landscapeforms®

annapolis™ bollard

The Annapolis™ Bollard is a handsome sentinel that performs multiple maneuvers with style. Standard Bollard, Security Bollard and Smart Bollard share basic design and construction characteristics, specialize in their features and functions. Annapolis offers distinctive solutions in scope and detail for path making and wayfinding, safety and security in outdoor environments.

standard

Annapolis Standard stands as a defining element to mark pathways, direct pedestrian flow, and create safety barriers between pedestrian and vehicular traffic. It is available in 6" and 12" diameters. A removable bollard option for the 6" diameter style provides on-site flexibility. And a lighted option combines the fixed Standard Bollard with low-voltage lighting that sheds a soft glow after dark. Like all Annapolis Bollards, the Standard Bollard is constructed of structural grade sheet steel for exceptional strength, with a cast aluminum top. Its polyester powdercoat finish resists rusting, peeling and fading, and an optional polyethylene sleeve provides protection from nicks and scratches.

security

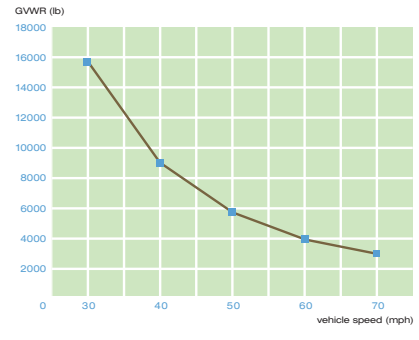
The Annapolis Security Bollard is engineered to provide very robust barriers between vehicular and pedestrian traffic, create permanent standoffs between vehicles and building structures, and disable vehicles that attempt trespass. It is available in 6" and 12" diameters. The 6" bollard is offered with optional solar-powered LED lighting. Security Bollard is engineered to stop vans, pick-ups, SUV's and other vehicle types at a range of speeds (see chart at right). It is designed to be permanently embedded at designated spacing and with special footings and internal concrete/steel reinforcement calculated by Landscape Forms to meet individual site requirements and project criteria.

Landscape Forms employs FEA (Finite Element Analysis), a software-based tool used by the aircraft and automotive industries, to predict and evaluate bollard performance under defined worst-case scenarios. In the Anti-Ram Analysis below, bollards were spaced 3' apart on center to assure the vehicle would strike 3 bollards at 90 degree impact. A 12" Annapolis Security Bollard is shown to stop a 16,000 lb. vehicle travelling at 30 mph, and a 6,000 lb. vehicle at 50 mph. Refer to our Security Bollard Technical Sheet for details and contact your Landscape Forms sales representative to discuss customized FEA analysis.

12" bollard impact strength

peak force on bollards: 226923 pounds (SF=0.9)

stopping distance: 3.281 feet (1meter=3.281 ft)



Note: Pass rating for maximum penetration is based on U.S. Department of State Anti-Ram guidelines, which is one meter of maximum penetration of the vehicle's cargo bed past the bollard location.

smart

Annapolis Smart Bollard is the industry's first bollard with integrated solar-powered lighting based on advanced lighting-emitting diode (LED) technology. Designed for use in areas where hard wiring is unfeasible or inconvenient, it is a reliable, economical, energy-saving solution for dividing pedestrian and vehicular traffic, and providing the security of uninterrupted illumination in outdoor spaces, from campuses to streetscapes. Smart Bollard integrates a completely self-contained solar-powered LED lighting unit into the 6" diameter fixed or removable Annapolis Standard Bollard and casts directional light above ground with 360° visibility and a range exceeding one mile.

The Benefits of Being Smart

Smart Bollard uses sustainable solar energy, saving on wiring-related installation, maintenance and energy costs. It is off the grid, so in case of power emergencies, it just glows on. Smart Bollard's LED lights are highly efficient, requiring a much smaller electrical current than incandescent bulbs while lasting about 20 times longer. Its microprocessor technology automatically turns lights on at dusk and off at dawn and its "intelligent energy management system" calibrates light output to ensure uninterrupted function. Its crystalline solar panel was designed for commercial applications and to withstand extreme environmental conditions. And Smart Bollard can help facilities earn LEED Renewable Energy credit. Refer to our Smart Bollard Technical Sheet for details.

Our Purpose Is To Enrich Outdoor Spaces

We believe in the power of design and its ability to influence and elevate the quality of public space. High quality products and outstanding customer experience makes us one of the world's premier designers and manufacturers of outdoor commercial furnishings.

