8 Things to Consider when Designing a Camera Perimeter
Protecting critical facilities and their resources against intrusion and misuse of materials is a critical role consultants and security integrators deal with every day. There are many guidelines that have been released that provide information as to the type of security measures that should be considered when protecting these facilities. However, the details involved with making these measures a reality are often missing. As the popular saying goes, ‘the devil is in the details.’ These details contribute greatly to the installation and operational performance of such systems. Whether you are a security professional trying to secure the physical assets of your company, a consultant helping that owner or an integrator installing the system, remembering a few key tips can go a long way in ensuring the implementation meets the objective. Here are 8 things to consider when designing a new camera-based security system, or when reviewing your existing one.

1. Understand Your Camera
Selection of a camera is often the easiest and most difficult aspect of the design. There are thousands of options out there, tons of spec sheets, IP or analog, dome or bullet. The choices are overwhelming. However, several characteristics of the selected camera sensor have a major impact on the placement and resulting coverage. It is important to take the time to properly address these items.

**Lens:** This is where most people start. The first reaction is to get a wide lens to be able to view as much of your facility as possible. This is certainly a valid approach; just remember that widening the view essentially dilutes your pixels. You only have so many pixels and by widening the field of view you are spreading the same number of pixels over a wider area. One net result is the reduction in the achievable detection distance. The converse approach is to select a very narrow lens to effectively increase the detection distance. This is also a common strategy, but don’t forget to think about the intended target size and speed. A narrow field of view means that the intruder has a shorter span of video to get across before being out of the camera view. The worst case scenario is when the intruder is very close to the camera. For most applications, the lens choice should give you enough scene width to allow ample time to detect the intruder at its maximum expected speed near the camera.

**Resolution:** This seems like an easy one. Higher resolution cameras give you more pixels, which in turn provide the ability to “see” greater distances and more details, both with an operator at the helm or through the aid of a video analytics product. If you are not careful, though, this ability to “see” more through higher resolution can be costly, as it can have a major impact on your network usage, storage costs, and processing requirements. The key is to understand what resolution is really required. To do that you need to know the smallest target you want to detect (human, car, etc.), how far away you want to
detect that object, and how many pixels of resolution are required by your video analytics software or the eyesight of your security folks to be able to “see” that object at the desired distance. Once you have that information, you can then go back to the camera specification and determine whether it can accommodate you with enough pixels. If not, you may consider going to a higher resolution camera, a larger lens, or decreasing your required distance. If your experience with resolutions has more to do with New Year’s Eve than cameras, there are many free calculators on the internet, as well as many knowledgeable product suppliers where you can get this information at no cost.

**Image Sensor Size:** If you’ve spent time making camera selections, then you’ve seen camera specification sheets and have noticed image sensor sizes, including ¼” CCD and ½” CCD. When designing a robust perimeter system, always super-size, right? Perhaps, but suffice it to say that the camera sensor size impacts the resulting image of the camera. Most camera range calculators will assume you are using a ¼” CCD sensor. If you are not, then you should probably touch base with your local camera layout expert to understand the effects of different size CCDs.

2. **Consider the Terrain**
In addition to obvious obstructions such as trees and buildings, don’t forget to consider terrain variations, such as rolling hills, which may impact your blind zone calculations. Ditches and culverts can also prove to be a problem. Another obstruction that is often overlooked is the perimeter fence itself. Looking through the fence can be very problematic based on the angle of the view and the type of fence in question. Even a chain link fence can appear solid when viewed from particular angles at certain times of the day.

3. **Look to the Future**
This may seem silly, but plan for growth. In this case, it’s not about adding more cameras, increasing bandwidth or drive space, it’s about real growth. That cute little sapling may not impact the perimeter today, but in a few years, how will it impact your design? Will the tree obscure the camera’s field of view thereby creating safe passage for an intruder? You are
thinking it’s just a tree. If it grows and becomes a problem just cut it down or keep it trimmed. Although that sounds logical, landscaping services are recurring costs, which are often harder to get approved versus the fixed cost of purchasing the perimeter system in the first place. Additionally, some locations are very restricted about destroying trees after they reach a certain size. At that point, the decision to remove it may be out of the hands of site owners, but they will have to bear the cost of modifying their security system to accommodate the tree.

Sometimes looking to the future is just about asking the correct question. If the current design includes the protection of an open space or makeshift storage yard, take the time to inquire about the future use of the area. Using one or two cameras with a wide field of view to cover an open space won’t be a very effective solution after new storage buildings are placed in that same location during the next fiscal year.

4. **Check your Blind Zone**

Every camera has a blind zone. The size of that blind zone is determined by the camera lens, the mounting height of the camera and the mounting angle. Basic geometry will allow you to determine the effective blind zone of each camera. If you assume a human target, the blind zone begins at the mounting location of the camera. As the person walks away from the camera, the blind zone ends at the point where you can see their entire body in the video. That also explains why a good perimeter design includes both the maximum range and the minimum range for each camera.

