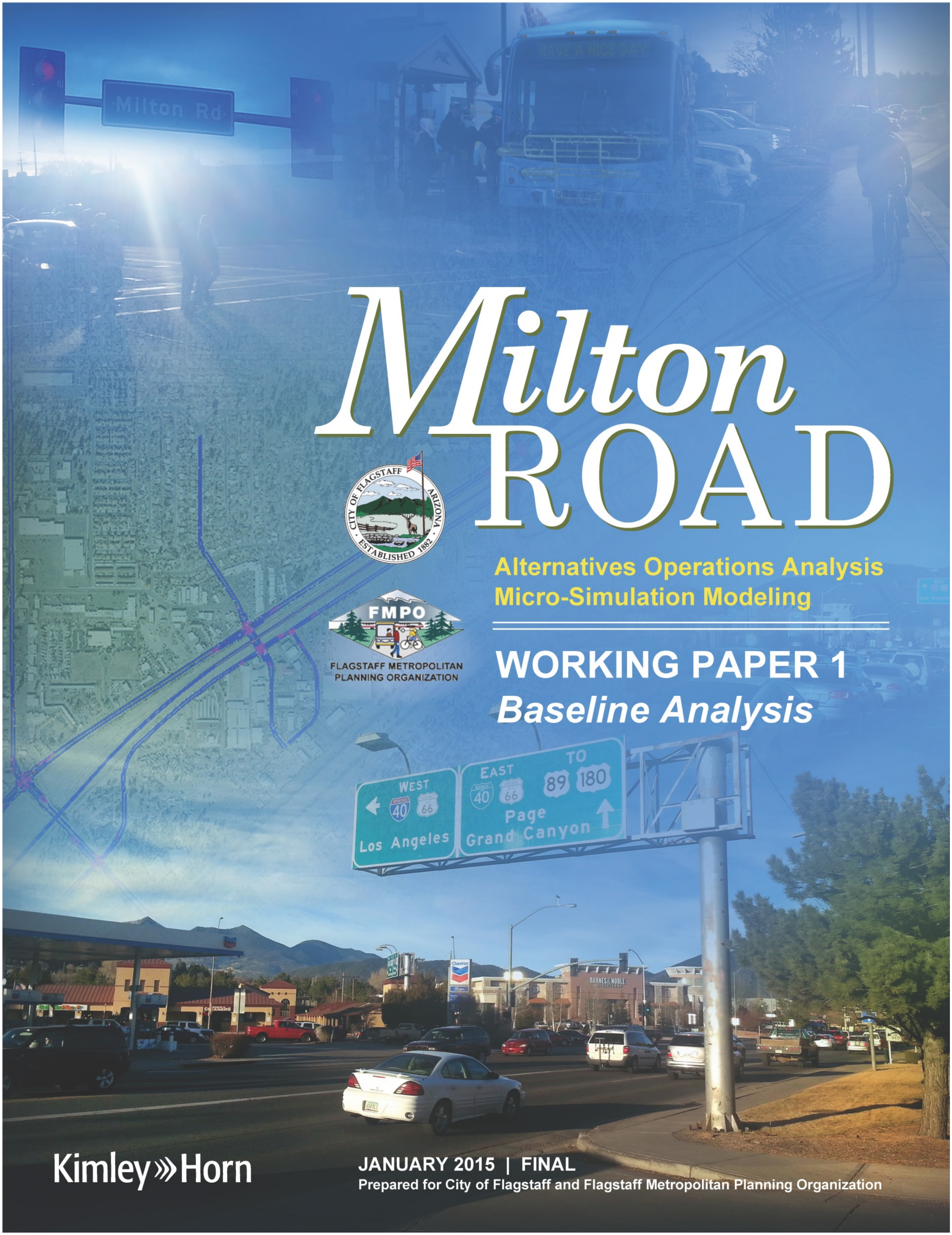

Milton ROAD

Alternatives Operations Analysis
Micro-Simulation Modeling

FLAGSTAFF METROPOLITAN PLANNING ORGANIZATION

WORKING PAPER 1
Baseline Analysis

Kimley»Horn

JANUARY 2015 | FINAL

Prepared for City of Flagstaff and Flagstaff Metropolitan Planning Organization

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PROJECT BACKGROUND

As Flagstaff has developed and evolved, the Milton Road/ Route 66/Business Route 40 corridor has transitioned from a state highway primarily serving regional vehicular traffic to a multi-functional roadway that also serves local pedestrian, bicycle, and transit travel and adjacent land uses. As an example, Milton Road serves a statewide function as it provides access to the Grand Canyon, a regional function as it connects to Northern Arizona University (NAU), and a local function as it serves businesses located along the corridor. Milton Road is used by vehicles, transit, bicyclists, and pedestrians. Inherent in a multi-functional roadway are competing priorities, be it regional traffic mobility vs. local access or vehicular capacity vs. multimodal accommodations. These competing priorities, combined with existing corridor constraints, have resulted in operational and safety issues on Milton Road that need to be addressed.

Many previously completed plans and studies have made recommendations or identified opportunities for ways to improve the Milton Road corridor. These documents include:

- Flagstaff Regional Land Use and Transportation Plan (2001)
- Flagstaff Urban Mobility Study (2004)
- Flagstaff Metropolitan Planning Organization (FMPO) Regional Transportation Plan Update: Safety Component (2008)
- FMPO Regional Transportation Plan 2030 (2009)
- FMPO U.S. 180 Winter Congestion Study (2012)
- Flagstaff Regional 5-Year and Long-Range Transit Plan (2013)
- Flagstaff Regional Plan 2030 (2014 – update to 2001 Plan)

Most of these previously completed documents utilized a variety of qualitative and quantitative criteria to evaluate a wide range of potential improvement alternatives. These evaluations were typically presented to stakeholders and public for review and input and refined and prioritized accordingly.

This project will be informed by these previously completed projects but will differ from them in that it will be a more technical evaluation measured primarily in quantifiable terms derived from micro-simulation models. This project also will not include extensive stakeholder and public involvement as the goal is to determine the operational effectiveness of alternative mobility treatments for a technical audience. The findings from this project will be incorporated into a more detailed corridor study that the Flagstaff Metropolitan Planning Organization (FMPO) plans to conduct in the future that will include more extensive stakeholder and public involvement.

