Safety Guidelines for Field Data Collection

Submitted to: The Southeastern Transportation Center

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February 2010

INTRODUCTION

Safety concerns are always present when personnel are working near or adjacent to a highway. Safety considerations must include the workers as well as the motoring public. Construction safety has received extensive attention, but this research focuses on personnel working near or adjacent to the highway and involved in activities such as: collecting data, setting up data collection equipment or administrating roadside interviews. Part Six of the Manual of Uniform Traffic Control Devices (MUTCD) discusses temporary traffic controls for maintenance activities. Some State Departments of Transportation provide their data collection personnel with supplemental policies, procedures and guidelines which will be discussed in this paper.

Policies and guidelines will be discussed in the context of intrusive and non-intrusive surveys. Intrusive surveys involve a surveyor having personal contact with a motorist along the roadway such as an origin-destination survey. These surveys involve stopping the vehicle on or adjacent to the roadway, a toll booth, rest area or truck weigh station. Non-intrusive surveys do not involve direct contact with a motorist and use such methods as placing road tubes across a highway or reading license plates.

Some states do not administer roadside intrusive surveys because of safety concerns. Other states permit these survey techniques only on lower volume, low speed roadways if adequate safety precautions are practiced. Some states rely on less intrusive techniques such as handing out postcards to motorists on ramps or in rest areas rather than conducting on site surveys. Questions that should be addressed include what are adequate safety provisions, where can these intrusive surveys be practiced safely and what procedures should be followed to ensure a safe environment? A recent study noted at least 10 states are relying on roadside interviews to collect valuable transportation planning data and a number of states have adopted written policies and practices manuals. (2) The observations from these states can be supplemented with the experiences of consultant firms that routinely conduct such surveys. Even non-intrusive surveys involve personnel working on or adjacent to the roadway which require safety guidelines and procedures to be developed and consequently followed.

PROJECT OBJECTIVE

The objective of this project is to define best safety practices associated with the collection of field data on or adjacent to highways. Guidelines for best practices will be based on experiences of agencies and private sector firms that have extensive experience with providing a safe operating environment for both field personnel and the motoring public. Best practices will be developed for different data collection activities defined as: duration of activities, location of activities on or adjacent to the roadway, roadway type and the roadway operating environment. Both intrusive and

non-intrusive data collection activities will be considered. Information will be presented on:

1. General requirements
2. Non-intrusive data collection techniques typically less than one hour at a site
3. Non-intrusive data collection techniques typically more than one hour at a site
4. Intrusive data collection techniques

GENERAL PROVISIONS

Most traffic data collection techniques are covered come under the general provisions of Part Six in the MUTCD "Temporary Traffic Control" (TTC). However, data collection procedures are not specifically covered in this section. Appropriate control devices used for the establishment of temporary traffic controls are presented in Part six of the MUTCD, stratified for different work activities in terms of: duration of activities, location in relation to the roadway, work type and highway type. As stated in Section six with reference to a temporary traffic control:

> "Each TTC zone is different. Many variables, such as location of work, highway type, geometrics, vertical and horizontal alignment, intersections, interchanges, road user volumes, road vehicle mix (buses, trucks, and cars), and road user speeds affect the needs of each zone. The goal of TTC in work zones is safety with minimum disruption to road users. The key factor in promoting TTC zone safety is proper judgment."

Typical applications of TTC zones are organized according to duration, location, type of work and highway type and will pertain to typical data collection activities. These applications are taken from Table 6H-1 (see Table 1) and are provided in the MUTCD.(1) As can be noted, these applications cover general TTC activities, but do not include a detailed layout for each situation.

Table 1: Index of Applications (taken from Table 6H1)
Modified to Reflect Typical Data Collection Activities

TYPICAL APPLICATION DESCRIPTION	TYPICAL APPLICATION
Work Outside of Shoulder (see Section 6G.06)	
Work Beyond the Shoulder	TA-1
Work on the Shoulder (see Section 6G.07 and 6G.08)	
Work on Shoulders	TA-3
Short Duration or Mobile Operation on Shoulder	TA-4
Shoulder Closure on Freeway	TA-5
Shoulder Work with Minor Encroachment	TA-6
Work Within the Traveled Way of Two-Lane Highways (see Sections 6G.10)	
Lane Closure on Two-Lane Road Using Flaggers	TA-10

Lane Closure on Two-Lane Road with Low Traffic Volumes	TA-11
Temporary Road Closure	TA-13
Work in Center of Road with Low Traffic Volumes	TA-15
Surveying Along Centerline of Road with Low Traffic Volumes	TA-16
Work in Center of Road with Low Traffic Volumes	TA-17
Work Within the Traveled Way of Urban Streets (see Section 6G.11)	
Lane Closure on Minor Street	TA-18
Work Within the Traveled Way at an Intersection and Sidewalks (see Sections 8G.13)	
Lane Closure on Near Side of Intersection	TA-21
Right Lane Closure on Far Side of Intersection	TA-22
Left Lane Closure on Far Side of Intersection	TA-23
Half Road Closure on Far Side of Intersection	TA-24
Multiple Lane Closures at Intersection	TA-25
Closure at Side of Intersection	TA-27
Sidewalk Closures and Bypass Sidewalks	TA-28
Work Within the Traveled Way of Multi-lane, Non-access Controlled Highways (see Sections 8G.12)	
Interior Lane Closure on Multi-lane Street	TA-30
Lane Closure on Street with Uneven Directional Volumes	TA-31
Lane Closure on Divided Highway	TA-33
Lane Closure with Temporary Traffic Barrier	TA-34
Mobile Operation on Multi-lane Road	TA-35
Work Within the Traveled Way of Expressways and Freeways (see Sections 8G.14)	
Work in Vicinity of Exit Ramp	TA-42
Partial Exit Ramp Closure	TA-43
Work in Vicinity of Entrance Ramp	TA-44

Four factors are utilized in the MUTCD to categorize TTC zone applications. They include (1)
The categories of work duration representing time at a location shall be:

1. Long-term stationary is work that occupies a location more than three days
2. Intermediate-term stationary is work that occupies a location more than one daylight period up to three days, or nighttime work lasting more than one hour
3. Short-term stationary is daytime work that occupies a location for more than one hour within a single daylight period
4. Short duration is work that occupies a location up to one hour
5. Mobile is work that moves intermittently or continuously

TTC zones are provided for the following locations:

1. Outside the shoulder
2. On the shoulder with no encroachment
3. On the shoulder with minor encroachment
4. Within the median
5. Within the traveled way

With reference to safety Section 6D.03 of the MUTCD explicitly states (1)

> "Equally as important as the safety of road users traveling through the TTC zone is the safety of workers. TTC zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for road workers on or near the roadway.

Maintaining TTC zones with road user flow inhibited as little as possible and using TTC devices that get the road user's attention and provide positive direction are of particular importance.

Source: (1)
Key elements of worker safety and management of the TTC should be considered to improve worker safety: (1)

1. Training
2. Worker safety apparel
3. Temporary traffic barriers
4. Speed reduction
5. Activity area
6. Worker safety planning
7. Shadow vehicle
8. Road closure
9. Law enforcement use
10. Lighting
11. Special devices

The specific coverage in the MUTCD regarding worker safety and management activities are presented in Appendix A. As previously mentioned, Table 1 has been modified to reflect activities typically associated with data collection activities. Reference should be made to Part Six of the MUTCD for appropriate TTC layouts.

Some states have developed their own supplemental standards to represent Temporary Traffic Controls. (40) For example, the Pennsylvania Department of Transportation has formulated Publication 213 "Temporary Traffic Control Guidelines."(3) Typical TTC layouts in Pennsylvania have been presented for short-term operations which are either – stationary or mobile and long-term stationary operations. Short-term stationary is defined as work that occupies a location up to 24 hours. Mobile operations reflect any operation that moves intermittently or continuously. Traffic Control Plans (TCP) figures are established for various conditions defined in terms of types of highway, work activity or work location, and duration. Further it is noted in the standards that some activities such as installing and removing portable traffic counters require less than 60 minutes at a site and as such are considered to be mobile operations; thus some of the signs and channelizing devices can be eliminated from those as noted in Publication 213. (3) Specific TCP figures are documented in the source document.

TYPE OF HIGHWAY	CONDITION	FIGURE NUMBER		
		SHORT-TERM OPERATION		LONG-TERM STATIONARY OPERATION
		STATIONARY	MOBILE	
	Work Area Adjacent to Any Roadway	PATA 5	PATA 6	PATA 24
	Numerous Nighttime Work Areas on or Beyond the Shoulder			PATA 25
	Minor Encroachment	PATA 7		
	Major Encroachment	PATA 8		
TWO-LANE, TWO-WAY HIGHWAYS	Work Area in the Center of the Roadway	PATA 9a S		PATA 9a L1
	Work Area in the Left or Right Side of the Roadway			PATA 9a L2
	Work Area in the Center of an Intersection	PATA 9b		
	Surveying Along Centerline of Road with Low Traffic Volumes	PATA 9a		
	Flagging	PATA 10a	PATA 11a*,11f	PATA 26a
	Intersection Flagging	PATA 10b		
	Single Flagger	PATA 10a	PATA 11f*	PATA 26b
	Stop Sign-Controlled Lane Closure	PATA 10d		PATA 26c
	Self-Regulating Lane Closure	PATA 10e		PATA 26d
	Flagger at One End, AFAD at the Other End	PATA 10AFAD-1		
	AFAD With Flagger at Both Ends	PATA 10AFAD-2		
	AFAD At Both Ends, Single Flagger Centrally Located	PATA 10AFAD-3		
	Road Closure	PATA 11d*,11e*	PATA 11a*	
	Moving Lane Closure		PATA 12	
	Temporary Traffic Control Signals			PATA 26a L
	Portable Traffic Control Signals	PATA 26a PS		PATA 26a PL
	Temporary Roadway			PATA 27
THREE LANE, TWO-WAY HIGHWAYS WITH PASSING	Work Area in the Single-Lane Approach	PATA 13a	PATA 12	PATA 28
	Work Area in Both Lanes of the Two-Lane Approach	PATA 13b		
	Work Area in One-Lane Approach and Left Lane of Two-Lane Approach	PATA 13a		
	Work Area in the Left or Right Lane of the Two-Lane Approach	PATA 16	PATA 16, 23	PATA 31
THREE-LANE, TWO-WAY HIGHWAYS WITH A CENTER LANE, LEFT TURN ONLY PATTERN	Work Area in One of the Through Lanes	PATA 14	PATA 12	PATA 29
	Work Area in the Two-Way Left Turn Lane	PATA 15	PATA 15	PATA 30
OTHER MULTILANE, UNDIVIDED HIGHWAYS	Work Area in the Left or Right Lane	PATA 16	PATA 16, 23	PATA 31
	Work Area in the Center Lane of a Three-Lane Approach	PATA 19	PATA 23	PATA 34
	Work Area Requiring the Closure of One Side of a Four-Lane Undivided Highway	PATA 17		PATA 32
	Work Area in a Two-Way Left Turn Lane	PATA 15	PATA 15	PATA 30
DIVIDED OR ONE-WAY HIGHWAY	Work Area in the Left or Right Lane	PATA 18	PATA 18, 23	PATA 33
	Work Area in the Center Lane of a Three-Lane, One-Way Roadway	PATA 19	PATA 23	PATA 34
	Work Area in Two Adjacent Lanes	PATA 20		PATA 35
	Lane Closure Near a Freeway or Expressway Exit Ramp	PATA 21		PATA 36
	Lane Closure Near a Freeway or Expressway Entrance Ramp	PATA 22		PATA 37
	Two-Way Traffic on One Roadway of a Normally Divided Highway			PATA 38
	Detour of a Numbered Traffic Route			PATA 39a
	Detour of an Unnumbered Traffic Route			PATA 39b
	Sidewalk Detour or Diversion			PATA 40
	Crosswalk Closures and Pedestrian Detours			PATA 41
	Temporary Bituminous Rumble Strip Patterns			PATA 42

Short-Term Stationary Operation -- Work that occupies a location up to 24 hours. * Daylight Only
Long-Term Stationary Operation -- Work that occupies a location more than 24 hours.
Mobile Operation -- Any operation that moves intermittently or continuously.

