Traffic Engineering and Highway Safety Bulletin

Gates Revisited: Design Details

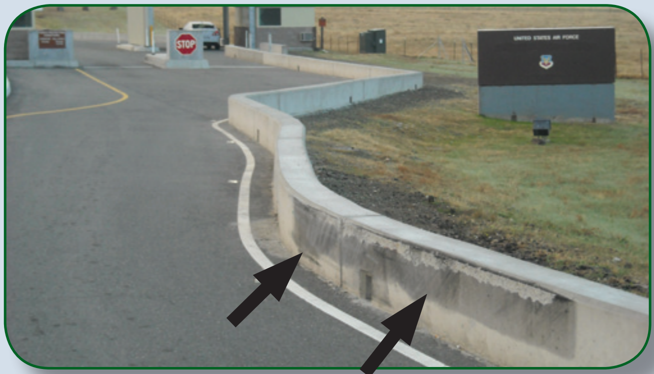
October 2011

Introduction

Entry Control Facilities/Access Control Points (ECF/ACPs) continue to be a focal point for many installations in all service branches. For this reason, SDDCTEA is releasing this bulletin to provide an update for designers and program administrators on the most recent policies and best practices.

The role of SDDCTEA regarding ECF/ACPs is outlined in a joint regulation, *DoD Transportation Engineering Program* (AR 55-80, OPNAVINST 11210.2, AFMAN 32-1017, MCO 11210.2D and DLAR 4500.19) which implements DoD Directive 4510.11 and DoD Instruction 6055.04. The regulation, directive, and instruction discuss the placement of traffic control devices on military roadways, the transportation engineering mission, and the traffic safety program. These documents assign the responsibility of interpreting the *Manual on Uniform Traffic Control Devices* (*MUTCD*) and approving variances to SDDCTEA. Furthermore, SDDCTEA is assigned the role of assisting military installation commanders in their mission to maintain roadways to nationally accepted standards that provide a safe driving environment for all roadway users.

How Did This Happen?



See page 3 for the answer.

One of the primary concerns of not maintaining military installation roadways to nationally accepted standards is the possibility of tort liability. Tort liability can occur when a breach of civil duty is proven. In most cases, if the breach is proven, the person who suffers injury or loss is due damages. These typically take the form of monetary compensation. In cases where damages are proven to be reimbursable, Exhibit 1 shows the typical costs that agencies can expect to incur.

Exhibit 1: Typical Costs of Crashes

Costs Associated with Crashes	
Only property damage occurs	$4,000
Injuries occur (cost per injury)	$80,000
Fatalities occur (cost per fatality)	$5,800,000

Source: Federal Highway Administration

This issue will provide a refresher on the components of an ECF/ACP and discuss how a well scoped and executed traffic engineering assessment can help reduce future complications in the design phase and can save both time and money during the construction phase of an ECF/ACP project; not to mention providing safe and less congested facilities for customers and motorists.

A functional ECF/ACP represents the result of planning and coordination efforts among project stakeholders. System components can be divided into two subcategories: planning components and physical components.

In This Issue...

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Planning Components

These components represent the major milestones that must be accomplished before an ECF/ACP is ready to be constructed. Each component plays a role in the eventual success or failure of the ECF/ACP that is constructed. Exhibit 2 shows each phase of the ECF/ACP planning process.

Stakeholder Engagement

It is imperative that the appropriate stakeholders be identified and engaged from the start of the ECF/ACP planning process. The ECF/ACP will have many users and will become a highly visible example of how well different disciplines can work together. Exhibit 3 is taken from SDDCTEA *Pamphlet 55-15, Traffic and Safety Engineering of Better Entry Control Facilities*, and shows some of the crucial stakeholders for ECF/ACP projects. Notice that SDDCTEA is included as a stakeholder. Engaging SDDCTEA early in the planning process can help get ECF/ACP projects start off in the right direction and set the tone for a project that will be viewed as a success both internally and externally.

