CHAPTER 7

CRASH INVESTIGATION SITES
7. Crash Investigation Sites (CIS)

7.1. Introduction and Usage

The idea of "crash investigation sites" or areas outside of the freeway mainline where investigations or minor vehicle repairs are made is an attempt to minimize the exposure to personal harm and the danger of causing additional incidents on the system. Crash investigation sites (CIS) are specially designated and signed areas off the mainline where motorists, law enforcement, and other public service vehicles can be temporarily located. The sites provide an area to complete small vehicle repairs, hand out citations, or conduct crash investigations. Typically these areas are well lit, safer than using a freeway lane or shoulders, and provide enough storage area to hold up to five passenger vehicles. They can be designed for uni-directional or bi-directional access from the mainline and are positioned at locations where there is a large probability of incidents and at regular intervals throughout a corridor. The sites take advantage of existing infrastructures, where available, or use specially constructed areas. Sites typically have phone service nearby to assist in the reporting of an incident. Use of the site is meant to reduce the congestion that is caused by stopped vehicle(s) on the roadway shoulder or in a traffic lane. The site also provides an area where troubled vehicles can pull over until the proper service or repair can be made and as a staging areas for major incidents.

A crash investigation site functions by serving the needs of distinct groups. The first is the motorist who has to decide where to place his or her partly operable vehicle after a minor altercation or mechanical trouble has occurred. This motorist may currently choose between a ramp, shoulder, or a freeway lane. The next group is law enforcement and other responding personnel. They are the ones called to the site of an incident, which in many cases may require them to walk only feet from a live traffic lane. The final group is the mainline traffic not involved with the incident. This group could become involved in secondary incidents or potentially harm the people responding to the first. For each group involved the crash investigation site provides an area where stopped vehicles and persons may conduct business away from moving traffic.

The primary function of a crash investigation site is to provide a safer alternative to freeway space for motorists and law enforcement officers that are dealing with minor traffic incidents and events. The other function of a crash investigation site is to provide a means to remove a potential risk to the mainline traffic and to increase system efficiency.

The greatest benefit of a crash investigation site is to promote an increase safety to individual motorists and law enforcement. However, there are other benefits to CIS that are not as obvious. Some of those benefits related to the groups already discussed are:

The individual motorist:

- Provides a place to make vehicle repairs or get service
- Better protects the motorists’ movements outside of the vehicle by reducing exposure to adjacent moving traffic
- Provides a location that is removed from vehicle exhaust and noise
• Provides access for communication to law enforcement
• Typically displays signage listing important phone numbers for service and information
• Allows more time to exchange information with another motorist or law enforcement
• Provides easier access to service vehicles
• Makes immediate response less critical when vehicle is out of traffic and enhances the locating process.

Law enforcement:
• Provides a safer location for conducting an investigation
• Provides an area for storage of mainline debris until it can be collected
• Provides a location for incapacitated vehicles from larger incidents and collisions
• Provides patrol assembly areas
• Provides staging location for activities unrelated to incident response such as snow removal, construction mobilization, etc.

Mainline traffic:
• Reduces the congestion caused by lane or roadside incidents
• Reduces travel time
• Reduces gasoline consumption
• Reduces the emissions generated by slowed vehicles
• Reduces secondary collisions associated with "rubbernecking"

A crash investigation site has other potential uses by public service, media, and emergency vehicles. However, the benefits to these groups occur infrequently.

7.2. CIS Types
There are several different ways to deploy crash investigation sites. They can range from making minor improvements to existing infrastructure, to constructing completely new locations. The type and scale of the CIS depends on the amount of space available, existing infrastructure, traffic volumes, and existing development. No single blueprint fits every location. The unique site conditions of each location require engineering judgment to design a suitable facility.

The following establishes a list of typical location strategies for long and short-term deployment of CIS and highlights the advantages and disadvantages of each.

Short-term Implementation (Temporary)
Short-term implementation is done to mitigate congestion brought on by construction projects, special events, and any situation where normal freeway conditions are altered for a short period of time. These sites typically use existing areas where pavement and adequate lighting are available. The cost to construct is generally inexpensive but there are exceptions. Typical sites usually require minor improvement with most of the cost going to signs and markings.
Long-term Implementation (Permanent)

Long-term implementation is done as part of an overall traffic management system. The design and selection of a site is done in conjunction with other sites to form a "coverage area". These crash investigation sites are strategically located to handle incidents occurring in the area. Sites are generally more expensive than the short-term sites and become a part of the surrounding infrastructure.

