



June 10, 2010

Mr. Daniel Koch
Director of Public Works
Parkville City Hall
8880 Clark Avenue
Parkville, MO 64152

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for a higher quality of life

**SUBJECT: Downtown Traffic Study
Missouri Traffic Engineering Assistance Program**

Dear Mr. Koch:

In accordance with the City's request, George Butler Associates, Inc. (GBA) has completed a study of the vehicle and pedestrian safety and circulation needs in Parkville's Downtown district which includes Main Street from the railroad crossing through the intersection with 1st Street, 1st Street from Main Street to River Park Drive, and East Street from the railroad crossing to River Park Drive. This study is funded through the Traffic Engineering Assistance Program (TEAP), sponsored by the Missouri Department of Transportation. The study included a series of inventories of existing conditions, traffic counts, review of the traffic crash history, analyses to identify potential traffic operations deficiencies, and the identification and evaluation of potential improvement alternatives.

EXISTING CONDITIONS

Traffic Volumes ...Traffic counts were obtained during the period from March 16 thru April 12, 2010. The counts were interrupted by a sudden, unexpected, 3-inch snow storm that hit the Kansas City area on March 19th. On-road machines recorded traffic volumes on Mill Street, Main Street, 1st Street, East Street, and River Park Drive by 15-minute intervals continuously from about 12:00 noon on March 16th through about 2:00 PM on March 19th, when the counters were removed due to the snow. By March 21st all snow had melted and, on March 23rd, in-field observers completed detailed counts of traffic movements through the five study intersections:

- Mill Street and Main Street
- Main Street and 1st Street
- East Street and 1st Street
- East Street and River Park Drive
- 1st Street and River Park Drive

9801 Renner Boulevard
Lenexa, Kansas
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O'Fallon, MO
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These counts of the weekday morning and evening commuter peak hours were recorded prior to the spring break of the local schools. Weather conditions had returned to sunny and warm with normal downtown pedestrian activity.

On-road machine counters were again set out from about 4:00 PM on Friday, April 9th through 12:00 Noon on Monday, April 12th, 2010 to obtain weekend traffic counts. In-field observers also counted the detailed vehicle and pedestrian movements at the study intersections during the Saturday shopping peak period from 12:00 Noon to 2:00 PM.

As can be seen on **Figure 1**, the daily traffic volumes in the study area on a typical weekday ranged from 16,745 vpd on River Park Drive east of 1st Street to 1700 vpd on East Street south of 1st Street. Weekday traffic volumes on 1st Street are 8715 vpd and 6145 vpd east and west of East Street, respectively. There is a significant through traffic flow pattern of almost 5000 vpd between Mill Street and River Park Drive via Main Street and 1st Street.

Figure 1 also lists the daily traffic volumes on a typical Saturday without any special events. As can be seen, the traffic volumes are generally lower than corresponding weekday volumes. However, it should be noted that the traffic volumes on East Street and on Main Street south of Mill Street are higher on Saturdays. This reflects the higher use of the parking lots in the English Landing area south of the railroad tracks for shopping and recreational activities on Saturdays.

Figures 2 and 3 depict the individual traffic movements through the study intersections during the weekday AM and PM commuter peak hours, respectively. The morning commuter peak hour was recorded to occur between 7:15 and 8:15 AM. The evening commuter peak hour occurred from 4:45 to 5:45 PM. These peak hourly traffic volumes indicate more clearly the predominant east-west traffic flow through the downtown between Mill Street on the west and River Park Drive on the east. As shown, the flow is predominantly eastbound in the morning and westbound during the evening.

Figure 4 depicts the individual traffic movements through the study intersections during the Saturday shopping peak hour. The traffic volumes on Saturday vary by less than 10% from one hour to the next from about 11:00 AM until about 6:00 PM. However, the peak hour was recorded from 12:00 Noon to 1:00 PM. The east-west through traffic flow can still be seen. However, it is more balanced and of much lower magnitude than during the weekday peaks.

Street Network ... All existing streets in the study area provide two-way traffic flow one lane in each direction. The construction of an additional westbound lane on River Park Drive east of the intersection with 1st Street is planned for this summer.

Main Street is the widest street in the study area. It is about 52 feet wide and provides angle parking along the east and west curbs in addition to the two traffic lanes.

East Street is about 36 feet wide north of 1st Street and 40 feet wide south of 1st Street. Angle parking is marked along the west curb north of 1st Street, while the east curb is not marked or signed to allow or prohibit parking. South of 1st Street, parallel parking is provided along both sides of East Street.

Mill Street and 1st Street are about 26 feet wide and no parking is allowed along either side of these streets. However, the south side of 1st Street is signed to allow 30-minute loading.

The study area is characterized by short block lengths which do not allow significant vehicle stacking. Available block lengths measured between intersecting street edges are as follows:

Main Street – RR to Mill	75 feet
Main Street – Mill to 1 st	90 feet
1 st Street – Main to East	180 feet
East Street – RR to 1 st	180 feet
1 st Street – East to River Park	80 feet
East Street – 1 st to River Park	110 feet

It was also observed that the corner radius in the southeast quadrant of the 1st Street and East Street intersection is about 1 foot due to a raised storm drainage inlet located exactly in the corner. This condition was observed to cause problems for northbound vehicle turning right onto 1st Street. These right turning vehicles either were forced to swing out past the centerline on 1st Street or jump up on the 8-inch high curb with their back tires in order to complete their right turn.

Traffic Controls ... Stop sign control is provided on the side street approaches to all study intersections.

Eastbound traffic on Mill Street stops at Main Street.

Westbound traffic on 1st Street also stops at Main Street.

Northbound and southbound traffic stops on East Street at 1st Street.

Northbound traffic also stops at River Park Drive.

Eastbound traffic on 1st Street stops at River Park Drive.

Southbound traffic on River Park Drive also stops at 1st Street.

Eastbound left turns and southbound right turns are prohibited at the intersection of 1st Street with River Park Drive.

A truck route is signed to require trucks to use a route along Main Street south of Mill Street, McAfee Drive between Main and East Streets, and East Street north to 1st Street and River Park Drive.

Traffic Crash History ... Spot maps of traffic crashes for calendar years 2006 through 2009 were provided by the Parkville Police Department. These spot maps indicated that relatively few traffic crashes have been recorded in the study area in the last four years.

2006 – 9 crashes

2007 – 6 crashes

2008 – 5 crashes

2009 – 4 crashes including 1 pedestrian injury crash

Pedestrian Facilities ... During the existing conditions inventory, it was observed that virtually none of the existing pedestrian ramps at the intersection corners meet current criteria. None of the ramps include detectable truncated dome warning strips. Other defects include:

- Sidewalk surfaces depressed below the curb presenting tripping and wheel chair difficulties
- Presence of ramps on one corner, but not on an adjacent corner
- Ramps with grades too steep or with vertical drop-offs
- Indirect pedestrian crossings presenting difficulty for visually impaired pedestrians
- Streetscape features blocking or restricting walkways

These defects are illustrated in the photographs included on **Exhibit A**.