Exhibit 2: Entry Control Facility Planning Process

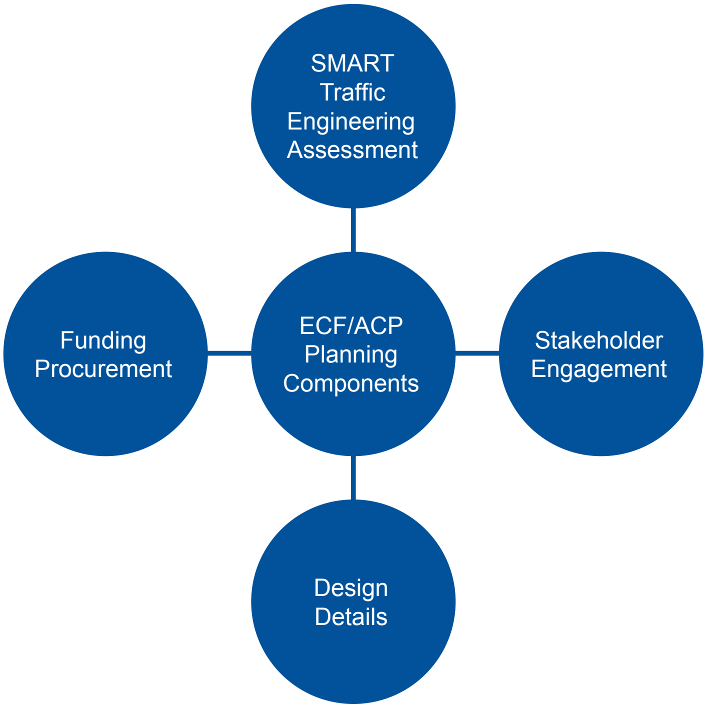


Exhibit 3: Entry Control Facility/Access Control Points Planning Stakeholders

Installation Stakeholders

- ✔ Security Forces
- ✔ Engineering and Public Works
- ✔ Safety Offices
- ✔ Communication Offices
- ✔ Installation Command
- ✔ Housing Contacts

Other Military Stakeholders

- ✔ SDDCTEA
- ✔ Command Groups
- ✔ Major Commands
  - Army Corps of Engineers
  - Naval Facilities Engineers

Other Stakeholders

- ✔ Local Police
- ✔ Emergency Services
- ✔ Local Municipality/County
- ✔ State DOT
- ✔ FHWA

SMART Traffic Engineering Assessment

One of the ways that SDDCTEA can help create the environment of a successful ECF/ACP project is by conducting or reviewing the results of a Security, Manpower, Automation, Roads and lanes, Traffic and safety (SMART) Traffic Engineering Assessment. The assessment methodology is described in detail in Pamphlet 55-15 and contains a complete roadmap for determining what physical components will be needed to successfully operate the ECF/ACP. Exhibit 4 shows a summary of the SMART ECF/ACP Traffic Engineering Assessment.

Exhibit 4: ECF/ACP Traffic Engineering Assessment Road Map

Pre-Site Visit Data Gathering

- ✔ Stakeholder Coordination
- ✔ Determine Applicable Standards, Guidance, and Regulations
- ✔ Gather Data
  - Previous Studies
  - Planning Data
  - Electronic Mapping
  - Force Protection Information
  - Signalized Intersection Data
  - Crash Data
  - Staffing Levels
  - Historical Traffic Volumes

Site Visit

- ✔ Security Evaluation
  - Physical Security
  - Antiterrorism
- ✔ Safety Audit
  - Guard Safety
  - Motorist Safety
  - High Crash Locations
- ✔ Traffic Volume and Classification Study
- ✔ Traffic Speed Study
- ✔ Manpower Assessment
- ✔ Accessibility and Development Impacts
  - Internal and External
- ✔ Aesthetics

Post-site Visit Analysis

- ✔ Adjust Traffic Volumes
  - Deployments
  - Future Demands
  - Development
  - Changes in Travel Patterns
- ✔ Determine Number of Needed Lanes
- ✔ Size Inspection Areas
- ✔ Size Facilities and Parking Areas
- ✔ Determine Manpower Needs
- ✔ Conduct and Document Evaluation of Alternatives
- ✔ Stakeholder Coordination
- ✔ Determine the Programmatic Cost

ECF/ACP planners are being increasingly faced with the need to evaluate and implement electronic processing by using handheld devices or structurally mounted devices that can provide identity verification to some extent. To assist planners with this evaluation process, SDDCTEA developed the SMART Decision Evaluator. This tool (discussed in depth in the November 2009 *Traffic Engineering and Highway Safety Bulletin*, http://www.tea.army.mil/pubs/dod.asp) is intended to be used in conjunction with the SMART Traffic Engineering Assessment and allows planners to choose from a variety of ID checking methods and processing rates.

