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FM 969 CORRIDOR

APPENDIX F

F

**PEAK HOUR TRAFFIC OPERATIONS MODEL
TECHNICAL MEMORANDUM**



TECHNICAL MEMORANDUM

Client: **City of Austin**
Project Name: **FM 969 Corridor Study**
Location: **Austin, Texas**
Project Number:
Issue Date: **January 12, 2011**

TO: **City of Austin**

FROM: **URS Team**

SUBJECT: **Task 3.3.1 – Peak Hour Traffic Operations Model Technical Memorandum**

The purpose of this memo is to describe the AM and PM peak hour traffic operations model that URS prepared for the FM 969 Corridor Study Project under Task 3.3.1. URS developed the traffic operations models using SYNCHRO software for intersection analysis and HCS software for roadway segments. The results will be used to develop short-term improvements.

The original scope only includes the section between US 183 and Decker Lane and the intersection of FM 969 and FM 973 for short-term improvements. In this analysis, URS also included the following intersections east of FM 973: FM 969 at SH 130, Gilbert Road, Hound Dog Trail, Hunters Bend Road and Taylor Lane because of the safety and congestion issues in this section.

1. Data Collection

URS conducted the following data collections along the corridor in order to develop the peak hour traffic operations model:

- Latest aerial map of the study corridor from CAPCOG.
- Traffic signal timing plans at signalized intersections from TxDOT and City of Austin.
- Field survey to document roadway and intersection geometry and to observe the peak hour traffic condition.
- TxDOT Annual Average Daily Traffic (AADT) counts and saturation counts.
- Historical traffic counts from traffic impact analysis (TIA) reports, Manor Expressway Study (CTRMA), and Travis County.
- 24-hour average daily traffic volumes (ADT) on selected roadway segments.
- Turning Movement Count (TMC) at selected intersections during AM (7-9) and PM (4-6) peak periods.

URS included a total of eleven (11) signalized intersections and three (3) unsignalized intersections on the FM 969 corridor between US 183 and Webberville Road in the model. The intersection of FM 969 and Tannehill Lane is included for the consideration of signal coordination due to its close proximity to the US 183 intersection (1,100 feet). Below is the list of the fourteen (14) intersections:

- 1) Tannehill Lane and FM 969
- 2) US 183 SB frontage road and FM 969

- 3) US 183 NB frontage road and FM 969
- 4) Craigwood Drive and FM 969
- 5) Johnny Morris Road and FM 969
- 6) Decker Lane and FM 969
- 7) Imperial Drive and FM 969
- 8) FM 973 and FM 969
- 9) SH 130 SB frontage roads and FM 969 (unsignalized)
- 10) SH 130 NB frontage roads and FM 969 (unsignalized)
- 11) Gilbert Road and FM 969
- 12) Hound Dog Trail and FM 969
- 13) Hunters Bend Road and FM 969
- 14) Taylor Lane and FM 969 (unsignalized)

Due to the limit in budget, turning movement counts were only collected at selected intersections. **Figure 1** shows the location of both ADT and TMC counts, which were collected between November 1st and 2nd, 2011. Raw traffic counts and intersection diagrams are shown in **Appendix E** of this report.

2. Existing Traffic Volumes

Existing ADT counts on FM 969 show traffic volumes gradually increase from the east to the west. As shown in Figure 2, the ADT is less than 5,000 per day close to the Village of Webberville and increases to 28,000 close to US 183. The percentage of trucks decreases from the east to the west from 12% east of Hunters Bend Road to 7% west of Decker Lane. **Figure 2** shows the 2010 TxDOT AADT counts and our 2011 ADT counts with the truck percentage at some locations.

2011 traffic counts on FM 969 show a strong directionality of traffic – with higher westbound traffic during AM peak periods and higher eastbound traffic during PM peak periods. In general, the AM peak hour is between 7 and 8 AM and it is earlier further east of SH 130. The PM peak traffic is not as condensed as that of the AM peak period and the PM peak hour is generally between 5 and 6 PM. **Figure 3** shows an example of the daily distribution of traffic volumes on FM 969 close to Johnny Morris Road.