7.2.1. Existing Sites – Lot and Local Streets

"Existing sites" are areas where the infrastructure necessary for implementation, of a CIS, already exists, but has not been designated for that use. Existing infrastructure may include existing parking facilities, private commercial property and public parking or curb space on a local street. Preferred existing sites are those that are not already heavily used for other purposes and where the incidents will not attract attention from onlookers. Commercial properties such as shopping malls, small businesses, and residential owners generally have concerns about "image" and should be avoided. More suitable sites include park and ride, commercial warehouse, and industrial lots.

Advantages:
- Typically less expensive to deploy
- Take less time to implement
- Generally do not require any additional construction

Disadvantages:
- Property owner may not be cooperative
- Municipality may not be approve of site location
- Potential debate over who has jurisdiction and is responsible for maintenance

Existing Site Issues:
Crash investigation sites that use existing lot areas are more cost effective than constructing a new site. However an existing lot may have certain characteristics, which may limit or eliminate its usefulness as a CIS location. Some of these characteristics are listed below:

Turning Movements - Site should be chosen to avoid the need for a motorist to make several turning movements especially left turns. In most situations each time a vehicle is required to make a left turn it will be forced to cross over a traffic lane going in the opposite direction. This can cause problems with debris left in the path of oncoming traffic and a potential hazard for responding agencies pushing or towing a vehicle to a site.

Controlled Intersections - Sites that limit the number of controlled intersections a vehicle needs to travel through are recommended. The condition of a vehicle involved in an incident is often questionable. Forcing partly disabled vehicles through controlled intersections increases the possibility of additional incidents and further breakdown of the vehicle before reaching the CIS.

Long Distances - Shorter distances are always better. Sites further from the mainline increase the chance of confusing the motorist.
7.2.2. Bi-directional Access on Freeway ROW – Median Sites

Bi-directional crash investigation sites are typically located on freeway median space. This space between the traffic flows allows the site to be utilized by both directions and eliminates the need for two separate sites.

Advantages:
- Accessible from both directions of traffic
- Less maneuvering required for responding vehicles

Disadvantages:
- Generally only has capacity for one incident at a time
- Requires a vehicle to merge through the faster left lane(s)
- Does not remove the incident from the freeway and from the view of both directions of motorists

7.2.3. Uni-directional Access on Freeway ROW – Off-ramp Sites

Uni-directional access on the freeway right of way can be accomplished three ways. The first is by using areas along an existing freeway off-ramps.

Advantages:
- Sites are close to the mainline
- More easily accessible than other CIS locations
- Sites are noticeable to exiting motorist reinforcing their use

Disadvantages:
- Incident is not completely removed from the view of the mainline
- Does not work for areas where there isn’t enough stopping distance prior to the site
- Sites located too close to the terminal may become blocked by queues

7.2.4. Uni-directional Access on Freeway ROW – On-ramp Sites

On-ramp locations are constructed spaces located just prior to the point where vehicles enter onto the freeway. In this situation a vehicle will enter the site from the mainline but enter back onto the freeway by using the on-ramp.

Advantages:
- Responding vehicles can use the local street network or freeway system to reach the site
- Sites are close to the mainline
- Less maneuvering required for responding vehicles
- Sites are noticeable to exiting motorist reinforcing their use

Disadvantages:
- All vehicles leaving the site must exit back onto the freeway system
- The vehicles are not completely removed from view of the mainline
7.2.5. Uni-directional Access on Freeway ROW – Freeway Shoulders
A "Shoulder site" is not located on the freeway shoulder but rather outside of it. The typically layout for a shoulder site uses the existing freeway shoulder as a buffer zone between the site and the freeway itself.

Advantages:
- Relatively easy to construct if freeway is level with surroundings
- Sites are close to the mainline
- Sites are noticeable to exiting motorist reinforcing their use

Disadvantages:
- All vehicles leaving the site must exit back onto the freeway system
- The vehicles are not completely removed from view of the mainline

7.2.6. Uni-directional Access off Freeway ROW- Bridge Underpass Sites
An example of a CIS that is accessible from only one direction and does not use existing freeway right of way is a bridge underpass location.

