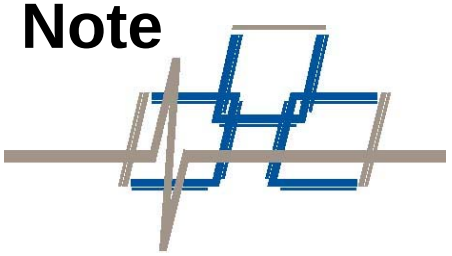
Fiber SenSys
PERIMETER SECURITY

Fence Top and Wall Top Protection

Application Note



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Introduction

The tuning parameters that maximize the probability of detection (PD) and rejection of nuisance alarm sources depend primarily on the medium on which the sensor is deployed. More rigid perimeter structures, such as walls, are less susceptible to vibration due to wind or other nuisances. However, rigid media also tend to transmit less vibration from intrusion attempts as well. Because of this behavior, zones implemented on more rigid structures must be tuned with higher sensitivity. Conversely, more flexible media, such as coils of razor wire, transmit vibration much more readily from wind, nuisances, or intruders. These zones must be tuned with lower sensitivity.

Whenever there is a major transition between perimeter media, it is recommended that separate sensors be deployed to protect the two media types. Rather than transition from one medium to the other with a single sensor, it is recommended that a separate zone be installed on each medium so that they can use a separate set of tuning parameters that adjusts for the differences between the mediums.

The Fiber Defender series fiber optic intrusion detection system can be deployed successfully to protect coils of concertina wire or razor wire used as top guards in both fence line and wall top applications. They can also be deployed to protect wall tops that use strands of barbed wire attached across outriggers or wall tops that lack a top guard altogether. Because the zones can be uniquely tuned, it is possible to protect perimeters that have any combination of these. With correct design and installation, it is possible to achieve a high PD without a high nuisance alarm rate. This application note will discuss the protection of various wall top, and fence top perimeter structures, and how to successfully protect these using Fiber Defender series fiber optic sensors.

1. Concertina Wire and Razor Coil Top Guards

In many high security applications, rows of concertina wire (c-wire) or razor coil are used as a top guard in place of, or in combination with, barbed wire. Concertina/razor wire poses a more challenging platform for deployment than fence fabric because it is much more susceptible to movement and vibration due to wind or nuisances. It is recommended that a separate zone be used to protect the concertina/razor wire top guard in order to properly tune the sensor to match the medium upon which it is deployed.

Deployment Types and Design

There are two main design approaches for razor coiled top guards. Selecting which design is best depends on the required PD, expected threat level, and budgetary goals. Below are the two design options:

1. **Single Run Sensor Cable Deployment**

A single run deployment is the most fundamental and cost-effective method for providing intrusion detection capability. It is accomplished by deploying a single fiber optic sensor cable run between 90º and 120º from the top of the coil, as shown below.

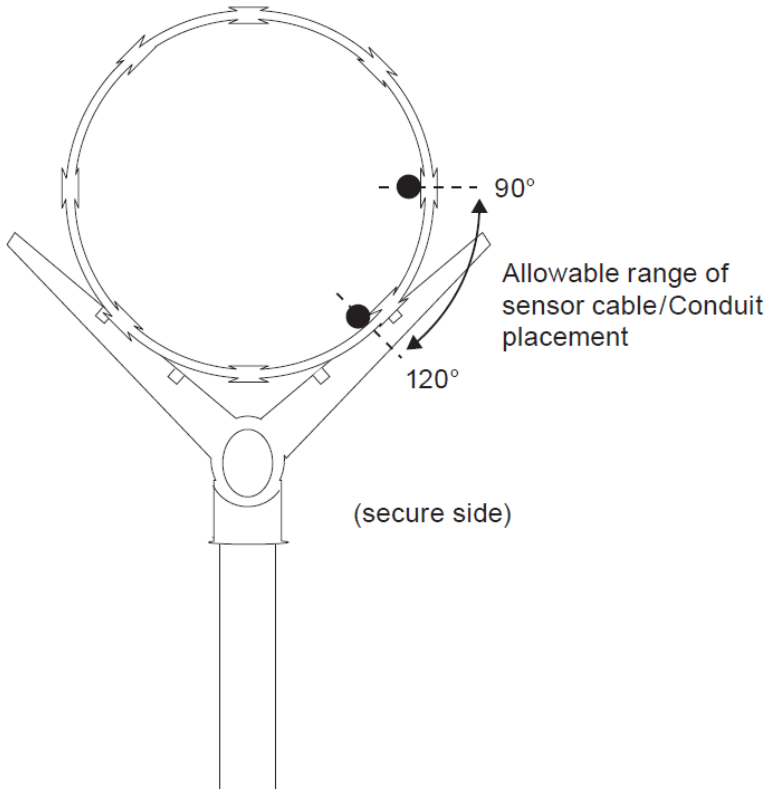

Figure 1: Sensor cable placement on the top guard coils for single run deployments

Placing the sensor cable/conduit assembly at the 90° position makes it more sensitive to vibration from intruders yet also more vulnerable to vibration from wind. Placing it at or close to the 120° position makes the system less sensitive but more stable.

