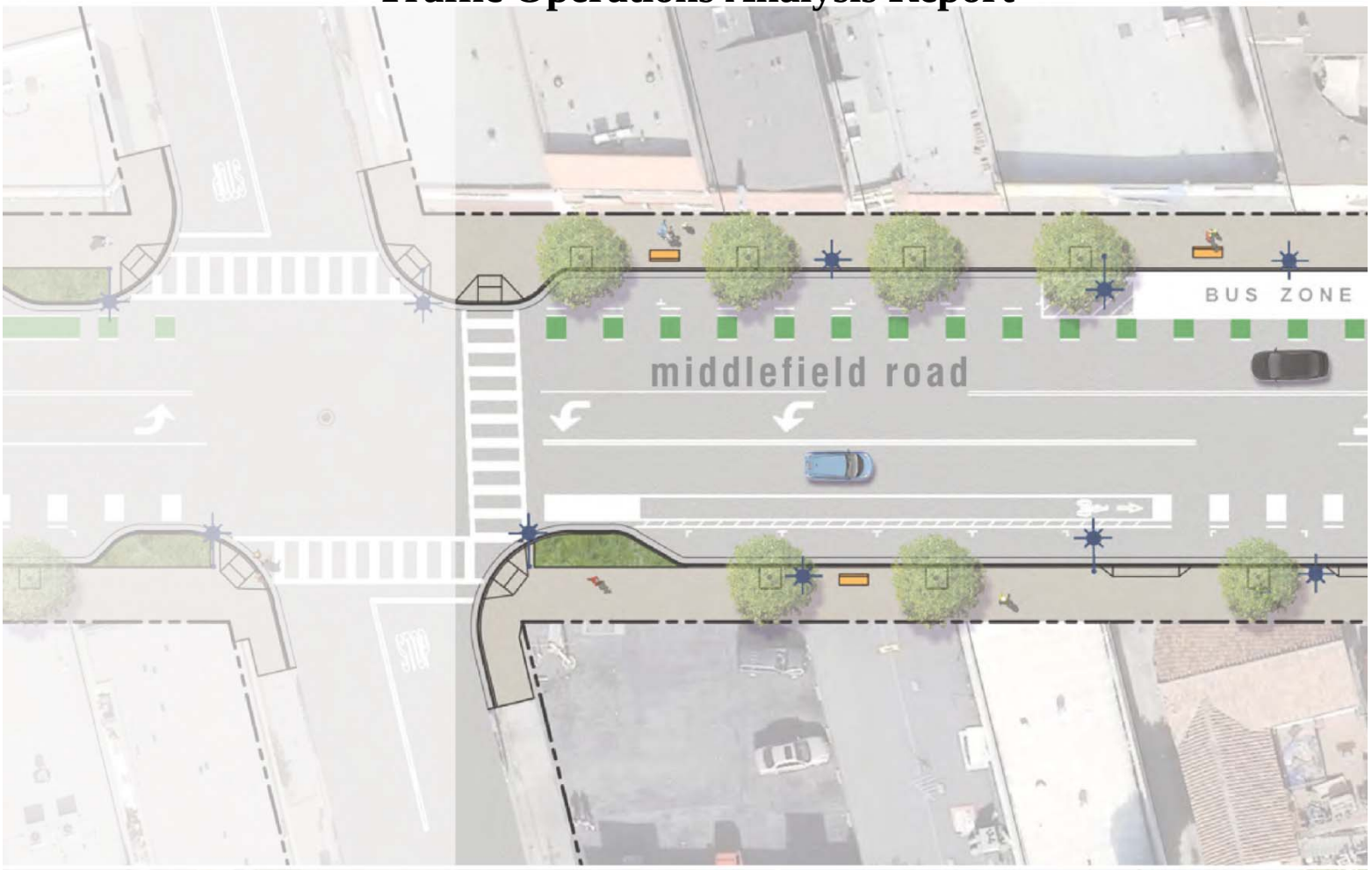
Middlefield Road Streetscape Project

Traffic Operations Analysis Report



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EXECUTIVE SUMMARY

Middlefield Road is a north-south arterial roadway that serves the North Fair Oaks area, an unincorporated area in San Mateo County. It is a thoroughfare that connects Redwood City to the north and Atherton/Menlo Park to the south. The County of San Mateo has a vision for the Middlefield Road Improvement Project to improve connectivity and reduce mobility barriers for all types of travel, including pedestrian, bicycle, automobile, and public transit; improve area health and safety by increasing walkability and bikeability; and improve travel and transit connections between North Fair Oaks, surrounding communities, and the region (North Fair Oaks Community Plan, November 2011). To define the vision further, a bilingual community outreach campaign was conducted in 2014. Through the effort, the key elements of the redesign of Middlefield Road were elected in order to put the bicyclists and pedestrians on equal footing with the motor-vehicles.

Within the study area, Middlefield Road is a four-lane facility, with two-through lanes in the northbound and southbound directions. There are currently no turn lanes and no bike lanes within the project limits. The existing sidewalks vary in width, but are generally 5 to 8 feet wide. With the presence of existing overhead poles and other signs, and driveways and intrusion from the fronts of diagonally-parked vehicles, the existing sidewalks are very congested. Existing parking is generally diagonal toward the curb/sidewalk. This condition requires backing movements for vehicles to exit the parking stalls, resulting in difficult conditions for both motorists and bicyclists. There are no bulbouts within the project limits. As a result, crosswalks are long (on the order of 75 feet). Longer crosswalks coupled with the diagonal on-street parking along much of the project length reduce pedestrian visibility to motorists and cyclists. Currently, there are five bus stops within the project study limits, three northbound and two southbound. A Union Pacific Railroad (UPRR) maintained at-grade crossing owned by Caltrain is located between Pacific Avenue and Northside Avenue. The tracks cross Middlefield Road at an angle in the vicinity where several driveways and roadways connect to Middlefield Road. The driveway immediately south and west of the tracks serves a medical clinic (North Fair Oak Medical Center) at 2700 Middlefield Road, which is located on private property. Currently, no trains are using these tracks. However, California Public Utilities Commission (CPUC) requires several modifications to the existing driveways at this location.

The purpose of the project is to:

- Improve pedestrian facilities with new sidewalks, trees, and furnishings
- Preserve local motorized vehicle access, while encouraging slower speeds
- Create a more walkable and bikeable community connection, and
- Improve travel and transit connections, that are safe, accessible, and convenient

The purpose of this report is to discuss the findings of the traffic operational analysis conducted to evaluate the existing conditions, opening year 2020 conditions and design year 2050

conditions for the intersections identified in the Middlefield Road Streetscape Project. In order to meet the objectives of the project, the following two alternatives were considered for the traffic operational analysis:

No-Build Alternative (Build 4 Lanes Alternative)

This alternative is the same as the Build 4 Lanes alternative, as there will be no change in conditions in terms of capacity and lane configurations. There are no changes to the on-street parking arrangement as well. Thus, the traffic analysis for the No-Build Alternative will be considered the same as the Build 4 Lanes Alternative.

Build 3 Lanes Alternative

Under this alternative, the following improvements are proposed on Middlefield Road between MacArthur Avenue to the north and Fifth Avenue to the south:

- Reallocate road space within the existing right-of-way by repurposing travel lanes and queuing storage for vehicular traffic as part of a "road diet". Therefore, the Middlefield Road segment between Pacific Avenue and Fifth Avenue will be converted to a three-lane roadway, with one through lane along northbound and southbound with a center two-way left turn lane (TWLT). At the intersections, the project proposes to provide left turn pockets. All proposed lanes are 11 feet wide.
- Add buffered bike lanes in the southbound and northbound directions, each with a 6.5 foot total width.
- Add bulbouts at each intersection to improve sight distances for pedestrians and reduce the lengths of the crosswalks to approximately 45 feet.
- Widen the sidewalks to 12 feet along the length of the project and remove the overhead wires and poles to improve the safety and accessibility for pedestrians, and to accommodate underground electrical facilities for PG&E.
- Replace the diagonal on-street parking with 8-foot wide parallel parking at the sidewalk curb, and have a striped buffer between the parking spaces and the bike lane. Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits. Conversion from angled to parallel parking as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield Road and 2nd Avenue, and 16 spaces will be provided at the Berkshire Lot.

In order to comply with the CPUC, the proposed project will also construct several modifications to the existing driveway to the North Fair Oak Health Center and the at-grade railroad crossing. The modifications include:

- Relocating the driveway and the Health Center signage
- Modifying raised medians and thus, the private property traffic circulation pattern
- Replacing and relocating track signal equipment as well as curbs
- Re-striping the driveway
- Restricting turning left movements from westbound Northside Avenue
- Signalizing the driveway access with railroad preemption

Traffic Data Collection

To properly assess the existing constraints and opportunities within the study area, forty-seven (47) intersection locations and two segment locations were identified for the analyses of the Middlefield Road Streetscape Project. The identified study intersections are along Middlefield Road, Spring Street, Bay Road, and Marsh Road.

The proposed improvements would be implemented on Middlefield Road between MacArthur Avenue and Fifth Avenue, which comprises of 12 of the 47 study intersections, and is referred to as "project study limits" herein. Even though the proposed improvements would be implemented within the project study limits, a larger study area (Traffic study limits), which includes the intersections on local parallel streets, was analyzed to capture any operational impacts outside of the project study limits. Therefore, the traffic study limits comprise of all the 47 study intersections.

The following data was obtained in 2015:

- Weekday vehicle turning movement counts at intersections (AM, School PM, and PM peak periods);
- Weekday bicycle and pedestrian counts at intersections (AM, School PM, and PM peak periods); and
- Weekday daily (24-hour) traffic volumes at segments.

The AM peak period counts were conducted from 7:00 to 9:00 AM, School PM peak period counts were conducted from 1:00 to 3:00 PM, and the PM peak period counts were conducted from 4:00 to 6:00 PM.

Development of Forecast Volumes

VTA- C/CAG (Valley Transportation Authority - City/County Association of Governments of San Mateo County) Forecast Traffic Models for the years 2013, 2020, and 2040 were used to forecast the traffic volumes within the project study area. The model forecast volumes were "post-processed" to obtain the opening year 2020 and 2040 volumes. Year 2040 volumes were then extrapolated to obtain the design year 2050 volumes.

Intersection Level of Service Analysis

Existing Conditions

- ✓ During the AM peak hour, within the traffic study limits, 7 of the 47 study intersections operate at County of San Mateo's unacceptable levels of service (LOS E or worse). However, within the project study limits, 3 of the 12 study intersections operate at unacceptable levels of service of LOS E or worse. All other intersections operate at acceptable levels of service (LOS D or better).
- ✓ During the School PM peak hour, within the Traffic Study Limits, 6 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). Within the project limits, 3 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at County of San Mateo's acceptable LOS D or better standards.
- ✓ During the PM peak hour, within the Traffic Study Limits, 16 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). However, within the project limits, 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at acceptable LOS D or better standards
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Opening Year 2020 No-Build Conditions

- ✓ During the AM peak hour, within the Traffic Study Limits, 15 of the 47 intersections and within the project limits, 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).
- ✓ During the School PM peak hour, within the Traffic Study Limits, 7 of the 47 intersections and within the project limits 5 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).
- ✓ During the PM peak hour, within the Traffic Study Limits, 20 of the 47 intersections and within the project limits 9 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Opening Year 2020 Build Conditions

Overall, due to the proposed improvements, the operating conditions of the study intersections either improved or stayed the same with a few exceptions as discussed below. The lane reduction along the project study limits was expected to cause degradation in LOS from the No-Build Conditions. In addition, the proposed modifications would divert commuter traffic volumes away from Middlefield Road within the project limits and encourage a modal switch to walking, bicycling, and transit use.

Based on the County of San Mateo's significance standards, a project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard overall LOS of 'D' and for the intersections that are not in compliance with the LOS standards (LOS D or better), a project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard LOS mentioned above and the proposed project increases average control delay at the intersection by four (4) seconds or more.

AM Peak Hour

- ✓ Within the traffic study limits, among the 15 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 6 intersections continue to operate at LOS E or worse, one intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, one intersection continue to operate at LOS E or worse, one intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

School PM Peak Hour

- ✓ Within the traffic study limits, among the 7 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ Within the project study limits, all the intersections perform at an acceptable LOS D or better in the Build conditions compared to the 5 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have *no significant impact.*

PM Peak Hour

- ✓ Within the traffic study limits, among the 20 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 15 intersections continue to operate at LOS

E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.

- ✓ Within the project study limits, among the 9 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 5 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

Mitigation Measures

Middlefield Road and Fifth Avenue (Intersection#16 AM and PM Peak Hour) – Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. As a result of the above improvements, the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the opening year 2020 Build conditions.

Design Year 2050 No-Build Conditions

Several study intersections are expected to fail (operate at an unacceptable LOS E or worse) based on the traffic growth projected in the design year 2050. The following results reveal the same:

- ✓ During the AM peak hour ,within the Traffic Study Limits, 35 of the 47 intersections and within the project limits, all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ During the School PM peak hour, within the Traffic Study Limits, 12 of the 47 intersections and within the project limits 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ During the PM peak hour, within the Traffic Study Limits, 34 of the 47 intersections and within the project limits all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Design Year 2050 Build Conditions

Overall, due to the proposed improvements, the operating conditions of the study intersections either improved or stayed the same with a few exceptions as discussed below. The lane reduction along the project study limits was expected to cause degradation in LOS from the No-Build Conditions. In addition, the proposed modifications would divert commuter traffic volumes away

from Middlefield Road within the project limits to other parallel routes such as El Camino Real, Bay Road and Spring Street and encourage a modal switch to walking, bicycling and transit use.

AM Peak Hour

- Within the traffic study limits, among the 35 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 32 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the following four intersections:
    - Intersection #11 - Middlefield Road and Berkshire Avenue
    - Intersection #12 - Middlefield Road and First Avenue
    - Intersection #18 - Middlefield Road and Seventh Avenue
    - Intersection #47 - El Camino Real and Fifth Avenue

School PM Peak Hour

- Within the traffic study limits, among the 12 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 4 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

PM Peak Hour

- Within the traffic study limits, among the 34 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 31 intersections continue to operate at LOS E or worse, two intersections deteriorate from an acceptable LOS D or better to an unacceptable LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions. .
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the following intersections:
  - Intersection #11 - Middlefield Road and Berkshire Avenue
  - Intersection #17 - Middlefield Road and Sixth Avenue
  - Intersection #18 - Middlefield Road and Seventh Avenue
  - Intersection #47 - El Camino Real and Fifth Avenue

Mitigation Measures

Middlefield Road and Berkshire Avenue (Intersection #11 AM and PM Peak Hour) – Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and First Avenue **(Intersection#12 AM Peak Hour)** – Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Fifth Avenue (Intersection#16 School PM Peak Hour) – Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. If the improvements are to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Sixth Avenue (Intersection#17 PM Peak Hour) – The installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is

to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Seventh Avenue (Intersection#18 AM and PM Peak Hour) – Potential improvement include modification of the eastbound approach (driveway) to a right only approach. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

El Camino Real and Fifth Avenue (Intersection#47 AM and PM Peak Hour) – Potential improvement include a second westbound left-turn pocket. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Table ES1 presents the summary of the delay and LOS under all the alternatives.

Queue Length Analysis

A queue length analysis was conducted for the intersections within the project study limits. The results of the 95th percentile queue analysis indicate that the queues are within the available storage for the majority of the locations under existing conditions except at the intersection of Middlefield Road and Fifth Avenue.

In the opening year 2020 conditions, the queue lengths were shorter or similar in the Build conditions compared to the No-Build conditions at the majority of the intersections with a few exceptions. The queue lengths exceeded the storage capacity at the following locations

1. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
2. Intersection of Middlefield Road and Dumbarton Avenue (No-Build conditions)
3. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
4. Intersection of Middlefield Road and Fourth Avenue (Build conditions)
5. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

At intersections where the queue lengths were longer than the No-Build condition queues, the difference was less than approximately two car lengths. However, at the intersection of El Camino Real and Fifth Avenue, the queues are longer due to the proposed project improvements.

In the design year 2050 conditions, due to the significant growth in traffic as projected by the forecast model, long queues are expected under both No-Build and Build conditions. The queue lengths are longer than the available storage at several locations compared to the 2020 conditions. The results reveal the same. The queue lengths exceeded the storage capacity at the following locations.

1. Intersection of Middlefield Road and MacArthur Avenue (No-Build and Build conditions)

2. Intersection of Middlefield Road and Hurlingame Avenue (No-Build and Build conditions)
3. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
4. Intersection of Middlefield Road and Pacific Avenue (Build conditions)
5. Intersection of Middlefield Road and Dumbarton Avenue (No-Build and Build conditions)
6. Intersection of Middlefield Road and Berkshire Avenue (No-Build conditions)
7. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
8. Intersection of Middlefield Road and Fourth Avenue (No-Build and Build conditions)
9. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

Pedestrian, Bicycle and Transit Impacts

This project aims at improving the safety, convenience, and accessibility to other modes of traffic, which include pedestrians, bicyclists, and transit users. To achieve the goals of the project, it is critical to propose improvements that would put the other modes of travel in equal footing with motorists. The following improvements are proposed to enhance the operating conditions for pedestrians, bicyclists, and transit.

Bike Lanes

There are currently no bike lanes within the project limits. The lack of marked bike lanes coupled with angled “head-in” parking to the sidewalk curbs, has resulted in an uncontrolled cycling experience. To address these issues, the project would add buffered bike lanes in the southbound and northbound directions, each with a 6.5-foot total width.

Bulbouts/Crosswalks

No bulbouts currently exist within the project limits. This condition results in fairly long crosswalk lengths (on the order of 75 feet long) and coupled with the diagonal parking present along much of the project length reduces pedestrian visibility to motorists and cyclists. To improve these issues, bulbouts are planned at each intersection, improving sight distances for pedestrians and reducing crossing lengths on the order of 45 feet.

Sidewalk Width

The existing sidewalks vary in width, but are generally 5 to 8 feet wide. With the presence of existing overhead poles and other signs, driveways, and intrusion from the fronts of diagonally-parked vehicles, the existing sidewalks are very congested. The project is planning on widening the sidewalks to 12 feet along the length of the project and removing the overhead wires and poles, improving the safety and accessibility for pedestrians and accommodating underground electrical facilities for PG&E.

Bus Stops

Similar to existing, there will be five bus stops within the project limits, three northbound and two southbound. The bus stops will be placed downstream of an intersection and will be 60-feet in length with tapers for entering and exiting the bus stop. A concrete pad will be provided for the bus stop, and SamTrans is investigating the possibility of adding bus shelters. An addition of bus shelters is not anticipated to have an effect on parking. Also, bus stops will be moved from upstream to a downstream of intersections to improve traffic flow.

At-Grade Railroad Crossing

A Union Pacific Railroad (UPRR) maintained at-grade crossing owned by Caltrain is located between Pacific Avenue and Northside Avenue. The following improvements are proposed at the driveways near the Railroad Track:

- Relocate the driveway and the Health Center signage
- Modify raised medians and thus, the private property traffic circulation pattern
- Replace and relocate track signal equipment as well as curbs
- Re-stripe the driveway
- Restrict turning left movements from westbound Northside Avenue – This would improve the safety and reduce the number of conflicting points.
- Signalize the driveway access with railroad preemption –Since the intersections of Middlefield Road/ Hurlingame Avenue, Middlefield Road/ Northside Avenue, Middlefield Road/ Redwood Junction, and Middlefield Road/ Pacific Avenue in the vicinity of the railroad are closely spaced, there is no orderly movement of conflicting flows. This would result in potential safety hazards. Signalization would offer the maximum degree of control at this location.

Since the improvements listed above improve safety, accessibility and convenience, the impacts to the pedestrians, bicycles and transit users are considered to be ***less-than-significant*** impact.

Parking Impacts

The existing parking within the project study limits is angle parking; when vehicles back out of the parking spaces, they block one of the existing through lanes and cause unsafe conditions for bicyclists. The current angle parking not only creates unsafe conditions for through traffic, but it also creates dangerous conditions for bicyclists along Middlefield Road. The angle parked vehicles were also observed to impede through traffic when they tried to back out of the parking spots. Cyclists were either interrupted by cars backing up from angled parking or had to move into the main traffic flow to avoid vehicles trying to park on-street. Some cyclists were observed using the sidewalk to completely move away from motorized vehicles, thereby taking up the sidewalks meant for foot traffic. Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits.

As a result of the proposed improvements, the diagonal on-street parking will be replaced with 8-foot wide parallel parking at the sidewalk curb and will have a striped buffer between the parking spaces and the bike lane. Conversion from angled to parallel parking as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield Road and 2nd Avenue, and 16 spaces at Berkshire Lot.

Since there is no loss in the number of on-street parking spaces and the proposed project improves safety for both motorists and bicyclists, the proposed project will have ***less-than-significant*** impacts, and no mitigation measures are required.

Table ES1 – Intersection Level of Service Summary

	No.	Intersection		Control	2015 Existing Conditions						2020 No-Build Conditions						2020 Build Conditions (3 Lanes Alternative)						2050 No-Build Conditions						2050 Build Conditions (3 Lanes Alternative)					
					AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
	1	Middlefield Rd	Willow St	Signal	B	12.7	B	17.4	C	28.2	B	13.0	B	17.4	C	31.3	B	12.7	B	17.0	C	29.1	C	21.2	C	22.3	**E**	**71.2**	B	19.0	C	21.3	**E**	**60.7**
	2	Middlefield Rd	Charter St	Signal	B	14.6	B	12.4	B	14.3	B	13.0	A	9.8	B	10.8	B	13.1	B	10.2	B	11.0	B	12.2	A	8.5	B	12.7	B	13.0	A	8.9	B	12.5
	3	Middlefield Rd	Flynn Ave	TWSC	D	30.6	**E**	**36.3**	D	30.0	D	31.3	D	34.0	D	30.6	D	29.2	D	28.4	D	27.6	**E**	**45.1**	**F**	**50.7**	D	29.4	**E**	**48.2**	**E**	**43.4**	D	32.0
	4	Middlefield Rd	Douglas Ave	Signal	A	9.4	A	4.6	A	6.8	B	12.7	A	6.0	A	9.0	B	12.7	A	6.3	A	9.3	**F**	**115.0**	B	10.4	D	54.2	**F**	**115.4**	B	11.2	D	43.6
Project Study Limits	5	Middlefield Rd	MacArthur Ave	TWSC	C	21.3	C	16.4	C	21.0	D	27.8	C	17.4	C	23.8	C	22.2	C	15.3	C	19.8	**F**	**Err**	C	21.8	**F**	**Err**	**F**	**Err**	C	17.2	**F**	**519.7**
	6	Middlefield Rd	Hurlingame Ave	TWSC	C	23.4	C	21.8	C	23.5	**E**	**35.1**	C	23.2	D	28.6	C	32.8	C	23.4	D	54.3	**F**	**Err**	**F**	**67.3**	**F**	**Err**	**F**	**660.5**	D	52.4	**F**	**564.7**
	7	Middlefield Rd	Northside Ave	TWSC	D	31.9	C	20.0	D	30.4	**F**	**52.1**	C	20.8	**E**	**36.0**	Merged with Intersection #6 under the Build Conditions						**F**	**Err**	**E**	**35.4**	**F**	**Err**	Merged with Intersection #6 under the Build Conditions					
	8	Middlefield Rd	Redwood Junction	TWSC	D	33.0	**E**	**39.9**	**F**	**133.9**	**E**	**43.5**	**E**	**50.0**	**F**	**250.7**	A	5.4	B	18.2	**E**	**56.4**	**F**	**683.9**	**E**	**49.5**	**F**	**Err**	**E**	**65.5**	A	9.8	**F**	**109.1**
	9	Middlefield Rd	Pacific Ave	TWSC	**E**	**41.9**	**E**	**40.8**	**F**	**93.1**	**F**	**68.5**	**F**	**54.5**	**F**	**190.5**	C	21.1	B	11.6	B	12.7	**F**	**Err**	**F**	**71.8**	**F**	**Err**	D	38.0	B	10.9	D	46.6
	10	Middlefield Rd	Dumbarton Ave	TWSC	D	32.9	D	33.0	**F**	**95.6**	**F**	**50.5**	**E**	**42.3**	**F**	**261.1**	C	21.1	C	18.4	**E**	**46.2**	**F**	**1,134.1**	**F**	**52.8**	**F**	**Err**	**F**	**694.7**	C	19.2	**F**	**Err**
	11	Middlefield Rd	Berkshire Ave	TWSC	B	14.9	B	14.0	C	17.8	C	18.9	B	14.9	C	23.1	C	17.6	B	13.7	D	26.2	**F**	**120.0**	C	16.2	**F**	**73.0**	**F**	**837.1**	B	14.3	**F**	**Err**
				Mitigations																									**A**	**7.5**	**A**	**2.6**	**B**	**14.3**
	12	Middlefield Rd	1st Ave	TWSC	D	25.5	C	23.2	**E**	**47.4**	**E**	**35.9**	D	27.5	**F**	**117.3**	C	18.5	C	16.0	**E**	**35.7**	**F**	**791.3**	D	33.1	**F**	**Err**	**F**	**Err**	C	16.2	**F**	**Err**
				Mitigations																									**A**	**7.4**	**A**	**3.1**	**A**	**8.6**
	13	Middlefield Rd	2nd Ave	TWSC	**F**	**60.0**	D	31.3	**F**	**62.3**	**F**	**210.5**	**E**	**47.8**	**F**	**210.5**	D	32.1	C	18.8	D	32.8	**F**	**Err**	**F**	**67.2**	**F**	**Err**	**F**	**Err**	C	19.7	**F**	**Err**
	14	Middlefield Rd	3rd Ave	TWSC	D	25.9	C	20.0	**E**	**39.1**	D	34.5	C	22.1	**F**	**67.3**	C	18.3	C	15.1	C	24.6	**F**	**591.5**	D	25.0	**F**	**Err**	**F**	**54.9**	C	15.1	**F**	**96.0**
	15	Middlefield Rd	4th Ave	TWSC	**F**	**80.9**	**E**	**44.4**	**F**	**63.3**	**F**	**268.0**	**F**	**73.6**	**F**	**333.8**	**F**	**50.5**	D	25.9	**F**	**59.2**	**F**	**Err**	**F**	**66.5**	**F**	**Err**	**F**	**Err**	C	23.8	**F**	**Err**
	16	Middlefield Rd	5th Ave	Signal	D	46.3	D	35.8	**E**	**59.6**	D	46.3	C	34.8	**E**	**68.6**	**F**	**96.9**	D	54.2	**F**	**107.5**	**F**	**438.0**	**E**	**59.7**	**F**	**460.6**	**F**	**414.8**	**E**	**77.8**	**F**	**418.1**
				Mitigations													**C**	**30.1**	**B**	**19.9**	**D**	**39.9**							**F**	**188.9**	**C**	**23.8**	**F**	**197.2**
Traffic Study Limits	17	Middlefield Rd	6th Ave	TWSC	**F**	**90.9**	D	29.4	**F**	**73.8**	**F**	**142.0**	D	29.4	**F**	**104.6**	**E**	**48.7**	C	21.2	**E**	**48.8**	**F**	**Err**	D	26.5	**F**	**638.7**	**F**	**Err**	C	18.1	**F**	**Err**
				Mitigations																									**A**	**7.9**	**A**	**4.2**	**A**	**8.9**
	18	Middlefield Rd	7th Ave	TWSC	C	22.1	C	21.4	C	19.1	C	23.4	C	21.4	C	20.4	C	18.7	C	17.9	C	17.2	**F**	**54.8**	C	20.0	C	22.8	**F**	**251.0**	C	15.8	**F**	**251.2**
				Mitigations																									**E**	**50.0**	**B**	**12.1**	**C**	**24.7**
	19	Middlefield Rd	Semicircular Rd	Signal	C	22.3	B	16.1	B	16.0	C	25.6	B	17.2	C	20.9	C	23.4	B	16.1	B	19.9	**F**	**231.7**	B	19.5	**F**	**100.9**	**F**	**215.6**	B	17.3	**F**	**87.2**
	20	Middlefield Rd	9th Ave	TWSC	B	13.8	C	15.3	C	18.0	C	16.2	C	15.5	C	22.3	B	14.5	B	13.9	C	18.7	D	26.7	B	14.5	**E**	**39.0**	C	19.6	B	12.5	D	31.7
	21	Middlefield Rd	Encinca Ave	TWSC	D	33.9	**E**	**35.1**	**E**	**39.6**	**F**	**71.9**	**E**	**37.0**	**F**	**81.6**	**E**	**37.0**	C	23.7	**E**	**45.7**	**F**	**414.0**	D	27.3	**F**	**524.6**	**F**	**124.9**	C	17.6	**F**	**149.8**
	22	Middlefield Rd	Placitas Ave	TWSC	C	22.7	C	17.4	**E**	**38.4**	**E**	**36.5**	C	18.3	**F**	**89.7**	C	23.9	B	14.8	**E**	**47.7**	**F**	**162.2**	C	16.8	**F**	**284.0**	**F**	**64.9**	B	13.0	**F**	**89.9**
	23	Middlefield Rd	San Benito Ave	TWSC	D	26.8	C	21.4	D	30.9	**E**	**48.3**	C	22.5	**F**	**57.4**	D	29.7	C	17.3	D	33.8	**F**	**202.5**	C	20.3	**F**	**435.8**	**F**	**71**	B	14.9	**F**	**111.5**
	24	Middlefield Rd	Fair Oaks Ln	TWSC	**F**	**321.2**	**E**	**46.9**	**F**	**796.6**	**F**	**Err**	**F**	**59.9**	**F**	**Err**	**F**	**614.9**	**E**	**35.3**	**F**	**Err**	**F**	**Err**	**E**	**42.7**	**F**	**Err**	**F**	**Err**	C	24.3	**F**	**Err**
	25	Middlefield Rd	Hollbrook Ln	TWSC	**E**	**40.3**	C	24.5	**F**	**59.3**	**F**	**106.6**	D	25.1	**F**	**161.8**	**E**	**49.9**	C	18.7	**F**	**70.1**	**F**	**1,520.5**	C	22.2	**F**	**Err**	**F**	**395.8**	C	15.8	**F**	**488.8**
	26	Middlefield Rd	Marsh Rd	Signal	D	37.4	C	29.3	D	38.0	D	48.1	C	30.3	D	49.5	D	39.5	C	27.0	D	42.4	**E**	**61.6**	C	29.3	**F**	**92.5**	D	50.2	C	25.2	**E**	**74.9**
	27	Fair Oaks Ave	Douglas Ave	TWSC	B	11.3	A	9.9	B	10.4	B	11.5	A	9.9	B	10.4	B	11.5	A	9.9	B	10.4	D	31.7	B	11.8	C	17.8	D	31.7	B	11.8	C	17.8
	28	Fair Oaks Ave	Hurlingame Ave	AWSC	A	8.1	A	7.7	A	8.0	A	8.2	A	7.7	A	8.0	A	8.2	A	7.7	A	8.0	B	12.3	A	7.8	B	10.3	B	12.3	A	7.8	B	10.3
	29	Fair Oaks Ave	Warrington Ave	TWSC	B	11.5	A	9.9	B	10.7	B	11.6	A	9.9	B	10.7	B	11.6	A	9.9	B	10.7	C	17.9	B	10.7	B	13.3	C	17.9	B	10.7	B	13.3
	30	Fair Oaks Ave	2nd Ave	AWSC	B	10.3	A	9.1	A	9.5	B	10.7	A	9.1	A	9.8	B	10.7	A	9.1	A	9.8	C	19.1	A	8.3	B	12.6	C	19.1	A	8.3	B	12.6
	31	Fair Oaks Ave	5th Ave	AWSC	C	22.8	B	12.6	**F**	**54.2**	D	27.8	B	12.8	**F**	**113.3**	D	27.8	B	12.8	**F**	**113.3**	**F**	**186.2**	C	15.4	**F**	**137.2**	**F**	**186.2**	C	15.4	**F**	**137.2**
	32	Spring St	Charter St	AWSC	C	15.9	B	10.6	B	13.0	C	16.5	B	10.6	B	13.3	C	16.5	B	10.6	B	13.3	**F**	**95.3**	B	10.4	**F**	**61.7**	**F**	**95.3**	B	10.4	**F**	**61.7**
	33	Spring St	Douglas Ave	AWSC	B	11.1	A	9.3	B	10.7	B	11.9	A	9.3	B	11.3	B	11.9	A	9.3	B	11.3	**F**	**155.9**	B	10.5	**F**	**71.4**	**F**	**155.9**	B	10.5	**F**	**71.4**
	34	Spring St	Hurlingame Ave	AWSC	A	9.1	A	8.2	A	9.7	A	9.4	A	8.2	B	10.2	A	9.4	A	8.2	B	10.2	A	9.1	A	8.0	A	9.2	A	9.1	A	8.0	A	9.2
	35	Spring St	Warrington Ave	TWSC	B	13.5	B	11.8	B	12.5	B	14.4	B	11.8	B	13.1	B	14.4	B	11.8	B	13.1	B	12.5	B	10.8	B	12.7	B	12.5	B	10.8	B	12.7
	36	Spring St	2nd Ave	AWSC	B	11.7	B	10.3	B	10.5	B	11.9	B	10.3	B	11.0	B	11.9	B	10.3	B	11.0	B	11.2	A	9.0	B	10.6	B	11.2	A	9.0	B	10.6
	37	Spring St	5th Ave	AWSC	D	26.7	B	13.7	D	34.2	D	30.3	B	13.7	**E**	**41.9**	D	30.3	B	13.7	**E**	**41.9**	**F**	**98.4**	B	11.8	**F**	**61.8**	**F**	**98.4**	B	11.8	**F**	**61.8**

No.	Intersection		Control	2015 Existing Conditions						2020 No-Build Conditions						2020 Build Conditions (3 Lanes Alternative)						2050 No-Build Conditions						2050 Build Conditions (3 Lanes Alternative)					
				AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
	North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
1	Middlefield Rd	Willow St	Signal	B	12.7	B	17.4	C	28.2	B	13.0	B	17.4	C	31.3	B	12.7	B	17.0	C	29.1	C	21.2	C	22.3	**E**	**71.2**	B	19.0	C	21.3	**E**	**60.7**
2	Middlefield Rd	Charter St	Signal	B	14.6	B	12.4	B	14.3	B	13.0	A	9.8	B	10.8	B	13.1	B	10.2	B	11.0	B	12.2	A	8.5	B	12.7	B	13.0	A	8.9	B	12.5
3	Middlefield Rd	Flynn Ave	TWSC	D	30.6	**E**	**36.3**	D	30.0	D	31.3	D	34.0	D	30.6	D	29.2	D	28.4	D	27.6	**E**	**45.1**	**F**	**50.7**	D	29.4	**E**	**48.2**	**E**	**43.4**	D	32.0
4	Middlefield Rd	Douglas Ave	Signal	A	9.4	A	4.6	A	6.8	B	12.7	A	6.0	A	9.0	B	12.7	A	6.3	A	9.3	**F**	**115.0**	B	10.4	D	54.2	**F**	**115.4**	B	11.2	D	43.6
38	Bay Rd	Charter St	AWSC	C	19.8	B	12.9	C	18.5	C	23.6	B	12.9	C	20.7	C	23.6	B	12.9	C	20.7	**F**	**65.5**	B	10.9	**F**	**98.1**	**F**	**65.5**	B	10.9	**F**	**98.1**
39	Bay Rd	Douglas Ave	AWSC	B	14.3	B	10.6	C	15.0	C	18.0	B	10.9	C	18.6	C	18.0	B	10.9	C	18.6	**F**	**56.9**	B	10.4	**F**	**63.3**	**F**	**56.9**	B	10.4	**F**	**63.3**
40	Bay Rd	Hurlingame Ave	TWSC	B	14.7	B	12.0	B	13.7	C	15.7	B	12.0	B	14.3	C	15.7	B	12.0	B	14.3	D	29.4	B	11.9	C	19.8	D	29.4	B	11.9	C	19.8
41	Bay Rd	Warrington Ave	TWSC	B	14.8	B	12.3	C	20.6	C	16.0	B	12.3	C	22.4	C	16.0	B	12.3	C	22.4	D	32.1	B	12.1	**E**	**40.7**	D	32.1	B	12.1	**E**	**40.7**
42	Bay Rd	2nd Ave	AWSC	B	14.9	B	11.4	D	25.7	C	17.6	B	11.4	**E**	**38.1**	C	17.6	B	11.4	**E**	**38.1**	**F**	**50.9**	B	10.4	**F**	**63.7**	**F**	**50.9**	B	10.4	**F**	**63.7**
43	Bay Rd	5th Ave	AWSC	C	23.3	C	16.0	**F**	**52.0**	D	29.6	C	16.1	**F**	**64.0**	D	29.6	C	16.1	**F**	**64.0**	**F**	**209.4**	B	14.5	**F**	**224.4**	**F**	**209.4**	B	14.5	**F**	**224.4**
44	Bay Rd	Spring St	TWSC	**F**	**55.9**	C	15.1	**F**	**100.9**	**F**	**350.9**	C	15.7	**F**	**696.1**	**F**	**350.9**	C	15.7	**F**	**696.1**	**F**	**Err**	**F**	**624.7**	**F**	**Err**	**F**	**Err**	**F**	**624.7**	**F**	**Err**
45	Bay Rd	Marsh Rd	Signal	C	24.1	B	15.0	B	17.6	C	31.3	B	14.8	B	15.9	C	31.3	B	14.8	B	15.9	**F**	**524.2**	B	13.5	**E**	**69.3**	**F**	**524.2**	B	13.5	**E**	**69.3**
46	Florence Ave	Marsh Rd	Signal	D	46.2	D	37.0	D	49.4	D	45.9	D	44.0	D	53.8	D	45.9	D	44.0	D	53.8	**F**	**268.8**	**E**	**60.0**	**F**	**201.4**	**F**	**268.8**	**E**	**60.0**	**F**	**201.4**
47	El Camino Real	5th Ave	Signal	C	31	C	24.7	C	29.7	D	44.3	D	52.5	C	31.2	D	43.7	D	50.6	C	32.3	**F**	**103.4**	C	22.4	D	54.3	**F**	**110.7**	C	23.3	**E**	**61.8**
			Mitigations																								**E**	**64.2**	**B**	**18.1**	**D**	**39.9**

Source: AECOM 2015
Notes:
1. Gray highlights indicate the project limits.
2. AM = morning peak hour, School PM = After school hour, PM = evening peak hour
3. Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections. Total control delay for the worst movement is presented for side-street stop controlled intersections.
4. Err under the Average delay column indicates that the program was unable to calculate the delay value.
5. Highlighted cell indicates a significant impact.
* Due to the proposed improvements within the project limits, the control was changed from a stop to a signal under the Build conditions.
Bold text indicates deficient intersection operations.