PROJECT PURPOSE AND OBJECTIVES

The purpose of this project is to assess the operational effectiveness of alternative mobility treatments for the Milton Road/Route 66/Business Route 40 corridor (including cross-streets) between I-17 and San Francisco Street. Project objectives include:

- Document existing and planned conditions for inclusion in the micro-simulation modeling
- Develop and calibrate an existing condition baseline micro-simulation baseline model
- Develop a future condition baseline micro-simulation baseline model
- Determine appropriate measures of effectiveness such as delay, queues, and travel time
- Use micro-simulation modeling to evaluate and document the performance of various improvement alternatives that represent different combinations of access management treatments, transit service patterns, and intersection configurations
- Provide preliminary materials to the FMPO Technical Advisory Committee (TAC) for review and input
- Present the findings to established boards, commissions, and committees as well as to ADOT Flagstaff District personnel and obtain their input
- Document the findings of the alternatives evaluation in such a manner that they can easily be incorporated into the planned corridor study for Milton Road

PROJECT STUDY AREA

The project study area is the Milton Road/Route 66/Business Route 40 corridor between I-17 and San Francisco Street. The project vicinity and key study area intersections are shown in **Figure 1**.

PROJECT REVIEW TEAM

The project review team (PRT) for this project is the FMPO TAC. This committee is comprised of representatives from the City of Flagstaff, Coconino County, Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA), and Arizona Department of Transportation (ADOT).

COLLECTION AND REVIEW OF DATA

Data collected for input into the VISSIM and Synchro simulation models was provided by FMPO, City of Flagstaff, ADOT, and NAIPTA, or was collected directly by Kimley-Horn. This data includes the following items:

- Previously completed plans and studies
- Historical Fall PM peak hour intersection movement counts
- New Fall PM peak hour intersection counts conducted by FMPO
- Pedestrian and bicycle volumes
- Train frequency and crossing closure durations
- Travel time data
- Information pertaining to transit routes, stops and frequencies
- Traffic signal timing cards
- Traffic signal coordination data sheets
- Field visit to confirm timing data and visually assess the corridor during PM peak hour conditions

MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
STUDY AREA VICINITY MAP

FIGURE 1

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DEVELOPMENT OF EXISTING CONDITION BASELINE VISSIM AND SYNCHRO MODELS

A VISSIM model developed as part of another project that contained the northern portion of the study area was provided by FMPO. A Synchro model that contained parts of the middle and southern portion of the study area was provided by the City of Flagstaff. These partial models were used as a basis for creating complete existing condition baseline models of the entire study corridor using both software packages.

Existing signal timing data information and lane configuration information was coded into the models. A field review of the corridor during the PM peak period on Wednesday, September 10 was completed to confirm existing conditions. The existing condition baseline lane configurations are shown in **Figure 2**.

DEVELOPMENT OF EXISTING CONDITION BASELINE DESIGN HOURLY VOLUMES

The Fall PM peak hour traffic period from 5:00PM-6:00PM was chosen as the design hour. The existing peak hour traffic counts were balanced between intersections at 15 minute intervals. This was done using the volume balancing feature in Synchro. If the upstream and downstream intersections were closely spaced, then the volumes were balanced directly between the two intersections. However, if the intersections were farther apart, with multiple access points between them, a right-in/right-out only dummy node or driveway was used to balance the traffic volumes between these intersections, thus preserving the actual count volumes at these locations. The balanced existing condition baseline design hourly volumes shown in **Figure 3** were then used as inputs into the existing condition baseline VISSIM and Synchro models.

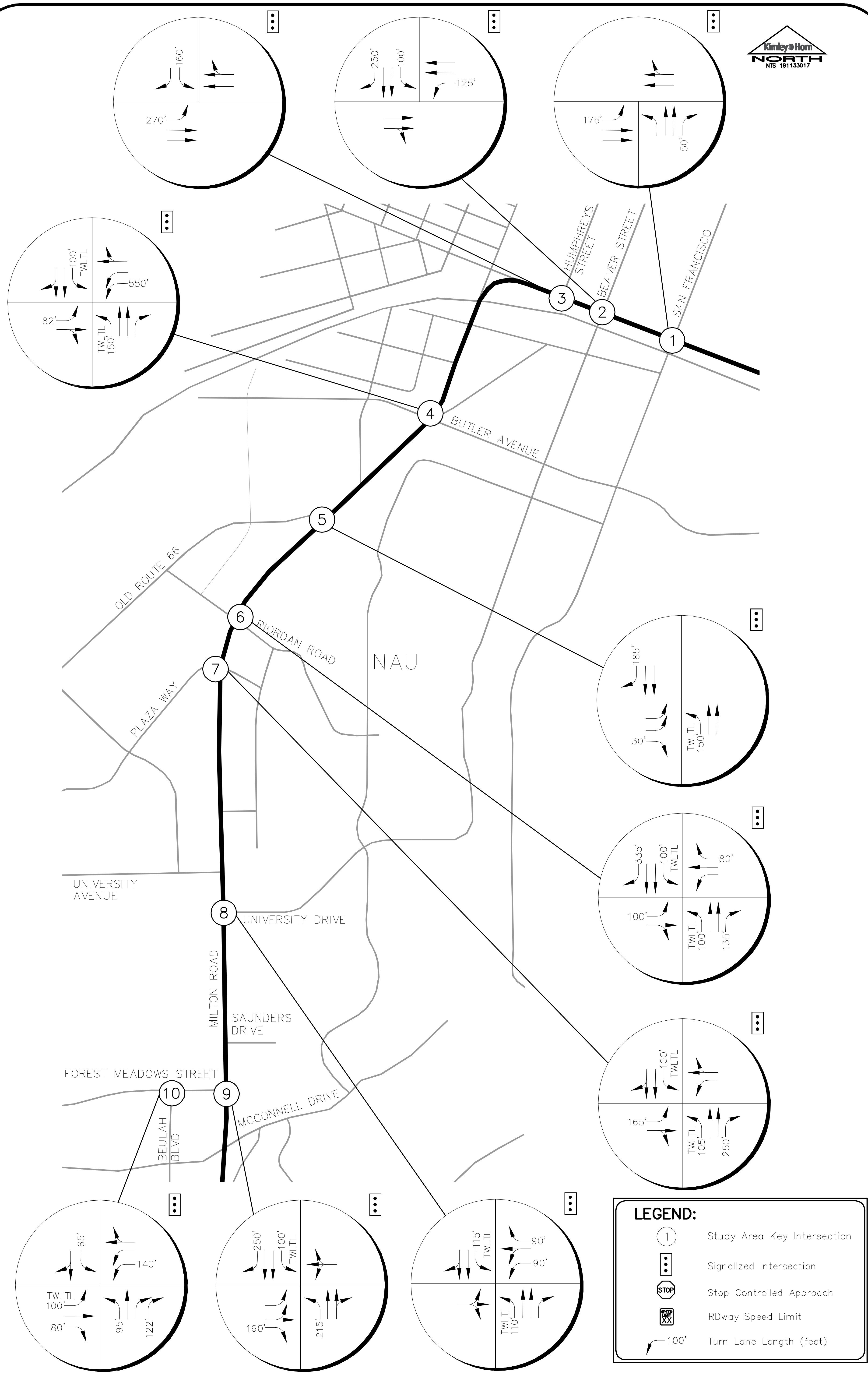
CALIBRATION OF EXISTING CONDITION BASELINE VISSIM AND SYNCHRO MODELS

The aforementioned field review of the corridor during the PM peak period was completed to aid in calibrating the existing condition baseline models by comparing results from the models with what was observed in the field in terms of delay, queues, and intermodal interactions.

