



BOSTON REGION METROPOLITAN PLANNING ORGANIZATION

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TECHNICAL MEMORANDUM

DATE: August 20, 2015
TO: Joseph Frawley, MassDOT Highway Division, District 3 Bryan Taberner, Director of Planning and Development, Franklin Michael Maglio, Town Engineer, Franklin
FROM: Seth Asante and Andrew Nagle, MPO Staff
RE: Route 140 Arterial Segment Study in Franklin

This memorandum summarizes the analyses and improvement alternatives resulting from the Route 140 Arterial Segment Study in Franklin. The opening sections provide background information for the study by describing the existing conditions and problems within the community. An assessment of the safety and operational problems, and a discussion of the potential improvement strategies, follows the background sections. The memo's final section presents study recommendations. The memorandum also includes technical appendices, which cite the methods used, and data applied, in the study, including detailed reports about the intersection capacity analyses. If implemented, the report's recommendations would result in an improved roadway corridor: one where it is safe to walk or bicycle to shops and schools; one that provides safer access to businesses; and one where traffic operates efficiently.

1 ORIGIN OF STUDY

The Boston Region MPO's Long-Range Transportation Plan (LRTP), *Paths to a Sustainable Region*, identified needs for all modes of transportation in the MPO region.¹ These needs guide decision making about which projects to include in future Transportation Improvement Plans (TIPs).² Examples of projects that address the region's current mobility needs are maintaining and modernizing roadways with high levels of congestion and safety problems; expanding the quantity and quality of walking and bicycling; increasing adherence to transit service schedules, and making transit service more efficient and modern. Based on previous and ongoing transportation planning work, including the Boston Region MPO's congestion management process (CMP), the Massachusetts Bay

¹ Paths to a Sustainable Region, the Long-Range Transportation Plan of the Boston Region Metropolitan Planning Organization, September 22, 2011.

² Transportation Improvement Program and Air Quality Conformity Determination, Federal Fiscal Years 2015–18, endorsed by the Boston Region Metropolitan Planning Organization on July 10, 2014.

Transportation Authority's (MBTA) Program for Mass Transportation (PMT), and other MPO planning studies, the LRTP identified 44 arterial segments in 45 communities where highways need improvements.

To identify strategies and solutions for addressing problems in some of these arterial segments, a study was included in the federal fiscal year (FFY) 2014 Unified Planning Work Programs (UPWP). An arterial segment study is a logical way to identify and address multimodal transportation needs in a corridor. An arterial segment study typically uses a holistic approach that analyzes services and makes associated recommendations within the roadway's right-of-way, and takes into account the needs of all abutters and users—pedestrians, bicyclists, motorists, and public-transportation riders.

During the past four years, the MPO has conducted these planning studies, and municipalities in the region have been receptive to them. The studies provide cities and towns with the opportunity to review the requirements of a specific arterial segment, starting at the conceptual level, before committing design and engineering funds. If the project qualifies for federal funds, the study's documentation also may be useful to the Massachusetts Department of Transportation (MassDOT).

2 STUDY BACKGROUND

2.1 Selection Process

Following a selection process based on safety conditions³, congested conditions⁴, multimodal significance⁵, regional significance⁶, and implementation potential⁷, the Route 140 arterial segment in Franklin was approved for study by the Boston Region MPO from a short list of 44 arterial segments. MassDOT Highway Division District 3, the 495/MetroWest Partnership, and the town of Franklin supported the study and were willing to review potential improvements for implementation.

³ Safety Conditions: Location has a higher-than-average crash rate for its functional class, location contains a HSIP-eligible crash cluster, location contains a top-200 high crash location, or location has a significant number of pedestrian and bicycle crashes (two or more per mile).

⁴ Congested Conditions: Travel time index is at least 1.3

⁵ Multimodal Significance: Location carries bus route(s), is adjacent to a transit stop or station, supports bicycle or pedestrian activities or has an implementation project to support one or more of these activities, or has need to accommodate pedestrians and bicyclists.

⁶ Regional Significance: Location carries high proportion of regional traffic or noticeable commuter bicycle traffic.

⁷ Implementation Potential: Location is under MassDOT jurisdiction, has a Transportation Improvement Process (TIP) "conceptual" status, or has a strong commitment from a city or town.

2.2 Study Location

Route 140 in Franklin is a north-south arterial, but generally runs in an east-west direction. Therefore, the eastbound direction in Franklin is designated Route 140 South and the westbound direction is designated Route 140 North. The local names are West Central Street and East Central Street. Route 140 in Franklin (excluding the segment in the town center from Emmons Street to Summer Street)—programmed in the FFY 2013 TIP—was the segment chosen for study. Figure 1 shows the two specific segments of focus, which are as follows:

1. West Central Street between Franklin Village Shopping Center and Beaver Street
2. East Central Street between King Street/Chestnut Street and the entrance to the Municipal Center and Big Y Store

2.3 Study Objectives

The purposes of this study were to inventory existing problems and develop multimodal improvements, which address the following:

- Increasing safety for pedestrians, bicyclists, and motorists
- Improving access to businesses
- Reducing congestion
- Promoting MassDOT's Healthy Transportation Compact

2.4 Public Participation

An advisory task force, composed of representatives from MassDOT Highway Division 3 and the town of Franklin, was established to participate in this study. MPO staff met with the task force twice: first to discuss the work scope and finalize the existing conditions and problems, and second to present improvements and obtain comments. Based on the problems in each arterial segment, the task force suggested the study should focus on:

- Evaluating the roadway cross-section for the West Central Street segment to improve safety, mobility, and accessibility to businesses within the segment
- Coordinating signal retiming for the East Central Street segment to improve safety and operations.

This memorandum reflects feedback from the task force. Appendix A includes a list of task force members and their comments.

3 EXISTING CONDITIONS

3.1 Roadway Features

West Central Street

The West Central Street segment is approximately 0.7 miles long, and is under MassDOT jurisdiction. This segment is an urban principal arterial on the National Highway System (NHS) Program, making it eligible for federal funds. West Central Street is a four-lane undivided roadway carrying about 21,000 vehicles per day. There are three signalized intersections in the study segment, and the driveway density is approximately 48 driveways per mile (both sides of roadway). The right-of-way is about 62 feet wide—consisting of four 12-foot-wide travel lanes, six-foot sidewalks, and one-foot shoulders on both sides. However, there is no useable shoulder in the segment. The posted speed limit is 40 mph in both directions and the land use adjacent to the roadway is zoned commercial. In addition, West Central Street connects I-495 and several communities to the west of Franklin, such as Bellingham and Milford.

East Central Street

The East Central Street segment is about 0.5 miles long and is owned by both MassDOT and the town of Franklin. It is an urban principal arterial and on the National Highway System (NHS) Program, making it eligible for federal funds. The right-of-way is approximately 55 feet wide—consisting of two 11-foot travel lanes, three-to-six-foot-wide shoulders, and five-foot sidewalks on both sides of the roadway. There are three signalized intersections in the segment and the driveway density is approximately 60 driveways per mile (both sides of roadway). The posted speed limit is 40 mph in both directions and the land use adjacent to the roadway is zoned commercial. In addition, East Central Street connects several communities to the east of Franklin including Wrentham and Foxborough.

3.2 West Central Street Intersections

West Central Street and Franklin Village Drive/Old Central Street

Franklin Village Drive and Old West Central Street intersect at West Central Street to form a four-leg intersection as shown in the aerial photo below. Each approach of West Central Street has an exclusive left-turn lane, two through lanes, and an exclusive right-turn lane. Franklin Village Drive and Old West Central Street have an exclusive left-turn lane, a through lane, and an exclusive right-turn lane on each approach. The intersection has a fully actuated traffic signal with functioning accessible pedestrian signals. The accessible pedestrian signals are devices with non-visual formats that communicate the WALK and DON'T WALK intervals at signalized intersections to pedestrians who are blind or who have low vision. The traffic signal is equipped with the Opticom system, which handles emergency vehicle preemption. The signal heads have

backplates, which improve visibility and are span-wire mounts. There are crosswalks with curb ramps across Old West Central Street and the east leg of West Central Street. The curb ramps lack detectable-warning-plates and do not fully comply with the Americans with Disabilities Act (ADA) standards. The intersection curb radii are adequate for trucks and buses servicing commercial and retail businesses and schools in the area. The busy Franklin Village Shopping Center is located on the south side of the intersection while Tri-County Regional Vocational Technical High School and a large residential area are located north of the intersection.



West Central Street at Franklin Village Drive

Source: Google Earth

West Central Street and Panther Way

Panther Way intersects West Central Street to form a four-leg intersection as shown in the aerial photo at the right. Each West Central Street approach has two travel lanes. Panther Way has one lane serving all southbound traffic movements and two lanes serving the northbound movements (an exclusive left-turn lane and a shared through/right lane). The intersection has a fully actuated traffic signal, and is equipped with emergency vehicle preemption only for the Panther Way approach because the Franklin Police Station is located on Panther Way. The signal heads are mast-arm mounts, but lack backplates, which allow for improved visibility. The pedestrian signals and pushbuttons function, but are not accessible. There are crosswalks and curb ramps at the intersection (see aerial photo above), but the curb ramps lack detectable warning plates. The intersection curb radii are adequate for trucks and



West Central Street at Panther Way

Source: Google Earth

buses servicing commercial and retail businesses and schools in the area. CVS Pharmacy, Taco Bell restaurant, and Vendetti Motors Inc. are located at the intersection. In addition, Panther Way provides access to Franklin High School, Highwood Apartments, and the Pirelli Veterans Skating Arena.

West Central Street and Beaver Street

Beaver Street intersects West Central Street to form a four-leg intersection as shown in the aerial photo at the right. West Central Street has three travel lanes on the eastbound approach (exclusive left-turn lane, through lane, and shared through/right-turn lane) and two travel lanes on the westbound approach (exclusive left-turn lane and shared through/right-turn lane). Beaver Street has two travel lanes on the southbound approach (exclusive right-turn lane and shared through/left lane) and one travel lane for all movements on the northbound approach. The intersection has a fully actuated traffic signal, but is not equipped with the Opticom system, which handles emergency vehicle preemption. The traffic signal heads are span-wire mounts, but do not have backplates. The intersection is equipped with functioning audible pedestrian signals, but they are not fully accessible. There is a crosswalk with curb ramps on all four legs of the intersection, but they lack detectable warning plates. The intersection curb radii are adequate for trucks and school buses servicing commercial and retail businesses and schools in the area. The land uses in the vicinity include commercial, agricultural, and residential.



West Central Street at Beaver Street

Source: Google Earth

3.3 East Central Street Intersections

East Central Street and King Street/Chestnut Street

King Street and Chestnut Street intersect East Central Street to form a four-leg intersection as shown in the aerial photo below. Each East Central Street approach has two travel lanes (exclusive left-turn lane and shared through/right-turn lane). Chestnut Street has one travel lane for all southbound traffic movements. King Street has two travel lanes (exclusive right-turn lane and shared through/left-turn lane).

The intersection has a fully actuated traffic signal with functioning pedestrian signals, but they are not accessible. It is equipped with an Opticom system, which handles emergency vehicle preemption. The traffic signal heads are mast-arm mounts, but the majority of them do not have backplates. There are crosswalks with curb ramps on all four legs of the intersection, but the curb ramps lack detectable warning plates. The intersection curb radii on King Street and Chestnut Street are not adequate for trucks to turn left onto East Central Street because both streets intersect East Central Street at an oblique angle. Truck drivers familiar with the intersection use Summer Street (located south of the intersection) to avoid this difficult maneuver. Walgreen Pharmacy, Franklin Ford, and Shaw's Supermarket are located at the intersection. In addition, Horace Mann Plaza and Big Y Store are located on East Central Street close to the intersection.



East Central Street at King Street/Chestnut Street

Source: Google Earth

East Central Street and Horace Mann Plaza/CVS Pharmacy Driveways

The driveways to the CVS Pharmacy and the Horace Mann Plaza intersect East Central Street to form a four-leg intersection as shown in the aerial photo at right. Each East Central Street approach has three travel lanes (exclusive left-turn lane, through lane, and exclusive right-turn lane). There are two travel lanes (exclusive right-turn lane and shared through/left-turn lane) for traffic exiting from either Horace Mann Plaza or the CVS Pharmacy. The intersection has a fully actuated traffic signal



East Central Street at Horace Mann Plaza Entrance

Source: Google Earth

with functioning pedestrian signals and pushbuttons, but they are not accessible. There is no emergency preemption at the intersection. The signal heads are mast-arm mounts and have backplates. There are supplementary signal heads with backplates on post mounts, which have been installed for the exclusive turn movements. There are crosswalks with curb ramps on three legs of the intersection except for the west leg of East Central Street. The curb ramps lack detectable warning plates. The intersection curb radii are adequate for trucks and buses servicing commercial businesses in the area. The land uses in the area are commercial, retail, and professional services.

East Central Street and Big Y Store/Municipal Center Driveways

The driveways to the Big Y Store and the Franklin Municipal Center intersect East Central Street to form a four-leg intersection as shown in the aerial photo at the right. Each approach of East Central Street has two travel lanes (exclusive left-turn lane and shared through/right-turn lane). There are two travel lanes for traffic exiting from the Big Y Store (exclusive right-turn lane and shared through/left-turn lane). There is one



East Central Street at Big Y Store Driveway

Source: Google Earth

travel lane for all traffic movements exiting from the municipal center. The intersection has a fully actuated traffic signal with functioning pedestrian signals, but they are not accessible. It is equipped with an Opticom system, which handles emergency vehicle preemption. The signal heads are mast-arm mounts and have backplates. There are supplementary signal heads with backplates on post mounts, which have been installed for the exclusive turn movements. There are crosswalks with curb ramps, but the curb ramps lack detectable warning plates on three legs of the intersection except for the east leg of East Central Street. The intersection curb radii are adequate for trucks and buses. The land uses in the area are commercial, retail, and professional services.

3.4 Vehicle, Pedestrian, and Bicyclist Volumes

The MassDOT Highway Division's Traffic Data Collection performed turning-movement counts (TMCs) at the signalized intersections in April 2014, when schools were in session. The counts were conducted during weekday morning

(7:00 AM to 9:00 AM), midday (11:00 AM to 1:00 PM), and evening (4:00 PM to 6:00 PM) peak travel periods and during Saturday midday (11:00 AM to 2:00 PM) travel period. Heavy vehicles such as school buses, transit buses, and trucks were counted separately. Pedestrian and bicycle counts were conducted simultaneously with the TMCs. In addition, MassDOT Highway Division's Traffic Data Collection conducted automatic traffic recorder (ATR) counts at nine locations on West Central Street, East Central Street, Beaver Street, Chestnut Street, and King Street. The ATR counts are continuous 48-hour traffic counts used to determine average daily traffic (ADT) of a roadway. In addition, MPO staff performed driveway counts at selected locations on West Central Street.

