VIDEO LIBRARY FOR VIDEO IMAGING DETECTION AT INTERSECTION STOP LINES

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DISCLAIMER

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CHAPTER 1. INTRODUCTION

OBJECTIVE

The objective of this activity was to record video that could be used for controlled evaluation of video image vehicle detection system (VIVDS) products and software upgrades to existing products based on a list of conditions that might be difficult to find in a timely manner. This library allows the user to present a wide range of weather, roadway, and lighting conditions to a VIVDS product in real time. The idea involves capturing the video and playing the recorded video through a VIVDS processor to determine the accuracy or change in accuracy to compare against a test protocol and/or verify claims of manufacturers. The test conditions include situations that are not easily obtainable and that might be particularly challenging for current detectors.

This research task anticipates that TxDOT will encounter situations fairly often in which the desired conditions for full-scale field testing of VIVDS are not available or where quick turnaround tests are needed. There may be a need for a quick decision on a firmware upgrade or on a new product to establish at least an initial and preliminary basis for forming a decision on success or failure. There will probably be occasions where these initial results using the video library need to be verified by field testing if the desired conditions become available or if time and other resources allow such testing. TxDOT might want to establish a formal policy for the use of the library and conditions in which field testing might be desirable.

PERTINENT CONSIDERATIONS FOR USING VIDEO RECORDING

Potential users of the video library must realize that it is another tool to assist TxDOT to improve the performance of VIVDS, but it will not replace all field testing. The strengths and weaknesses of using a video library need to be addressed so that users have the appropriate expectations. A noteworthy attribute of the concept is that the video, once recorded, is always available, facilitating quick turnaround results based on the recorded conditions. Testing can occur quickly and easily in a lab or office setting, in some cases reducing or possibly eliminating the need for more time-consuming and costly field trips involving equipment setup. The list of conditions in which recorded video has the greatest value might include rare weather or light conditions that would not be available through field evaluation, especially during certain seasons of the year. Even off-line testing with a traffic signal controller (e.g., hardware in the loop) to determine detection input and controller response is feasible using this technique. TTI recorded audio signals that indicate the controller state so that lab testing can also include this feature for VIVDS products that claim to improve performance by monitoring the controller status.

A potential limitation is future resistance by the manufacturers. TTI discussed the concept with all three of the major Texas suppliers of VIVDSs during the project kickoff meeting in September 2007 to solicit their response to this concept. All said that they already used recorded video for their own purposes, so they tacitly validated the concept for some applications. The general consensus was that recorded video “has its place,” but it was not a panacea to replace all field testing.

Another limitation of this technique is that it is not appropriate for VIVDS using integrated cameras and processors. However, manufacturers might also have a non-integrated version of the same system that could suffice for test purposes with results being applicable to both types. Another weakness is that this test would completely omit the camera and might not exactly replicate the desired position or other aspects of the camera. Both camera position and camera quality are known to contribute directly to VIVDS performance. The video library concept attempts to overcome these two factors by using a standard camera like most of the ones currently used by TxDOT and by using typical camera placements. Finally, the video library will probably never have every roadway, lighting, and weather variation to precisely meet every need. However, as time goes on, TxDOT can add new recorded video to more fully complete the list of desired conditions.

Test Methodology

To fully appreciate how test results might be used, one needs to understand the methodology used for the tests. The first step is to select the desired road geometry and other field conditions such as camera height and placement, followed by finding one or more sites that closely replicate the conditions. The next step involves requesting clearance from the operating agency since the recording activity requires access to the agency's controller cabinet. Field personnel then record traffic under the selected conditions using either an existing camera or one installed by research staff.

Recording the traffic requires placement of a digital video recorder (DVR) inside the controller cabinet or next to it, perhaps inside a data collection trailer. At least one VIVDS manufacturer is capable of improving performance by monitoring the signal controller phase status. Therefore, TTI developed a means of generating a unique audible signal to be recorded by the DVR for each signal phase to indicate controller phase status. Of course, recording this audible signal required being connected to the signal controller cabinet and hence the need for being either inside the cabinet or in close proximity to it. TTI researchers decided that the best means of recording the controller status was to use the audio portion of the recording medium for subsequent replay.

Some basic equipment that is required to test VIVDSs using the pre-recorded video is as follows:

- DVD player,
- video monitor,
- VIVDS processor,
- Dual-Tone Multi-Frequency (DTMF) decoder (if signal status is required by the VIVDS processor), and
- coaxial cables and connectors.

The playback portion of this procedure involves playing the selected DVD through a DVD player as an input to the VIVDS processor. (If the VIVDS processor can utilize the phase status, the technician should connect the audio from the DVD player to the DTMF decoder to generate contact-closure outputs indicating the phase status.) Persons performing the test will then draw video detection zones appropriate for the approach and begin video playback. Viewing the video detectors during playback allows observers to compare the number of detections by the VIVDS to a manual count at the end of the video of interest or by selected time intervals.