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REFERENCE GUIDE FOR TYPICAL FIGURES

Table 2: From Publication 213 Pennsylvania Department of Transportation Source (3)

Overall Safety Philosophy

As stated in the Traffic Counting Field Procedures established by the Connecticut Department of Transportation: (4)

> "An effective safety procedure program requires a team effort."
>
> "Safety is everyone's responsibility – Managers, Supervisors and employees."

The Colorado Department of Transportation explicitly states that procedures for properly identifying the presence of data collection efforts are covered by the MUTCD – Section 6. Also, the maintenance of workplace safety must be conducted in accordance with the Federal Occupation Safety and Health Administration (OSHA) requirements. (5)

In this report various safety guidelines are presented for both intrusive and non-intrusive data collection procedures. What is common to both elements is a holistic approach where safety is considered in all aspects of the operation: planning and preparation, site selection, and field execution. The safety guidelines promulgated are not afterthoughts but an integral part of all aspects of the data collection effort. Specific guidelines will be discussed under the two respective topics: intrusive and non-intrusive techniques. It must be remembered all these activities are subject to Part 6 of the MUTCD and appropriate OSHA regulations for personal safety equipment requirements as well as state requirements.

NON-INTRUSIVE DATA COLLECTION TECHNIQUES – TYPICALLY LESS THAN ONE HOUR AT A SITE:

Safety policies and guidelines have been established by various State Department of Transportations, agencies and consultants for the installation and removal of portable counters associated with obtaining traffic volumes, classification and/or installing, repairing data collection equipment. The results of a national survey of all State Department of Transportations and an internet search to obtain the safety guidelines and procedures established for field personnel are presented in the following sections.

Both the States Department of Transportation in Pennsylvania and Florida have developed training videos that have an explicit consideration of safety procedures for personnel responsible for setting up and retrieving traffic counters. The guidelines presented would also be appropriate for other short term data collection activities that generally require less than 60 minutes at a site. As any data collection activity the guidelines address a systematic approach towards safety considering that safety must be integrated with all aspects of the data collection activity including: (3) (6)

1. Training
2. Preparation – Assembling Material, Checking Equipment, etc.
3. Selecting An Appropriate Site
4. Driving To/From the Field Site
5. Personal Protection Attire
6. Setting Up and Retrieving Field Equipment

While these materials focus on traffic counters, the safety guidelines can easily apply to other short-term data collection activity.

1. Training

Safety requires that field personnel are familiar with the data collection equipment, procedures as well safety procedures and first aid techniques.

The Florida DOT specifies: (6)

"All traffic count personnel must be provided a minimum of two weeks of training by accompanying an experienced field technician who is collecting traffic data. All personnel must be provided training in first aid techniques and be familiar with the following safety procedures before they are allowed in the field."

The Pennsylvania DOT specifies: (3)

"All persons that will be engaged in installing and removing portable traffic counters shall view PennDOT's Traffic Counter Training video, which includes safety and installation/removal best practices."

The Pennsylvania guidelines apply to all personnel, not just representatives of the Department. This refers to "the personnel of Metropolitan Planning Organizations, Regional Planning Organizations, contracted vendors and others engaged in the installation, maintenance, repair or removal of traffic counting equipment on highways within the Commonwealth". (3)

2. Office-Shop Preparation

Prior to the start of the day, field personnel should review their work assignment and review all background information: traffic volumes, location, driving time, etc. Preparation also involves checking equipment and making sure that all equipment is available and functioning properly. Adequate preparation can help reduce the time personnel spend on or adjacent to a roadway troubleshooting equipment. This is consistent with a strategy to always have field personnel spend less time in potentially hazardous locations. Part of the preparation is to have all vehicles that are used by traffic data collector personnel be equipped with the adequate equipment which in Florida includes: (6)

1. Orange Safety vests (worn by technician during all field operations)
2. Four-way flashing lights and a minimum of two yellow strobes mounted on a light bar
3. Appropriate tools and supplies (e.g. spray paint, asphalt tape, nails, hammers, etc.)
4. Appropriate manuals for counters
5. Fire extinguisher
6. First aid kit
7. Two-way radio or cellular phone
8. Orange cones

9. Traffic counters
10. Security chain and locks

As noted in Florida, safety equipment is part of field equipment to be transported by field personnel. Added to the list can be flashlights and batteries, flares, hard hats, tick repellants, mini strobe light, etc.

If field personnel are not familiar with a site locations site scoping becomes an important safety activity. Sabra, Wang and Associates (SWA) specifies for their personnel responsible for conducting manual intersection count (7):

> "Once a task has been assigned, each person must visit the site before the day of the count, to become familiar with site specific characteristics such as parking, traffic flow, traffic control, surrounding land uses, etc. It is expected that observation and data collection will be performed as far away from the traveled way as reasonably possible so as not to interfere with traffic patterns, while not encroaching on private properties but allowing the Counter to clearly and accurately see and record all applicable movements."

Another firm, JMT states for manual intersection turning movement counts: (8)

> "When a manual traffic count request is received we go to http://maps.live.com/ if the location is unfamiliar. This allows for an aerial visual of the intersection location so as to determine the geometrics and potentially the number of staff to accurately perform the traffic count. We will also go to the data base and look for any existing traffic counts at or near the traffic count location so as to get a history of the count to get an idea of the traffic volumes. If there is enough time from when a traffic count comes into the office and it's due date, one of our staff will go out to the traffic count location prior to the count being performed and gather field information which includes land configurations, photographs and any unusual traffic anomalies that the traffic counters should be aware of when doing the traffic count (e.g. free flowing right turns). If we see that the best location to observe the traffic movements is from a private or business parking area we will approach the owner or manager of the business and explain that there will be people here in a day or so gathering data for a traffic study and if they can park on the property to do this work."

It is important as part of the office preparation to check the day's schedule to ensure there is adequate time to complete the work so the field personnel are not rushed. Where counts are scheduled at specific starting times, the field personnel should arrive at least 15 minutes before the count is to be initiated to allow adequate time for safe driving to the site and adequate time for set-up. It has been suggested hurried activities can lead to unsafe practices.

3. Site Selection

Safety considerations are an integral aspect of determining an appropriate site to set up a counter or collect data. The North Carolina TMT Traffic Data Workflow states: (9)

"All counter installations must comply with Traffic Survey safety policies which include:

- Technicians are prohibited from installing road tubes on interstate mainline travel lanes.
- Under no circumstances are technicians to work within the limits of a work zone.
- Technicians must perform the risk assessment process for each counter installation. (see Appendix B for site selection parameters)
- Technicians will travel to a station location specified in the project request and perform a risk assessment on the segment the station is located. Personnel will select a location that provides safe working conditions and conditions for collection of good quality counts. Criteria required for these conditions are:
    - Installations must be a minimum of 200 ft from intersections
    - Installations must be a minimum of 500 ft from ramp junctions
    - Avoid placing counters near busy driveways
    - Short high volume multilane segments will require staggering directional counter installations away from signals to avoid queuing traffic
    - Installations must not be placed on bridges
    - Installations must not be placed within railroad right of ways
    - A maximum of three through lanes may be collected on a single tube sensor
    - Tubes may be run across all lanes with a knot used to limit lanes detected
    - Center turn lanes must be collected with one of the directional installations
    - Select locations where there is little traffic using a center turn lane

If there is no location where a count may be installed safely, or the requested count location is not consistent with what is in the field, contact your supervisor immediately. Field Supervisors must contact the Field Operations Engineer immediately."

Appendix B provides an elaboration of the site selection criteria reflecting a strong emphasis on safety which consider: sight distance, highway geometry, environmental conditions and intersections.

It is important that the site selection procedures considers not only the safety of field personnel, but also the potential queuing of vehicles which could effect the free flow

of vehicles and interfere with the count as well as pose additional hazards to motorists.
As suggested by North Carolina policy, some states have adopted a ramp balancing procedure to keep count personnel off high speed-high volume interstate highways. For example, Tennessee, which used to restrict count personnel from placing portable count equipment on interstate highways of three or more lanes, has now expanded the policy to use a ramp balancing procedure for the counts on all interstate highways.

Risk assessment is the responsibility of the field personnel and many states leave the decision where to count strictly with these individuals.
Pennsylvania DOT specifies: (3)

> "Do not attempt to set a counter in an obviously dangerous area – look for a safer location. If this is not possible, do not attempt to set the counter, but inform the supervisor of the problem."

Florida DOT states: (6)

> "All traffic count personnel have the right to request that their supervisor assign additional help to assist them if they deem there is a need for a two-person crew to set equipment safely."

In North Carolina: (9)

> "The policy of the Group is that the field technician has final determination on where to install a counter. If the technician feels there is no safe place to install a counter, they are required NOT to install it. Field supervisors will perform a safety audit on the segment and will make the final determination as to whether a count can be collected."

With reference to night work Florida DOT states: (6)

> "Night work should be done only when traffic flow dictates it to be necessary, and then only with two or more technicians. One person should spot while the other is working near the pavement. At least one set of eyes should always be on traffic when someone is working in the traveled way. Reflective vests must be worn at all times when working at night."

Since there are always hazards associated with work on or adjacent to a highway, all efforts must be undertaken to minimize exposure to hazards by exercising good judgment with site selections.

4. Driving To/From Sites – Vehicle Operators

Accessing and egressing the field sites are part of the hazards associated with data collection activities. State DOT guidelines specifically address the driving experience and parking at the data collection site.

The North Carolina TMT Traffic Data Workflow specifies: (9)

"Technicians must comply with motor vehicle laws of North Carolina. Defensive driving techniques must be used when operating a State vehicle. Anytime a counter is being installed you are working in your own work zone. Traffic data collection activities fall under Mobile Operations in the MUTCD. This requires the use of rotating flashing yellow and white lights during all work activities on the highway. These lights must be in good working condition for you to work. Inspect them daily. If they are not operating properly, contact your supervisor immediately to arrange repairs. Always review maps to determine the route to be taken to the next station while stopped. Do not attempt to read the map while driving."

Pennsylvania specifies: (3)

"Drive defensively. Other drivers are often impatient as you turn or slow down to set up the counters. Use turn signals, mirrors, and avoid backing up whenever possible. Be aware that the typical van creates blind spots to the rear and to the side."

5. Personal Protection Equipment and Attire

The Pennsylvania Department of Transportation specifies: (3)

a) "Employees who are exposed to moving vehicles (live traffic) or construction equipment shall wear a department-issued hard hat (helmet) along with high-visibility attire.
b) Employees exposed to moving vehicles and equipment must always wear a high-visibility Class II fluorescent yellow-green (or fluorescent yellow-green-orange) vest.
c) Employees exposed to moving vehicles and equipment at night must always wear fluorescent yellow-green (of fluorescent yellow-green-orange) vests in combination with fluorescent high-visibility pants or leggings that together equals Class III.
d) Department employees operating as flaggers must wear fluorescent yellow-green-orange (or fluorescent yellow-green) Class II high-visibility reflective vests in combination with fluorescent high-visibility pants or leggings that together equals Class III."

The following are regulations regarding equipment and attire for personal protection as specified in the Department's "Safety Policy Manual," Publication 445.

a. "High Visibility Safety Apparel - All personnel involved in the installation, maintenance, repair, or removal of traffic counting equipment shall wear a high-visibility vest, shirt, or jacket. For nighttime conditions, similar outerwear shall be reflectorized.
b. Head Protection - During the installation, maintenance, repair, or removal of traffic counting equipment, all personnel shall wear a hard hat. The hard hat may only be removed at the point of and during any task that makes it difficult to keep the hard hat on the head, at which time the hard hat may be removed and placed next to the worker to the complete task. The hard hat

must be replaced immediately after completing the task. These tasks may include but are not limited to: kneeling to install portable counters and/or road tubes, in-pavement sensor installations, and routing of sensor lead wire.

c. Eye Protection - Wear safety goggles/glasses with side-impact protection during any installation, maintenance, repair, or removal of traffic counting equipment that may cause an object or material to become airborne. Eyewear must meet ANSI Z87.1 standards.
d. Hand Protection - Wear gloves during any installation, maintenance, repair, or removal of traffic counting equipment that may cause abrasions, lacerations, blisters, or punctures to the hand(s)."