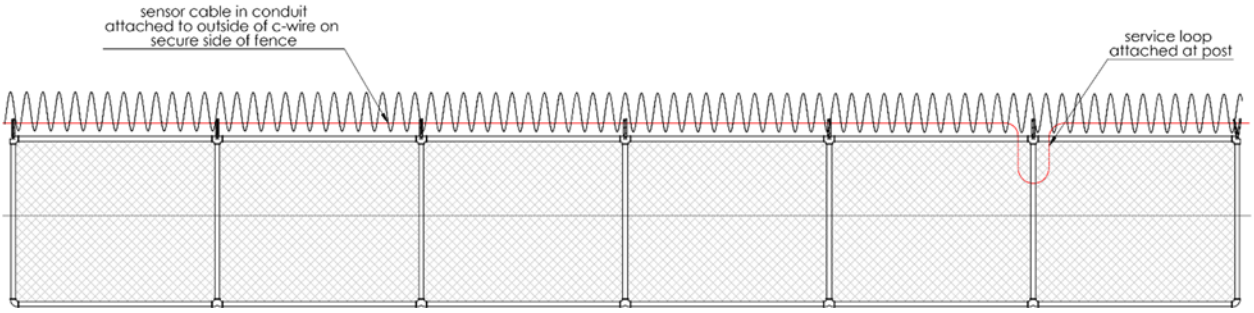

Figure 2: Single Run Cable Deployment

For facilities facing higher threat levels, and more sophisticated intrusion attempts, a double run is recommended. In the double run deployment, the outgoing and return strands of sensing fiber are aligned vertically on the secure side, shown below.

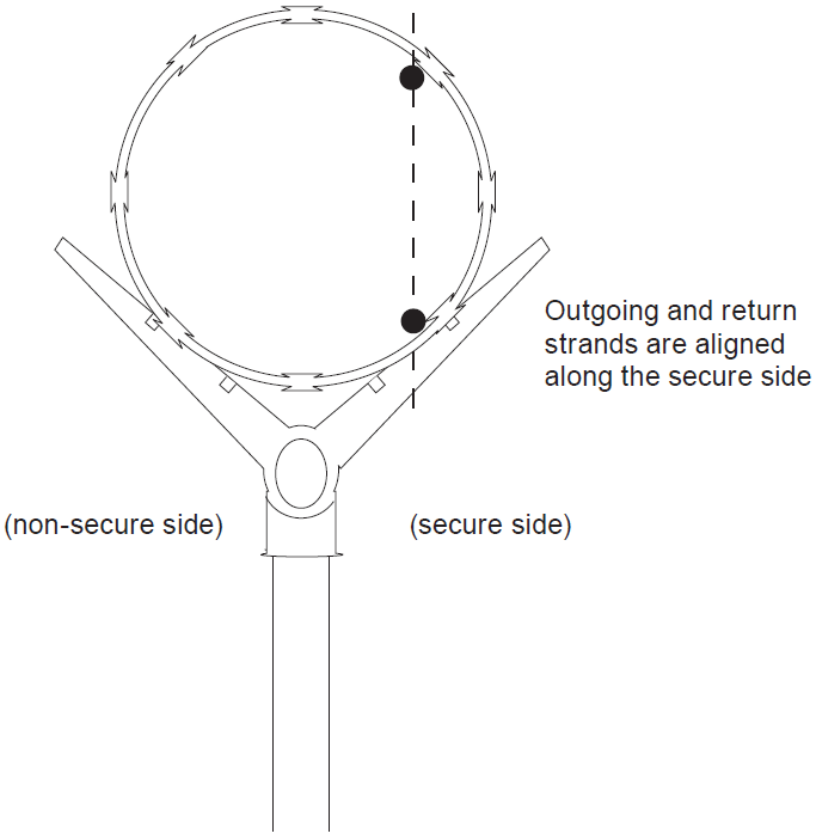

Figure 3: Sensor cable placement on the top guard coils for double run deployments

With both deployment configurations, there must be sufficient cable to cover the protected area and still allow creation of service loops. Service loops are excess lengths of sensor cable added

to the cable run at periodic intervals, usually in the form of small, local loops in the cable. A properly installed service loop measures 8” ± 2” (20 cm ± 5 cm) wide, centered around the post.