Figure 2 FM 969 Average Daily Traffic Volumes

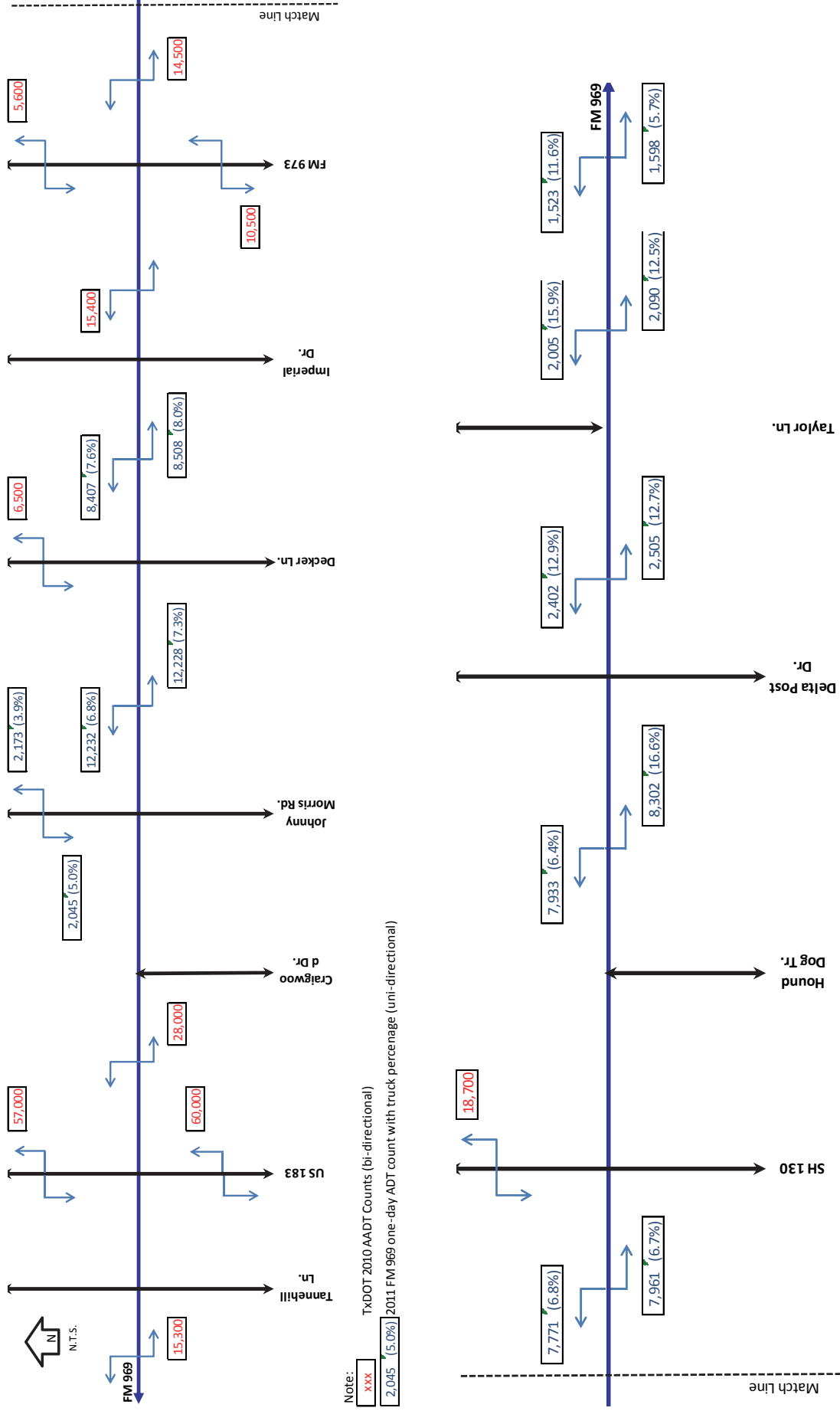
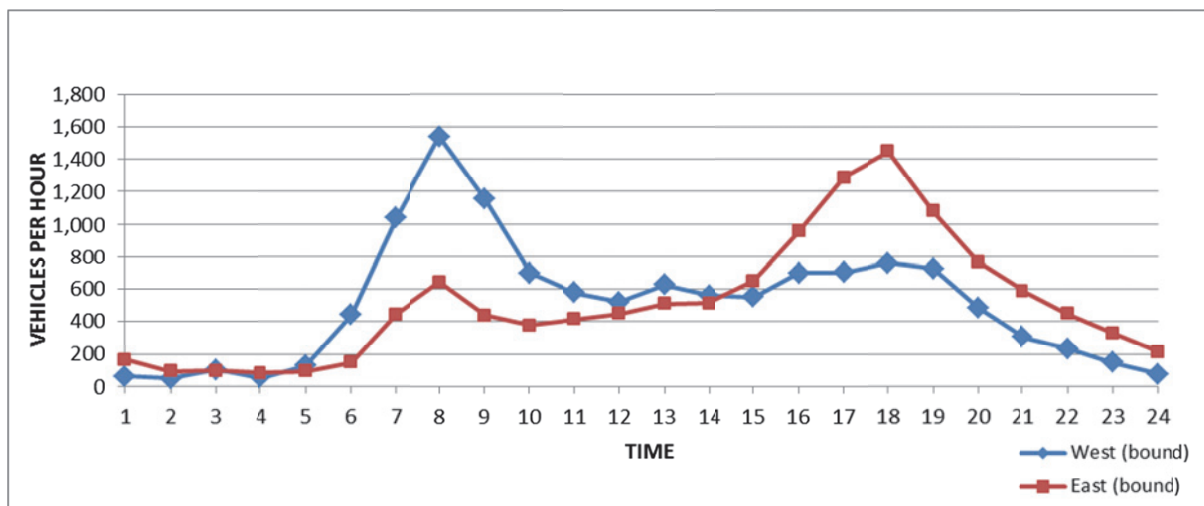