Funding Procurement

In many cases the success of an ECF/ACP can be determined long before the facility is ever constructed. If SMART Traffic Engineering Assessments are not done correctly, the project can risk being under-funded. When this occurs, ECF/ACP designers and constructors are forced to make difficult decisions regarding which standard or requirement to waive. When standards or requirements are waived, the installation may have to assume some level of risk or be forced to program follow-up projects that mitigate risks.

Answer from Page 1

This happened because a traffic engineering assessment that identified the controlling design vehicle was not done and the design was not reviewed for compliance with requirements.

The conceptual cost estimates that are developed as part of the traffic engineering assessment should serve two purposes:

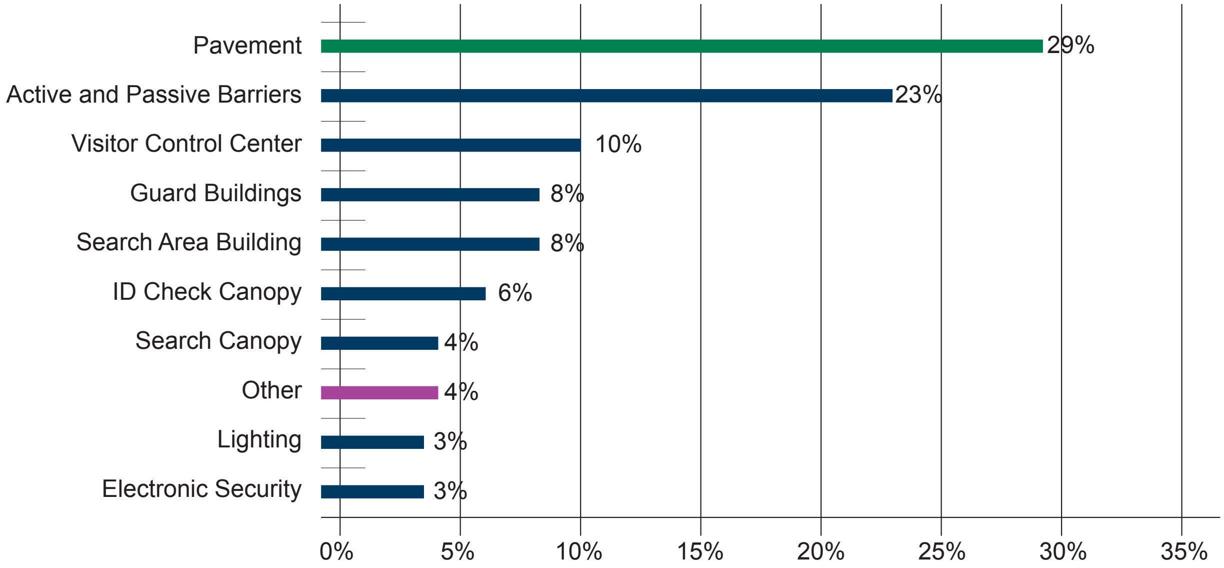
✔ Provide for an order of magnitude estimate to be used during option evaluation and in the charette process.

✔ Provide the basis for Form DD 1391.

Once programmed, most projects have difficulty receiving additional funds as the design moves forward if changes are necessary. It is important from the start of the project that an accurate footprint be created and that the major costs associated are understood. Exhibit 5 shows the sources of costs associated with constructing new ECFs/ACPs.

What Exhibit 5 shows is that pavement is the most costly item associated with ECF/ACP construction. This further reinforces the need for a strong ECF/ACP planning process component. Using the ECF/ACP Traffic Engineering Assessment Road Map and paying close attention to the design details will help planners understand the true economic impact of the ECF/ACP to be constructed before costs are programmed.