On November 24, 2006, the Federal Highway Administration issued a new final rule (23 CFR Part 634) regarding the use of high-visibility safety apparel by workers within highway rights-of-way. The rule states, "All workers within the right-of-way of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel.) As defined by the new federal rule, high-visibility safety apparel refers to protective clothing which meets the requirements of ANSI performance class 2 or 3. Furthermore, the term "workers" in this rule is defined to include "people on foot whose duties place them within the right-of-way of a Federal-aid highway, such as highway construction and maintenance forces, survey crews, utility crews, responders to incidents within the highway right-of-way, and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way of a Federal-aid highway".(10)

6. Installing and Retrieving Field Equipment:

Installing and retrieving field equipment requires personnel to be on or adjacent to the highway. Specific guidelines provided by DOTs involve:

1. Have adequate sight distance to be seen by oncoming traffic
2. Use of a flagger or uniform police officer is sight distance is not adequate
3. Selecting an adequate gap to cross traffic
4. Scheduling installation for off peak traffic
5. Equip field vehicles with a flashing or revolving yellow strobe light or bar of lights
6. Park all vehicles on the shoulder as far to the right as possible with four way flashers, yellow strobe lights or light bar and head lights on
7. Long term parking of vehicle should be off the roadway as far to the right as possible

In addition, the Connecticut DOT has provided a specific commentary on safety activities to be practiced by field personnel involved in the installation and retrieval of field count equipment. The presentation is in the form of a very detailed

description of activities. All these guidelines are presented in Appendix C. (3,6,9,11,16)

7. Other Safety Considerations

Safety can also be addressed by the types of equipment utilized and how the equipment is positioned. Some additional thoughts include:

The Illinois Department of Transportation has purchased high powered nail and screw guns for faster installations in order to reduce the amount of time that field personnel spend on the roadway installing count equipment. (12)

The New York Department of Transportation has developed mobile traffic monitoring platforms to support non-intrusive sensor technology to reduce dangers to personnel by keeping traffic counters out of the traffic stream. (13)

The Nevada Department of Transportation warns personnel not to hold onto a portable loop when a vehicle hits it as the sensor can become entangled underneath a vehicle, leading to personal injury or death. Also, if a recorder is located on a sidewalk the recorder must be placed inside a drop box, in compliance with the Americans with Disabilities Act, in order to minimize potential risk to the public. (14)

The Pennsylvania DOT states

> "Avoid setting traffic counters in areas of tall grass where ticks and other flying insects may be harboring. Wear a good pair of hiking shoes, long sleeve shirts, and durable jeans that protect the legs."
>
> "Look for a stable (but not too hard) surface to strike nails or spikes into and be careful to strike the center of the nail head or spike to avoid ricochet. Carefully secure the "dead end" of the road tube far enough away from the path of travel to reduce the possibility of injury by a passing vehicle." (3)

NON-INTRUSIVE DATA COLLECTION TECHNIQUES – TYPICALLY MORE THAN ONE HOUR AT A SITE:

Many data collection activities as setting up permanent traffic counter facilities, conducting manual intersection turning movement counts, collecting or recording license plate images with a camera require being at a site for over an hour. Again Part Six of the MUTCD needs to be consulted for appropriate control devices based on the duration of activities, location of activities in relation to the roadway, and type of highway. Appropriate local standards also need to be consulted.

a. Collecting Data by Observation (Intersection Counts)

JMT has the traffic counters position themselves at the best location to view the traffic movements with an eye to the safety of the public and their employees. (8)

> "We have our traffic counters sit together in a vehicle so they can communicate with one another as the count progresses. If the intersection is particularly large and all movements cannot be viewed from one location then the counters will sit in different quadrants of the intersection so as to get the best viewing/vantage of the traffic movements. All of our traffic counters have cell phones and the cell phone numbers of one another as well as the data traffic manager."

SWA requires: (7)

> "All data collection should be performed from within the vehicle unless instructed otherwise in order to remain less visible to traveling motorists. No lawn chairs, beach blankets, etc. should be used, and proper attire must be work at all times; i.e. no beach attire that may be a distraction to passing motorists. SWA will provide *windshield flyers to be displayed at all times* during the data collection assignment indicating "TRAFFIC SURVEY IN PROGESS", as well as company business cards and official letters authorization to be produced upon request to police, state highway representatives, or other appropriate parties. SWA will provide safety vests, flashing warning lights or other special safety equipment if necessary, and will coordinate with local authorities for sensitive data collection locations (i.e. schools, military bases, toll facilities, etc.)."

The Arkansas DOT specifies (11):

> "Employees collecting data by observation must, when possible, park in places that are out of the way such as driveways, parks, parking areas or extra-wide shoulders. It may be necessary to use parking lights or other adequate warning devices."

b. Collecting Data by LPR or Video Image Processing Equipment

On high speed facilities video image processing or automatic license plate recognition technology (LPR) may be utilized. While not stopping vehicles on the highway or diverting vehicles to a rest area or ramp, this technique does require having personnel on or near the roadway to position and monitor cameras. The cameras may be positioned adjacent to the roadway mounted in barrels as practiced by the Alliance Transportation Group or mounted on tripods from overpasses. The equipment may be in position for over a 24 hour time period. Many of the safety procedures that will be discussed for the intercept procedures in the next section will also apply to this data collection methodology. Although video cameras and LPR technology are accepted means of collecting data for external surveys and are considered passive data collection techniques with no interruption or inconvenience to the traveling public they still involve personnel working in close proximity to the roadway. A description of the equipment set-up followed by the Alliance Group for an application in Washoe County (Reno) in Nevada states as follows: (15)

"The use of video cameras to capture license plate information is a proven and accepted technology application for external station surveys. Video license plate capture is a passive data collection technique that provides external-through trip information with no interruption or inconvenience to the traveling public. This technique is especially helpful in jurisdictions with non-intercept policies or for high volume facilities. Prior to the survey date, Alliance prepared each site. Site preparation includes distribution of barrels and bases, pavement marking, and ATR counter placement. Alliance conducts its video license plate collection using digital video cameras and power supplies located inside of standard traffic barrels snapped into place on a heavy rubber base. The barrels have a hatch cut out of the leading side of the barrel to access the camera and a rectangle cut out of the following side of the barrel for video capture (see Figure 1). This technique draws little attention and, therefore no interruption to the traveling public. Pavement markings are utilized to indicate barrel placement and framing. Each lane of traffic, inbound and outbound, is covered by one camera. Paint is placed on the shoulder to indicate barrel placement and then on the roadway to indicate camera framing. Paint is also placed on the roadway to indicate a unique station/barrel number to insure that the proper barrel and videotapes are used to record that lane of traffic."

Some agencies have a policy not to conceal data collection equipment such as cameras that record license plate data. It is felt concealed data cameras could be misinterpreted by the public and cause misunderstandings. Rather all attempts are made to use the media to identify the presence of data collection equipment and the reasons why this data is needed and how it will be used. Changeable message signs are also utilized to identify the presence of survey equipment. (16)

Recently Alliance has utilized GIS technology to help locate cameras, generators, vehicles, signs, cones. It is stated the use of GIS technology enhances safety because it requires less time for setting up the site, which is particularly useful because the setup task usually occurs before dawn. (16)

Figure 1: Basic Barrel Placement (*from Alliance Transportation Group External Travel Study pg 12*)

The Alliance Transportation Group has provided some insights into the safety procedures they practice: (17)

a. Safety depends on utilizing well-trained experienced engineers to lead the effort.
b. A comprehensive approach needs to be taken towards safety including planning, site selection and data collection operational procedures.
c. Site selection is the key to safety. Extensive efforts are used in evaluating each location and selecting the site. In the 2008 external survey conducted for Phoenix site selection criteria included (39):
    - Sight distances at the location
    - Safety aspect for the survey personnel such as the ability to park vehicles
    - Barrel/camera placement
    - Angle of the sun
    - Availability of structures to run the video cables from one side of the road to the other without impacting traffic. No cabling is placed in the travel lanes.
d. Preferred set-ups are summarized with hand prepared traffic control plans. Formal traffic control plans are prepared if requested by the sponsor.
e. Training is an integral aspect of preparation and in the recruitment process candidates are made aware of the potential dangers and not recruited if not comfortable with the risks.
f. Remote camera control and focusing are used to avoid the need to enter or cross the roadway to monitor equipment.
g. The traffic control requirements of the MUTCD are always followed. Typical setups following the MUTCD TCP for work beyond the shoulder (TA-1) are noted for a typical two and four lane undivided setup (Figures 2 & 3)
h. Barriers and tripods are mounted so as to not interfere with traffic or pedestrian flow.
i. Whenever possible vehicles are always parked behind positive barriers such as guardrails.
j. Alliance has perfected the mounting of a camera in an orange traffic barrel which is placed adjacent to the roadway. They note only one barrel being struck in many years of application.
k. Bernardin Lockmueller and Associates mention they try to recruit personnel for the video surveys who come from survey crews since they are used to working next to roadways. (18)

Additionally the TxDOT requires in their specifications of conducting external surveys: (34)

a. “A TCP may need to be developed to provide a visual separation between the temporary video survey work and the normal through lanes of traffic.
b. For set-ups adjacent to the highway facility being surveyed, the vendor shall place all video and incidental equipment behind a barrier such as a guard rail

or concrete barrier if possible. The vendor shall place video cameras in a manner and location so that they are visible to motorists.

c. Changeable message boards shall be required at all video capture survey sites.
d. The vendor shall provide their personnel with all required safety equipment and instruct personnel to observe all safety policies, rules and requirements at all times, including, but not limited to, wearing hard hats, safety shoes, safety vests, goggles, etc."

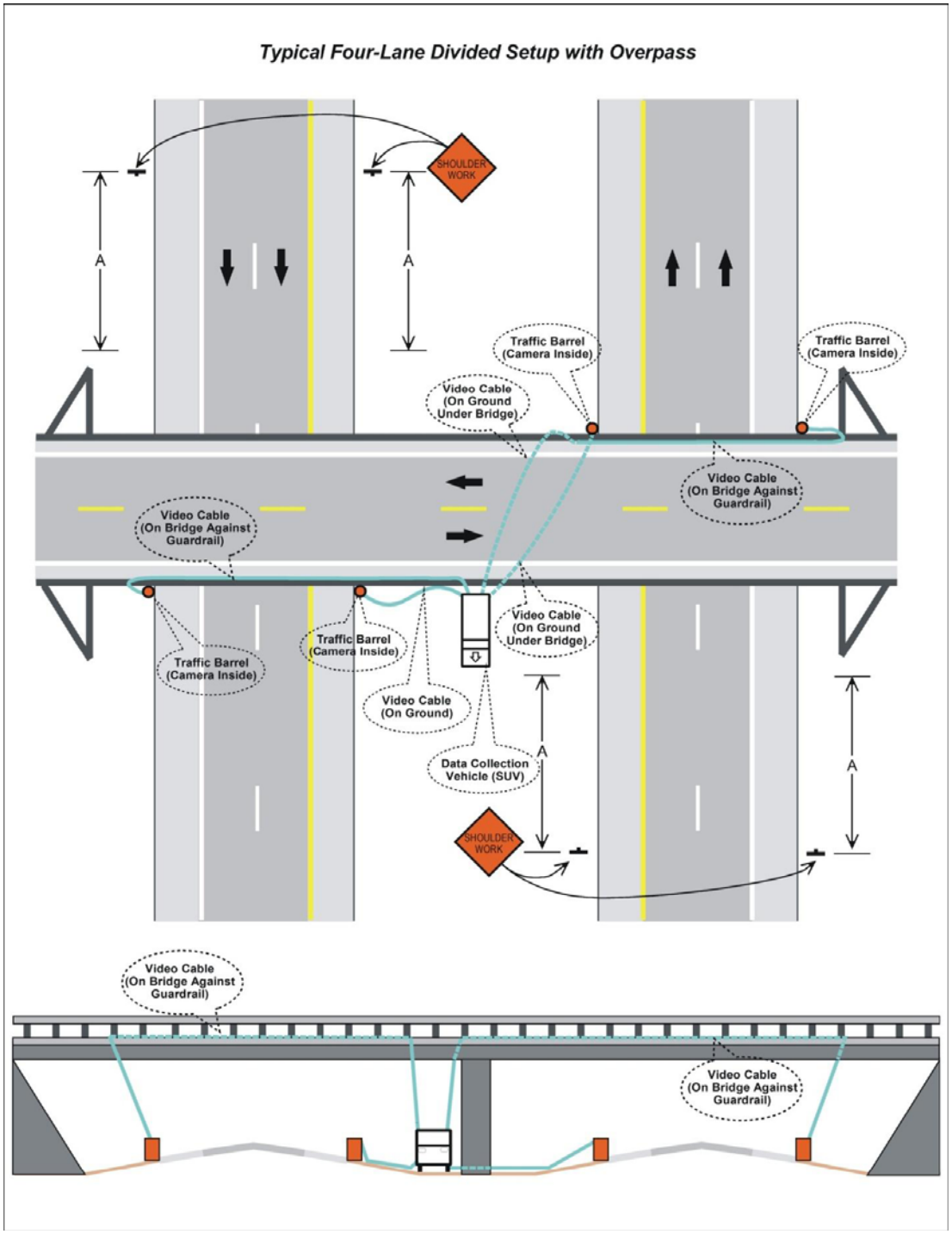

Figure 2: Typical Four-Lane Divided Setup with Overpass (Source 39)