Differences between Tests Using Recorded Video and Real-World Tests

Table 1 summarizes the steps that would probably serve TxDOT's needs for each component of the test, assuming TxDOT might use the Wavetronix Advance at some future time. It indicates that most of the steps are the same for the field lab component as with the video library component. As in the field lab discussion above, the best way to accomplish the recording of Wavetronix Advance data for subsequent replay would utilize a personal computer (PC) for data storage.

Table 1. Comparison of Field Lab and Video Library Procedures.

Field Lab Procedure	Video Library Procedure
1. Select test approach at field lab site	1. Select data collection site(s)
2. Determine test conditions (e.g., weather, free flow, isolated vehicles)	2. Determine test conditions (e.g., weather, free flow, isolated vehicles)
3. Install VIVDS camera and processor	3. Install VIVDS camera
4. Interface with signal controller (phase status)	4. Interface with signal controller (phase status)
5. Install Wavetronix SmartSensor Advance	5. Install Wavetronix SmartSensor Advance
6. Install PC in cabinet (or trailer)	6. Install PC in cabinet (or trailer)
7. Set VIVDS detection zones at 4:1 in test lane(s)	7. –
8. Install Wavetronix HD at 4:1 point (if used)	8. –
9. Select data collection time interval(s)	9. Select data collection time interval(s)
10. Install and initiate DVR	10. Install and initiate DVR
11. Synchronize system clocks	11. Synchronize system clocks
12. Collect data and video	12. Collect SS data and record video to DVD
13. Run TTI analysis program (histograms)	13. –
14. –	14. Run DVD through VIVDS synchronized with PC running Wavetronix file
15. Submit analysis results to TxDOT	15. Submit results, DVD, and data to TxDOT

In both the field lab data collection and the recorded video library data collection, the process could involve simultaneous recording from the Wavetronix Advance (if used) for fronts of vehicles. The process could also collect deactivation data if desired, but this additional data would require another type of detector. For using a DVD from the video library, one would need to record vehicle trajectories in either the temporal or spatial domains, or both, so that the detection point of a vehicle by a VIVDS could be matched with that vehicle's trajectory in time and space from the baseline system(s). The Advance generates a practically continuous stream of data consisting of vehicle speed, distance from the detector, and a timestamp, so the trajectory of each vehicle would come from this output, converted into the appropriate format to be a companion file to be used for replay simultaneously with each recorded DVD.

In Table 1, dashes indicate differences in this side-by-side comparison between the field lab components and the video library components. Steps 1 through 6 are similar, with the field lab test likely being done at a known field lab site and the video recording likely being done at a site to be determined. Of course, the two sites could be the same. Step 7 would involve setting the VIVDS detection zones at 4:1 (or other value but not more than 10:1) and then establishing the actual zones to be used for testing, whereas the video recording for the video library would not involve this step. In Step 8, the video recording could also use another detection device for detecting the rears of vehicles. The type of analysis that would be done for each component explains the difference in Step 13. For the field lab procedure, the analysis would probably involve a program developed by TTI or others to create histograms of activations (and possibly deactivations). These results would serve as the basis of pass-fail decisions by TxDOT—probably relying on 85th percentile correct detections. Step 14 in the video library procedure would involve running the DVD from recorded field video through one or more VIVDSs in a lab or office setting. This step would not be part of the field lab procedure. Step 15 in both cases would involve submitting results, etc., to TxDOT although these results would differ between the two processes. Since the video library would primarily serve future needs, it would not include the more finished analysis provided by the field lab procedure.

Image Quality and Video Storage Format

TTI researchers made a phone call to the Belgium headquarters offices of Traficon, Inc., for the primary reason of determining the camera specification that had to be used for recording video to be used for the Traficon VIVDS processor. Preliminary information provided during the Project 0-6030 kickoff meeting suggested that the Traficon product required a higher-resolution camera than the other two products. TTI had already established that the camera needed for the other two systems must have 480 lines of vertical resolution and should be color. Control Technologies, Inc., the Texas distributor of Traficon products, sent two representatives to the project kickoff meeting, who stated that the Traficon product would not perform optimally unless it used a camera meeting the PAL standard, which requires 580 lines of vertical resolution. Also, another company representative from California had forwarded a camera specification the day before this phone call, and it also indicated a PAL specification, but it also did not require a color camera. Recording video for the video library at two different resolutions, requiring two different cameras, would have been undesirable.

Although other statements and indicators suggested that the Traficon VIVDS required a camera with higher resolution than the other two competitors, the company chief executive officer (CEO) stated that, in ordinary circumstances such as intersection and freeway detection, the Traficon VIVDS operates just as well with 480 lines as it does with 580 lines of resolution. It can also use a color camera, but it is not needed. Traficon uses some algorithms that compensate for some of the typical problems (e.g., shadow suppression) encountered. For some applications such as inside tunnels, Traficon prefers a high-end camera, but for intersections the camera could be an inexpensive model, even with 380 lines.