Exhibit 5: Average Percentage of Costs by Category for ECF/ACPs



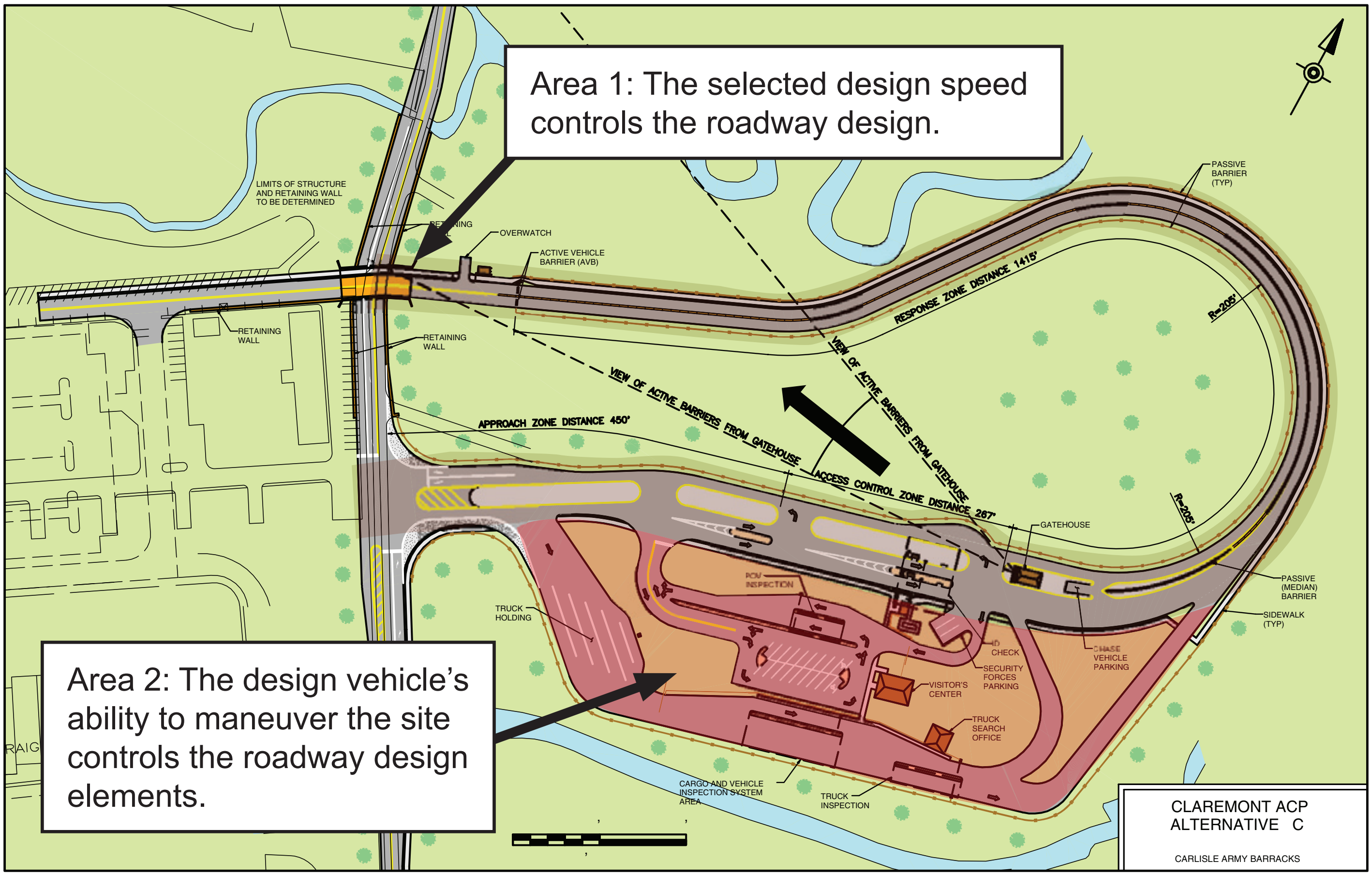
Courtesy of the US Army Corps of Engineers Center of Standardization for Access Control Points

Design Details

Since many ECFs/ACPs are constructed using design-build contracts, it is extremely important for conceptual designers to think about many of the design details when even the most basic layout is utilized. A couple of the critical areas to be given special attention are design speed and turning paths of slow moving vehicles. SDDCTEA's Pamphlet 55-15 indicates that a logical design speed for ECFs/ACPs is 25 mph, because in most states, 25 mph is the lowest enforceable posted speed limit. It is recognized that if traffic citations are handled within the installation's judicial system, many may be able to enforce actual speed limits that are lower than 25 mph. However, from a roadway design standpoint, 25 mph should be the minimum design value selected.

