.g., barbed wire and razor tape) may be installed at the top or bottom of the fencing. • Aircraft cabling can be attached to the fencing interior with anchored in-ground footings to reinforce resistance. 	<ul style="list-style-type: none"> • To provide temporary or permanent perimeter definition around large or small facilities, buildings, restricted areas, walkways or parking lots. • To channel pedestrian circulation. • To prevent access to unauthorized areas. • To protect against vehicle ramming or penetration. • To provide effective delay or deterrents where necessary in a high-threat environment where aesthetics are important.

Though ornamental fencing systems can be manufactured of metal, plastic or wood, this *Recommended Practice* concentrates on those systems made of various types of metal. Other materials, such as vinyl and plastic-coated metal products are being introduced to the fencing industry. These coating materials have demonstrated use in reducing maintenance, upkeep and repair, as well as extending life cycle, and should be considered in the final fencing selection. Each of the materials has specific maintenance issues and concerns that can impact the use and life expectancy of the system

- Some ornamental fencing is designed and installed for temporary use, while others are installed for long-term or permanent use. A combination of the types of installation that may best suit a facility or an area’s specific security requirements should be carefully evaluated as part of the security risk assessment and design processes. Installation is critical to fencing systems design and selection and there are as many installation methods as there are varieties of fencing materials. Ornamental fencing adjacent to gates should be designed with consideration to prevent reaching through or use of tools between the pickets to open the gate. Manufacturers’ recommended installation methods should always be followed.

Table 2 identifies the suggested uses, strength and weakness and level of protection provided for ornamental fencing.

TABLE 2
Strengths and Weaknesses of Ornamental Fencing

Fencing system	Strengths	Weaknesses	Level of Protection	Average Life
Metal or aluminum alloy fencing	<ul style="list-style-type: none"> • Low maintenance. • Aesthetic appearance. • Easily configurable by size or shape. • Vertical fencing pickets limit foothold or handgrip to scale over fencing. • Easily repaired. • Picket spacing can enhance natural surveillance. When visibility is not a requirement, narrow picket spacing should be considered to minimize climbing. • May require several cuts to develop an opening large enough for human penetration. 	<ul style="list-style-type: none"> • Horizontal bracing may provide a foothold. • Medium to high cost. • May not be “off-the-shelf.” • May require specialized installation. 	Medium	20 years

3. Applications of ornamental fencing systems

Height, application, and type are important to the environment of an ornamental fencing system. For example, where a 4 ft. (1.22 m) ornamental fence may be appropriate for a sidewalk or walkway, a 12 ft. (3.66 m) ornamental fencing systems with barbed wire installed along the top may be equally appropriate to surround critical infrastructure, a perimeter boundary, etc. The type of fencing system should be suitable to the application and environment. Local ordinances and code requirements should be reviewed during the planning and early design stages to determine if any ornamental fencing systems requirements or restrictions apply or exist.

3.1 Clear zones

Clear zones provide an unobstructed view of the fencing system to make it more difficult for potential intruders to be concealed from observation. Where practical, transit agencies should identify and designate clear zones on the exterior and interior sides of their property's fencing system.

3.2 Standoff distance

The most effective tactic to keep threats away from assets is the use of standoff distance. In general, the more standoff distance provided, the more the risk is reduced.

3.3 Fencing system protection

Fencing system and their components in the proximity of moving vehicle traffic may be prone to damage from bumping, hitting, or by vehicles otherwise driving into or through them.

3.3.1 Vehicle barriers

To enhance anti-vehicle physical security resistance, some fencing systems integrate anti-vehicle barriers into systems designed to control pedestrian access.

3.3.2 Signs

The language of signage should meet all applicable federal, state and local laws and ordinances (Title VI, ADA requirements, etc.)

3.4 Inspection and maintenance

Fencing systems should be regularly and systematically inspected for integrity, functionality and signs of damage.

4. Fencing system elements

Various materials, components, and hardware make up fencing systems. Most fencing systems contain some types of common element(s) and are designed using standardized industry practices. Commonly designed fencing systems elements and industry practices are listed below.

- **Pickets.** Pickets, sometimes referred to as pales, should be spaced with consideration for vulnerability to climbing or penetration. Check local codes in your area. Authorities often mandate maximum picket spacing distance. Pickets should be securely fastened to the exterior side of posts and supporting hardware (bracing bars, rods, wire, etc.) to prevent gaps, misalignments, sway or removal.
- **Environmental coating.** Metal fencing systems exposed to various environmental conditions may be protected with a wide range of exterior coatings, including zinc (galvanized), aluminum, metallic or polyvinyl chloride coatings. The color of fence coatings should also be considered. Lighter-colored fencing materials, typically covered with polymer protection, allow objects, people and other assets seen through an ornamental fence to contrast with their environment. The contrasting effect to foreground or background colors (e.g., dark foreground to light background and vice versa) affords greater opportunities to observe and identify potential threats.
- **Height.** Fencing pickets should be at least the height of the posts supporting them. Pickets installed in a security environment should always be higher than supporting posts.
- **Posts.** Fencing systems posts should be as tall in height as the material they support, be of sufficient strength to hold the fencing materials in place; and be firmly set in the ground to prevent shifting by wind, erosion or other environmental conditions. The depth of fence post installation should be appropriate for the region and consider the winter freeze and thaw cycles.