Annapolis™ Bollard Specifications

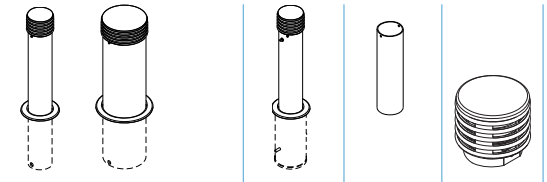
Annapolis bollards are constructed of structural grade steel for exceptional strength, with cast aluminum top and spun aluminum base ring.

Standard Bollard: Available in 6" and 12" diameter, with or without low-voltage lighting. A protective polyethylene sleeve is available in black or silver. Both sizes are designed to be securely embedded in concrete. For additional site flexibility, the 6" diameter is offered in a removable style; slides into supplied, embedded, galvanized steel socket. A keyed lock secures the bollard when in the socket. Upon removal, a cover plate fits flush with the surface; secured with a chain. Cover plate/chain stores within the bollard base when the bollard is in the socket. All 6" styles, including 6" removable bollard may be fitted with the Smart bollard top to provide solar powered lighting.

Smart Bollard: Available in 6" diameter, may be specified with embedded or removable bollard style. The solar panel, which is encapsulated in patented domed polycarbonate housing, collects energy from the sun and converts it to electrical current. Energy is stored in a sealed lead-acid rechargeable battery that delivers extremely reliable power output over a long period of time. The microprocessor technology automatically turns lights on at dusk, off at dawn. It casts directional light above ground with 360 degree visibility and a range exceeding one mile. For more detailed specifications, refer to Annapolis Smart Bollard Technical Sheet.

SOLAR TECHNOLOGY

Security Bollard: Available in 6" and 12" diameter. 6" dia. security bollard may be specified with Smart solar-powered LED light. Security bollard is designed to be permanently embedded with a reinforced footing and internal concrete/steel reinforcement. Landscape Forms can provide project specific assessment of the ability of the Annapolis Security Bollard to deter vans, pick-ups and SUVs using criteria supplied by the customer. For more detailed specifications, refer to Annapolis Smart Bollard Technical Sheet. Contact your Landscape Forms sales representative to discuss specific project criteria and request customized FEA analysis.



6" x 33" 12" x 33" dia. x h	removable bollard	protective sleeve	lighted bollard top

Finishes

Metal is finished with Landscape Forms' proprietary Pangard II polyester powdercoat, a hard yet flexible finish that resists rusting, chipping, peeling and fading. Call for standard color chart.

To Specify
Choose 6" or 12" diameter embedded style, or 6" removable style. Specify black or silver protective polyethylene sleeve or without sleeve. Specify with or without lighting based on the following guidelines. 6" embedded and surface mount, available with hard wired or solar powered lighting; 6" removable only offered with solar lighting; 12" embedded only offered with hard wired lighting.

landscapeforms.com

Visit our website for product details, pricing, color charts, technical sheets, sales office locations. Download JPG images, brochure PDF, CAD details, CSI specifications, and assembly instructions.

Metal is the world's most recycled material and is fully recyclable. Consult our website for recycled content for this product. Powdercoat finish on metal parts contains no heavy metals, is HAPS-free and has extremely low VOCs.

landscapeforms®
800.521.2546 269.381.3455 *fax*
431 Lawndale Avenue, Kalamazoo, MI 49048
landscapeforms.com

ANNAPOLIS SMART BOLLARD

Annapolis™ Smart Bollard is the first bollard using solar technology to power LED lighting. Smart Bollard integrates a completely self-contained solar-powered LED light into the standard 6" diameter Annapolis bollard. This bollard is not just the smartest in its class. It's in a class all its own.

Smart Bollard was developed in response to customer requests for a lighted bollard designed for use in areas where wiring is unfeasible or inconvenient, or where security concerns demand lighting that is off the grid. It is a reliable, economical, energy-saving solution for marking pathways, dividing pedestrian and vehicular traffic, and providing security in settings ranging from corporate and university campuses to urban streetscapes.

Smart Bollard casts diffused light above the ground. Its high output white LEDs provide 360° visibility. Because it requires no wiring, Smart Bollard breaks new ground as the first removable bollard with integrated lighting.

The Benefits of Being Smart:

- **Smart Bollard is solar powered.** It is environmentally responsible in its reliance on sustainable energy. And the absence of wiring saves on installation, maintenance and energy costs.
- **Smart Bollard is off the grid.** In case of power emergencies due to natural or man-made causes, it just glows on.
- **Smart Bollard is intelligent.** Digital technology automatically turns lights on at dusk and off at dawn. An "intelligent energy management system" calibrates light output to the amount of energy in storage to ensure uninterrupted function.
- **Smart Bollard is efficient.** LED light is generated by tiny silicon chips which require a much smaller electrical current than incandescent bulbs and waste almost no energy through heat dissipation. And high-intensity LEDs typically enjoy over 100,000 hours of life, and last about 20 times longer than incandescent bulbs.
- **Smart Bollard is state of the art.** The completely unitized LED light, which has no internal moving parts, is environmentally sealed in a clear tempered glass dome that traps sunlight and protects the solar panel from damage and dirt.