ANALYSES

Traffic Operations ... A series of delay and vehicle queuing calculations were completed to determine the existing levels of service and areas where vehicle stacking was inadequate. Levels of Service are defined by the amount of average delay in seconds per vehicle is experienced by drivers during the peak hours. As listed in **Exhibit B**, the Levels of Service range from Level of Service (LOS) A to LOS F, with LOS A being the best condition with 10 seconds of delay or less per vehicle that enters an intersection. LOS F is the largest range which includes any delay more than 50 seconds per vehicle at stop signs and more than 80 seconds per vehicle at signalized intersections.

The results of the weekday peak hour level of service analyses are shown on **Figures 5 and 6** for the AM and PM commuter peaks, respectively.

- As shown, the existing levels of service during the morning peak hour are generally LOS or LOS B for all movements at the five study intersections.
- The one exception is the southbound traffic movement on River Park Drive approaching the intersection with 1st Street. As shown, the ratio of the traffic volume to the capacity (i.e., V/C) for this movement is 4.5 during this morning commuter peak hour. These motorists experience extreme delays (LOS F) and vehicle queues or backups.
- This traffic movement also experiences LOS F with extreme vehicle queues during the PM peak hour, with a V/C = 4.3.
- During the PM peak hour, some of the other vehicle movements degrade from LOS B to LOS C or LOS D. These LOS C & D traffic operations are still generally manageable and do not cause significant problems.
- However, it should be noted that the westbound traffic movement on 1st Street at Main Street also experiences vehicle queues of about 200 feet up to 95% of the PM peak hour. This queue backs along 1st Street through the intersection with East Street.

In comparing the AM, PM, and Saturday peak hour traffic volumes shown on Figures 2, 3, and 4, it can be seen that the weekday commuter peak hour conditions are significantly higher than the Saturday peak hour. The Saturday peak hour conditions are not critical to the design for improvements and have not been analyzed in detail.

Traffic Crashes ... The analyses of the recent traffic crash history indicates that no correctable crash patterns can be identified. Typically, five or more crashes of a particular type, such as right angle, left turn, rear end, etc., during a one year period are required to identify a correctable traffic crash pattern. Three or less crashes of any type occurred at any of the five study intersections during any 12-month period. Five of the nine crashes during 2006 involved parked vehicles.

Future Traffic Volumes... In order to determine what improvements should be considered to serve not only today's traffic demands but also expected traffic growth in the area, a set of AM and PM commuter peak hour traffic volumes were developed. These future traffic volumes were determined for a 20-year design horizon based on previous studies complete by GBA in the City, including future development plans for Park University. The land use growth projections developed as part of the Highway 45 location and design study indicate that traffic should be expected to grow by about 50% over the next 20 years. This includes

the continued growth along Mill Street, River Road, and Crooked Road to the west and East Street to the north.

The projected future traffic volumes during the AM and PM weekday commuter peak hours are shown on **Figures 7 and 8**, respectively.

Future Traffic Operations ... A similar set of level of service and queue length calculations were also completed using the future (Year 2030) traffic projections. The results of these future year weekday peak hour level of service analyses are shown on **Figures 9 and 10** for the AM and PM commuter peaks, respectively.

- As shown on Figure 9, the future AM peak hour conditions are generally expected to be only slightly worse than the existing morning peak hour conditions.
- The eastbound vehicle queue on 1st Street at River Park Drive is expected to exceed the available block length up to 95% of the time.
- Most significantly is the southbound level of service and vehicle queues on River Park Drive north of 1st Street where the AM peak hour V/C ratio will increase from 4.5 to 12.5, or about 3 times worse than today.
- As shown on Figure 10, the future PM peak hour conditions are expected to be significantly worse than current PM peak hour conditions if no improvements are made.
- Several movements are expected to operate at LOS E or F and the vehicle queues along 1st Street and along East Street are expected to exceed to available block lengths creating the possibility of gridlock conditions.
- The southbound level of service and vehicle queues on River Park Drive north of 1st Street will further degrade with the PM peak hour V/C ratio increasing from 4.3 to 27.7, or about 6 times worse than today.

IMPROVEMENT NEEDS AND ALTERNATIVES

In order to address the pedestrian facility needs, a series of corner curb extensions, or "blub-outs", could be constructed as shown in **Exhibit 1**. These corner curb extensions shadow the parked vehicles, provide shorter and more direct pedestrian crosswalks, allow the vehicle stopped on the side streets to increase the sight distance to conflicting vehicles on the main street, and allow space for pedestrian streetscape amenities without blocking the narrow sidewalks.

Perhaps one of the most important of these advantages is illustrated on **Exhibit C**. As can be seen in the top two photo's, when westbound drivers on 1st Street attempt to view conflicting traffic on Main Street north and south of the intersection from the existing stop bar on 1st

Street, their available sight distance is severely limited by the adjacent buildings and parked vehicles. This has the effect of requiring drivers to take longer to decide if they have adequate gaps in the Main Street traffic to proceed. This decreases the traffic service capacity and degrades the levels of service. The westbound drivers are forced to slowly advance into the intersection to see around parked vehicles, which then positions their vehicle across the crosswalk blocking pedestrians and creating an unsafe condition.

If the corner curb extension is constructed, then the stop bar and crosswalk can be moved closer to the north-south travel lanes, which greatly improves the sight distance, as shown in the bottom photo's on Exhibit C.

If the corner extensions are provide as shown on Exhibit 1, then it also provides the opportunity to correct the corner pedestrian ramp defects described above. This is especially true at the intersection of 1st Street with East Street. At this intersection the corner curb extensions would also allow the deficient radius in the southeast corner to be corrected.

One of the primary improvement needs identified by the study was caused by the three closely spaced intersections of 1st Street, East Street, and River Park Drive. An alternative was identified which eliminated one of the intersections along River Park Drive. This alternative realigned 1st Street so that it intersected River Park Drive as a T-type intersection with a free flowing eastbound right turn lane from 1st Street onto River Park Drive, as shown on **Exhibit 2**. This intersection configuration would allow the River Park Drive traffic to operate as the through movement across the T of the intersection. The westbound traffic movements from River Park Drive onto 1st Street would operate as a left turn movement. Due to the large number of vehicle that would need to make westbound left turns both today and in the future from River Park Drive onto 1st Street, the new T-type intersection would need to be controlled by a traffic signal.