Figure 3 Daily Traffic Distribution on FM 969 at Johnny Morris Road

Turning movement counts at the following intersections were not collected due to the limit in budget. Their turning movement volumes were developed either based on directional ADT volumes or based on historical traffic counts from traffic impact analysis reports (TIA) or TxDOT counts.

- Johnny Morris Road and FM 969
- Imperial Drive and FM 969
- Hound Dog Trail and FM 969
- Hunters Bend Road and FM 969
- Taylor Lane and FM 969

Directional ADT volumes at the intersections of Johnny Morris Road and FM 969 were collected on all legs except the south leg. The south leg is the driveway leading to the City of Austin Walnut Creek Wastewater Treatment Plant which carries very few volumes based on field observation. Nominal volumes were assigned to the south leg to develop the turning movement volumes at this intersection.

TxDOT recently collected traffic volumes at the intersections on FM 969 of Imperial Drive, Hound Dog Trail and Hunters Bend Road to develop traffic signal timing for signal installation projects. These volumes were compared to existing year ADT volumes on FM 969 to develop existing year turning movement volumes.

Turning movement volumes at the intersection of Taylor Lane was obtained from a 2009 TIA report for Whisper Valley provided by the City of Austin. The volumes were compared to existing ADT counts to be adjusted to existing year turning movement volumes.

The final adjusted turning movement volumes at all intersections during the AM and PM peak hours were shown in **Figures 4 and 5** and were used for base year (2011) traffic analysis.

2011 AM Peak Hour TMC

FM 969

Tannehill Ln.

US 183 SB

US 183 NB

Craigwood Dr.

Johnny Morris Rd.

Decker Ln.

Hunters Bend Rd.