The VISSIM model is the primary model for this study because of its capability to model interactions between vehicles, trains, buses, pedestrians, and bicyclists and to model queue delay and interactions in oversaturated conditions. As such, most of the calibration effort concentrated on getting the existing condition baseline VISSIM model to reflect existing conditions with reasonable accuracy.

The following steps were taken to help calibrate the existing condition baseline VISSIM model:

- A more cooperative lane change behavior was created for congested arterial links, such as southbound Milton Road between Route 66 and Humphreys Street and northbound Milton Road between Butler Avenue and Route 66.
- The peak hour existing counts and 15-minute seeding volumes were balanced along Milton Road in 15-minute intervals.



MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
EXISTING CONDITION BASELINE LANE CONFIGURATIONS

FIGURE 2

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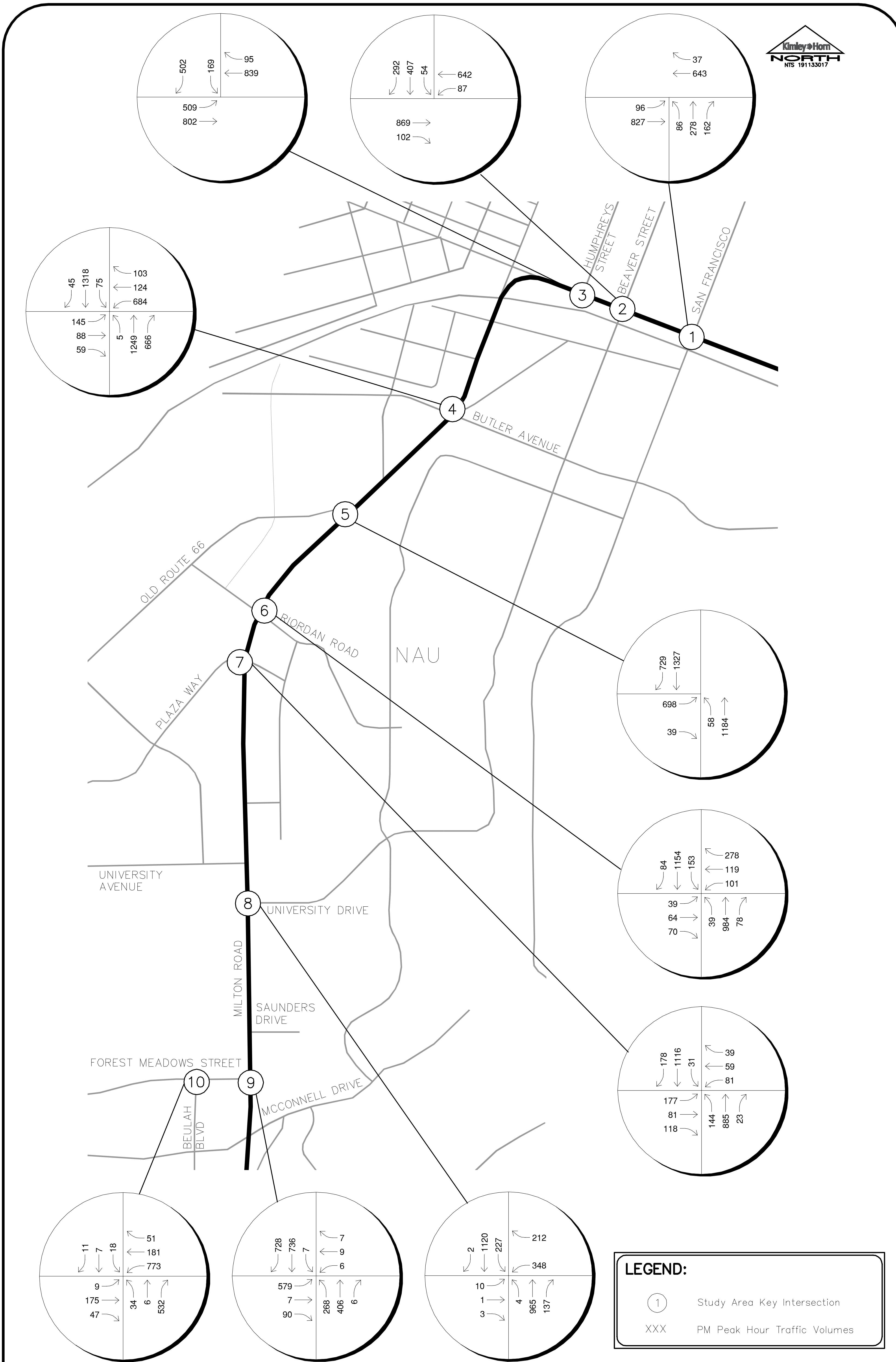

MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
EXISTING CONDITION BASELINE PM PEAK HOUR DESIGN VOLUMES

FIGURE 3

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- Lane change distance for the southbound right-turn at Milton Road/Route 66 was modified to reflect the existing imbalance in lane utilization as during congested times traffic shifts to the outside through lane early to ensure easy access to the right-turn lane at Route 66.
- Pedestrian volumes at signalized intersections were updated to model the field observation that there were pedestrians crossing almost every cycle at signalized intersections in the study area.
- Permissive left-turn and right-turn gap acceptance at high volume locations, such as the eastbound left-turn at Milton Road/Humphreys Street, were adjusted to better reflect observed conditions.
- Keep-clear zones were included for driveways and intersections along southbound Milton Road between Route 66 and Humphreys Street.
- The default VISSIM car-following parameters (Wiedemann 74 for arterial) were not modified because the default parameters produce good representation of the existing saturation flow rate.
- Five (5) simulation runs (sample size) with different random seeds were determined to be sufficient to provide 95% confidence level for model output randomness (sample error)

The existing condition baseline VISSIM model calibration achieved the following targets derived from the *FHWA Traffic Analysis Toolbox Volume III* calibration guidelines produced in July 2004:

- Volume percentage difference:
  - Simulated and measured link approach volumes are within 15% of each other for more than 85% of links
  - Sums of simulated and measured link approach volumes within the calibration area are within 5% of each other
- Travel time
  - Average northbound model travel time along Milton Road from south of Forest Meadows Street to east of San Francisco Street is within 7% of field measured travel time
  - Average southbound model travel time along Milton Road from east of San Francisco Street to south of Forest Meadows Street is within 3% of field measured travel time
- Existing condition baseline VISSIM model runs were observed to represent field conditions in terms of:
  - Signal operations
  - Pedestrian activities at intersections
  - Locations of bottlenecks or critical movements
  - Patterns and extent of queues at intersection and congested links
  - Lane utilization/choice

While the model calibrated well overall, there are specific movements that did not calibrate quite as well, most notably the following:

- Eastbound movements at Milton Road/Butler Avenue – modeled queues were much longer than observed queues, likely due to modeled right-turn volumes not turning right if the downstream southbound queue on Milton Road backs up to the intersection whereas field observations noted eastbound right-turning vehicles joining the downstream southbound queue, even if it meant they partially blocked part of the intersection
- Westbound movements at Milton Road/Riordan – modeled queues were much shorter than observed queues, likely due to westbound traffic volumes being lighter the day the intersection volumes were counted compared to the day the field observation was conducted

These movements that did not calibrate well are lower-volume, less-critical movements from a corridor perspective. As such, these discrepancies are not anticipated to have a significant impact on the corridor analysis findings.