1. INTRODUCTION

This report discusses the traffic operational analysis conducted to evaluate the existing conditions and future conditions for the intersections identified in the Middlefield Road Streetscape Project. This report also describes the methodology that AECOM used in coordination with the City/County Association of Governments (C/CAG) models to develop future forecast traffic volumes to be used for this study. The project proposes a redesign of Middlefield Road which will put pedestrians and bicyclists on equal footing with motor-vehicle drivers. In addition to existing conditions, the traffic analysis evaluates project Opening Year (2020) and project Future (or Design) Year (2050) conditions with and without the proposed project.

1.1 BACKGROUND

Middlefield Road is a north-south arterial roadway that serves the North Fair Oaks area, an unincorporated area in San Mateo County. It is a thoroughfare that connects Redwood City to the north and Atherton/Menlo Park to the south.

County of San Mateo has a vision for the Middlefield Road Improvement Project to improve connectivity and reduce mobility barriers for all types of travel, including pedestrian, bicycle, automobile, and public transit; improve area health and safety by increasing walkability and bikeability; and improve travel and transit connections between North Fair Oaks, surrounding communities, and the region (North Fair Oaks Community Plan, November 2011). This vision was further defined with the completion of a bilingual community outreach campaign in 2014 which entailed conducting surveys and distributing posters and flyers, as well as open communication with community members during several community meetings. Through that effort, key elements of the redesign were defined, including reconfiguring Middlefield Road to a 3-lane roadway (one lane in each direction with a center left turn lane) with parallel parking, bike lanes, and wider sidewalks. The expanded sidewalk space will accommodate site amenities, such as benches, landscaping, street lights, trash receptacles, street art, public spaces, wayfinding signage, and low impact development. In addition, the project involves undergrounding of overhead utilities within the project area.

Separate from this project, the County is also preparing a Parking Solutions Study for the overall North Fair Oaks community as well as a Construction Mitigation Plan.

1.2 PURPOSE AND NEED

The purpose of the project is to:

- Improve pedestrian facilities with new sidewalks, trees, and furnishings
- Preserve local motorized vehicle access, while encouraging slower speeds
- Create a more walkable, bikeable community connection

- Improve travel and transit connections, that are safe, accessible, and convenient

1.3 STUDY AREA AND PROPOSED PROJECT DESCRIPTION

Middlefield Road is a north–south minor arterial roadway connecting Redwood City with Atherton/Menlo Park. The project study limits span between MacArthur Avenue and Fifth Avenue. **Figure 1 and Figure 2** show the Vicinity and Location Maps. Even though the project study limits are from MacArthur Avenue and Fifth Avenue, the traffic study limits extend along Middlefield Road between Willow Street and Marsh Road, Fair Oaks Avenue between Douglas Avenue and Fifth Avenue, Spring Street between Charter Street and Fifth Avenue, Bay Road between Charter Street and Marsh Road, Marsh Road between Middlefield Road and Bay Road, and the intersection of El Camino Real and Fifth Avenue. The extended traffic study area would capture any operational impacts outside of the project limits due to the proposed improvements.

Within the project study area, Middlefield Road is a four-lane facility, with two-through lanes in the northbound and southbound directions, and no turn lanes. There are currently no bike lanes within the project limits. The existing sidewalks vary in width, but are generally 5 to 8 feet wide. With the presence of existing overhead poles and other signs, driveways, and intrusion from the fronts of diagonally-parked vehicles, the existing sidewalks are very congested. Existing parking is generally diagonal toward the curb/sidewalk. This condition requires backing movements for vehicles to exit the parking stalls resulting in difficult conditions for both motorists and bicyclists. There are no bulbouts within the project limits. As a result, crosswalks are long (on the order of 75 feet). Longer crosswalks coupled with the diagonal on-street parking along much of the project length reduce pedestrian visibility to motorists and cyclists. Currently, there are five bus stops within the project study limits, three northbound and two southbound.

A Union Pacific Railroad (UPRR) maintained at-grade crossing owned by Caltrain is located between Pacific Avenue and Northside Avenue. The tracks cross Middlefield Road at an angle in the vicinity where several driveways and roadways connect to Middlefield Road. The driveway immediately south and west of the tracks serves a medical clinic at 2700 Middlefield Road, which is located on private property. This driveway also provides access to several other parcels via an access roadway which is situated within an easement. Currently, no trains are using these tracks. For the 2700 Middlefield Road driveway, in 2013 the private property owner constructed improvements in support of the expansion of the North Fair Oak Health Center from 30 employees to 110. Improvements constructed by the private property owner within the easement and near the at-grade crossing were not authorized by the CPUC through General Order (GO) 88-B.

To meet the purpose and need, the project proposes the following improvements at Middlefield Road between MacArthur and Fifth Avenue:

- Reallocate road space within the existing right-of-way by repurposing travel lanes and queuing storage for vehicular traffic as part of a “road diet”. Therefore, the Middlefield

Road segment between MacArthur and Fifth Avenue will be converted to a three-lane roadway, with one through lane along northbound and southbound with a center two-way left turn lane (TWLT). At the intersections, the project proposes to provide left turn pockets.

- Add buffered bike lanes in the northbound and southbound directions, each with a 6.5 foot total width.
- Add bulbouts at each intersection to improve sight distances for pedestrians and reduce the lengths of the crosswalks to approximately 45 feet.
- Widen the sidewalks to 12 feet along the length of the project and remove the overhead wires and poles to improve safety and accessibility for pedestrians, and to accommodate underground electrical facilities for PG&E.
- Replace the diagonal on-street parking with 8-foot wide parallel parking at the sidewalk curb and have a striped buffer between the parking spaces and the bike lane.

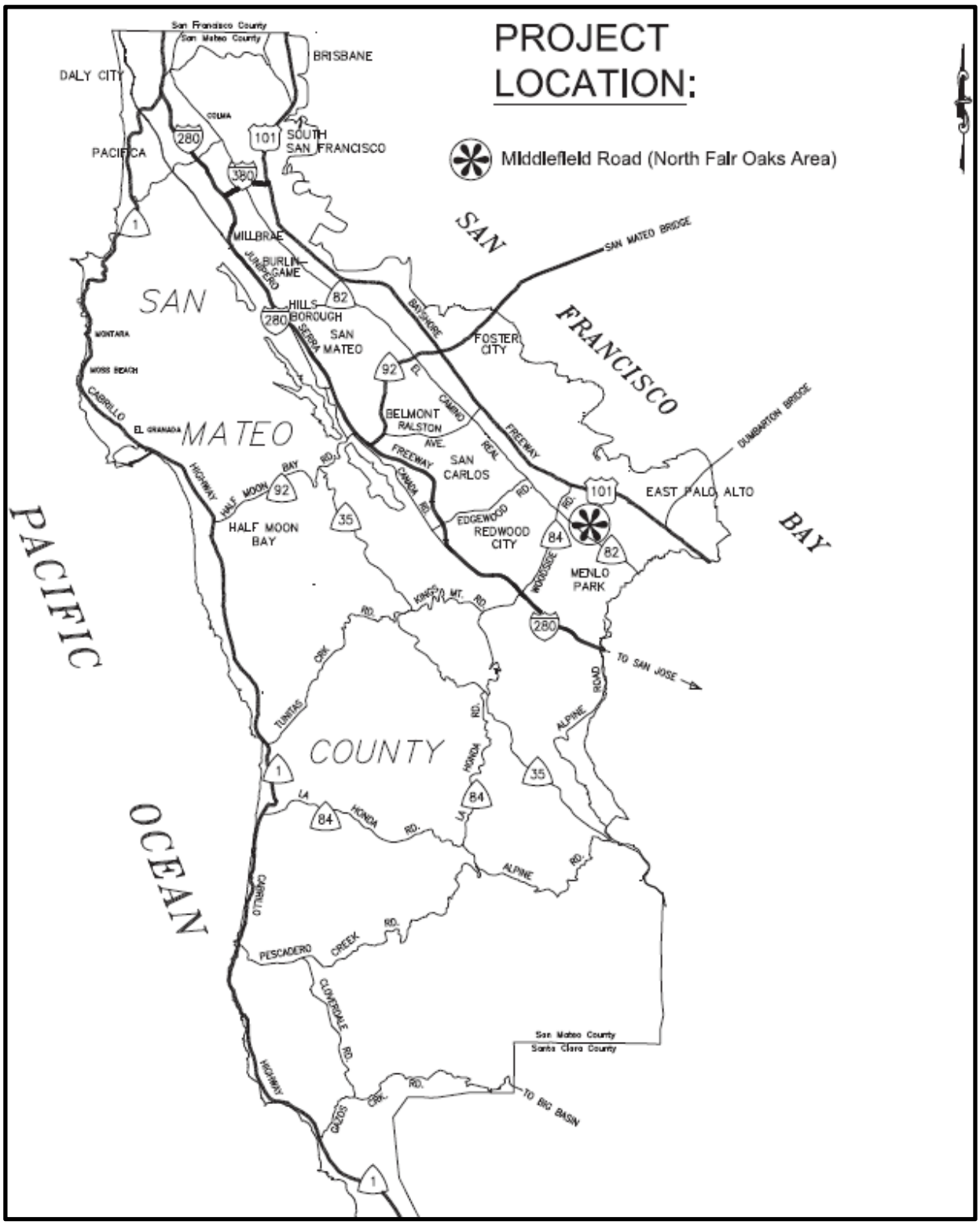
In order to comply with the CPUC, the proposed project will also construct several modifications to the existing driveway to the North Fair Oak Health Center and the at-grade railroad crossing. The modifications include:

- Relocating the driveway and the Health Center signage
- Modifying raised medians and thus, the private property traffic circulation pattern
- Replacing and relocating track signal equipment as well as curbs
- Re-striping the driveway
- Restricting turning left movements from westbound Northside Avenue
- Signalizing the driveway access with railroad preemption

CPUC expressed safety concerns related to motorists bypassing the automatic warning devices when turning left from westbound Northside Avenue, and the need to signalize the driveway access with railroad preemption. Long-term modifications, such as signalization, are required within three years to comply with CPUC standards.

Figure 1 – Project Vicinity Map

Figure 2 – Project Location Map



1.4 TRAFFIC ANALYSIS METHODS

Intersection operating conditions and level of service (LOS) were evaluated for the peak hour (four consecutive 15-minute periods with the highest overall traffic throughput) during the weekday AM (7:00 AM to 9:00 AM), school PM (1:00 PM to 3:00 PM), and weekday PM (4:00 PM to 6:00 PM) peak periods. Trafficware's Synchro version 9 software package was used in the evaluation and SimTraffic was used for the queue length analysis. Synchro utilizes the 2000 *Highway Capacity Manual* (2000 HCM) methodology in calculating intersection LOS and vehicle delay. The following measures of effectiveness (MOEs) were calculated based on 2000 HCM methodologies and were considered in the evaluation of intersection operations and performance:

- Vehicle delay (measured in seconds per vehicle); and
- 95^{th} percentile queue length (measured in feet);

1.4.1 Vehicle Delay

Vehicle (control) delay is the primary measure of performance in the HCM. It includes the time lost due to acceleration and deceleration of a vehicle, in addition to the stopped time of a vehicle due to a traffic control device. The delay-based operations analysis uses various intersection characteristics (e.g., traffic volumes, lane geometry, signal control, and signal phasing / timing) to estimate the average control delay experienced by motorists at an intersection. The HCM methodology qualitatively characterizes traffic conditions based on the delay value, ranging from LOS A to LOS F. LOS A indicates free-flow traffic conditions with little or no delay experienced by motorists and LOS F indicates congested conditions where traffic flows exceed design capacity and may result in long delays.

For signalized intersections, the methodology determines the capacity of each lane group approaching the intersection and calculates an average delay (in seconds per vehicle) for each of the various movements at the intersection. A combined weighted delay and LOS are presented for each intersection. For unsignalized intersections with one-way or two-way stop-control intersection LOS and delay are typically reported for the worst stop-controlled approach (or yield movement).

Intersection level of service criteria for signalized and unsignalized intersections is summarized in **Table 1.**

Table 1: Level of Service Criteria for Signalized and Unsignalized Intersections

Level of Service	Average Delay (seconds / vehicle)		Description
	Signalized	Unsignalized	
A	≤ 10.0	≤ 10.0	Little or no traffic delay
B	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0	Minimal traffic delay
C	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0	Average traffic delay
D	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0	Long traffic delay
E	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0	Very long traffic delay
F	> 80.0	> 50.0	Extreme traffic delay

Source: Transportation Research Board, *Highway Capacity Manual*, 2000.

1.4.2 Queue Length

The operational analysis includes an evaluation of the 95th percentile queue lengths (measured in feet). The 95th percentile queue has only a five percent probability of being exceeded during the analysis time period. When compared to the actual storage capacity, these queue lengths provide an estimate of capacity constraints due to queue backups as well as inadequacies in storage length. Unless otherwise noted, the storage capacity is taken as the distance to the nearest intersection, major driveway, or pedestrian crossing.

1.5 Pedestrian, Bicycle and Transit Analysis

Pedestrian conditions along Middlefield Road between MacArthur Avenue and Fifth Avenue were qualitatively assessed, including existing pedestrian facilities and activity levels. Bicycle conditions along the project study limits were qualitatively assessed, including existing bicycle facilities and activity levels. Transit conditions throughout the study area were qualitatively assessed.

1.6 Significant Impact Criteria

The determination of significance for project impacts is based on applicable policies, regulations, goals and guidelines defined by the County of San Mateo.

- A project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard overall LOS of 'C' with no individual movement operating at worse than 'D'. On occasion, level of service 'D' may be allowed for peak periods in very dense urban conditions per the County's discretion. Since Middlefield Road is located in a dense urban setting, LOS

"D" was used as the acceptable standard for both the signalized and unsignalized intersections in this study.

- A project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard LOS mentioned above, and the proposed project increases average control delay at the intersection by four (4) seconds or more.

1.7 REPORT ORGANIZATION

- Chapter 2 – Existing Conditions
- Chapter 3 – Alternatives Considered
- Chapter 4 – Development of Traffic Forecast Volumes
- Chapter 5 – Opening Year 2020 Conditions
- Chapter 6 – Design Year 2050 Conditions
- Chapter 7 – Conclusions

2. EXISTING CONDITIONS

2.1 EXISTING ROADWAY NETWORK

A brief description of the existing roadway network is provided in this section. For the purposes of this study, Middlefield Road has been defined in a north–south orientation, while cross streets have been defined in an east–west orientation.

Middlefield Road. Middlefield Road is a north–south minor arterial roadway connecting Redwood City with Atherton/Menlo Park. Within the study area, Middlefield Road is a four-lane, two-way road, with angled on-street parking and no designated bike lanes. Just south of the intersection with Northside Avenue, Middlefield Road crosses a railroad right-of-way (ROW) owned by the Union Pacific Railroad (UPRR), part of the UPRR's Niles Subdivision and used primarily by freight trains and *Capitol Corridor* passenger rail services. UPRR also owns a separate ROW along the north side of Fruitvale Avenue serving a branch line of the Niles Subdivision that originally connected to Redwood City (via the Sequoia Station), with a lead branching off to the south to serve industrial uses along the Oakland Estuary.

Fair Oaks Avenue. Fair Oaks Avenue is a residential north-south local roadway that runs parallel to and east of Middlefield Road between Douglas Avenue and Fifth Avenue within the study area. Fair Oaks Avenue runs parallel with the railroad at the furthest south end and is a two-lane, two-way road with parallel parking on both sides of the roadway.

Spring Street. Spring Street is a mixed-use north-south major collector roadway that runs parallel to and east of Fair Oaks Avenue. Spring Street runs parallel with the railroad at the furthest south end and is a two-lane, two-way road with parallel parking on both sides of the roadway.

Bay Road. Bay Road is a north-south minor arterial roadway that runs parallel to and east of Spring Street. Bay Road is a four-lane, two-way road with parallel parking on both sides of the roadway. South of Fifth Avenue Bay Road is two lanes with two-way left turns and becomes Florence Street at Fifth Avenue / Spring Street.

Florence Street. Florence Street is a north-south minor arterial roadway that is a continuation of the furthest south end of Bay Road at Fifteenth Avenue. Florence Street is a two-way, two lane with two-way left turn roadway with parallel parking on both sides of the roadway in the residential sections and designated bikes lanes south of Marsh Road.

El Camino Real (Route 82). El Camino Real is a north–south state roadway that runs parallel to and west of Middlefield Road. El Camino Real is a six-lane, two-way road with parallel parking on both sides of the roadway.

2.2 EXISTING PEDESTRIAN AND BICYCLE NETWORK

Within the project limits, sidewalks are provided on both sides of Middlefield Road. Unsignalized crosswalks (marked) are provided at Hurlingame Avenue, Pacific Avenue, Dumbarton Avenue, Second Avenue, and Fourth Avenue. All unsignalized side streets within the project limits are stop-controlled; pedestrians can cross when the vehicles come to a halt. The only signalized crosswalk is at Fifth Ave which provides crossings at all four legs of the intersection. All cross streets with Middlefield Road within the project limits have sidewalks provided on at least one side of the streets.

Class I bike paths provide an exclusive right-of-way for bicyclists and pedestrians, with cross flows of motorists minimized. Class II bike lane provide a restricted right-of-way designated for the exclusive or semi-exclusive use of bicycles with through travel by motor vehicles or pedestrians prohibited, but with vehicle parking and cross flows by pedestrians and motorists permitted. Class III bike routes provide a right-of-way designated by signs or permanent markings indicating the roadway is shared by pedestrians and motorists.

Within project limits, bicycles are allowed on Middlefield Road but there are no designated bike lanes. Nearest Class II bike lanes to the project area are along Maple Street (northwest of project site) and along sections of Broadway. There are no separate Class I bike paths in the project vicinity.

In addition, SamTrans buses that serve the project area have front-loading bicycle racks (typically accommodating a total of two bicycles). Similarly, bicycles are allowed on all Caltrain services. Bike racks and bike lockers (for rent) are available at the Redwood City Caltrain Station. Atherton Station also has bike lockers available for rent. **Figure 3** presents the existing pedestrian and bicycle volumes for the study intersections.

2.3 EXISTING TRANSIT NETWORK

Transit service in the Project vicinity is provided by the San Mateo County Transportation Authority SamTrans bus service and Caltrain Commuter Rail.

2.3.1 SamTrans

SamTrans is the primary surface transit provider in Redwood City, providing regularly-scheduled fixed-route service to major activity centers and transit hubs within San Mateo County. Caltrain's Redwood City Transit Center functions as a major transfer station for SamTrans buses. There are three pairs of bus stops within the project area.

Three SamTrans routes operate along Middlefield Road within Project limits:

- *Route 296.* Route 296 is a SamTrans South County Route providing service between Redwood City Caltrain Station and Bayshore / Donohoe via Menlo Park and East Palo Alto. The route operates on weekdays between 5:00 AM and 11:00 PM with headways between 15 to 20 minutes throughout the day. Weekend and holiday service operates between 9:00 AM and 8:00 PM with headways of 30 minutes.

- *Route 297.* Route 297 is a SamTrans South County Route providing service between Redwood City Caltrain Station and Palo Alto Transit Center. The route operates on weekdays between 1:00 AM and 5:00 AM with two buses running southbound and then northbound. Between 10:45 PM and 12:00 AM there are two hourly services in each direction. During the weekends Route 297 runs more regularly in the northbound direction with hourly headways between 3:30 AM and 8 AM and between 6:45 PM and mid-night. There are two hourly services in the southbound direction 12:30 AM to 2 AM and three hourly services between 6:30 AM and 9 AM. The evening southbound services operate between 7:30 PM to 12 mid-night with hourly headways.

- *Route 397.* Route 397 is a SamTrans Multi-city Route operating between Palo Alto Transit Center and downtown San Francisco, with stop at San Francisco International Airport. This hourly service operates both during the weekdays and weekends with the same schedule. There are three northbound services between 12:45 PM to 3 PM and four southbound services between 1 PM and 4 PM.

In addition, Route 79 operates within part of the project limits on school days only. This service connects Kennedy Middle School which is east of the project area to the area southwest of the project area at the intersection of Florence Street and 17th Ave. There are three westbound services in the morning and between two to four services in the afternoon depending on the days of the week. The headway for the morning services ranges between three minutes to about 40 minutes. The headway for the afternoon services ranges between three minutes to two hours.

2.3.2 Caltrain

Caltrain connects Redwood City to San Francisco in the north as well as San Jose in the south. The project area is served by Redwood City Caltrain Station to the north and Atherton Caltrain Station to the south. Redwood City Caltrain Station is located north of Woodside Road, near the intersection of Middlefield Road and Jefferson Avenue. It is part of the Redwood City Transit Center. On weekdays, while all local Caltrain services stop at this station, only some baby bullet and limited-stop services call at this station. During the weekends, all Caltrain services stop at the Redwood City Station. Atherton Caltrain Station is located south west of the project area, at the intersection of Fair Oaks Lane and Lloyden Drive. There is no weekday Caltrain service at the Atherton Station. All weekend Caltrain services stop at Atherton Station except four services (two in each direction).

2.4 EXISTING TRAFFIC DATA COLLECTION

This section documents and presents the existing traffic data collection for the Middlefield Road Streetscape Project.

To properly assess the existing constraints and address impacts around the local street around the project study area due to reduction of through lane capacity, forty-seven (47) intersection locations and two segment locations were identified for the analyses of the Middlefield Rd Streetscape Project. The following data was obtained in 2015:

- Weekday vehicle turning movement counts at intersections (AM, midday, and PM peak periods);
- Weekday bicycle and pedestrian counts at intersections (AM, midday, and PM peak periods); and
- Weekday daily (24-hour) traffic volumes at selected segments;

Turning movement counts along with pedestrian and bicycle volumes were conducted on Tuesday, June 2, 2015 at Middlefield Road / Fair Oaks Avenue / Spring Street / Bay Road / Florence Avenue, and on Tuesday, December 8, 2015 at El Camino Real /Fifth Avenue.

The AM peak period counts were conducted from 7:00 to 9:00 AM, School PM peak period counts were conducted from 1:00 to 3:00 PM and the PM peak period counts were conducted from 4:00 to 6:00 PM.

ADT volumes were collected for the segment along Middlefield Road between Placitas Avenue and San Benito Avenue as well as between Northside Avenue and Pacific Avenue from December 4 to December 10, 2015.

The study intersections and the corresponding intersection control are listed below. The existing lane geometry and a summary of the peak hour turning movement volumes for the study intersections are illustrated in **Figure 4**. See **Appendix B** for the study intersection turning movement counts collected and 24-hour bi-directional segment volumes.

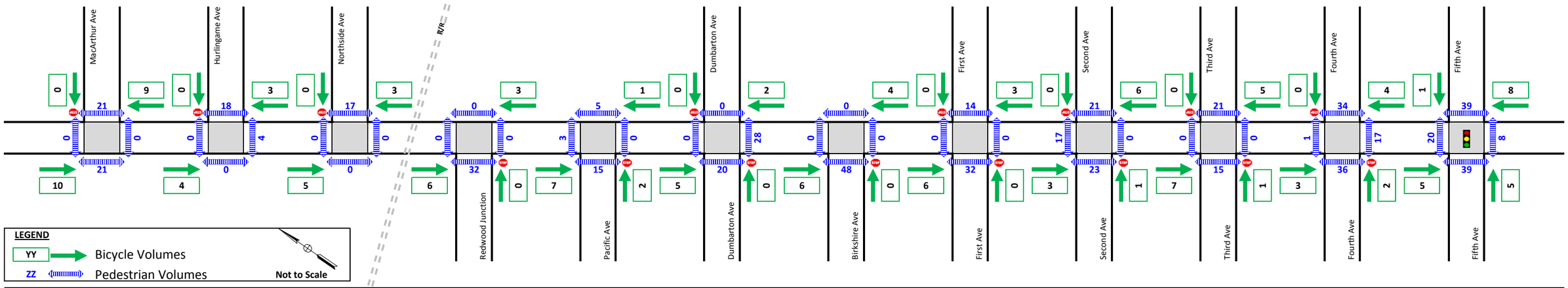
1. Middlefield Road / Willow Street (signal);
2. Middlefield Road / Charter Street (signal);
3. Middlefield Road / Flynn Avenue (two-way stop control);
4. Middlefield Road / Douglas Avenue (signal);
5. Middlefield Road / MacArthur Avenue (two-way stop control);
6. Middlefield Road / Hurlingame Avenue (two-way stop control);
7. Middlefield Road / Northside Avenue (two-way stop control);
8. Middlefield Road / Redwood Junction (two-way stop control);
9. Middlefield Road / Pacific Avenue (two-way stop control);
10. Middlefield Road / Dumbarton Avenue (two-way stop control);
11. Middlefield Road / Berkshire Avenue (two-way stop control);
12. Middlefield Road / 1st Avenue (two-way stop control);
13. Middlefield Road / 2nd Avenue (two-way stop control);
14. Middlefield Road / 3rd Avenue (two-way stop control);
15. Middlefield Road / 4th Avenue (two-way stop control);
16. Middlefield Road / 5th Avenue (signal);
17. Middlefield Road / 6th Avenue (two-way stop control);
18. Middlefield Road / 7th Avenue (two-way stop control);
19. Middlefield Road / Semicircular Road (signal);
20. Middlefield Road / 9th Avenue (two-way stop control);
21. Middlefield Road / Encinca Avenue (two-way stop control);
22. Middlefield Road / Placitas Avenue (two-way stop control);
23. Middlefield Road / San Benito Avenue (two-way stop control);
24. Middlefield Road / Fair Oaks Lane (two-way stop control);
25. Middlefield Road / Hollbrook Lane (two-way stop control);
26. Middlefield Road / Marsh Road (signal);
27. Fair Oaks Avenue / Douglas Avenue (two-way stop control);
28. Fair Oaks Avenue / Hurlingame Avenue (two-way stop control);
29. Fair Oaks Avenue / Warrington Avenue (two-way stop control);
30. Fair Oaks Avenue / 2nd Avenue (all-way stop control);
31. Fair Oaks Avenue / 5th Avenue (all-way stop control);
32. Spring Street / Charter Street (all-way stop control);
33. Spring Street / Douglas Street (all-way stop control);
34. Spring Street / Hurlingame Avenue (all-way stop control);
35. Spring Street / Warrington Avenue (two-way stop control);
36. Spring Street / 2nd Avenue (all-way stop control);

37. Spring Street / 5th Avenue (all-way stop control);
38. Bay Road / Charter Street (all-way stop control);
39. Bay Road / Douglas Avenue (all-way stop control);
40. Bay Road / Hurlingame Avenue (two-way stop control);
41. Bay Road / Warrington Avenue (two-way stop control);
42. Bay Road / 2nd Avenue (all-way stop control);
43. Bay Road / 5th Avenue (all-way stop control);
44. Bay Road / Spring Street (two-way stop control);
45. Bay Road / Marsh Road (signal);
46. Florence Avenue / Marsh Road (signal); and,
47. El Camino Real / 5th Avenue (signal)

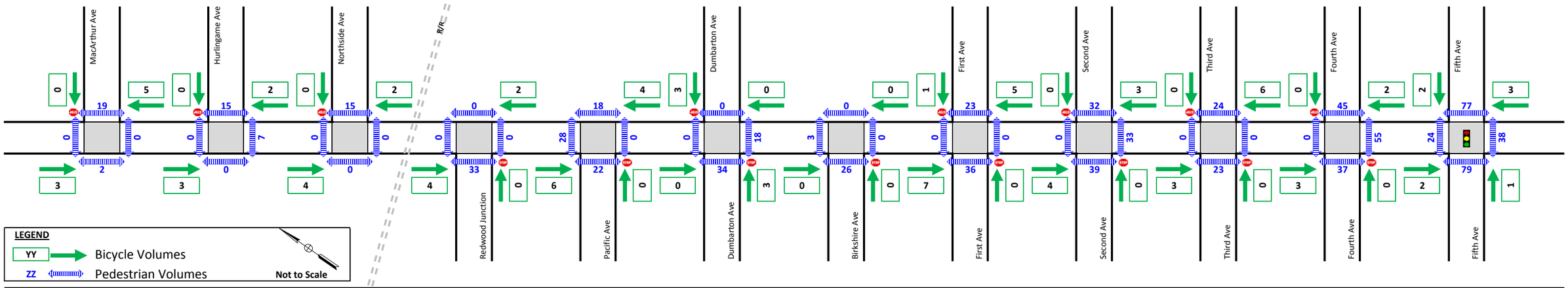
Figure 3 - Existing Pedestrian and Bicycle Volumes