This alternative would still have two closely spaced intersections along 1st Street. The distance between the intersection of 1st Street with East Street and the new T-type intersection of 1st Street with River Park Drive would be about 50 feet. As such, it would also be required that East Street be converted to a one way northbound operation between 1st Street and English Landing Drive south of the railroad tracks. This would eliminate westbound left turn movements from 1st Street onto East Street and provide a separate northbound left turn and right turn lanes on East Street at the 1st Street intersection.

In order to evaluate this alternative, a series of design traffic volumes and level of service / queuing analyses were developed. These design

traffic volumes and level of service / queuing results are summarized on the **Figures 11 through 18**:

- Figure 11 – Modified Existing AM Peak Hour Traffic Volumes
- Figure 12 – Modified Existing PM Peak Hour Traffic Volumes
- Figure 13 – Modified Existing AM Peak Levels of Service
- Figure 14 – Modified Existing PM Peak Levels of Service
- Figure 15 – Modified Future AM Peak Hour Traffic Volumes
- Figure 16 – Modified Future PM Peak Hour Traffic Volumes
- Figure 17 – Modified Future AM Peak Levels of Service
- Figure 18 – Modified Future PM Peak Levels of Service

As can be seen on **Figures 13 and 14**, the overall traffic operation in the study area is generally improved, especially for the southbound traffic movement on River Park Drive where the level of service improves from LOS F with unmanageable vehicle queues over 2500 feet long to LOS C with vehicle queues of 250 to 320 feet. It should be noted that to serve the westbound left turn movement at the intersection of 1st Street with Main Street, it will be necessary to eventually add stop sign control for the southbound traffic on Main Street.

Likewise, as indicated on **Figures 17 and 18**, the overall traffic operation in the study area in Year 2030 is also generally improved. However, it must be noted that by Year 2030 the east-west traffic volumes through the Parkville downtown are expected to grow to the point where the westbound vehicle queues would be expected to stack up from the Main Street intersection along 1st Street to and through the River Park Drive.

RECOMMENDATIONS

It is recommended that the City consider the corner curb extensions to improve sight distance, enable better pedestrian circulation, upgrade the corner pedestrian ramps, and correct corner radii.

Due to the high current and projected peak hour traffic volumes along 1st Street, it is recommended that the 30-minute loading zone along the south curb line between Main and East Streets be restricted to off-peak hours. This should be done by replacing the existing red on white "NO PARKING 30 MINUTE LOADING ZONE" signs with an assembly of a red on white "NO STOPPING 7AM - 9AM 4PM – 6PM" sign next to a green on white "30 MINUTE LOADING 6PM – 7AM 9AM – 4PM" sign.

It is recommended that the City consider modifying the three-intersection complex of River Park Drive, 1st Street, and East Street to create two T-type intersections as shown on Exhibit 2. This recommendation also includes converting East Street to a one-way northbound operation south of 1st Street. This improvement should improve the traffic operations in this area of the downtown for current conditions and for a

few years into the future. If traffic continues to grow due to land use growth in the City, then within the 20-year design period the levels of service along 1st Street during the PM commuter peak hours will return to unmanageable levels with excess vehicle queues leading to potential gridlock within the downtown area.

There is however some question regarding how much the traffic can continue to grow along River Park Drive due to the two / three lane capacity of this thoroughfare. The current traffic volumes on River Park Drive east of the downtown area recorded at more than 16,500 vehicles per day and projected to about 25,000 vpd are beyond the accepted capacity of a 2 / 3-lane roadway, which is about 12,000 to 15,000 vpd. Likewise, the current traffic volumes (i.e., 6,000 to 8,700 vpd) along 1st Street west of River Park Drive are very close to the practical capacity of a 2-lane downtown street of about 10,000 vpd.

Therefore, in addition to the modified intersection at River park Drive with 1st Street it is recommended that planning proceed for a bypass of the downtown which includes grade-separated crossings of the railroad east and west of the downtown. This by-pass could possibly intersect Mill Street in the vicinity of the intersection with Crooked Road, cross over the railroad, then align to the south of the English Landing commercial area and run east along McAfee Drive crossing again over the railroad to intersect with River Park Drive at perhaps the access road to Park University. There are many obvious environmental concerns that would need to be addressed with such a by-pass alignment. However, without such an improvement it is doubtful that traffic growth can continue to be managed through the downtown area for very many more years.

Sincerely,

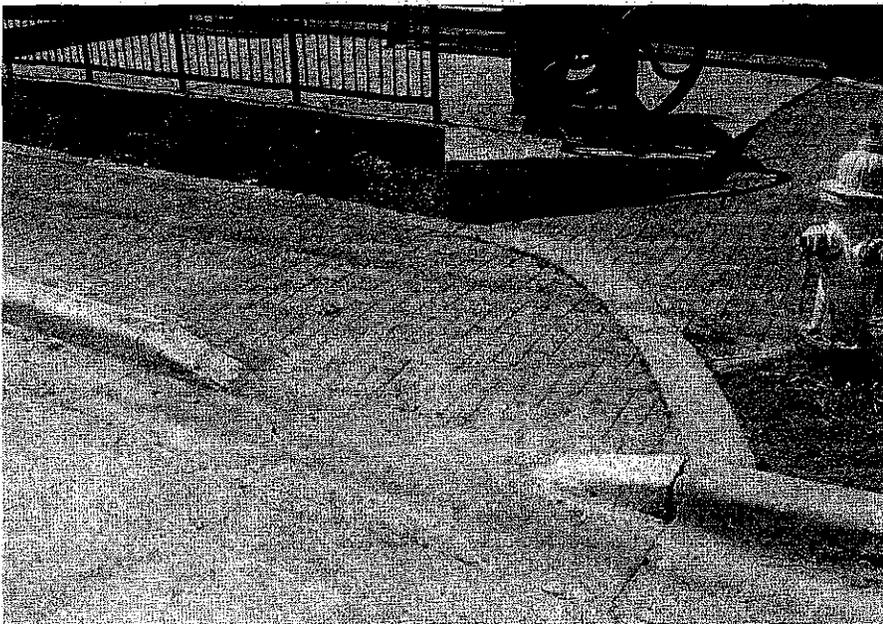
GEORGE BUTLER ASSOCIATES, INC.