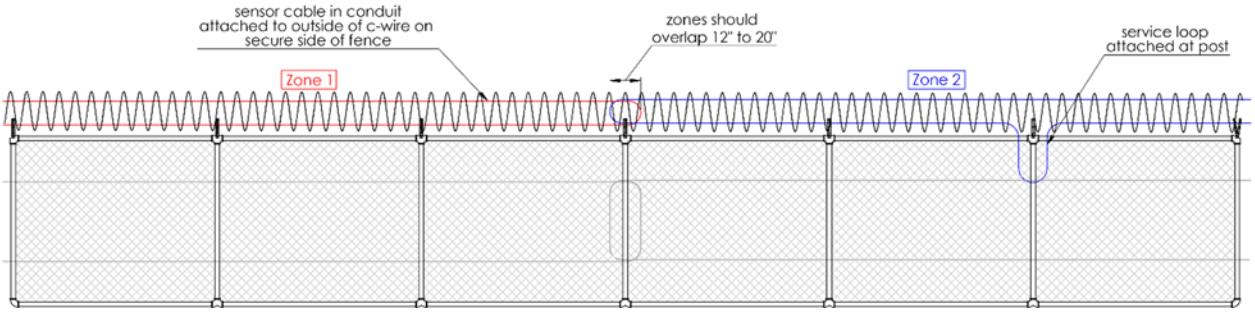

Figure 4: Double Run Cable Deployment

Service loops are placed in the perimeter about every 300 ft. (91 m), ensuring there is sufficient extra sensor available in the run in the event the sensor cable must be repaired.

Installation

With the sensor cable within protective conduit, follow the below steps:

1. Lay out the sensor cable/conduit assembly next to the zone to be protected
2. Carefully run the sensor through the inside of the concertina wire or razor coils from one end of the protected zone to the other
3. Position the sensor on the “secure” side of the coils at the locations described in the above section
4. Using stainless steel wire ties, attach the sensor cable in conduit to the coils at every point where the run intersects the c-wire coils

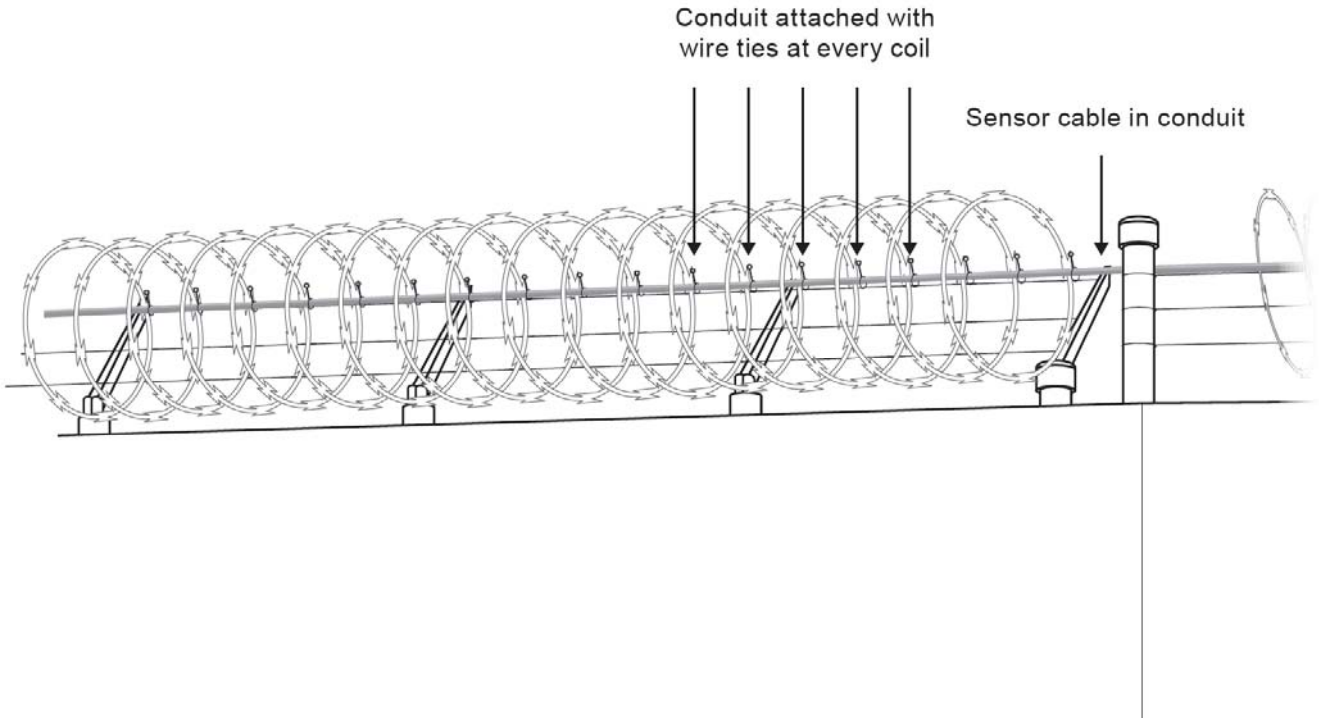

Figure 5: Wire tie locations in concertina wire

5. Every 300 ft (91 m), loop the cable down onto the secure side of the fence at a fence post to create a service loop. Run the cable 12” to 18” (30 cm to 45 cm) down along the fence post with 8” ± 2” (20 cm ± 5 cm) width centered at the post.