AECOM

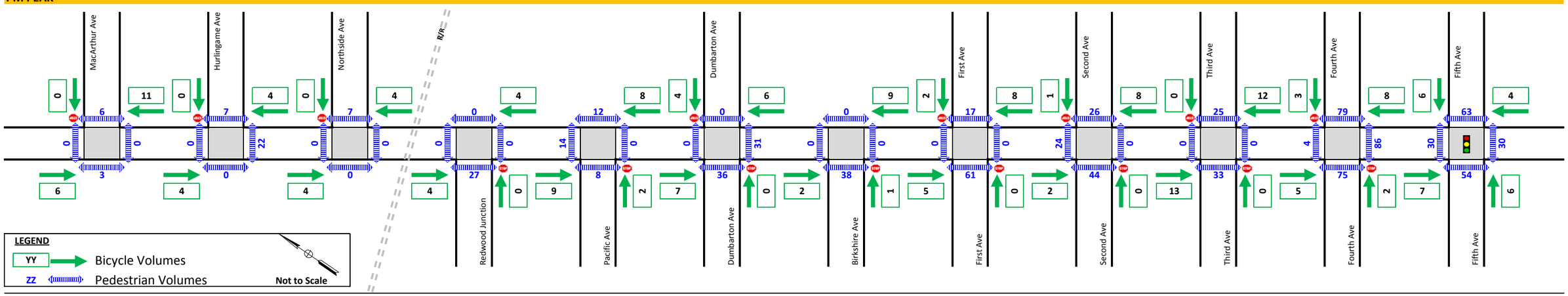
AM PEAK

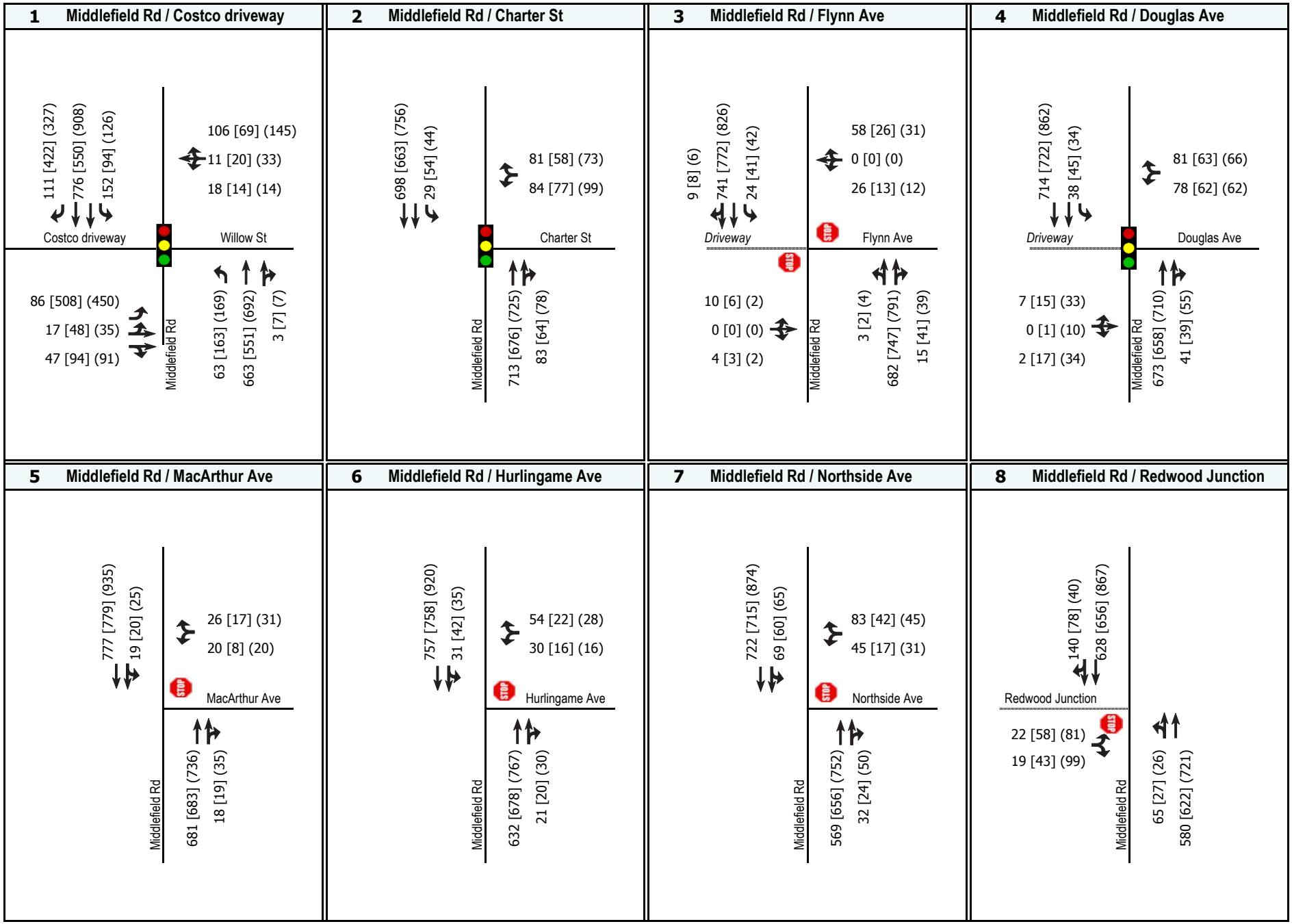


SCHOOL PEAK



PM PEAK





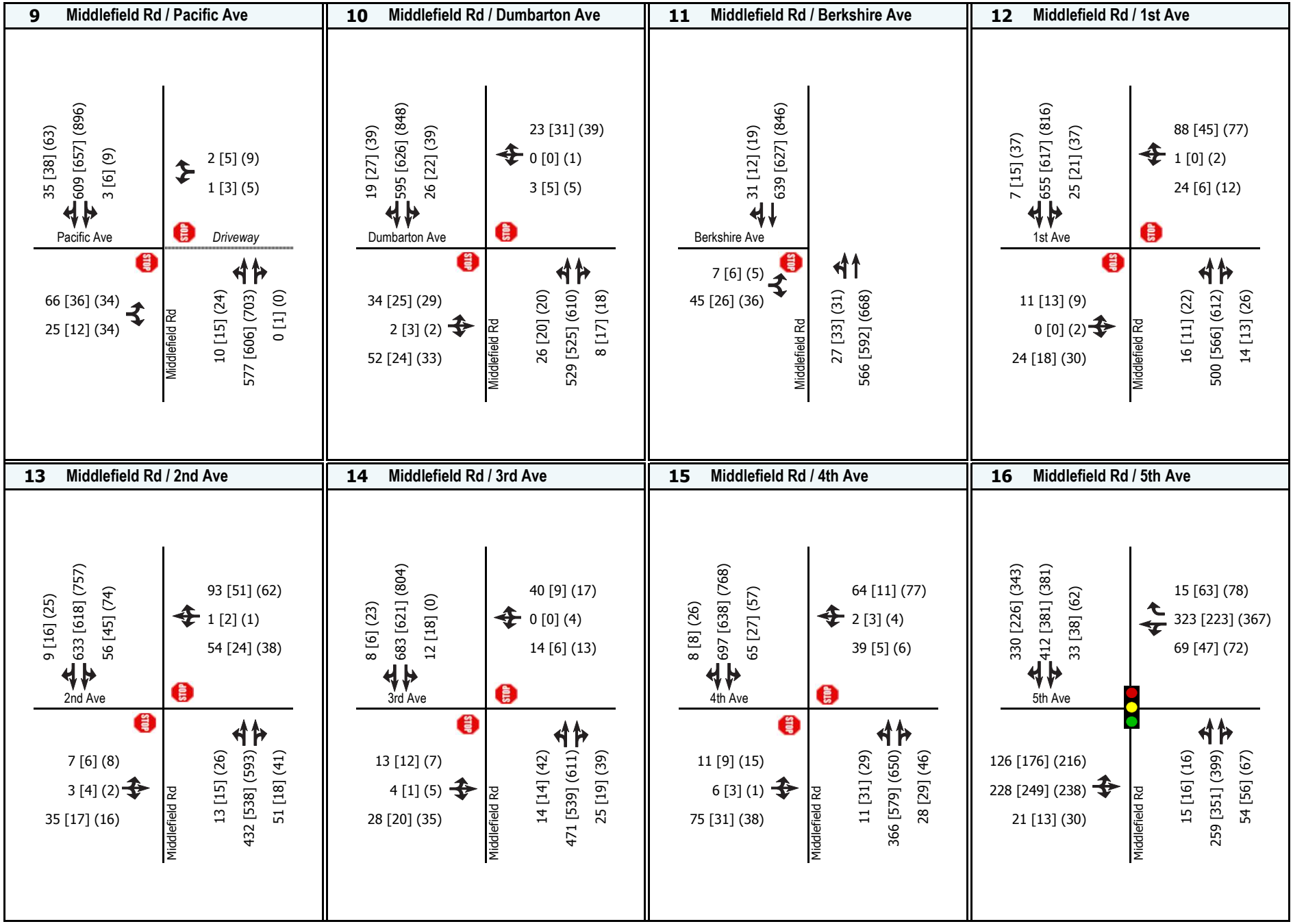
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 4A

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 4B

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES

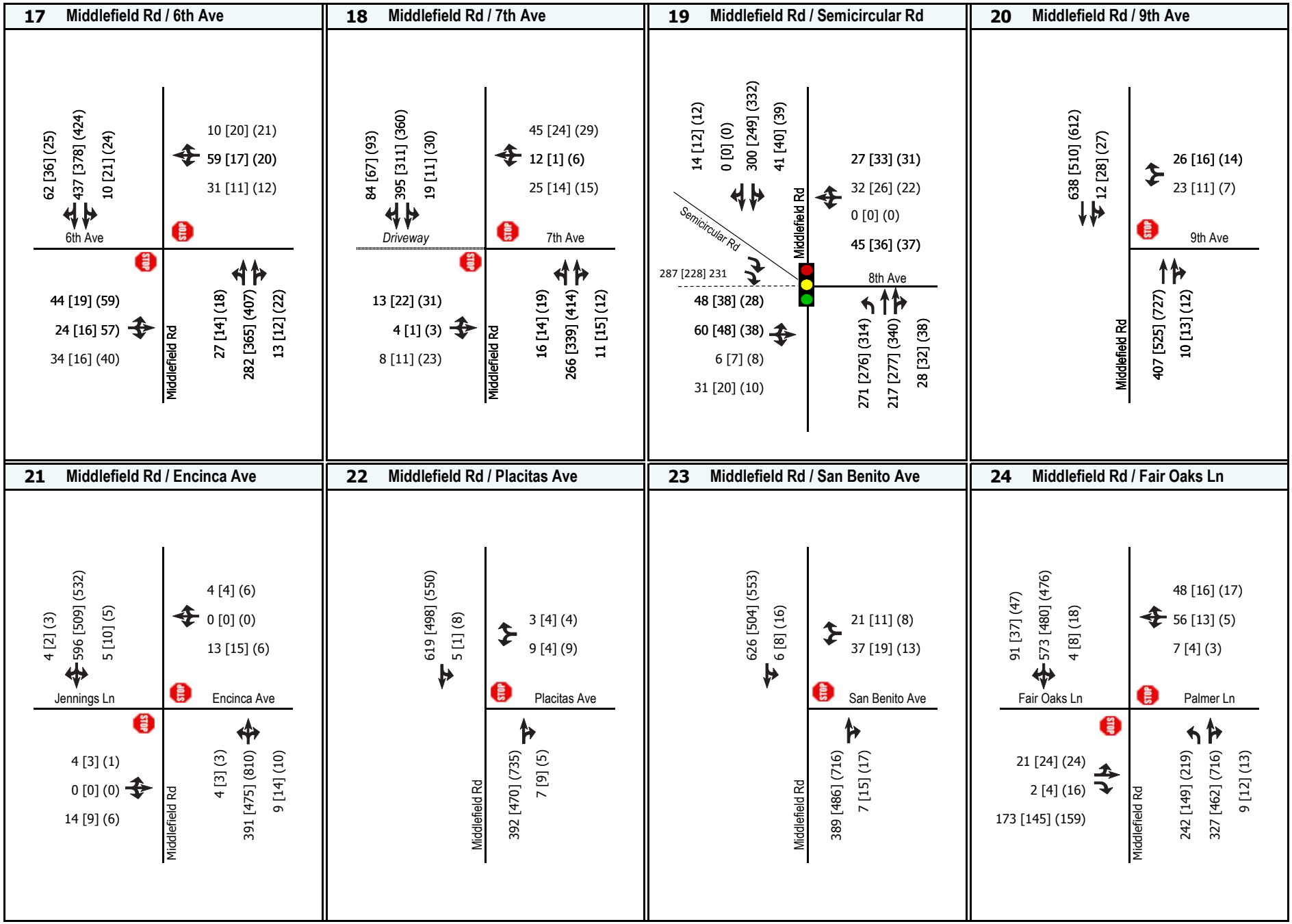
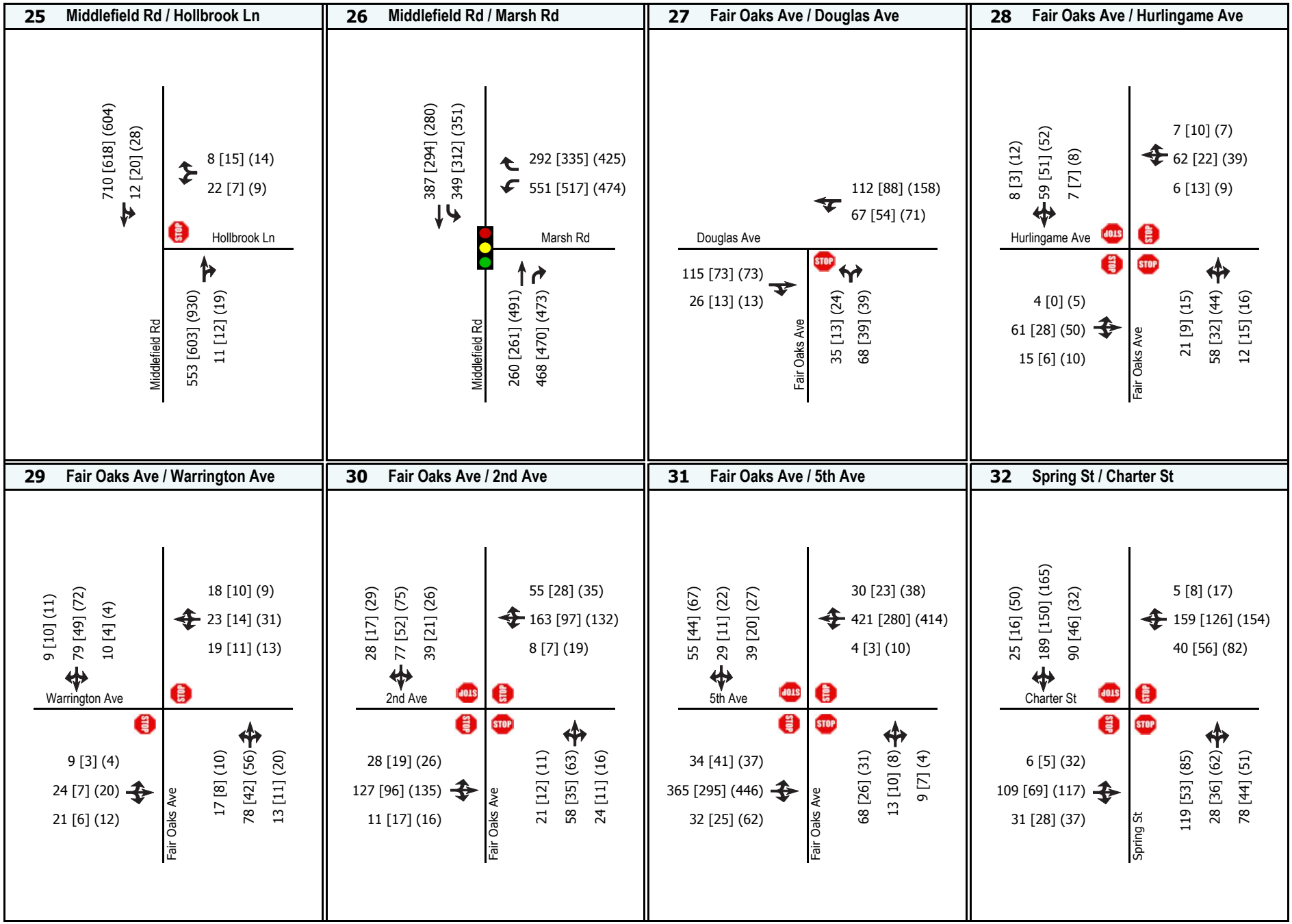


FIGURE 4C

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES



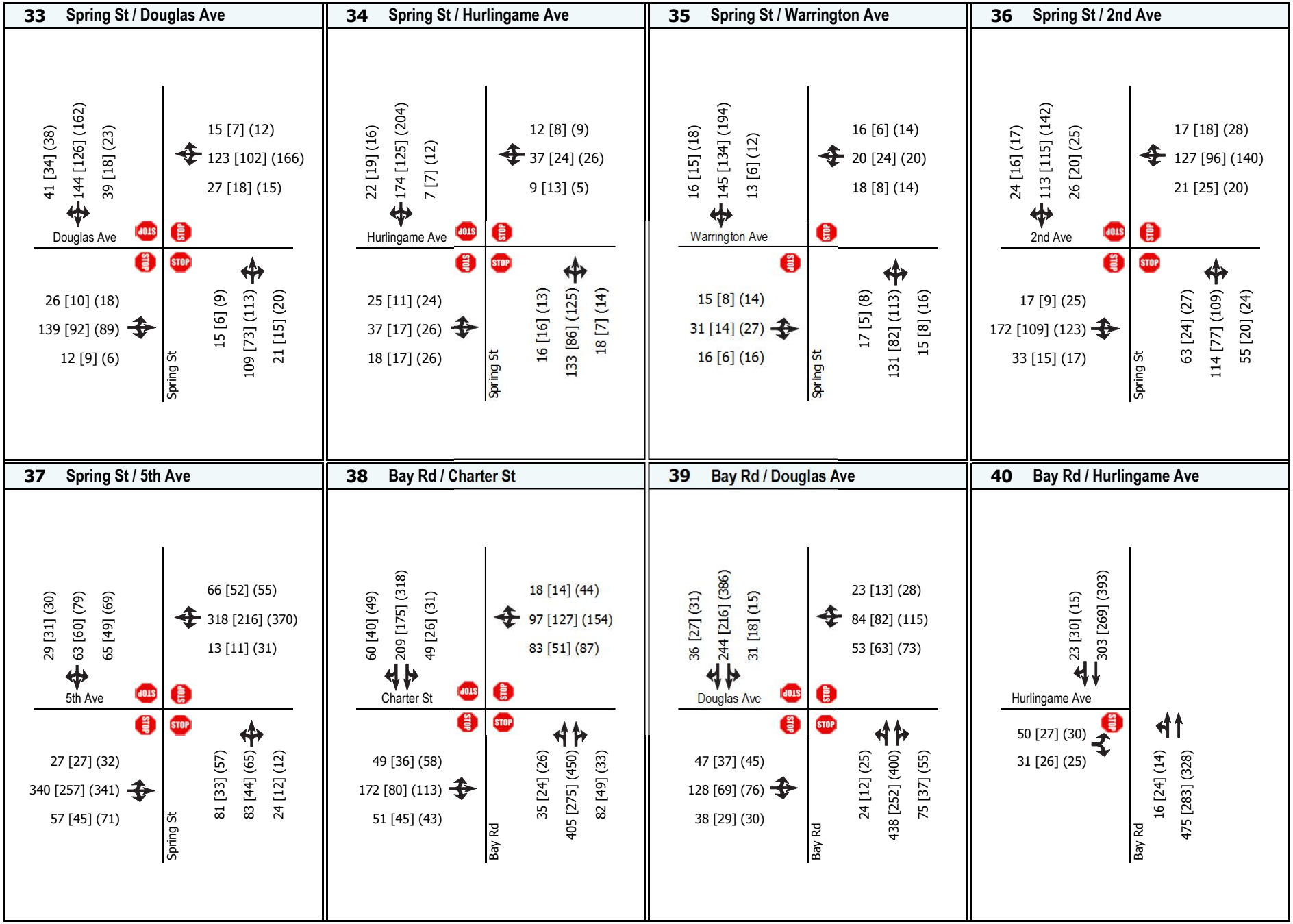
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 4D

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES



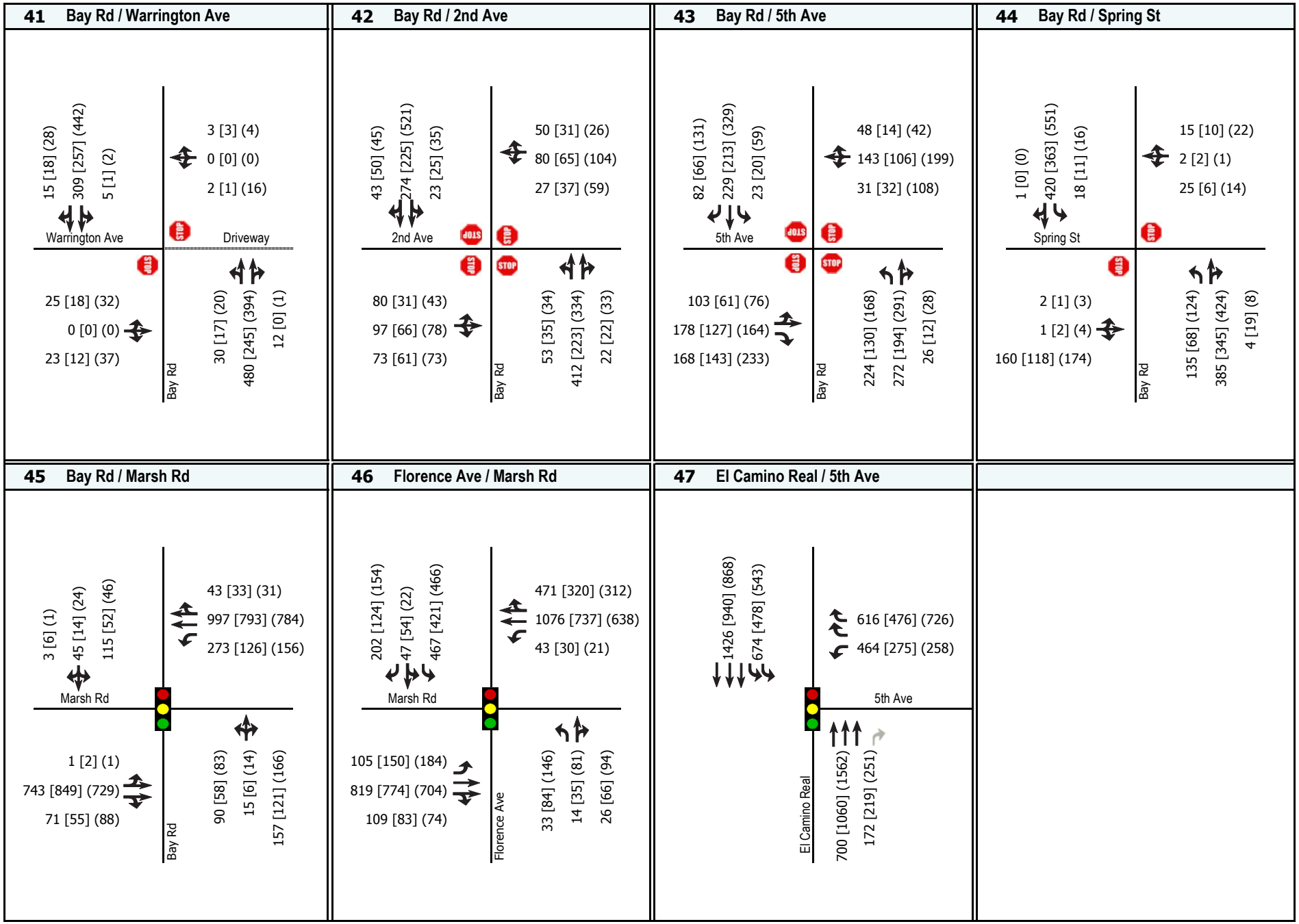
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 4E

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 4F

EXISTING LANE CONFIGURATION AND TRAFFIC VOLUMES

2.5 EXISTING INTERSECTION LEVEL OF SERVICE

Existing intersection lane configurations signal timings and turning movement volumes were used to calculate the levels of service for the study intersections during each peak hour. The results of the LOS analysis using the Synchro software program for Existing Conditions are presented in **Table 2. Appendix C** contains the corresponding LOS calculation sheets.

The results of the LOS calculations indicate that the majority of the study intersections operate at acceptable levels of service of LOS D or better according to the County of San Mateo LOS standards with the exception of the following:

- ✓ During the AM peak hour, within the Traffic Study Limits, 7 of the 47 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). However, within the project limits, 3 of the 12 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at the County's acceptable LOS D or better standards.
- ✓ During the School PM peak hour, within the Traffic Study Limits, 6 of the 47 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). Within the project limits, only 3 of the 12 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at the County of San Mateo's acceptable LOS D or better standards.
- ✓ During the PM peak hour, within the Traffic Study Limits, 16 of the 47 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). However, within the project limits, 8 of the 12 intersections operate at the County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at acceptable LOS D or better standards.

Within the traffic study limits, 26 of the 47 intersections are Two-Way Stop Control (TWSC) intersections, 12 of the 47 are All-Way Stop Control (AWSC) intersections and the remaining 9 are signalized intersections. As mentioned earlier, the LOS delay thresholds are different for an unsignalized intersections compared to the signalized intersections. For a TWSC, the intersection delay is analyzed based on the worst movement delay. Therefore, most times, TWSC fail mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. High traffic volumes on the major street can cause significant delay for minor street drivers to enter or cross the intersection, as well as for major street drivers looking for a gap in traffic to make a left or U-turn maneuver. For a Signal or AWSC intersections, the intersection is analyzed based on the weighted average overall intersection delay.

Table 2 Existing Intersection Level of Service

	No	Intersection		Control	AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
Study Limits	1	Middlefield Rd	Willow St	Signal	B	12.7	B	17.4	C	28.2
	2	Middlefield Rd	Charter St	Signal	B	14.6	B	12.4	B	14.3
	3	Middlefield Rd	Flynn Ave	TWSC[1]	D	30.6	**E**	**36.3**	D	30.0
	4	Middlefield Rd	Douglas Ave	Signal	A	9.4	A	4.6	A	6.8
Project Limits	5	Middlefield Rd	MacArthur Ave	TWSC[1]	C	21.3	C	16.4	C	21.0
	6	Middlefield Rd	Hurlingame Ave	TWSC[1]	C	23.4	C	21.8	C	23.5
	7	Middlefield Rd	Northside Ave	TWSC[1]	D	31.9	C	20.0	D	30.4
	8	Middlefield Rd	Redwood Junction	TWSC[1]	D	33.0	**E**	**39.9**	**F**	**133.9**
	9	Middlefield Rd	Pacific Ave	TWSC[1]	**E**	**41.9**	**E**	**40.8**	**F**	**93.1**
	10	Middlefield Rd	Dumbarton Ave	TWSC[1]	D	32.9	D	33.0	**F**	**95.6**
	11	Middlefield Rd	Berkshire Ave	TWSC[1]	B	14.9	B	14.0	C	17.8
	12	Middlefield Rd	1st Ave	TWSC[1]	D	25.5	C	23.2	**E**	**47.4**
	13	Middlefield Rd	2nd Ave	TWSC[1]	**F**	**60.0**	D	31.3	**F**	**62.3**
	14	Middlefield Rd	3rd Ave	TWSC[1]	D	25.9	C	20.0	**E**	**39.1**
	15	Middlefield Rd	4th Ave	TWSC[1]	**F**	**80.9**	**E**	**44.4**	**F**	**63.3**
	16	Middlefield Rd	5th Ave	Signal	D	46.3	D	35.8	**E**	**59.6**
Traffic Study Limits	17	Middlefield Rd	6th Ave	TWSC[1]	**F**	**90.9**	D	29.4	**F**	**73.8**
	18	Middlefield Rd	7th Ave	TWSC[1]	C	22.1	C	21.4	C	19.1
	19	Middlefield Rd	Semicircular Rd	Signal	C	22.3	B	16.1	B	16.0
	20	Middlefield Rd	9th Ave	TWSC[1]	B	13.8	C	15.3	C	18.0
	21	Middlefield Rd	Encinca Ave	TWSC[1]	D	33.9	**E**	**35.1**	**E**	**39.6**
	22	Middlefield Rd	Placitas Ave	TWSC[1]	C	22.7	C	17.4	**E**	**38.4**
	23	Middlefield Rd	San Benito Ave	TWSC[1]	D	26.8	C	21.4	D	30.9
	24	Middlefield Rd	Fair Oaks Ln	TWSC[1]	**F**	**321.2**	**E**	**46.9**	**F**	**796.6**
	25	Middlefield Rd	Hollbrook Ln	TWSC[1]	**E**	**40.3**	C	24.5	**F**	**59.3**
	26	Middlefield Rd	Marsh Rd	Signal	D	37.4	C	29.3	D	38.0
Traffic Study Limits	27	Fair Oaks Ave	Douglas Ave	TWSC[1]	B	11.3	A	9.9	B	10.4
	28	Fair Oaks Ave	Hurlingame Ave	AWSC	A	8.1	A	7.7	A	8.0
	29	Fair Oaks Ave	Warrington Ave	TWSC[1]	B	11.5	A	9.9	B	10.7
	30	Fair Oaks Ave	2nd Ave	AWSC	B	10.3	A	9.1	A	9.5
	31	Fair Oaks Ave	5th Ave	AWSC	C	22.8	B	12.6	**F**	**54.2**
	32	Spring St	Charter St	AWSC	C	15.9	B	10.6	B	13.0
	33	Spring St	Douglas Ave	AWSC	B	11.1	A	9.3	B	10.7
	34	Spring St	Hurlingame Ave	AWSC	A	9.1	A	8.2	A	9.7
	35	Spring St	Warrington Ave	TWSC[1]	B	13.5	B	11.8	B	12.5
	36	Spring St	2nd Ave	AWSC	B	11.7	B	10.3	B	10.5

	No	Intersection		Control	AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
	37	Spring St	5th Ave	AWSC	D	26.7	B	13.7	D	34.2
	38	Bay Rd	Charter St	AWSC	C	19.8	B	12.9	C	18.5
	39	Bay Rd	Douglas Ave	AWSC	B	14.3	B	10.6	C	15.0
	40	Bay Rd	Hurlingame Ave	TWSC[1]	B	14.7	B	12.0	B	13.7
	41	Bay Rd	Warrington Ave	TWSC[1]	B	14.8	B	12.3	C	20.6
	42	Bay Rd	2nd Ave	AWSC	B	14.9	B	11.4	D	25.7
	43	Bay Rd	5th Ave	AWSC[2]	C	23.3	C	16.0	**F**	**52.0**
	44	Bay Rd	Spring St	TWSC[1]	**F**	**55.9**	C	15.1	**F**	**100.9**
	45	Bay Rd	Marsh Rd	Signal	C	24.1	B	15.0	B	17.6
	46	Florence Ave	Marsh Rd	Signal	D	46.2	D	37.0	D	49.4
	47	El Camino Real	5th Ave	Signal	C	31.0	C	24.7	C	29.7

Source: AECOM 2015
Notes:
1. Gray highlights indicate the project limits.
2. AM = morning peak hour, School PM = After school hour, PM = evening peak hour
3. Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections. Total control delay for the worst movement is presented for side-street stop controlled intersections.
Bold text indicates deficient intersection operations.

2.6 EXISTING CONDITIONS QUEUE ANALYSIS

Sim-Traffic simulation provides real time operating conditions, whereas Synchro provides capacity based analysis results. In order to replicate the queues observed in the field at critical locations, Sim-Traffic model was used. **Table 3** presents the results of 95th percentile queues at the study intersections within the project limits. The results of the queue analysis are based on multi-run Sim traffic simulation. As observed in the field, the queue lengths from the model show that the queues are within the provided storage capacity except at the intersection of Middlefield Road and Fifth Avenue. The queue lengths that exceed the available storage are underlined in the table below. The corresponding Sim Traffic queue length calculation sheets are presented in **Appendix C**.

Table 3 – Existing Conditions 95th Percentile Queue Length – SimTraffic Results

No.	Intersection	Existing Conditions Queue Length (Ft)					
5	Intersection: 5: Middlefield Rd & MacArthur Ave		WBLR	NBT	NBTR	SBLT	SBT
		Storage Capacity	1,500	200	200	200	200
		AM PEAK	57	0	0	14	0
		SCHOOL PM PEAK	45	0	0	34	0
		PM PEAK	67	0	0	100	63
6	Intersection: 6: Middlefield Rd & Hurlingame Ave		WBLR	NBT	NBTR	SBLT	SBT
		Storage Capacity	1,700	50	50	200	200
		AM PEAK	56	10	30	59	16
		SCHOOL PM PEAK	55	10	26	74	19
		PM PEAK	60	27	36	114	100
7	Intersection: 7: Middlefield Rd & Northside Ave		WBLR	NBT	NBTR	SBLT	SBT
		Storage Capacity	425	50	50	50	50
		AM PEAK	157	10	23	43	10
		SCHOOL PM PEAK	28	0	16	44	9
		PM PEAK	79	32	35	45	20

No.	Intersection	Existing Conditions Queue Length (Ft)						
8	Intersection: 8: Middlefield Rd & Redwood junction		EBLR	NBLT	NBT	SBT	SBTR	
		Storage Capacity	300	100	100	50	50	
		AM PEAK	43	63	0	13	23	
		SCHOOL PM PEAK	90	53	0	0	9	
		PM PEAK	251	73	21	0	19	
9	Intersection: 9: Middlefield Rd & Pacific Ave/Driveway		EBLR	WBLR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	950	100	2,200	2,200	100	100
		AM PEAK	69	1	9	3	1	0
		SCHOOL PM PEAK	62	3	30	19	19	36
		PM PEAK	119	10	28	15	26	31
10	Intersection: 10: Middlefield Rd & Dumbarton Ave		EBLTR	WBLTR	NBL	NBTR	SBLT	SBTR
		Storage Capacity	425	425	1,650	1,650	500	500
		AM PEAK	62	59	43	25	44	42
		SCHOOL PM PEAK	75	44	55	32	52	49
		PM PEAK	79	53	62	54	84	70
11	Intersection: 11: Middlefield Rd & Berkshire Ave		EBLR	NBLT	NBT	SBT	SBTR	
		Storage Capacity	825	1,250	1,250	850	850	
		AM PEAK	56	49	29	10	10	
		SCHOOL PM PEAK	47	44	10	10	38	
		PM PEAK	51	56	0	10	0	
12	Intersection: 12: Middlefield Rd & 1st Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	825	850	1,100	1,100	1,050	1,050
		AM PEAK	41	68	30	0	29	0
		SCHOOL	42	52	19	0	33	0

No.	Intersection	Existing Conditions Queue Length (Ft)						
		PM PEAK						
		PM PEAK	60	67	40	0	58	0
13	Intersection: 13: Middlefield Rd & 2nd Ave		EBL TR	WBLTR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	825	775	850	850	1,300	1,300
		AM PEAK	52	99	31	21	46	16
		SCHOOL PM PEAK	46	71	59	30	58	28
		PM PEAK	46	111	52	50	73	72
14	Intersection: 14: Middlefield Rd & 3rd Ave		EBL TR	WBLTR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	785	745	525	525	1,600	1,600
		AM PEAK	54	52	10	0	12	0
		SCHOOL PM PEAK	46	24	27	0	25	0
		PM PEAK	48	44	49	0	0	22
15	Intersection: 15: Middlefield Rd & 4th Ave		EBL TR	WBLTR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	785	800	250	250	1,900	1,900
		AM PEAK	67	73	30	3	33	37
		SCHOOL PM PEAK	59	39	61	44	40	67
		PM PEAK	159	87	139	133	120	218
16	Intersection: 16: Middlefield Rd & 5th Ave		EBL TR	WBLT	WBR	NBLT	NBTR	SBLT	SBTR
		Storage Capacity	2,200	1,500	80	800	800	2,200	2,200
		AM PEAK	796	322	65	110	138	185	229
		SCHOOL PM PEAK	698	372	<u>127</u>	133	140	208	229
		PM PEAK	<u>2,779</u>	470	<u>119</u>	277	281	267	291

Source: AECOM 2015

Notes:

<u>Underline</u> indicates queue length exceeds storage capacity.