Figures 2 and 3 show the peak-hour turning movement volumes for the signalized intersections along with the ADT for West Central Street and East Central Street, respectively. The selected driveway counts on West Central Street are shown in Figure 4. The TMC, ADT, and driveway counts are in Appendix B. Table 1 presents the number of pedestrians and bicyclists observed at the intersections. These volumes may be low because of the colder weather in April, high traffic volume during peak periods, and lack of amenities that provide safety and comfort for bicyclists, such as shoulders or bicycle lanes. Table 2 shows the percentage of trucks in the study-area intersections, which range between 1.7 and 4.2 percent. These truck rates are not considered particularly high for peak-period traffic conditions. Staff also identified that turning radii at the King Street/Chestnut Street intersection inhibit truck traffic flow.

TABLE 1
Pedestrian and Bicycle Volumes

Arterial Segment/ Intersection	Weekday Pedestrians	Saturday Pedestrians	Weekday Bicyclists	Saturday Bicyclists
West Central Street at				
Franklin Village Drive	0	3	2	4
Panther Way	17	52	0	5
Beaver Street	19	38	1	3
East Central Street				
King Street/Chestnut Street	28	36	1	3
Horace Mann Plaza	17	33	3	3
Big Y Store Driveway	30	32	1	5

Source: Central Transportation Planning Staff.

TABLE 2
Percentage of Heavy Vehicles at the Signalized Intersections

Intersection/Approach	Percentage of Heavy Vehicles
<i>West Central Street at Franklin Village Drive</i>	
West Central Street Eastbound	3.7%
West Central Street Westbound	3.3
Franklin Village Drive	2.7
Old West Central Street	2.8
<i>West Central Street at Panther Way</i>	
West Central Street Eastbound	3.6%
West Central Street Westbound	3.6
Panther Way Northbound	4.2
Panther Way Southbound	2.7
<i>West Central Street at Beaver Street</i>	
West Central Street Eastbound	3.7%
West Central Street Westbound	3.4
Beaver Street Northbound	4.5
Beaver Street Southbound	3.1
<i>East Central Street at King Street/Chestnut Street</i>	
East Central Street Eastbound	2.9%
East Central Street Westbound	3
King Street Northbound	3.9
Chestnut Street Southbound	4.1
<i>East Central Street at Horace Mann Plaza</i>	
East Central Street Eastbound	3.2%
East Central Street Westbound	3.2
CVS Northbound	0.6
Horace Mann Plaza Southbound	1.7
<i>East Central Street at Big Y Driveway</i>	
East Central Street Eastbound	3.8%
East Central Street Westbound	3.3
Big Y Driveway Northbound	1.9
Municipal Center Southbound	4

Source: Central Transportation Planning Staff.

3.5 Existing Transit Service

The Greater Attleboro Regional Transit Authority (GATRA) operates the Franklin Area Bus (FAB) within the study area. During weekdays, the bus service connects Franklin Village Mall to the Big Y store—the termini of the bus route. The bus service operates along a circuit route; with one traveling clockwise around the circuit and the other operating counter clockwise. On Saturdays, the bus route is extended to Whole Foods/Old Navy and Market Basket on Route 126 in Bellingham. The bus service connects major shopping centers, apartments, and schools, and the route includes East Central Street with stops at the Horace Mann Plaza and the Big Y Store. Bus service also connects the

Franklin Village Shopping Center via Pond Street and Old West Central Street. The FAB operates Monday through Friday every 60 minutes from 6:40 AM to 5:36 PM and Saturday every 60 minutes from 8:20 AM to 5:45 PM. In addition to the designated stops, passengers may board FAB anywhere along the bus route as long as it is safe for the bus to stop. To signal the bus driver, the passenger waves to the driver as the vehicle approaches. All GATRA vehicles are equipped with accessibility for wheelchairs.⁸

Many commuter rail riders who board the MBTA's Franklin Line from the Forge Park Station and Franklin/Dean College Station use portions of West Central Street and East Central Street to access the station.

3.6 Existing Safety Conditions

MPO staff used January 2009 through December 2012 crash data from the MassDOT's Registry of Motor Vehicles database to evaluate safety for motorists, pedestrians, and bicyclists. The following section describes the analysis and results of the safety assessment.

Segment Crash Summary

A crash summary that identifies severity, manner of collision, ambient light, road surface, and weather conditions is presented in Table 3. This summary is based on 2009-12 crash reports from the MassDOT Registry of Motor Vehicles crash database. The most recent 2012 statewide average crash rate for an urban principal arterial is 3.35 crashes per million vehicles-miles traveled.⁹ Both arterial segments analyzed had high crash rates, which exceeded the statewide average crash rate for an urban principal arterial. See Appendix C for the crash rate worksheets.

In addition, the analysis indicates that the West Central Street and East Central Street crashes display similar statistics:

- Between 25 and 30 percent of crashes in each arterial segment resulted in an injury.
- Between 74 and 80 percent of crashes in each arterial segment were angle and rear-end crash types—many of these crashes occurred because of motorists running red lights, failing to yield right-of-way, following too close, and being inattentive or distracted.

⁸ Greater Attleboro Regional Transit Authority (GATRA), Franklin Area Bus, Bus Schedule Effective January 23, 2012, http://www.gatra.org/wp-content/uploads/Franklin_schedule_0112.pdf

⁹ Published by MassDOT based on crash information queried on August 13, 2014

- There were two pedestrian and bicyclist crashes in the West Central Street segment and four pedestrian and bicyclist crashes in the East Central Street segment.

TABLE 3
2009–12 Crash Summary
West Central Street and East Central Street Segments

Crash Variable	West Central Street	East Central Street
<i>Crash Severity</i>	--	--
Fatal injury	0	1
Non-fatal injury	32	25
Property damage only	95	58
Unknown /not reported	5	2
<i>Manner of Collision</i>	--	--
Angle	47	31
Rear-end	60	33
Sideswipe, opposite direction	0	2
Sideswipe, same direction	11	6
Single vehicle crash	10	9
Head-on	1	1
Unknown /not reported	3	4
<i>Road Surface Condition</i>	--	--
Dry	90	57
Wet	22	13
Sand, mud, dirt, oil, gravel	1	0
Snow	1	2
Not reported	18	14
<i>Ambient Light Condition</i>	--	--
Daylight	108	66
Dark - lighted roadway	18	14
Dark - roadway not lighted	1	2
Dark - unknown roadway lighting	0	1
Dusk	2	2
Not reported/unknown	3	1
<i>Weather Condition</i>	--	--
Clear	88	59
Cloudy	16	10
Rain	20	10
Snow/ice/freezing rain	4	3
Not Reported/unknown	4	4
<i>Bicycle and pedestrian involved</i>	--	--
Bicyclist	1	1
Pedestrian	1	3
Total crashes	132	86
Four-year average	33	22
Segment crash rate	6.04	5.74
Principal arterial (other)—average statewide crash rate	3.35	3.35

Notes: * The AM peak period is 7:00 AM to 9:00 AM, and the PM peak period is 4:00 PM to 6:00 PM.
Source: Central Transportation Planning Staff.

Intersection Crash Summary

Table 4 presents a crash summary at the intersections that identifies severity, manner of collision, road surface, weather, and ambient light conditions. The summary excludes crashes at the intersection of East Central Street and the Big Y store/Franklin Municipal Center driveways because the traffic signal was installed in 2012 and the Big Y store opened in August 2012. Therefore, adequate crash data do not exist for the intersection.

For MassDOT Highway Division District 3 (which includes the town of Franklin), the average crash rate for signalized intersections is 0.89 crashes per million entering vehicles (MEV).¹⁰ Analyses indicate that the average crash rates exceed the District 3 average crash rate for a signalized intersection for the following intersections:

- West Central Street and Franklin Village Drive intersection. This intersection is on the list of Highway Safety Improvement Program (HSIP) crash cluster. An HSIP eligible cluster is one in which the total number of "equivalent property damage only" crashes in the cluster is within the top 5% of all clusters in that region¹¹.
- East Central Street and King Street/Chestnut Street intersection

Collision Diagrams

MPO staff used police crash reports to prepare collision diagrams, which are useful for examining patterns and developing safety strategies (see Figures 5 through 9).¹² The collision diagram numbers uniquely identify each crash and may be used to cross reference the crash records provided in Appendix C. Figures 5 through 9 show the locations with the highest concentration of crashes as follows:

- West Central Street and Franklin Village intersection
- West Central Street at the entry/exit points to Dunkin Donuts, Burger King, and Tedeschi food store
- West Central Street and Panther Way intersection
- West Central Street at the entry/exit points to Honey Dew Donuts
- West Central Street and Beaver Street intersection
- East Central Street and King Street/Chestnut Street intersection

¹⁰ Published by MassDOT based on crash information queried on January 23, 2013

¹¹ "Equivalent property damage only" is a method of combining the number of crashes with the severity of crashes based on a weighted scale where a fatal crash is worth 10, an injury crash is worth 5, and a property damage only crash is worth 1.

¹² Some crash reports did not have diagrams and are not included in Figures 5 to 9.

TABLE 4
Crash Summary: Study Intersections

Crash Variable	West Central Street and Franklin Village Drive	West Central Street and Panther Way	West Central Street and Beaver Street	East Central Street and King Street/ Chestnut Street	East Central Street and Horace Mann Plaza
Severity	--	--	--	--	--
Fatal	0	0	0	1	0
Non-fatal injury	11	4	6	12	3
Property damage only	45	9	11	16	6
Not Reported/unknown	3	2	0	1	0
Manner of Collision	--	--	--	--	--
Angle	24	2	2	11	3
Rear-end	27	7	9	10	5
Sideswipe, same direction	4	2	2	0	0
Single vehicle crash	3	2	2	1	0
Head-on	0	0	0	0	1
Not reported/unknown	1	2	2	1	0
Road Surface Condition	--	--	--	--	--
Dry	39	11	14	20	5
Wet	11	3	1	4	1
Sand, mud, dirt, oil, gravel	1	0	0	0	0
Not Reported/unknown	8	1	2	6	3
Ambient Light Conditions	--	--	--	--	--
Daylight	47	13	14	18	7
Dark - lighted roadway	9	2	1	8	2
Dark-not lighted roadway	0	0	1	1	0
Dark-unknown roadway lighting	0	0	0	1	0
Dusk	1	0	0	1	0
Not Reported/unknown	2	0	1	1	0
Weather Condition	--	--	--	--	--
Clear	40	11	13	19	6
Cloudy	6	3	2	2	2
Rain	10	0	0	6	1
Snow	1	1	1	2	0
Not Reported/unknown	3	0	1	1	0
Period*	--	--	--	--	--
Peak	19	8	5	7	2
Off-peak	40	7	12	23	7
Total Crashes	59	15	17	30	9
Four year average (rounded)	15	4	4	8	2
Intersection crash rate	1.03	0.45	0.63	0.91	0.32
MassDOT District 3 average crash rate	0.89	0.89	0.89	0.89	0.89

* The AM peak period is 7:00 AM to 9:00 AM, and the PM peak period is 4:00 PM to 6:00 PM.
Source: Central Transportation Planning Staff.

3.7 Existing Traffic Operations Conditions

Staff conducted traffic operations analyses consistent with the Highway Capacity Manual (HCM) methodologies (included in Appendix D)¹³. HCM methodology demonstrates driving conditions at signalized and unsignalized intersections in terms of LOS ratings from A through F. LOS A represents the best operating conditions (little to no delay), while LOS F represents the worst operating conditions (long delay). LOS E represents operating conditions at capacity (limit of acceptable delay). Table 5 presents the control delays associated with each LOS for unsignalized and signalized intersections.

TABLE 5
Intersection Levels of Service Criteria

Level of Service	Signalized Intersections Control Delay (seconds per vehicle)	Unsignalized Intersections Control Delay (seconds per vehicle)
A	0-10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Source: Highway Capacity Manual 2010.

The town of Franklin and MassDOT Highway Division District 3 provided existing signal timings, as-built traffic signal plans, and phase sequences of the signalized intersections (included in Appendix D). Using the data collected, MPO staff built traffic analysis networks for the AM and PM peak hours with Synchro¹⁴ traffic simulation software to assess the capacity and quality of traffic flow through the signalized intersections. Tables D-1 through D-2 in Appendix D show the existing LOS in terms of delay and queues. In both arterial segments, the severe delays and queues occur in the PM peak period and on Saturday midday peak period because of the high volume of work and shopping trips. The critical movements operating at LOS F are:

- West Central Street eastbound left-turn movement at Franklin Village Drive intersection during the PM peak period
- Franklin Village Drive northbound left-turn movement during Saturday midday peak period
- West Central Street westbound through movement at Beaver Street intersection during the PM peak period

¹³ Highway Capacity Manual 2010, Transportation Research Board of the National Academies, Washington, DC, December 2010.

¹⁴ Trafficware Inc., Synchro Studio 8, Synchro plus SimTraffic, Build 801, Version 563, Sugar Land, Texas.

- East Central Street westbound left-turn movement at King Street/Chestnut Street intersection during Saturday midday period

4 IDENTIFIED PROBLEMS

Based on existing conditions' analyses, field reconnaissance, and task force discussions, the following problems were identified.

4.1 West Central Street Segment

- Lack of safety for motorists, pedestrians, and bicyclists:
 - High number of crashes (132 crashes in four years) at signalized intersections and entry/exit points of major business driveways.
 - Arterial segment crash rate exceeded the average crash rate for an urban principal arterial
 - Intersection crash rate for the Franklin Village Drive intersection exceeded MassDOT Highway Division District 3 average crash rate for a signalized intersection. It is a HSIP crash cluster.
 - Two vehicle-pedestrian crashes.
- Lack of left-turn lanes for turning into busy business driveways creates safety and access-management problems.
- Absence of roadway shoulders creates safety problems for motorists entering West Central Street from business driveways, especially on the south side of the roadway because of sloping terrain on the south side, which limits sight distance and sight lines for motorists.
- High speeds (posted speed limit of 40 mph) and absence of roadway shoulders create safety problems, which discourage bicyclists from using segment. Field observations indicated high travel speeds during the off-peak period.
- Lack of signal head backplates at Panther Way and Beaver Street intersections reduces signal visibility when there is sun glare.
- Insufficient length of left-turn lanes creates traffic queues that spill over into through travel lanes causing disruptions. For example, the high-volume traffic turning from West Central Street onto Franklin Village Drive, Old Central Street, and Beaver Street during PM and Saturday midday peak travel periods interrupts through traffic flow.