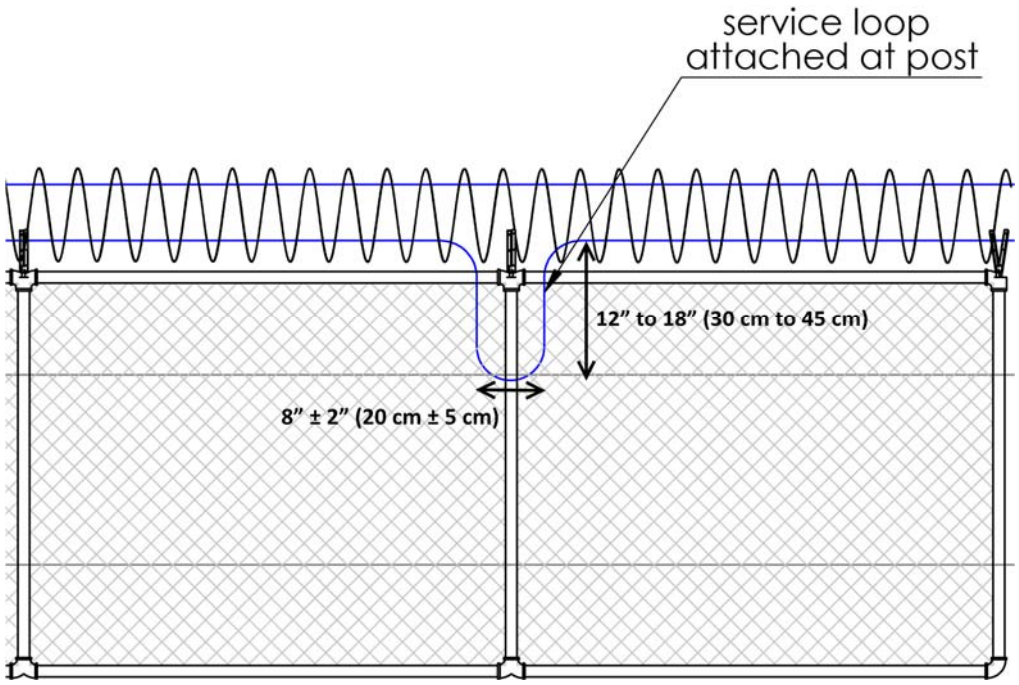

Figure 6:Service Loop Dimensions

2. Barbed Wire Top Guards

Barbed wire is the most commonly used deterrent against intrusions on fences or walls. A motivated intruder has many options for bypassing barbed wire, such as cutting, covering and climbing, or using care when climbing. Fiber optic sensors can be attached directly to barbed wire along a perimeter in order to protect the perimeter from motivated intruders who are not deterred by the presence of barbed wire.

Barbed wire can be installed along a perimeter in multiple ways. Common implementations use three to six strands of barbed wire attached to outriggers along a chain link fence, at the tops of cement or brick walls, or on rooftops. This section of the application note will discuss protecting perimeters that include barbed wire along the perimeter using Fiber Defender series fiber optic sensors.

The typical way to protect a fence with a barbed wire top guard is to deploy the fence sensor in a high security configuration that includes vertical loops of sensor up each outrigger as shown below. For more information, see the High Security Installation section of the Site Design application notes: **AN-ENG-027 Site Design and Installation for FD300 Series** or **AN-SM-036 FD500 Series - Site Design and Assessment**.