Once the existing condition baseline VISSIM model was calibrated, the existing condition baseline Synchro model was calibrated to generally approximate the overall intersection level of service and delay calculated by VISSIM so that the Synchro model can be used to test improvement alternatives (as Synchro is more efficient than VISSIM at testing alternatives). It should be noted that the queue lengths in Synchro are generally not as long as the VISSIM model queue lengths due to Synchro not being able to model queue delay and interactions in oversaturated conditions as well as VISSIM.

The following steps were taken to help calibrate the existing condition baseline Synchro model:

- Reduced the saturation flow rate from 1900 vehicles per hour of green (vphg) to 1700 vphg
- Reduced the link speeds from 30 miles per hour (mph) to 20 mph
- Reduced the southbound through lane utilization factor at Milton Road/Route 66 from 0.95 to 0.70 to account for observed lane imbalance
- Reduced the southbound through lane utilization factor at Milton Road/Butler Avenue from 0.95 to 0.80 to account for observed lane imbalance

EXISTING CONDITION BASELINE VISSIM MODEL MEASURES OF EFFECTIVENESS

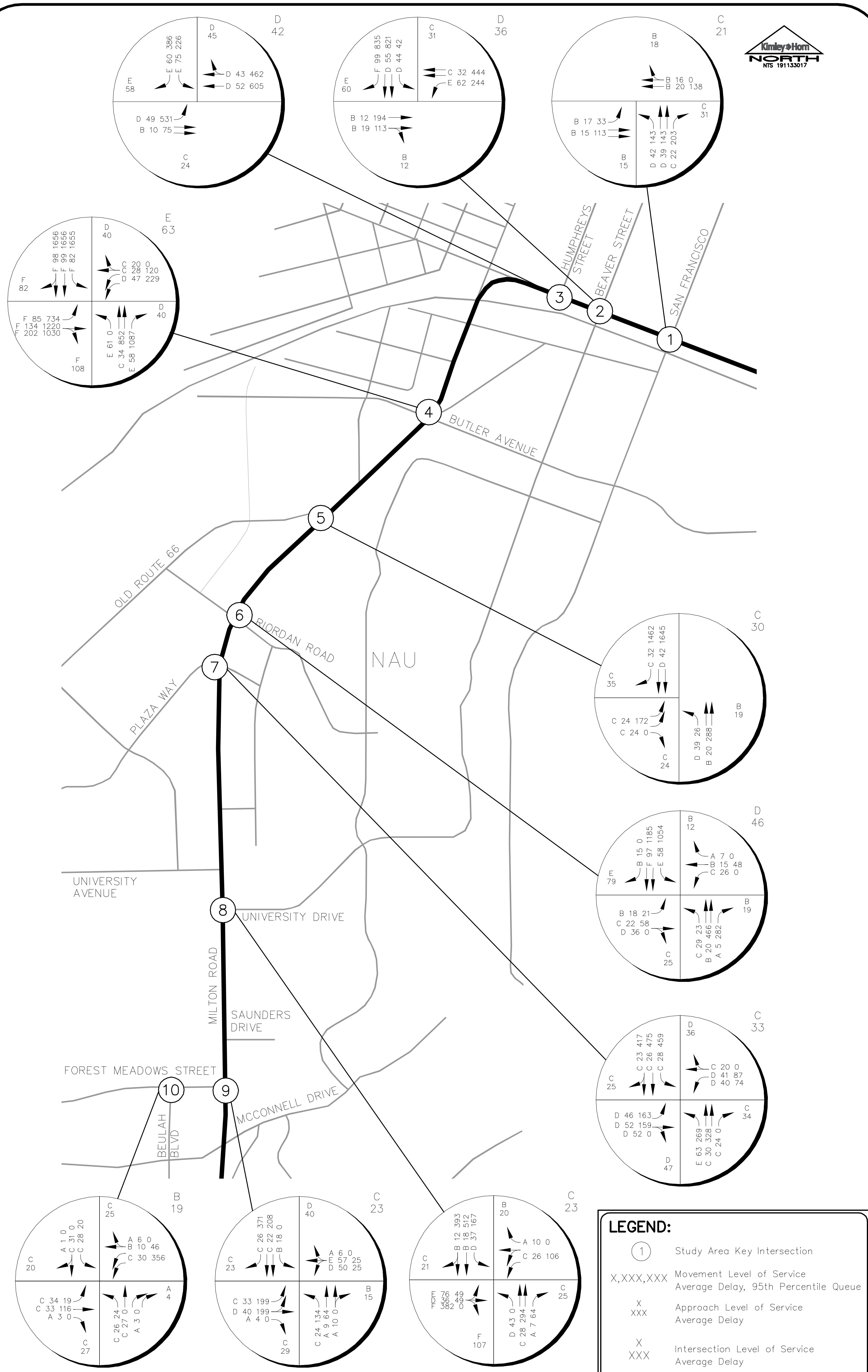
Table 1 shows the intersection measures of effectiveness (MOEs) derived from the existing condition baseline VISSIM model. These same MOEs are also shown graphically in **Figure 4**. The MOEs consist of level of service (LOS), average delay per vehicle (in seconds), and 95th percentile queue length (in feet). LOS is related to average delay per vehicle as follows: LOS A: 0-10, LOS B: 10-20, LOS C: 20-35, LOS D: 35-55, LOS E: 55-80, and LOS F: 80+.

Table 2 shows the network MOEs derived from the existing condition baseline VISSIM model.