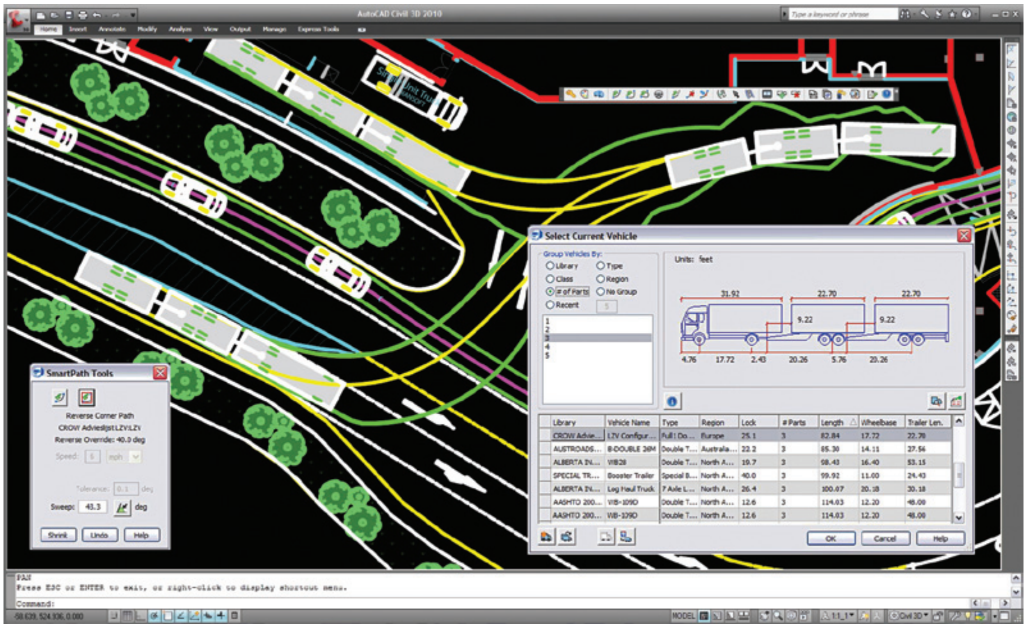
Exhibit 6 shows two areas that need to be considered for proper geometric design. Area 1 shows the main travel corridor onto and off of the installation; this is the area where a selected design speed will control the roadway design. Area 2 shows the inspection facilities and visitor center. In this area, the ability of the design vehicle to move around the site in the required directions will control the roadway design. For designing elements in Area 1, use the most recently adopted AASHTO *Policy on Geometric Design of Highways and Streets* (Greenbook) to select the proper design elements. Keep in mind that slow moving large vehicles will need more roadway width to navigate these relatively tight curves. See SDDCTEA's *Pamphlet 55-15*, Chapter 3 for AASHTO-compliant design details for ECF/ACPs.

Exhibit 6: Typical ECF/ACP Applied Layout



To design the elements in Area 2, use the AASHTO Greenbook vehicle turning templates to make sure that vehicles can maneuver the site. There are a few software products available, such as the one shown in Exhibit 7, that can help designers double check the accuracy of the facilities being designed.

Exhibit 7: Vehicle Design Elements



Graphic courtesty of Transoft Solutions, Inc.

Physical Components

An extremely important aspect of detailed design that crosses over into physical components is the use of Active Vehicle Barriers (AVBs). These devices continue to be one of the most challenging physical components of ECFs/ACPs. From the planning aspect, specifying their correct location requires planners to consider the specific operational effects. In an environment where fiscal competition needs to be encouraged, this can be difficult. As shown in Exhibit 8, the AVB needs to be placed at the end of the response zone however, the location is dependent on what takes place in the approach and access control zones.

The length of the response zone, and location of the AVBs, is dependent on the maximum attainable speed of threat vehicles in the approach zone as well as the location where guards detect the threat vehicle. This can be in either the approach or access control zone. Once the potential threat is identified, 9 seconds of delay is needed for AVB activation when the speed limit is 25 mph and there are no intersections near the barriers. A complete discussion on the philosophy of 9 seconds and other considerations that might affect the placement of AVBs is included in SDDCTEA Pamphlet 55-15.

Speed Detector Settings for AVBs

One of the ways that detection of potential threats can be improved is by installing advance speed detectors in the approach zone. The speed detection devices can be embedded in the pavement, installed using video analytics or radar detection. Regardless of the type of detector used, the threshold speed setting is very important. It is important since the location of the AVBs is predicated on the fact that potential threats will be identified earlier. If the detection device is turned off, then the AVB location is no longer valid. Note that if alternatives to using speed dectection exist, consider them first since speed detection has the potential for false positive calls.