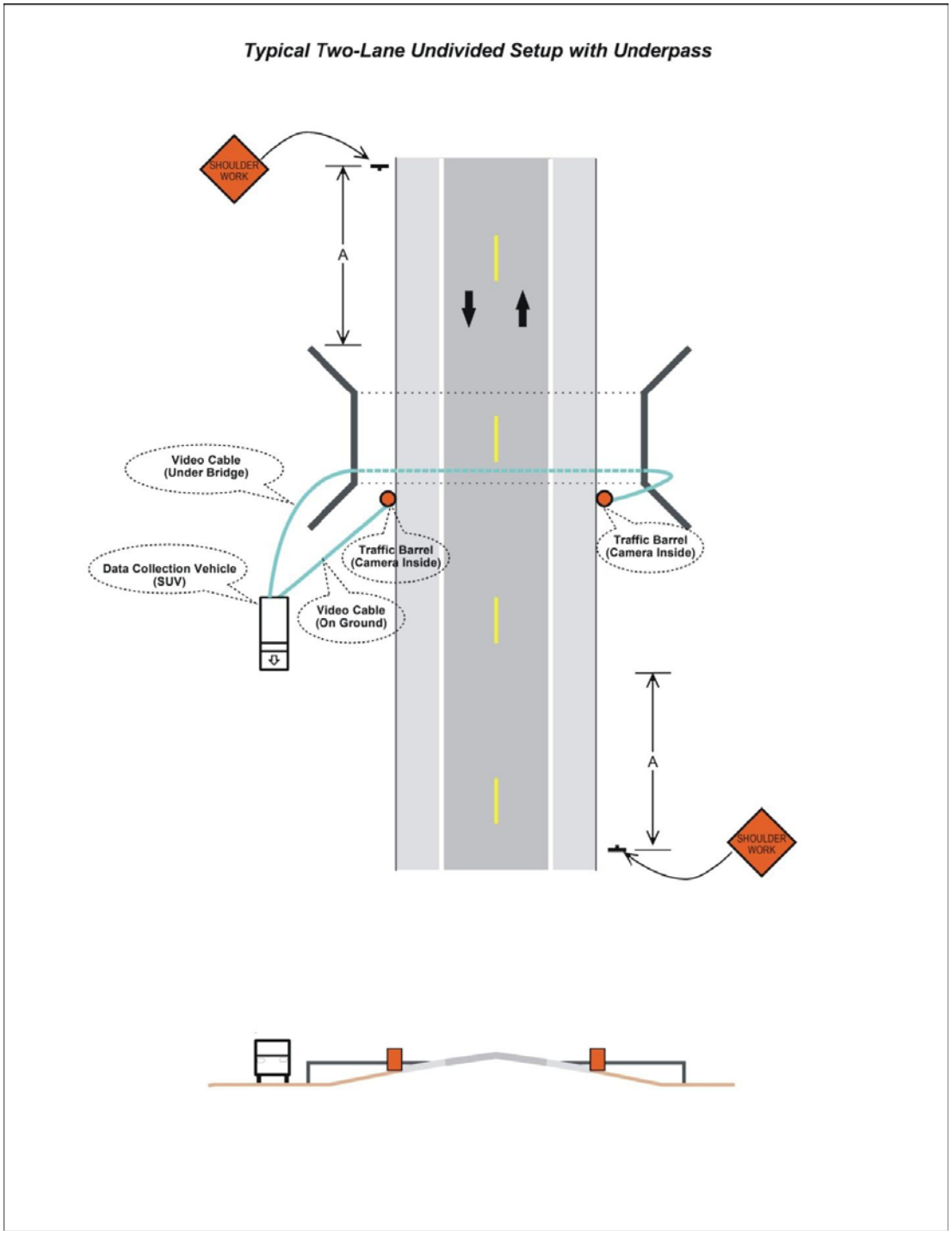

Figure 3: Typical Two-Lane Undivided Setup Underpass (Source 39)

The Colorado DOT requires any sites where video cameras will be used within the right-of-way (ROW) should have a vehicle with high-intensity rotating, flashing or oscillating overhead light or strobe light parked off the shoulder, and a 'Survey Crew' sign displayed.

INTRUSIVE DATA COLLECTION TECHNIQUES

The roadside external origin-destination survey is an integral aspect of the urban transportation planning process. These surveys are conducted near the external boundaries of an urbanized area where major roadways carry traffic into/out and through the urban area. A sample of vehicles are stopped and information is collected on the trip origin, destination, purpose of travel and characteristics of vehicle. While these data collection procedures provide valuable information on external movement through an urban area they are coming under increased scrutiny because of safety concerns and the resulting delay to mainline traffic. Because of these concerns the roadside intercept technique is either not conducted or restricted to lower volume, lower speed facilities. Guy (1) reported that based on his 2004 survey question "Is your DOT permitted to stop traffic to ask motorists questions about their origins and destinations" all 14 of the states responding stated they are legal and only seven states indicated they are used, even if only rarely. Hard (19) has reported that "based on years of field observations, TxDOT has had a long-standing policy that roadways with two-way volumes greater than 20,000 annual average daily traffic (AADT) should be surveyed using a high-volume method.

By comparison the policy utilized in the Triangle Regional Cordon Station Study specified the roadside interview is normally linked to highways with average daily traffic up to 30,000 vpd. (20) Ohio limits direct interview surveying to routes with less than 30,000 vpd (40) The Alliance Transportation Group who have extensive experience conducting roadside intercept surveys in more than 15 states said they have never conducted intercept surveys on roadways with over 18,500 vpd (17).

Texas's experience indicates the state's metropolitan areas have conducted intercept interview methods on Interstate highways where the traffic volumes are less than 20,000 vpd by diverting non-commercial mainline traffic to low-volume off ramps. Other MPO areas briefly intercept vehicles at the external cordon and distributed postcard mail back survey cards to motorists. Again this technique is problematic on high volume-high speed facilities. Other external survey procedures are passive, as discussed in the previous section, under non- intrusive survey and involve recording the license plates of passing vehicles by a video camera or utilizing license plate recognition (LPR) equipment. A license plate match algorithm is then used to determine external movements through the urbanized area or state motor vehicle records can be accessed and the motorists contacted with a mail out or telephone survey. As discussed in the non-intercept surveys data collection section, the license plate recording technique still involves safety issues as equipment and personnel

need to be located on or adjacent to the roadway or on overpasses to set-up and monitor the equipment.

Roadway intercept methods are routinely applied for commercial vehicles as part of state-wide or metropolitan area freight studies. Again a roadside or intercept survey has advantages that include high statistical reliability, broader geographic coverage and more complete data collection when compared to general mail or telephone surveys. Commercial vehicles are usually intercepted at weigh stations, toll facilities, ports of entry, truck stops or rest areas. Extensive commercial vehicle studies have been conducted for the states of Washington, Vermont, Texas, California, Oregon, the Province of Ontario, and the Kansas City Metropolitan areas among others. (21) (22) (23) (24) (25) (26) (27)

Unfortunately, it is more difficult to utilize the intercept method for non-commercial vehicles at the MPO cordon because the lack of adequate parking spaces. Some studies have utilized interchange ramps, but commercial vehicles are excluded from those surveys because of safety concerns associated with large vehicle negotiating the interchange grades. (28)

As presented by Hard (18), the roadside interview intercept methods capture more complete and extensive data than by other procedures (see Tables 2 and 3). As such they provide valuable information when applied in environments that promotes safe operations. Interview intercept surveys have been routinely conducted in Texas for many of the state's 25 metropolitan planning organization and external studies conducted as part of the Kansas City Regional External Station Survey, Front Range (Denver) Travel Survey, Triangle Region Cordon Study in North Carolina, the External and Through Trip Survey for the Delaware Valley (Philadelphia), Phoenix External Travel Survey. (29) (30) (31) (32) However, roadside interviews are not routinely applied on high speed high volume roadways. In any situation where vehicles are stopped on or adjacent to a roadway will involve serious safety concerns and requires adopting procedures as discussed by this report. Experience has demonstrated external roadside interview and handout surveys can be safely and effectively conducted with the provisions presented in this section.

Data Element(s)	External Survey Method		
	Intercept	License	License
Time/Date/Location	✓	✓	✓
Occupancy	✓		✓
Vehicle Information/Classification	✓		
Residence Location	✓		✓
Overnight Information	✓		
Out of State Information	✓		
Location of Trip Origin	✓		✓
Time Left Origin	✓		
Type of Place at Origin	✓		
Purpose for Being at Origin	✓		✓
Local Trip Indicator	✓	✓	✓
Through Trip Indictor	✓	✓	✓
Location of Trip Destination	✓		✓
Purpose for Traveling to Destination	✓		✓
Information on Travel Out of State	✓		
Information on Travel In State	✓		
Information on Trips Made Prior to Being Surveyed	✓		

Table 2. Non-Commercial Vehicle External Survey Data Elements. Source: (19)

Data Element(s)	External Survey Method		
	Intercept	License Match	License Mailout
Time/Date/Location	✓	✓	✓
Occupancy	✓		✓
Vehicle Information/Classification	✓		
Cargo Being Carried	✓		✓
Vehicle Type	✓		
Cargo Weight	✓		✓
Type of Container	✓		
Mexican Cargo Indicator	✓		
Cargo Pickup Location Information	✓		
Cargo Drop-Off Location Information	✓		
Vehicle Information	✓		
Location Vehicle Traveling From	✓		
Information on Location Being In/Out of Texas	✓		
Location of Trip Origin	✓		✓
Time Left Origin	✓		
Type of Place at Origin	✓		
Purpose for Being at Origin	✓		✓
Local Trip Indicator	✓	✓	✓
Through Trip Indicator	✓	✓	✓
Location of Trip Destination	✓		✓
Purpose for Traveling to Destination	✓		✓
Information on Travel Out of State	✓		
Information on Travel In State	✓		
Information on Trips Made Prior to Survey	✓		

Table 3. Commercial Vehicle External Survey Data Elements.
Source: (19)

1. **Adopting A Comprehensive Safety Vision**

Conducting a roadway intercept survey which involves stopping traffic on or adjacent to a highway requires a comprehensive vision of safety that permeates all aspects of the data collection effort. Safety is not just establishing a traffic control plan, but adopting a comprehensive analysis that integrates safety into every aspect of the effort. Guidelines have been developed based on analysis of roadside intercept methods utilized by consultants and agencies. As stated by J. D. Allen of Alliance Transportation Group, (17) "One must take a comprehensive approach that includes safety concerns as part of planning, site selection and data collection operations."

Safety concerns must be considered from the very on-set of a survey. Site selection and inter-agency coordination are essential aspects that require safety considerations along with defining an operational plan, establishing a traffic control plan, recruiting and training personnel, and continually monitoring the field procedures.

Safety considerations must start with defining how an operational strategy can be applied at specific locations, meeting the concerns and requirements of various constituencies. As previously discussed an intercept data collection technique (interview or post card handout) must reflect the policies of the agencies involved. Generally intercept procedures are relegated to low volume, low speed facilities or diverting traffic off the mainline to a ramp, rest area, truck weigh station, pull-out area, etc. Rarely will vehicles be stopped on an interstate or other high speed facility.