Researchers also asked if Traficon uses recorded video for test purposes. The CEO responded that the company has perhaps thousands of recordings that it uses for this purpose. Their representatives have experience with digital video storage, but promises from the company to provide TTI with some requested video were never fulfilled. The CEO stated that Traficon sometimes needs recorded video that includes specific weather or lighting conditions or inferior camera positions, and they need to optimize performance under those conditions.

One of the cautions offered by the Traficon CEO was that installers need to avoid internal reflections inside the camera. The comment seemed to refer to either cheap cameras or avoiding the horizon, or both. The CEO emphasized that cheap cameras can still perform poorly even if aimed below the horizon because of reflections. The camera must be totally black inside to suppress internal reflections. Auto focus (for night applications) can use a welder's lens over the camera lens to replicate low-light conditions. Once the camera is set using this method, it will be set for night conditions.

Researchers also asked about the appropriate format for video storage on DVDs. The Traficon CEO said perhaps the best format was regular MPEG-2; it will result in about 2.5 hours of video stored on each DVD. Researchers asked if anyone within Traficon had experience with storing video using a DVR and for any recommendations on which recording units work best. Again, Traficon representatives promised to send information but never followed through.

The research team considered two options for video collection—DVD recorders and MPEG-4 DVRs. A DVR would allow longer continuous recording and require less space for data storage, but researchers could not find a DVR that would provide a quality playback image. Even at the highest-quality settings, the MPEG-4 compression artifacts were apparent and could possibly interfere with the VIVDS processing. Researchers ultimately decided to record directly to DVDs in the MPEG-2 format. This option provided a higher-quality image on a convenient and easily transportable medium. The downside to this approach is a limitation on recording length (2 to 2.5 hours per disc), which requires personnel to swap discs and manually restart the recording.

To summarize, here are some conclusions based on these findings:

- The Traficon VIVDS does not require a special camera for "normal" operations.
- Use the same camera with 480 lines (color or mono) for all three test systems.
- Further discussion indicated that this research should use MPEG-2 instead of MPEG-4 (requires more memory but better quality).

CHAPTER 2. FIELD VIDEO RECORDING

INTRODUCTION

Field video recording proceeded over a period of several months while waiting for the necessary weather or light conditions to occur. In some cases, researchers installed a video trailer for these recordings because the camera quality and other factors available at existing intersections were not adequate for this task. Parking the trailer next to the controller cabinet facilitated connecting to the controller and recording controller state simultaneously with video.

TARGETED CONDITIONS

The targeted conditions for capture on video recordings included traffic/highway conditions, camera location, certain weather conditions, and lighting. The recorded video contains conditions that were available at the time of recording, so not all conditions are available on the final recordings.

Traffic/Highway Conditions

Most Texas intersections have between one and five lanes on each approach, so TTI looked for sites that fit this range. For stop line detection, which is the focus of this project, other highway factors such as horizontal and vertical approach alignment are not considered significant. The height and offset of the camera are directly related to the number of lanes, more so for side-mounted cameras compared to cameras centered over the approach lanes. One offsetting factor for side-mounted cameras is height. Higher mounting locations for a given offset tend to improve VIVDS performance, as long as the support does not move excessively in high winds or due to vibration.

Camera Position

Camera position is related to the number of lanes through the amount of horizontal offset between the camera and the subject lane. The offset is not necessarily critical for through lanes, but it is critical for left-turn lanes. Installers should position the camera to adequately detect left-turn lanes if a separate left-turn phase and turn lanes are provided. The three positions for cameras are: centered, left, and right. Centered or left-side cameras (as viewed by approaching motorists) are desirable for some camera mounting heights to be able to properly cover the left-turn lanes. There may still be issues of false detections due to tall vehicles turning, but correction may be possible using directional detectors at the left-turn stop line. Typical heights that are available in each of the three camera positions are 25 ft centered over lanes and 30 to 35 ft for left- or right-mounted cameras.

Weather and Lighting

Targeted weather conditions are as follows:

- sunny and clear,
- moving clouds (casting shadows),
- rain,
- fog,
- snow, and
- dust storms.

Some of the rare weather events were not available to the research staff during the course of the project, so TTI requested video from VIVDS manufacturers. Unfortunately, promises made by manufacturers to provide the requested video were not fulfilled. Even if they had been delivered, TTI would have had no control over the quality of the video, the position of the camera, or indications of controller state, which might have compromised their usefulness.

Desired light conditions included the following:

- full daylight,
- full dark with street lighting,
- full dark without street lighting, and
- light transitions—sunset and sunrise.

Light direction was also important for daylight video recording. East-west roadways tend to cause glare issues, so TTI chose one site with an east-west orientation. Other sites had a different orientation for comparison purposes.

BASELINE DATA

TTI manually counted from one to five signal cycles of traffic from each DVD and provides results at the end of this document. This method required two individuals to independently replay the video, starting and ending at a known and recorded point, and counting the number of vehicles in each lane. Reviewer "A" did not know the results from reviewer "B" and vice versa. If the counts from the two individuals differed by more than 3 percent, the process had to be repeated until the difference was within the established limit. Researchers chose segments of video based partly on critical events (e.g., tall vehicles turning, artifacts that might affect performance, etc.) or selected weather or light conditions. TTI did not use an early proposed technique that would have involved the Wavetronix Advance.