Advantages:
- Typically less expensive to deploy
- Takes less time to implement
- Generally do not require any additional construction

Disadvantages:
- Property owner may not be cooperative
- Municipality may not approve of site location
- Potential debate over who has jurisdiction over space and is responsible for maintenance

7.3. Basic Design Elements
As discussed previously, current crash investigation sites vary in shape and size. With the lack of any one standard a designer may have a difficult time deciding how to configure a site. Presented here to assist the design is a list of basic CIS elements. The site elements are individual pieces of the design, which must be addressed when developing a site’s layout. The elements include access, security, capacity, communication, and the proper signing to assist in the identification of the site. Each element is crucial to the development of a usable site that functions as a tool in the overall freeway traffic management system.

Signing and Markings
The ability to place signs appropriately along the approach and at a crash investigation site is crucial to the operational use of the site. Motorists are informed of CIS locations via WisDOT Type I signs along the mainline. These signs must be coordinated with existing signs, with 800-ft spacing maintained between all Type I signs.

Additional areas the designer needs to address when looking at signing and marking are as follows:
• Signs needed to promote site on freeway.
• Signs needed to guide vehicles to site from freeway.
• Signs to isolate site from surrounding area.
• How the sites are referenced.
• Marking leading to site.
• Markings that delineate the site.

Site Access
Access to and from the site must allow for slightly damage and or mechanically troubled vehicles to maneuver easily without introducing further risk to the vehicle and others. Site access factors include:

• Deceleration and acceleration distances
• Entering and existing tapers
• Stable relatively smooth surface conditions (stone, asphalt, concrete, etc.)
• Access from the freeway
• Distance from the freeway
• Setback from the travel lane edge
• Access back to the freeway

Security Issues
The motorist will ideally feel secure at a cash investigation site. They must have the confidence that once leaving the mainline they will not be placing themselves at risk of additional harm. Motorists should not feel stranded in an unsafe environment, and quite possibly in a worst-case scenario threatened by another motorist. The following design considerations relate to security.

• Lighting requirements
• Visibility of the site to the public (i.e. avoidance of isolated locations)
• Surrounding neighborhood conditions
• Regularity of law enforcement patrols

Capacity
Typical crash investigation sites in several states are approximately 1000 square feet in area and 100 feet in length, but there is no established standard. The site can be as large or as small as needed to accomplish a given function. The following considerations relate to capacity needs at a site:

• Type of vehicle the site will hold
• Maximum time the site will be occupied by vehicle(s)
• Maximum number of vehicles occupying site at any one time

Communications
There are two types of communication to consider. First, the motorist needs clear instructions as to how to use the site, i.e. activities that are prohibited and permitted. Second,
the motorist needs to be able to request appropriate assistance from services located outside the site. The flowing elements facilitate one or both types of communication:

- Instructions concerning permitted/prohibited activities, who to contact, maximum stay allowed at site
- Availability of existing payphone
- Feasibility of placing payphone at site
- Feasibility of placing call box at site
- Telephone numbers to make available at site
- Any legal information concerning use of the site
- Site identification number

7.4. Approaches to Site Placement

So far, different site location strategies have been presented but little has been said on how the placement of the crash investigation sites is determined. CIS can be constructed on or off the freeway, at varying distances from each other, and placed in areas of anticipated or actual need. With a number of options available it is important to establish guidelines to govern the placement of CIS to assure some consistency throughout the roadway system. Typically there are two differing approaches to establishing these guidelines. The first is a systematic approach looking at anticipated needs of the motorist and the other is a problematic approach, which looks at existing needs and problems. Each approach has different advantages and shortcomings.

Problematic Placement

This approach works to place sites in areas where a significant number of incidents in the past have occurred. Reference is made to crash data accumulated over a period of time to isolate specific locations for deployment. By providing sites in areas where incidents consistently occur it is believed that the CIS will be utilized more frequently and the impact on improving travel times maximized. The following looks at this approach more closely.