2.7 EXISTING FIELD OBSERVATIONS

Field observations of vehicles, pedestrians, and bicyclists at the project site and at study area locations were conducted during the weeks of June 2015 to verify the calculated LOS and observe overall transportation characteristics. In general, observations indicated that most of the study intersections are operating at or near the calculated levels of service. Specific descriptions for unique findings are listed below.

During the AM peak period, northbound is the peak travel direction, and in the PM peak period, southbound is the peak travel direction within the project study limits. In general, the PM peak period carries more vehicles compared to other peak periods. Due to high traffic volumes along the southbound direction, the minor streets must wait longer to find a gap in order to merge onto Middlefield Road. As a result, heavy delay is experienced by the minor street traffic. Due to the above reason, several of the study intersections operate at unacceptable levels of service of LOS E or worse during the PM peak hour.

Middlefield Road within the project study limits contains several retail land uses. Heavy pedestrian activity was observed in order to access the land uses. Based on the pedestrian counts obtained within the project limits, pedestrians generally made use of the marked crosswalks to cross Middlefield Road, and higher pedestrian movements were observed in the PM peak period. In addition, a higher number of jaywalking pedestrians were observed in the vicinity of Second Avenue to Fourth Avenue, particularly during the School PM peak hour. All four legs of the signalized crosswalk at Fifth Avenue were well used during the peak hours. The existing sidewalks are not wide enough and were congested at times when there were many pedestrians.

Due to the lack of designated bike lanes and due to the presence of angular on-street parking, conflicts between cyclists and vehicles parking or backing out were observed. Cyclists were either interrupted by cars backing up from angled parking or had to move into the main traffic flow to avoid vehicles trying to park on-street. Some cyclists were observed using the sidewalk to completely move away from motorized vehicles, thereby taking up the sidewalks meant for foot traffic.

The existing parking within the project study limits is angle parking; when vehicles back out of the parking spaces, they block one of the existing through lanes and cause unsafe conditions for bicyclists. The current angle parking not only creates unsafe conditions for through traffic, but it also creates dangerous conditions for bicyclists along Middlefield Road. The angle parked vehicles were observed to impede through traffic when they tried to back out of the parking spots and the buses also impede through traffic when stopped at bus stops.

3. ALTERNATIVES CONSIDERED

By working collaboratively with the County, residents, and other key stakeholders, and also keeping the key functional objectives in mind, the following two alternatives were considered to be pursued further for operational analysis.

3.1 NO-BUILD ALTERNATIVE (BUILD 4 LANES ALTERNATIVE)

This alternative is the same as the Build 4 Lanes alternative, as there will be no change in conditions in terms of capacity and lane configurations. There are no changes to the on-street parking arrangement as well. Thus, the traffic analysis for the No-Build Alternative will be considered the same as the Build 4 Lanes Alternative.

3.2 BUILD 3 LANES ALTERNATIVE

Under this alternative, the following improvements are proposed on Middlefield Road between MacArthur Avenue to the north and Fifth Avenue to the south:

- Reallocate road space within the existing right-of-way by repurposing travel lanes and queuing storage for vehicular traffic as part of a “road diet”. Therefore, the Middlefield Road segment between MacArthur Avenue and Fifth Avenue will be converted to a three-lane roadway, with one through lane along northbound and southbound with a center two-way left turn lane (TWLT). At the intersections, the project proposes to provide left turn pockets. All proposed lanes are 11 feet wide.
- Add buffered bike lanes in the southbound and northbound directions, each with a 6.5 foot total width.
- Add bulbouts at each intersection to improve sight distances for pedestrians and reduce the lengths of the crosswalks to approximately 45 feet.
- Widen the sidewalks to 12 feet along the length of the project and remove the overhead wires and poles to improve the safety and accessibility for pedestrians, and to accommodate underground electrical facilities for PG&E.
- In order to comply with the CPUC, the proposed project will also construct several modifications to the existing driveway to the North Fair Oak Health Center and the at-grade railroad crossing. The modifications include:
    - Relocating the driveway and the Health Center signage
    - Modifying raised medians and thus, the private property traffic circulation pattern
    - Replacing and relocating track signal equipment as well as curbs
    - Re-striping the driveway
    - Restricting turning left movements from westbound Northside Avenue

  - Signalizing the driveway access with railroad preemption

- Replace the diagonal on-street parking with 8-foot wide parallel parking at the sidewalk curb and have a striped buffer between the parking spaces and the bike lane. Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits. Conversion from angled to parallel parking as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield Road and 2nd Avenue, and 16 spaces will be provided at Berkshire Lot.

The Study Area and conceptual design plans for this option are included in **Appendix A**.

4. DEVELOPMENT OF FORECAST TRAFFIC VOLUMES

4.1 TRAFFIC FORECASTING MODEL AND PROCEDURE

The travel demand model used for this project was VTA-C/CAG (Valley Transportation Authority- City/County Association of Governments of San Mateo County) Forecast Traffic Models for 2013, 2020 and 2040. The model forecast volumes were "post-processed" using the methodology described next. The ADT and peak period model volumes (existing conditions) from VTA- C/CAG were extrapolated and compared to 2015 field counts to identify any major differences (greater than 20% difference in forecast volumes).

4.2 POST PROCESSING METHODOLOGY

The Opening Year for the Streetscape Project is defined as 2020. The current VTA- C/CAG Forecast Traffic Models include a baseline model network for the year 2013. Traffic Turning Movement Counts were collected in June and December of 2015 which was used to confirm existing year traffic volumes. These counts were checked against the historic data and seasonal data available to make sure that normal traffic conditions were captured. The standard Caltrans methodology, as defined in NCHRP Report 765, was then applied at each study intersection to factor these existing traffic counts on Middlefield Road to the year 2020 by applying the factored model growth between the baseline and future model volumes as estimated by VTA-C/CAG. Link volumes for the intersections were obtained from the VTA-C/CAG models, and the corresponding growth in link volumes was applied to the existing counts link volumes. Using Furness method and existing turning movement volumes, future turning movement volumes were determined.

The Design Year for the Streetscape Project is defined as 2050. The Design Year traffic volumes for each study intersection were developed using two steps. The first step was similar to that of the Opening Year post-processing methodology described above. The model growth from the 2020 model and 2040 future model was applied to the existing traffic counts to get the 2040 post-processed traffic volumes. The second step was to extrapolate 2040 post processed traffic volumes to 2050 Design Year traffic volumes. Since the 2050 model or socioeconomic data was not available, using the Furness method and existing turning movement volumes, growth rates per movement were determined and applied to 2040. If the model produced a negative growth, then it was assumed that the traffic would remain the same to be conservative, unless there was a clear cause and explanation for the change in traffic. Traffic flow was also "conserved" between the post-processed volumes by direction and time period.

4.3 BUILD 3 LANE OPTION

As described above the future operational forecast volumes were developed using the C/CAG-VTA model and the forecast volumes were processed using a standard process in order to obtain the volumes for this alternative to use in the operational analysis. Since this project proposes a reduction in the through lanes within the project limits along Middlefield Road, the traffic is expected to divert and travel on other parallel routes such as to El Camino Real, Bay Road, and Spring Street to reach their destination. The traffic diversion map is attached in **Appendix A.**

Traffic Forecasting Scenarios Analyzed

Traffic forecasts for the following scenarios were developed and analyzed for the following four scenarios:

1. Opening Year (2020) No-Build and Build 4 Lane Alternative
2. Opening Year (2020) Build 3 Lane Alternative
3. Design Year (2050) No-Build and Build 4 Lane Alternative
4. Design Year (2050) Build 3 Lane Alternative

5. OPENING YEAR 2020 CONDITIONS

Opening Year (2020) traffic operating conditions for the Middlefield Road Streetscape project were analyzed using the Synchro/Sim-Traffic software models. To create the 2020 models, the existing conditions synchro network was modified to reflect the 2020 forecasted demands. For the 2020 build alternative, the synchro network was coded to be consistent with the design plans for the project.

5.1 NO-BUILD OPERATING CONDITIONS

This section summarizes the 2020 No-Build operating conditions for the AM, School PM, and PM peak hours. **Figure 5** presents the AM and PM peak-hour turning movement volumes at the study intersections under this scenario.

Level of service calculations were conducted to evaluate intersection operations under the Opening Year 2020 No-Build conditions. The results of the LOS analysis are summarized in **Table 4. Table 4** presents the LOS along with existing conditions LOS for the purpose of comparison. The corresponding LOS calculation sheets are included in **Appendix C.**

AM Peak Hour

- Under the Opening Year 2020 No-Build conditions, 8 additional intersections performed at unacceptable standards (LOS E or worse) compared to the Existing Conditions.
- Within the Traffic Study Limits, 15 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.
- Within the project limits, 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.

School PM Peak Hour

- Under the Opening Year 2020 No-Build conditions, 1 additional intersection performed at unacceptable standards (LOS E or worse) compared to the Existing Conditions.
- Within the Traffic Study Limits, 7 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.
- Within the project limits, 5 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.

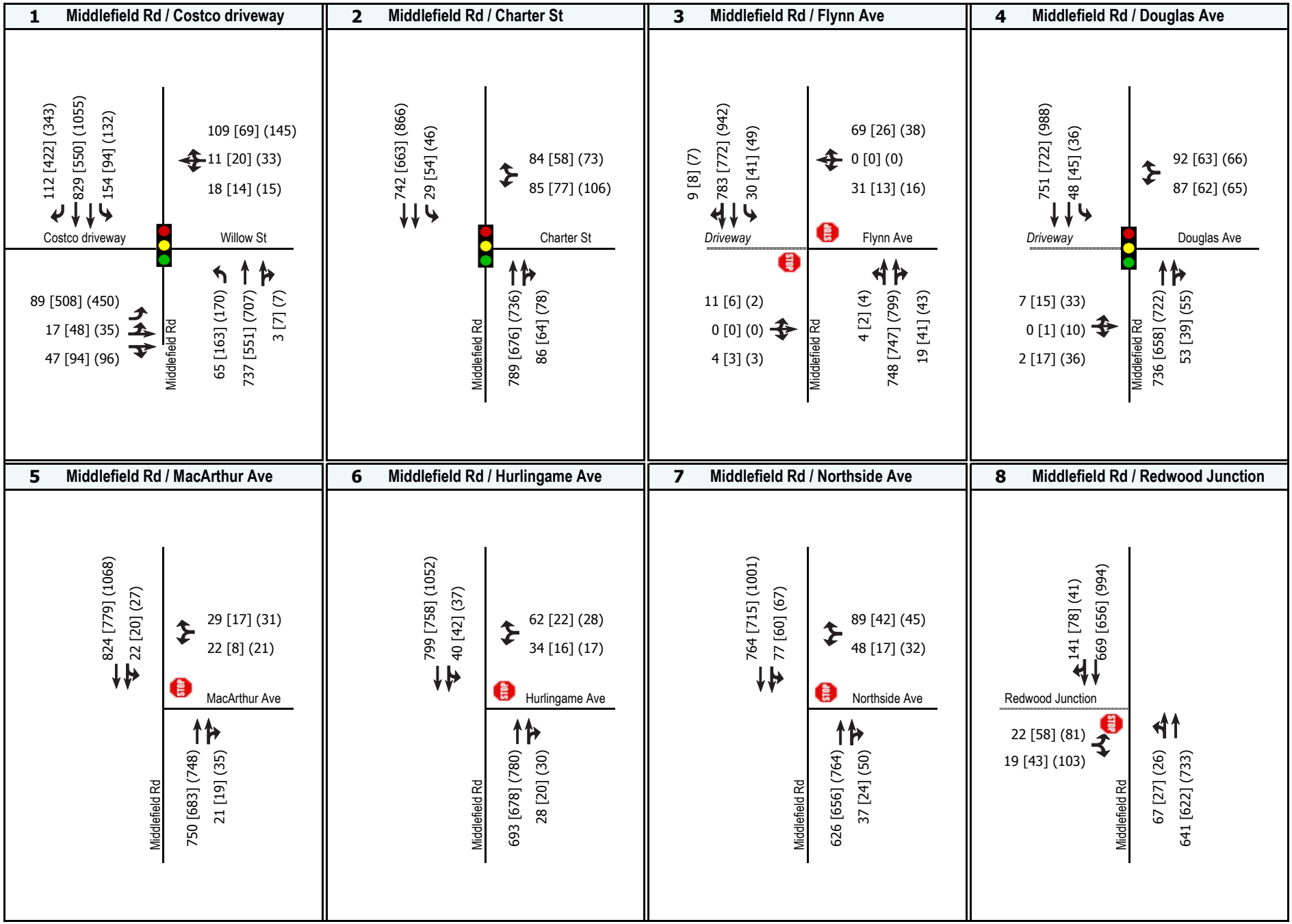
- All other intersections operate at acceptable levels of service of LOS D or better.

PM Peak Hour

- Under the Opening Year 2020 No-Build conditions, 4 additional intersection performed at unacceptable standards (LOS E or worse) compared to the Existing Conditions.
- Within the Traffic Study Limits, 20 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.
- Within the project limits, 9 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse) under the Opening Year 2020 No-Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.

The reason for poor performance under the 2020 No-Build conditions can be attributed to:

1. The traffic growth as projected by the forecast model for the opening year 2020 based on the lane use change between the existing and opening year 2020.
2. Within the project limits, most of the intersections that operate at unacceptable levels of service are two-way stop controlled intersections. TWSC intersections fail mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. The operational efficiency of a two-way stop controlled intersection will naturally decrease as the major street volume increases. High traffic volumes on the major street can cause significant delay for minor street drivers to enter or cross the intersection, as well as for major street drivers looking for a gap in traffic to make a left or U-turn maneuver.



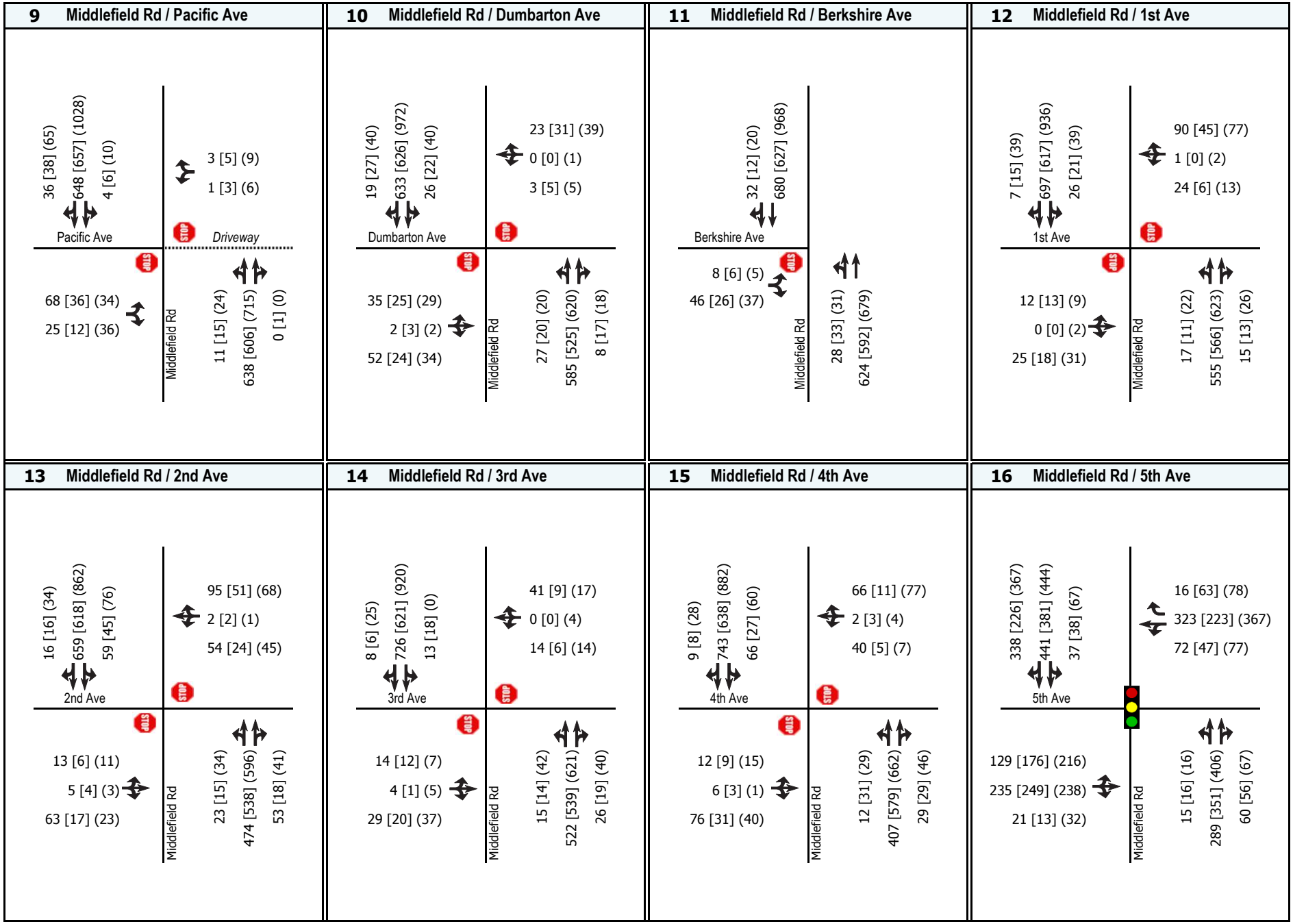
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5A

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



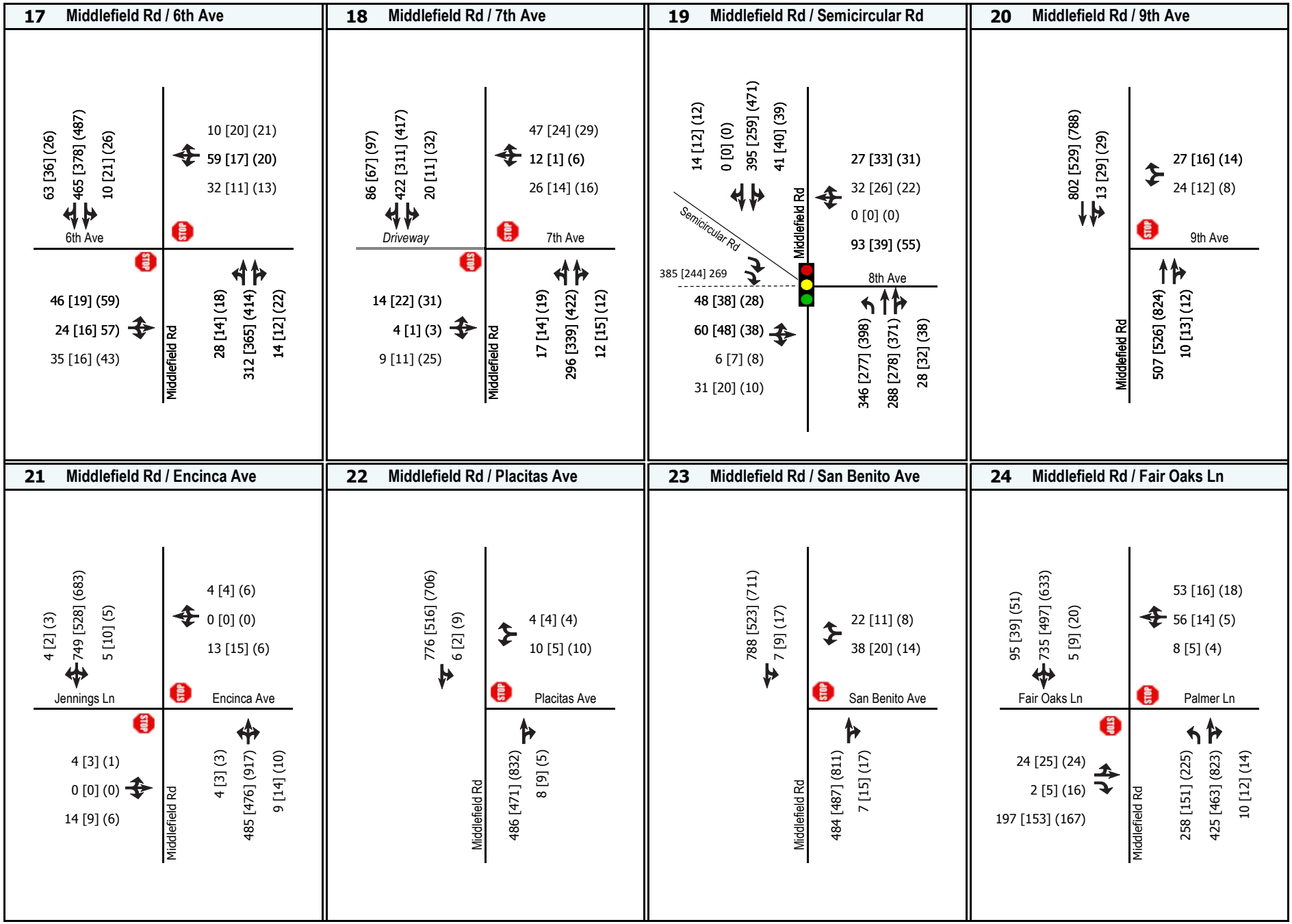
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5B

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



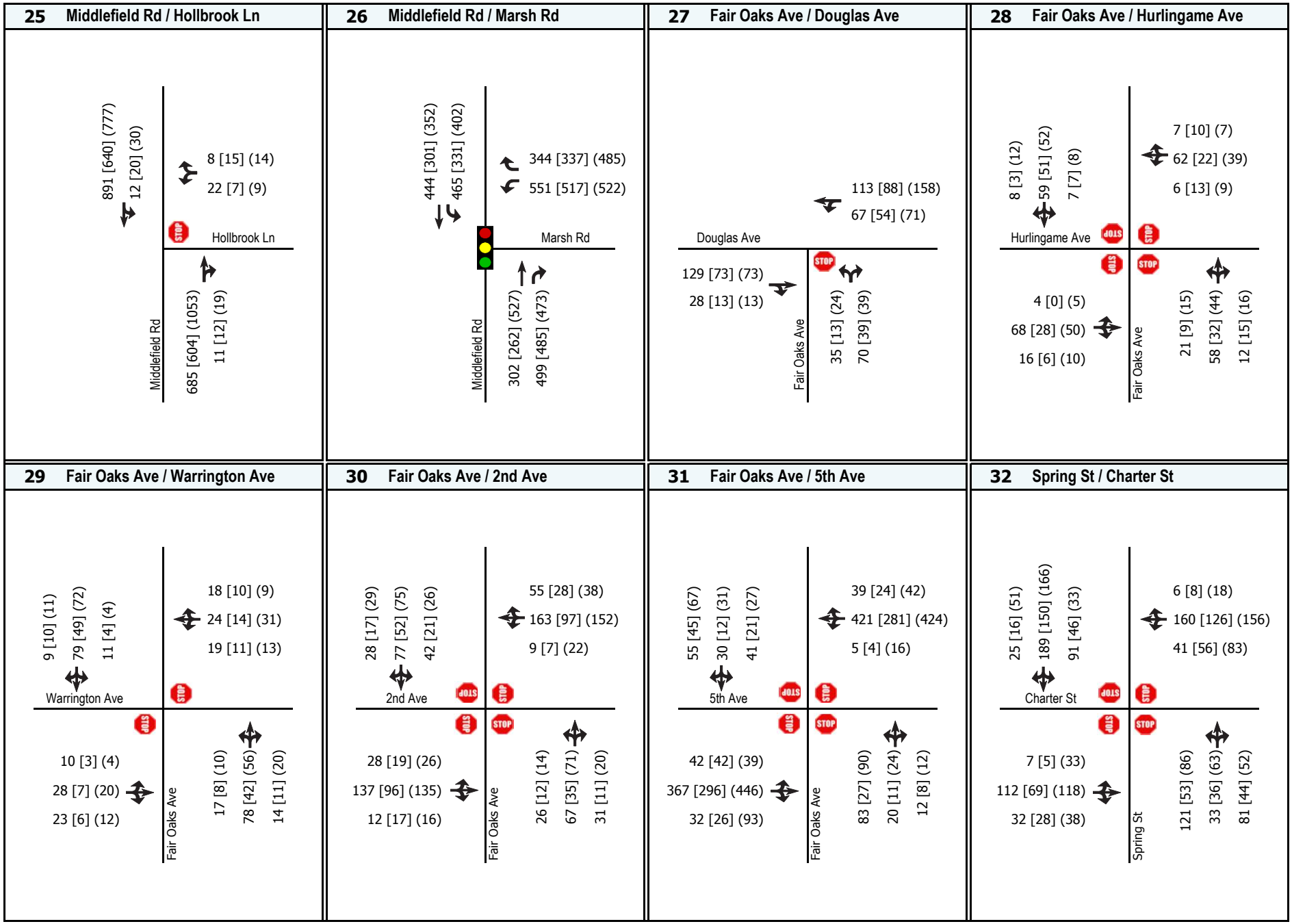
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5C

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 lane Option)



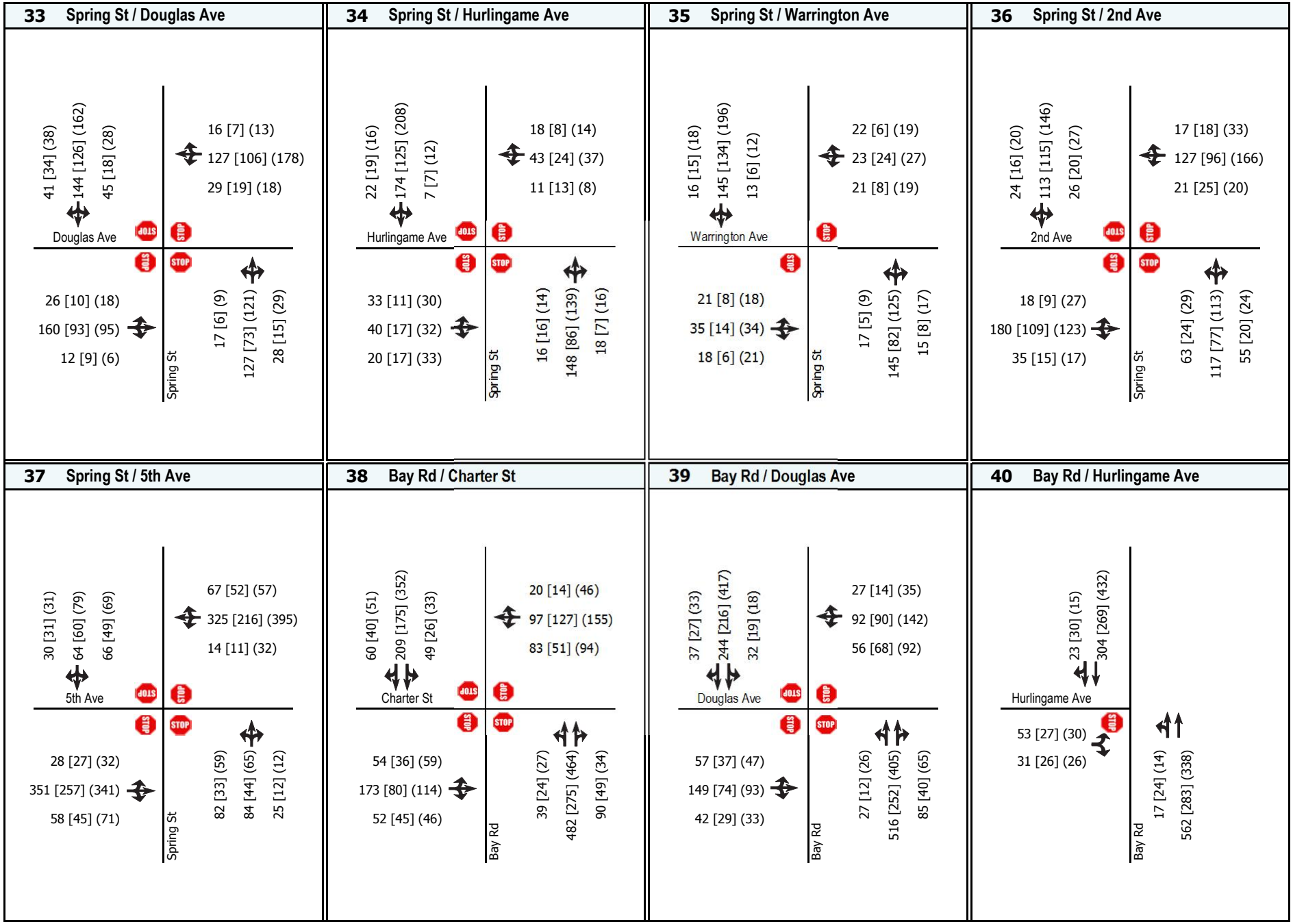
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5D

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes

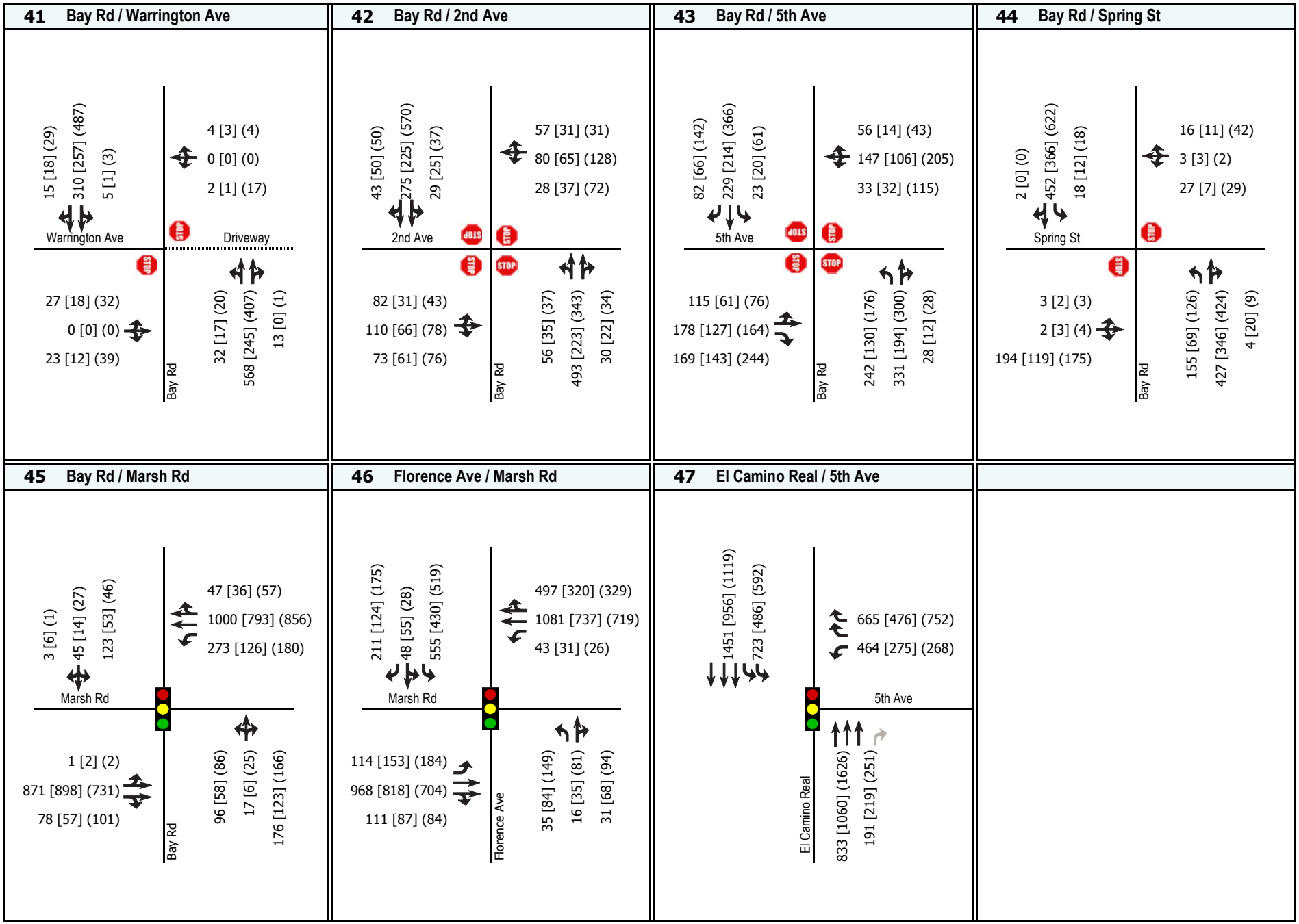
Traffic Signal

STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5E

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 5F

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)

Table 4 – Year 2020 No-Build Conditions vs Existing Conditions Intersection Level of Service