SITES SELECTED

TTI selected sites in College Station/Bryan to optimize the budget for data collection efforts. Video recording began at the intersection of F.M. 2818 at Holleman Drive, followed by F.M. 60 (University Drive) at Spring Loop and finally F.M. 60 at Discovery Drive. For the first two sites, researchers chose locations where they could safely park a data collection trailer next to the controller cabinet (for left- and right-side cameras). TTI made use of existing center-mounted cameras (on the mast arm mounted on a riser) where possible, but not all candidate locations had cameras that met the selected specification. When centered cameras were available that met the desired specification such as at Holleman Drive and Discovery Drive, TTI added a video splitter in the cabinet to send the image simultaneously to the VIVDS processor and the DVR. This change required amplifying the signal to minimize signal loss to the video processor.

Figure 1 shows the area of the F.M. 2818/Holleman Drive site. Recorded video monitored the eastbound approach. One reason for selecting this site and camera position was the due east-west orientation of F.M. 2818. The camera faced westward and had significant sun glare issues during certain times of the day. Figure 2 shows the intersection layout. Figure 3 shows the area of the F.M. 60/Spring Loop intersection. Figure 4 is a more detailed layout of the intersection, indicating the position of the video trailer. Figure 5 shows the area of the F.M. 60/Discovery Drive intersection, and Figure 6 shows the details of that intersection.

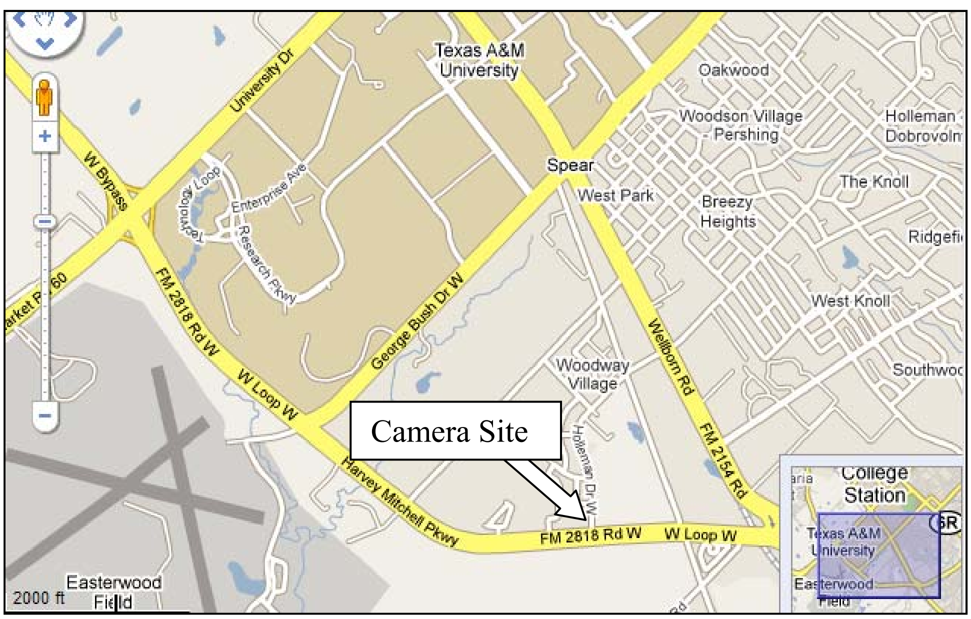

Figure 1. Map of F.M. 2818/Holleman Drive Area.