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This is a pretty straightforward concept when you have one camera following another camera along a fence line. Where most blind zone mistakes occur is when the coverage takes a turn, for example, at the corner of a property. The next camera is often placed directly at the corner, making it very difficult for it to cover the blind zone of the previous camera. In these cases, the camera may need to be moved away from the fence corner to insure coverage.
5. Don’t get stuck in the Dark
It’s easy to get caught up in the perimeter layout, taking time to evaluate camera locations, lenses and image resolution only to forget that everything changes when the sun goes down. In most cases, the limiting factor in coverage occurs in the evening hours. How do you intend to cover the scene in darkness? Will you use some type of illuminant, such as infrared or a visible light source, or perhaps a thermal sensor? A camera that can cover a 500m fence line during the day may be reduced to 200m at night due to the type of illumination being considered. This not only impacts the layout, but obviously has consequences on the final budget. An infrared-illuminated camera will provide some facial details and can allow viewing of license plates, but this adds a piece of equipment (mounting, power and maintenance) and is susceptible to weather conditions like rain, snow and fog. A thermal camera will cost you more and copes better with weather conditions, but won’t be able to provide facial or license plate details. Bottom line: take the time to consider how the scene will be covered in nighttime operations.

6. Get an Image
The saying is true. A picture is worth a thousand words. If at all possible, try to get an image from each proposed camera location, mimicking the intended view. Getting the image at about the same camera height is ideal, but just getting a snapshot at ground level can also be helpful. If you are a consultant or integrator, this is often difficult to achieve given the nature of site visits and other restrictions, but it will provide an added level of confidence in your design and help retain some of those small details you may have forgotten after being on site. If you are the site owner or consultant, making the effort to allow these views to be captured can go a long way in uncovering problems early in the design. Images can be used as a great collaboration tool to gain consensus on the objective of the camera and insure that the location and view will achieve the cameras’ intended mission. It is amazing how many installations move forward without these basic, but invaluable pieces of information.

7. A Camera Worksheet is Key
Hopefully by now you realize that there are lots of little details that can get overlooked when planning to secure your facilities with video. What better way to capture all that info than in a simple camera worksheet? Ask yourself: What is the objective of the camera? What is the brand and model? What lens is being used? Where is it to be located? How far does it need to detect? How will it be illuminated at night? Your worksheet doesn’t need to be overly complex, but it will save you hours of headaches by ensuring you have all the pertinent details for each camera location. Make sure to keep it updated. Although these types of tools are extremely important in the design phase, they are even more invaluable months into the installation if there are some unanticipated design changes.
8. **Use a Camera Layout Tool:**

There are many different approaches to actually creating the final layout: the old T-square and triangle method, placing polygons on Google Earth, AutoCAD, PowerPoint, and vendor-specific tools. In all cases, the objective is to get a visual representation of the protection to be provided by the cameras used in the perimeter layout. This layout can take into account all the items mentioned in this article and present them as a visual tool to facilitate responses to bids, discussions on budget,

A camera layout tool takes into account multiple design factors including camera lens, mounting height and resolution, and creates a visual representation of the resulting security coverage. The resulting graphical representation is invaluable in allowing the review and refinement of the design.
sensor selection, installation trade-off considerations and ultimately peace of mind that intended areas are fully covered. The key to a good camera layout tool is one that takes into account the various aspects of the design (lens size, camera sensor, cameras locations, blind zones), gives a good visual presentation of the final design and allows for easy modification as plans change. Taking the time to find a layout tool that works for you can save you a vast amount of time during all phases of a perimeter protection project. There are many security product suppliers and consultants that have access to these tools and are very willing to provide layout advice, in exchange for a chance to win your business for current or future security needs. Take advantage of their knowledge and the work they have invested in these types of application tools.

At first glance, the idea of using cameras to protect a perimeter, facility or other asset seems pretty easy. It’s something that integrators and security consultants do all the time. However, it is important to take the time to reflect on the fundamentals and reconsider the many details and aspects that can impact the effectiveness of the final design. Several key considerations have been highlighted in this discussion. Although this list should not be considered exhaustive, it’s hopefully a good starting point to build on.
Fence Integration: Critical Facilities often have large, fenced perimeters which make the use of an intelligent fence an attractive security measure. Although intelligent fences are great detection devices, you still require eyes on the intruder. Check out this article describing how the combination of video analytics and intelligent fences can be used to protect these critical facilities.

PTZ Auto Follow: Oftentimes, facilities have security sensors but lack a large security force to manage and react to them. Enabling cameras with PTZ Auto Follow allows the camera to automatically follow the intruder so your security personnel can coordinate a response. Check out a narrated video of PTZ Auto Follow in action.

Camera Layout Help or Demo: Request help with your camera layout or view a live demonstration to get ideas on how to protect your facilities. Ask questions and get a better understanding of the best way to achieve your security goals within your given budget. Contact Us.

About PureTech Systems

PureTech Systems Inc. is a manufacturer of wide-area perimeter surveillance software solutions including internally developed outdoor video analytics, PTZ Auto Follow, multi-sensor integration and a map-based (real object size) command and control. It is offered to fortune 1000 firms, petro-chemical, water and electric utilities, seaports, airports and federal, state and local governments. With headquarters in Phoenix Arizona, PureTech Systems serves national and international markets. To find out more about PureTech Systems Inc., visit our website at www.puretechsystems.com, follow us on Twitter or sign up for our email list.