	No.	Intersection		Control	Existing Conditions						2020 No-Build Conditions					
					AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
	1	Middlefield Rd	Willow St	Signal	B	12.7	B	17.4	C	28.2	B	13.0	B	17.4	C	31.3
	2	Middlefield Rd	Charter St	Signal	B	14.6	B	12.4	B	14.3	B	13.0	A	9.8	B	10.8
	3	Middlefield Rd	Flynn Ave	TWSC[1]	D	30.6	**E**	**36.3**	D	30.0	D	31.3	D	34.0	D	30.6
	4	Middlefield Rd	Douglas Ave	Signal	A	9.4	A	4.6	A	6.8	B	12.7	A	6.0	A	9.0
Project Limits	5	Middlefield Rd	MacArthur Ave	TWSC[1]	C	21.3	C	16.4	C	21.0	D	27.8	C	17.4	C	23.8
Project Limits	6	Middlefield Rd	Hurlingame Ave	TWSC[1]	C	23.4	C	21.8	C	23.5	**E**	**35.1**	C	23.2	D	28.6
Project Limits	7	Middlefield Rd	Northside Ave	TWSC[1]	D	31.9	C	20.0	D	30.4	**F**	**52.1**	C	20.8	**E**	**36.0**
Project Limits	8	Middlefield Rd	Redwood Junction	TWSC[1]	D	33.0	**E**	**39.9**	**F**	**133.9**	**E**	**43.5**	**E**	**50.0**	**F**	**250.7**
Project Limits	9	Middlefield Rd	Pacific Ave	TWSC[1]	**E**	**41.9**	**E**	**40.8**	**F**	**93.1**	**F**	**68.5**	**F**	**54.5**	**F**	**190.5**
Project Limits	10	Middlefield Rd	Dumbarton Ave	TWSC[1]	D	32.9	D	33.0	**F**	**95.6**	**F**	**50.5**	**E**	**42.3**	**F**	**261.1**
Project Limits	11	Middlefield Rd	Berkshire Ave	TWSC[1]	B	14.9	B	14.0	C	17.8	C	18.9	B	14.9	C	23.1
Project Limits	12	Middlefield Rd	First Ave	TWSC[1]	D	25.5	C	23.2	**E**	**47.4**	**E**	**35.9**	D	27.5	**F**	**117.3**
Project Limits	13	Middlefield Rd	Second Ave	TWSC[1]	**F**	**60.0**	D	31.3	**F**	**62.3**	**F**	**210.5**	**E**	**47.8**	**F**	**210.5**
Project Limits	14	Middlefield Rd	Third Ave	TWSC[1]	D	25.9	C	20.0	**E**	**39.1**	D	34.5	C	22.1	**F**	**67.3**
Project Limits	15	Middlefield Rd	Fourth Ave	TWSC[1]	**F**	**80.9**	**E**	**44.4**	**F**	**63.3**	**F**	**268.0**	**F**	**73.6**	**F**	**333.8**
Project Limits	16	Middlefield Rd	Fifth Ave	Signal	D	46.3	D	35.8	**E**	**59.6**	D	46.3	C	34.8	**E**	**68.6**
Traffic Study Limits	17	Middlefield Rd	Sixth Ave	TWSC[1]	**F**	**90.9**	D	29.4	**F**	**73.8**	**F**	**142.0**	D	29.4	**F**	**104.6**
Traffic Study Limits	18	Middlefield Rd	Seventh Ave	TWSC[1]	C	22.1	C	21.4	C	19.1	C	23.4	C	21.4	C	20.4
Traffic Study Limits	19	Middlefield Rd	Semicircular Rd	Signal	C	22.3	B	16.1	B	16.0	C	25.6	B	17.2	C	20.9
Traffic Study Limits	20	Middlefield Rd	Ninth Ave	TWSC[1]	B	13.8	C	15.3	C	18.0	C	16.2	C	15.5	C	22.3
Traffic Study Limits	21	Middlefield Rd	Encinca Ave	TWSC[1]	D	33.9	**E**	**35.1**	**E**	**39.6**	**F**	**71.9**	**E**	**37.0**	**F**	**81.6**
Traffic Study Limits	22	Middlefield Rd	Placitas Ave	TWSC[1]	C	22.7	C	17.4	**E**	**38.4**	**E**	**36.5**	C	18.3	**F**	**89.7**
Traffic Study Limits	23	Middlefield Rd	San Benito Ave	TWSC[1]	D	26.8	C	21.4	D	30.9	**E**	**48.3**	C	22.5	**F**	**57.4**
Traffic Study Limits	24	Middlefield Rd	Fair Oaks Ln	TWSC[1]	**F**	**321.2**	**E**	**46.9**	**F**	**796.6**	**F**	**Err**	**F**	**59.9**	**F**	**Err**
Traffic Study Limits	25	Middlefield Rd	Hollbrook Ln	TWSC[1]	**E**	**40.3**	C	24.5	**F**	**59.3**	**F**	**106.6**	D	25.1	**F**	**161.8**
Traffic Study Limits	26	Middlefield Rd	Marsh Rd	Signal	D	37.4	C	29.3	D	38.0	D	48.1	C	30.3	D	49.5
Traffic Study Limits	27	Fair Oaks Ave	Douglas Ave	TWSC[1]	B	11.3	A	9.9	B	10.4	B	11.5	A	9.9	B	10.4
Traffic Study Limits	28	Fair Oaks Ave	Hurlingame Ave	AWSC	A	8.1	A	7.7	A	8.0	A	8.2	A	7.7	A	8.0
Traffic Study Limits	29	Fair Oaks Ave	Warrington Ave	TWSC[1]	B	11.5	A	9.9	B	10.7	B	11.6	A	9.9	B	10.7
Traffic Study Limits	30	Fair Oaks Ave	Second Ave	AWSC	B	10.3	A	9.1	A	9.5	B	10.7	A	9.1	A	9.8
Traffic Study Limits	31	Fair Oaks Ave	Fifth Ave	AWSC	C	22.8	B	12.6	**F**	**54.2**	D	27.8	B	12.8	**F**	**113.3**

No.	Intersection		Control	Existing Conditions						2020 No-Build Conditions					
				AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
	North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
32	Spring St	Charter St	AWSC	C	15.9	B	10.6	B	13.0	C	16.5	B	10.6	B	13.3
33	Spring St	Douglas Ave	AWSC	B	11.1	A	9.3	B	10.7	B	11.9	A	9.3	B	11.3
34	Spring St	Hurlingame Ave	AWSC	A	9.1	A	8.2	A	9.7	A	9.4	A	8.2	B	10.2
35	Spring St	Warrington Ave	TWSC[1]	B	13.5	B	11.8	B	12.5	B	14.4	B	11.8	B	13.1
36	Spring St	Second Ave	AWSC	B	11.7	B	10.3	B	10.5	B	11.9	B	10.3	B	11.0
37	Spring St	Fifth Ave	AWSC	D	26.7	B	13.7	D	34.2	D	30.3	B	13.7	**E**	**41.9**
38	Bay Rd	Charter St	AWSC	C	19.8	B	12.9	C	18.5	C	23.6	B	12.9	C	20.7
39	Bay Rd	Douglas Ave	AWSC	B	14.3	B	10.6	C	15.0	C	18.0	B	10.9	C	18.6
40	Bay Rd	Hurlingame Ave	TWSC[1]	B	14.7	B	12.0	B	13.7	C	15.7	B	12.0	B	14.3
41	Bay Rd	Warrington Ave	TWSC	B	14.8	B	12.3	C	20.6	C	16.0	B	12.3	C	22.4
42	Bay Rd	Second Ave	AWSC	B	14.9	B	11.4	D	25.7	C	17.6	B	11.4	**E**	**38.1**
43	Bay Rd	Fifth Ave	AWSC[2]	C	23.3	C	16.0	**F**	**52.0**	D	29.6	C	16.1	**F**	**64.0**
44	Bay Rd	Spring St	TWSC[1]	**F**	**55.9**	C	15.1	**F**	**100.9**	**F**	**350.9**	C	15.7	**F**	**696.1**
45	Bay Rd	Marsh Rd	Signal	C	24.1	B	15.0	B	17.6	C	31.3	B	14.8	B	15.9
46	Florence Ave	Marsh Rd	Signal	D	46.2	D	37.0	D	49.4	D	45.9	D	44.0	D	53.8
47	El Camino Real	Fifth Ave	Signal	C	31.0	C	24.7	C	29.7	D	44.3	D	52.5	C	31.2

Source: AECOM 2015
Notes:
1. Gray highlights indicate the project limits.
2. AM = morning peak hour, School PM = After school hour, PM = evening peak hour
3. Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections. Total control delay for the worst movement is presented for side-street stop controlled intersections.
**At times, intersections may show a reduction in average delay of the worst movement when the total unblocked volumes are lower. This indicates less conflict and as a result the delay is lower.
Bold text indicates deficient intersection operations.

5.2 BUILD OPERATING CONDITIONS

This section summarizes the 2020 Build operating conditions for the AM, School PM and PM peak hours. **Figure 6** presents the AM and PM peak-hour turning movement volumes at the study intersections under this scenario.

Level of service calculations were conducted to evaluate intersection operations under Opening Year 2020 Build conditions. The results of the LOS analysis are summarized in **Table 5** along with the No-Build conditions LOS for the purpose of comparison. The corresponding LOS calculation sheets are included in **Appendix C.**

AM Peak Hour

- Within the traffic study limits, among the 15 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 6 intersections continue to operate at LOS E or worse, 1 intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, one intersection continue to operate at LOS E or worse, 1 intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the impact criteria listed in Chapter 1, the proposed project will have a **significant impact** at one intersection:
    - Intersection #16 –Middlefield Road and Fifth Avenue

A detailed discussion on the impacted intersections is presented in the next section of this chapter.

School PM Peak Hour

- Within the traffic study limits, among the 7 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, all the intersections perform at an acceptable LOS D or better in the Build conditions compared to the 5 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.

- Based on the impact criteria listed in Chapter 1, the proposed project will have *no significant impact.*

PM Peak Hour

- Within the traffic study limits, among the 20 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 15 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, among the 9 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 5 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the impact criteria listed in Chapter 1, the proposed project will have a **significant impact** at one intersection:
    - Intersection #16 –Middlefield Road and Fifth Avenue

A detailed discussion on the impacted intersections is presented in the next section of this chapter.

5.3 INTERSECTION IMPACTS AND MITIGATION MEASURES

Based on the impact criteria listed in Chapter 1, the proposed project will have a significant impact at the following intersections during the indicated peak hours:

Intersection #16 (Middlefield Road and Fifth Avenue) – Though the intersection operates at an unacceptable LOS F during both the No-Build and Build conditions, the average delay increases by 4.0 seconds or more in the opening year 2020 Build conditions compared to the No-Build conditions thereby significantly impacting the intersection per the County of San Mateo's significance standards. The intersection of Middlefield Road and Fifth Avenue would get significantly impacted due to the reduction in the through lanes per the proposed design and thus, increasing the overall delay at the intersection.

Mitigation: *Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. As a result of the above improvements, the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the opening year 2020 Build conditions.*

Overall, due to the proposed improvements, the operating conditions of the study intersections either improve or stay the same with respect to level of service, except at some intersections where the LOS deteriorates. The lane reduction along the project study limits was expected to

cause degradation in LOS from the No-Build Conditions. In addition, the proposed modifications would divert commuter traffic volumes away from Middlefield Road within the project limits and encourage a modal switch to walking, bicycling and transit use, thereby meeting the project goals.

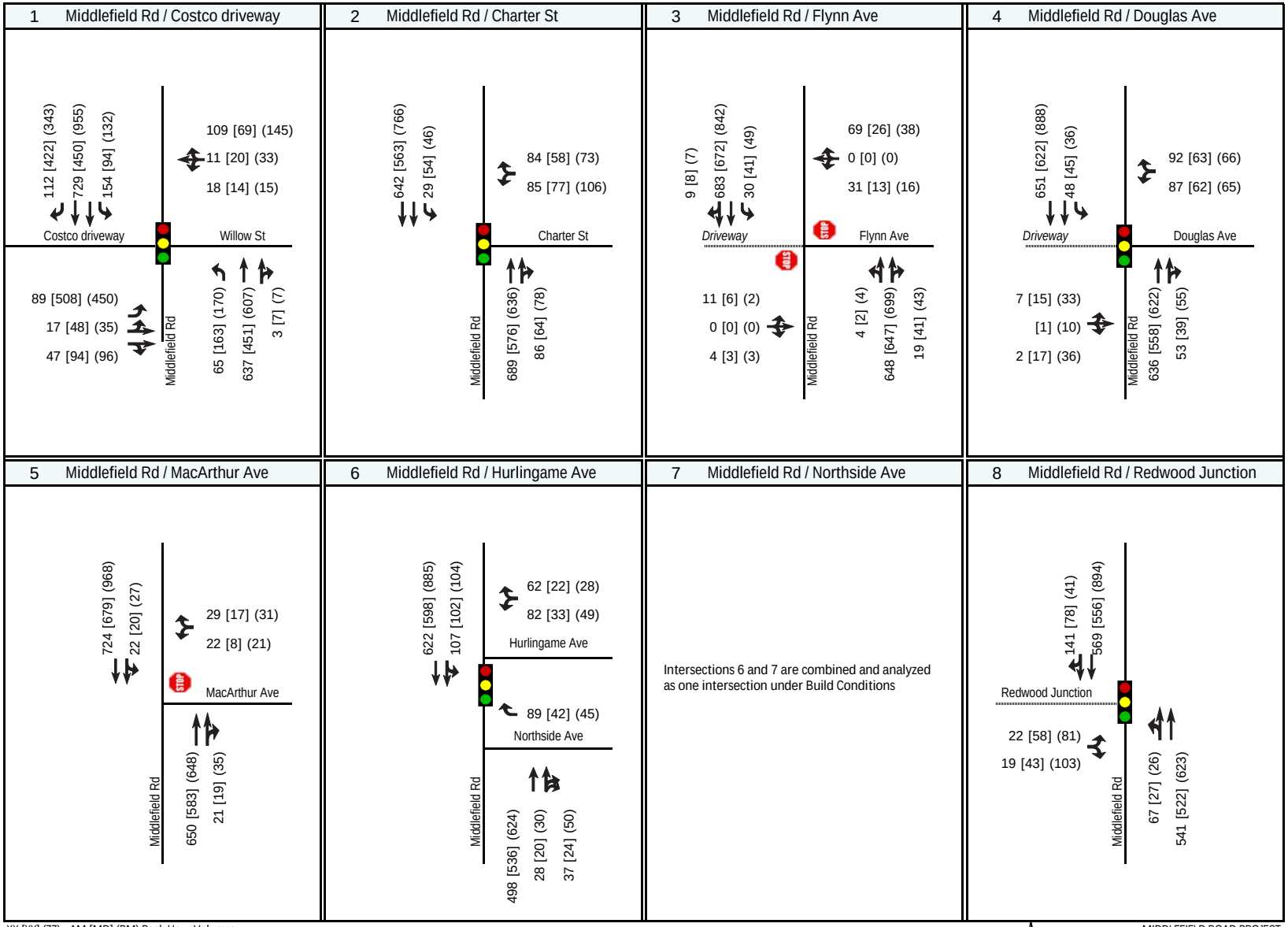
5.4 QUEUE LENGTH ANALYSIS

In addition to the LOS results, **Table 6** presents the results of the 95th percentile Sim Traffic queues under Opening Year 2020 No-Build and Build conditions at the study intersections within the project limits. The results of the queue analysis are based on multi-run Sim traffic simulation. From the results, it can be concluded that the queue lengths are shorter or similar in the Build conditions compared to the No-Build conditions at the majority of the intersections with the few exceptions.

The following list provides a summary of the intersections that exceed the storage capacity and the corresponding alternative.

1. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
2. Intersection of Middlefield Road and Dumbarton Avenue (No-Build conditions)
3. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
4. Intersection of Middlefield Road and Fourth Avenue (Build conditions)
5. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

At the intersections of Middlefield Road and Hurlingame Avenue, and Middlefield Road and Redwood Junction, the queue lengths were longer than the No-Build condition queues in one or more of the peak hours. But, the difference was less than approximately two car lengths. However, at the intersection of El Camino Real and Fifth Avenue, the queues are longer due to the proposed project improvements. The queues that exceeded the available storage are underlined in **Table 6**. The corresponding Sim Traffic queue length calculation sheets are presented in **Appendix C.**



MIDDLEFIELD ROAD PROJECT

FIGURE **6**A

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build **3** Lanes)

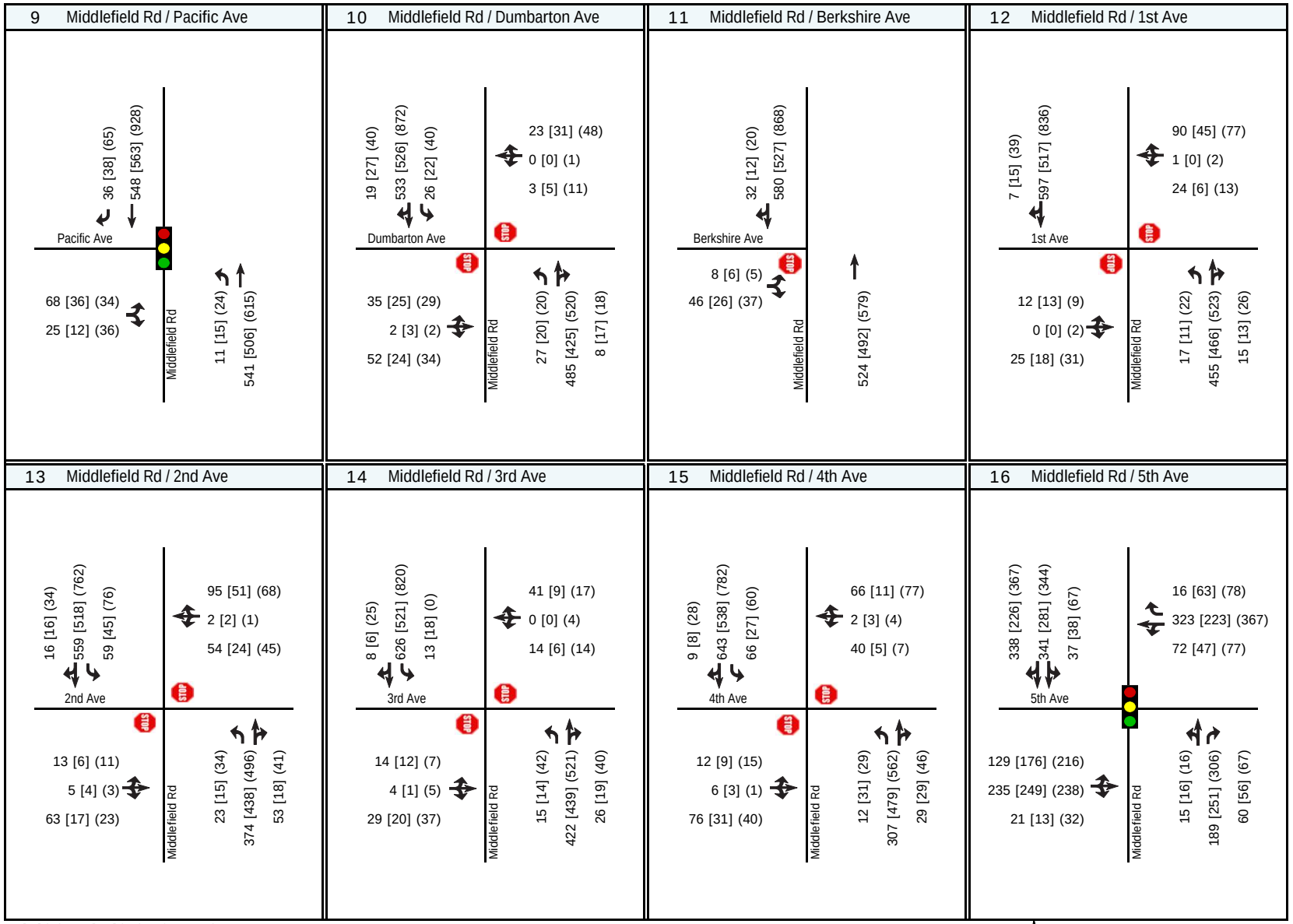
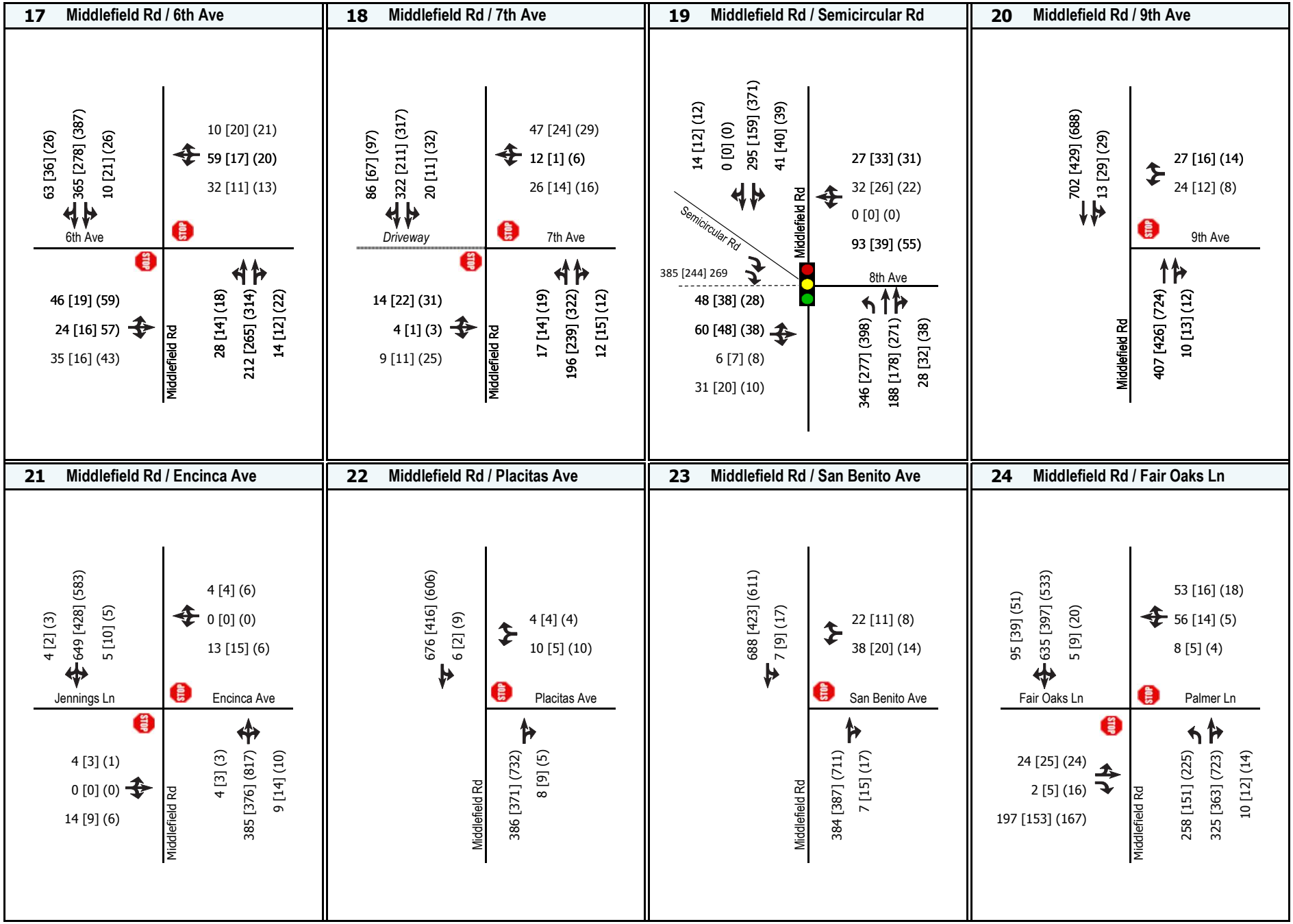


FIGURE **6**B

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build **3** Lanes)



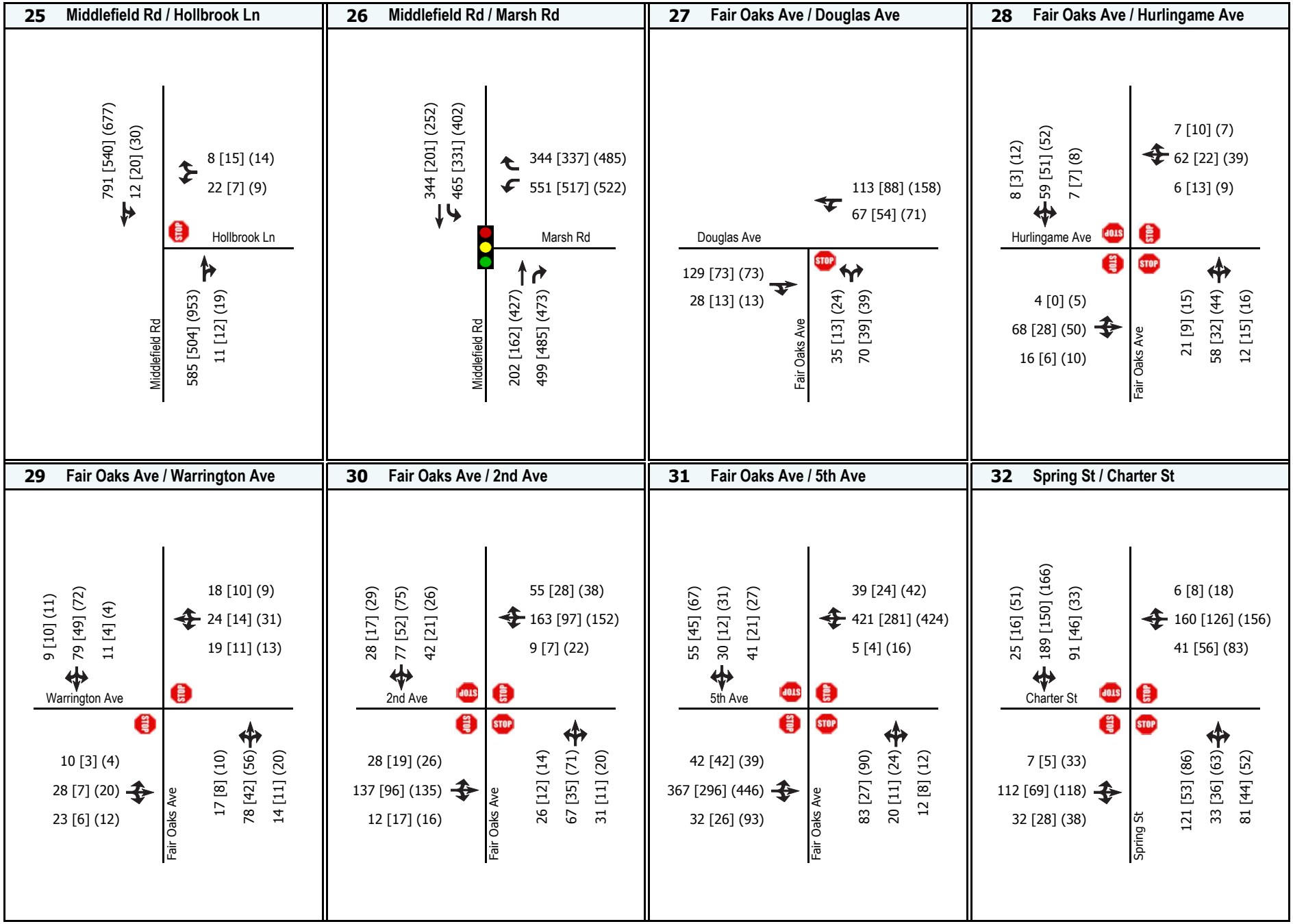
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 6C

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



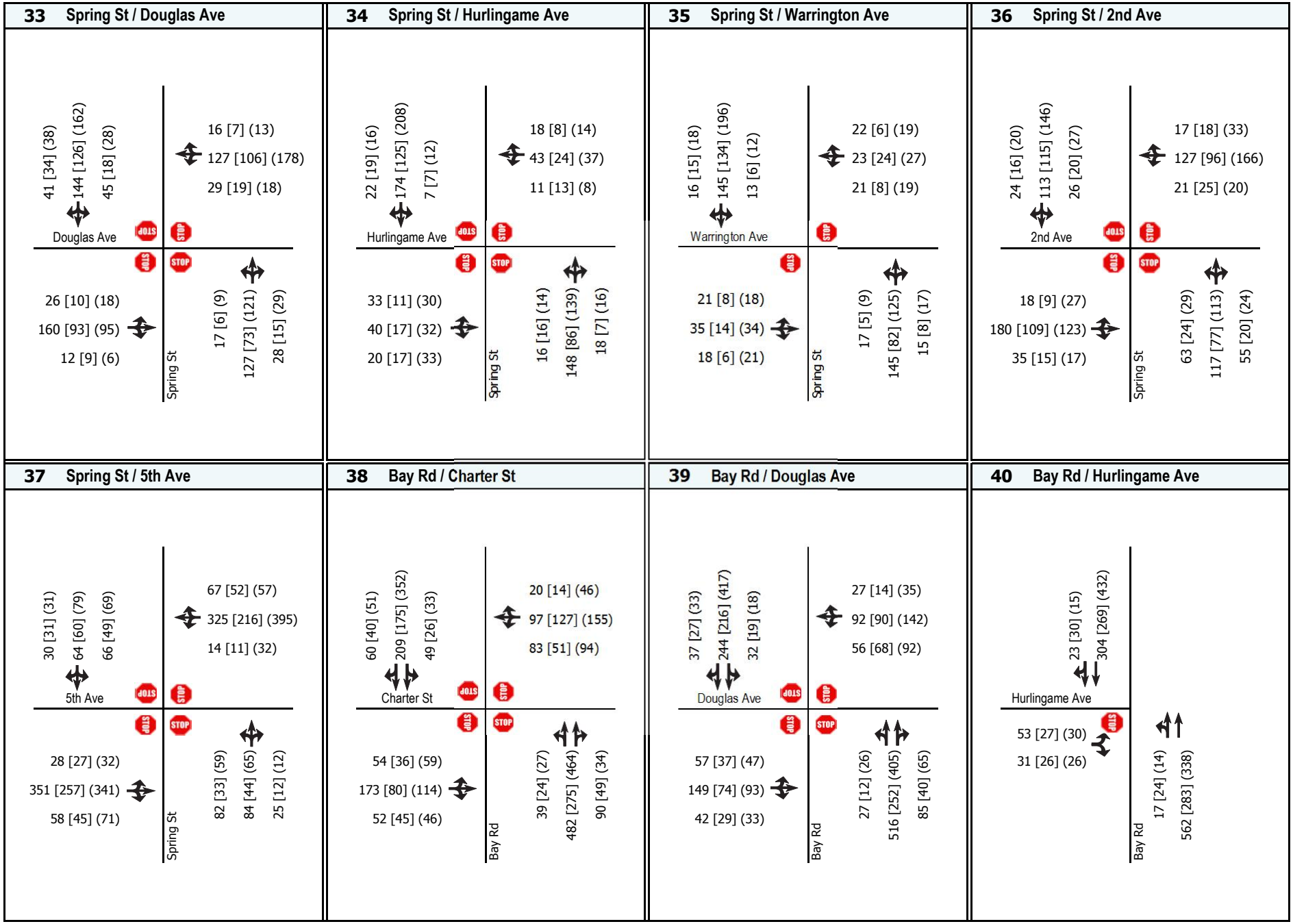
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 6D

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes

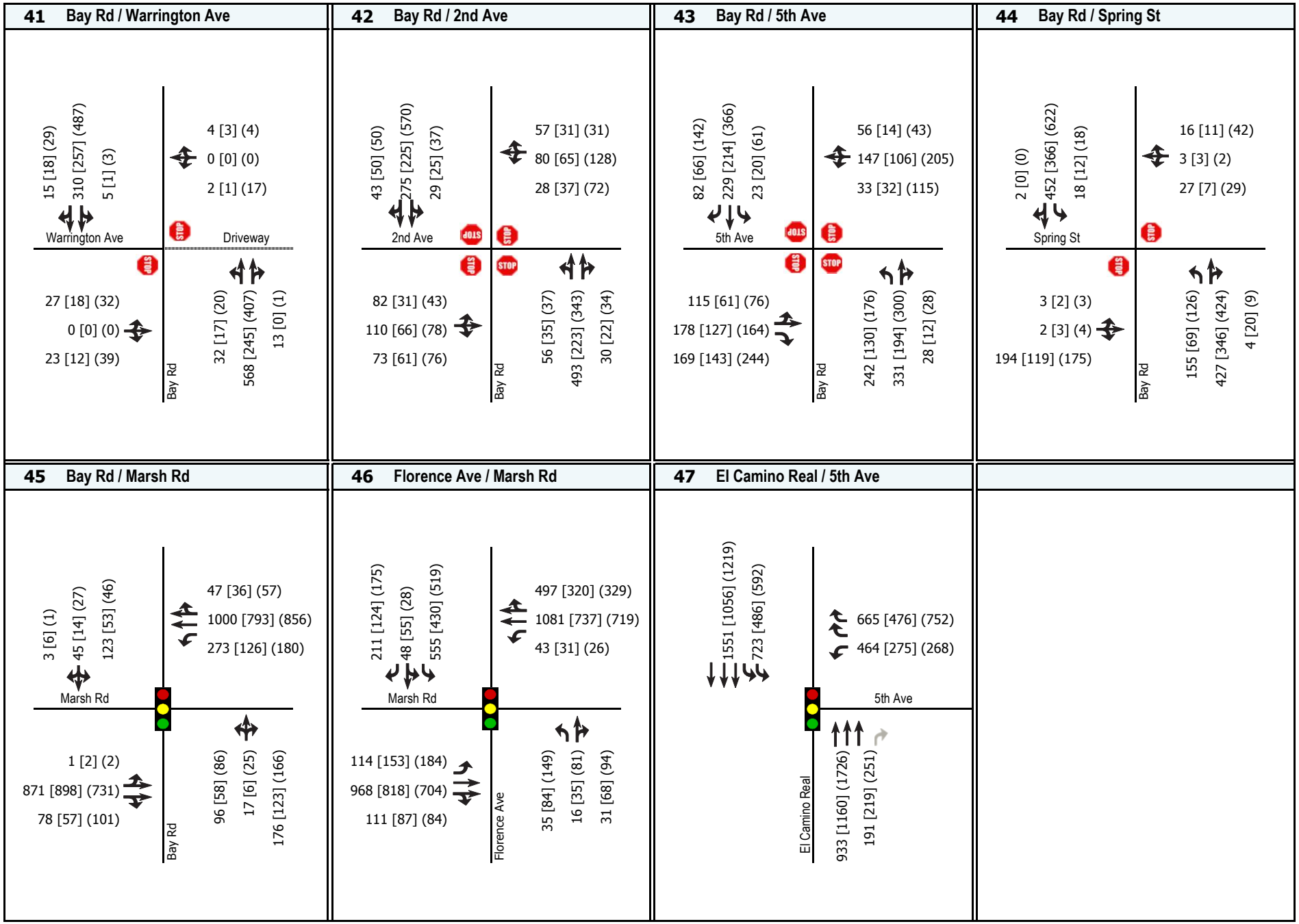
Traffic Signal

STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 6E

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 6F

2020 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)

Table 5 – Year 2020 No-Build Conditions vs Build Conditions Intersection Level of Service Summary