2. **Typical Applications**

Strategies for implementing roadside interviews must consider the type of roadway and number of lanes. Interviews are usually conducted only in one direction. Typical layout consists of a two-lane operation, a four-lane operation, or intersection operation and diverting mainline traffic to a ramp or other storage facility.

a. *Overview of 2-Lane Station Operations* "The survey administration process for two-lane highways involves stopping a random sequence of vehicles passing through each 2-lane survey station. The percentage of vehicles stopped depends on the average daily traffic volume at each station location. Two-lane external survey stations involve the creation of a temporary median with cones and other traffic control devices in the center of the two lanes of traffic. Traffic control professionals slow traffic to about 10 miles per hour as vehicles approach the coned median. Interviewers administer the survey to drivers from the coned area. Since only a percentage of vehicles are surveyed, traffic control professionals "clear out the lane" once interviewers have finished administering the survey to vehicles at the head of the line. Since the survey takes less than one minute to administer, the total delay to the typical vehicle entering the station is less than two minutes." In other applications where space was available vehicles to be surveyed would be diverted to a survey area while

non-surveyed vehicles could pass through the site at a reduced speed." (20)

b. *Overview of 4-Lane Station Operations* "The survey administration process for four-lane highways involved with stopping a random sequence of vehicles that passed through each 4-lane survey station. As with the 2-lane stations, the percentage of vehicles stopped depended on the average daily traffic volume at each station location. Four-lane external survey stations were created by closing the left lane of traffic approximately one mile from the station. Variable message boards and other traffic control devices were also used to inform travelers about the lane closure. An opening to the left lane is established about 500 yards from the survey station. Traffic control professionals flagged groups of three – six vehicles (depending on the number of surveyors present) into the opening to the left lane. Interviewers administered the survey from the median or left shoulder of divided highways. If the highway did not have a median, cones were used to create a temporary median. Since only a small percentage of vehicles were actually selected (typically 10-20%), most drivers did not experience any delay in their trip because they continued driving in the right lane. Those who are flagged into the left lane were delayed about one - two minutes. As soon as the surveys are completed the participant's vehicles proceed out of the survey stations (as a platoon) in the left lane, which is free-flow since all other traffic is traveling in the right lane." (20) Typical station layout for two and four lanes are noted in Figures 4 & 5 respectively.(40)

c. *Overview of Intersection Operations* for the Knik Arm Bridge Traffic O-D study in Anchorage, Alaska survey questionnaires were distributed to motorists in the form of a postage-paid business reply card. As such the contact with the motorist was relatively short and the interviewers were only in communication with the motorists while they were stopped during a red cycle. An additional worker monitored the signal and when it was about to change from red to green, they blew a whistle to alert the survey personnel to terminate the distribution and leave the roadway until the next red cycle. (32)

d. *Overview of Diversion from the Mainline to an Interchange Ramp* traffic would be slowed on the mainline highway and random platoons of vehicles to be survey would be flagged to leave the mainline onto an interchange ramp to be surveyed. Vehicles were only diverted from the right-most lane and commercial vehicles were not interviewed. All other vehicles proceeded through the site without being stopped. Once the ramp interview was completed the vehicles would use the adjacent on ramp and proceed back to the mainline.(28)

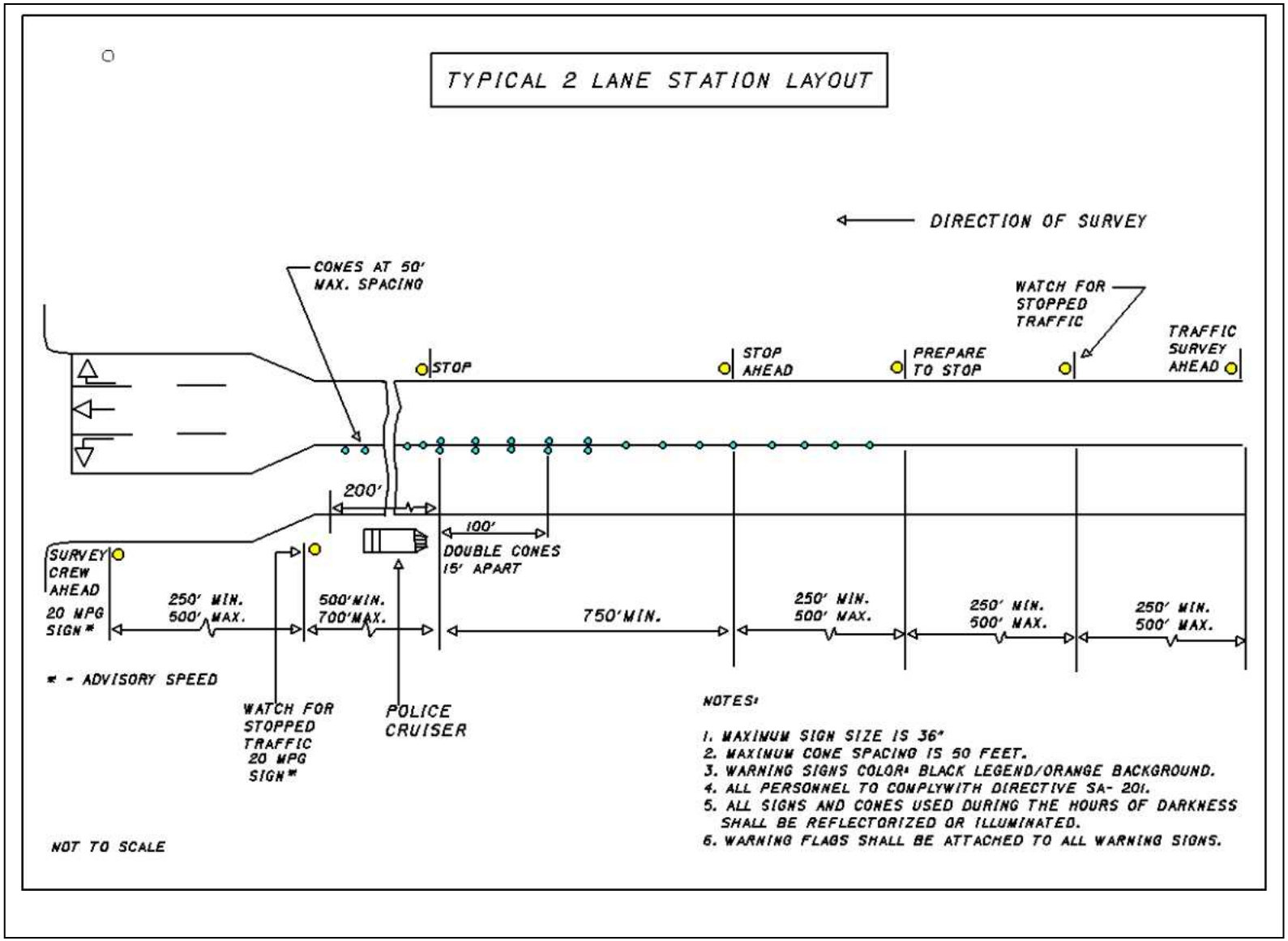

Figure 4: Typical Two Lane Station Layout
(*Source 40*)

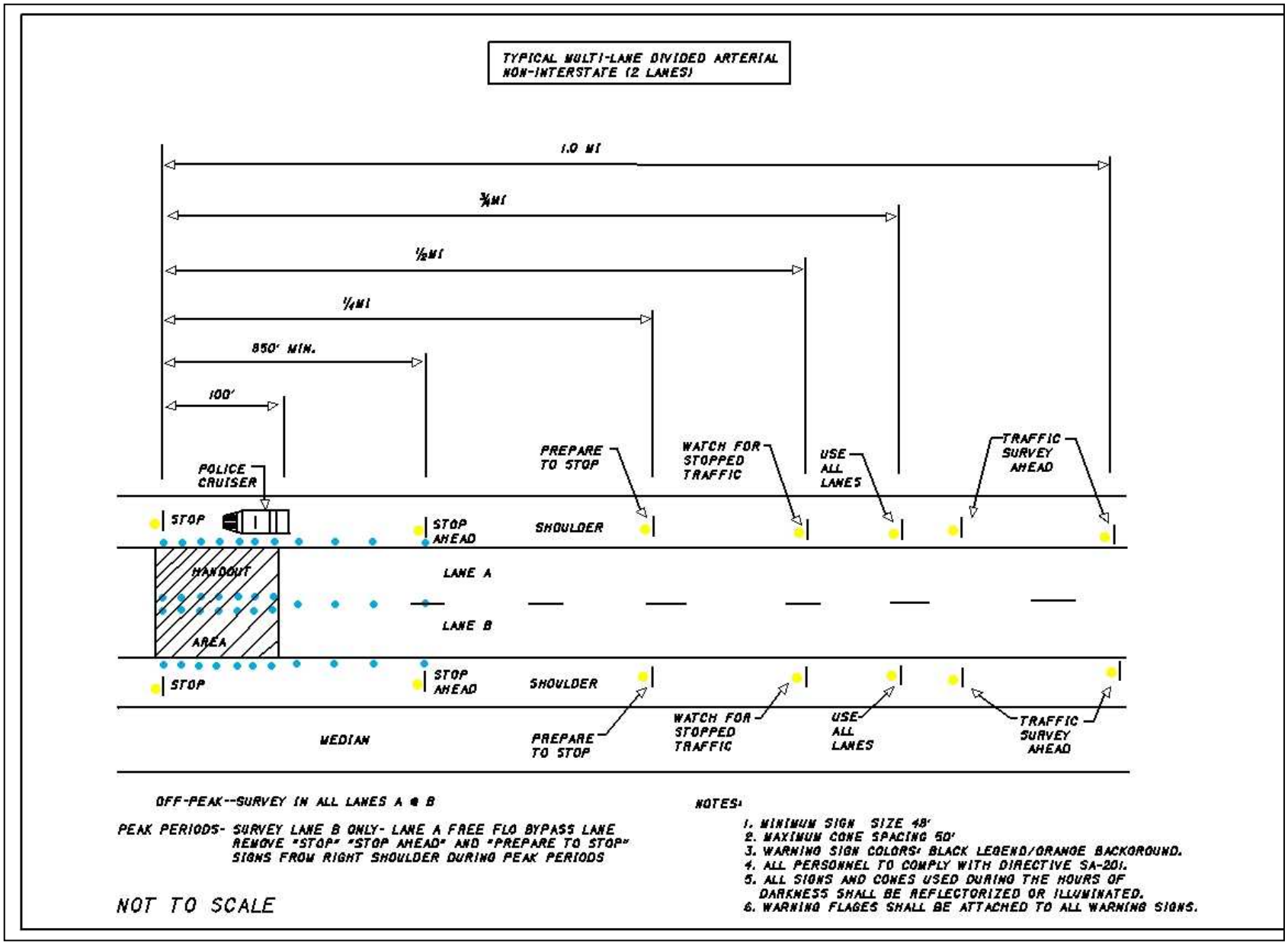

Figure 4: Typical Two Lane Station Layout (cont.)
(Source 40)