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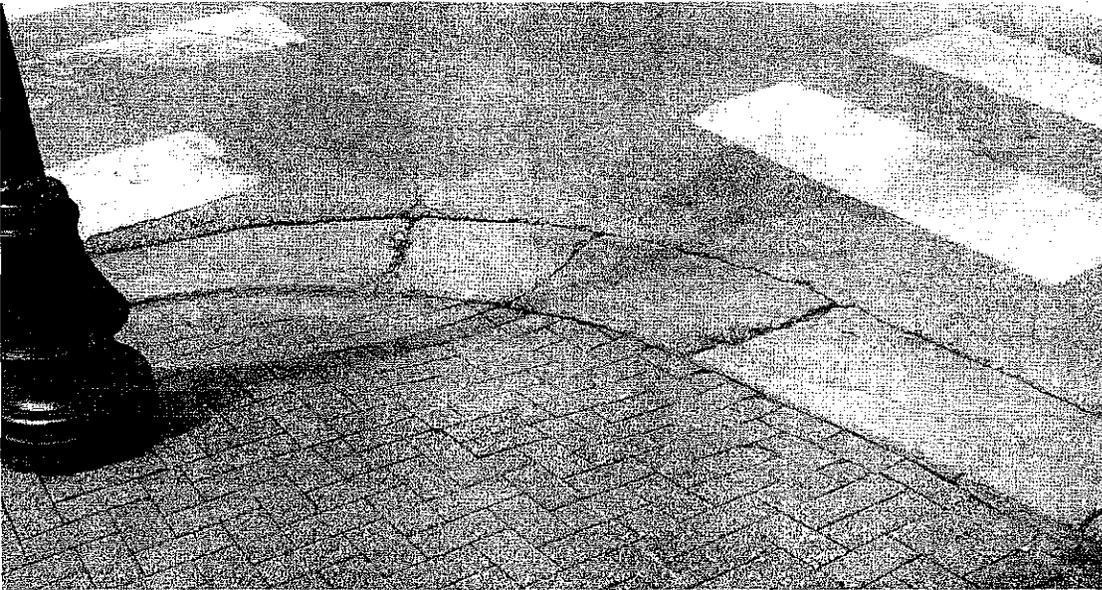
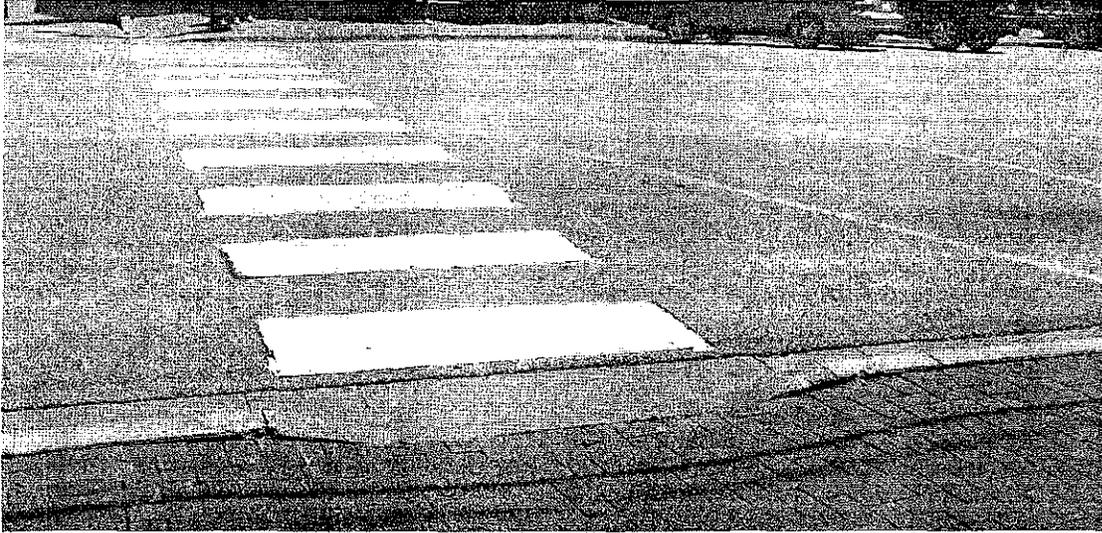
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EXHIBIT A

EXISTING CONDITIONS – CORNER PEDESTRIAN RAMPS



Main Street and Mill Intersection



Main Street and 1st Street Intersection



1st Street and East Street Intersection

EXHIBIT B

Level of Service Definitions

Level of service criteria are outlined in the 2000 edition of the "Highway Capacity Manual" (HCM) for both signalized and unsignalized intersections. The HCM defines the level of service as a measure of the quality of traffic flow. There are six different levels of service for each facility type, each representing a range of operating conditions. Each level of service is designated by a letter from "A" to "F", with "A" being the most desirable condition and "F" being the least desirable condition. The level of service criteria, as reported by the 2000 HCM, for both signalized and unsignalized intersections are listed below:

Unsignalized Intersections		Signalized Intersections	
Level of Service	Average Control Delay (sec/veh)	Level of Service	Control Delay per Vehicle (sec)
A	≤ 10	A	≤ 10
B	> 10 and ≤ 15	B	> 10 and ≤ 20
C	> 15 and ≤ 25	C	> 20 and ≤ 35
D	> 25 and ≤ 35	D	> 35 and ≤ 55
E	> 35 and ≤ 50	E	> 55 and ≤ 80
F	> 50	F	> 80

**EXHIBIT C
INTERSECTION SIGHT DISTANCE**



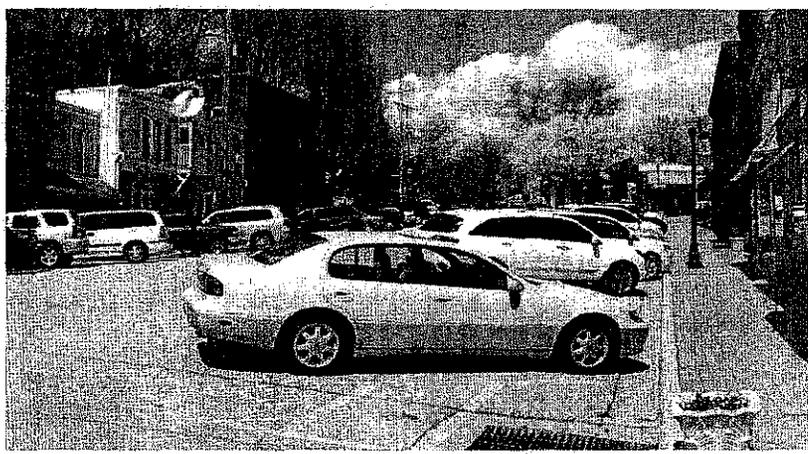
Looking South Down Main Street
from Existing 1st Street Stop Bar