	No.	Intersection		Control	2020 No-Build Conditions						2020 Build Conditions					
					AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
	1	Middlefield Rd	Willow St	Signal	B	13.0	B	17.4	C	31.3	B	12.7	B	17.0	C	29.1
	2	Middlefield Rd	Charter St	Signal	B	13.0	A	9.8	B	10.8	B	13.1	B	10.2	B	11.0
	3	Middlefield Rd	Flynn Ave	TWSC[1]	D	31.3	D	34.0	D	30.6	D	29.2	D	28.4	D	27.6
	4	Middlefield Rd	Douglas Ave	Signal	B	12.7	A	6.0	A	9.0	B	12.7	A	6.3	A	9.3
Project Limits	5	Middlefield Rd	MacArthur Ave	TWSC[1]	D	27.8	C	17.4	C	23.8	C	22.2	C	15.3	C	19.8
	6*	Middlefield Rd	Hurlingame Ave	TWSC[1] / Signal	**E**	**35.1**	C	23.2	D	28.6	C	32.8	C	23.4	D	54.3
	7*	Middlefield Rd	Northside Ave	TWSC[1] / Signal	**F**	**52.1**	C	20.8	**E**	**36.0**	Merged with Intersection #6 under the Build Conditions					
	8*	Middlefield Rd	Redwood Junction	TWSC[1] / Signal	**E**	**43.5**	**E**	**50.0**	**F**	**250.7**	A	5.4	B	18.2	**E**	**56.4**
	9*	Middlefield Rd	Pacific Ave	TWSC[1] / Signal	**F**	**68.5**	**F**	**54.5**	**F**	**190.5**	C	21.1	B	11.6	B	12.7
	10	Middlefield Rd	Dumbarton Ave	TWSC[1]	**F**	**50.5**	**E**	**42.3**	**F**	**261.1**	C	21.1	C	18.4	**E**	**46.2**
	11	Middlefield Rd	Berkshire Ave	TWSC[1]	C	18.9	B	14.9	C	23.1	C	17.6	B	13.7	D	26.2
	12	Middlefield Rd	First Ave	TWSC[1]	**E**	**35.9**	D	27.5	**F**	**117.3**	C	18.5	C	16.0	**E**	**35.7**
	13	Middlefield Rd	Second Ave	TWSC[1]	**F**	**210.5**	**E**	**47.8**	**F**	**210.5**	D	32.1	C	18.8	D	32.8
	14	Middlefield Rd	Third Ave	TWSC[1]	D	34.5	C	22.1	**F**	**67.3**	C	18.3	C	15.1	C	24.6
	15	Middlefield Rd	Fourth Ave	TWSC[1]	**F**	**268.0**	**F**	**73.6**	**F**	**333.8**	**F**	**50.5**	D	25.9	**F**	**59.2**
	16	Middlefield Rd	Fifth Ave	Signal	D	46.3	C	34.8	**E**	**68.6**	**F**	**96.9**	D	54.2	**F**	**107.5**
				Mitigations							**C**	**30.1**	**B**	**19.9**	**D**	**39.9**
Traffic Study Limits	17	Middlefield Rd	Sixth Ave	TWSC[1]	**F**	**142.0**	D	29.4	**F**	**104.6**	**E**	**48.7**	C	21.2	**E**	**48.8**
	18	Middlefield Rd	Seventh Ave	TWSC[1]	C	23.4	C	21.4	C	20.4	C	18.7	C	17.9	C	17.2
	19	Middlefield Rd	Semicircular Rd	Signal	C	25.6	B	17.2	C	20.9	C	23.4	B	16.1	B	19.9
	20	Middlefield Rd	Ninth Ave	TWSC[1]	C	16.2	C	15.5	C	22.3	B	14.5	B	13.9	C	18.7
	21	Middlefield Rd	Encinca Ave	TWSC[1]	**F**	**71.9**	**E**	**37.0**	**F**	**81.6**	**E**	**37.0**	C	23.7	**E**	**45.7**
	22	Middlefield Rd	Placitas Ave	TWSC[1]	**E**	**36.5**	C	18.3	**F**	**89.7**	C	23.9	B	14.8	**E**	**47.7**
	23	Middlefield Rd	San Benito Ave	TWSC[1]	**E**	**48.3**	C	22.5	**F**	**57.4**	D	29.7	C	17.3	D	33.8
	24	Middlefield Rd	Fair Oaks Ln	TWSC[1]	**F**	**Err**	**F**	**59.9**	**F**	**Err**	**F**	**614.9**	**E**	**35.3**	**F**	**Err**
	25	Middlefield Rd	Hollbrook Ln	TWSC[1]	**F**	**106.6**	D	25.1	**F**	**161.8**	**E**	**49.9**	C	18.7	**F**	**70.1**

No.	Intersection		Control	2020 No-Build Conditions						2020 Build Conditions					
				AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
	North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
26	Middlefield Rd	Marsh Rd	Signal	D	48.1	C	30.3	D	49.5	D	39.5	C	27.0	D	42.4
27	Fair Oaks Ave	Douglas Ave	TWSC[1]	B	11.5	A	9.9	B	10.4	B	11.5	A	9.9	B	10.4
28	Fair Oaks Ave	Hurlingame Ave	AWSC	A	8.2	A	7.7	A	8.0	A	8.2	A	7.7	A	8.0
29	Fair Oaks Ave	Warrington Ave	TWSC[1]	B	11.6	A	9.9	B	10.7	B	11.6	A	9.9	B	10.7
30	Fair Oaks Ave	Second Ave	AWSC	B	10.7	A	9.1	A	9.8	B	10.7	A	9.1	A	9.8
31	Fair Oaks Ave	Fifth Ave	AWSC	D	27.8	B	12.8	**F**	**113.3**	D	27.8	B	12.8	**F**	**113.3**
32	Spring St	Charter St	AWSC	C	16.5	B	10.6	B	13.3	C	16.5	B	10.6	B	13.3
33	Spring St	Douglas Ave	AWSC	B	11.9	A	9.3	B	11.3	B	11.9	A	9.3	B	11.3
34	Spring St	Hurlingame Ave	AWSC	A	9.4	A	8.2	B	10.2	A	9.4	A	8.2	B	10.2
35	Spring St	Warrington Ave	TWSC[1]	B	14.4	B	11.8	B	13.1	B	14.4	B	11.8	B	13.1
36	Spring St	Second Ave	AWSC	B	11.9	B	10.3	B	11.0	B	11.9	B	10.3	B	11.0
37	Spring St	Fifth Ave	AWSC	D	30.3	B	13.7	**E**	**41.9**	D	30.3	B	13.7	**E**	**41.9**
38	Bay Rd	Charter St	AWSC	C	23.6	B	12.9	C	20.7	C	23.6	B	12.9	C	20.7
39	Bay Rd	Douglas Ave	AWSC	C	18.0	B	10.9	C	18.6	C	18.0	B	10.9	C	18.6
40	Bay Rd	Hurlingame Ave	TWSC[1]	C	15.7	B	12.0	B	14.3	C	15.7	B	12.0	B	14.3
41	Bay Rd	Warrington Ave	TWSC	C	16.0	B	12.3	C	22.4	C	16.0	B	12.3	C	22.4
42	Bay Rd	Second Ave	AWSC	C	17.6	B	11.4	**E**	**38.1**	C	17.6	B	11.4	**E**	**38.1**
43	Bay Rd	Fifth Ave	AWSC[2]	D	29.6	C	16.1	**F**	**64.0**	D	29.6	C	16.1	**F**	**64.0**
44	Bay Rd	Spring St	TWSC[1]	**F**	**350.9**	C	15.7	**F**	**696.1**	**F**	**350.9**	C	15.7	**F**	**696.1**
45	Bay Rd	Marsh Rd	Signal	C	31.3	B	14.8	B	15.9	C	31.3	B	14.8	B	15.9
46	Florence Ave	Marsh Rd	Signal	D	45.9	D	44.0	D	53.8	D	45.9	D	44.0	D	53.8
47	El Camino Real	Fifth Ave	Signal	D	44.3	D	52.5	C	31.2	D	43.7	D	50.6	C	32.3

Source: AECOM 2015

Notes:

1. Gray highlights indicate the project limits.
2. AM = morning peak hour, School PM = After school hour, PM = evening peak hour
3. Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections. Total control delay for the worst movement is presented for side-street stop controlled intersections.
4. Err under the Average delay column indicates that the program was unable to calculate the delay value.

* Due to the proposed improvements within the project limits, the control was changed from a stop to a signal under the Build conditions.

Bold text indicates deficient intersection operations.

Table 6- Opening Year 2020 No-Build Conditions vs Build Conditions 95th Percentile Queue Length – SimTraffic Results

No.	Intersection		2020 No-Build AlternativeConditions Queue Length (Ft)						2020 Build AlternativeConditions Queue Length (Ft)					
5	Intersection: 5: Middlefield Rd & MacArthur Ave		WBLR	NBT	NBTR	SBLT	SBT		WBLR	NBT	NBTR	SBLT	SBT	
		Storage Capacity	1,500	200	200	200	200		1,500	200	200	200	200	
		AM PEAK	60	0	0	30	0		65	20	35	10	10	
		SCHOOL PM PEAK	40	0	10	45	0		45	10	35	25	0	
		PM PEAK	60	0	0	110	90		65	20	10	55	35	
6	Intersection: 6: Middlefield Rd & Hurlingame Ave		WBLR	NBT	NBTR	SBLT	SBT		WBLR	NBT	NBTR	SBLT	NWR	
		Storage Capacity	1,700	50	50	200	425		1,700	50	50	200	425	
		AM PEAK	90	15	30	65	25		630	10	10	160	40	
		SCHOOL PM PEAK	45	20	20	110	75		105	40	25	170	30	
		PM PEAK	55	30	45	200	205		140	50	40	160	35	
7	Intersection: 7: Middlefield Rd & Northside Ave		WBLR	NBT	NBTR	SBLT	SBT		Merged with Intersection #6 under the Build Conditions					
		Storage Capacity	425	50	50	50	50							
		AM PEAK	145	20	30	45	15							
		SCHOOL PM PEAK	30	20	20	45	25							
		PM PEAK	110	25	30	50	40							
8	Intersection: 8: Middlefield Rd & Redwood junction		EBLR	NBLT	NBT	SBT	SBTR		EBLR	NBL	NBT	SBTR		
		Storage Capacity	300	100	100	50	50		300	100	100	50		
		AM PEAK	40	80	35	0	15		70	80	35	105		
		SCHOOL PM PEAK	110	75	0	0	45		170	35	50	115		
		PM PEAK	440	50	35	55	45		360	35	40	110		
9	Intersection: 9: Middlefield Rd & Pacific Ave/Driveway		EBLR	WBLR	NBLT	NBTR	SBLT	SBTR	EBLR	NBL	NBT	SBT	SBR	
		Storage Capacity	950	100	2,200	2,200	100	100	950	100	2,200	100	100	
		AM PEAK	110	0	15	5	10	0	145	75	335	55	15	
		SCHOOL PM PEAK	90	10	45	35	30	45	85	70	310	55	0	
		PM PEAK	190	5	50	15	80	75	125	80	420	60	20	

No.	Intersection		2020 No-Build AlternativeConditions Queue Length (Ft)						2020 Build AlternativeConditions Queue Length (Ft)					
10	Intersection: 10: Middlefield Rd & Dumbarton Ave		EBLTR	WBLTR	NBL	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	425	425	1,650	1,650	500	500	425	425	60	1,650	60	500
		AM PEAK	60	45	45	65	50	40	75	40	35	55	30	90
		SCHOOL PM PEAK	85	60	60	40	55	55	55	45	35	60	40	80
		PM PEAK	475	310	70	65	680	690	70	80	35	90	40	125
11	Intersection: 11: Middlefield Rd & Berkshire Ave		EBLR	NBLT	NBT	SBT	SBTR		EBLR	NBT	SBTR			
		Storage Capacity	825	1,250	1,250	850	850		825	1,250	850			
		AM PEAK	60	55	25	20	35		50	45	60			
		SCHOOL PM PEAK	45	55	30	20	15		50	30	40			
		PM PEAK	265	45	0	455	465		65	0	200			
12	Intersection: 12: Middlefield Rd & 1st Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBTR	
		Storage Capacity	825	850	1,100	1,100	1,050	1,050	825	850	60	1,100	1,050	
		AM PEAK	55	95	25	0	30	5	45	80	30	15	20	
		SCHOOL PM PEAK	45	45	40	0	35	0	40	45	15	0	0	
		PM PEAK	455	325	25	0	110	110	115	115	35	5	90	
13	Intersection: 13: Middlefield Rd & 2nd Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	825	775	850	850	1,300	1,300	825	775	60	850	60	1,300
		AM PEAK	65	125	20	35	50	30	65	115	20	40	50	115
		SCHOOL PM PEAK	40	70	55	45	80	40	45	75	25	55	45	85
		PM PEAK	385	1,935	65	45	300	305	200	590	30	45	95	270
14	Intersection: 14: Middlefield Rd & 3rd Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	785	745	525	525	1,600	1,600	785	745	60	525	60	1,600
		AM PEAK	55	45	30	0	20	0	110	70	15	0	15	225
		SCHOOL PM PEAK	45	35	15	0	0	20	45	35	15	0	5	20
		PM PEAK	440	280	45	5	335	315	405	305	40	40	0	335

No.	Intersection		2020 No-Build AlternativeConditions Queue Length (Ft)							2020 Build AlternativeConditions Queue Length (Ft)						
15	Intersection: 15: Middlefield Rd & 4th Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR		EBLTR	WBLTR	NBL	NBTR	SBL	SBTR	
		Storage Capacity	785	800	250	250	1,900	1,900		785	800	60	250	60	1,900	
		AM PEAK	120	115	55	35	60	60		465	655	25	70	95	295	
		SCHOOL PM PEAK	55	45	75	80	90	120		95	45	60	95	50	210	
		PM PEAK	430	640	195	205	290	280		435	760	50	155	105	315	
16	Intersection: 16: Middlefield Rd & 5th Ave		EBLTR	WBLT	WBR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLT	WBR	NBL	NBTR	SBL	SBTR
		Storage Capacity	2,200	1,500	80	800	800	2,200	2,200	2,200	1,500	80	100	800	60	2,200
		AM PEAK	240	340	90	135	145	225	265	335	450	90	90	175	75	240
		SCHOOL PM PEAK	340	245	115	175	190	245	260	410	280	105	70	175	75	295
		PM PEAK	1,360	555	130	280	285	250	265	2,030	530	130	70	180	85	245

Source: AECOM 2015
Notes:
Underline indicates queue length exceeds storage available capacity.

5.5 PEDESTRIAN, BICYCLE AND TRANSIT IMPACTS

The following improvements are proposed to enhance the operating conditions for pedestrians, bicyclists and transit users at the project location.

5.5.1 Bike Lanes

There are currently no bike lanes within the project limits. The lack of marked bike lanes coupled with angled "head-in" parking to the sidewalk curbs, has resulted in an uncontrolled cycling experience. To address these issues, the project is adding buffered bike lanes in the southbound and northbound directions, each with a 6.5 foot total width.

5.5.2 Bulbouts/Crosswalks

No bulbouts currently exist within the project limits. This condition results in fairly long crosswalk lengths (on the order of 75 feet long) and coupled with the diagonal parking present along much of the project length reduces pedestrian visibility to motorists and cyclists. To improve these issues, bulbouts are planned at each intersection, improving sight distances for pedestrians and reducing crossing lengths on the order of 45 feet.

5.5.3 Sidewalk Width

The existing sidewalks vary in width, but are generally 5 to 8 feet wide. With the presence of existing overhead poles and other signs, driveways and intrusion from the fronts of diagonally-parked vehicles, the existing sidewalks are very congested. The project is planning on widening the sidewalks to 12 feet along the length of the project and removing the overhead wires and poles, improving the safety and accessibility for pedestrians and accommodating underground electrical facilities for PG&E.

5.5.4 Bus Stops

Similar to existing conditions, there will be 5 bus stops within the project limits, 3 northbound and 2 southbound. The bus stops will be placed downstream of an intersection and will be 60-feet in length with tapers for entering and exiting the bus stop. A concrete pad will be provided for the bus stop and SamTrans is investigating the possibility of adding bus shelters. Additional bus shelters are not anticipated to have an effect on parking. Also, bus stops will be moved from upstream to a downstream of intersections to improve traffic flow.

5.5.5 At-Grade Railroad Crossing

A Union Pacific Railroad (UPRR) maintained at-grade crossing owned by Caltrain is located between Pacific Avenue and Northside Avenue. The tracks cross Middlefield Road at an angle in the vicinity where several driveways and roadways connect to Middlefield Road. The driveway immediately south and west of the tracks serves a medical clinic at 2700 Middlefield Road, which is located on private property. This driveway also provides access to several other parcels via an access roadway which is situated within an easement. Currently, no trains are using these tracks. The project proposes improvements to the streets and driveways in the vicinity to improve clarity for turning movements and reduce the potential for conflicting vehicle movements in the area, and/or stranding of vehicles on the tracks.

For the 2700 Middlefield Road driveway, in 2013 the private property owner constructed improvements in support of the expansion of the North Fair Oak Health Center from 30 employees to 110. Improvements constructed by the private property owner within the easement and near the at-grade crossing were not authorized by the CPUC through General Order (GO) 88-B; thus, the CPUC requires several modifications including:

- Relocating the driveway and the Health Center signage
- Modifying raised medians and thus, the private property traffic circulation pattern
- Replacing and relocating track signal equipment as well as curbs
- Re-striping the driveway
- Restricting turning left movements from westbound Northside Avenue - This would improve the safety and reduce the number of conflicting points.
- Signalizing the driveway access with railroad preemption - Since the intersections of Middlefield Road/ Hurlingame Avenue, Middlefield Road/ Northside Avenue, Middlefield Road/ Redwood Junction, and Middlefield Road/ Pacific Avenue in the vicinity of the railroad are closely spaced, there is no orderly movement of conflicting flows. This would result in potential safety hazards. Signalization would offer the maximum degree of control at this location.

The improvements discussed above improve safety, comfort, and convenience for pedestrians, bicyclists and transit users. This is in alignment with the project goals. Therefore, the proposed project will have *no significant impacts* and no mitigation measures are required.

5.6 PARKING IMPACTS

The existing parking within the project study limits is angle parking; when vehicles back out of the parking spaces, they block one of the existing through lanes and cause unsafe conditions for bicyclists. The current angle parking not only creates unsafe conditions for through traffic, but it also creates dangerous conditions for bicyclists along Middlefield Road. The angle parked vehicles were also observed to impede through traffic when they tried to back out of the parking

spots. Cyclists were either interrupted by cars backing up from angled parking or had to move into the main traffic flow to avoid vehicles trying to park on-street. Some cyclists were observed using the sidewalk to completely move away from motorized vehicles, thereby taking up the sidewalks meant for foot traffic. Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits.

As a result of the proposed improvements, the diagonal on-street parking will be replaced with 8-foot wide parallel parking at the sidewalk curb and will have a striped buffer between the parking spaces and the bike lane. Conversion from angled to parallel parking as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield Road and 2nd Avenue, and 16 spaces at Berkshire Lot.

Since there is no loss in the number of on-street parking spaces and the proposed project improves safety for both motorists and bicyclists, the proposed project will have ***less-than-significant*** impacts, and no mitigation measures are required.

6. DESIGN YEAR 2050 CONDITIONS

Design Year (2050) traffic operating conditions for the Middlefield Road Streetscape Project were analyzed using the Synchro software and SimTraffic models. To create the 2050 models, 2020 model synchro network was modified to reflect the 2050 forecasted demands. For the 2050 Build alternative, the synchro network was coded to be consistent with the design plans for the project.

6.1 NO-BUILD OPERATING CONDITIONS

This section summarizes the 2050 No-Build operating conditions for the AM, School PM, and PM peak hours. **Figure 7** presents the AM , School PM, and PM peak-hour turning movement volumes at the study intersections under this scenario.

Level of service calculations were conducted to evaluate intersection operations under Opening Year 2050 No-Build conditions. The results of the LOS analysis are summarized in **Table 7** along with Build conditions LOS for the purpose of comparison. The corresponding LOS calculation sheets are included in **Appendix C.**

Several study intersections are expected to fail (operate at an unacceptable LOS E or worse) based on the traffic growth projected in the design year 2050. The operational conditions results reveal the same.

- ✓ During the AM peak hour ,within the Traffic Study Limits, 35 of the 47 intersections and within the project limits, all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ During the School PM peak hour, within the Traffic Study Limits, 12 of the 47 intersections and within the project limits 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ During the PM peak hour, within the Traffic Study Limits, 34 of the 47 intersections and within the project limits all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ All other intersections operate at acceptable levels of service of LOS D or better

6.2 BUILD OPERATING CONDITIONS

This section summarizes the 2050 Build operating conditions for the AM, School PM, and PM peak hours. **Figure 8** presents the AM, School PM, and PM peak-hour turning movement volumes at the study intersections under this scenario.

Level of service calculations were conducted to evaluate intersection operations under Design Year 2050 Build conditions. The results of the LOS analysis are summarized in **Table 7** along

with the No-Build conditions LOS for the purpose of comparison. The corresponding LOS calculation sheets are included in **Appendix C.**

AM Peak Hour

- Within the traffic study limits, among the 35 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 32 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the impact criteria listed in Chapter 1, the proposed project will have a **significant impact** at the following four intersections:
    - Intersection #11 - Middlefield Road and Berkshire Avenue
    - Intersection #12 - Middlefield Road and First Avenue
    - Intersection #18 - Middlefield Road and Seventh Avenue
    - Intersection #47 - El Camino Real and Fifth Avenue

A detailed discussion on the impacted intersections is presented in the next section of this chapter.

School PM Peak Hour

- Within the traffic study limits, among the 12 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 4 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the impact criteria listed in Chapter 1, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

A detailed discussion on the impacted intersections is presented in the next section of this chapter.

PM Peak Hour

- Within the traffic study limits, among the 34 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 31 intersections continue to operate at LOS E or worse, two intersections deteriorate from an acceptable LOS D or better to unacceptable LOS E or worse, and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the impact criteria listed in Chapter 1, the proposed project will have a **significant impact** at the following intersections:
  - Intersection #11 - Middlefield Road and Berkshire Avenue
  - Intersection #17 - Middlefield Road and Sixth Avenue
  - Intersection #18 - Middlefield Road and Seventh Avenue
  - Intersection #47 - El Camino Real and Fifth Avenue

A detailed discussion on the impacted intersections is presented in the next section of this chapter.

6.3 INTERSECTION IMPACTS AND MITIGATION MEASURES

Based on the impact criteria listed in Chapter 1, the proposed project will have a significant impact at the following intersections during the indicated peak hours:

Intersection #11 (Middlefield Road and Berkshire Avenue) – During both the AM peak hour and PM peak hour, the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, and the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. The intersection of Middlefield Road and Berkshire Avenue is a Two-Way stop controlled intersection. This intersection would get significantly impacted mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. In addition, since this project proposes a reduction in the through lanes, the major street volume naturally increases

making it even more difficult for the minor street traffic to find a gap to merge onto the major street.

Mitigations: *Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Intersection #12 (Middlefield Road and First Avenue) – During the AM peak hour, though the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. The intersection of Middlefield Road and First Avenue is a two-way stop controlled intersection. This intersection would get significantly impacted mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. In addition, since this project proposes a reduction in the through lanes, the major street volumes naturally increases making it even more difficult for the minor street traffic to find a gap to merge on to the major street.

Mitigations: *Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Intersection #16 (Middlefield Road and Fifth Avenue) - During School PM peak hour, the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, and the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. The intersection of Middlefield Road and Fifth Avenue would get significantly impacted due to the reduction in the through lanes per the proposed design, which in turn increases the overall delay at the intersection.

Mitigations: *Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. If the improvements are to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Intersection #17 (Middlefield Road and Sixth Avenue) – In the PM peak hour, though the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. The intersection of Middlefield Road and 6th

Avenue is a two-way stop controlled intersection. This intersection would get significantly impacted mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. Even though this intersection is outside the project limits, the operational impacts due to the proposed improvements would adversely affect this intersection causing it to fail in the Build conditions.

Mitigations: *Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Intersection #18 (Middlefield Road and Seventh Avenue) – In the AM peak hour, though the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. In the PM peak hour, the LOS deteriorates from an acceptable LOS C under the design year 2050 No-Build conditions to an unacceptable LOS F under the Build conditions. The intersection of Middlefield Road and 7th Avenue is a two-way stop controlled intersection. This intersection would get significantly impacted mainly due to the delay experienced by the vehicles on the minor street waiting for a gap to merge onto the major street. Even though this intersection is outside the project limits, the operational impacts due to the proposed improvements would adversely affect this intersection causing it to fail in the Build conditions.

Mitigations: *Potential improvement includes modification of the eastbound approach (driveway) to a right-out only approach. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Intersection #47 (El Camino Real and Fifth Avenue) - In the AM peak hour, though the intersection operates at an unacceptable LOS F under both the No-Build and Build conditions, the average delay increases by 4.0 seconds or more in the design year 2050 Build conditions compared to the No-Build conditions, thereby significantly impacting the intersection per the County of San Mateo's significance standards. In the PM peak hour, the LOS deteriorates from an acceptable LOS D under the design year 2050 No-Build conditions to an unacceptable LOS E under the Build conditions. Due to the reduction in the through lanes within the project limits along Middlefield Road, the traffic is expected to divert and travel on other parallel routes to reach their destination. Since El Camino Real is one of the major parallel routes to Middlefield Road, the addition of traffic would cause an impact at this intersection.

Mitigations: *Potential improvement includes a second westbound left-turn pocket. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a* ***less-than-significant*** *impact under the design year 2050 Build conditions.*

Overall, the proposed project either improves or maintains the level of service at the study intersections. However, there are few intersections where the motor-vehicle LOS deteriorates. Since the Build alternative involves lane reduction to a create a two-lane corridor with a center left turn lane, a degradation in intersection LOS is expected from the No-Build Alternative. In addition, the proposed modification would divert commuter traffic volumes away from Middlefield Road within the project limits and encourage modal switch to walking, bicycling and transit use.

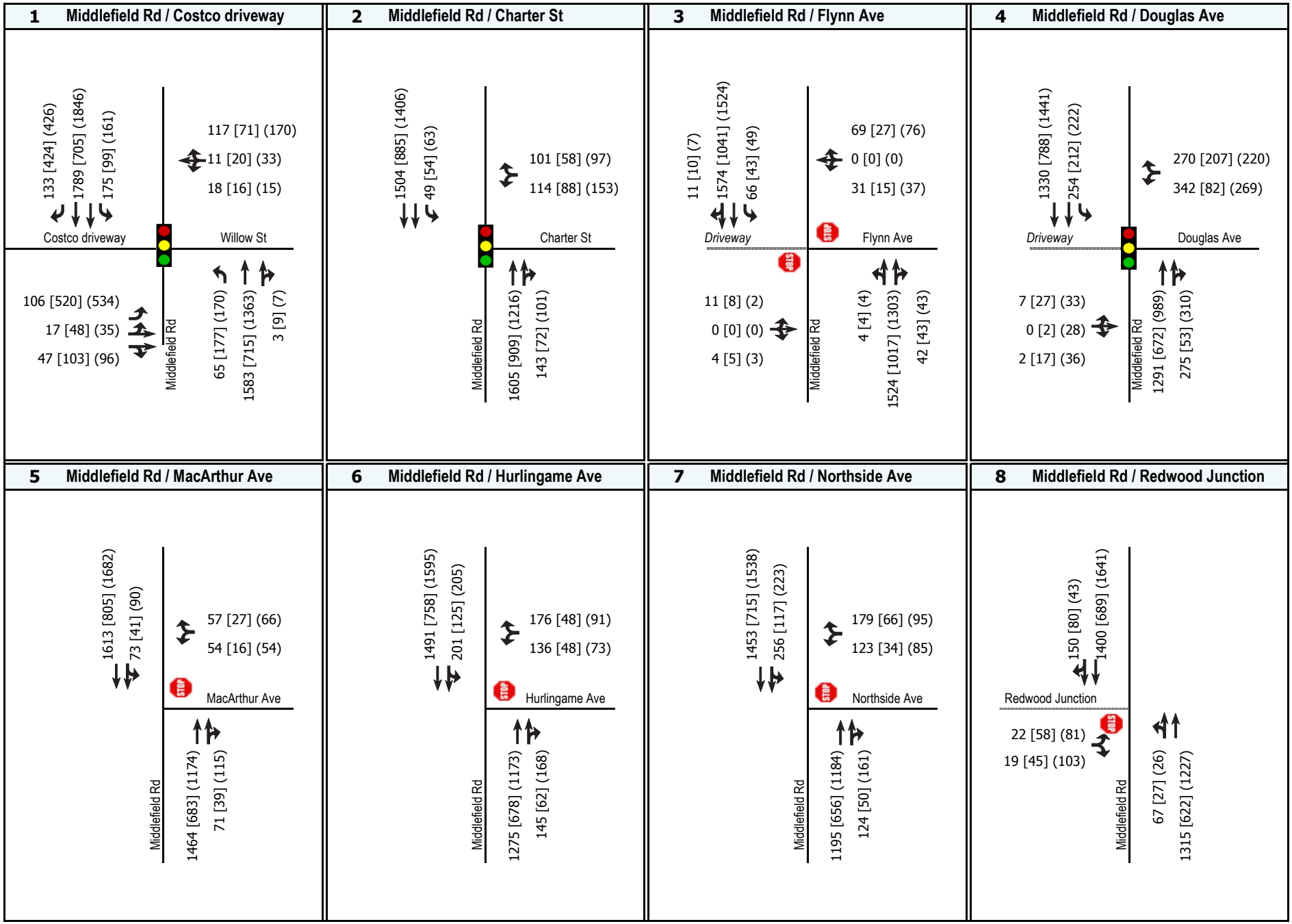
6.4 QUEUE LENGTH ANALYSIS

In addition to the LOS results, **Table 8** presents the results of the 95th percentile Sim Traffic queues under Design Year 2050 No-Build and Build conditions at the study intersections within the project limits. From the results, it can be concluded that the queue lengths exceed the storage capacity at most of the location during one or more of the peak hour. The results of the queue analysis are based on multi-run Sim traffic simulation.

The following list provides a summary of the intersections that exceed the storage capacity and the corresponding alternative.