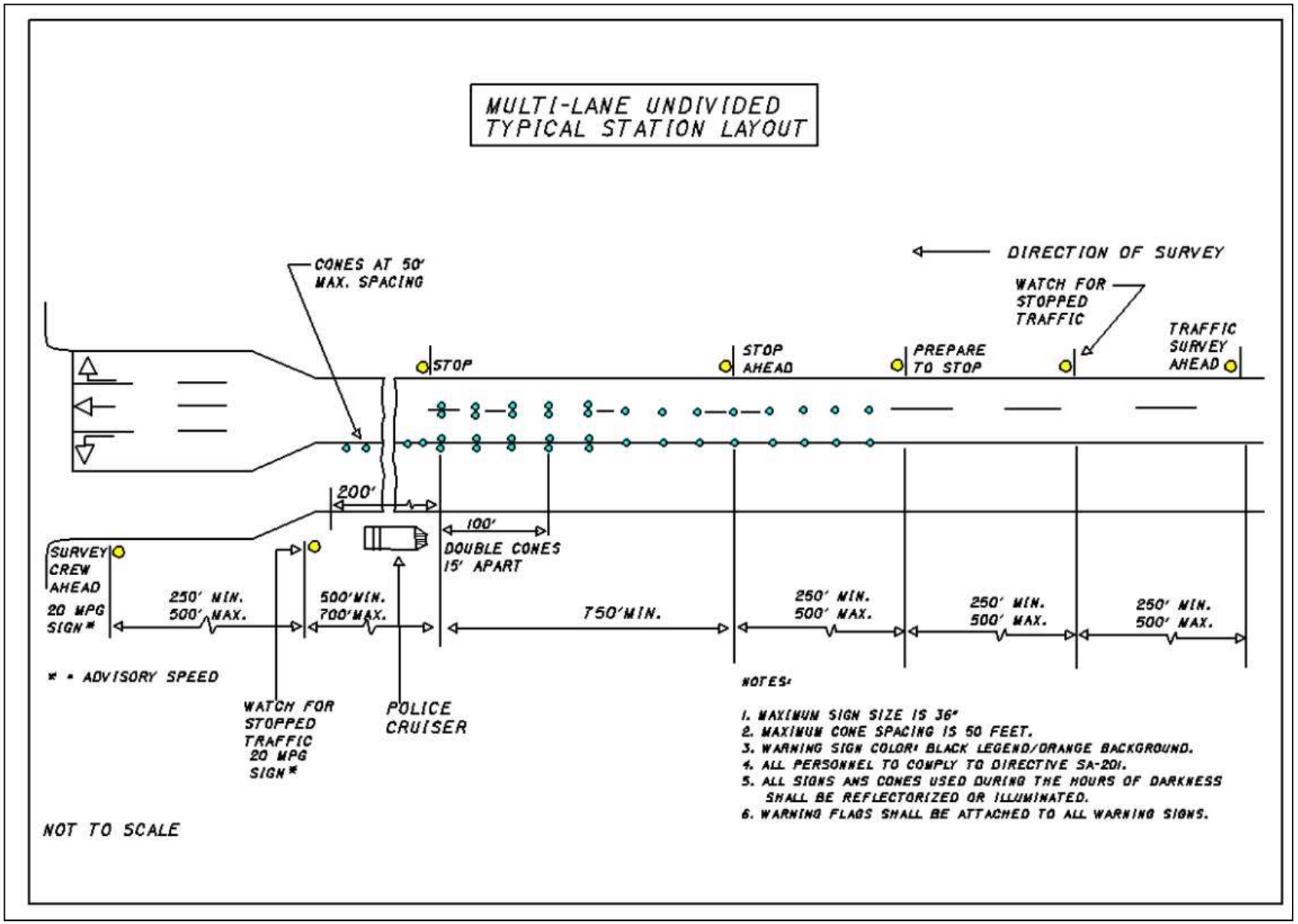

Figure 5: Multi Lane Undivided Typical Station Layout
(*Source 40*)

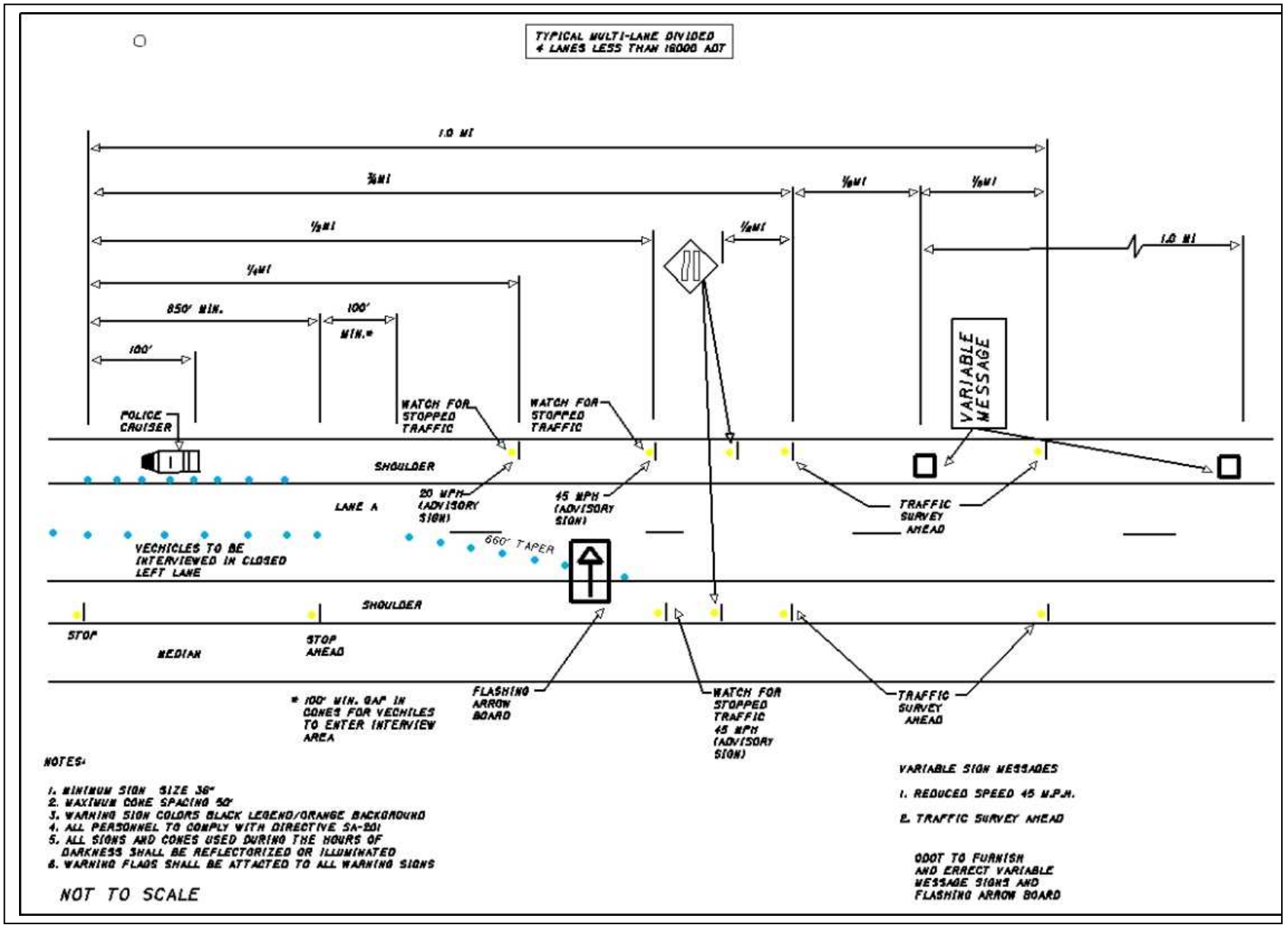

Figure 5: Multi Lane Undivided Typical Station Layout (cont.)
(*Source 40*)

3. Safety Considerations

Based upon a review of a number of origin-destination surveys and contact with consultants the following experiences and observations were assembled to safely conduct intercept surveys. The critical point is that a comprehensive approach must be taken that includes safety in all aspects of the process.

a. Project Coordination
b. Public Awareness
c. Site Selection
d. Recruitment of Survey Personnel
e. Training
f. Traffic Control Plan
g. Conducting Pilot Test
h. Executing the Survey
i. Contingency Plans

a. Project Coordination – An activity utilized by the Triangle Regions Cordon Station Survey (20) was to establish a project team consisting of stakeholders and to hold a kick off meeting to discuss the scope of the study, determine the preferred locations, and the types of surveys to be administered. In making decisions about locations, survey procedures, etc. safety has to be of paramount concern. Critical decisions need to be made about the desirability of on-site presence of law enforcement officials, hours of operation (sunrise to sunset or night time surveys), influence of weather conditions on the survey, how vehicles are to be surveyed (will they be pulled in platoons or groups), the number of interviews needed to obtain the desired sample size and which vehicles are to be surveyed. In some studies conducted on multi-lane facilities, because of safety concerns, vehicles traveling at high rates of speed, traveling in the left lane or in closely packed platoons are allowed to pass without any attempt to stop. Also, commercial vehicles might be excused for safety reasons. It is important to identify the various permits that need to be obtained as well as policies and regulations that are to be followed. Necessary approvals and permits from affected counties, municipalities and DOT's need to be involved. All this preparation will require time. It has been reported that for the Front Range Travel Behavior Study: (28)

> "Due to the complexity of the safety issues associated with the survey method, it took over a year to resolve problems, develop traffic control plans (TCPs), and obtain approval from the Colorado DOT to conduct the surveys."

For example, a proposal for manually distributing postcards to stopped vehicles, as part of the Mendocino Origin-Destination survey, included obtaining encroachment permits from CalTrans. Because the surveys would have less than four foot separations between the travel lane and the surveyor, which is a violation of CalTrans policy, the request to distribute questionnaires was denied and a non-intercept

method had to be adopted. (33) It is important that these issues and concerns be voiced early. A critical policy is the utilization of law enforcement officials on the site. The Alliance Transportation Group always utilizes police officer in cruisers with the lights on to help control speeds and discourage inappropriate behavior or abuse towards the survey crews (17). Ohio requires law enforcement personnel to be present at each location where traffic is to be stopped. Two law enforcement officers are required at sites with an ADT greater than 100,000 vpd. (40) In some surveys the police have refused involvement because of various reasons including safety concerns.(18) It is essential that state and local law enforcement agencies be included as vital stakeholders. In Ohio, the law enforcement officers are responsible for all safety issues including closing the station due to inclement weather and insuring the traffic queue does not back up beyond the traffic control devices. (40)

b. Public Awareness – Many believe that increased awareness will improve the willingness of drivers to respond, reducing survey times and potentially maximizing safety and minimizing the accident potential associated with roadway surveys. Public information can include media press, releases to the news media, letters to community leaders, brochures, a survey hotline, variable message signs. It is anticipated advance notification will enhance safety, but not encourage drivers to divert to a parallel roadway facility.
c. Site Selection Process – as suggested in the Triangle Regional Cordon Station Survey potential sites for data collection stations were reviewed with regard to: (20)
    - ***Safety*** Could the survey be administered without posing a significant risk to the persons administering the survey and the traveling public?
    - ***Reliability*** Would the data collected from the location accurately represent the travel patterns that will be modeled? Were there access roads before or after the proposed location for the station that would allow travelers to bypass the station?
    - ***Sustainability*** Would the site support data collection operations over the course of a 10-12 hour day? Was there enough room?

    Each of the proposed sites needs to be visited by the survey team. Specific attention needs to be given to ambient traffic conditions, sight distances, prevailing speeds, availability of shoulders, auxiliary lanes, roadside development, etc. Table 4 provides specifications to consider in site selection. Representatives from Alliance Transportation Group have stated: (19)

    > "Site selection is a key aspect to safety. Once the general locations are selected for each facility the firm's principles spend several hours or days evaluating each location and selecting from one to three specific sites. For each site they take pictures, and measurements. They note sight distances, horizontal and vertical curves, roadway geometrics, shoulder drop offs, space to stand, space to park, driveway locations, obstructions and numerous other characteristics at each site. These

data and images are compiled and a presentation is developed. They take the results to the client and interactively select the best specific site for each location."

Table 4
Site Selection Factors to be Considered (19)

Potential survey sites should be evaluated on the basis of:

- Sight distance(at least 800 feet in each direction)
- Proximity to intersections, on-ramps, etc. (be outside the TTC zone or about 2000 feet)
- Vertical and horizontal curvature
- Ongoing repair and construction projects
- Shoulder width, auxiliary lanes
- Places to park vehicles
- Traffic signals and tollbooths
- Speeds
- Roadside development – interference with businesses, ability to park vehicles
- Safe zones for surveyors – sidewalks, auxiliary lanes, medians, traffic islands, etc.

Phoenix guidelines are: (30)

"Each of the proposed sites was visited before any surveys were scheduled to review conditions in the field and finalize the site location and the traffic control requirements. During the site visit, consideration was paid to ambient traffic conditions, apparent sight distances, prevailing speeds, presence/absence of shoulders, auxiliary lanes, and roadside development. Photographs and sketches were prepared of the proposed survey site."

The Texas DOT requires videos be shot of sites for 200 feet before to 200 feet after the TCP (35).

In order to minimize queuing problems and safety issues resulting from traffic backing up on the main line, trade offs have to be made between site design, availability of a bypass lane, number of interviewers, sample size and the length of time required to administer the survey. TxDOT policies specify: (30)

"No vehicle at the survey site being interviewed in a queue shall be stopped for more than six minutes. If the stopped time for any vehicle in the survey site reader is six minutes, the vendor shall immediately terminate all interviews in progress and release all vehicles in the survey station and queue." Also "if a queue of ten or more vehicles occurs, the surveys shall be suspended and the traffic flagged through until the queue has dissipated." Given these or related specifications it is important a site be selected to safely

accommodate the number of interviewers required and the maximum potential queue length.

d. Recruitment of Survey Personnel – it is always a challenge to obtain a large, short term labor force to conduct field surveys. Members must be selected to be reliable, remain alert for long periods of time, provide a positive and professional attitude at all times. Conducting personal interviews is particularly a strenuous and potentially dangerous activity. Obviously if personnel contact with motorists is required additional qualifications will also be required. The Alliance Transportation Group places emphasis on utilizing a high level well-trained experienced engineer to lead the effort. Survey supervisors will be selected to ensure surveys are conducted safely and the traffic control set-up for each site is properly installed before the survey starts and ensuring the survey is properly shut down and the equipment stowed at the end of the day.