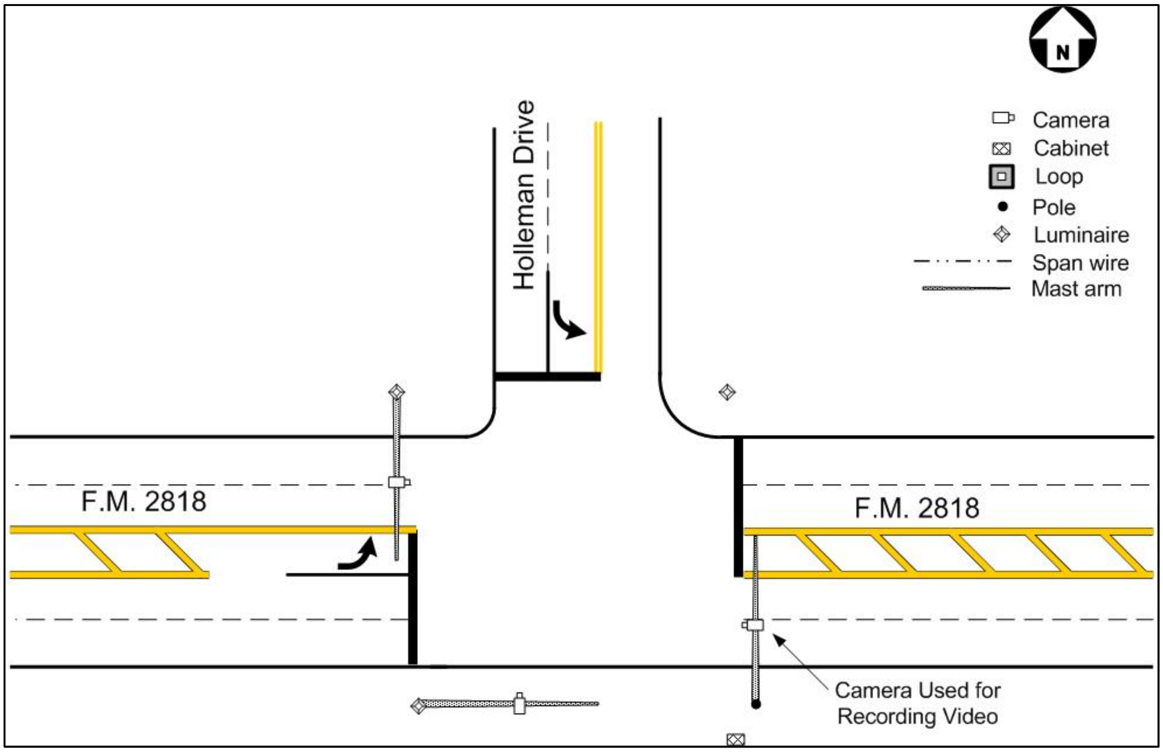

Figure 2. Layout of F.M. 2818/Holleman Drive Intersection.

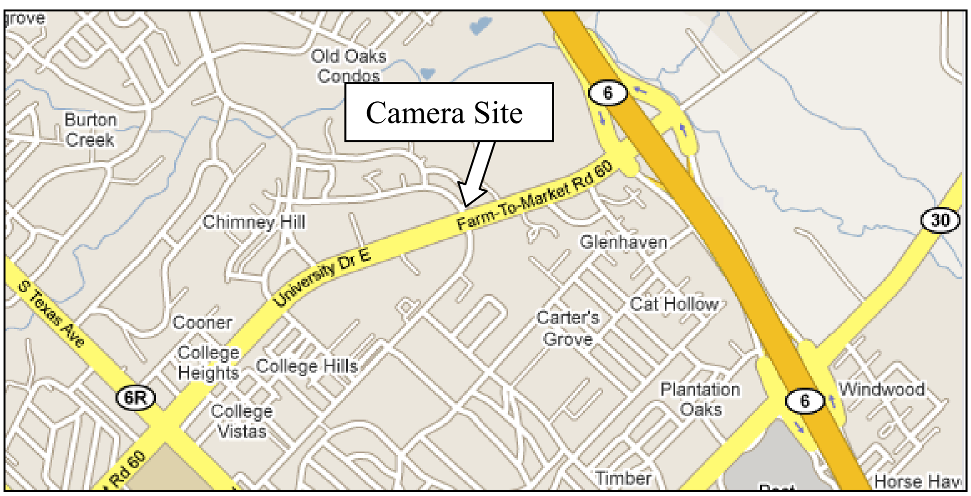

Figure 3. Map of F.M. 60/Spring Loop Area.