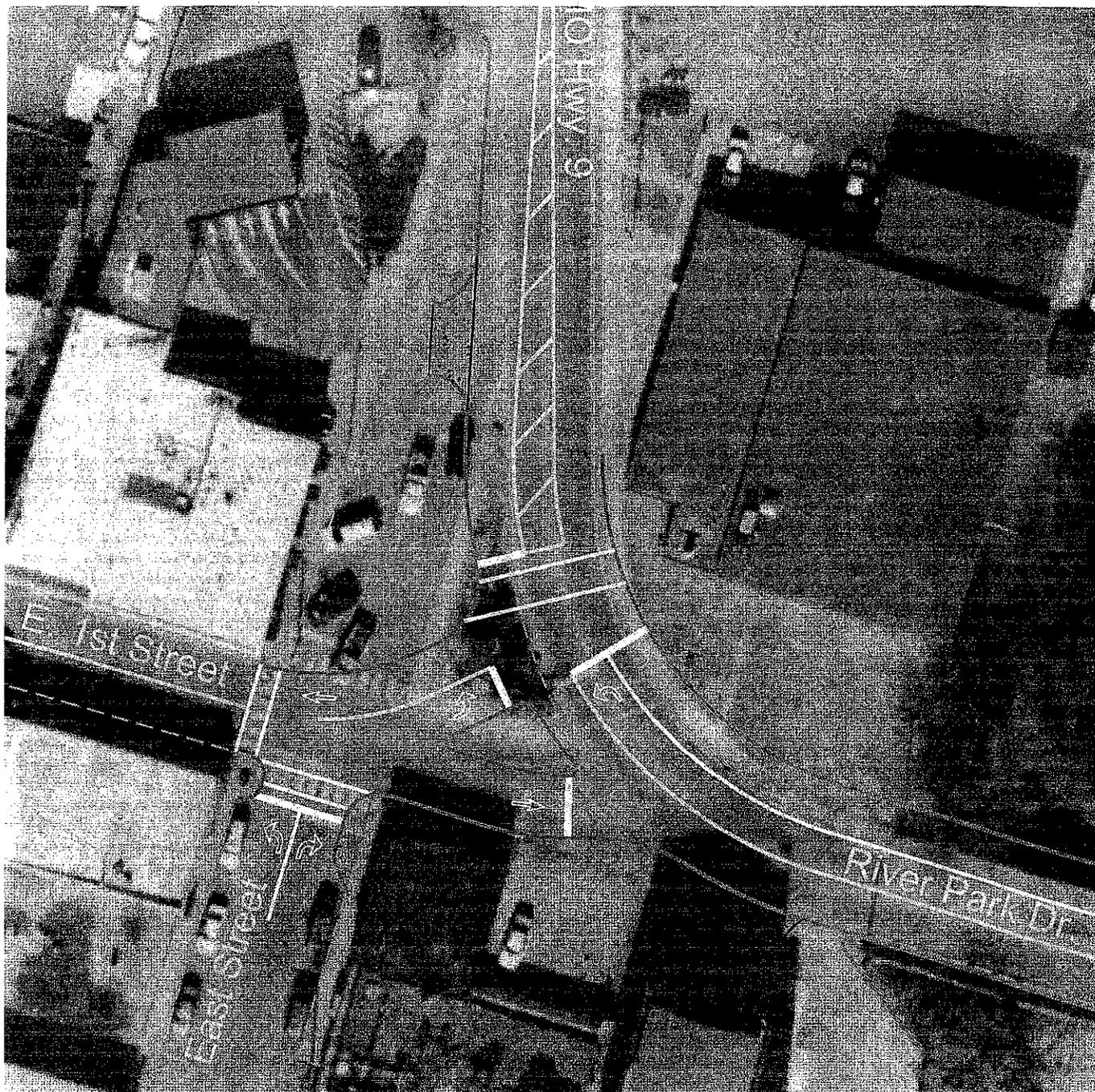
Looking North Up Main Street
from Existing 1st Street Stop Bar



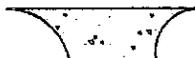
Looking South Down Main Street
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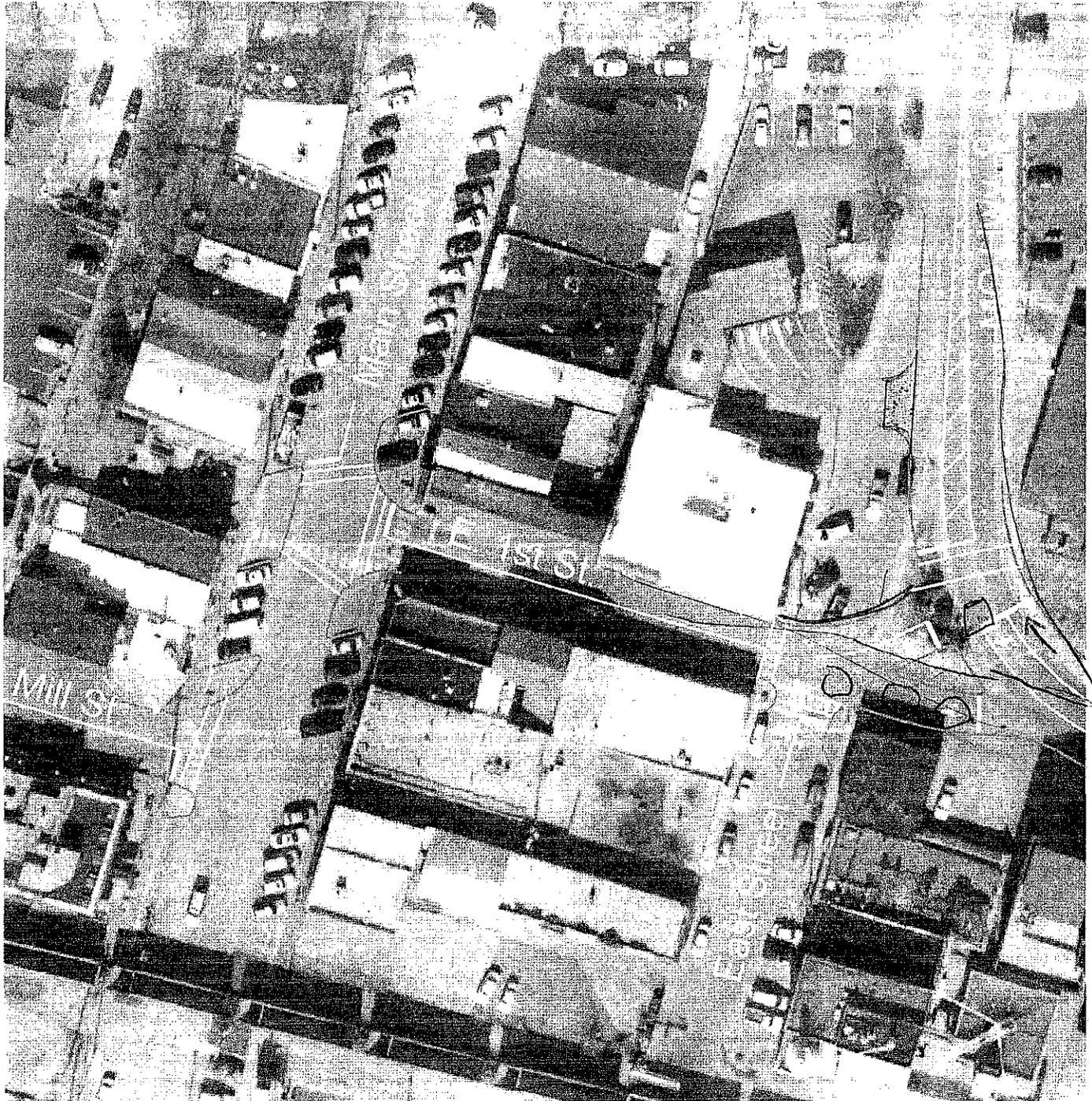