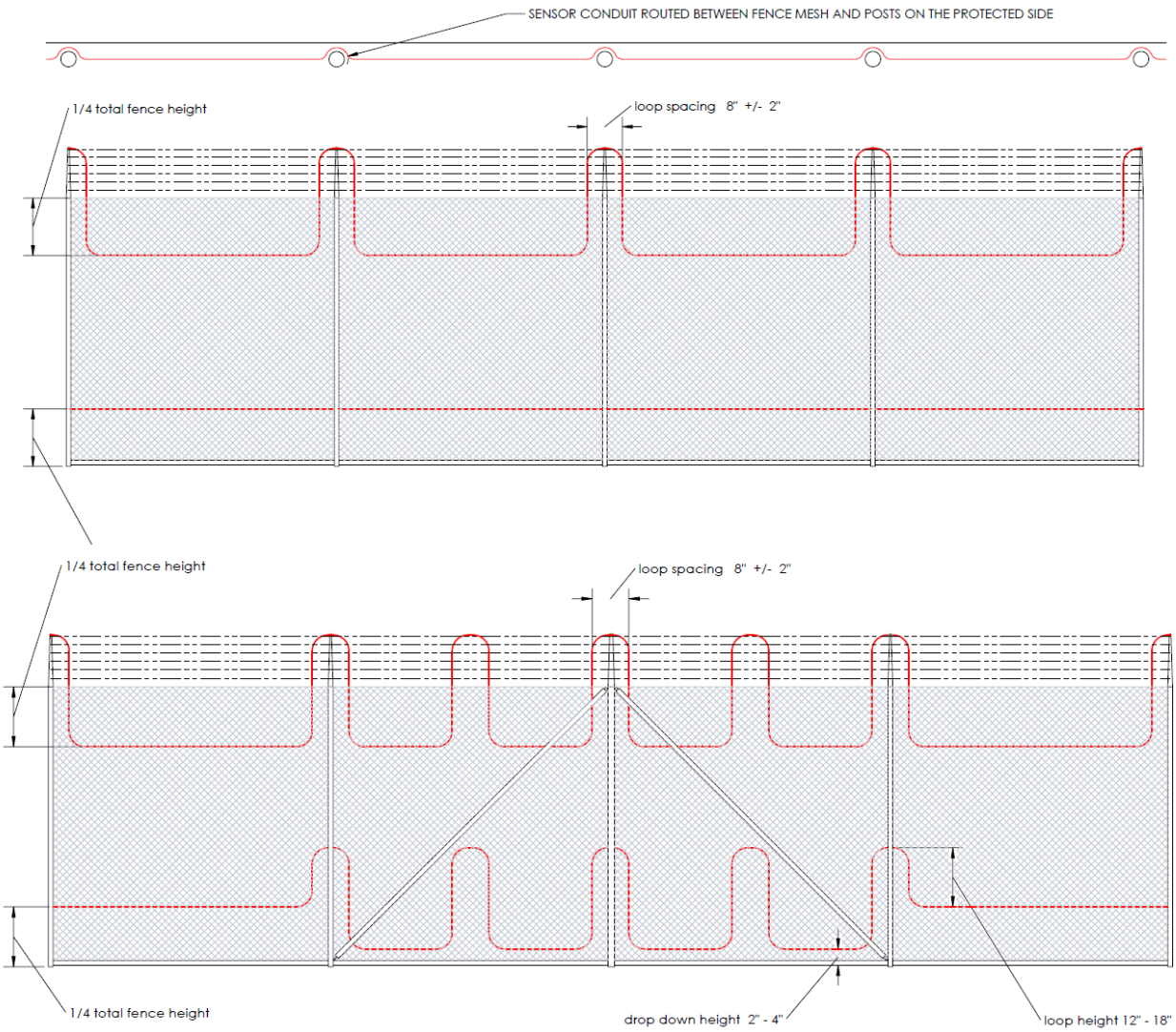

Figure 7: Examples of barbed wire sensor deployment

Only vertical runs of sensor cable can be used on barbed wire when it is combined with a fence zone; never run the sensor horizontally along the barbed wire when the fenced area is protected as a part of the same fiber loop. Horizontal runs along barbed wire are susceptible to excess vibration due to wind and nuisances. If it is desirable to have horizontal runs of sensor cable along a barbed wire top guard, a separate zone must be used with different parameters to protect the barbed wire.

If there is any concern that the barbed wire top guard will need significantly different tuning parameters, it is recommended that a separate zone be implemented on the barbed wire. In the case where the perimeter is a brick, stone, or concrete wall, it is always recommended to use a separate zone for the barbed wire top guard.

To create a separate zone to protect barbed wire top guards, a double run configuration is used. The outgoing strand is attached horizontally along the top-most strand of barbed wire and the

return strand is routed along the bottom most strand, with loops up to the top strand at each outrigger.

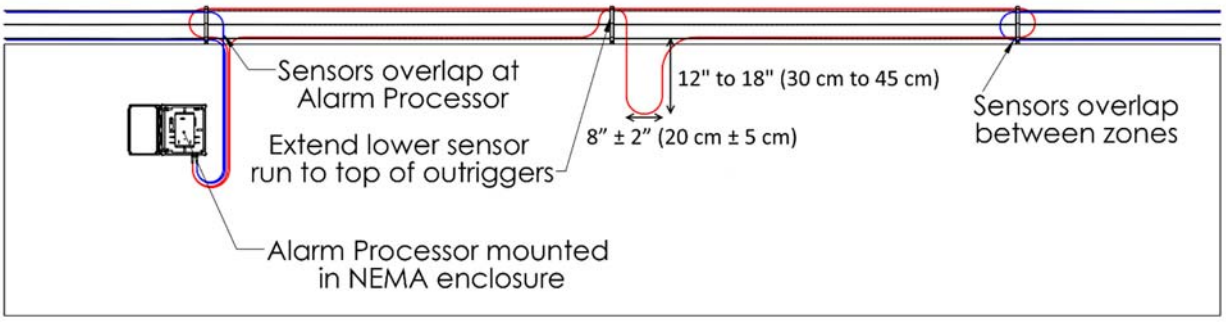

Figure 8: Example of separate zone being used to protect barbed wire top guard.

Be sure to firmly attach the barbed wire to each outrigger to prevent rattling, which could generate nuisance alarms.