4.2 East Central Street Segment

- Lack of safety for motorists, pedestrians, and bicyclists:
 - High number of crashes (86 crashes in four years) at the signalized intersections and at the entry/exit points of major business driveways in the segment.

- Segment crash rate exceeded the average crash rate for an urban principal arterial.
- Intersection crash rate for the King Street/Chestnut Street intersection exceeded MassDOT Highway Division District 3 average crash rate for a signalized intersection.
- Three vehicle/pedestrian crashes and one vehicle/bicyclist crash in the segment.
- Lack of traffic signal coordination creates congestion and queues in the segment.
- Insufficient length of left-turn lane for the high-volume traffic turning left onto King Street creates a traffic queue that interrupts through traffic flow.
- Lack of signal head backplates at King Street/Chestnut Street intersection reduces signal visibility when there is sun glare.

5 FUTURE TRAFFIC CONDITIONS

Planners typically use a planning model to systematically forecast future traffic volume based on changes in the transportation network or land use. For this study, staff used the Boston Region MPO's regional travel demand model set recently adopted for the Long-Range Transportation Plan (LRTP). This model's socioeconomic components are derived from Metropolitan Area Planning Council (MAPC) forecasts. The model is calibrated at a regional level for 164 cities and towns, which includes the 101 cities and towns in the MPO region. For site-specific development and transportation projects, the model requires calibration to replicate local travel patterns in the project area before it may be used to forecast future impacts. Using this model, staff projected that traffic on West Central Street and East Central Street would grow 0.3 percent per year, resulting in three percent total growth between 2014 and 2024. The existing peak-hour turning-movement volumes were increased by three percent to 2024 future turning-movement volumes, which were used to test the alternatives.

6 IMPROVEMENT ALTERNATIVES

MPO staff worked with the task force to develop short- and long-term strategies to address safety, operations, and access-management problems, which were identified in both segments. The short-term strategies are low-cost improvements that can be implemented within one to three years. The long-term improvements are more complicated, and require funding resources and design and engineering efforts.

6.1 West Central Street Improvements

For this segment, the strategy was to evaluate different roadway cross-sections to improve safety, operations, and access management. Potential alternatives

that would widen the roadway between Dunkin Donuts and Beaver Street were not evaluated in this study because they were not recommended by the task force. MPO staff developed three alternatives for consideration based on discussions with the task force. In addition, MPO staff proposed several enhancements for the intersections to improve safety and operations. All of the improvements are mostly within the existing roadway's right-of-way and take into account the needs of abutters and users.

General Intersection Improvements

West Central Street and Franklin Drive Intersection

- Lengthen the West Central Street eastbound left-turn lane from 175 to 350 feet or widen it to a double left-turn lane, which would accommodate the high volume PM peak-period traffic traveling to the Tri-County Regional Vocational Technical High School and the residential area north of the intersection. The double left-turn lane option also requires widening the Old West Central Street outbound approach to receive two lanes of traffic.
- Adjust the clearance intervals to be consistent with MassDOT's standard, which would reduce the high number of angle crashes within the intersection.
- Conduct a road safety audit to discuss additional safety countermeasures for this intersection because it is an HSIP crash cluster.

West Central Street and Panther Way Intersection

- Add backplates to the signal heads to improve visibility during sun glare. This improvement would require a structural review of the signal equipment to ensure that the mast arms could accommodate the additional wind load.
- Upgrade pedestrian signals to make them accessible.
- Add detectable warning plates to the curb ramps.

West Central Street and Beaver Street Intersection

- Lengthen the eastbound left-turn lane on West Central Street from 200 to 400 feet to accommodate the high volume PM traffic traveling to Beaver Street northbound.
- Eliminate West Central Street eastbound through/right lane at Beaver Street intersection, allowing proposed shoulders to be extended through the intersection.
- Add a left-turn lane to the Beaver Street northbound approach. A left-turn lane would significantly reduce delay at the approach and improve traffic operations at the intersection. Adding a left-turn lane may impact the abutting properties.

- Add backplates to the signal heads to improve visibility during sun glare. A structural review of the signal equipment is required for this improvement.
- Upgrade audible pedestrian signals to make them accessible and add detectable warning plates to the curb ramps.

Cross-Sectional Improvements

Alternative 1: Three-Lane Cross-Section with a Two-Way Left-Turn Lane (Road Diet)

Alternative 1 is a three-lane cross-section with a two-way left-turn lane (TWLTL) and five-to-six-foot-wide shoulders as shown in Figures 10A and 10B. The effectiveness of converting a four-lane cross-section to a three-lane cross-section depends on a number of factors including: traffic flow patterns, spacing of major intersections, adjacent land uses, and future traffic growth. Tables D-3 through D-6 show the results of the intersection LOS analysis for Alternative 1 in terms of delay and queues (included in Appendix D). Arterial performance measures of Alternative 1 in terms of arterial total delay, number of stops, and average speeds are presented in Table D-7.

Using protected/permissive signal phasing for the left-turn movements, analysis indicates that Alternative 1 would operate at LOS D or better at the Panther Way intersection, and the 50th percentile traffic queue length is acceptable. The Synchro analyses show large differences between the 50th percentile and 95th percentile queue lengths on West Central Street at the Panther Way intersection. For example, during the PM peak period the westbound approach has a 50th percentile queue length of only 239 feet and a 95th percentile queue length of 1057 feet. More analysis may be necessary on this issue.

Benefits of Alternative 1 are as follows:

- Provides left-turn lanes for motorists accessing business driveways, which would reduce crashes along the corridor, especially left-turn related crashes involving drivers exiting West Central Street to business driveways, and vice versa.
- Provides six-foot shoulders on West Central Street, which benefits bicyclists and motorists exiting business driveways. This recommendation also is compliant with the goals of MassDOT's Healthy Transportation Compact.
- Removes a travel lane in each direction on West Central Street, which would calm traffic, reduce traffic speed, and increase user safety.
- Provides users of most business driveways with a safe place to wait while pulling out into traffic on West Central Street. The left turns out of the driveways are improved as much as possible with the TWLTL.

Disadvantages of Alternative 1 area are as follows:

- May create traffic queues on West Central Street at the Panther Way intersection during peak periods
- May increase potential of head-on conflicts

Providing TWLTL where it currently does not occur would reduce left-turn related crashes by approximately 37-to-54 percent.^{15,16} Also, estimates of the safety benefits of adding a six-foot right shoulder suggest seven-to-eleven percent reduction in run-off-road crashes. Alternative 1 can be a cost-effective safety measure for the roadway segment given the high frequency of rear-end crashes involving a lead vehicle desiring to make a left-turn, and angle crashes involving vehicles turning left across two travel lanes. It also will help accommodate bicyclists through the corridor.

Alternative 2: Three-Lane Cross-Section with Left-Turn Lanes (Road Diet)

Alternative 2 is a three-lane cross-section with left-turn lanes at selected locations and five-to-six-foot-wide shoulders as shown in Figures 11A and 11B. Tables D-3 through D-6 show results of the intersection LOS analysis for Alternative 2 in terms of delays and queues (included in Appendix D). The arterial performance measures of Alternative 2 in terms of arterial travel time, stops, and speeds are presented in Table D-7. Alternative 2 produces similar intersection and arterial LOS as in Alternative 1.

Alternative 2 has many of the benefits and disadvantages of Alternative 1. The primary benefit distinguishing the alternatives is that Alternative 2 reduces the potential of head-on conflicts. The primary disadvantage distinguishing Alternative 2 from Alternative 1 is that with Alternative 2 (left-turn lanes), some business driveways will not benefit from having a safe place to wait while pulling out into traffic on West Central Street. The left turns out of driveways are not improved as much as possible with the TWLTL.

Similar to Alternative 1, adding left-turn lanes can be a cost-effective safety measure for four-lane roadway segments with a high frequency of rear-end and angle crashes involving left-turn movements. A major synthesis of research on left-turn lanes demonstrated that exclusive turn lanes on the average reduce about 50 percent of left-turn related crashes.^{17,18}

¹⁵ Crash Modification Factors Clearinghouse, U.S. Department of Transportation, Federal Highway Administration, <http://www.cmfclearinghouse.org/index.cfm>

¹⁶ Gates, T. J., Noyce, D. A., Talada, V., and Hill, L., "The Safety and Operational Effects of "Road Diet" Conversion in Minnesota." 2007 TRB 86th Annual Meeting: Compendium of Papers CD-ROM, Vol. TRB#07-1918, Washington, D.C., (2007)

¹⁷ Gluck, J., H. S. Levinson, and V. Stover, 1999, Impacts of Access Management Techniques, NCHRP Report 420, Transportation Research Board.

Alternative 3: Four-Lane Cross-Section with the Option of Either Left-Turn Lanes or a TWLTL

Alternative 3 is a four-lane cross-section with the option of left-turn lanes at selected locations or a TWLTL (Figures 12A and 12B). This alternative has one eastbound through travel lane and two westbound through travel lanes. Alternative 3 has no shoulders because of right-of-way constraints. Staff analyzed Alternative 3 because of likely operational traffic problems (traffic queues) at the Panther Way intersection with the three-lane cross-section concepts identified in Alternative 1 and Alternative 2.

Tables D-3 through D-6 show the results of the intersection LOS analysis for Alternative 3 in terms of delay and queues (included in Appendix D). Table D-7 shows the arterial performance measures of Alternative 3 in terms of arterial travel time, stops, and speeds. Analysis indicates that Alternative 3 would operate at a better LOS B at the Panther Way intersection compared to Alternative 1 and Alternative 2. Similar to Alternative 1, more analysis may be necessary to evaluate the duration and impacts of queues, especially at the eastbound approach at Panther Way intersection.

Benefits of Alternative 3 are as follows:

- Reduces traffic queues westbound on West Central Street during the AM, PM, and Saturday midday peak periods.
- Provides left-turn lanes for motorists accessing business driveways, which would improve safety by reducing left-turn related crashes involving drivers exiting West Central Street to business driveways, and vice versa.
- Reduces traffic speed on West Central Street in the eastbound direction; however, it is not expected to reduce traffic speed in the westbound direction.

Disadvantages of Alternative 3 are as follows:

- Not compliant with MassDOT's Healthy Transportation Compact. Lack of West Central Street shoulders would not benefit bicyclists, nor would it be beneficial to motorists exiting business driveways especially from the south side.
- May create a traffic queue on West Central Street eastbound approach at the Panther Way intersection during peak periods.

¹⁸ Crash Modification Factors Clearinghouse, U.S. Department of Transportation, Federal Highway Administration, <http://www.cmfclearinghouse.org/index.cfm>

- Would not calm traffic nor would it reduce traffic speed in the westbound direction because Alternative 3 keeps two travel lanes westbound on West Central Street.

6.2 East Central Street Segment

MassDOT and the town of Franklin operate segment traffic signals. Since the traffic signals are not coordinated, congestion and queues exist in this segment during peak travel periods. The strategy was to develop new timing plans to coordinate the three traffic signals to improve safety and operations. Traffic signal coordination occurs when a group of two or more traffic signals work together, so that vehicles moving along the arterial segment make the least number of stops possible. Signal retiming and coordination are cost-effective and short-term improvements.

General Intersection Improvements

East Central Street and King Street/Chestnut Street Intersection

- Lengthen the westbound left-turn lane on East Central Street from 200 to 400 feet to accommodate the high-volume left-turn movement onto King Street.
- Add backplates to the signal heads to improve visibility, which would require a structural review of the signal equipment to ensure that it could accommodate the additional wind load.
- Add detectable warning plates to the curb ramps to help people with low vision.
- Upgrade pedestrian signals to make them accessible.

Retime and Coordinate Traffic Signals

Staff input traffic volume, signal timing, and intersection geometric and lane assignment data into a Synchro 8 model to analyze the delays, queues, and LOS at signalized intersections. Three scenarios were analyzed: existing conditions, 2014 retimed conditions, and 2024 future conditions. Each scenario also was evaluated at four time-of-day periods: AM peak, midday, PM peak, and Saturday midday periods. Horace Mann Shopping Plaza, Big Y store, Franklin Municipal Center, and businesses on East Central Street attract significant amounts of traffic during the midday and PM peak periods.

A range of cycle lengths were tested, and the cycle length that provided the most efficient progression along the segment in terms of the number of stops, delay, and average speed was selected. Table 6 shows the cycle lengths for each scenario. The final component of the retiming and coordination analyses is time-of-day settings. These settings determine the optimal timing plan for each hour of

a typical weekday or weekend. Four time-of-day settings were identified by evaluating count data (hourly traffic volumes) from the segment. They are:

- AM peak: 7:00 AM to 10:00 AM
- Midday: 10:00 AM to 3:30 PM
- PM peak: 3:30 PM to 7:00 PM
- Saturday peak: 11:00 AM to 2:00 PM

TABLE 6
East Central Street Segment—Summary of Cycle Lengths

Scenario	Chestnut Street/ King Street Intersection	Horace Mann Plaza Intersection	Big Y/Municipal Driveways Intersection
AM Peak Hour	--	--	--
2014 Existing	98	97	100
2014 Existing (retimed)	90	90	90
2024 Future (retimed)	95	95	95
Midday Peak Hour	--	--	--
2014 Existing	98	97	100
2024 Existing (retimed)	90	90	90
2024 Future (retimed)	110	110	110
PM Peak Hour	--	--	--
2014 Existing	98	97	100
2024 Existing (retimed)	90	90	90
2024 Future (retimed)	95	95	95
Saturday Peak Hour	--	--	--
2014 Existing	88	97	100
2024 Existing (retimed)	120	120	120
2024 Future (retimed)	120	120	120

Source: Central Transportation Planning Staff.

Tables D-8 through D-11 show the results of the intersection LOS analyses (included in Appendix D). Table D-12 shows the results of the arterial performance measures. The results indicate that signal retiming and coordination would improve traffic flow in the segment by reducing delays and improving travel times during peak periods. By comparing the 2014 existing conditions to the 2014 retimed conditions, staff found the following improvements in travel time:

- AM peak hour: 2 percent eastbound and 15 percent westbound
- Midday peak hour: 6 percent eastbound and 18 percent westbound
- PM peak hour: 7 percent eastbound and 19 percent westbound
- Saturday midday peak hour: 2 percent eastbound and 10 percent westbound

7 SUMMARY AND NEXT STEPS

7.1 Summary

The study identified transportation needs of the West Central Street and East Central Street arterial segments, and developed short- and long-term recommendations to address those needs. The main transportation concerns in the West Central Street segment are safety, access, and mobility. In the East Central Street segment, the main transportation concerns are safety and traffic operations. MPO staff working with a task force developed three long-term alternatives for improving user safety, access to business driveways, and accommodating pedestrians and bicyclists on the West Central Street segment. In the East Central Street segment, MPO staff developed new timing plans to coordinate the traffic signals to reduce congestion. In addition, MPO staff proposed short-term improvements at the East Central Street and King Street/Chestnut Street intersection to increase safety and operations.