Table 1: Existing Condition Baseline Intersection Measures of Effectiveness

Intersection	NB Approach				EB Approach				SB Approach				WB Approach				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Milton Rd/San Francisco St																	
LOS	D	D	C	C	B	B	-	B	-	-	-	-	-	B	B	B	C
Average Delay (s)	42	39	22	31	17	15	-	15	-	-	-	-	-	20	16	18	21
95% Queue (ft)	143	143	203	-	33	113	-	-	-	-	-	-	-	138	0	-	-
Milton Rd/Beaver St																	
LOS	-	-	-	-	-	B	B	B	D	D	F	E	E	C	-	C	D
Average Delay (s)	-	-	-	-	-	12	19	12	44	55	99	60	62	32	-	31	36
95% Queue (ft)	-	-	-	-	-	194	113	-	42	821	835	-	244	444	-	-	-
Milton Rd/Humphreys St																	
LOS	-	-	-	-	D	B	-	C	E	-	E	E	-	D	D	D	D
Average Delay (s)	-	-	-	-	49	10	-	24	75	-	60	58	-	52	43	45	42
95% Queue (ft)	-	-	-	-	531	75	-	-	226	-	386	-	-	605	462	-	-
Milton Rd/Butler Ave																	
LOS	E	C	E	D	F	F	F	F	F	F	F	F	D	C	C	D	E
Average Delay (s)	61	34	58	40	85	134	202	108	82	99	98	82	47	28	20	40	63
95% Queue (ft)	0	852	1087	-	734	1220	1030	-	1655	1656	1656	-	229	120	0	-	-
Milton Rd/Route 66																	
LOS	D	B	-	B	C	-	C	C	-	D	C	C	-	-	-	-	C
Average Delay (s)	39	20	-	19	24	-	24	24	-	42	32	35	-	-	-	-	30
95% Queue (ft)	26	288	-	-	172	-	0	-	-	1645	1462	-	-	-	-	-	-
Milton Rd/Riordan Rd																	
LOS	C	B	A	B	B	C	D	C	E	F	B	E	C	B	A	B	D
Average Delay (s)	29	20	5	19	18	22	36	25	58	97	15	79	26	15	7	12	46
95% Queue (ft)	23	466	282	-	21	58	0	-	1054	1185	0	-	0	48	0	-	-
Milton Rd/Plaza Way																	
LOS	E	C	C	C	D	D	D	D	C	C	C	C	D	D	C	D	C
Average Delay (s)	63	30	24	34	46	52	52	47	28	26	23	25	40	41	20	36	33
95% Queue (ft)	269	328	0	-	163	159	0	-	459	475	417	-	74	87	0	-	-
Milton Rd/University Dr																	
LOS	D	C	A	C	E	D	F	F	D	B	B	C	C	-	A	B	C
Average Delay (s)	43	28	7	25	76	36	382	107	37	18	12	21	26	-	10	20	23
95% Queue (ft)	0	294	64	-	49	49	0	-	167	512	393	-	106	106	0	-	-
Milton Rd/Forest Meadows St																	
LOS	C	A	A	B	C	D	A	C	B	C	C	C	D	E	A	D	C
Average Delay (s)	24	9	10	15	33	40	4	29	18	22	26	23	50	57	6	40	23
95% Queue (ft)	134	64	0	-	199	199	0	-	0	208	371	-	25	25	0	-	-
Forest Meadows St/Beulah Blvd																	
LOS	C	C	A	A	C	C	A	C	C	C	A	C	C	B	A	C	B
Average Delay (s)	26	27	3	4	34	33	3	27	28	31	1	20	30	10	6	25	19
95% Queue (ft)	24	0	0	-	19	116	0	-	20	0	0	-	356	46	0	-	-

Level of Service definitions in seconds per vehicle: A≤10, B >10-20, C>20-35, D>35-55, E>55-80, F>80



MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
EXISTING CONDITION
BASELINE INTERSECTION MEASURES OF EFFECTIVENESS

FIGURE 4

Kimley-Horn

Table 2: Existing Condition Baseline Network Measures of Effectiveness

Network	Number of Vehicles	11,072
	Total Travel Time (h)	752
	Total Distance (mi)	10,410
	Total Delay (h)	407
Per Vehicle	Average Northbound Speed (mph)	17
	Average Southbound Speed (mph)	11
	85th Percentile Northbound Speed (mph)	25
	85th Percentile Southbound Speed (mph)	22
	Average Northbound Travel Time (s)	448
	Average Southbound Travel Time (s)	755
	Average Delay (s)	132
	Average Number of Stops	4
	Average Stop Delay (s)	69

IDENTIFIED DEFICIENCIES PER EXISTING CONDITION BASELINE VISSIM MODEL

A review of the existing condition baseline VISSIM model MOEs identified the following general study area corridor deficiencies:

- Intersection LOS E at Milton Road/Butler Avenue
- Excessive (i.e., greater than 1,000 feet) southbound queuing on Milton Road between Plaza Way and Route 66
- Excessive southbound queuing on Milton Road between Route 66 and Beaver Street
- Excessive northbound queuing at Milton Road/Butler Avenue
- Inefficient traffic signal phasing and coordination – constrained by pedestrian crossing times
- Vehicle queuing adversely impacts bus travel times and maneuverability
- Long distances between some signalized pedestrian crossings
- No dedicated bicycle facilities
- Uncontrolled access and driveways spaced close together

DEVELOPMENT OF FUTURE CONDITION BASELINE VISSIM AND SYNCHRO MODELS

The future condition baseline VISSIM and Synchro models incorporate existing conditions plus the following committed/programmed improvements:

- Extend Beulah Boulevard to University Avenue
- Realign and connect University Avenue and University Drive at Milton Road and update the signal phasing and timing to accommodate the new geometric configuration
- Add a southbound right-turn lane on Milton Road at Plaza Way
- Change Bus Route 4 (southbound on Milton Road) from 30-minute headways to 20-minute headways

- Adjust the traffic signal timing splits to reflect the likelihood that signal timing changes would occur if volumes increased significantly. This does not include changes to signal phasing, cycle lengths, or coordination offsets.

The future condition baseline lane configurations are shown in **Figure 5**.