Looking North Up Main Street
from Proposed 1st Street Stop Bar



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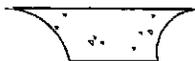
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- Proposed Entrance
-  Proposed Curb Lines



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Proposed Curb Lines

Proposed Curb Lines



Proposed Entrance

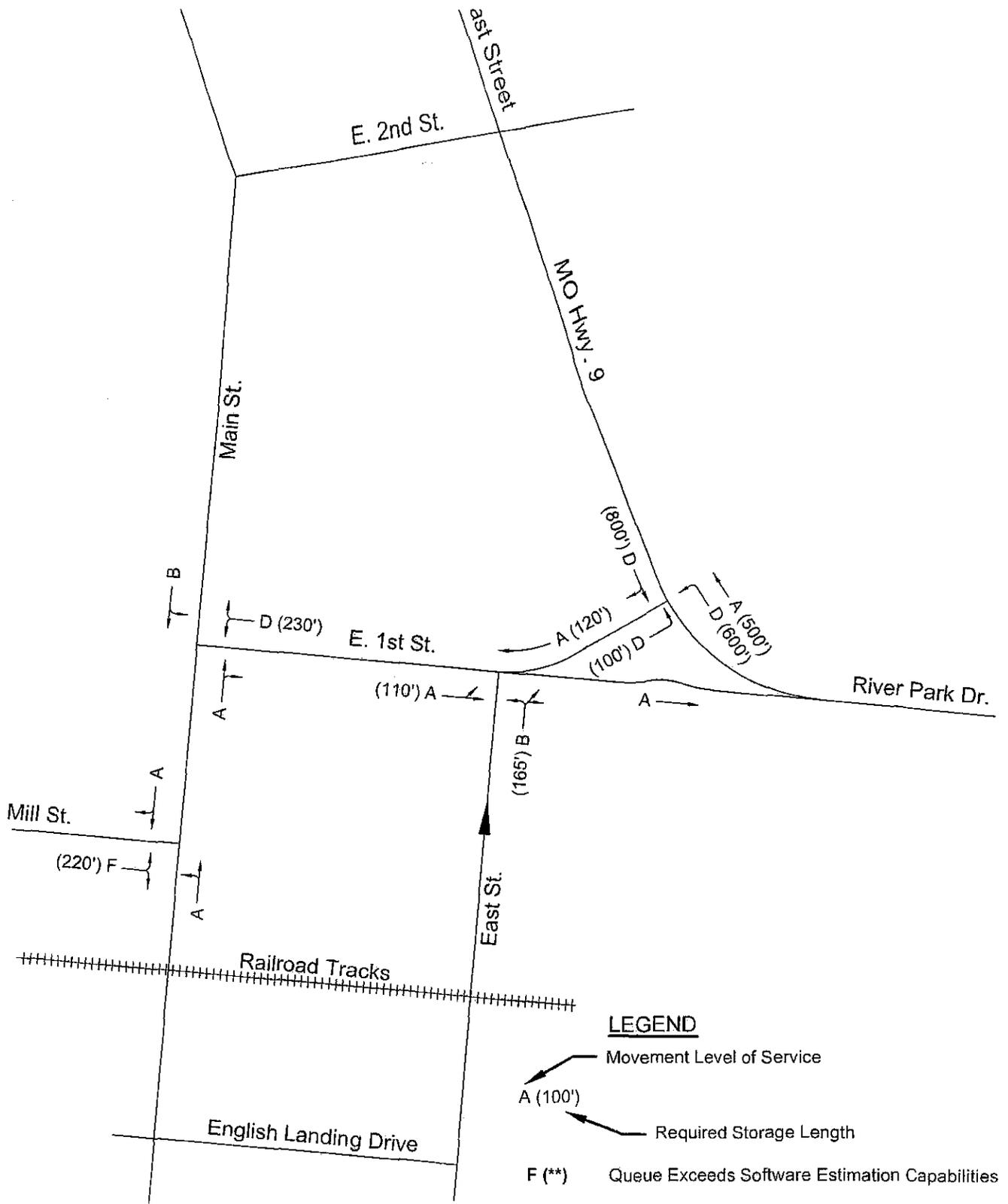
GBA