The primary factors for selecting the preferred cross-section for the West Central Street segment are cost and effectiveness. MPO staff recommend either Alternative 1 or Alternative 2 for improving safety and traffic operations.

- **Alternative 1:** three-lane cross-section with TWLTL and shoulders would improve user safety, provide access to business driveways, and accommodate bicyclists, and pedestrians.
- **Alternative 2:** three-lane cross-section with left-turn lanes at selected locations and shoulders would have similar results to Alternative 1.
- **Alternative 3:** four-lane cross-section with the option of left-turn lanes at selected locations or TWLTL would improve user safety, provide access to business driveways, and function well at Panther Way intersection. However, these improvements do not conform to MassDOT's Healthy Transportation Compact because they do not accommodate bicyclists.

In Alternative 1, most business driveways would benefit from having a safe place to wait while pulling out into traffic on West Central Street, and the left turns out of the business driveways would be improved with a TWLTL. However, Alternative 1 may increase the potential of head-on collisions.

In Alternative 2, some of the business driveways would not realize the benefit of having a safe place to wait while pulling out into traffic on West Central Street, and the left turns out of the driveways would not work as well as the TWLTL. However, Alternative 2 may reduce the potential of head-on collisions.

7.2 Next Steps

The study provides MassDOT and the town of Franklin with an opportunity to begin identifying the needs of West Central Street and East Central Street, and to start planning design and engineering efforts. The long-term improvements hinge on cooperation between MassDOT and the town of Franklin in selecting the preferred alternative for implementation. The next steps are to implement the preferred low-cost, short-term improvements and to complete project notification forms (PNF) for the long-term improvements.

MassDOT is responsible for implementing the short- and long-term improvements on the West Central Street segment. It is important for MassDOT to examine the design of the long-term alternatives, and participation in this process by the West Central Street business community is important.

The recommendation to retime and coordinate traffic signals on East Central Street may require new equipment to synchronize the signal controllers. In addition, it may be necessary to replace one or more of the controllers in case they cannot accommodate the suggested four time-of-day recommendations, or if they do not work with the other controllers. Because of the mixed jurisdictions of the traffic signals in the East Central Street segment, MassDOT and the town of Franklin have shared responsibility for implementing and operating a coordinated signal system. The town of Franklin is responsible for implementing the recommended improvements at the intersection of East Central Street and King Street/Chestnut Street.

Transportation decision making is complex, and is influenced by factors such as financial limitations and agency programmatic commitments. Project development is the process that takes a transportation improvement from concept to construction. Appendix E includes an overview of the project development process.

SA/sa

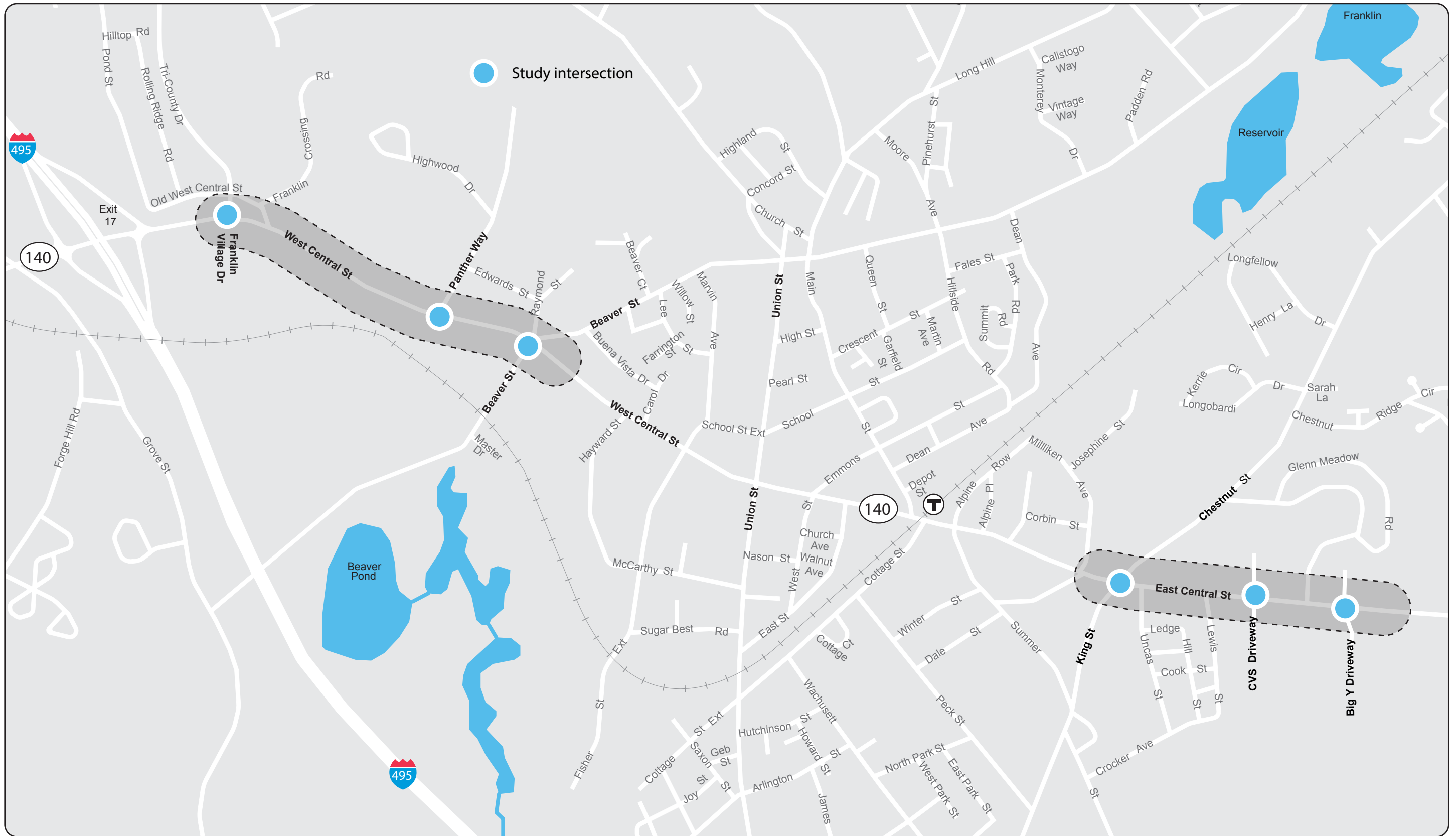


FIGURE 1
Study Locations and Intersections

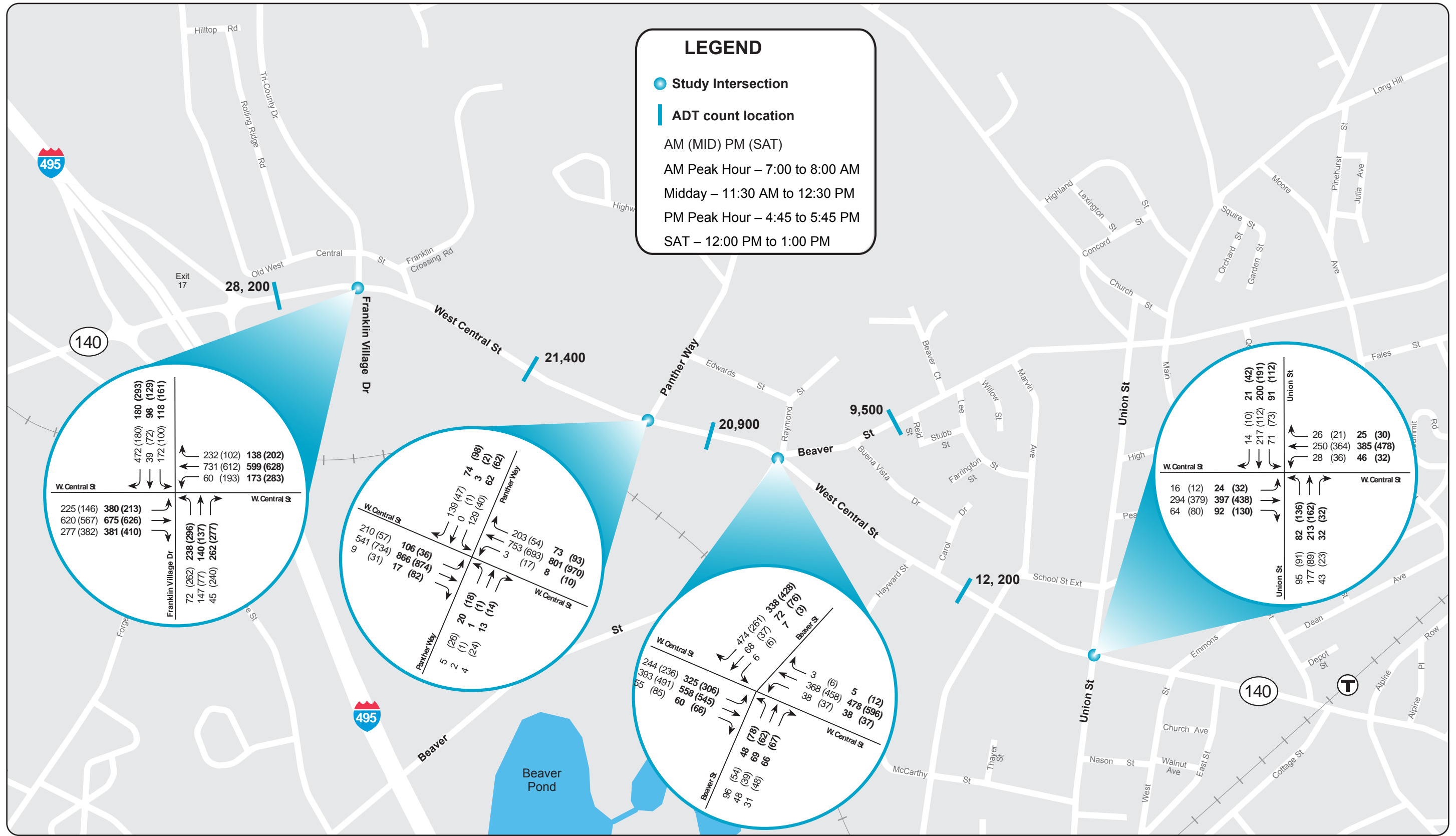


FIGURE 2
West Central Street: Existing Turning-Movement Volumes and Average Daily Traffic Volumes

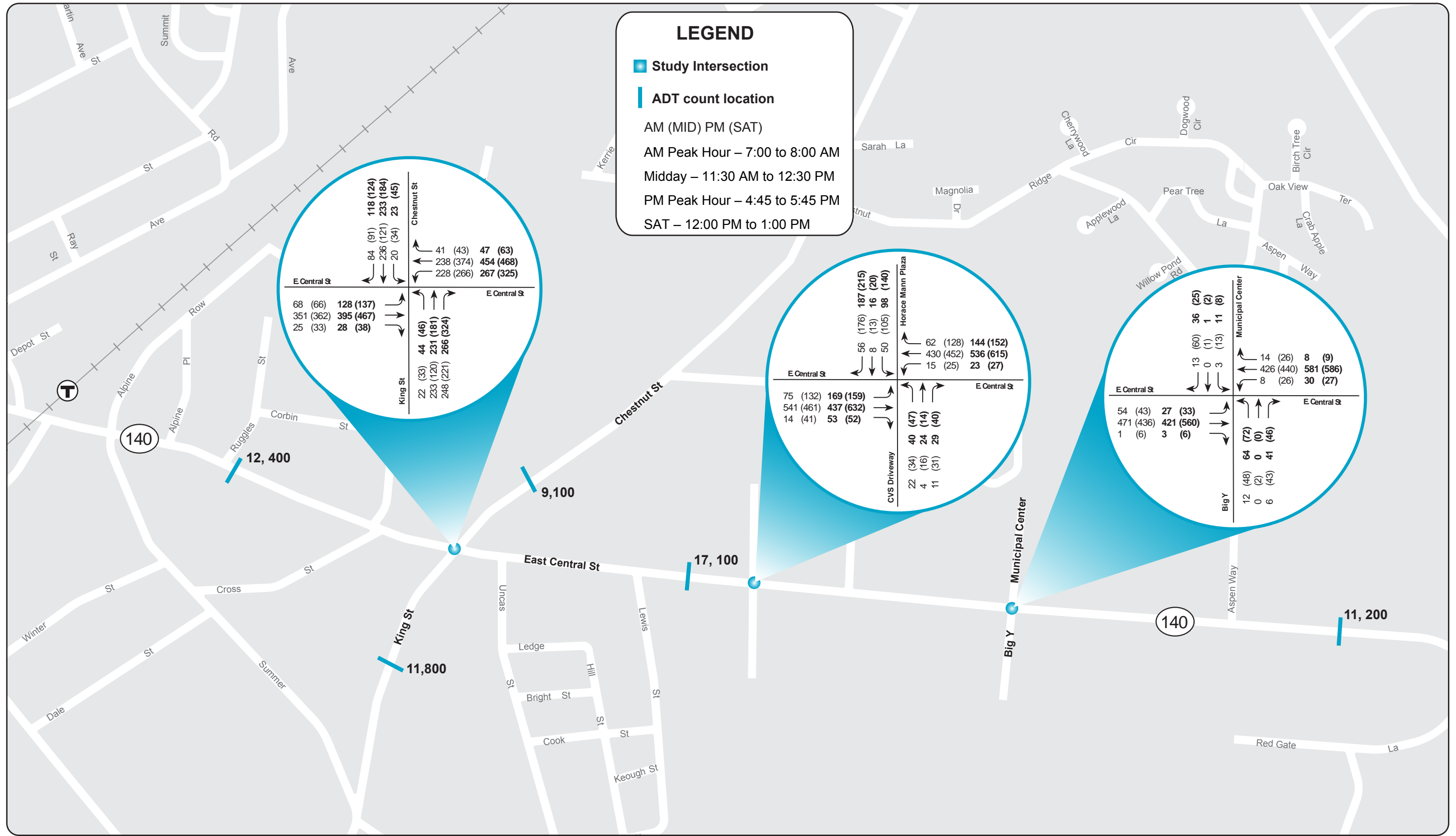


FIGURE 3
East Central Street: Existing Turning-Movement Volumes and Average Daily Traffic Volumes