- **Bracing.** Top, middle or bottom bracing rails may be necessary to reinforce an ornamental fencing systems' structural integrity between posts or at corners, to firmly secure pickets, or to enhance fencing system security. Bracing should always be installed on the inward side of the fencing systems. Note that excessive bracing can also facilitate climbing, and should be used only when necessary. When vehicle crash resistance is a requirement, fencing should be structurally designed to withstand specific vehicle weight and speed criteria. This may involve concrete retaining walls or other barriers beneath the fencing.
- **Outriggers.** Single barbed wire arms called outriggers may be installed and directed inward or outward of the property or in a vertical position. Double barbed-wire arms (forming a "V") can be installed on top of fencing posts and directed simultaneously inward and outward of the property. It is most difficult to scale a fence from the outward-leaning side of any outriggers.
- **Barbed wire.** Strands of barbed wire attached to arms at the top of or sides of fencing systems should be attached in strands of three or more.
- **Concertina wire** (also referred to as "barbed tape" or "barbed concertina wire"). Attach unraveled and stretched coils to the top or to the sides of fencing systems or to strands of barbed wire that are installed to the top of fencing systems. However, coils installed at the ground level in single or multiple coils should be connected to the adjacent fencing systems, other coils of wire, and staked to the ground to prevent removal by humans or shifting by winds, erosion or other environmental conditions.
- **Razor tape** (also referred to as "razor wire"). Attach unraveled and stretched coils to the top or to the sides of fencing systems or to the strands of barbed wire installed on the top of fencing systems. However, coils installed at the ground level in single or multiple coils should be connected to the fencing systems, other coils of wire, and staked to the ground to prevent removal by humans or shifting by winds, erosion or other environmental conditions.
- **Hardware.** Install all hardware and components (screws, nuts, bolts, hinges, bracing, rods, wire, etc.) to the interior side of the fencing systems and peen or spot-weld them in place to prevent removal.

5. Security best practices

Transit systems' security awareness and the implementation of best practices affect a transit agency's overall security posture. Additional information about transit system security best practices for fencing systems is listed in "Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities."

Examples of transit system security best practices specific to ornamental fencing systems are included below:

- **Pickets.** Pickets should be spaced with consideration for vulnerability to climbing or penetration.
- **Eliminate the top rail.** Omitting the top rail eliminates a handhold, thus making the fence more difficult to climb. An alternative to installing a top rail could be the installation of a taut 7-gauge coil spring wire.
- **Bolt or rivet barbed wire arm.** Secure the barbed wire arm to the post by bolt or rivet to prevent its removal.
- **Add barbed tape to barbed wire.** This added fence-top configuration increases the difficulty of scaling fencing systems, thereby increasing the intruder's delay.
- **Bury the pickets.** Burying the picket approximately 12 in. deep in solid ground can prevent penetration from under the ornamental fence's perimeter. As an alternative, pour a concrete "apron" of at least 6 in. at the bottom of the pickets.
- **Contrast.** Designing color contrast into fencing system components can affect visibility. For instance, dark foreground colors against light background colors enhance the ability to see the details of activity along a fence line, whereas light foreground colors against dark backgrounds can have the same effect of enhancing view. The contrast afforded by dark- or light-colored fencing can be limited

if it is not adequately analyzed against color patterns or treatments, as well as the changing seasons, of the area. The tones, patterns and colors of the area should be understood.

- **Prevent hardware component removal:** Peen or spot-weld all bolts. This action reduces the potential removal of nuts and bolts.
- **Add secondary fencing around critical infrastructure.**

6. For more information

A fencing-system-specific checklist provides users with additional guidance and information for planning and designing ornamental fencing systems, but is not all-inclusive. The “Ornamental Fencing System Checklist” is provided in Appendix B of “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities.”

References

American Public Transportation Association, *Recommended Practice*, “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities,” 2010.

ASTM International, *Standard Guide for Design and Construction of Chain Link Security Fencing*, ASTM F 2611-06, 2006. <http://astm.nufu.eu/std/ASTM+F2611+-+06>

Definitions

Definitions associated with ornamental fencing systems are incorporated into the APTA *Recommended Practice* “Master Fencing Systems to Control Access at Revenue and Nonrevenue Transit Facilities,” as referenced above.

Abbreviations and acronyms

ADA Americans with Disabilities Act
CPTED crime prevention through environmental design