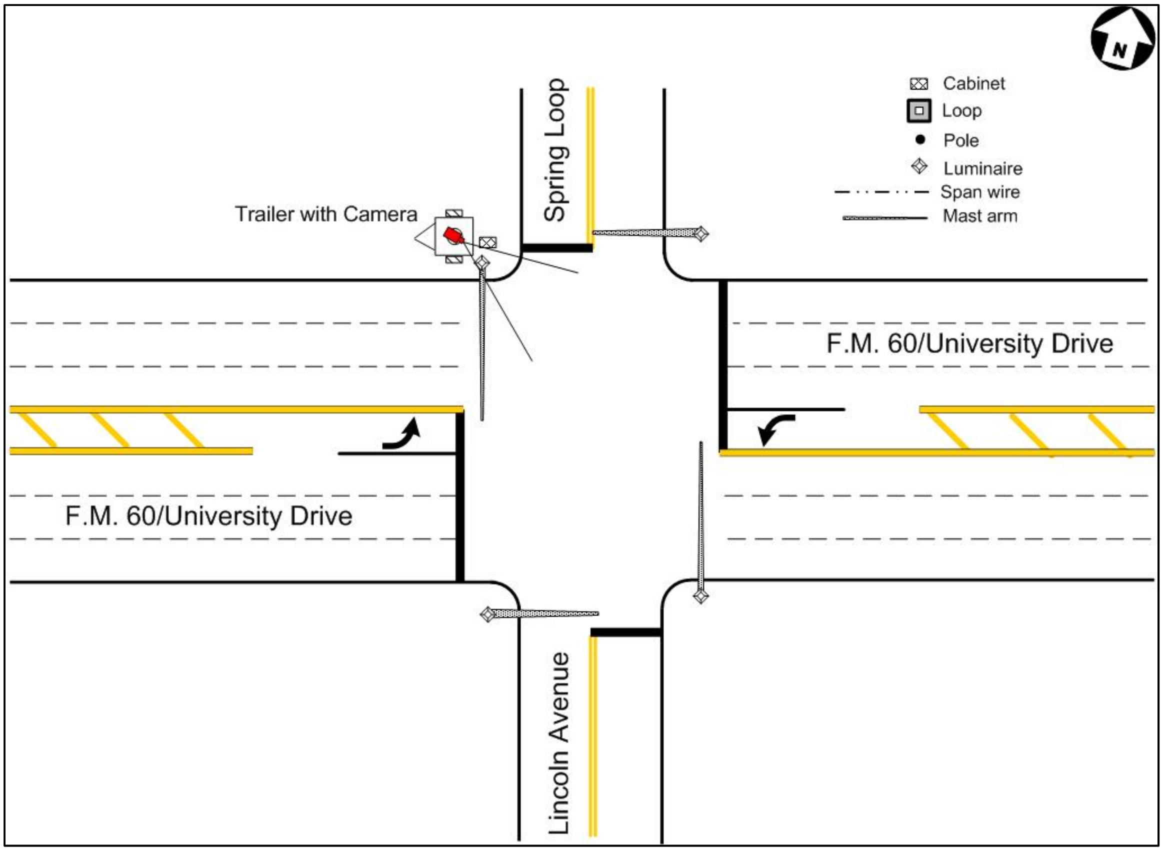

Figure 4. Layout of F.M. 60/Spring Loop Intersection.

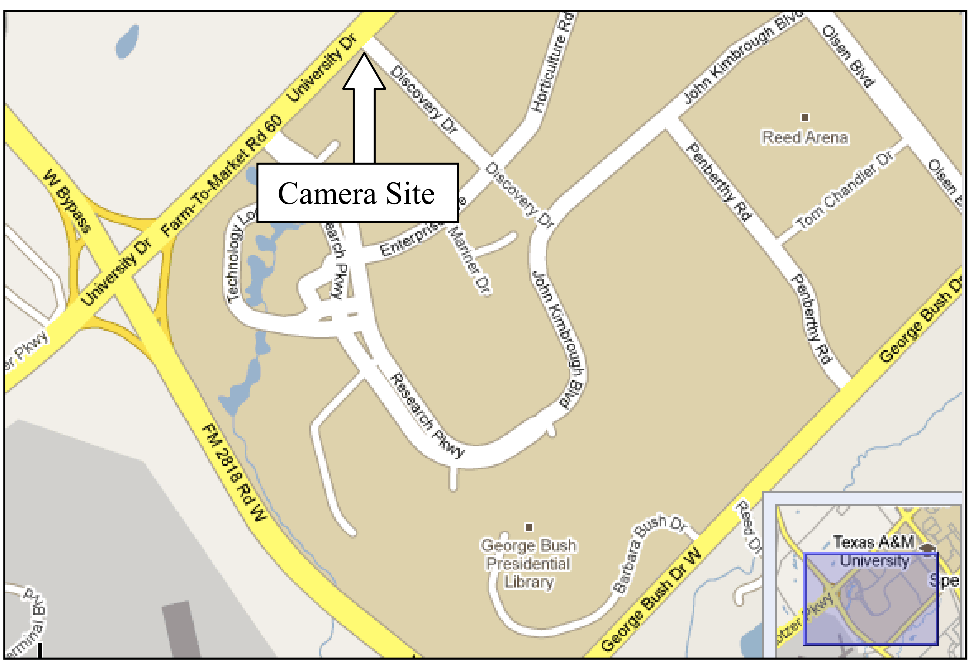

Figure 5. Map of F.M. 60/Discovery Drive Area.