Determining Speed Detector Settings

- ✔ Conduct a traffic engineering assessment
- ✔ Collect free-flow speed data near the ECF/ACP for at least 24 hours
- ✔ Determine the 85th percentile speed
- ✔ Set the detector at 85th percentile + 10 mph

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The Latest AVB News

There continues to be many developments in the area of AVB considerations. SDDCTEA is participating and coordinating with several entities on AVB issues. The summary below describes the most recent developments for AVB considerations.

Placement

Active Vehicle Barriers need to be placed far enough away from the ID checkpoint to allow guards to detect the potential threat, allow safety devices to activate, and the barrier to engage. Ideally, providing curvature on roadways would provide a physical limit to a threat vehicle's maximum attainable speed. The location of the AVBs would be calculated based on this maximum attainable speed through the curves. If that situation does not exist and cannot be created, then advance speed detection should be considered.

Placement near roundabouts

Roundabouts have many documented benefits for use, including sustainability and efficient traffic operations. Exhibit 8 shows a typical detail for placing AVBs near a roundabout. The placement of the outbound AVBs is the key consideration in this scenario.

Placement near intersections

Both the SDDCTEA Pamphlet 55-15 and the Army Access Control Point Standard Design/Criteria have included a detail for the case when AVBs are co-located at a signalized intersection. In most cases, the delay time with this placement is increased from 9 seconds to 11, 12, or 13 seconds. This increase in time is governed by the outbound barriers, and is needed because a vehicle traveling outbound must travel over the STOP line, then clear the intersection and the barriers before the barriers can be activated. The time required increases with the width of the intersection.

A staggered placement is an alternative which can avoid this increased amount of time. With a staggered placement, locate the outbound barriers at least 300 feet from the intersection. Both the inbound and outbound barriers can operate within 9 seconds. If this is used, be sure to verify that the outbound barriers are not vulnerable to a covert threat (threat vehicle approaches ID check area, is denied entry, travels through turnaround, then attempts to enter the base through the outbound lanes).

Exhibit 9 compares the two placement methods.