FIGURE 4
 West Central Street: Selected Driveway Counts

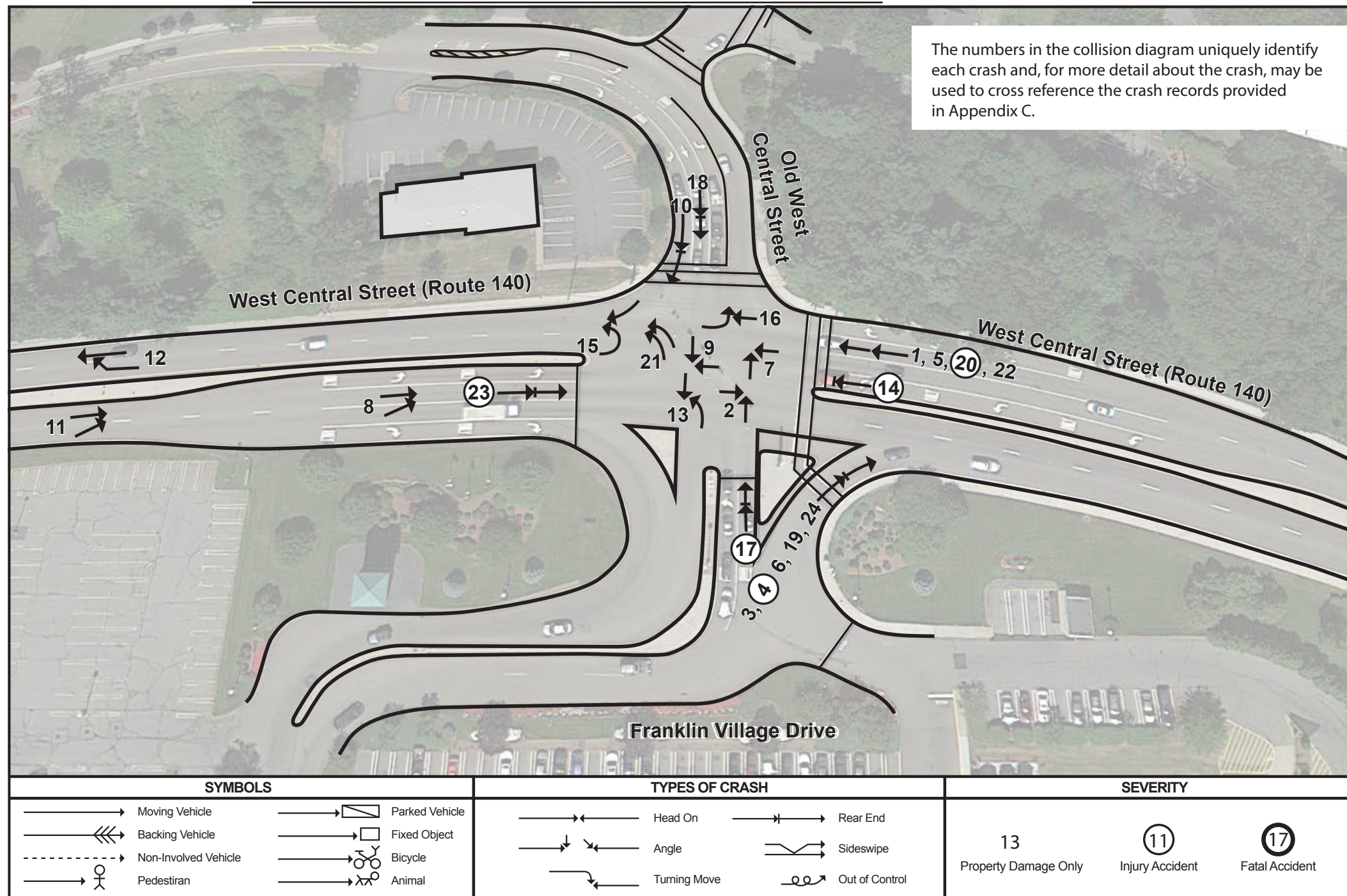


FIGURE 4 (continued)
West Central Street: Selected Driveway Counts

CITY/TOWN: FRANKLIN DATE PREPARED: 6/15/2014 REGION: DISTRICT 3 PREPARED BY: SETH ASANTE

ROADWAY NAMES: WEST CENTRAL STREET AND FRANKLIN VILLAGE DRIVE TIME PERIOD ANALYZED: 2009–2013

SOURCE OF CRASH REPORTS: MASSDOT RMV



CITY/TOWN: FRANKLIN DATE PREPARED: 6/15/2014 REGION: DISTRICT 3 PREPARED BY: SETH ASANTE

ROADWAY NAMES: WEST CENTRAL STREET FROM BURGER KING'S DWY TO WENDY'S DWY TIME PERIOD ANALYZED: 2009-2013

SOURCE OF CRASH REPORTS: MASSDOT RMV

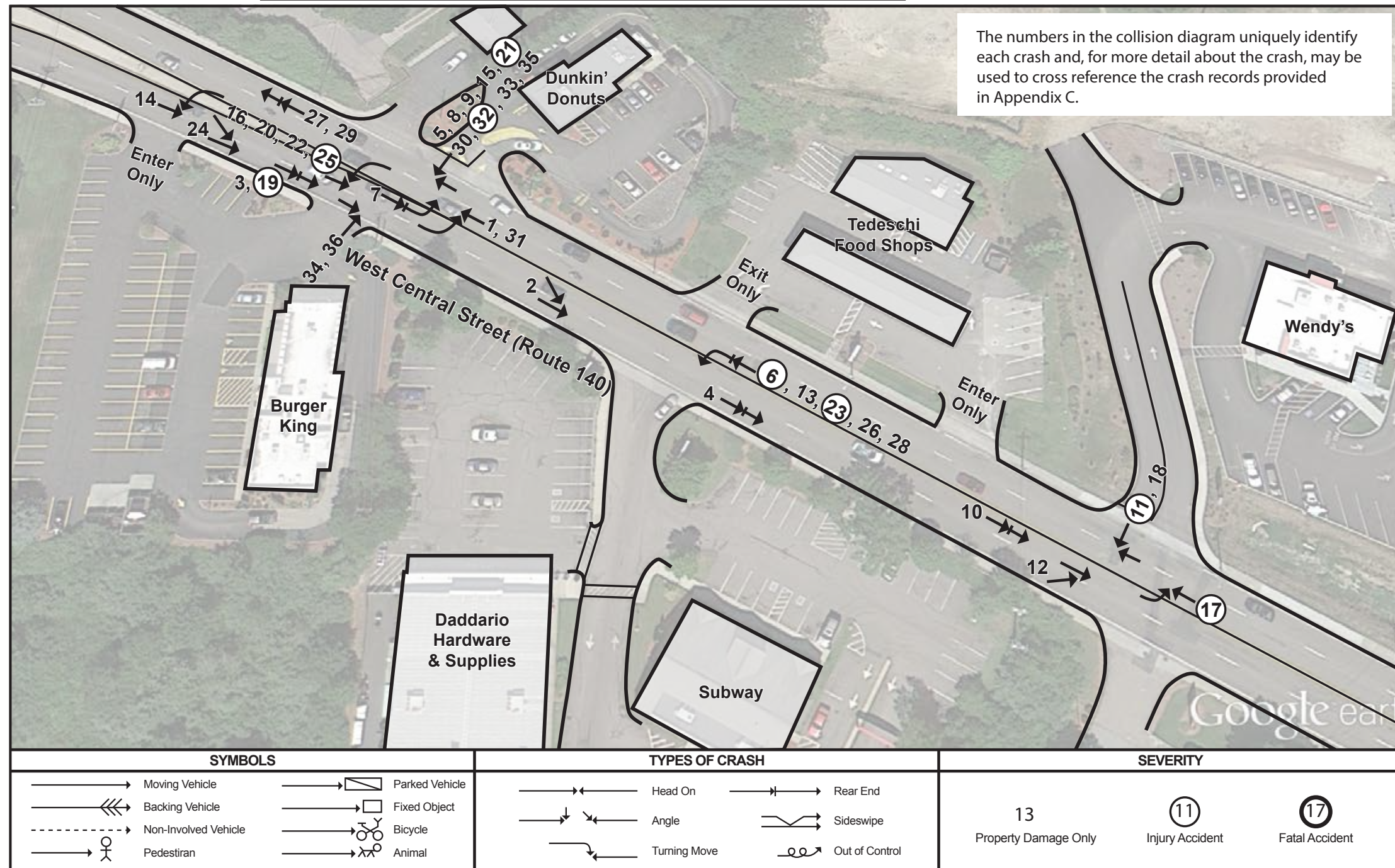
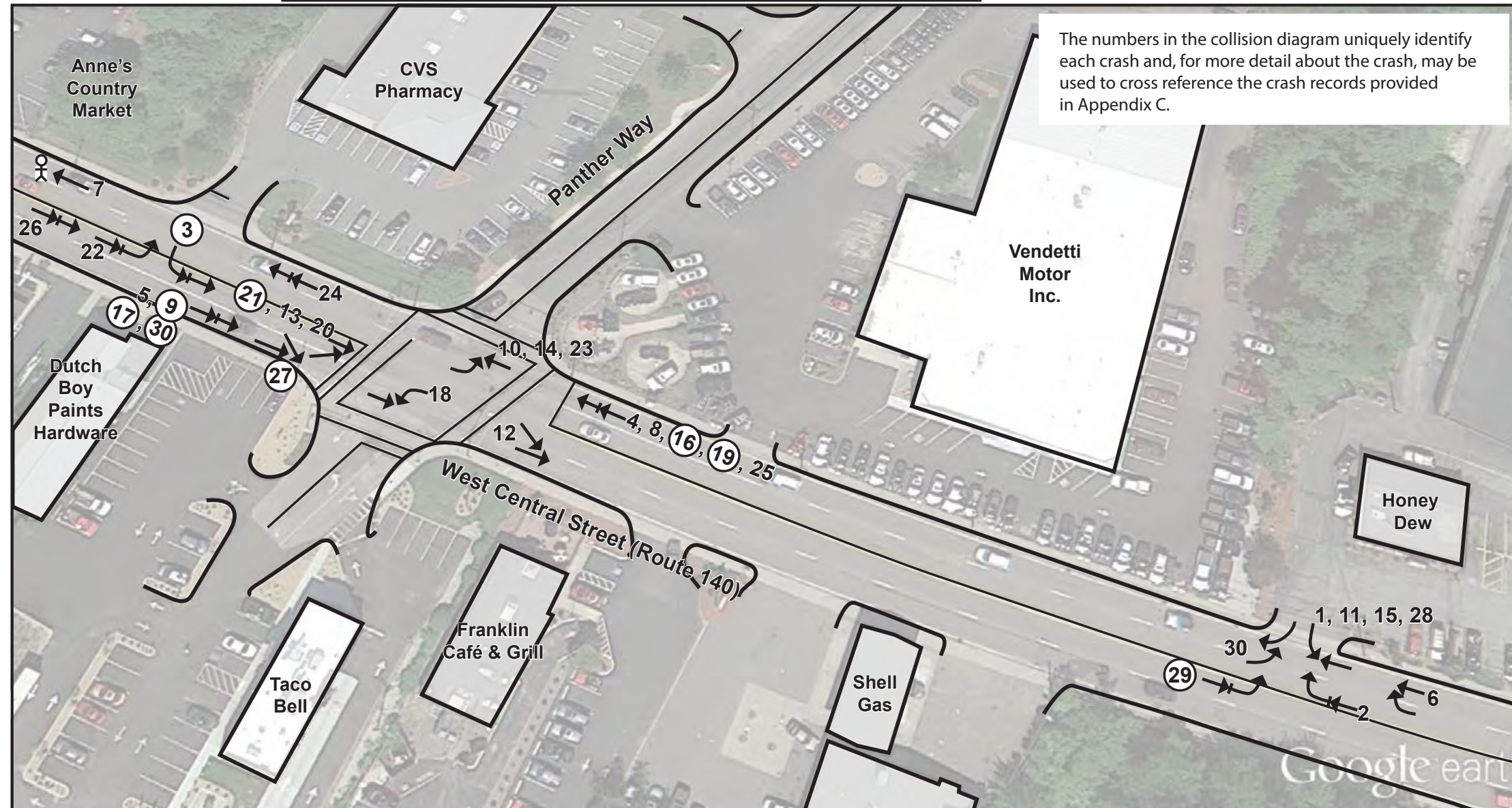


FIGURE 6
Collision Diagram for West Central Street
from Burger King's Driveway to Wendy's Driveway