Interestingly, the Washington state truck intercept study relied on volunteer groups to be the surveyors. This group worked well and was thought to be an advantage because the individuals were from the local area and knew the local roads and commodities moving by truck. Whatever group is selected it's important that they follow all safety regulations and remain alert, never straying into traffic. (26) Proper qualifications must be attained. Many organizations specifically require, similar to TxDOT, that flaggers utilized as part of the Traffic Control Plan be certified. (35)

e. Training Sessions – training is a critical aspect of any study, whether interviewing drivers, handing out questionnaires or positioning equipment near the roadway. When interviews are conducted the training usually includes classroom and on-site instruction. The Texas DOT specifies a pilot external travel survey be conducted as part of the training effort. The Alliance Transportation Group recommends as part of its training effort: (17)

> "All staff members are required to complete a full day of training a substantial portion of which is on safety. Both principals of the survey are certified flagger instructors and work zone traffic control instructors. They show two training videos and the instructors work hard to instill in the trainees the need to remain vigilant and not get comfortable with the traffic. They have a supervisor continuously monitor the actions of workers as it relates to safety throughout the data collection process."

Training should be a continuous process to ensure personnel safety. Written guidelines outlining safety requirements are frequently handed out to personnel. Examples of these guidelines are contained in Appendix D.

f. Traffic Control Plan – In many applications formal traffic control plans must be developed, which reflect the existing roadway geometry, signing,

temporary traffic control devices such as signs and cones, and the interviewer refuge area, location of flaggers, etc. The general concept of each plan was to slow traffic before the survey area, support flagging into the survey area, provide a safe area for the interviewers to work, and allow the surveyed vehicles to return safely to the roadway. Traffic control plans must be prepared in accordance with the provisions of the MUTCD and applicable local agency requirement amendments. As part of the agency coordination process, the State Patrol and local law enforcement officers should have an opportunity to provide comments and suggestions on the traffic control plans.(39)

Typical applications of TCPs are presented in Chapter 6H of the MUTCD for various situations. Additional resources are available from the Federal Highway Administration on topics of – work zone information on best practices, flagging procedures, safety resources for work zones, etc. (10) Since the MTUCD does not explicitly discuss the placement or responsibility of law enforcement officials, the publication "Guide for Law Enforcement Personnel in Work Zones" provides a valuable supplement to the MUTCD. (36) Again these represent minimum standards and states and local jurisdictions can have more restrictive regulations.

g. Pilot Tests – prior to initiating the survey it is important to visit the sites to review the traffic control plans and operational procedures. The Front Range Survey (Denver) conducted a two hour in field pilot to verify the methodologies to be followed. The following feedback was received as examples of how the pilot test can serve to enhance safety (287).
"*Comment* – The traffic control was not set at the right location initially, and had to be changed on the fly in the field.
Recommendation – Traffic control plans will be clarified with exit numbers or distances to landmarks to ensure that the location is correct.
Comment – The flagger asked that the flagging position be moved forward from within the gore area to the tip of the gore, to allow motorists to react and enter the survey area safely. This change was implemented in the field.
Recommendation – Based on the flagging results obtained, this change will be implemented on the traffic control plans for the full surveys.
Comment – The cone line separating the interviewer area from the general traffic lanes (state highway sites) needs closer cone spacing, because motorists in the through lanes may perceive the large gaps between cones as additional pull-offs for surveys. This change was implemented in the field.
Recommendation – Based on motorist behavior in the field, this change was successful, and will be implemented in the full survey.
Comment – The cones spacing separating the interviewers from the interview vehicles need to be closer. One refusal vehicle entered the interviewer area, perceiving this as an escape area. In addition, safe egress for refusal and emergency vehicles should be addressed where possible.

Recommendation – The cone spacing will be tightened. Surveyors will ask that refusals wait until the survey(s) in front of them has been completed, and follow these vehicles back onto the highway. The surveyors will warn motorists if a vehicle is approaching; they will not tell them it is safe to proceed. Cones will be used to prevent egress to the left (into the interviewer area) and protect the interview staff.

Egress for emergency vehicles will be provided in one of two ways. At sites where there is sufficient room to the right (most interstate sites, where the survey is being performed on the left edge of the ramp), the vehicles may exit the survey platoon to the right. They will be in conflict with existing exit ramp traffic, and motorists must make their own decision regarding the safety of the maneuver. For sites with no egress to the right, the interviewer will communicate the emergency to the site supervisor. The site supervisor will alert all of the interviewers of the situation, ongoing interviews will be paused, and the site supervisor will move cones to allow the vehicle to exit through the interview area. The cones will be immediately replaced by the site supervisor, and the other surveys will resume.

Comment – Radios should be provided to facilitate communications between the site supervisor and the sample control manager.

Recommendation – This change will be made to allow for better communication and safety.

h. Executing the Survey – Personnel will be expected to arrive 20-30 minutes before the survey is initiated. Traffic control equipment will be in place before the survey can commence activity. Supervisors need to insure all personnel are wearing appropriate safety apparel such as hard-hat, reflective vests to insure a high degree of visibility. The Alliance Transportation Group provides the following safety guidance as part of the surveyor's instruction packet: (16)

> "The approved traffic control plans and survey procedures lower the chances of safety problems; however, you as an interviewer must be alert and prepared for the unexpected. When preparing for the survey, check your surrounds and avenues of escape. Never put your back to oncoming traffic. It a situation arises which jeopardizes you or someone else's safety, immediately let everyone know and get clear of the danger zone. Remember – SAFETY FIRST!"

It is important that survey personnel do not mill around near the roadway or wander in the roadway during breaks or at the end of their shift. All personnel need to remain at their designated positions and remain alert.

i. Contingency Plans – unforeseen circumstances can always occur during a survey. Of particular concern are weather conditions (rain, slippery roads, high winds, fog, etc.) that can compromise safety. These unforeseen

circumstances may require closing the survey site so it is appropriate to plan for back up data collection days if a site needs to be closed for safety reasons.

CONCLUSIONS

Safety concerns associated with field data collection have been discussed for three types of data collections activities:

- Non-Intrusive Data Collection Techniques – Typically Less Than One Hour at a Site
- Non-Intrusive Data Collection Techniques – Typically More Than One Hour at a Site
- Intrusive Data Collection Techniques

A common approach exists for all three activities based upon policies, guidelines and operational experiences presented by various DOTs and consultant active with data collection. Common is the concept that safety is an integral element of all activities that comprise the data collection effort, not just activities that occur at the site. Safety encompasses a holistic approach where safety training is a vital part of the preparations for data collection activities. Also, a critical aspect involves site selection and making adequate preparations before leaving the office/shop for the field.

It is important that sites be selected where field crews can see and be seen. It is important that adequate sight distance be available to slow vehicles and allow motorists to adjust to the presence of field personnel. Also, field personnel entering the highway must have enough time to view oncoming traffic and if necessary exit the roadway. Intersections and busy driveways can pose unique problems with turning vehicles. Roadways will need to have shoulders to park vehicles or lanes that can be used to pull vehicles over with proper TCP and flaggers. Environmental factors always need to be considered as they may compromise sight distance. Likewise night-time conditions pose unique challenges which may require additional lighting and/or personnel serving as traffic spotters. Many organizations have policies restricting surveys to daytime hours.

It is important that all equipment be functioning properly in order to minimize time spent by field personnel near or adjacent to the roadway. Some DOTs are purchasing equipment to reduce the amount of time field personnel need to spend installing equipment or equipment relying on non-intrusive sensor technology to keep data collection equipment out of the roadway. Crews must be hired with an understanding of the demanding tasks and the concerns for personnel safety. Safety training is a critical and ongoing activity. Law enforcement officials should be stationed at the survey site to support safety activities.

Driving to/from the site and having adequate equipment, including safety equipment are part of overall safety preparations. Certainly all field data collection activities need to be planned from a safety perspective. All preparations must consider the requirements specified in Part 6 of the MTUCD "Temporary Traffic Control" (TCP) and appropriate state and local amendments. Personnel must have correct protection attire which meets Federal Highway Administration and OSHA requirements.

As stated by the Connecticut Department of Transportation (4):

"An effective safety program requires a team effort"

"Safety is everyone's job"

and

"Safety is an integral aspect of all Data Collection Activities".

Appendix A

Key Elements of Worker Safety and TTC Management as Presented in the MUTCD (1)

The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

1. Training – all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.
2. Worker Safety Apparel – all workers exposed to the risks of moving roadway traffic or construction equipment should wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Safety Apparel" (see Section 1A.11), or equivalent revisions, and labeled as ANSI 107-1999 standard performance for Class 1, 2 or 3 risk exposure. A competent person designated by the employer to be responsible for the worker safety plan within the activity area of the job site should make the selection of the appropriate class of garment.
3. Temporary Traffic Barriers – temporary traffic barriers should be placed along the work space depending on factors such as lateral clearance of workers from adjacent traffic, speed of traffic, duration and type of operations, time of day, and volume of traffic.
4. Speed Reduction – reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers or flaggers, should be considered.
5. Activity Area – planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.
6. Worker Safety Planning – a competent person designated by the employer should conduct a basic hazard assessment for the work site and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, "General Duty Clause" Section 5(a)(1) – Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1926.20(b)(2) of "Occupational Safety and Health Administration Regulations, General Safety and Health Provisions" (see Section 1A.11).

Option:
The following are additional elements of TTC management that may be considered to improve worker safety:

1. Shadow Vehicle – in the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights and warning signs, may be used to protect the workers from impacts by errant vehicles. The shadow vehicle may be equipped with a rear-mounted impact attenuator.
2. Road Closure – if alternate routes are available to handle road users, the road may be closed temporarily. This may also facilitate project completion and thus further reduce worker vulnerability.
3. Law Enforcement Use – in highly vulnerable work situations, particularly those of relatively short duration, law enforcement units may be stationed to heighten the awareness of passing vehicular traffic and improve safety through the TTC zone.
4. Lighting – for nighttime work, the TTC zone and approaches may be lighted.
5. Special Devices – these include rumble strips, changeable message signs, hazard identification beacons, flags, and warning lights. Intrusion warning devices may be used to alert workers to the approach of errant vehicles."

Appendix B
North Carolina TMT Traffic Data Workflow
Traffic Survey Group—Portable Count Safety Specifications

Each time a traffic counter is to be installed, the field technician must evaluate conditions along a highway segment to determine if it can be done safely. Technicians have the option of selecting any location on a highway segment a station is located. They must evaluate each location being considered for the following conditions:

Sight Distance – This is how far away you can observe an approaching vehicle. You must have enough distance to perform each step in the installation process and be able to exit the travel lanes without requiring an action from a motorist to avoid you. It gives the motorist time to observe you also. How much distance is needed is directly related to how fast traffic is traveling. The faster vehicles are traveling, the more sight distance is needed to perform an activity safely. Curves, hills, and obstructions limit sight distance. Shifting away from these features increases sight distance. Heavy traffic flow will limit sight distance also.

Highway Geometry – The configuration of the highway affects where you can pull off, how far you can pull off, how you need to install a tube, where you have to hammer a nail, and how far you have to cross a road. Shoulders are areas where you can work and wait for breaks in traffic. Select locations with the best shoulder conditions. Avoid locations with shoulders that have uneven ground. Avoid locations where there is a transition (e.g. lane tapers, the end of a median, ramp junctions). Motorists must focus on the transition and are less likely to observe you.

Environmental Conditions – Weather and lighting affect sight distance. Rain and fog will severely reduce how far away you can see a vehicle approaching. It affects the ability of motorists to observe you. Avoid poor weather conditions. Check the weather forecasts frequently and adjust your work hours accordingly. At night, you can observe the lights on vehicles from far away, but judging how far away they are is very difficult. When working at night, observe approaching vehicles more carefully to judge their distance. Use objects, such as utility poles to assist in judging distances at night.