How the Annapolis Smart Bollard Works:

The solar panel in the light collects energy from the sun and converts it to electrical current. Energy is stored in a sealed lead-acid rechargeable battery that provides a large energy capacity for its size and delivers extremely reliable power output over a long period of time. *(battery can be replaced after expected life of three years)* The solar panel begins charging at dawn and stops at dusk when the light automatically goes on.

Location Selection

Smart Bollard requires adequate sunlight and suitable ambient temperature to function effectively. It is a viable solution for areas with an average of at least 4 hours or more sunlight per day year round, at latitudes within 50° North or South, and at a temperature range of –40° F to 115° F. Care must be taken in the placement of units. Even in sunny locations the light will not function if the bollard is in the shade for most of the day. Under typical conditions, Smart Bollard will run for up to 14 hours per day and require four hours of daylight to recharge. Under extreme weather conditions, Smart Bollard can operate for up to 150 hours without recharging.

Warranty

Smart Bollard is a Landscape Forms product that meets the company's stringent standards of quality, durability and performance. It is covered by the Landscape Forms three-year warranty.

Specifications:

Sizes	6" diameter x 33" high
Bollard Tube	structural steel pipe
Bollard Top	aluminum casting
Optional Protective Sleeve	polyethylene
Metal Finish	Pangard II® Powdercoat. Standard, optional and customs colors available.
Mounting	surface mount, embedded or removable with embedded socket.

Solar Light Specifications:

Lamp	3 Osram white LED's
Color Temp	3,500° K
LED Luminous Flux	30 lumens
LED Energy Consumption	.38 watt @ 40mA
TM21 LED Lifespan	Up to 60,000 hours
Solar Top	tempered Borosilicate glass top with Mono-Crystalline PV cells
Diffused Lens	translucent acrylic
Protection Rating	IP66 for solar light assembly
Horizontal Output	360°
Average Direct Sunlight Exposure to Maintain Function	4 hours
Latitude Range	50° S to 50° N
Battery	valve regulated lead-acid
Nominal Battery Voltage	6 volts
Capacity	7.2 amp–hr at 20–hr discharge rate
Temperature Range	-40°F to 115°F
Maximum Operation	14 hours

02/2012

ANNAPOLIS™ BOLLARD: FOCUS ON SECURITY

Landscape Forms' customized computer analysis helps clients assess the ability of Annapolis bollards to meet project-specific security criteria.

SECURITY SOLUTION = THREAT ASSESSMENT + RISK MANAGEMENT + DESIGN

Security is in the spotlight. It's a major issue in the design of buildings and outdoor venues, in public and private arenas, at high profile and business-as-usual locations all over the world.

While security concerns are often driven by fear, effective security solutions are based on realistic assessments of threat. Threat levels and appropriate solutions are typically defined through a process of probability-based risk management. Many security experts propose holistic security solutions that include physical barriers, technology, building infrastructure and education and training as integrated parts of a total systems approach.

In addition to risk calculation, design professionals have become vocal advocates for a community value design process that includes aesthetics, accessibility, and the impacts on street life and the quality of public spaces in security solution design.

BOLLARDS ARE PART OF A TOTAL SECURITY SOLUTION

Bollards are key components of safety and security plans. The outstanding design and engineering of Landscape Forms' Annapolis bollards have made them a popular choice among design professionals and facility managers alike. Fixed and removable 6" and 12" Annapolis bollards are used to perform a variety of functions, from separating vehicular and pedestrian traffic, to creating permanent security standoffs and disabling trespassing vehicles.

FINITE ELEMENT ANALYSIS EVALUTES BOLLARD PERFORMANCE

While the U.S. Department of State (DOS SD-STD-02.01, Revision A) anti-ram standards evaluate bollards for high-risk applications against impact by a 15,000 lb. vehicle, many commercial projects identify smaller vehicle types and weights as more probable threats.

To assess the performance of Annapolis, Landscape Forms engineers have conducted Finite Element Analysis (FEA) of bollard components under controlled conditions. The results of these software analyses, (see charts on reverse side) help customers make informed decisions about bollard applications in relation to their assessed needs.