Exhibit 8: Active Vehicle Barriers Placed Near A Roundabout

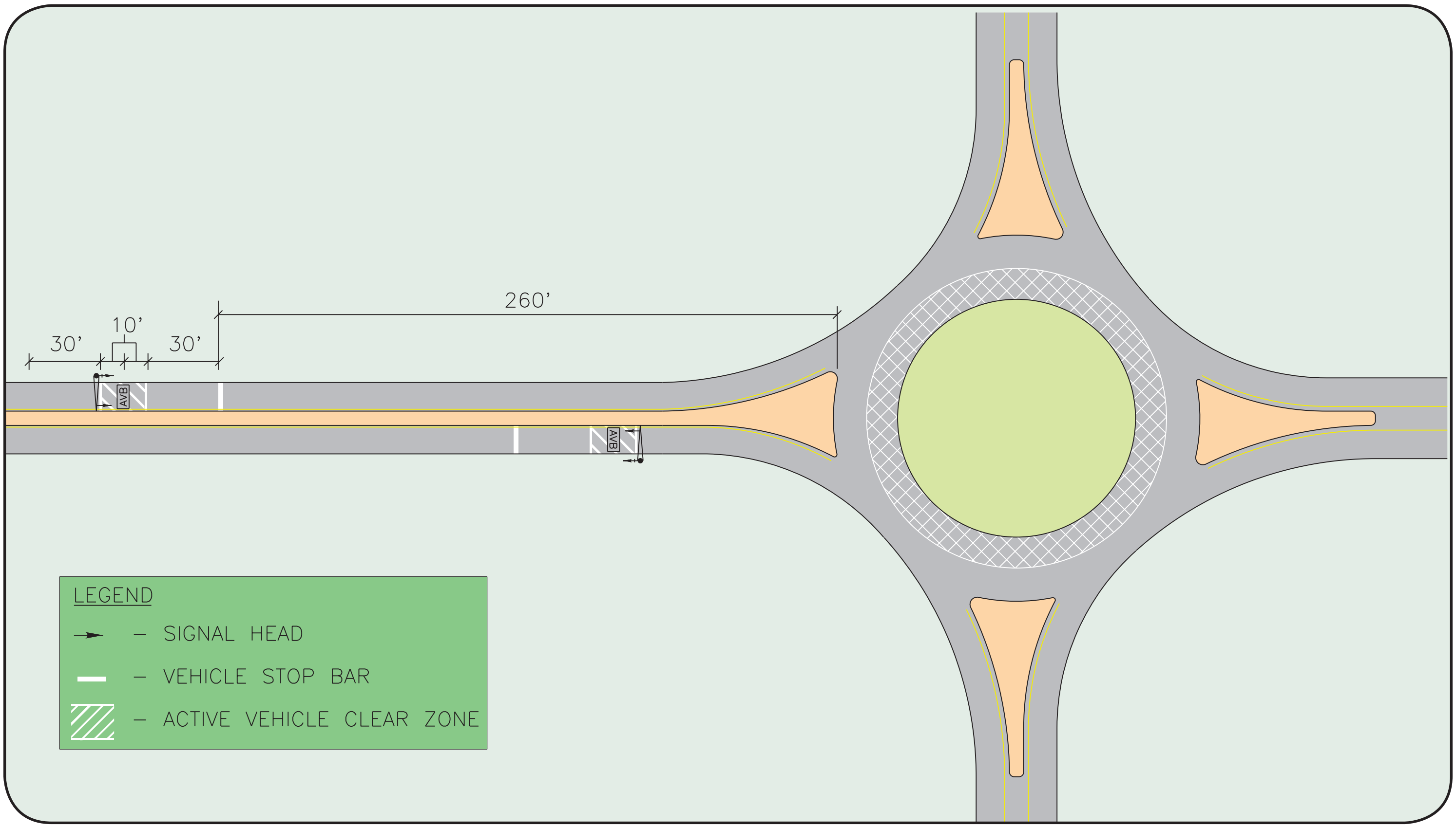
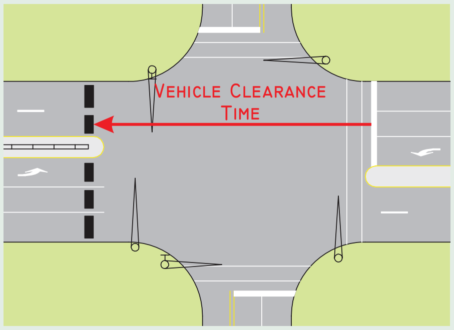
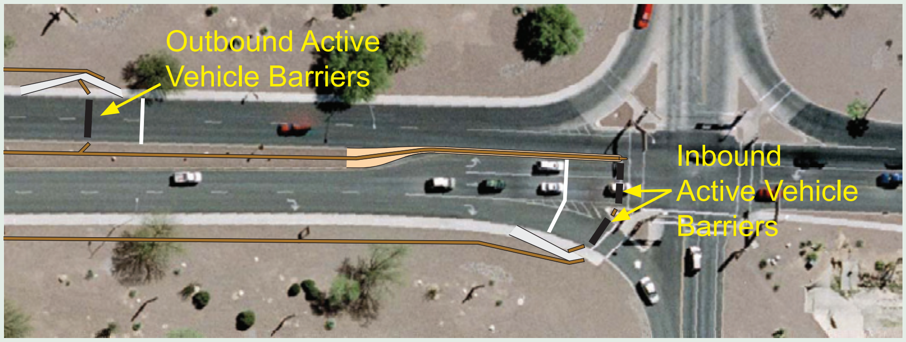


Exhibit 9: Active Vehicle Barrier Placement Considerations Near an Intersection

Layout	Time Consideration
	AVB activation time greater than 9 seconds due to vehicle clearance time needed
	AVB activation time: 9 seconds