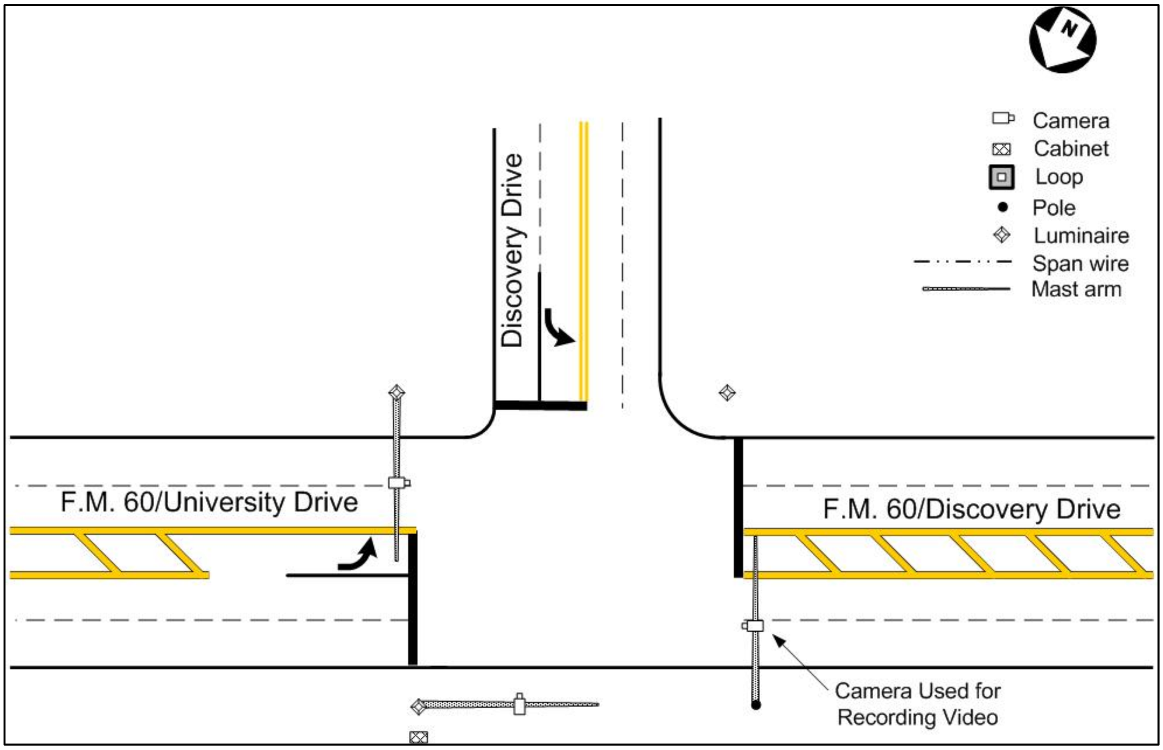

Figure 6. Layout of F.M. 60/Discovery Drive Intersection.

Description of DVD Contents

TTI originally recorded video on 17 DVDs from the selected sites. Once observers reviewed the targeted scenes and identified start points, they methodically counted the number of vehicles crossing the stop line for several consecutive signal cycles. The counts started with the beginning of a green phase, continued through the targeted number of cycles, and ended at the termination of a red phase. Thus, each count included full cycles during each target period. Observers tallied the counts by lane so each site had counts for through lanes and left-turn lanes. Naming of lanes is consistent with the drivers' view. For example, the left through lane is the lane next to the left-turn lane. The F.M. 2818/Holleman and the F.M. 60/Discovery Drive sites have two through lanes and one left-turn lane on the recorded approach, and F.M. 60/Spring Loop has three through lanes and one left-turn lane on the recorded approach.

Tables 2 through 17 contain the results of counts based on human observations. Some of the DVDs have a text overlay showing the actual clock time, whereas others do not. On DVDs that did not have text overlay, the location reference uses the DVD time (as indicated on the digital video recorder/player). These tables use the word "Timestamp" to indicate actual clock time when that is available. The DVDs recorded a distinguishable audio signal for each signal state for future use with equipment that can utilize the signal.

Table 2. Vehicle Counts from December 10, 2008, at F.M. 2818/Holleman Drive (Disc 1).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
0:50:40 – 0:58:26	5,4,4,4	16,7,16,16	30,24,22,22	Snow melt, glare
1:10:28 – 1:16:30	5,5,5	21,24,22	27,31,35	Thicker snow, more glare
1:18:36 – 1:20:30	2	19	35	Lens change day/night
1:24:38 – 1:30:26	11,5,3	23,24,26	38,36,38	Darker, more snow/glare
1:44:39 – 1:52:26	4,8,4,5	24,16,22,13	41,33,26,36	Dark, wet, heavy glare
1:52:26 – 1:58:27	3,12,5	20,17,17	34,27,36	Camera losing focus

Table 3. Vehicle Counts from October 14, 2008, at F.M. 2818/Holleman Drive (Disc 2).

Timestamp	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
12:28:38 – 12:40:00	2,6,6,0,13	8,13,10,0,23	13,31,20,0,41	Perfect weather, no problems

Table 4. Vehicle Counts from March 3, 2009, at F.M. 60/Spring Loop (Disc 3).

DVD Time	Vehicle Counts				Comments
	L.T. Lane	Lt. Through	Ctr. Through	Rt. Through	
0:00:01 – 0:08:22	10,5,4,6	16,17,11,14	17,12,15,16	23,22,19,22	Left-turning vehicles
1:34:39 – 1:41:09	4,5,3,2	15,13,10,16	10,11,11,13	13,15,15,16	Crossing vehicles, darker

Table 5. Vehicle Counts from March 4, 2009, at F.M. 60/Spring Loop (Disc 4).

DVD Time	Vehicle Counts				Comments
	L.T. Lane	Lt. Through	Ctr. Through	Rt. Through	
0:01:02 – 0:08:40	4,5,2,4	17,15,13,16	16,13,13,15	21,15,19,18	Rain, pavement glare
0:15:01 – 0:21:22	4,0,3,5	11,12,8,7	13,13,16,13	8,12,12,7	Wet pavement glare, no rain
1:21:50 – 1:29:07	0,1,4,1	5,15,12,7	8,11,17,8	8,17,10,16	Water drops on camera lens

Table 6. Vehicle Counts from March 5, 2009, at F.M. 60/Spring Loop (Disc 5).