architects
engineers



PROJECT NUMBER
12175.00
DATE
5/27/2010

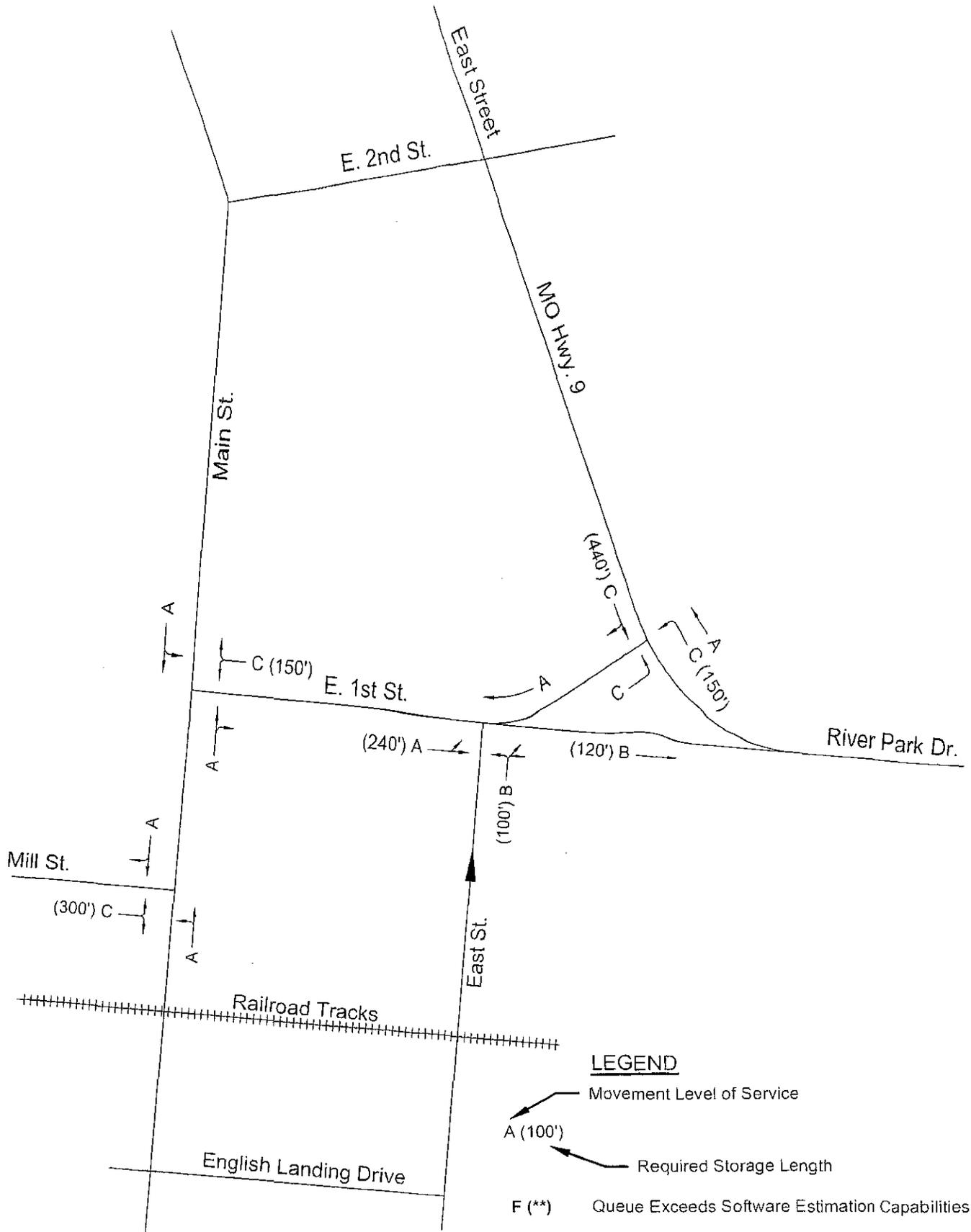
Downtown Parkville, MO

EXHIBIT 1



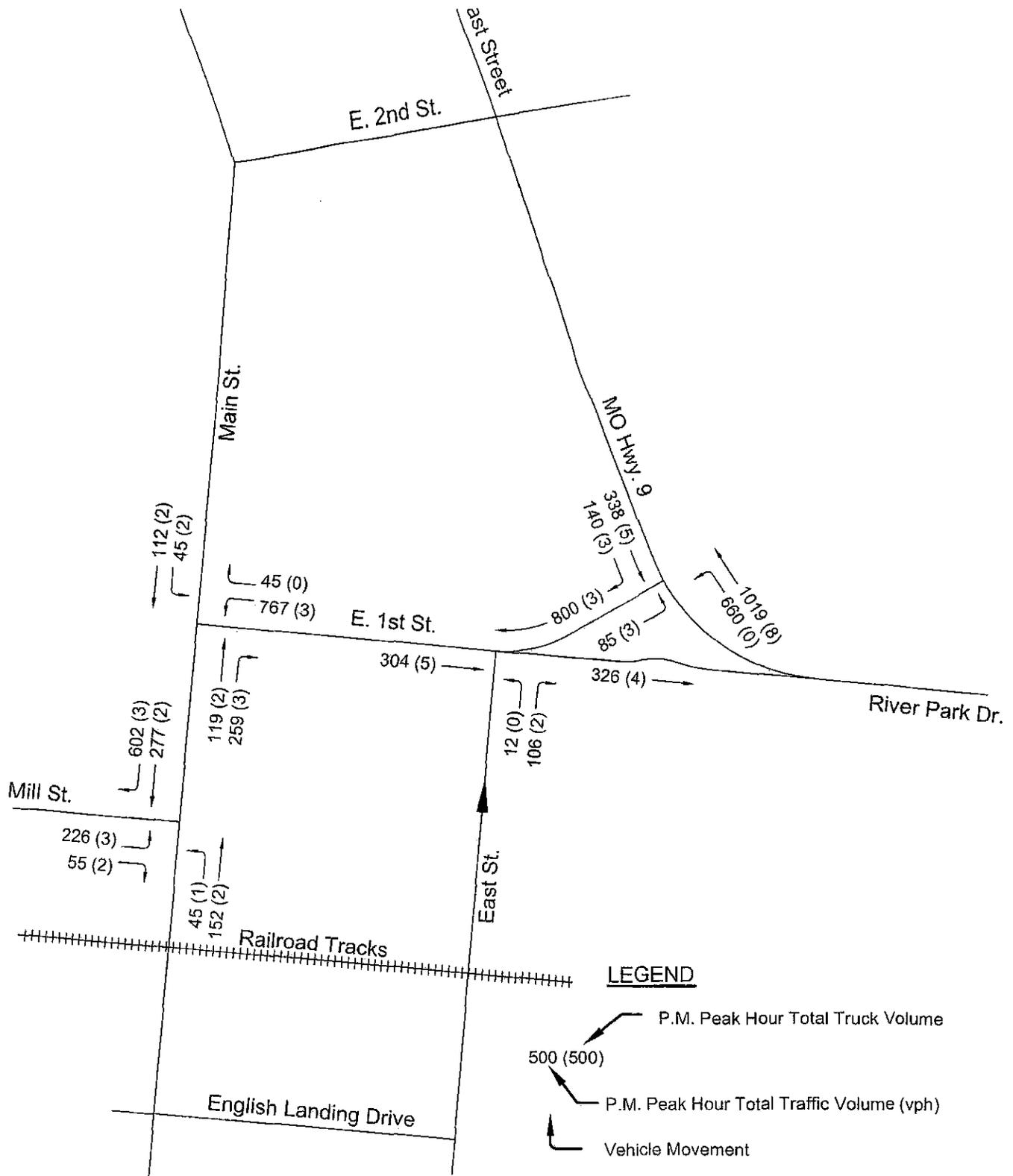
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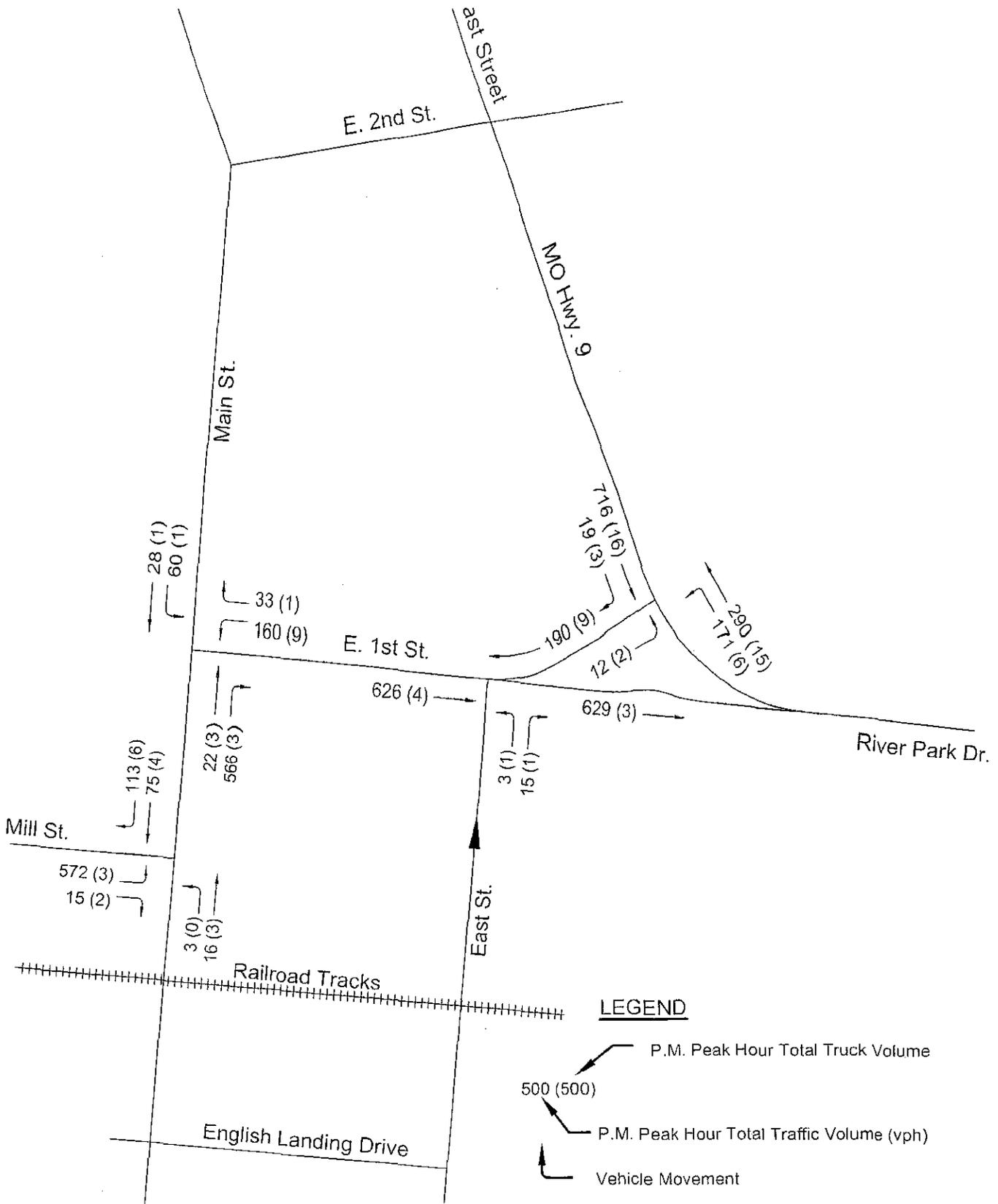
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- A (100') Required Storage Length
- F (**) Queue Exceeds Software Estimation Capabilities