FM 973

FM 969

Match Line

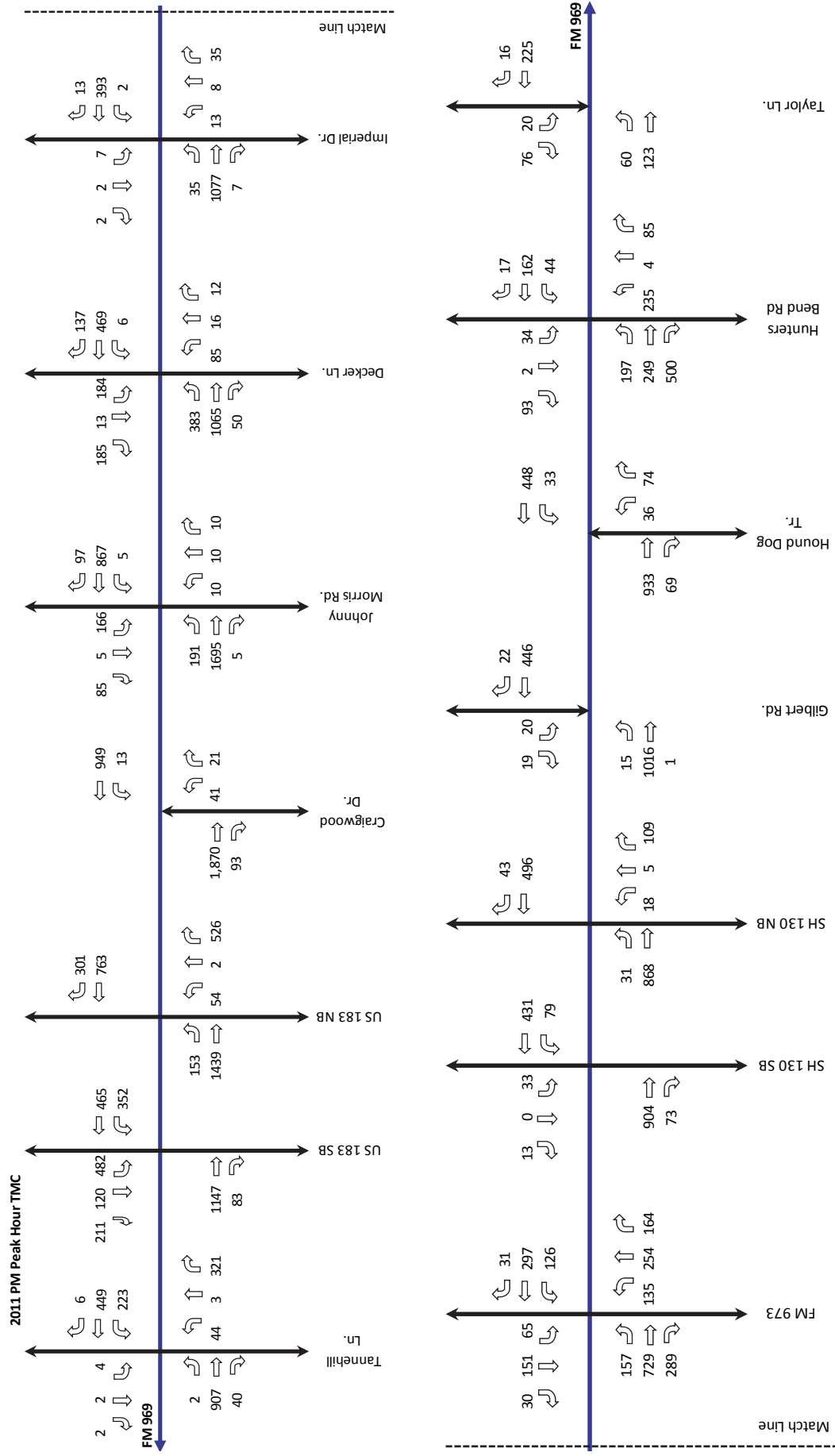
Match Line

Taylor Ln.

Vehicle Counts (Left Turn, Through/Right Turn, Right Turn):

- Tannehill Ln. to FM 969: 1, 4, 4, 197, 7, 288, 974, 479
- FM 969 to Tannehill Ln.: 0, 269, 17, 39, 5, 190, 423, 41
- US 183 SB to FM 969: 133, 572
- US 183 NB to FM 969: 44, 1, 321
- Craigwood Dr. to FM 969: 842, 30
- Johnny Morris Rd. to FM 969: 44, 580, 10
- Decker Ln. to FM 969: 145, 526, 122
- Hunters Bend Rd. to FM 969: 81, 18, 101
- FM 973 to FM 969: 19, 204, 115
- FM 969 to FM 973: 217, 272, 22
- FM 969 to Taylor Ln.: 58, 292

Figure 5 Final Adjusted Turning Movement Volumes on FM 969 – PM Peak Hour



3. Existing Condition Analysis – Intersection

Traffic analyses were conducted at each study intersection for Existing Conditions (2011), using Synchro® 7 software. The traffic analysis focuses on the capacity analysis, which is presented in standard level-of-service (LOS) format. Level of service refers to the operational conditions within traffic stream and motorists' perceptions of conditions in terms of delay, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. Level of service is designated from A to F, with A representing the best traffic conditions with the least delay and F representing poor conditions with the highest delay.

Level-of-service criteria for signalized intersections are based on average control delay per vehicle on all approaches in a 15-minute analysis period. **Table 1** lists the criteria and general characteristics associated with each level of service for signalized intersection.