Installation

With the sensor cable within protective conduit, follow the below steps:

1. Lay out the sensor cable/conduit assembly next to the zone to be protected
2. Carefully run the sensor along the top strand of barbed wire to the end of the zone
3. Using stainless steel wire ties, attach the sensor to the barbed wire every 12” (30 cm)
4. Run the return length of sensor cable along the bottom strand of barbed wire back to the start of the zone, looping up to the top strand at each outrigger
5. Attach the sensor to the mid and upper barbed wire strands when forming the loop at each outrigger

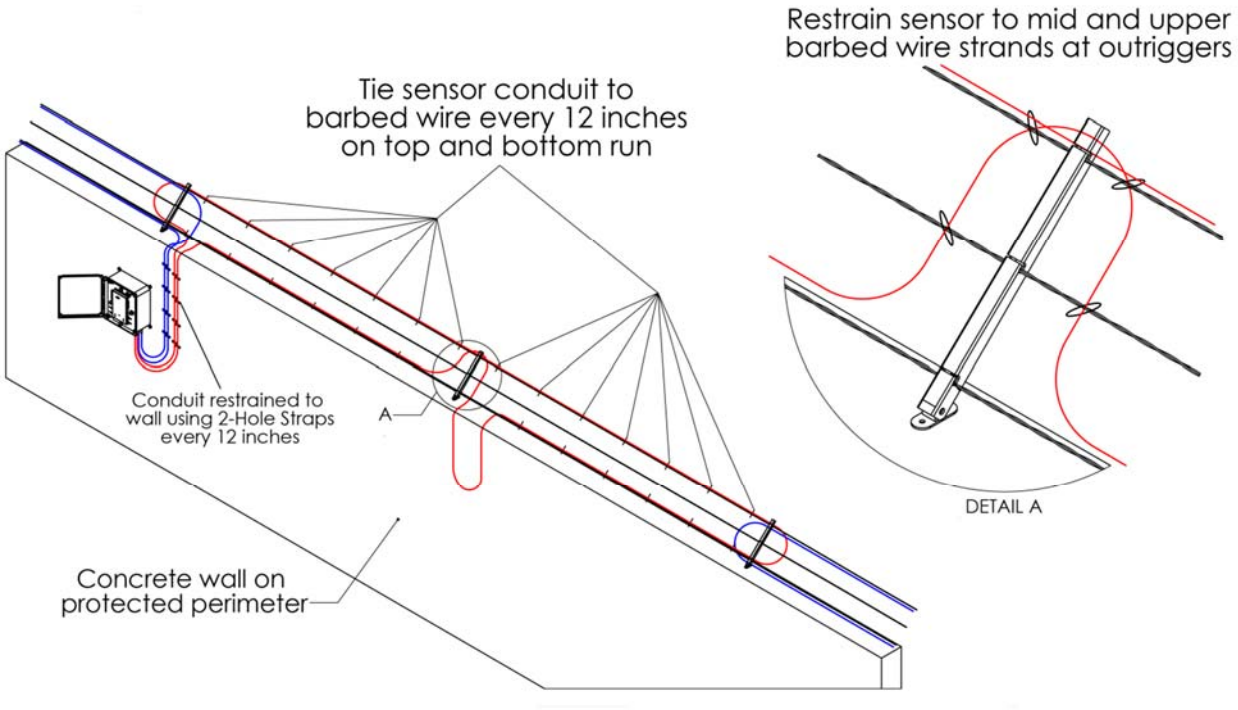

Figure 9:Installing sensing zone to a barbed wire top guard

6. Every 300 ft. (91 m), loop the cable down onto the secure side of the wall or fence at an outrigger to create a service loop. Run the cable 12” to 18” (30 cm to 45 cm) down along the fence or wall with loops 8” ± 2” (20 cm ± 5 cm) in width.

3. Perimeter Walls without a Top Guard

Concrete caps resting on SC-4 sensing fiber can be used in residential areas for decorative purposes when implemented on brick walled perimeters. Decorative foam caps that mimic the appearance of concrete or stone resting caps can be used in their place, which make ideal platforms for concealed sensor cable. Sensor cable placed under a loose resting cap will detect an intruder attempting to climb over the top of the wall (figure 10).