1. Intersection of Middlefield Road and MacArthur Avenue (No-Build and Build conditions)
2. Intersection of Middlefield Road and Hurlingame Avenue (No-Build and Build conditions)
3. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
4. Intersection of Middlefield Road and Pacific Avenue (Build conditions)
5. Intersection of Middlefield Road and Dumbarton Avenue (No-Build and Build conditions)
6. Intersection of Middlefield Road and Berkshire Avenue (No-Build conditions)
7. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
8. Intersection of Middlefield Road and Fourth Avenue (No-Build and Build conditions)
9. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

The queues that exceeded the available storage are underlined in **Table 8**. The corresponding Sim Traffic queue length calculation sheets are presented in **Appendix C.**



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes

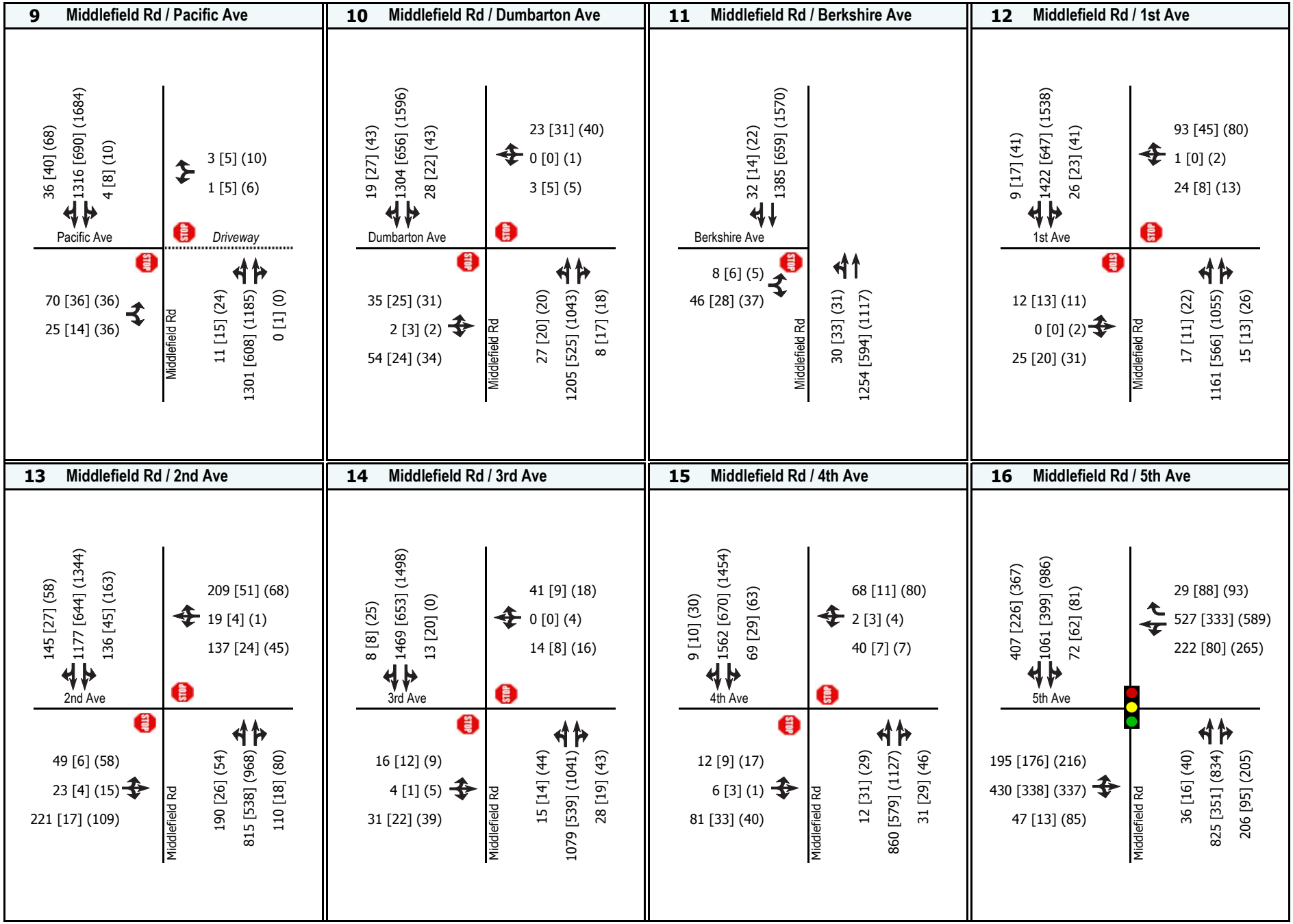
Traffic Signal

Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7A

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



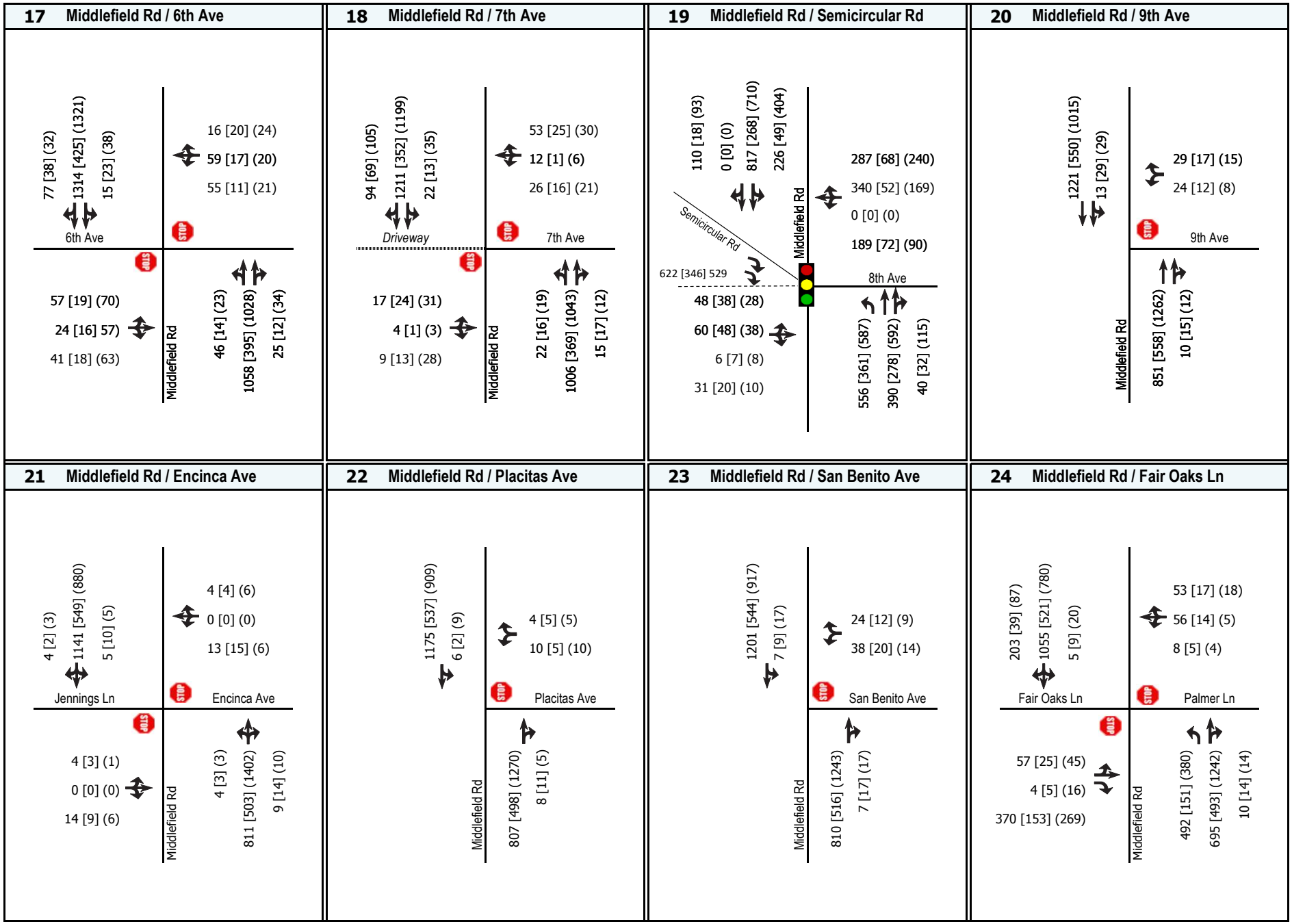
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7B

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



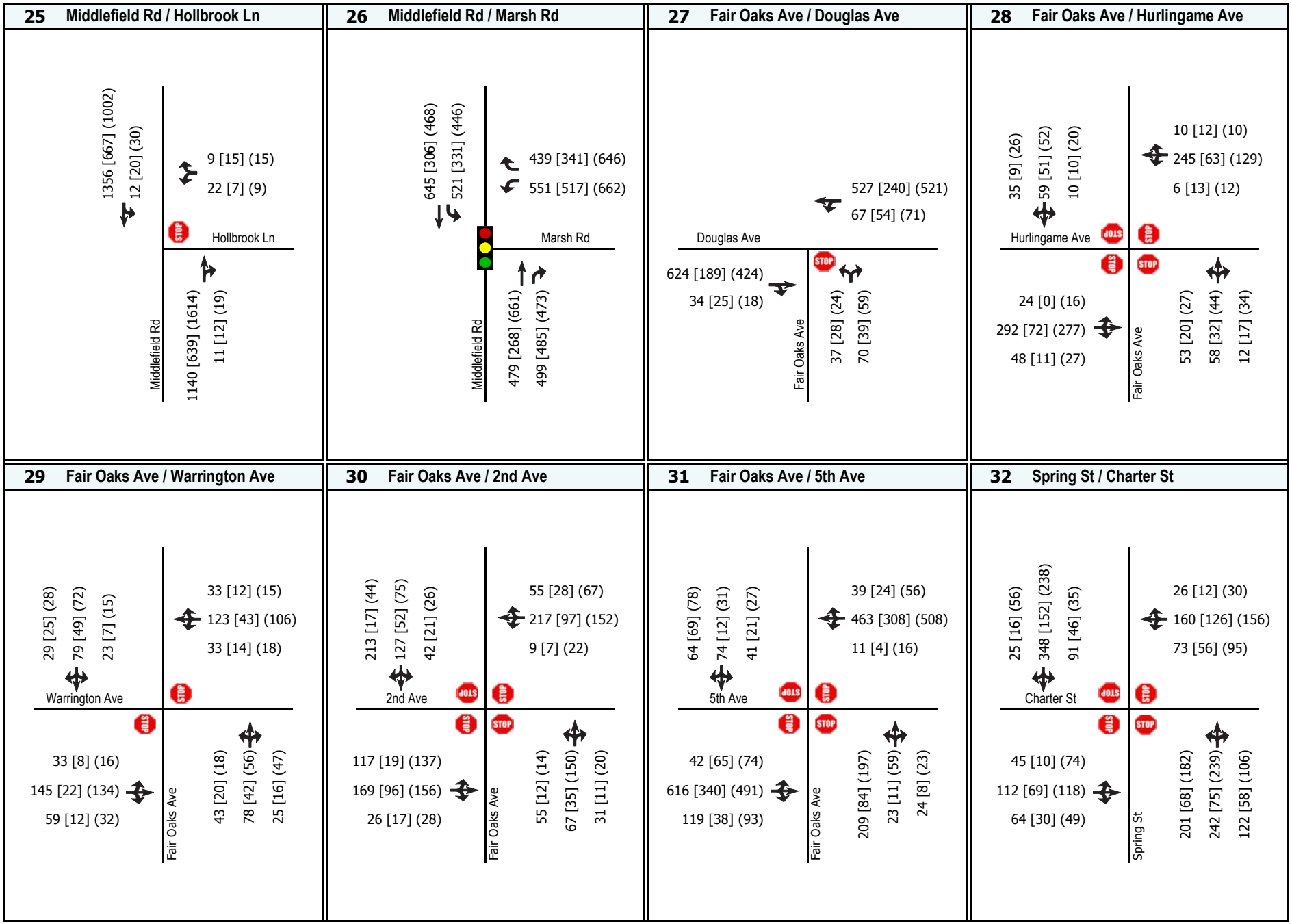
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7C

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



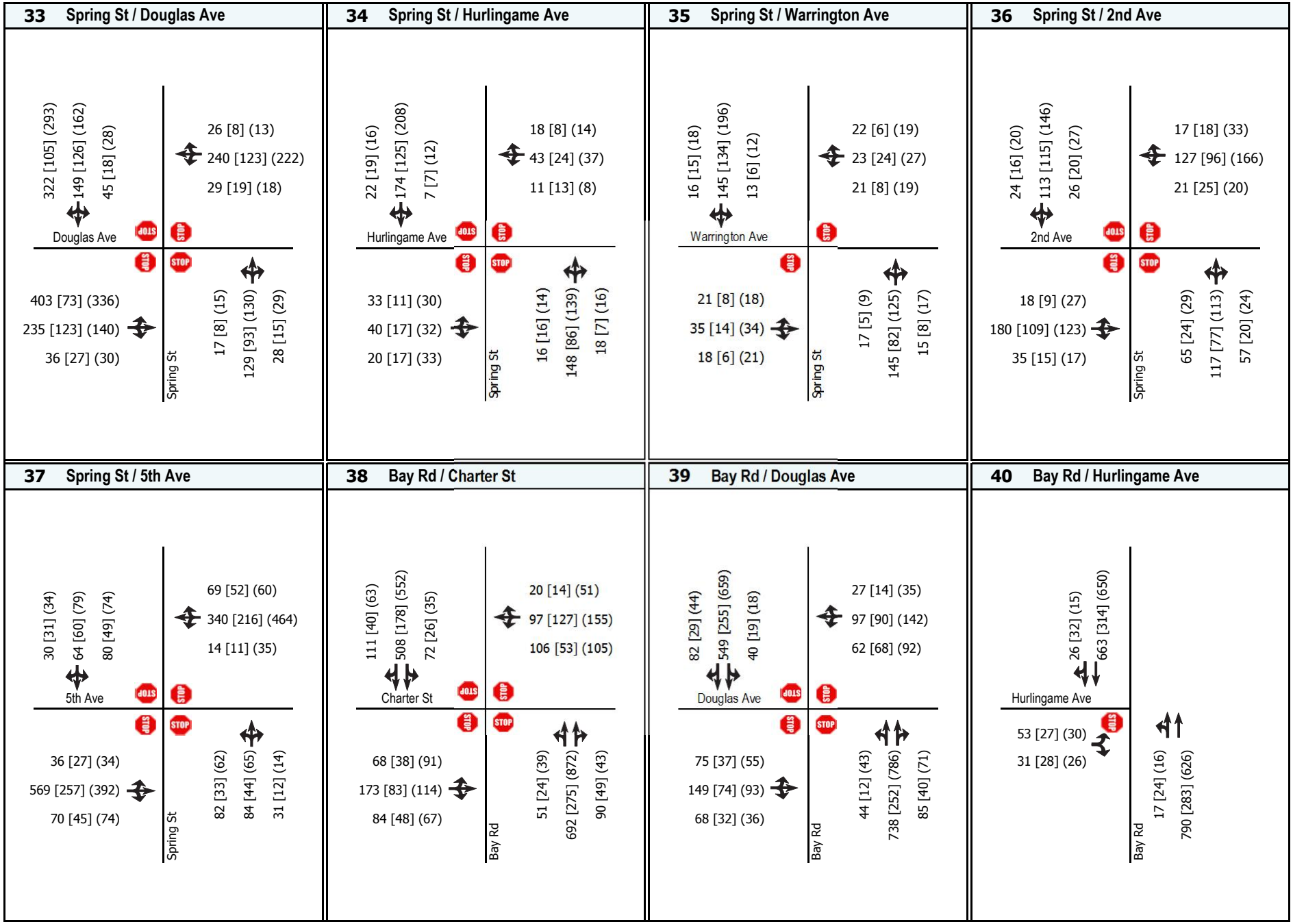
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7D

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



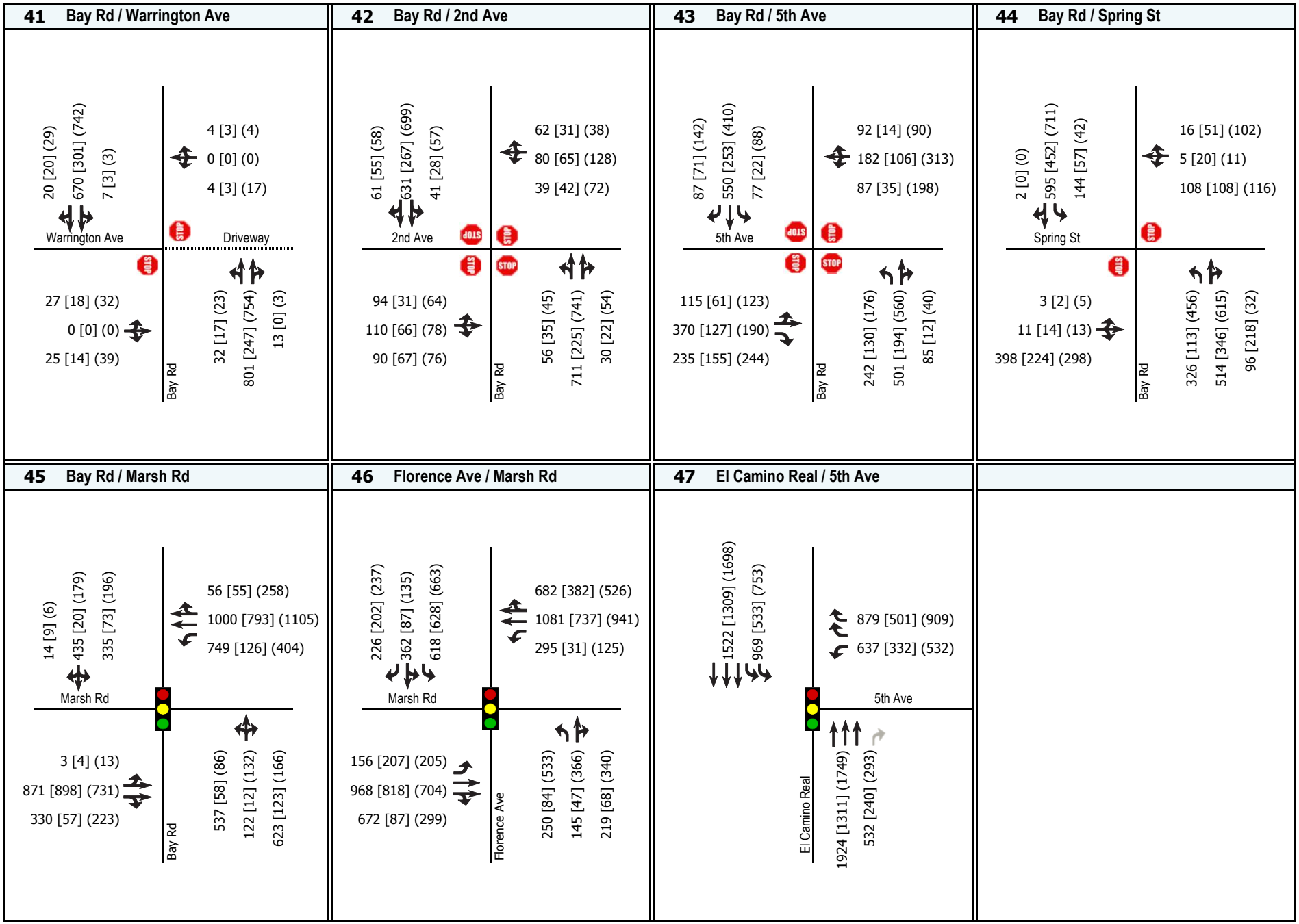
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7E

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes

Traffic Signal

Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 7F

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (No Build and Build 4 Lane Option)

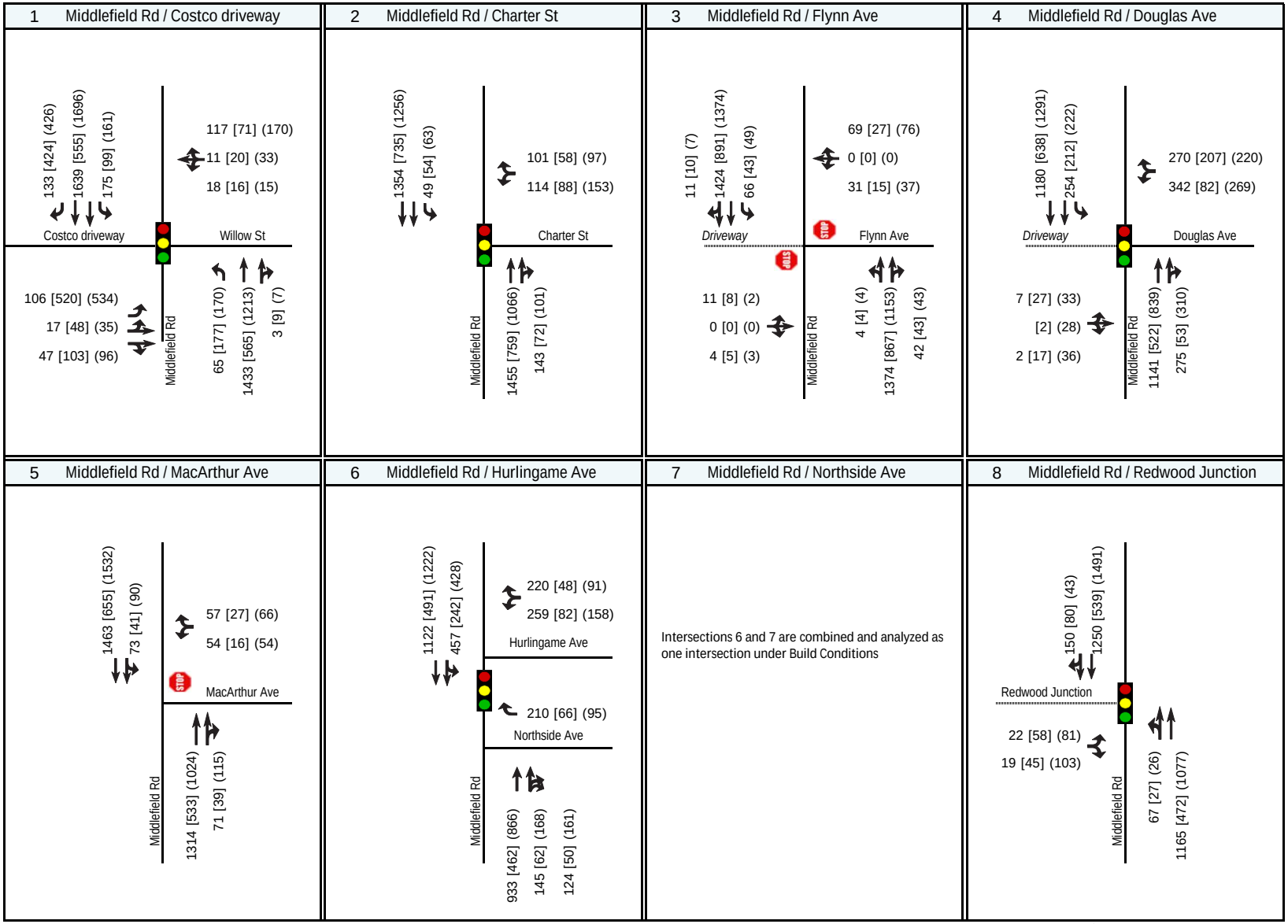
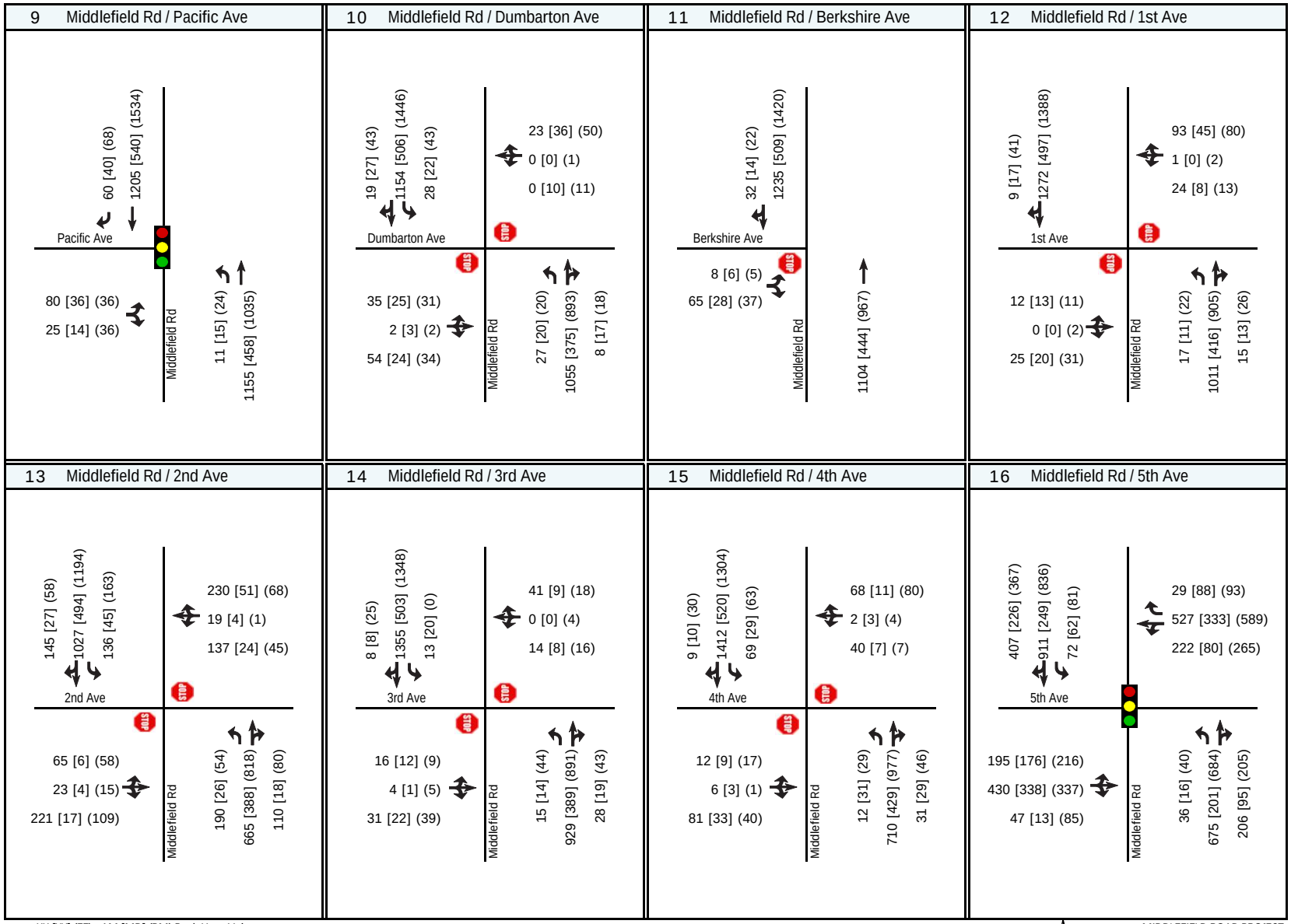


FIGURE **8**A

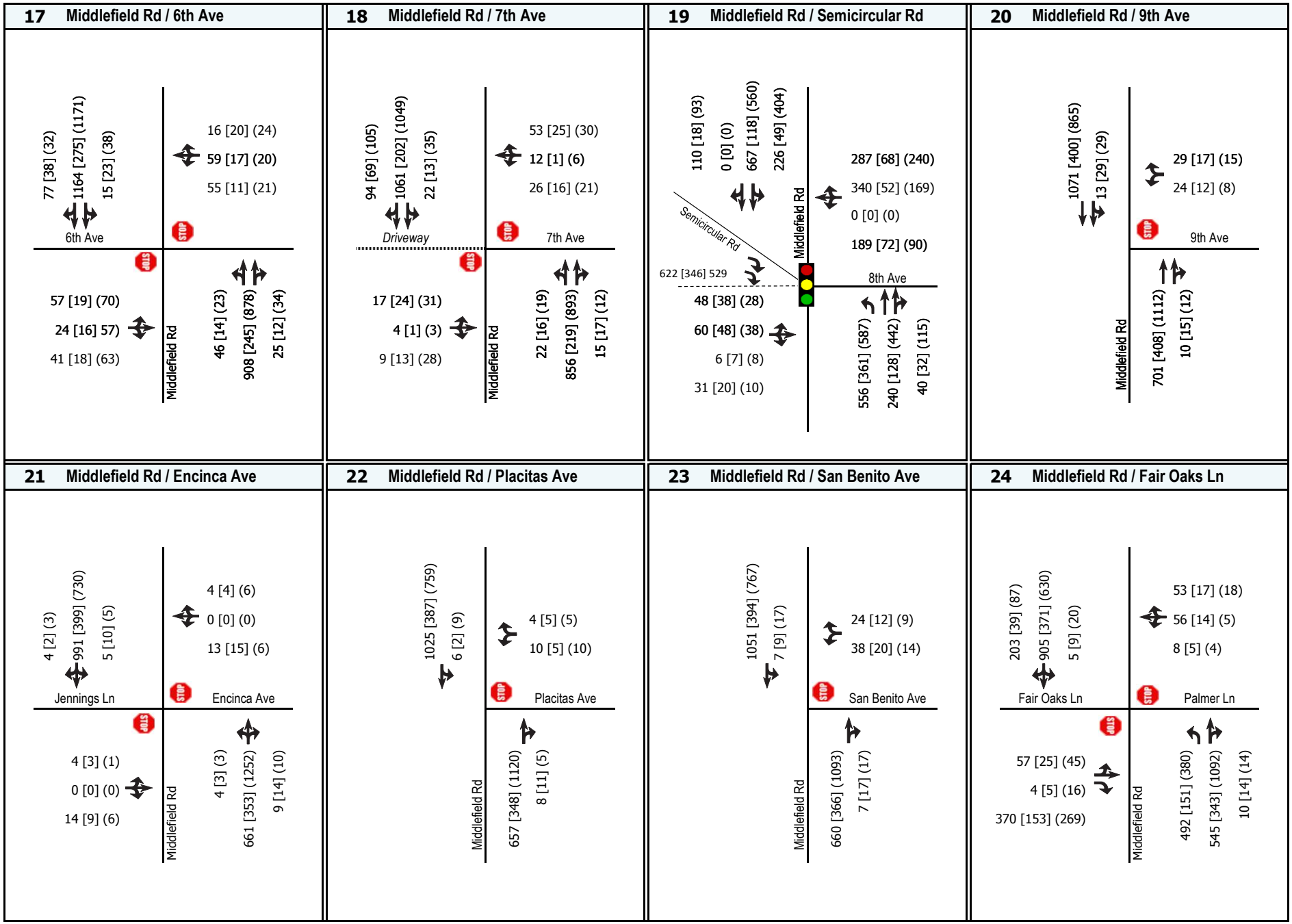
2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build **3** Lanes)



MIDDLEFIELD ROAD PROJECT

FIGURE **8**B

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build **3** Lanes)



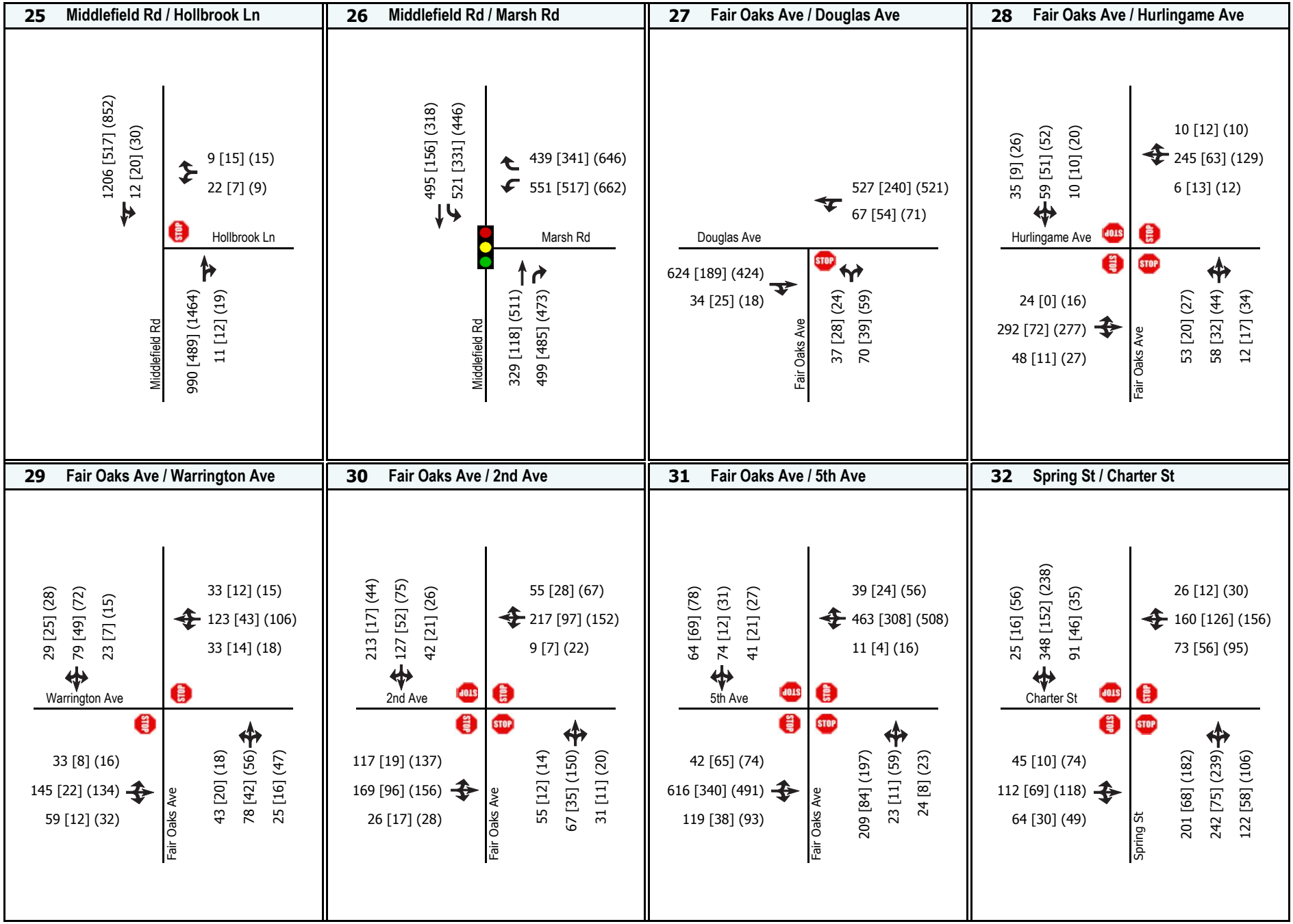
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 8C

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



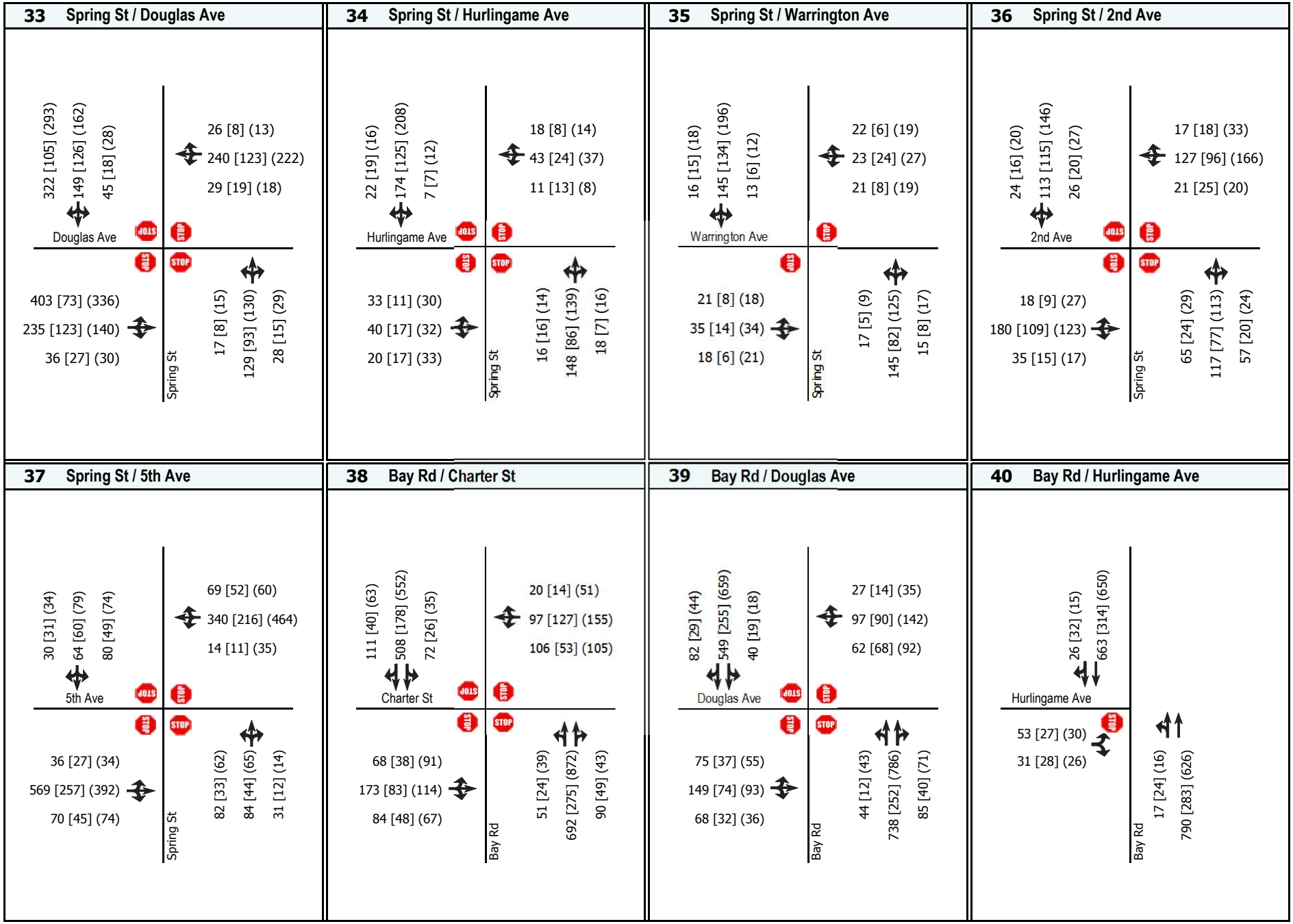
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 8D