Table 1 HCM Level of Service at Signalized Intersection

Level of Service	Average Intersection Delay (sec/veh)	Description
A	≤ 10	No delays at intersection; smooth progression of traffic. Uncongested operations. All vehicles clear in a single signal cycle.
B	> 10 and ≤ 20	No delays at intersection; smooth progression of traffic. Uncongested operations. All vehicles clear in a single signal cycle.
C	> 20 and ≤ 35	Moderate delay; satisfactory-to-good progression of traffic. Light congestion. Occasional backups on critical approaches.
D	> 35 and ≤ 55	Little or no progression of traffic along the roadway with a high probability of stopping at signalized intersections operating at this level of service. Significant congestion on critical approaches, but intersection is functional. Vehicles will wait through more than one cycle during short peak periods.
E	> 55 and ≤ 80	Heavy traffic flow conditions. Probable delays of two or more traffic signal cycles. No progression. Limit of stable flow. Blockage of intersection may occur if signal does not provide for protected turning movements.
F	> 80	Unstable traffic flow. Heavy congestion. Traffic moves in forced-flow condition. Three or more cycles required to pass through intersection. Total breakdown with stop-and-go conditions.
*	$>> 80$	Very unstable traffic flow. Very heavy congestion. Traffic moves in forced-flow condition. More than three cycles required to pass through intersection. Total breakdown. Stop-and-go only. Delays are beyond the range of the <i>Highway Capacity Manual</i> equations. Represents an extreme level of over-saturation.

(Source: Highway Capacity Manual 2010)

For unsignalized intersections, HCM establishes LOS criteria based on average control delay of a critical minor movement. Average control delay is the average time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. **Table 2** lists the HCM criteria for LOS at unsignalized intersections.

Table 2 HCM Level of Service at Unsignalized Intersection

Level of Service	Average Intersection Delay (sec/veh)	Description
A	≤ 10	Little or no delay
B	> 10 and ≤ 15	Short traffic delay
C	> 15 and ≤ 25	Average traffic delay
D	> 25 and ≤ 35	Long traffic delay
E	> 35 and ≤ 50	Very long traffic delay
F	> 50	Extreme delays; possibly severe congestion

(Source: Highway Capacity Manual 2010)

The level of service for Existing Condition during AM and PM peak hours are presented in **Table 3**. Detailed Synchro® worksheets were provided to the City in a separate technical memorandum. It should be noted that the traffic signal at the intersection of Gilbert Road and FM 969 only operates between 6:50 and 8:00 AM and between 2:30 and 3:30 PM, mainly to serve the school on Gilbert Road. During the PM peak period (4:00 to 6:00 PM), this intersection was analyzed as a two-way STOP controlled intersection with yellow flashers on FM 969 and red flashers on Gilbert Road.

Table 3 Intersection Capacity Analysis for Existing Condition (2011)

Intersection	Traffic Control	AM Peak	PM Peak
1. Tannehill Lane and FM 969	Signal	A	B
2. US 183 SB frontage road and FM 969	Signal	C	F
3. US 183 NB frontage road and FM 969	Signal	F	F
4. Craigwood Drive and FM 969	Signal	A	A
5. Johnny Morris Road and FM 969	Signal	C	C
6. Decker Lane and FM 969	Signal	F	C
7. Imperial Drive and FM 969	Signal	A	A
8. FM 973 and FM 969	Signal	B	C
9. SH 130 SB frontage roads and FM 969	OWSC*	E	D
10. SH 130 NB frontage roads and FM 969	OWSC*	C	C
11. Gilbert Road and FM 969	Signal / TWSC ⁺	A	D
12. Hound Dog Trail and FM 969	Signal	C	C
13. Hunters Bend Road and FM 969	Signal	F	D
14. Taylor Lane and FM 969	OWSC*	B	B