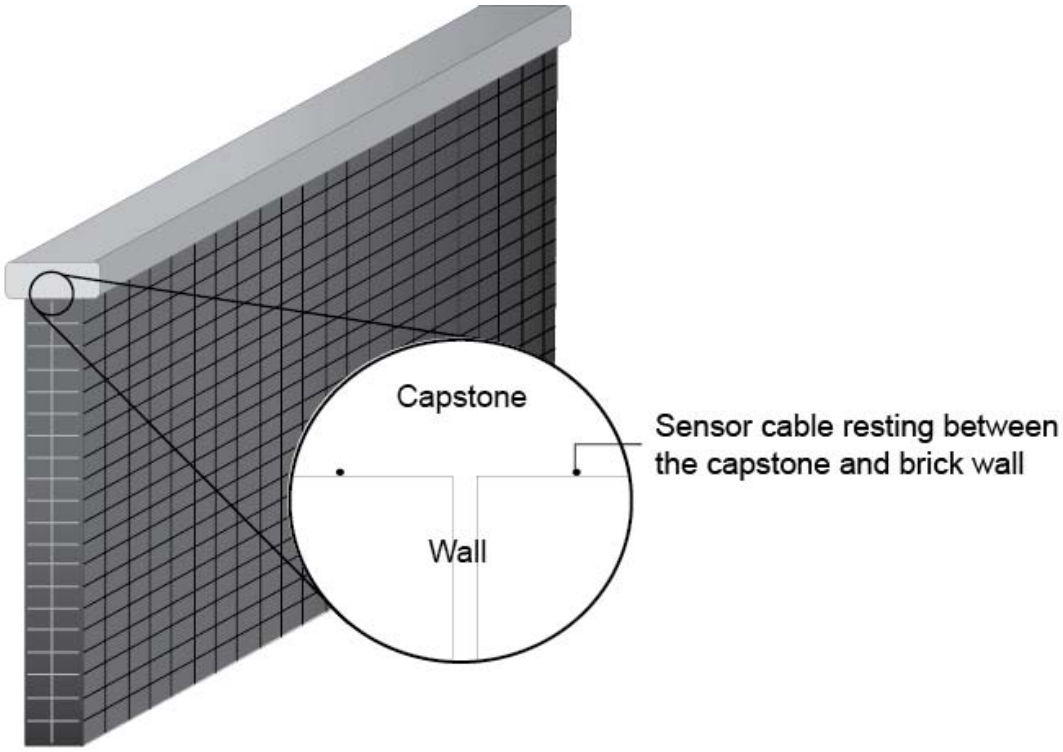

Figure 10: Deployment under a loose resting cap

When deploying sensor cable within a wall cap, use a loopback configuration and ensure there is equal weight distribution of the resting cap across the sensor cable (two cable strands can carry the weight evenly, as opposed to a single strand of cable which forms a fulcrum). Wall caps with sensor cable channels can also be used. Keep in mind that the resting cap should be secure enough to prevent movement during strong winds yet loose enough to move during an intrusion. Likewise, the wall cap should be unaffected by the presence of small birds, squirrels, etc.