Advantages:
- Addresses an existing need in high incident prone areas
- Cost is reduced because the number of sites deployed is limited
- Simple to locate sites in a corridor

Disadvantages:
- Changes to roadway designs and construction can shift incident locations leading to deploying CIS in areas where problems may no longer exist.
- Less visible to drivers, less obvious to use
- Difficult to promote their use due to frequency of sites deployed

Systematic Placement

This approach places crash investigation sites more evenly distributed throughout a corridor. An effort is made to provide uniform coverage by keeping sites at regular intervals. By placing sites in this fashion the CIS will have greater coverage and is be available to more people and potential more incidents.
Advantages:

• Higher frequency makes them available to more motorists
• Increase visibility to motorist traveling through a corridor
• Easier to promote due to frequency

Disadvantages:

• More expensive to deploy a large number of sites
• More work involved with locating appropriate locations

Hybrid Placement

This approach combines systematic and problematic placement of crash investigation sites. In this approach problem sites are located first with systematic site place used to fill in the gaps throughout a corridor.

7.5. CIS Design Process

The most important major design elements are described in this section, but other factors not listed may need to be considered when designing CIS. The design process presented here demonstrates the steps needed for proper CIS deployment. It does not, however, take every possible variable into consideration. The designer must understand that a certain amount of judgment is always necessary for a successful deployment. A graphical representation of this process is shown in Figure 7-1.

1) Determine the Type of Deployment required for CIS design
2) Collect data required to initiate design of the CIS
3) Conduct site location and analysis
4) Prepare site design and layout
5) Investigate requirements for and prepare local agency agreements
6) Utilizing the table found at the back of this chapter and the information contained within Appendix A, determine the construction details needed for the proposed design, details which need to be modified, and new details which need to be created to provide a complete construction plan.
7) Utilizing the table found at the back of this chapter and the information contained within Appendix B, determine the special provisions needed for the proposed design, special provisions which need to be modified, and new special provisions which need to be created to provide a complete construction plan.

Each step will be examined more in greater detail in the following sections.

7.6. Determination of CIS Deployment Type

The designer must know if the CIS deployment is to be approached systematically, problematically or hybrid fashion. In a problematic approach the designer will focus efforts on researching where incidents that might utilize a CIS happen most frequently. With this information a few locations can be identified and sites designed. In a systematic approach designers are not just concerned with the location of incident "hot spots" but also incidents along the entire system. Generally the systemic approach requires more sites since the goal is
to provide system coverage. In a hybrid method work combines the two. The remaining steps in the design process, regardless of the placement approach, are done similarly.

7.7. Initial Data Collection

Data collection activities consist of three steps. Each step establishes the foundation for which decision will be made on exact CIS locations. The steps are:

Step 1 - Gather incident data for the system or corridor under review. Incident data should be within the past five years and be divided into traffic direction, incident severity, and time of day. Incident locations that occur between 7:30am to 9:30am and 4:30pm to 6:30pm should be given highest priority.
Figure 7-1: Crash Investigation Site Design Process
Step 2 – Develop base maps for system, corridor, and high-incident.

Step 3 - Contact local, county, and state law enforcement to collect their input on locations for potential sites. Law enforcement have a good understanding of exact locations and where a site will or won’t be beneficial. It is also important to remember that if a site is to be used effectively it must have the support of officers that may have to use it.

Once this data is gathered, initial site location and analysis can be completed. However, additional data collection may be necessary if CIS locations change during the site design process.

7.8. Site Location and Analysis

Initially locations for site placement will be selected from available base mapping. The initial locations are chosen based on a systematic or problematic placement. More precise sites will be identified at each location and analyzed for feasibility. A set of criteria is then applied to each site under review. The criteria used in the review process is listed and explained below:

The first four criteria correlate to the convenience or difficulty of maneuvering disabled vehicles to the site. It is desirable to limit the number of turns, controlled intersections, and total travel distance in driving a vehicle from the mainline to the CIS.

1. Number of right turns made to access the site.
All turning movements add potential confusion and difficulty to accessing the CIS.

2. Number of left turns made to access the site.
Left turn movements usually conflict with other traffic. Left turns impede ease of access more than right turns.

3. Number of controlled intersections along the route leading to the site.
The condition of a vehicle involved in an incident is often questionable. Forcing partly disabled vehicles through controlled intersections increases the possibility of additional incidents and further breakdown of the vehicle before reaching the CIS. Sites that can be accessed without entering a controlled intersection are preferable.