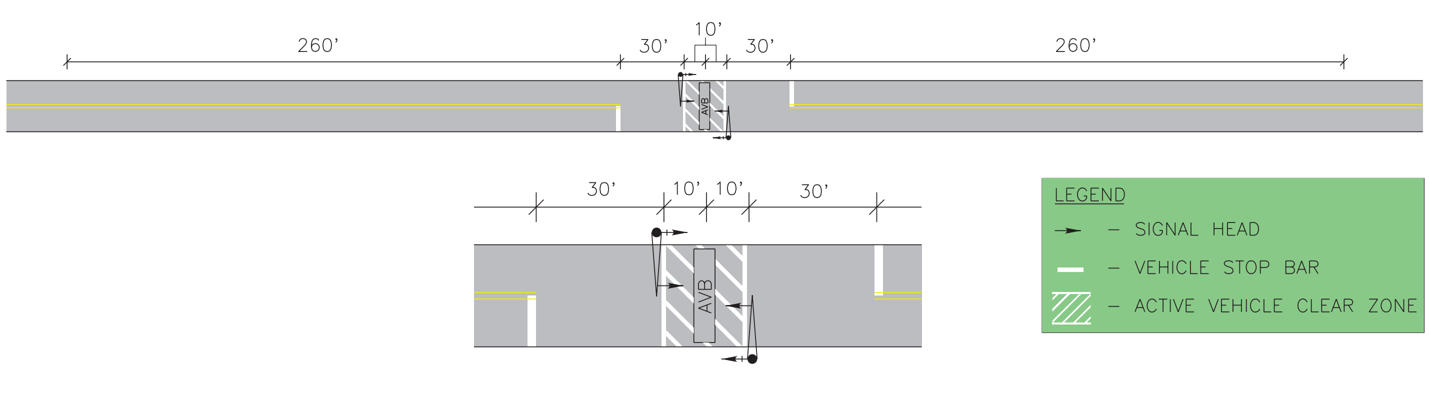
Pavement Markings

Regardless of the type of AVB chosen for use, efforts should be made to delineate the device as much as possible using retroreflective material. Additionally, pavement markings near the barrier should be installed with the intent of meeting the MUTCD requirements. SDDCTEA has created a pavement marking detail that is recommended for use in conjunction with AVBs and is shown in Exhibit 10.

Controls

SDDCTEA is participating and coordinating with the USACE's Protective Design Center (PDC) and Electronic Security Center on the development of a guide specification for AVB controllers and the integration of safety and traffic control devices into one system. The study includes bench tests to determine what the best configuration is for these items. The results of the study and the guide specification are expected to be finalized later this year. The PDC is the lead agency for this effort.

Exhibit 10: Pavement Markings Near AVB



Types of AVBs

SDDCTEA's Pamphlet 55-15 discussed different types of AVBs, and indicated that net type barriers were preferred. Through feedback from installations, coordination with PDC, and from experience with net barriers, some concerns have been identified. SDDCTEA is no longer making recommendations as to a preference for a specific type of AVB. Instead, designers need to evaluate the specifics of the location and choose the AVB that is most appropriate. Use Exhibit 11 as a guide to selecting the correct AVB.

Exhibit 11: Typical Applications for Active Vehicle Barriers by Type

Barrier Type	Use appropriate across multiple lanes?	Use at co-location with an intersection?	Use across single lane?	Use near a roundabout?
Wedge	Yes (1 unit per lane)	Yes (1 unit per lane)	Yes	Yes, outbound considerations needed
Net	No	No	Yes	Yes, outbound considerations needed and not more than one lane span

Barrier Deployments

When installing AVBs it is important to consider the consequences of barrier deployments. SDDCTEA recommends the use of engineered passive barriers parallel to the ACP/ECF corridor in lieu of rocks or trees. It is more difficult to achieve the principles of a forgiving roadway as outlined in the AASHTO Roadside Design Guide when using these natural passive barriers. There are also concerns for AVB deployment on the roadway itself. As Exhibit 11 indicates, the use of net barriers near an intersection is discouraged. This is due to the deflection that can occur and the impact that the deflection can have on motorists moving through the intersection.

The placement of crosswalks near AVBs is also discouraged. The impact to a pedestrian could be severe if a collision occurs. Even when there is no activation, unauthorized individuals should not be encouraged to be near the mechanical parts of any installed AVB.

Finally, AVBs must have suppression controls in place to make sure that deployment does not occur when a vehicle is directly over the AVB. However, these loops should be individually controlled for inbound and outbound lanes. Exhibit 11 also indicates that single barriers should not be placed to control multiple lanes. If there are existing installations where AVBs control multiple lanes, suppression controls should be configured for uniform operation across all lanes. In the case of multiple wedge barriers being used, the suppression controls should be configured so that each lane can work independently. The types of suppression controls typically used at AVBs are inductive loops. When used, these loops should be included in the AVB maintenance test plan to ensure they are working properly.

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OFFICIAL BUSINESS

Reference List

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- ✔ Institute of Transportation Engineers. *Traffic Engineering Handbook*. Washington D.C. 2009.
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