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



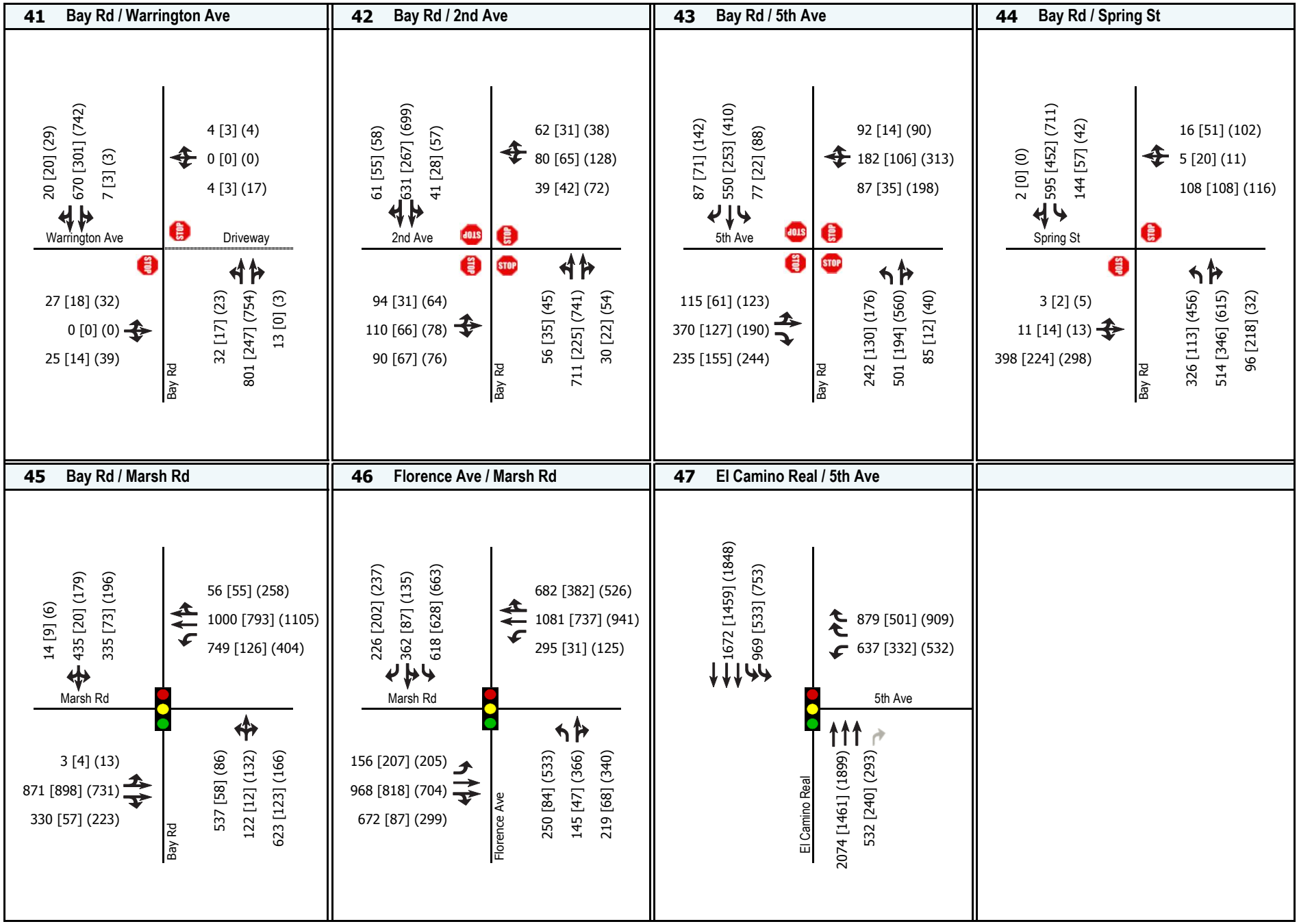
XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal STOP Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 8E

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)



XX [YY] (ZZ) - AM [MD] (PM) Peak Hour Volumes

Travel Lanes Traffic Signal Stop Sign

MIDDLEFIELD ROAD PROJECT

FIGURE 8F

2050 LANE CONFIGURATION AND TRAFFIC VOLUMES (Build 3 Lanes)

Table 7 - Year 2050 No-Build Conditions vs Build Conditions Intersection Level of Service Summary

	No.	Intersection		Control	2050 No-Build Conditions						2050 Build Conditions					
					AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
		North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
	1	Middlefield Rd	Willow St	Signal	C	21.2	C	22.3	**E**	**71.2**	B	19.0	C	21.3	**E**	**60.7**
	2	Middlefield Rd	Charter St	Signal	B	12.2	A	8.5	B	12.7	B	13.0	A	8.9	B	12.5
	3	Middlefield Rd	Flynn Ave	TWSC[1]	**E**	**45.1**	**F**	**50.7**	D	29.4	**E**	**48.2**	**E**	**43.4**	D	32.0
	4	Middlefield Rd	Douglas Ave	Signal	**F**	**115.0**	B	10.4	D	54.2	**F**	**115.4**	B	11.2	D	43.6
Project Limits	5	Middlefield Rd	MacArthur Ave	TWSC[1]	**F**	**Err**	C	21.8	**F**	**Err**	**F**	**Err**	C	17.2	**F**	**519.7**
	6*	Middlefield Rd	Hurlingame Ave	TWSC[1] / Signal	**F**	**Err**	**F**	**67.3**	**F**	**Err**	**F**	**660.5**	D	52.4	**F**	**564.7**
	7*	Middlefield Rd	Northside Ave	TWSC[1] / Signal	**F**	**Err**	**E**	**35.4**	**F**	**Err**	Merged with Intersection #6 under the Build Conditions					
	8*	Middlefield Rd	Redwood Junction	TWSC[1] / Signal	**F**	**683.9**	**E**	**49.5**	**F**	**Err**	**E**	**65.5**	A	9.8	**F**	**109.1**
	9*	Middlefield Rd	Pacific Ave	TWSC[1] / Signal	**F**	**Err**	**F**	**71.8**	**F**	**Err**	D	38.0	B	10.9	D	46.6
	10	Middlefield Rd	Dumbarton Ave	TWSC[1]	**F**	**1,134.1**	**F**	**52.8**	**F**	**Err**	**F**	**694.7**	C	19.2	**F**	**Err**
	11	Middlefield Rd	Berkshire Ave	TWSC[1]	**F**	**120.0**	C	16.2	**F**	**73.0**	**F**	**837.1**	B	14.3	**F**	**Err**
				Mtigations							**A**	**7.5**	**A**	**2.6**	**B**	**14.3**
	12	Middlefield Rd	First Ave	TWSC[1]	**F**	**791.3**	D	33.1	**F**	**Err**	**F**	**Err**	C	16.2	**F**	**Err**
				Mitigations							**A**	**7.4**	**A**	**3.1**	**A**	**8.6**
	13	Middlefield Rd	Second Ave	TWSC[1]	**F**	**Err**	**F**	**67.2**	**F**	**Err**	**F**	**Err**	C	19.7	**F**	**Err**
	14	Middlefield Rd	Third Ave	TWSC[1]	**F**	**591.5**	D	25.0	**F**	**Err**	**F**	**54.9**	C	15.1	**F**	**96.0**
	15	Middlefield Rd	Fourth Ave	TWSC[1]	**F**	**Err**	**F**	**66.5**	**F**	**Err**	**F**	**Err**	C	23.8	**F**	**Err**
	16	Middlefield Rd	Fifth Ave	Signal	**F**	**438.0**	**E**	**59.7**	**F**	**460.6**	**F**	**414.8**	**E**	**77.8**	**F**	**418.1**
				Mitigations							**F**	**188.9**	**C**	**23.8**	**F**	**197.2**
Traffic Study Limits	17	Middlefield Rd	Sixth Ave	TWSC[1]	**F**	**Err**	D	26.5	**F**	**638.7**	**F**	**Err**	C	18.1	**F**	**Err**
				Mitigations							**A**	**7.9**	**A**	**4.2**	**A**	**8.9**
	18	Middlefield Rd	Seventh Ave	TWSC[1]	**F**	**54.8**	C	20.0	C	22.8	**F**	**251.0**	C	15.8	**F**	**251.2**
				Mitigations							**E**	**50.0**	**B**	**12.1**	**C**	**24.7**
	19	Middlefield Rd	Semicircular Rd	Signal	**F**	**231.7**	B	19.5	**F**	**100.9**	**F**	**215.6**	B	17.3	**F**	**87.2**
	20	Middlefield Rd	Ninth Ave	TWSC[1]	D	26.7	B	14.5	**E**	**39.0**	C	19.6	B	12.5	D	31.7
	21	Middlefield Rd	Encinca Ave	TWSC[1]	**F**	**414.0**	D	27.3	**F**	**524.6**	**F**	**124.9**	C	17.6	**F**	**149.8**
	22	Middlefield Rd	Placitas Ave	TWSC[1]	**F**	**162.2**	C	16.8	**F**	**284.0**	**F**	**64.9**	B	13.0	**F**	**89.9**
	23	Middlefield Rd	San Benito Ave	TWSC[1]	**F**	**202.5**	C	20.3	**F**	**435.8**	**F**	**71**	B	14.9	**F**	**111.5**
	24	Middlefield Rd	Fair Oaks Ln	TWSC[1]	**F**	**Err**	**E**	**42.7**	**F**	**Err**	**F**	**Err**	C	24.3	**F**	**Err**
	25	Middlefield Rd	Hollbrook Ln	TWSC[1]	**F**	**1,520.5**	C	22.2	**F**	**Err**	**F**	**395.8**	C	15.8	**F**	**488.8**

No.	Intersection		Control	2050 No-Build Conditions						2050 Build Conditions					
				AM Peak		School PM		PM Peak		AM Peak		School PM		PM Peak	
	North/South	East/West		LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)	LOS	Avg. Delay (sec.)
26	Middlefield Rd	Marsh Rd	Signal	**E**	**61.6**	C	29.3	**F**	**92.5**	D	50.2	C	25.2	**E**	**74.9**
27	Fair Oaks Ave	Douglas Ave	TWSC[1]	D	31.7	B	11.8	C	17.8	D	31.7	B	11.8	C	17.8
28	Fair Oaks Ave	Hurlingame Ave	AWSC	B	12.3	A	7.8	B	10.3	B	12.3	A	7.8	B	10.3
29	Fair Oaks Ave	Warrington Ave	TWSC[1]	C	17.9	B	10.7	B	13.3	C	17.9	B	10.7	B	13.3
30	Fair Oaks Ave	Second Ave	AWSC	C	19.1	A	8.3	B	12.6	C	19.1	A	8.3	B	12.6
31	Fair Oaks Ave	Fifth Ave	AWSC	**F**	**186.2**	C	15.4	**F**	**137.2**	**F**	**186.2**	C	15.4	**F**	**137.2**
32	Spring St	Charter St	AWSC	**F**	**95.3**	B	10.4	**F**	**61.7**	**F**	**95.3**	B	10.4	**F**	**61.7**
33	Spring St	Douglas Ave	AWSC	**F**	**155.9**	B	10.5	**F**	**71.4**	**F**	**155.9**	B	10.5	**F**	**71.4**
34	Spring St	Hurlingame Ave	AWSC	A	9.1	A	8.0	A	9.2	A	9.1	A	8.0	A	9.2
35	Spring St	Warrington Ave	TWSC[1]	B	12.5	B	10.8	B	12.7	B	12.5	B	10.8	B	12.7
36	Spring St	Second Ave	AWSC	B	11.2	A	9.0	B	10.6	B	11.2	A	9.0	B	10.6
37	Spring St	Fifth Ave	AWSC	**F**	**98.4**	B	11.8	**F**	**61.8**	**F**	**98.4**	B	11.8	**F**	**61.8**
38	Bay Rd	Charter St	AWSC	**F**	**65.5**	B	10.9	**F**	**98.1**	**F**	**65.5**	B	10.9	**F**	**98.1**
39	Bay Rd	Douglas Ave	AWSC	**F**	**56.9**	B	10.4	**F**	**63.3**	**F**	**56.9**	B	10.4	**F**	**63.3**
40	Bay Rd	Hurlingame Ave	TWSC[1]	D	29.4	B	11.9	C	19.8	D	29.4	B	11.9	C	19.8
41	Bay Rd	Warrington Ave	TWSC	D	32.1	B	12.1	**E**	**40.7**	D	32.1	B	12.1	**E**	**40.7**
42	Bay Rd	Second Ave	AWSC	**F**	**50.9**	B	10.4	**F**	**63.7**	**F**	**50.9**	B	10.4	**F**	**63.7**
43	Bay Rd	Fifth Ave	AWSC[2]	**F**	**209.4**	B	14.5	**F**	**224.4**	**F**	**209.4**	B	14.5	**F**	**224.4**
44	Bay Rd	Spring St	TWSC[1]	**F**	**Err**	**F**	**624.7**	**F**	**Err**	**F**	**Err**	**F**	**624.7**	**F**	**Err**
45	Bay Rd	Marsh Rd	Signal	**F**	**524.2**	B	13.5	**E**	**69.3**	**F**	**524.2**	B	13.5	**E**	**69.3**
46	Florence Ave	Marsh Rd	Signal	**F**	**268.8**	**E**	**60.0**	**F**	**201.4**	**F**	**268.8**	**E**	**60.0**	**F**	**201.4**
47	El Camino Real	Fifth Ave	Signal	**F**	**103.4**	C	22.4	D	54.3	**F**	**110.7**	C	23.3	**E**	**61.8**
			Mitigations							**E**	**64.2**	**B**	**18.1**	**D**	**39.9**

Source: AECOM 2015

Notes:

1. Gray highlights indicate the project limits.
2. AM = morning peak hour, School PM = After school hour, PM = evening peak hour
3. Whole intersection weighted average control delay expressed in second per vehicle for signalized intersections and all-way stop controlled intersections. Total control delay for the worst movement is presented for side-street stop controlled intersections.
4. Err under the Average delay column indicates that the program was unable to calculate the delay value.
5. Highlighted cell indicates a significant impact.

* Due to the proposed improvements within the project limits, the control was changed from a stop to a signal under the Build conditions.

Bold text indicates deficient intersection operations.

Table 8- Design Year 2050 No-Build Conditions vs Build Conditions 95th Percentile Queue Length Summary – SimTraffic Results

No.	Intersection		2050 No-Build Conditions Queue Length (Ft)						2050 Build Conditions Queue Length (Ft)					
5	Intersection: 5: Middlefield Rd & MacArthur Ave		WBLR	NBT	NBTR	SBLT	SBT		WBLR	NBT	NBTR	SBLT	SBT	
		Storage Capacity	1,500	200	200	200	200		1,500	200	200	200	200	
		AM PEAK	490	20	45	265	290		875	130	85	115	75	
		SCHOOL PM PEAK	50	0	20	90	0		50	55	45	30	15	
		PM PEAK	915	10	20	275	295		840	100	125	210	215	
6	Intersection: 6: Middlefield Rd & Hurlingame Ave		WBLR	NBT	NBTR	SBLT	SBT		WBLR	NBT	NBTR	SBLT	NWR	
		Storage Capacity	1,700	50	50	200	200		1,700	50	50	200	425	
		AM PEAK	2,240	20	25	250	265		1,925	20	40	175	170	
		SCHOOL PM PEAK	125	35	40	135	105		205	40	50	170	20	
		PM PEAK	2,250	45	50	235	255		1,995	40	60	165	35	
7	Intersection: 7: Middlefield Rd & Northside Ave		WBLR	NBT	NBTR	SBLT	SBT		Merged with Intersection #6 under the Build Conditions					
		Storage Capacity	425	50	50	50	50							
		AM PEAK	595	15	35	50	50							
		SCHOOL PM PEAK	170	30	40	45	20							
		PM PEAK	655	35	50	75	60							
8	Intersection: 8: Middlefield Rd & Redwood junction		EBLR	NBLT	NBT	SBT	SBTR		EBLR	NBL	NBT	SBTR		
		Storage Capacity	300	100	100	50	50		300	100	100	50		
		AM PEAK	110	80	55	20	45		90	50	65	70		
		SCHOOL PM PEAK	120	65	40	15	30		305	50	40	100		
		PM PEAK	430	50	75	60	65		395	30	85	95		
9	Intersection: 9: Middlefield Rd & Pacific Ave/Driveway		EBLR	WBLR	NBLT	NBTR	SBLT	SBTR	EBLR	NBL	NBT	SBT	SBR	
		Storage Capacity	950	100	2,200	2,200	100	100	950	100	2,200	100	100	
		AM PEAK	700	0	50	15	60	60	190	35	585	105	15	
		SCHOOL PM PEAK	75	5	65	60	30	45	90	60	335	70	25	
		PM PEAK	845	20	65	80	90	90	220	75	440	160	15	

No.	Intersection		2050 No-Build Conditions Queue Length (Ft)						2050 Build Conditions Queue Length (Ft)					
10	Intersection: 10: Middlefield Rd & Dumbarton Ave		EBLTR	WBLTR	NBL	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	425	425	1,650	1,650	500	500	425	425	60	1,650	60	500
		AM PEAK	250	50	85	90	550	545	330	50	25	205	15	555
		SCHOOL PM PEAK	115	50	50	40	215	250	50	50	35	50	40	70
		PM PEAK	820	195	100	115	720	710	560	330	25	105	75	710
11	Intersection: 11: Middlefield Rd & Berkshire Ave		EBLR	NBLT	NBT	SBT	SBTR		EBLR	NBT	SBTR			
		Storage Capacity	825	1,250	1,250	850	850		825	1,250	850			
		AM PEAK	585	50	60	380	390		335	80	415			
		SCHOOL PM PEAK	80	55	20	320	325		45	30	20			
		PM PEAK	875	40	0	425	435		470	0	445			
12	Intersection: 12: Middlefield Rd & 1st Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBTR	
		Storage Capacity	825	850	1,100	1,100	1,050	1,050	825	850	60	1,100	1,050	
		AM PEAK	305	290	20	15	95	95	235	350	15	90	105	
		SCHOOL PM PEAK	90	180	30	20	80	75	55	55	15	0	0	
		PM PEAK	475	370	35	0	100	100	515	390	15	105	0	
13	Intersection: 13: Middlefield Rd & 2nd Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	825	775	850	850	1,300	1,300	825	775	60	850	60	1,300
		AM PEAK	455	2,725	175	135	285	290	395	2,550	75	90	80	295
		SCHOOL PM PEAK	105	340	115	65	230	235	40	90	25	65	35	90
		PM PEAK	430	1,695	65	85	265	265	415	1,070	30	60	105	265
14	Intersection: 14: Middlefield Rd & 3rd Ave		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR
		Storage Capacity	785	745	525	525	1,600	1,600	785	745	60	525	60	1,600
		AM PEAK	440	505	20	10	330	330	410	335	15	0	30	270
		SCHOOL PM PEAK	50	90	20	0	270	270	45	35	10	0	20	75
		PM PEAK	455	540	30	0	310	315	445	540	25	0	0	245
15	Intersection: 15:		EBLTR	WBLTR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLTR	NBL	NBTR	SBL	SBTR

No.	Intersection		2050 No-Build Conditions Queue Length (Ft)							2050 Build Conditions Queue Length (Ft)						
	Middlefield Rd & 4th Ave	Storage Capacity	785	800	250	250	1,900	1,900		785	800	60	250	60	1,900	
		AM PEAK	425	750	175	180	290	285		365	665	15	100	65	250	
		SCHOOL PM PEAK	360	75	200	210	300	310		220	70	50	100	80	280	
		PM PEAK	425	735	275	285	285	285		455	455	65	245	75	250	
16	Intersection: 16: Middlefield Rd & 5th Ave		EBLTR	WBLT	WBR	NBLT	NBTR	SBLT	SBTR	EBLTR	WBLT	WBR	NBL	NBTR	SBL	SBTR
		Storage Capacity	2,200	1,500	80	800	800	2,200	2,200	2,200	1,500	80	100	800	60	2,200
		AM PEAK	2,690	2,870	50	285	280	250	255	2,445	2,780	50	90	160	95	240
		SCHOOL PM PEAK	2,755	410	135	285	285	275	275	1,270	830	130	60	180	90	255
		PM PEAK	2,780	2,740	90	265	280	250	265	2,350	2,595	90	130	160	100	245

Source: AECOM 2015
Notes:
Underline indicates queue length exceeds storage capacity.

6.5 PEDESTRIAN, BICYCLE, TRANSIT AND PARKING IMPACTS

The project improvements are discussed in the opening year 2020 conditions chapter and the results are expected to be the similar under design year 2050. To summarize, the following improvements are proposed to enhance the operating conditions for pedestrians, bicyclists, and transit users, and therefore *no significant impacts* are expected under both the design year 2050 Build conditions.

- Add buffered bike lanes in the southbound and northbound directions, each with a 6.5 foot total width.
- Add bulbouts at each intersection to improve sight distances for pedestrians and reduce the lengths of the crosswalks to approximately 45 feet.
- Widen the sidewalks to 12 feet along the length of the project and remove the overhead wires and poles to improve the safety and accessibility for pedestrians and to accommodate underground electrical facilities for PG&E.
- Replace the diagonal on-street parking with 8-foot wide parallel parking at the sidewalk curb and have a striped buffer between the parking spaces and the bike lane.

The following improvements are proposed at the driveways near the Railroad Track.

- Relocate the driveway and the Health Center signage
- Modify raised medians and thus, the private property traffic circulation pattern
- Replace and relocate track signal equipment as well as curbs
- Re-stripe the driveway
- Restrict turning left movements from westbound Northside Avenue
- Signalize the driveway access with railroad preemption

Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits. Conversion from angled to parallel parking, as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield and 2nd Ave and 16 spaces at Berkshire Lot.

Since there is no loss to the number of on-street parking spaces and the proposed project improves the safety for both motorists and bicyclists, the proposed project will have *no significant impacts* and no mitigation measures are required

7. CONCLUSIONS

The changes proposed under the Project (3 lane option) would substantially improve the safety and attractiveness of bicycle and pedestrian facilities along Middlefield Road in accordance with various County and community goals. The reduction in auxiliary queuing storage at some locations in the corridor may result in slight increases in travel time along the corridor for motorists and transit users, but the magnitude of these effects is less than might be expected. Overall, the Build Alternative would meet the key objectives of the proposed project. The results of the traffic operational analysis for the Existing conditions, Opening Year 2020 conditions, and Design Year 2050 conditions are presented below.

Intersection Level of Service Analysis

Existing Conditions

- ✓ During the AM peak hour, within the traffic study limits, 7 of the 47 study intersections operate at County of San Mateo's unacceptable levels of service (LOS E or worse). However, within the project study limits, 3 of the 12 study intersections operate at unacceptable levels of service of LOS E or worse. All other intersections operate at acceptable levels of service (LOS D or better).
- ✓ During the School PM peak hour, within the Traffic Study Limits, 6 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). Within the project limits, 3 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at County of San Mateo's acceptable LOS D or better standards.
- ✓ During the PM peak hour, within the Traffic Study Limits, 16 of the 47 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). However, within the project limits, 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse). All other intersections operate at acceptable LOS D or better standards
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Opening Year 2020 No-Build Conditions

- ✓ During the AM peak hour, within the Traffic Study Limits, 15 of the 47 intersections and within the project limits, 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).
- ✓ During the School PM peak hour, within the Traffic Study Limits, 7 of the 47 intersections and within the project limits 5 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).

- ✓ During the PM peak hour, within the Traffic Study Limits, 20 of the 47 intersections and within the project limits 9 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse).
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Opening Year 2020 Build Conditions

Overall, due to the proposed improvements, the operating conditions of the study intersections either improved or stayed the same with a few exceptions as discussed below. The lane reduction along the project study limits was expected to cause degradation in LOS from the No-Build Conditions. In addition, the proposed modifications would divert commuter traffic volumes away from Middlefield Road within the project limits and encourage a modal switch to walking, bicycling, and transit use.

Based on the County of San Mateo's significance standards, a project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard overall LOS of 'D' and for the intersections that are not in compliance with the LOS standards (LOS D or better), a project will be considered to have a significant impact if the project will cause the intersection to operate at a level of service that violates the standard LOS mentioned above and the proposed project increases average control delay at the intersection by four (4) seconds or more.

AM Peak Hour

- ✓ Within the traffic study limits, among the 15 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 6 intersections continue to operate at LOS E or worse, one intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, one intersection continue to operate at LOS E or worse, one intersection deteriorate from an acceptable LOS D to an unacceptable LOS F and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

School PM Peak Hour

- ✓ Within the traffic study limits, among the 7 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E

or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.

- ✓ Within the project study limits, all the intersections perform at an acceptable LOS D or better in the Build conditions compared to the 5 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have *no significant impact.*

PM Peak Hour

- ✓ Within the traffic study limits, among the 20 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 15 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ Within the project study limits, among the 9 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 5 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.
- ✓ Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

Mitigation Measures

Middlefield Road and Fifth Avenue (Intersection#16 AM and PM Peak Hour) – Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. As a result of the above improvements, the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the opening year 2020 Build conditions.

Design Year 2050 No-Build Conditions

Several study intersections are expected to fail (operate at an unacceptable LOS E or worse) based on the traffic growth projected in the design year 2050. The following results reveal the same:

- ✓ During the AM peak hour ,within the Traffic Study Limits, 35 of the 47 intersections and within the project limits, all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)

- ✓ During the School PM peak hour, within the Traffic Study Limits, 12 of the 47 intersections and within the project limits 8 of the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ During the PM peak hour, within the Traffic Study Limits, 34 of the 47 intersections and within the project limits all the 12 intersections operate at County of San Mateo's unacceptable standards (LOS E or worse)
- ✓ All other intersections operate at acceptable levels of service of LOS D or better.

Design Year 2050 Build Conditions

Overall, due to the proposed improvements, the operating conditions of the study intersections either improved or stayed the same with a few exceptions as discussed below. The lane reduction along the project study limits was expected to cause degradation in LOS from the No-Build Conditions. In addition, the proposed modifications would divert commuter traffic volumes away from Middlefield Road within the project limits to other parallel routes such as El Camino Real, Bay Road and Spring Street and encourage a modal switch to walking, bicycling and transit use.

AM Peak Hour

- ➢ Within the traffic study limits, among the 35 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 32 intersections continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- ➢ Within the project limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions.
- ➢ All other intersections operate at acceptable levels of service of LOS D or better.
- ➢ Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the following four intersections:
    - o Intersection #11 - Middlefield Road and Berkshire Avenue
    - o Intersection #12 - Middlefield Road and First Avenue
    - o Intersection #18 - Middlefield Road and Seventh Avenue
    - o Intersection #47 - El Camino Real and Fifth Avenue

School PM Peak Hour

- ➢ Within the traffic study limits, among the 12 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 4 intersections continue to operate at LOS E

or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.

- Within the project study limits, among the 8 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 1 intersection continue to operate at LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the intersection of Middlefield Road and Fifth Avenue (Intersection #16).

PM Peak Hour

- Within the traffic study limits, among the 34 intersections that operate at an unacceptable LOS E or worse in the No-Build conditions, 31 intersections continue to operate at LOS E or worse, two intersections deteriorate from an acceptable LOS D or better to an unacceptable LOS E or worse and the remaining intersections operate at an acceptable LOS D or better in the Build conditions.
- Within the project study limits, all the intersections would operate at unacceptable conditions (LOS E or worse) under both 2050 No-Build conditions and Build conditions with the exception of the intersection of Middlefield Road and Pacific Avenue which improves from an unacceptable LOS F in the No-Build conditions to an acceptable LOS D in the Build conditions. .
- All other intersections operate at acceptable levels of service of LOS D or better.
- Based on the County of San Mateo's significance standards, the proposed project will have a **significant impact** at the following intersections:
  - Intersection #11 - Middlefield Road and Berkshire Avenue
  - Intersection #17 - Middlefield Road and Sixth Avenue
  - Intersection #18 - Middlefield Road and Seventh Avenue
  - Intersection #47 - El Camino Real and Fifth Avenue

Mitigation Measures

Middlefield Road and Berkshire Avenue (Intersection #11 AM and PM Peak Hour) – Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and First Avenue **(Intersection#12** ***AM Peak Hour*****)** – Installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be

implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Fifth Avenue (Intersection#16 School PM Peak Hour) – Potential improvements at this intersection would include 1) Re-striping the eastbound and westbound approaches to include a left-turn pocket and a shared through/right turn lane 2) Signal timing modifications. If the improvements are to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Sixth Avenue (Intersection#17 PM Peak Hour) – The installation of a signal would improve operations to an acceptable LOS (LOS D or better). If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Middlefield Road and Seventh Avenue (Intersection#18 AM and PM Peak Hour) – Potential improvement include modification of the eastbound approach (driveway) to a right only approach. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

El Camino Real and Fifth Avenue (Intersection#47 AM and PM Peak Hour) – Potential improvement include a second westbound left-turn pocket. If the improvement is to be implemented, then the levels of service impact at this intersection will reduce to a ***less-than-significant*** impact under the design year 2050 Build conditions.

Queue Length Analysis

A queue length analysis was conducted for the intersections within the project study limits. The results of the 95th percentile queue analysis indicate that the queues are within the available storage for the majority of the locations under existing conditions except at the intersection of Middlefield Road and Fifth Avenue.

In the opening year 2020 conditions, the queue lengths were shorter or similar in the Build conditions compared to the No-Build conditions at the majority of the intersections with a few exceptions. The queue lengths exceeded the storage capacity at the following locations

1. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
2. Intersection of Middlefield Road and Dumbarton Avenue (No-Build conditions)
3. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
4. Intersection of Middlefield Road and Fourth Avenue (Build conditions)
5. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

At intersections where the queue lengths were longer than the No-Build condition queues, the difference was less than approximately two car lengths. However, at the intersection of El Camino Real and Fifth Avenue, the queues are longer due to the proposed project improvements.

In the design year 2050 conditions, due to the significant growth in traffic as projected by the forecast model, long queues are expected under both No-Build and Build conditions. The queue lengths are longer than the available storage at several locations compared to the 2020 conditions. The results reveal the same. The queue lengths exceeded the storage capacity at the following locations.

1. Intersection of Middlefield Road and MacArthur Avenue (No-Build and Build conditions)
2. Intersection of Middlefield Road and Hurlingame Avenue (No-Build and Build conditions)
3. Intersection of Middlefield Road and Redwood Junction (No-Build and Build conditions)
4. Intersection of Middlefield Road and Pacific Avenue (Build conditions)
5. Intersection of Middlefield Road and Dumbarton Avenue (No-Build and Build conditions)
6. Intersection of Middlefield Road and Berkshire Avenue (No-Build conditions)
7. Intersection of Middlefield Road and Second Avenue (No-Build and Build conditions)
8. Intersection of Middlefield Road and Fourth Avenue (No-Build and Build conditions)
9. Intersection of Middlefield Road and Fifth Avenue (No-Build and Build conditions)

Pedestrian, Bicycle and Transit Impacts

This project aims at improving the safety, convenience, and accessibility to other modes of traffic, which include pedestrians, bicyclists, and transit users. To achieve the goals of the project, it is critical to propose improvements that would put the other modes of travel in equal footing with motorists. The following improvements are proposed to enhance the operating conditions for pedestrians, bicyclists, and transit.

Bike Lanes

There are currently no bike lanes within the project limits. The lack of marked bike lanes coupled with angled “head-in” parking to the sidewalk curbs, has resulted in an uncontrolled cycling experience. To address these issues, the project would add buffered bike lanes in the southbound and northbound directions, each with a 6.5-foot total width.

Bulbouts/Crosswalks

No bulbouts currently exist within the project limits. This condition results in fairly long crosswalk lengths (on the order of 75 feet long) and coupled with the diagonal parking present along much of the project length reduces pedestrian visibility to motorists and cyclists. To

improve these issues, bulbouts are planned at each intersection, improving sight distances for pedestrians and reducing crossing lengths on the order of 45 feet.

Sidewalk Width

The existing sidewalks vary in width, but are generally 5 to 8 feet wide. With the presence of existing overhead poles and other signs, driveways, and intrusion from the fronts of diagonally-parked vehicles, the existing sidewalks are very congested. The project is planning on widening the sidewalks to 12 feet along the length of the project and removing the overhead wires and poles, improving the safety and accessibility for pedestrians and accommodating underground electrical facilities for PG&E.

Bus Stops

Similar to existing, there will be five bus stops within the project limits, three northbound and two southbound. The bus stops will be placed downstream of an intersection and will be 60-feet in length with tapers for entering and exiting the bus stop. A concrete pad will be provided for the bus stop, and SamTrans is investigating the possibility of adding bus shelters. An addition of bus shelters is not anticipated to have an effect on parking. Also, bus stops will be moved from upstream to a downstream of intersections to improve traffic flow.

At-Grade Railroad Crossing

A Union Pacific Railroad (UPRR) maintained at-grade crossing owned by Caltrain is located between Pacific Avenue and Northside Avenue. The following improvements are proposed at the driveways near the Railroad Track:

- Relocate the driveway and the Health Center signage
- Modify raised medians and thus, the private property traffic circulation pattern
- Replace and relocate track signal equipment as well as curbs
- Re-stripe the driveway
- Restrict turning left movements from westbound Northside Avenue – This would improve the safety and reduce the number of conflicting points.
- Signalize the driveway access with railroad preemption –Since the intersections of Middlefield Road/ Hurlingame Avenue, Middlefield Road/ Northside Avenue, Middlefield Road/ Redwood Junction, and Middlefield Road/ Pacific Avenue in the vicinity of the railroad are closely spaced, there is no orderly movement of conflicting flows. This would result in potential safety hazards. Signalization would offer the maximum degree of control at this location.

Since the improvements listed above improve safety, accessibility and convenience, the impacts to the pedestrians, bicycles and transit users are considered ***less-than-significant***.

Parking Impacts

The existing parking within the project study limits is angle parking; when vehicles back out of the parking spaces, they block one of the existing through lanes and cause unsafe conditions for bicyclists. The current angle parking not only creates unsafe conditions for through traffic, but it also creates dangerous conditions for bicyclists along Middlefield Road. The angle parked vehicles were also observed to impede through traffic when they tried to back out of the parking spots. Cyclists were either interrupted by cars backing up from angled parking or had to move into the main traffic flow to avoid vehicles trying to park on-street. Some cyclists were observed using the sidewalk to completely move away from motorized vehicles, thereby taking up the sidewalks meant for foot traffic. Currently, there are approximately 125 parking spaces on Middlefield Road within the project limits.

As a result of the proposed improvements, the diagonal on-street parking will be replaced with 8-foot wide parallel parking at the sidewalk curb and will have a striped buffer between the parking spaces and the bike lane. Conversion from angled to parallel parking as well as bulbouts at all intersections will result in a parking loss of approximately 55 spaces on the street. As a separate project, the County is currently constructing two surface parking lots that will create 59 parking spaces: 44 spaces will be provided at Middlefield Road and 2nd Avenue, and 16 spaces at Berkshire Lot.

Since there is no loss in the number of on-street parking spaces and the proposed project improves safety for both motorists and bicyclists, the proposed project will have ***less-than-significant*** impacts, and no mitigation measures are required.