4. Travel distance from mainline.
A badly damaged vehicle may not be able to leave the freeway system on its own power, however, it can be pushed by a patrol to a site nearby that does not require extensive maneuvering. Slightly damaged vehicles, also benefit from a closer site. Sites located close to the mainline provide the greatest benefit for the maximum number of different incident situations. They also provide a secondary storage area for emergency vehicles, snow removal equipment, etc...

5. Does the site utilize local streets, commercial property, or DOT right-of-way?
Sites proposed on commercial property or local city streets require approval from third parties. These parties will in most cases not be receptive to having crash investigation sites located in "their backyard". Approval for DOT right of way space is considerably easier and therefore a more favorable option.
6. Is the site currently paved?
Sites located in areas with existing pavement require less cost to construct and maintain. Therefore a site that is already paved is preferred.

7. Does the site provide adequate lighting?
All crash investigation sites require an adequate level of lighting. Sites that already have sufficient lighting are less costly to construct. A site that has good lighting is preferred.

8. Is access available to the site from more than one direction?
Sites that are accessible from multiple directions are more cost effective than uni-directional sites. Having one location that can be accessed by both directions of travel are more convenient to patrols and tow trucks, which can then respond from either direction. Bi-directional sites are preferred.

9. Is available space greater than 1000 sqft?
The typical crash investigation site is designed to hold a total of five vehicles. This provides enough room for two passenger cars, one patrol, and two tow trucks. Sites smaller than 1000 square feet should be rejected if other nearby larger sites are available. However, other states in the nation do operate sites that can only accommodate two or three vehicles at most. If a larger site is not available than a smaller site should be considered.

All sites at each location should be identified and examined using the criteria mentioned. In most cases the criteria will show that a freeway off ramp is the best site. However, there is not always sufficient space on a ramp for CIS deployment. As a result the criteria is helpful in identifying the best alternatives available beyond the ramp sites.

7.9. CIS Design/Layout Requirements
The layout guidelines proposed here follow closely with what has been expressed and observed by other Transportation Departments deploying crash investigation sites. These guidelines should be viewed as minimum standards and should not be treated as comprehensive guidelines.

7.9.1. Layout Guidelines
The following guidelines can be related directly back to the design elements. These guidelines are meant as a reference only. The individual designer must ultimately decide the best design based on sound engineering judgment. The following have been developed under general assumptions and not actual field conditions.

1) The site should be approximately 1,000 square feet in size. (large enough to accommodate two passenger vehicles, one patrol, and two trucks)
2) Avoid tapers that are larger than 5:1 as the site could be mistaken for a traffic lane.
3) The site should be set back at least 8 feet from a travel lane. (space equivalent in size to the frontal width of a mid-sized passenger car)
4) The site should have a paved surface and be free from surface defects that can cause a temporary loss of control by a driver.
5) The site should provide sufficient lighting to allow for its utilization at night under
adverse weather conditions.
6) The site **shall not be isolated** in such a manner that allows criminal activity may go unobserved.
7) The site should have **advance signing on the freeway system** not less than one mile in advance of its location.
8) The site should have **identification signing at its approach**.
9) The site should have a **sign with site identification number within the site limits**.
10) The site shall have sufficient **markings to delineate its perimeter**.
11) **Tapers** into and out of the site should be marked with diagonals to further distinguish the site from a traffic lane.

7.9.2. District 2 Early Deployment Model – USH 45

The following designs were developed for use on the USH 45 Corridor. The sites shown represent the first concentrated systematic corridor deployment for CIS. The first type is a "typical" CIS located on an off-ramp. The other is for a park-and-ride lot deployment. The sites will be in operation early 2000 and evaluated to identify their feasibility.

![Figure 7-2: Exit Ramp CIS Deployment](image-url)
7.10. Local Agency Integration

Where is required CIS are located outside of the Wisconsin DOT right-of-way, with a local agency agreement between the State and the local jurisdiction. The agreement will outline maintenance operational responsibilities. In District 2, a CIS evaluation is underway by the Traffic Incident Management Enhancement (TIME) Program. Comments and recommendations from that work will refine existing drafts of proposed local agency agreements. In the future a document will be made available that acts as a blueprint for future local agency agreements.

7.11. CIS Construction Details

Construction details for crash investigation sites are currently being compiled and will be available in the next submission.


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