DEVELOPMENT OF FUTURE CONDITION BASELINE DESIGN HOURLY VOLUMES

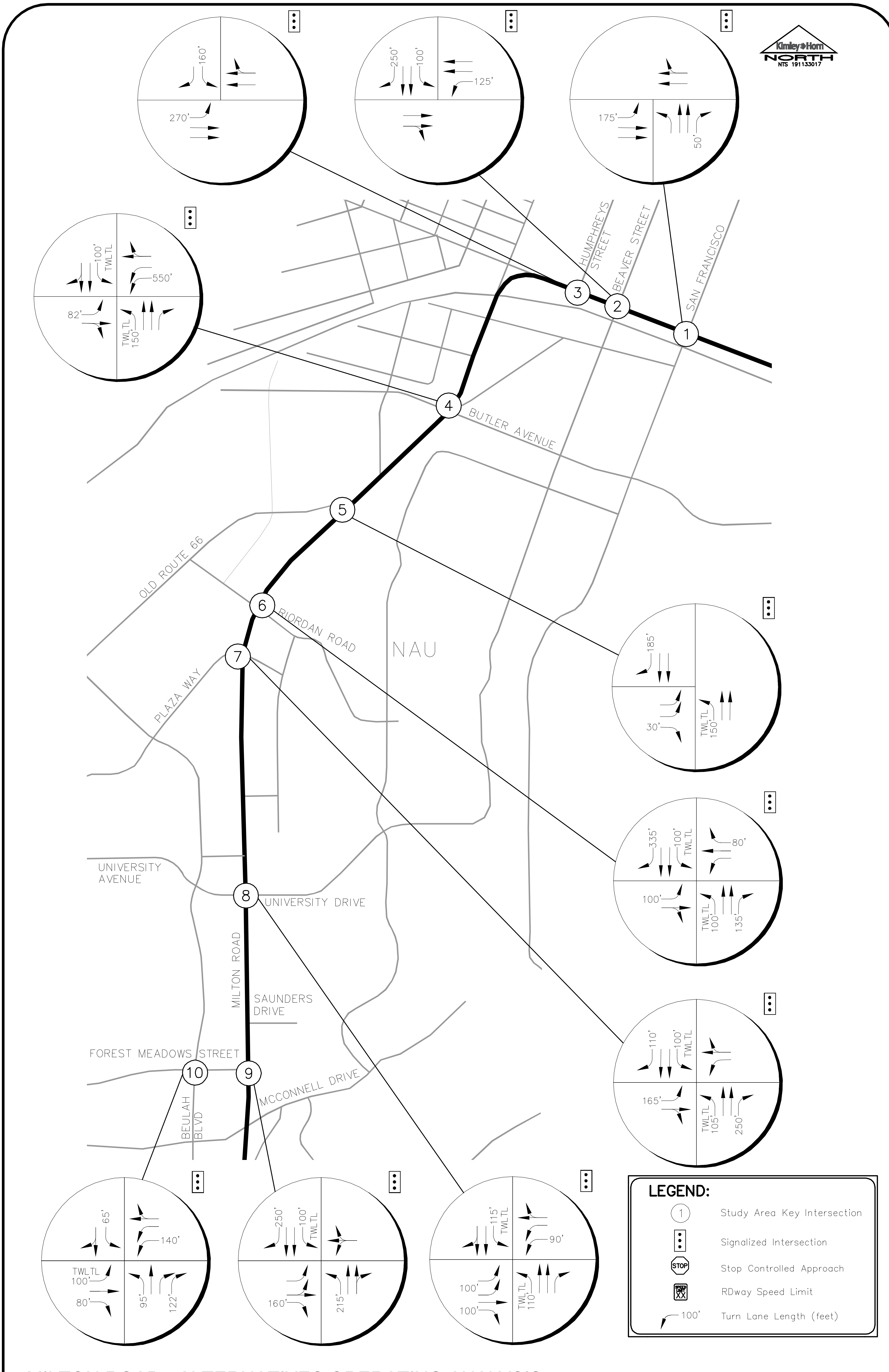
In conjunction with the FMPO TAC, it was determined that future condition baseline design hourly volumes should reflect a 20% growth over existing volumes rather than a specific horizon year. Not using a specific horizon year removes the issue of trying to predict when growth will occur and instead looks at the scenario when traffic grows by 20% – whatever timeframe that may be in.

The 20% growth also acts as a sensitivity analysis for existing volumes in that if there are seasonal peaks that approach a 20% increase over typical Fall volumes, the 20% growth provides a sense of how the network will operate under those seasonal peak conditions.

The 20% value was derived after reviewing historical volumes on Milton and Route 66 over the last five years (per the ADOT Traffic Data Management System (TDMS) website). There was not a consistent pattern of growth from year to year at the same location, nor a consistent pattern of growth between locations, but the average annual growth was generally in the 1%-3% range. The 20% growth factor is equivalent to 1% growth over 18 years, or 2% growth over 9 years, or 3% growth over 6 years. These timeframes (6-18 years) align with the desired timeframe of this study being the near- and mid-term future rather than the long-term future because the focus of this analysis is on operational improvements rather than large-scale network changes.

The extension of Beulah Boulevard to University Avenue and the realignment of University Avenue/University Drive will alter travel patterns in the vicinity of these improvements. The FMPO travel demand model was utilized to estimate how traffic volumes will change once these improvements are implemented. New PM peak hour volumes at the Milton Road/University Drive intersection and adjacent intersections were developed in conjunction with FMPO.

The existing condition baseline design hourly volumes were updated to account for the programmed Beulah/University improvements, grown by 20%, and rebalanced between intersections, thereby creating the future condition baseline design hourly volumes. The future condition baseline design hourly volumes shown in **Figure 6** were then used as inputs into the future condition baseline VISSIM and Synchro models.



MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
FUTURE CONDITION BASELINE LANE CONFIGURATIONS

FIGURE 5

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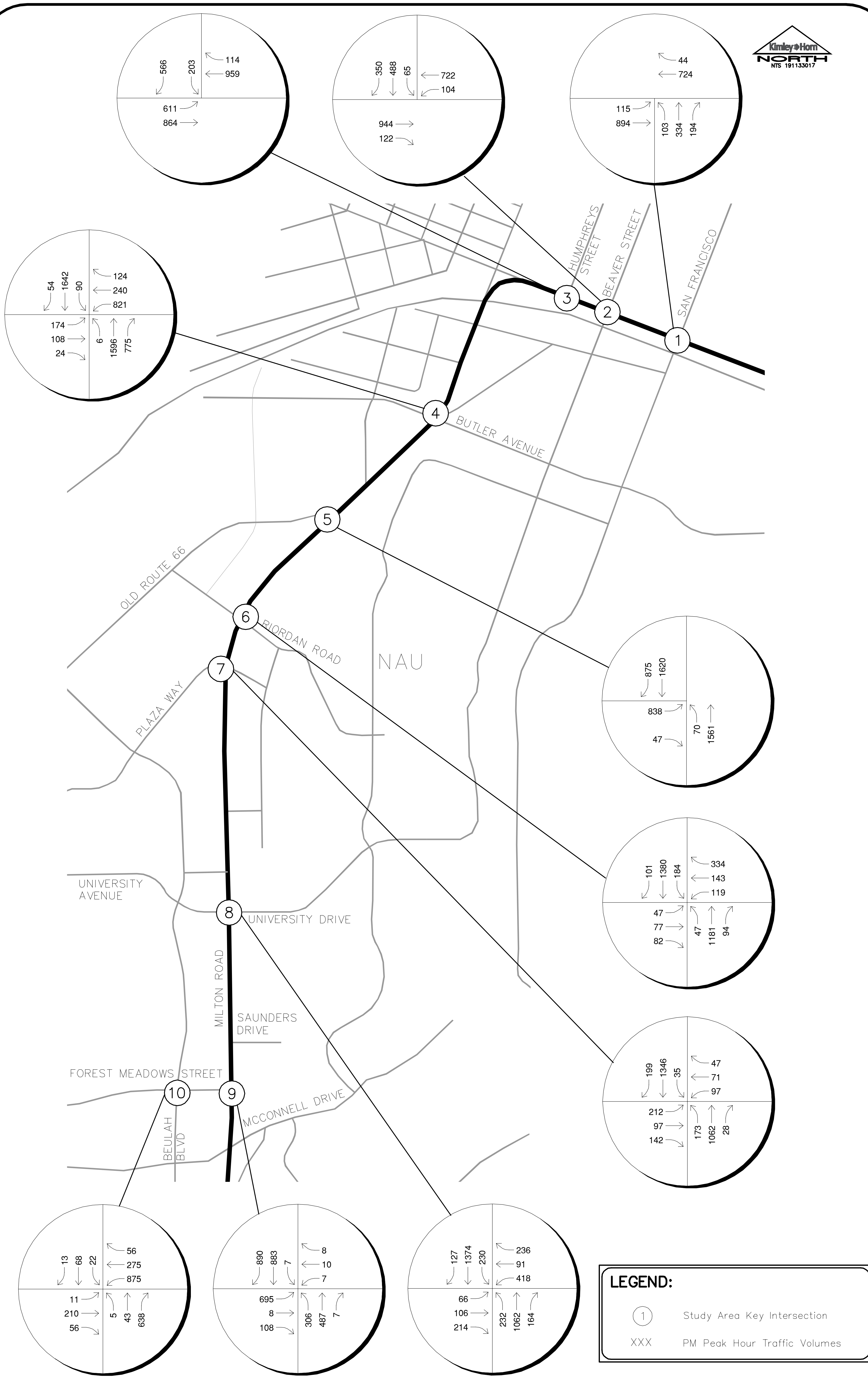

MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
FUTURE CONDITION BASELINE PM PEAK HOUR DESIGN VOLUMES

FIGURE 6

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FUTURE CONDITION BASELINE VISSIM MODEL MEASURES OF EFFECTIVENESS

Table 3 shows the intersection MOEs derived from the future condition baseline VISSIM model. These same MOEs are also shown graphically in **Figure 7**. Similar to the existing condition, the future condition baseline MOEs consist of LOS, average delay per vehicle (in seconds), and 95th percentile queue length (in feet).

Table 4 shows the network MOEs derived from the future condition baseline VISSIM model.

Table 5 shows a summary of the intersection MOEs derived from the existing and future condition baseline VISSIM models for comparison purposes.

IDENTIFIED DEFICIENCIES PER FUTURE CONDITION BASELINE VISSIM MODEL

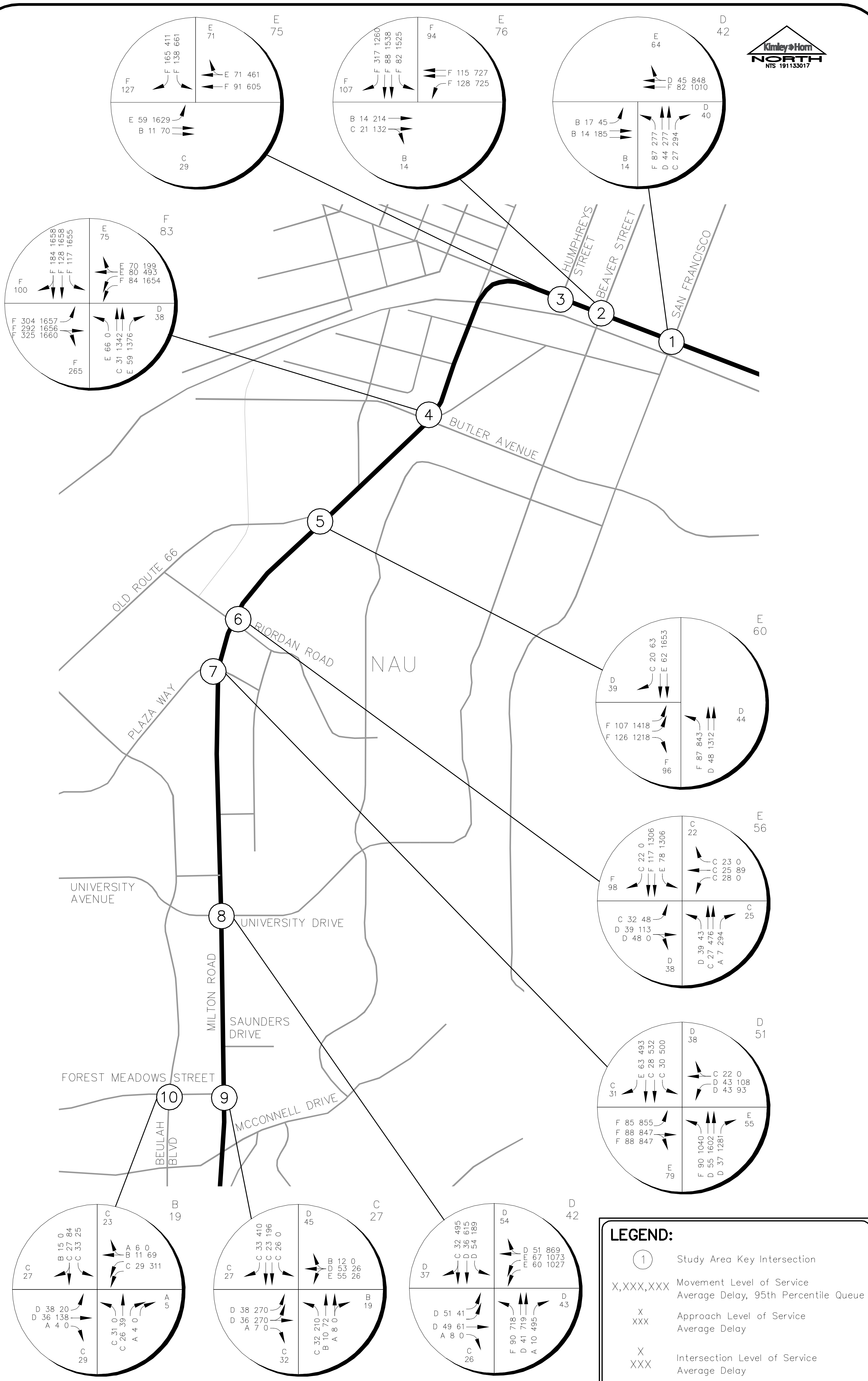
A review of the future condition baseline VISSIM model MOEs identified the following general study area corridor deficiencies that are *in addition* to the deficiencies previously identified from the existing condition baseline VISSIM model MOEs:

- Intersection LOS E at Milton Road/Beaver Street, Milton Road/Humphreys Street, Milton Road/Route 66, and Milton Road/Riordan Road
- Intersection LOS F at Milton Road/Butler Avenue
- Excessive westbound queuing at Milton Road/San Francisco Street
- Excessive southbound queuing at Milton Road/Beaver Street
- Excessive eastbound queuing at Milton Road/Humphreys Street
- Excessive northbound and eastbound queuing at Milton Road/Route 66
- Excessive northbound queuing at Milton Road/Plaza Way
- Excessive westbound queuing at Milton Road/University Drive

Table 3: Future Condition Baseline Intersection Measures of Effectiveness

Intersection	NB Approach				EB Approach				SB Approach				WB Approach				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Milton Rd/San Francisco St																	
LOS	F	D	C	D	B	B	-	B	-	-	-	-	-	F	D	E	D
Average Delay (s)	87	44	27	40	17	14	-	14	-	-	-	-	-	82	45	64	42
95% Queue (ft)	277	277	294	-	45	185	-	-	-	-	-	-	-	1010	848	-	-
Milton Rd/Beaver St																	
LOS	-	-	-	-	-	B	C	B	F	F	F	F	F	F	-	F	E
Average Delay (s)	-	-	-	-	-	14	21	14	82	88	317	107	128	115	-	94	76
95% Queue (ft)	-	-	-	-	-	214	132	-	1525	1538	1260	-	725	727	-	-	-
Milton Rd/Humphreys St																	
LOS	-	-	-	-	E	B	-	C	F	-	F	F	-	F	E	E	E
Average Delay (s)	-	-	-	-	59	11	-	29	138	-	165	127	-	91	71	71	75
95% Queue (ft)	-	-	-	-	1629	70	-	-	661	-	411	-	-	605	461	-	-
Milton Rd/Butler Ave																	
LOS	E	C	E	D	F	F	F	F	F	F	F	F	F	E	E	E	F
Average Delay (s)	66	31	59	38	304	292	325	265	117	128	184	100	84	80	70	75	83
95% Queue (ft)	0	1342	1376	-	1657	1656	1660	-	1655	1658	1658	-	1654	493	199	-	-
Milton Rd/Route 66																	
LOS	F	D	-	D	F	-	F	F	-	E	C	D	-	-	-	-	E
Average Delay (s)	87	48	-	44	107	-	126	96	-	62	20	39	-	-	-	-	60
95% Queue (ft)	843	1312	-	-	1418	-	1218	-	-	1653	63	-	-	-	-	-	-
Milton Rd/Riordan Rd																	
LOS	D	C	A	C	C	D	D	D	E	F	C	F	C	C	C	C	E
Average Delay (s)	39	27	7	25	32	39	48	38	78	117	22	98	28	25	23	22	56
95% Queue (ft)	43	476	294	-	48	113	0	-	1306	1306	0	-	0	89	0	-	-
Milton Rd/Plaza Way																	
LOS	F	D	D	E	F	F	F	E	C	C	E	C	D	D	C	D	D
Average Delay (s)	90	55	37	55	85	88	88	79	30	28	63	31	43	43	22	38	51
95% Queue (ft)	1040	1602	1281	-	855	847	847	-	500	532	493	-	93	108	0	-	-
Milton Rd/University Dr																	
LOS	F	D	A	D	D	D	A	C	D	D	C	D	E	E	D	D	D
Average Delay (s)	90	41	10	43	51	49	8	26	54	36	32	37	60	67	51	54	42
95% Queue (ft)	718	719	495	-	41	61	0	-	189	615	495	-	1027	1073	869	-	-
Milton Rd/Forest Meadows St																	
LOS	C	B	A	B	D	D	A	C	C	C	C	C	E	D	B	D	C
Average Delay (s)	32	10	8	19	38	36	7	32	26	23	33	27	55	53	12	45	27
95% Queue (ft)	210	72	0	-	270	270	0	-	0	196	410	-	26	26	0	-	-
Forest Meadows St/Beulah Blvd																	
LOS	C	C	A	A	D	D	A	C	C	C	B	C	C	B	A	C	B
Average Delay (s)	31	26	4	5	38	36	4	29	33	27	15	27	29	11	6	23	19
95% Queue (ft)	0	39	0	-	20	138	0	-	25	84	0	-	311	69	0	-	-

Level of Service definitions in seconds per vehicle: A≤10, B >10-20, C>20-35, D>35-55, E>55-80, F>80



MILTON ROAD - ALTERNATIVES OPERATING ANALYSIS
FUTURE CONDITION
BASELINE INTERSECTION MEASURES OF EFFECTIVENESS

FIGURE 7

Kimley»Horn

Table 4: Future Condition Baseline Network Measures of Effectiveness

Network	Number of Vehicles	13,006
	Total Travel Time (h)	1,229
	Total Distance (mi)	11,303
	Total Delay (h)	855
Per Vehicle	Average Northbound Speed (mph)	14
	Average Southbound Speed (mph)	8
	85th Percentile Northbound Speed (mph)	20
	85th Percentile Southbound Speed (mph)	17
	Average Northbound Travel Time (s)	528
	Average Southbound Travel Time (s)	985
	Average Delay (s)	237
	Average Number of Stops	5
	Average Stop Delay (s)	154

Table 5: Comparison of Existing and Future Intersection Measures of Effectiveness

Intersection	Existing	Future Baseline
Milton Rd/San Francisco St		
LOS	C	D
Average Delay (s)	21	42
Longest 95% Queue (ft)	203	1,010
Milton Rd/Beaver St		
LOS	D	E
Average Delay (s)	36	76
Longest 95% Queue (ft)	835	1,538
Milton Rd/Humphreys St		
LOS	D	E
Average Delay (s)	42	75
Longest 95% Queue (ft)	605	1,629
Milton Rd/Butler Ave		
LOS	E	F
Average Delay (s)	63	83
Longest 95% Queue (ft)	1,656	1,660
Milton Rd/Route 66		
LOS	C	E
Average Delay (s)	30	60
Longest 95% Queue (ft)	1,645	1,653
Milton Rd/Riordan Rd		
LOS	D	E
Average Delay (s)	46	56
Longest 95% Queue (ft)	1,185	1,306
Milton Rd/Plaza Way		
LOS	C	D
Average Delay (s)	33	51
Longest 95% Queue (ft)	475	1,602
Milton Rd/University Dr		
LOS	C	D
Average Delay (s)	23	42
Longest 95% Queue (ft)	512	1,073
Milton Rd/Forest Meadows St		
LOS	C	C
Average Delay (s)	23	27
Longest 95% Queue (ft)	371	410
Forest Meadows St/Beulah Blvd		
LOS	B	B
Average Delay (s)	19	19
Longest 95% Queue (ft)	356	311

Level of Service definitions in seconds per vehicle: A≤10, B >10-20, C>20-35, D>35-55, E>55-80, F>80