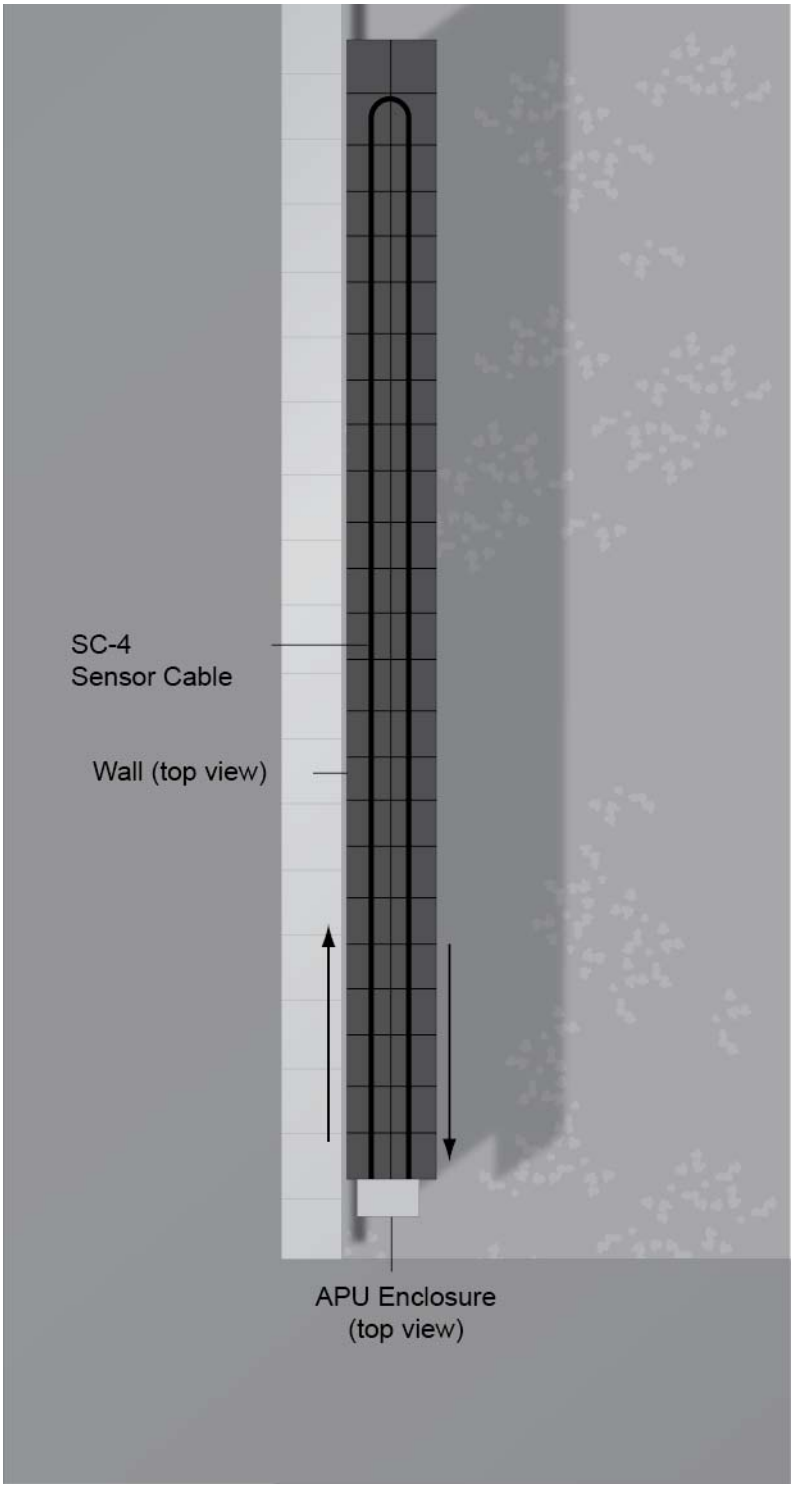

Figure 11: Loopback deployment below the capstone (top view)

Sensor cable can be deployed on outriggers to protect concrete perimeter walls without capstones. This configuration is designed to detect intruders attempting to climb over the top or using ladder assisted climbs. The sensor will detect the intruder upon contact. Therefore, it is imperative that the conduit be installed in a manner which will force the intruder to contact the conduit.

Outriggers used to support the sensor cable should be embedded in the wall at least 2.5 cm (1 inch) or more and should have approximately 10 cm (4 inches) of clearance from the top of the wall. Outriggers should be embedded near the outside edge of the wall at approximately a 45° angle to ensure any attempt to scale the wall using a ladder will be protected. As with brick wall/capstone deployments, the sensor cable should be deployed in a loopback configuration (see figure 12).

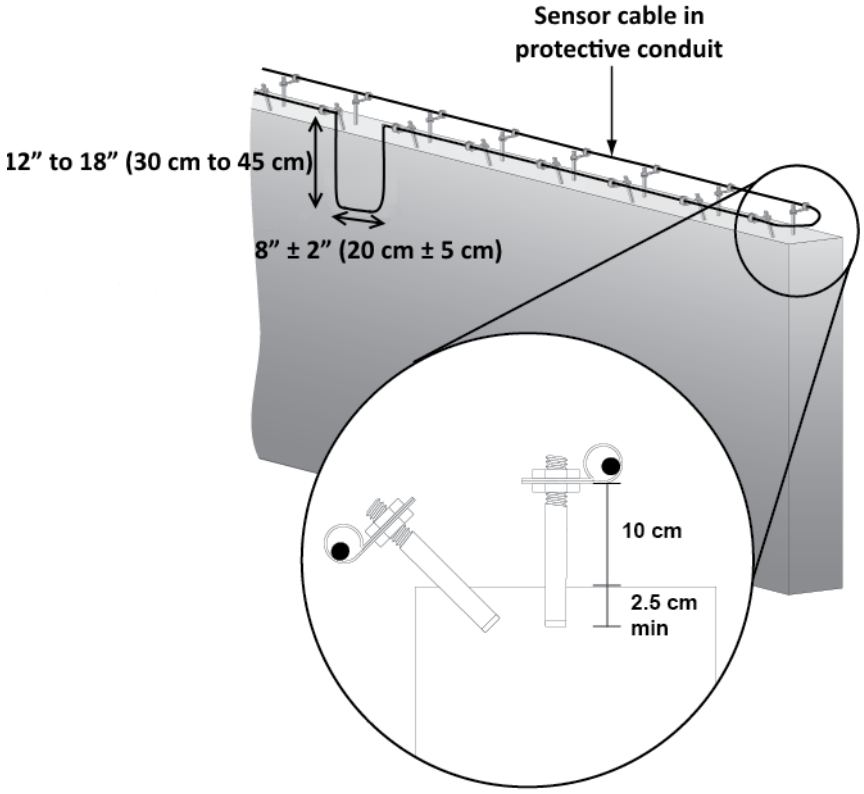

Figure 12: Protecting a concrete perimeter wall.
Note: The intruder must contact the conduit for an alarm to be generated.

All sensor cable should be deployed inside protective conduit with this configuration. Service loops should be installed every 300 ft. (91 m) down along the secure side of the wall.

Appendix A. Referenced Documents

AN-ENG-027 Site Design and Installation for FD300 Series
AN-SM-036 FD500 Series - Site Design and Assessment

Note: It is possible to download these documents online from the **Fiber Sensys** web page: www.fibersensys.com