DVD Time	Vehicle Counts				Comments
	L.T. Lane	Lt. Through	Ctr. Through	Rt. Through	
0:00:18 – 0:07:34	3,0,0,1	3,6,4,8 3,8	,8 ,5 9,9	,5 ,9	Fog
1:31:24 – 1:33:09	3	11	11	12	Lens, light transition

Table 7. Vehicle Counts from October 3, 2008, at F.M. 2818/Holleman Drive (Disc 6).

Timestamp	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
10:58:24 – 11:06:50	15,0,8	32,0,14	48,1,22	Sun glare
11:32:22 – 11:41:04	2,4,4,7	14,17,10,12	23,28,25,18	Sun glare increased

Table 8. Vehicle Counts from October 7, 2008, at F.M. 2818/Holleman Drive (Disc 7).

Timestamp	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
7:08:17 – 7:16:16	2,1,4,1	8,3,6,12	10,11,11,14	Dark, wet road glare
8:44:14 – 8:54:12	6,1,2,3	11,6,2,3	21,9,11,7	Tall vehicles
9:12:25 – end DVD	5,2	9,5	28,6	Sun glare

Table 9. Vehicle Counts from October 8, 2008, at F.M. 2818/Holleman Drive (Disc 8).

Timestamp	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
14:43:45 – 14:52:27	8,9,5,3	5,14,15,13	9,31,25,28	Sun glare on windshields
15:34:44 – 15:46:44	9,3,3,8	29,11,22,12	57,18,53,26	Sun glare increased
16:38:51 – 16:46:43	1,2,4,6	8,14,18,12	24,27,35,29	Sun glare

Table 10. Vehicle Counts from October 13, 2008, at F.M. 2818/Holleman Drive (Disc 9).

Timestamp	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
17:59:50 – 18:06:54	6,4,13,7	31,29,40,26	33,33,45,42	Late p.m. sun glare
18:25:08 – 18:35:01	3,3,2,5,4	14,12,21,10,12	24,18,25,17,23	Lens anomaly & glare
19:06:49 – 19:17:41	11,3,8,4	29,6,18,9	51,11,30,19	Dusk, headlight glare

Table 11. Vehicle Counts from December 8, 2008, at F.M. 2818/Holleman Drive (Disc 10).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
1:14:36 – 1:23:17	1,4,10,3	2,14,23,5	4,20,38,13	Overcast

Table 12. Vehicle Counts from December 8, 2008, at F.M. 2818/Holleman Drive (Disc 11).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
0:06:52 – 0:14:26	5,3,4,10	21,22,29,37	27,33,40,44	Camera image fade in & out
0:19:52 – 0:23:25	6,5	22,23	34,32	Camera iris changing
0:36:25 – 0:45:44	6,3,10,7	16:21:31:16	28,30,48,35	Dusk, headlight glare
0:57:15 – 0:58:53	3	6	20	Camera lost focus
1:08:48 – 1:17:51	11,6,4,3	13,15,13,20	23,22,36,24	Headlight glare, camera

Table 13. Vehicle Counts from December 9, 2008, at F.M. 2818/Holleman Drive (Disc 12).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
0:00:16 – 0:10:45	6,6,9,6	9,9,25,8	16,16,37,19	Light rain
1:34:24 – 1:45:17	6,4,7,3	17,10,9,7	29,22,14,11	Cloud shadows on roadway

Table 14. Vehicle Counts from December 9, 2008, at F.M. 2818/Holleman Drive (Disc 13).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
0:01:41 – 0:09:38	4,9,5,5	17,18,19,19	32,32,28,33	Sleet, camera loses focus
0:35:48 – 0:43:33	5,2,3,6	9,5,11,7	28,22,27,12	Camera focus in & out

Table 15. Vehicle Counts from July 15, 2009, at F.M. 60/Discovery Drive (Disc 14).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
1:46:54 – 1:50:00	2,3,0	8,8,1	7,7,1	Glare from vehicles

Table 16. Vehicle Counts from July 15, 2009, at F.M. 60/Discovery Drive (Disc 15).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
01:11:12– 01:18:33	1,0,0,0	7,9,8,12	6,11,8,6	Vehicle shadows
01:20:27– 01:26:29		7,18,14,4	7,15,10,2	Vehicle shadows
01:26:36– 01:40:18	1,0,0,1	13,2,12,16	14,1,11,24	Vehicle shadows
01:40:25 –02:10:18	5,1,2	62,25,11	44,30,11	Vehicle shadows

Table 17. Vehicle Counts from July 20, 2009, at F.M. 60/Discovery Drive (Disc 16).

DVD Time	Vehicle Counts			Comments
	L.T. Lane	Lt. Through	Rt. Through	
0:00:00 –00:17:27	6,3,3,2	20,17,9,25	14,13,9,13	Overcast
0:17:27 – 00:26:03	0,1,0,2	12,4,7,34	6,3,6,26	Overcast