Intersections – Maintain adequate spacing between an installation and intersections. Motorists are focusing on making turning movements or crossing the intersection. There must be a minimum of 200 ft between an installation and the near side of an intersection. This provides you time to observe a vehicle coming out of a crossing street and the motorist can complete the turning movement and observe you. This applies to both intersections with traffic signals and stop signs. Driveways are like

mini-intersections. Avoid locations next to busy driveways. You will have vehicles coming out of or turning into driveways. Always be aware of driveways and watch for traffic when working near them. Ramp junctions on the mainline travel lanes of non-interstate freeways are high speed intersections. You must install counters much further from these intersections. A minimum of 500 ft must be maintained. (Source 9)

APPENDIX C
Specific Guidelines for the Installation and Retrieving Field Equipment

The Pennsylvania DOT states (3): “Since the installation and removal of portable traffic counters normally takes less than 60 minutes, therefore if applicable, refer to notes on the figures in Publication 213 to eliminate the signs and channelizing devices. The vehicle and traffic counting personnel shall be seen by approaching traffic for a distance, in feet, equal to ten times the posted speed limit. In addition, if the counting equipment cannot be safely installed due to a narrow shoulder, insufficient sight distance, heavy traffic volumes, or any other unsafe condition, use a flagger or a uniformed police officer to assist the traffic-counter personnel. If this assistance is not available, do not attempt to set the counter. Notify the immediate supervisor.”

The North Carolina Traffic Data Group notes (9):

“The volume of traffic directly impacts how much time is available to cross or work in the roadway. Gaps in the traffic stream are when you can perform these activities. You must observe traffic and select an adequate gap to perform a task and be out of the travel lanes without requiring a motorist to avoid you. Traffic at the tail end of a gap may be traveling faster than traffic at the front end. This reduces the amount of time available to perform an activity. Be careful of large trucks. There may be smaller vehicles behind them that you can not see. Wait until you are sure there are no vehicles behind a truck before attempting to move into the travel lanes. If the traffic stream does not have adequate gaps to safely perform an installation, do not attempt to install the counter. Schedule the installation for a time of day when traffic is lighter and adequate gaps in the traffic stream occur. Schedule installations at high volume stations for off peak hours or at night. Low volume streets usually can be collected any time of day. Be aware that some locations have a lot of retail and restaurants and they have a peak hour in the middle of the day in addition to the typical AM and PM commuter peak hours.”

With reference to the vehicle, the Pennsylvania DOT specifies (3):

a) “The vehicle(s) used during the installation, maintenance, repair, or removal of traffic counting equipment shall be equipped with either a flashing or revolving yellow strobe light or a bar of lights. The light or bar of lights shall be at a location on the vehicle where it is visible by approaching traffic from all directions.
b) Pull the vehicle(s) onto the shoulder and turn on the four-way flashers, flashing, or revolving yellow strobe light or light bar, and headlights to give additional warning to approaching motorists.”

Arkansas DOT notes (11):
Employees engaged in data collection while traveling at reduced speed should drive as far to the right of the traveled roadway as the nature of the work permits. Employees should park on the shoulder or as far as possible to the right of the traveled roadway when brief stops are necessary. When long-term parking is required, the vehicle should be parked off the roadway and in such a manner so that it will not block the sight distance of approaching traffic.

The Connecticut Department of Transportation provides a commentary of safety activities associated with the installation and retrieval of count equipment. The presentation is in the form of a dialog following the activities of count personnel (16):

a) Approaching a traffic count location –"Whether setting out equipment or picking up equipment, approach a traffic count location the same way; slow down and turn the vehicle's strobe lights and mini-strobe lights on. Assess the area, look out for such things as traffic conditions, sight lines, roadway geometry, weather, construction, driveways to homes or businesses, etc. If unable to secure a safe location, contact your immediate supervisor for assistance. (Either additional personnel or an amended location) Do not place yourself or the motoring public at risk!

   When setting out equipment, while still in the vehicle, select a pole, sign, guardrail, etc. to secure the traffic recorder. Then pull the vehicle off the road and on to the shoulder as far as possible to limit interference with commuters in the travel lanes. Stop the vehicle, shift the transmission into "park", engage the emergency brake and leave the vehicle running. Then get out of the vehicle, check for traffic and wear a vest, steel-toed shoes and, if conditions warrant, a portable mini-strobe light.

b) Traffic control –Methods illustrated for controlling traffic through work areas are typical situations (See Figures 1 and 2). The appropriate application of the standard protective controls is determined by actual field conditions. Traffic control cone patterns will be used when a work operation requires that any part of a vehicle protrudes onto any part of the travel lanes or shoulder areas. The protection prescribed for each situation shall be based on the following:
   - Speed and volume of traffic.
   - Duration of operation.

   Flashing/strobe lights and traffic cones will be used when short duration stops are made or when vehicles are on emergency patrol type activity and the equipment can be contained within the shoulder area. In case of horizontal or vertical sight restrictions in advance of the work area, the traffic control patterns shall be extended to provide adequate sight distance to the approaching traffic. If any type of taper is present on the traffic control pattern to shift traffic, the entire length of the taper should be installed on a tangent section of roadway. When working on multi-lane highways, the larger

42-inch traffic cones should be used. Set out traffic cones to enclose the work area around the vehicle. One cone is set in front of the driver's side headlight and one cone behind the driver's side taillight. Then cones are set out at an angle starting from the taillight cone and continuing towards the shoulder of the road. Five cones should be sufficient to accomplish this. (Additional cones may be used at any time.) Although each situation must be dealt with individually, conformity with these provisions is required. In situations not adequately covered by these provisions set forth in the traffic control patterns, the field staff should contact their Supervisor for assistance prior to setting up the work zone.

c) Allowable adjustment on traffic control patterns – The traffic control cone patterns indicate the locations and spacing of traffic cones and devices under the ideal conditions. However, after arriving at the site the Supervisor in charge of the operation can be contacted to authorize modifications to these traffic control patterns. If adjustments are made to these standard traffic control cone patterns, the adjustments should always be made to improve the visibility of the field staff and to better control the flow of traffic. The traffic control cone patterns must consider:
    - the safety of the employees
    - the activity in and out of abutting properties, driveways and side roads
    - the vertical and horizontal curvature of the roadway

d) Securing the road tube – In preparation of setting out a road tube, it must be checked to verify that it is in good working condition with no cuts, or breaks. Every effort should be made to inspect all equipment, prior to arriving at the site. On the far side (the side opposite the end that is inserted into the traffic recorder) of the tube a PK nail is inserted securely into the end. If the far side of the tube is going to be across the street from where the vehicle is parked, a tube, c clamps, nails, hammer and large cone are brought to that side of the road. The tube is unrolled and the far side clamp secured in the shoulder of the road. While facing the oncoming traffic, the field person places a cone (or cones) in front of the work area, making sure the cone does not block his view of the oncoming traffic. The "c" portion of the clamp goes over the portion of the tube where the center of the PK nail is inside. The tongue portion of the clamp faces away from the traffic recorder. PK nails are driven through the two holes in the clamp, securing the clamp to the road. The tube is then brought across the road to secure the 'near side' of the tube tot he road. (The 'near side' of the tube is the side closest to the traffic recorder.) If the near side is across the street from where the vehicle is parked, a cone, nails, hammer and clamps are brought over. While facing the oncoming traffic, the field person places a cone (or cones) between himself and the traffic. A clamp is placed over the tube so that the tongue faces the traffic recorder. PK nails are driven through the two holes in the clamp, securing it to the shoulder.

There are occasions when the tube has to be secured to the road in the travel lane itself (such as classification, lane subtraction and directional counts). To conduct a typical classification count, for example, the road tube, c clamps, nails, hammer and two large cones are brought out to the center double yellow line. The field person should position themselves between the two cones, paying special attention to the oncoming traffic and secure the far side of the tube to the road in the same manner as stated previously. Once this is completed, the tube, cones and the other accessories are brought to the near side of the road. The other end of the tube is then secured to the shoulder of the road. Another tube and the above stated accessories along with a tape measure as brought back out to the center yellow line. The field person positions himself between the cones and measures a distance of twelve feet from the secured tube. The second tube is now secured. When completed the tube and accessories are brought back to the near side of the road.

e) Securing the traffic recorder – Once the tube is secured to the road, the traffic recorder can be secured. With the clasp side of the traffic recorder facing towards the road, the recorder is placed so it is slightly forward (out of sight of the oncoming traffic) and behind the object (for protection) to which it is being secured. After the set up is complete, the field man moves on to the next count location, remembering to turn the vehicle's strobe light off.

f) Competing a traffic count – After a traffic recorder has collected data it is time to "pick up" the counting equipment. The tube is then removed from the road. The field man goes to the far side of the road with a cone and wrecking bar. The cone is placed in front of the field man as he faces the oncoming traffic. The field man slides the wrecking bar under the clamp and pries it up, removing the two PK nails from the road. The field man returns to the near side of the road with the cone, tube, wrecking bar and nails. While facing the oncoming traffic, he slides the wrecking bar under the near side clamp and pries it up, removing the three PK nails from the road. At this point, remove the near side clamp which will eliminate the chance of it crimping or cutting the tube. The tube is wrapped and put away. All the tools and accessories are put back in the vehicle. The cones are then removed from the road and put into the vehicle. The pick-up is now complete. The field man moves on to the next count location, remembering to turn the vehicle's strobe light off.

APPENDIX D
Typical Instruction to Survey Personnel

Safety Procedures

Your safety is an essential part of this survey! To help ensure your safety:

- All survey staff assigned to work site will work strictly within the confines of the work zone,
- All staff in the work site will wear an orange vest during their assigned work times,
- No staff will be allowed to cross the roadways while there is traffic present,
- Staff shall park their vehicles away from the work zone so as to allow for smooth transition of vehicular movement,
- Staff shall not impede the flow of traffic through the work site,
- Your site supervisor has final authority at the work site.

Source: (26)

!!SAFETY, SAFETY, SAFETY!!

1. Wait until trucks are completely stopped before approaching them.
2. Make sure survey set-up site is conducive to the safe flow of survey and non-survey truck traffic.
3. Be mindful of passing trucks.
4. Individuals not conducting surveys should remain clear of all traffic and trucks.
5. Never engage in arguments with truck drivers.
6. Wear reflective safety vest at all times!
7. Wear headlamps during nighttime hours.
8. Always cooperate with Commercial Vehicle Enforcement Officers, especially in regard to safe traffic flows.
9. Never step onto the running board of the truck.
10. Always speak clearly and loudly, while looking at the driver. Be courteous and finish the survey by thanking them for their time.

Source: Extracted from Strategic Freight Transportation Analysis, 2002-2003

ROADSIDE SAFETY

Safety vests and hardhats must be work by all personnel at all times when working at the video collection site. Even if you're just standing outside the vehicle you must still have your vest and hardhat on. While it is acceptable to remove your vest and hardhat while you are sitting in the vehicle, be sure to put them on as soon as you get out of the vehicle.

Be patient. Always look both ways before crossing the traffic lanes and make sure that you have plenty of time tog et across the roadway without running. If you have any doubts about how fast an approaching vehicle is traveling wait for a longer gap in the traffic.

When you are working at the barrels setting up and making adjustments to the cameras, be sure that you are working on the side of the barrel away from the traffic. Whenever possible you should avoid turning your back to the approaching traffic.

When routing cable on overpasses, be sure to watch for traffic at all times. As much as possible, try to walk on the shoulder so that traffic lane is on your right side and you are walking toward any oncoming traffic.

When crossing the traffic lanes and making adjustments to the cameras during dusk, night time, our predawn time periods, remember to use the lights on the portable battery packs so that you can see and to make you more visible to drivers.

State of Washington Guidelines for Truck Survey Interviews

- Be Alert and Promote On-site Safety.
- Always Wear Safety Vests and Hats While On-site.
- Never Approach a Truck When it is Moving.
- Do Not Allow Traffic Congestion to Occur in the Interview Area.
- Take Regular Breaks.

EMERGENCIES

If you experience an emergency related to equipment, try contacting your sub zone supervisor first and then your zone supervisor using the numbers provided.

If you experience an emergency requiring law enforcement or medical assistance, call 911 to request assistance and then contact your sub zone supervisor and zone supervisor using the numbers provided.

Source: (17)

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