* OWSC – one-way stop control

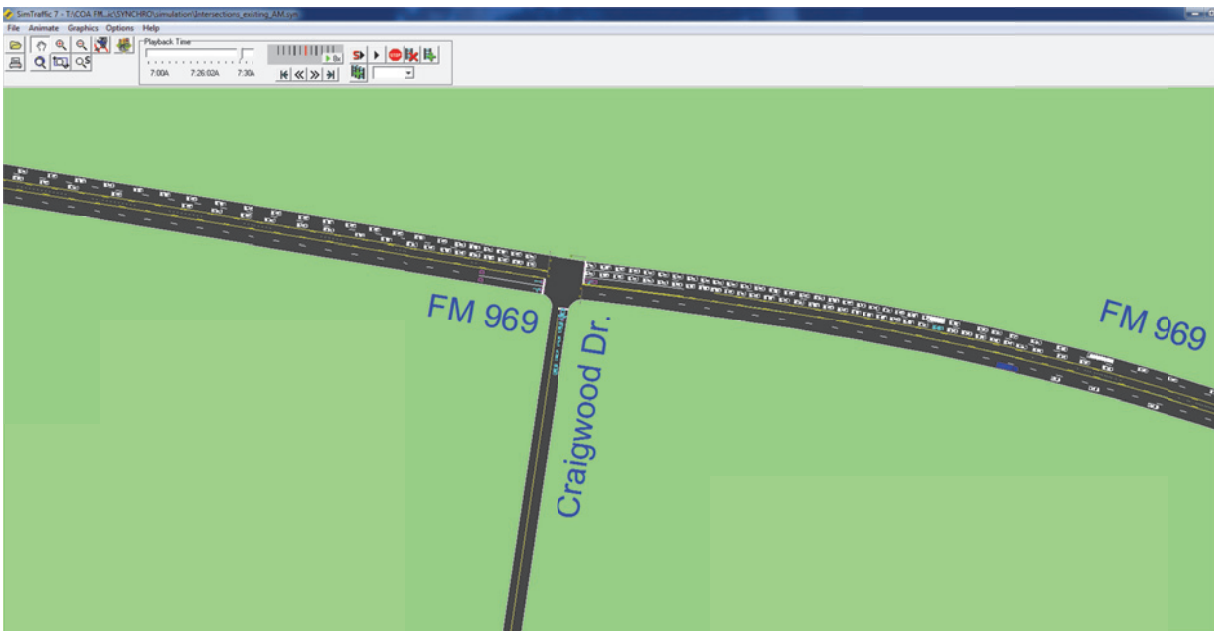
⁺ TWSC – two-way stop control

The above table shows that the intersections of FM 969 at US 183 frontage roads, Decker Lane and Hunters Bend Road all operate at unsatisfactory level of service (F) during the peak hours. This is consistent with our field observations. The intersection of FM 969 and SH 130 frontage roads is getting close to its capacity under STOP control which indicates a traffic signal may be needed in the near future. The traffic signal at Gilbert Road and FM 969 needs to be changed to operate full day with the planned south leg of Gilbert Road.

It should be noted that SYNCHRO, based on the HCM methodology, does not account for “spill-back” or “lane-blocking” from queue at downstream intersection. The actual performance of an intersection may be worse than predicted by the Synchro Report. An example is the intersections of FM 969 at Craigwood Drive. Because the westbound movement during the AM peak hours is heavily affected by the congestion at US 183, field observation shows significant delay and slow speed for westbound movement between US 183 and Jonny Morris even though SYNCHRO analysis reports satisfactory LOS for the overall intersection. Multiple simulation runs were conducted with the animation tool in Synchro – SimTraffic to record more measure of effectiveness for this intersection as shown in **Table 4**. In addition, **Figure 6** shows a snapshot of the westbound queue on FM 969 during AM peak period which is more consistent with the field condition.

Table 4 Intersection Delay and Speed at Craigwood (2011 AM Peak)

Approach	EB	WB	NB	All
Delay per vehicle (seconds)	4.6	52.9	48.7	34.2
Average speed (mph)	45	15	6	16

Figure 6 Snapshot of SimTraffic Animation at FM 969 and Craigwood Drive (AM Peak)

4. Existing Condition Analysis – Roadway Segment

The LOS for selected segments of FM 969 in the study area was analyzed using the Highway Capacity Software (HCS+ T7F) which is based on methods suggested in the HCM. **Table 5** summarizes the existing roadway traffic condition analysis results and also includes number of lanes, daily volume, peak-hour volume, and LOS. Detailed analysis is included in **Appendix C**.

Table 5 Two-way Roadway Capacity Analysis for Existing Condition (2011)

	Number of Lanes	ADT Volume	Peak Hour Volume		LOS
			AM	PM	
B/W Johnny Morris and Decker Lane	4 lanes ¹	24,460	2,181	2,210	C
B/W Decker Lane and FM 973	4 lanes ¹	16,915	1,576	1,652	B
B/W FM 973 and SH 130	2 lanes ²	15,732	1,414	1,388	E
B/W SH 130 and Hunters Bend Road	2 lanes ³	16,235	1,336	1,462	E
B/W Taylor Lane and Webberville	2 lanes ²	4,095	423	384	C

¹ Some sections with an additional two-way left-turn lane.

² The two-lane section between FM 973 and SH 130.

³ The two-lane section between Hound Dog Trail and Hunters Bend Road that has a two-way-left-turn-lane.

5. Next Steps: Improvement Options

The next phase of the FM 969 Corridor Study is to develop includes improvement alternates for the FM 969 corridor in the short-, medium- and long-term period.