CITY/TOWN: FRANKLIN DATE PREPARED: 6/15/2014 REGION: DISTRICT 3 PREPARED BY: SETH ASANTE

ROADWAY NAMES: WEST CENTRAL STREET FROM PANTHER WAY TO HONEY DEW DRIVEWAY TIME PERIOD ANALYZED: 2009-2013

SOURCE OF CRASH REPORTS: MASSDOT RMV



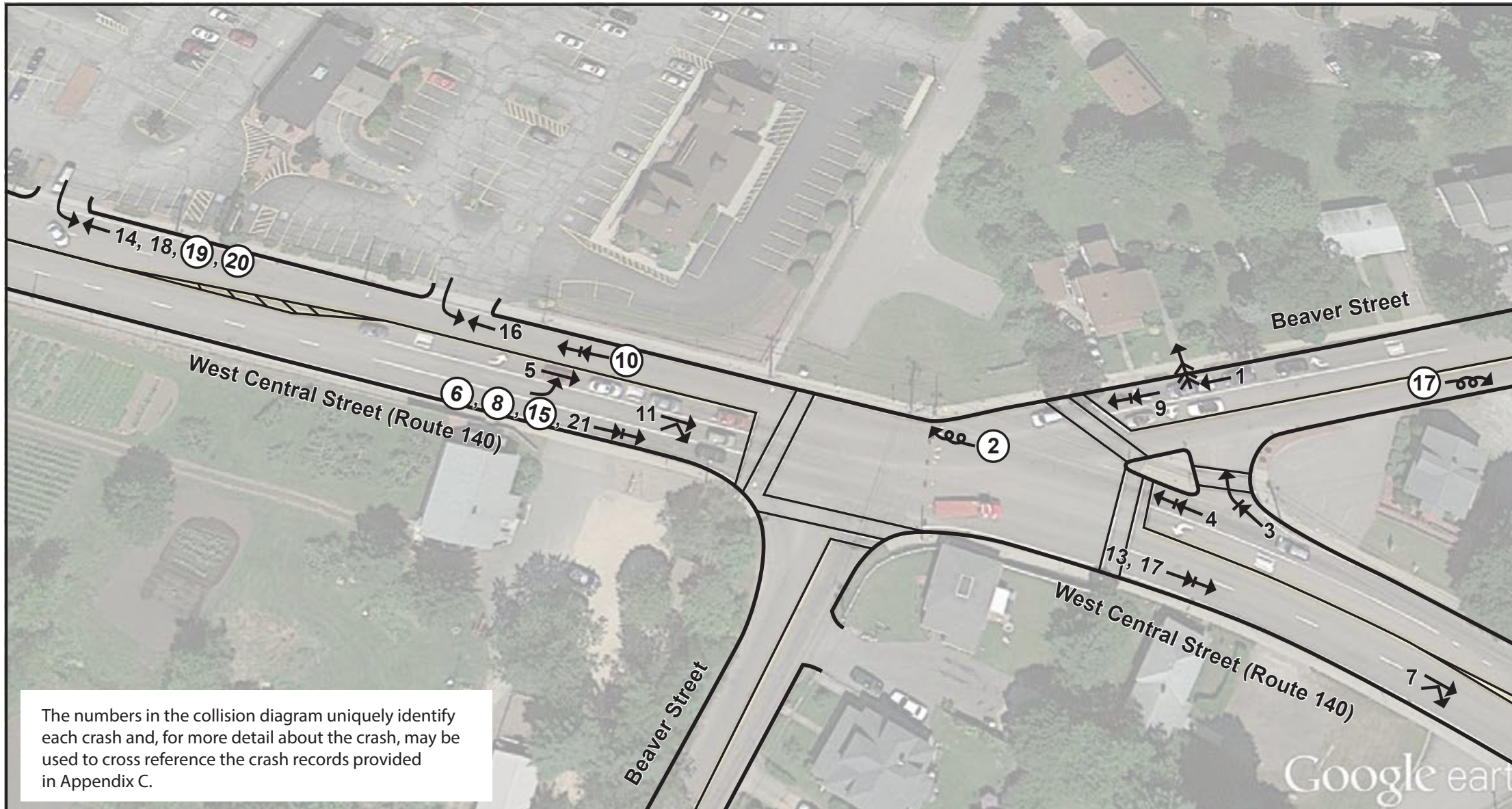
SYMBOLS		TYPES OF CRASH		SEVERITY		
Moving Vehicle	Parked Vehicle	Head On	Rear End	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">13 Property Damage Only</div> <div style="text-align: center;">11 Injury Accident</div> <div style="text-align: center;">17 Fatal Accident</div> </div>		
Backing Vehicle	Fixed Object	Angle	Sideswipe			
Non-Involved Vehicle	Bicycle	Turning Move	Out of Control			
Pedestrian	Animal					

BOSTON REGION MPO **FIGURE 7**
Collision Diagram for West Central Street from Panther Way to Honey Dew Driveway
Priority Corridors for L RTP Needs Assessment: Route 140 Arterial Segment Study

CITY/TOWN: FRANKLIN DATE PREPARED: 6/15/2014 REGION: DISTRICT 3 PREPARED BY: SETH ASANTE

ROADWAY NAMES: WEST CENTRAL STREET AND BEAVER STREET TIME PERIOD ANALYZED: 2009-2013

SOURCE OF CRASH REPORTS: MASSDOT RMV



SYMBOLS		TYPES OF CRASH		SEVERITY		
Moving Vehicle	Parked Vehicle	Head On	Rear End	13	11	17
Backing Vehicle	Fixed Object	Angle	Sideswipe	Property Damage Only	Injury Accident	Fatal Accident
Non-Involved Vehicle	Bicycle	Turning Move	Out of Control			
Pedestrian	Animal					

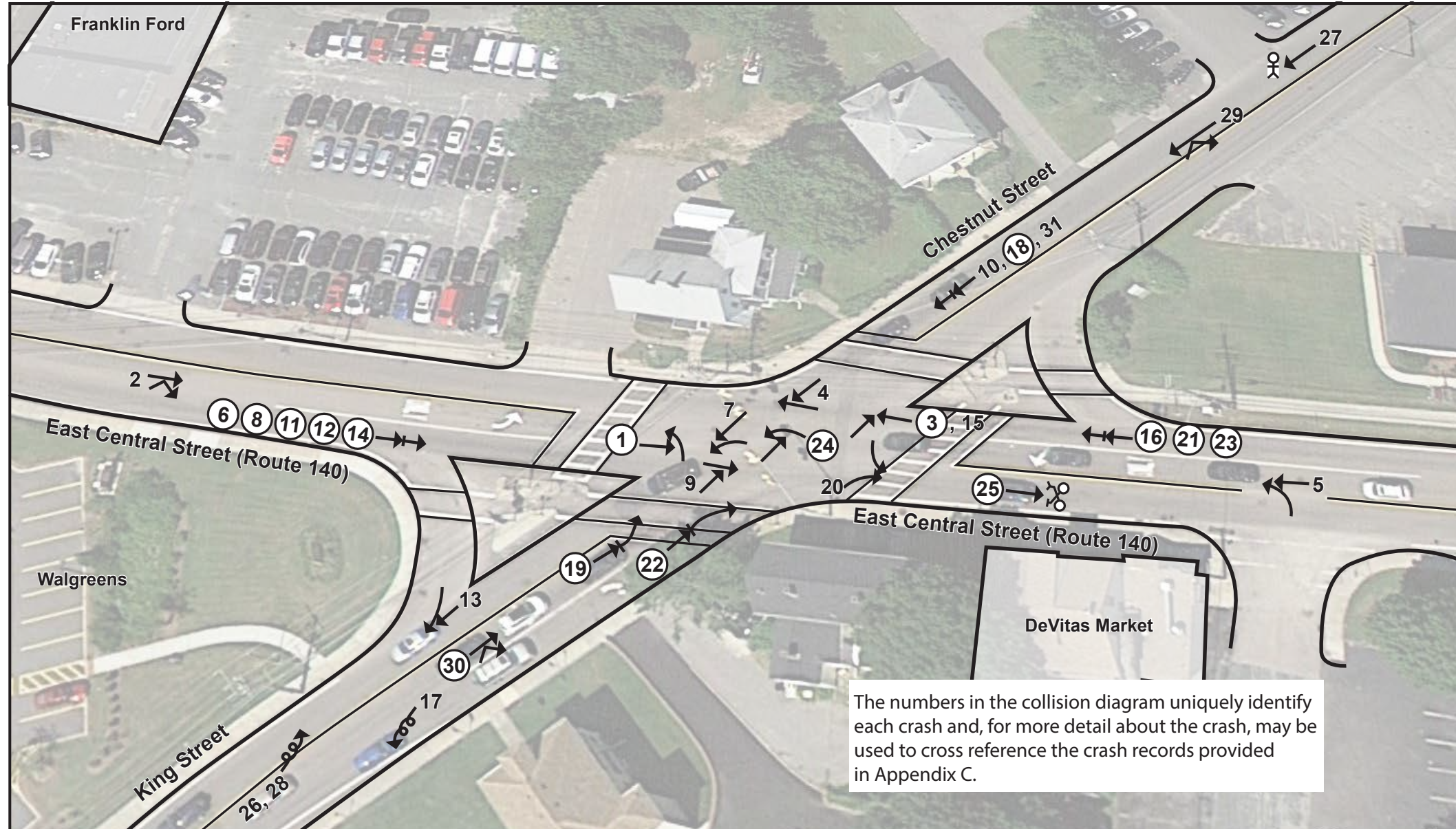


FIGURE 8
Collision Diagram for West Central Street and Beaver Street Intersection

CITY/TOWN: FRANKLIN DATE PREPARED: 6/15/2014 REGION: DISTRICT 3 PREPARED BY: SETH ASANTE

ROADWAY NAMES: EAST CENTRAL STREET AND CHESNUT STREET/KING STREET TIME PERIOD ANALYZED: 2009-2013

SOURCE OF CRASH REPORTS: MASSDOT RMV

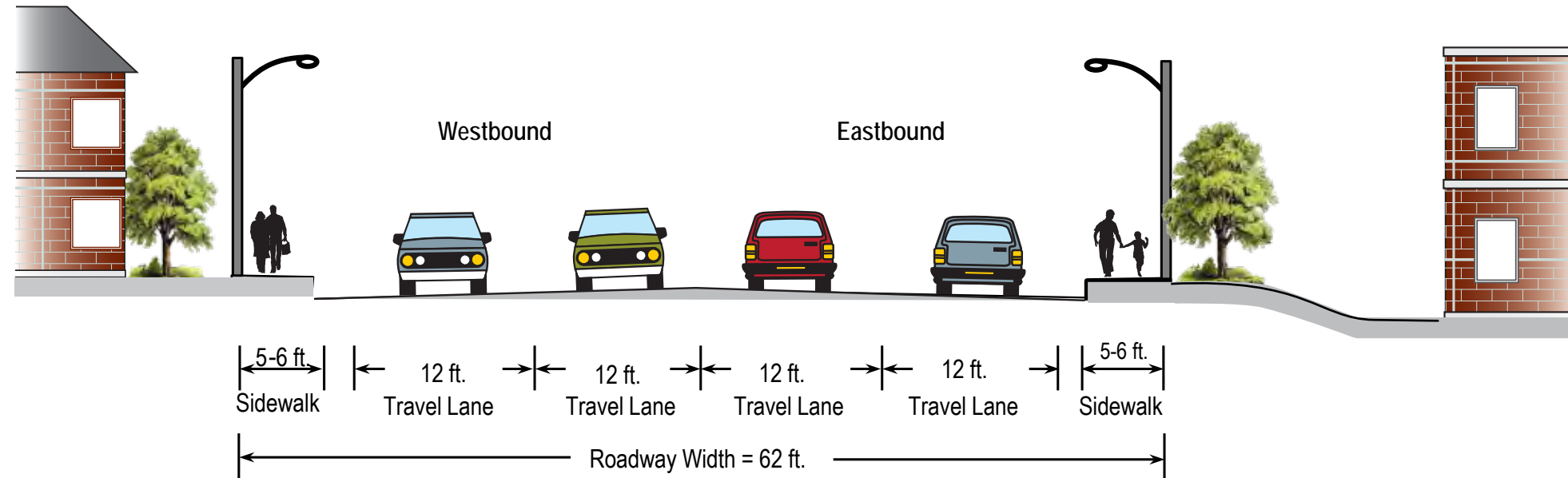


The numbers in the collision diagram uniquely identify each crash and, for more detail about the crash, may be used to cross reference the crash records provided in Appendix C.

SYMBOLS		TYPES OF CRASH		SEVERITY						
→	Moving Vehicle	→	Parked Vehicle	→←	Head On	→	Rear End	13	11	17
←←←	Backing Vehicle	→	Fixed Object	↘↙	Angle	↔	Sideswipe	Property Damage Only	Injury Accident	Fatal Accident
- - -	Non-Involved Vehicle	→	Bicycle	↪	Turning Move	○	Out of Control			
→	Pedestrian	→	Animal							

Existing:

West Central Street Existing Four-Lane Cross-Section



Alternative 1:

West Central Street Three-Lane Cross with Two-Way Left-Turn Lane

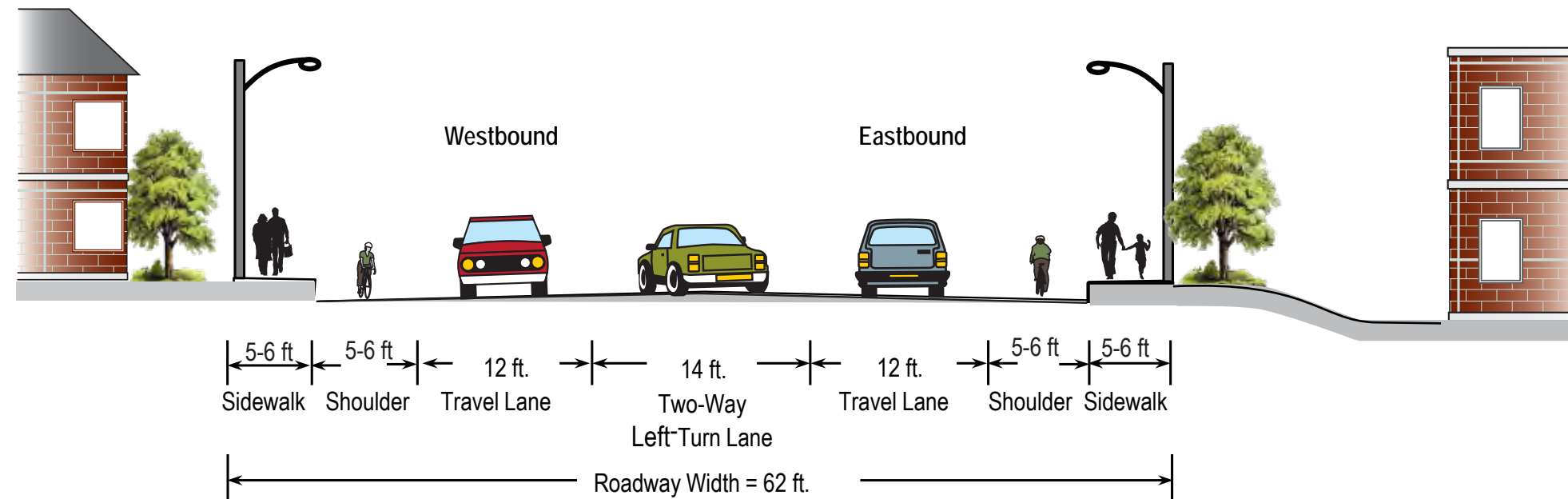


FIGURE 10A
Alternative 1: Three-Lane Cross-Section with Two-Way Left-Turn Lane

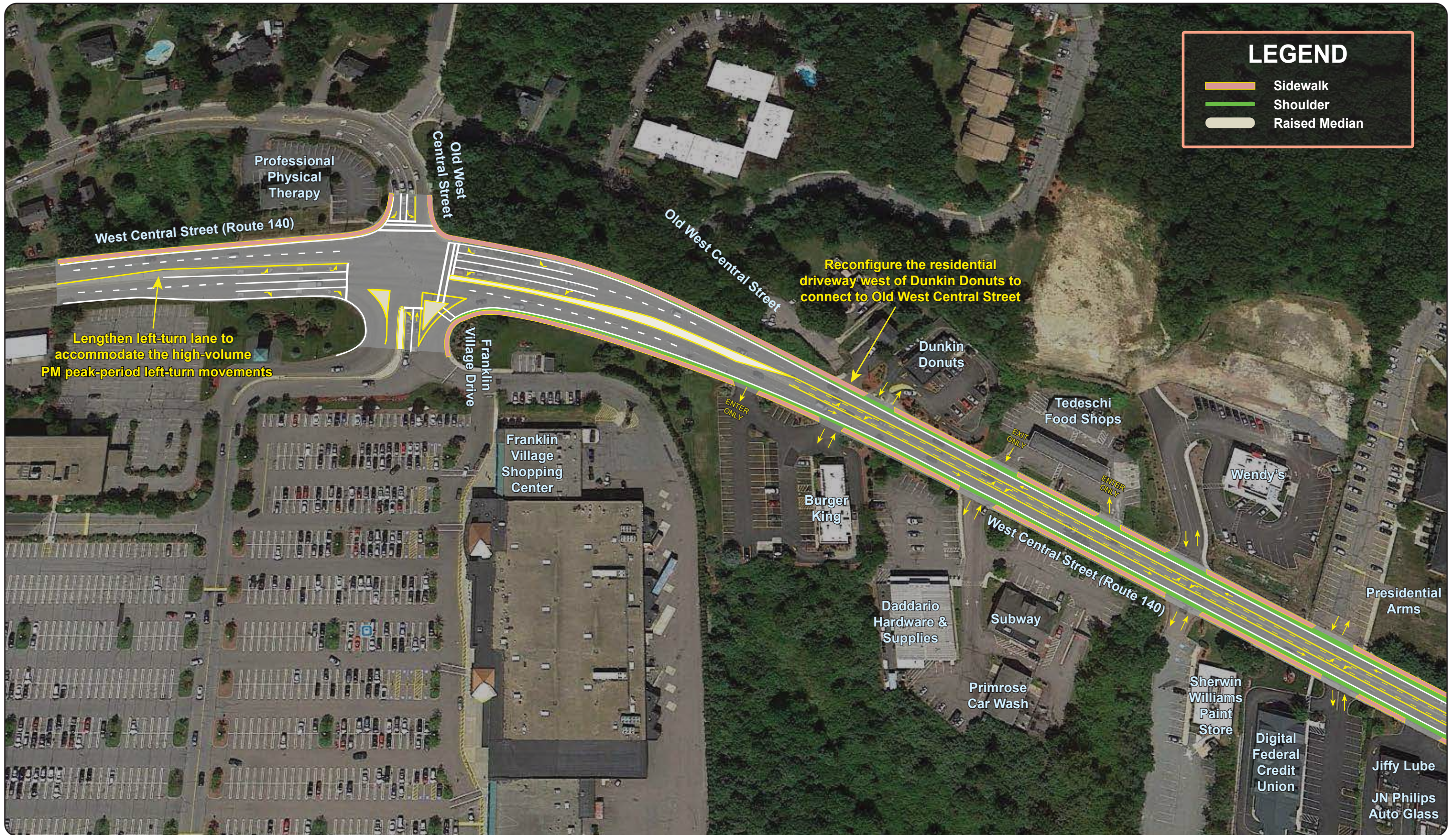
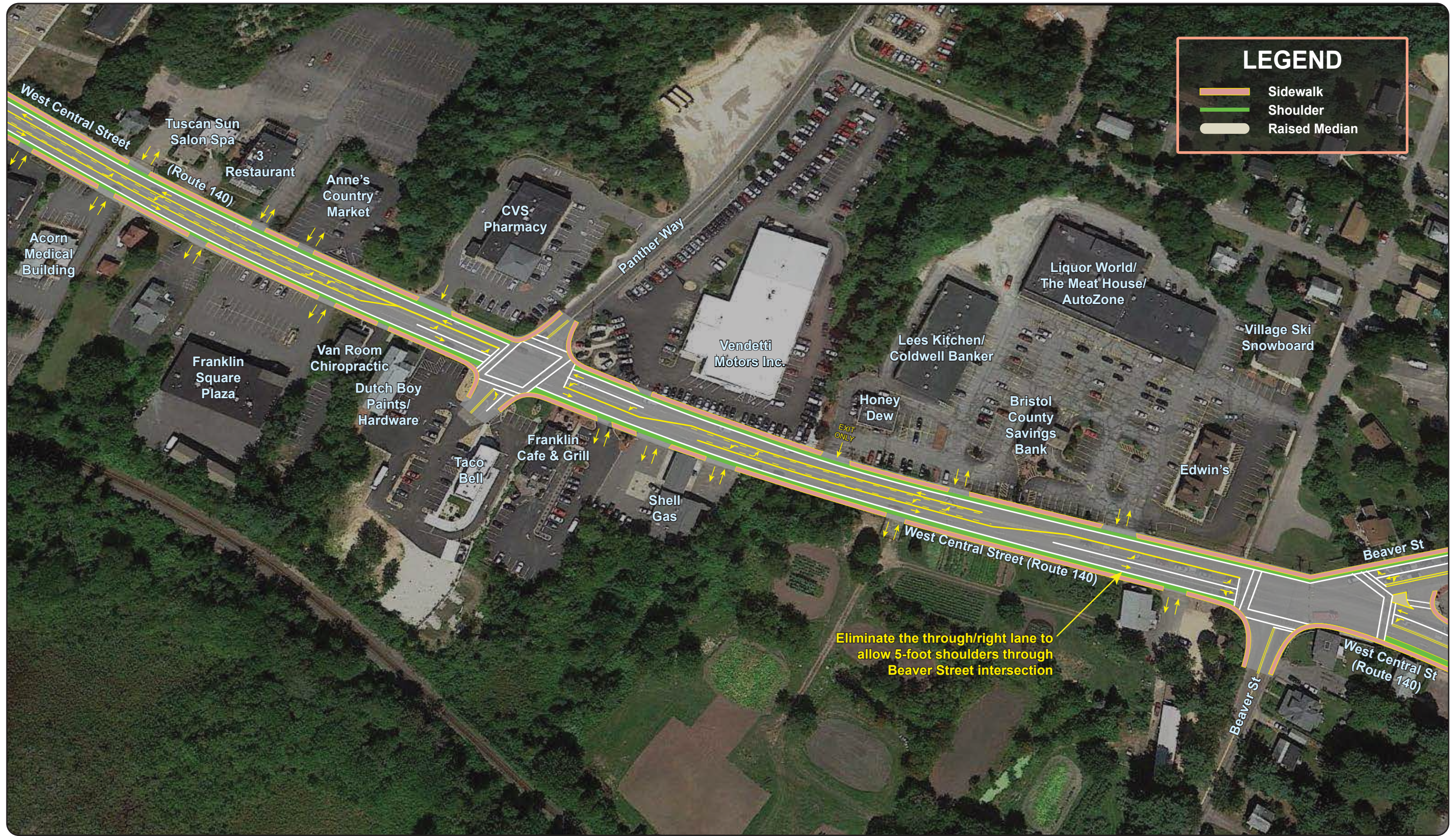


FIGURE 10B
Alternative 1: Three-Lane Cross-Section with Two-Way Left-Turn Lane



LEGEND

- Sidewalk
- Shoulder
- Raised Median

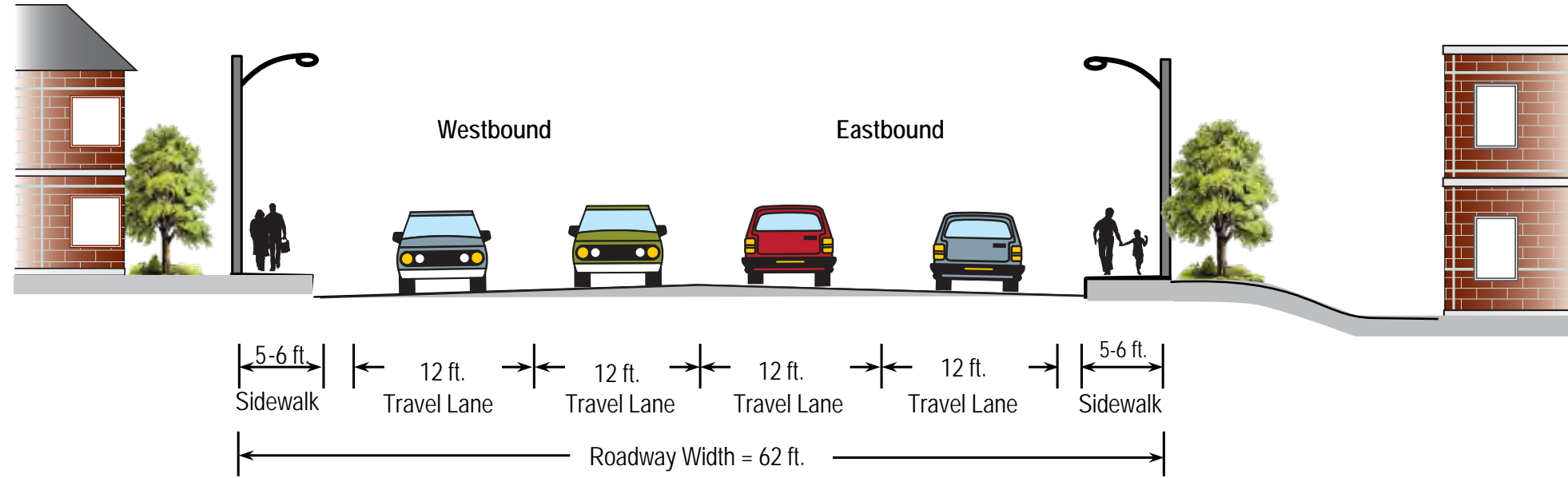
Eliminate the through/right lane to allow 5-foot shoulders through Beaver Street intersection



FIGURE 10B (continued)
Alternative 1: Three-Lane Cross-Section with Two-Way Left-Turn Lane

**West Central Street
Existing Four-Lane Cross-Section**

Existing:



**West Central Street
Three-Lane Cross-Section with Left-Turn Lanes**

Alternative 2:

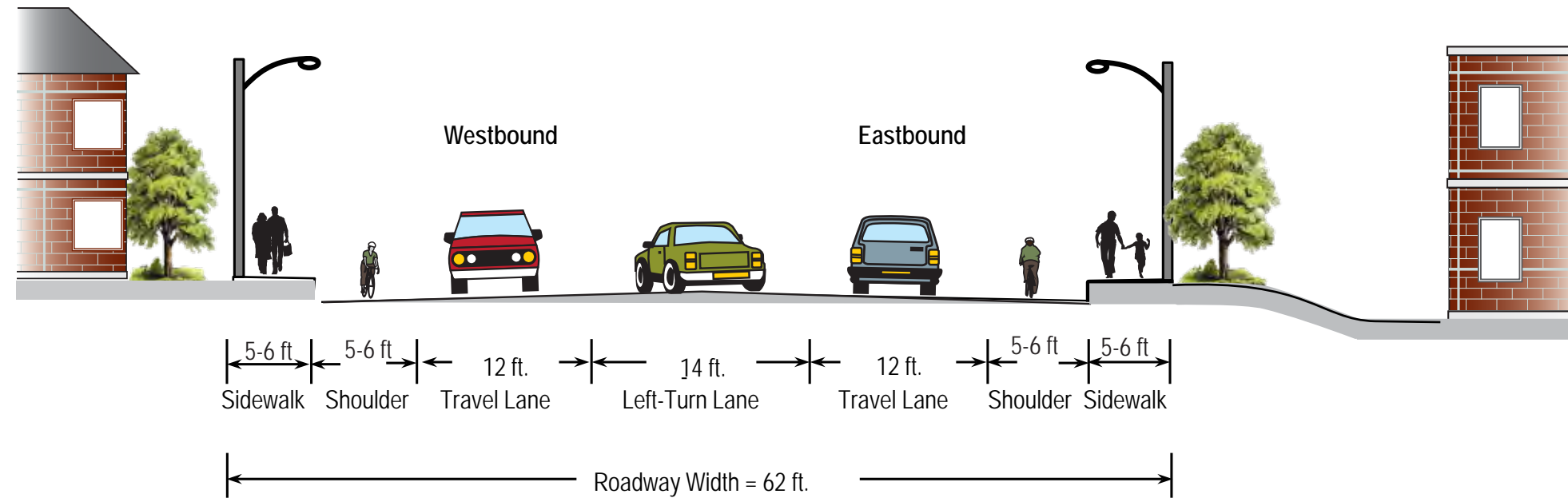


FIGURE 11A
Alternative 2: Three-Lane Cross-Section with Left-Turn Lanes

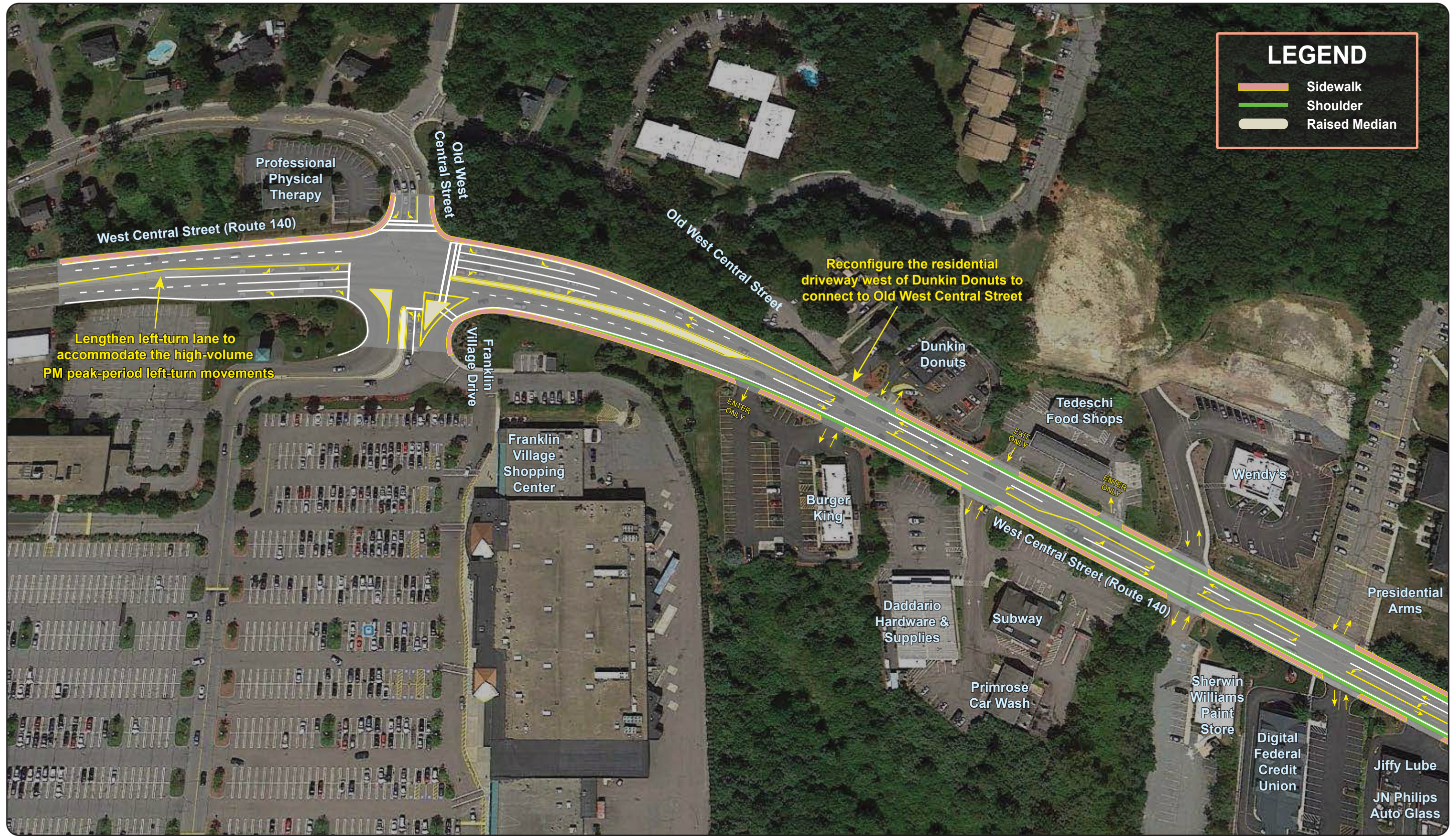


FIGURE 11B
Alternative 2: Three-Lane Cross-Section with Left-Turn Lanes

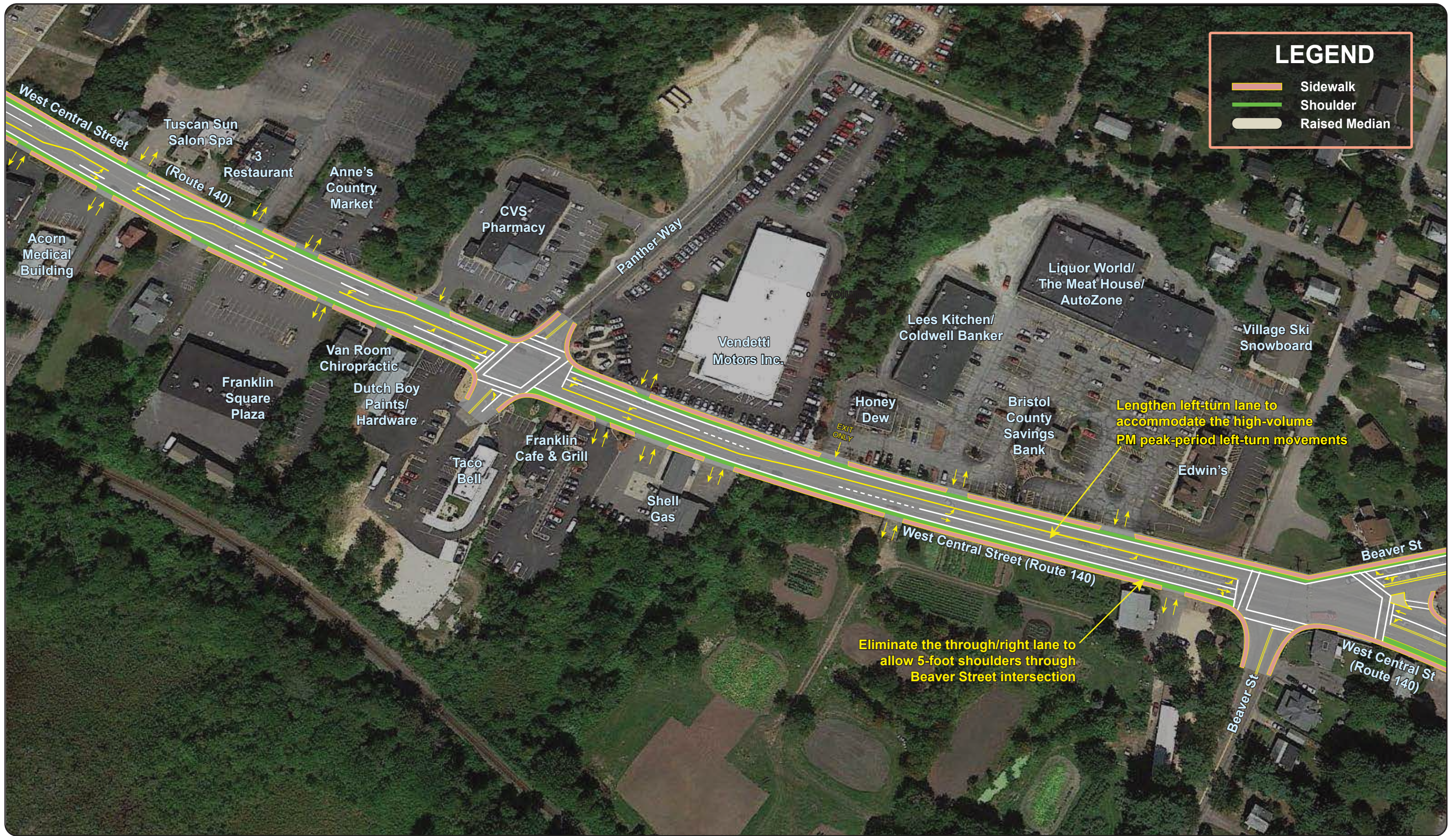
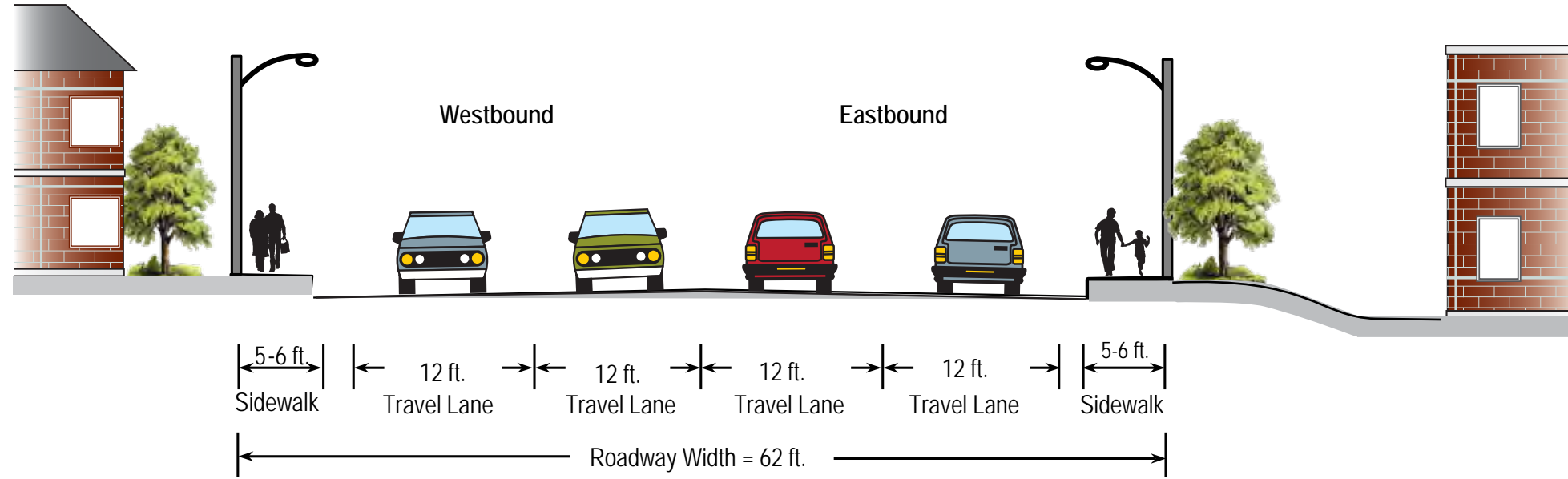


FIGURE 11B (continued)
Alternative 2: Three-Lane Cross-Section with Left-Turn Lanes

**West Central Street
Existing Four-Lane Cross-Section**

Existing:



**West Central Street
Four-Lane Cross-Section with Option of Either
Two-Way Left-Turn Lane or Left Lanes**

Alternative 3:

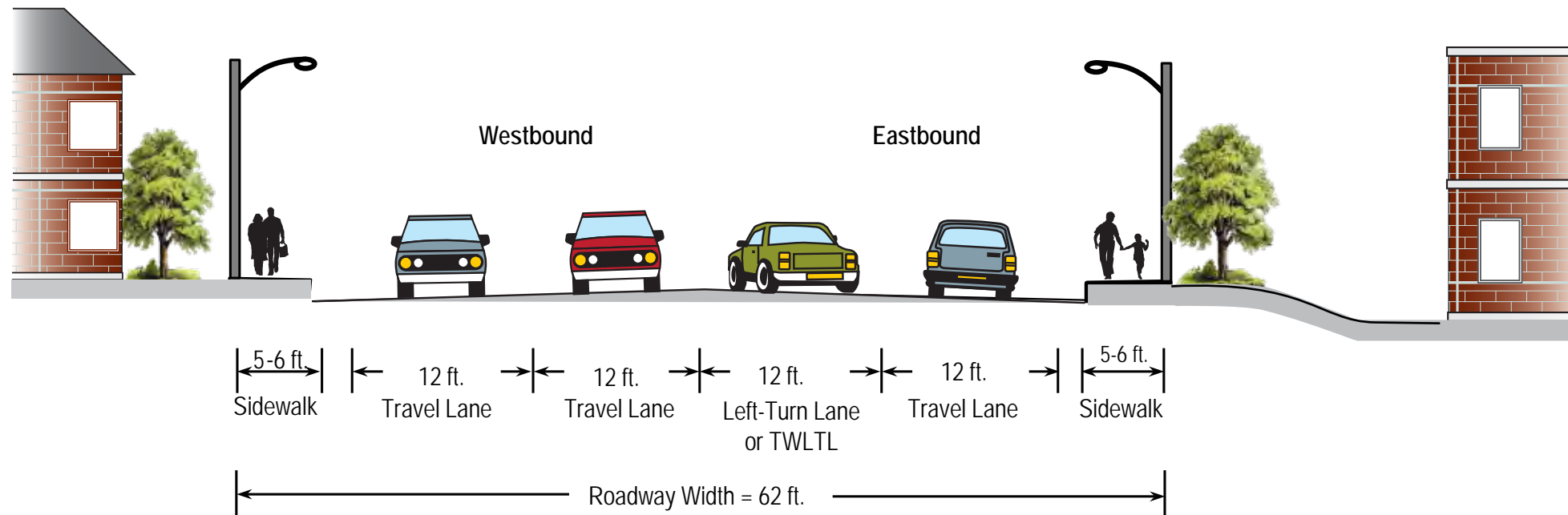


FIGURE 12A
Alternative 3: Four-Lane Cross-Section with
Option of Either Two-Way Left-Turn Lane or Left-Turn Lanes

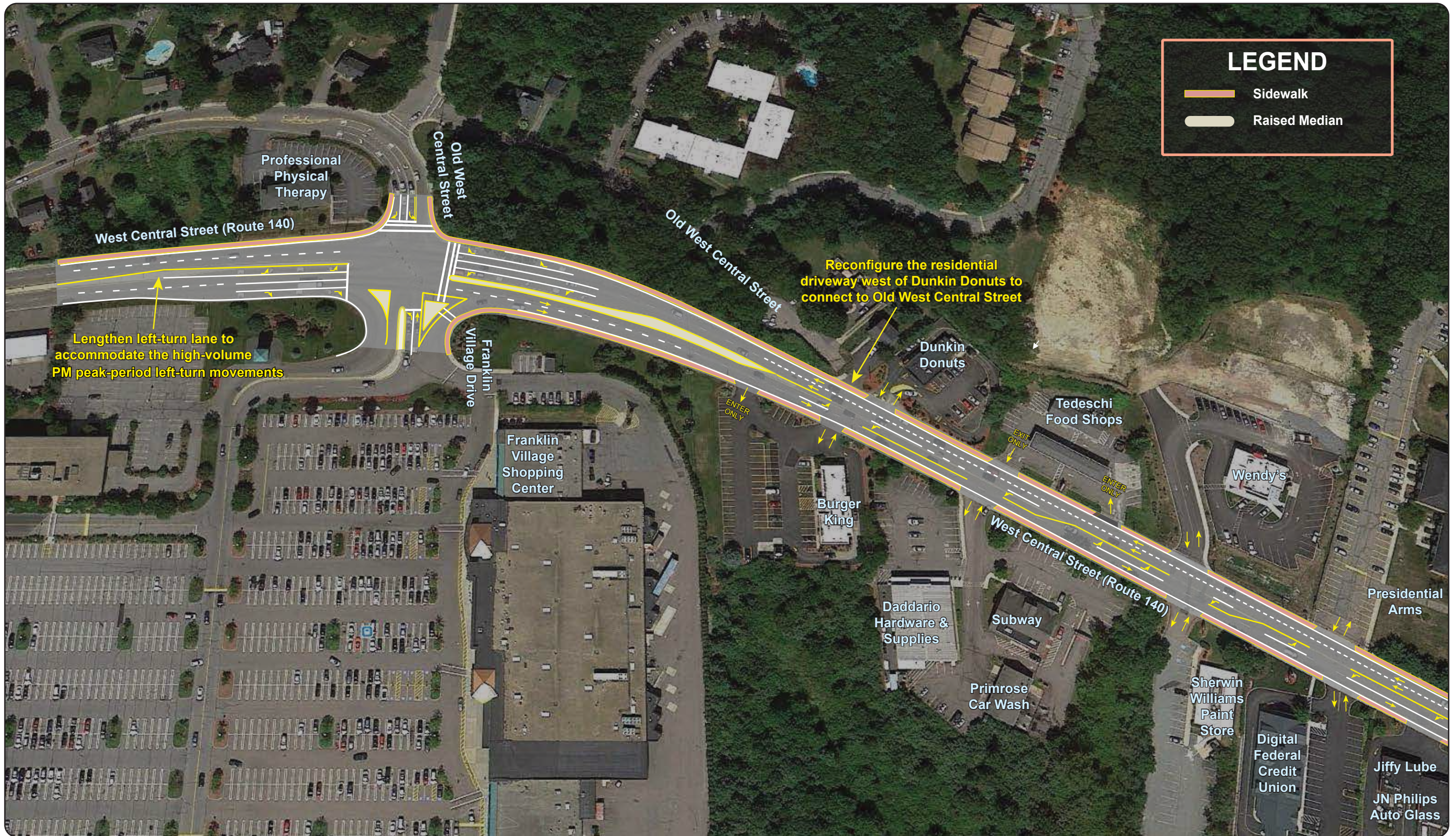


FIGURE 12B
Alternative 3: Four-Lane Cross-Section with Left-Turn Lanes



FIGURE 12B (continued)
Alternative 3: Four-Lane Cross-Section with Left-Turn Lanes