ANNAPOLIS ANTI-RAM ANALYSIS FOR YOUR PROJECT

Landscape Forms can provide project specific assessment of the ability of Annapolis bollards to deter vans, pick-ups and SUV's using criteria supplied by the customer or derived from anti-ram standards established by the U.S. Department of State (DOS SD-STD-02.01, Revision A).

Many commercial projects have written specifications for security that include bollard criteria. Providing a copy of these criteria to your Landscape Forms sales representative is the first step in requesting anti-ram analysis for your project. When written specifications are not available and the data presented in this technical sheet is not pertinent, the following basic information is required to evaluate Annapolis for your project:

- Make/Model or Gross vehicle weight rating of vehicle
- Speed of vehicle
- Design layout of bollards
- Also required if applicable: preferred size and spacing of bollard, limits to depth of footings or other site requirements

When project specific FEA analysis is completed, Landscape Forms will recommend the appropriate Annapolis bollard and provide installation drawings to detail spacing and footings required to meet the project criteria.

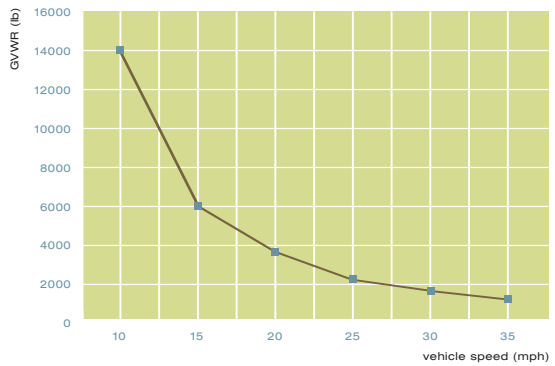
Contact your Landscape Forms sales representative to discuss your specific project criteria and request customized FEA analysis.

ANNAPOLIS ANTI-RAM ANALYSIS CHART

Landscape Forms' analysis of Annapolis bollards installed with special footing and internal concrete/steel reinforcement returned the results shown below. For this simulation, we chose to space the bollards 3' apart (on center) to assure the vehicle would strike 3 bollards when impact is at 90 degrees. For example: a 6" Annapolis bollard will stop a 14,000 lb. vehicle travelling at 10 mph and a 2,000 lb. vehicle at 25 mph. A 12" Annapolis bollard will stop a 16,000 lb. vehicle travelling at 30 mph and a 6,000 lb. vehicle at 50 mph.

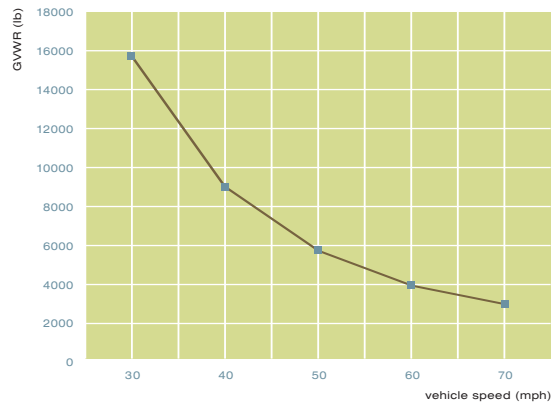
6" bollard impact strength

peak force on bollards: 22800 pounds (SF=0.9) | stopping distance: 3.281 feet (1meter=3.281 ft)



12" bollard impact strength

peak force on bollards: 226923 pounds (SF=0.9) | stopping distance: 3.281 feet (1meter=3.281 ft)



Note: Pass rating for maximum penetration is based on U.S. Department of State Anti-Ram guidelines, which is one meter of maximum penetration of the vehicle's cargo bed past the bollard location. Contact Landscape Forms for installation drawings and instructions.

For trucks, vans and sport utility vehicles gross vehicle weight rating (GVWR) is the sum of the vehicle weight including driver, passengers, cargo, fuel, coolant and any options or accessories.

GVWR (lbs.)	vehicles types
> 10,000	AMC Hummer Dodge Ram 3500 Pickup Ford Econoline E350 Van
6,000~10,000	Chevy Tahoe (half ton) Dodge Ram 2500 pickup Cadillac Escalade
< 6,000	Chevy S-10 Blazer Ford Explorer GMC Jimmy

WHAT IS FEA?

Finite Element Analysis is a powerful mathematical tool for analyzing mechanical components and systems. The software-based tool, which is integrated with CAD, accurately predicts and evaluates the performance of components subjected to thermal and structural loads. FEA is used by NASA, aircraft manufacturers, and the automotive industry to ensure that design components meet deformation, stress, vibration and temperature specifications for defined worst-case scenarios.