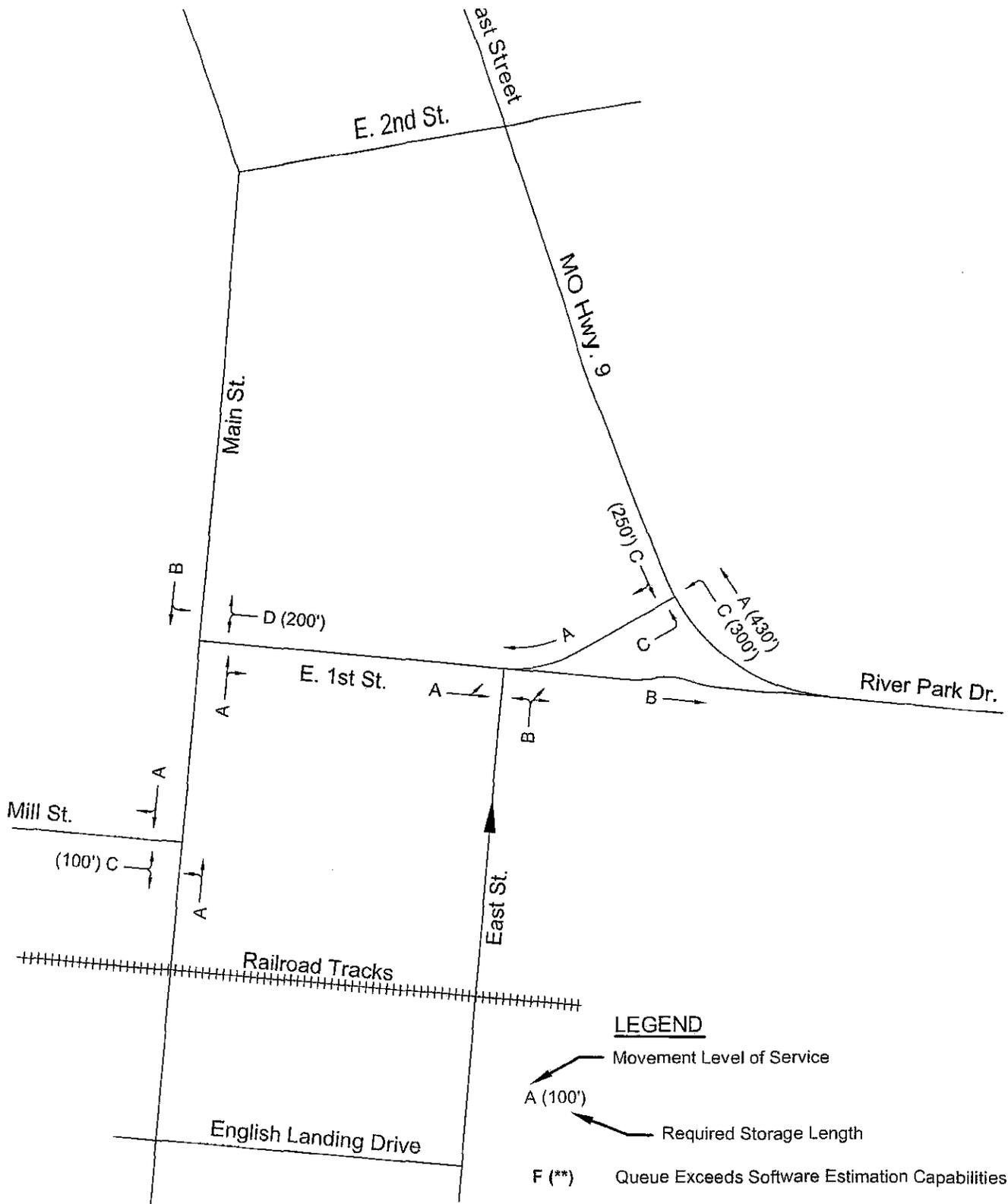


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-  Movement Level of Service
 -  A (100')
 -  Required Storage Length
 -  F (**)
- Queue Exceeds Software Estimation Capabilities

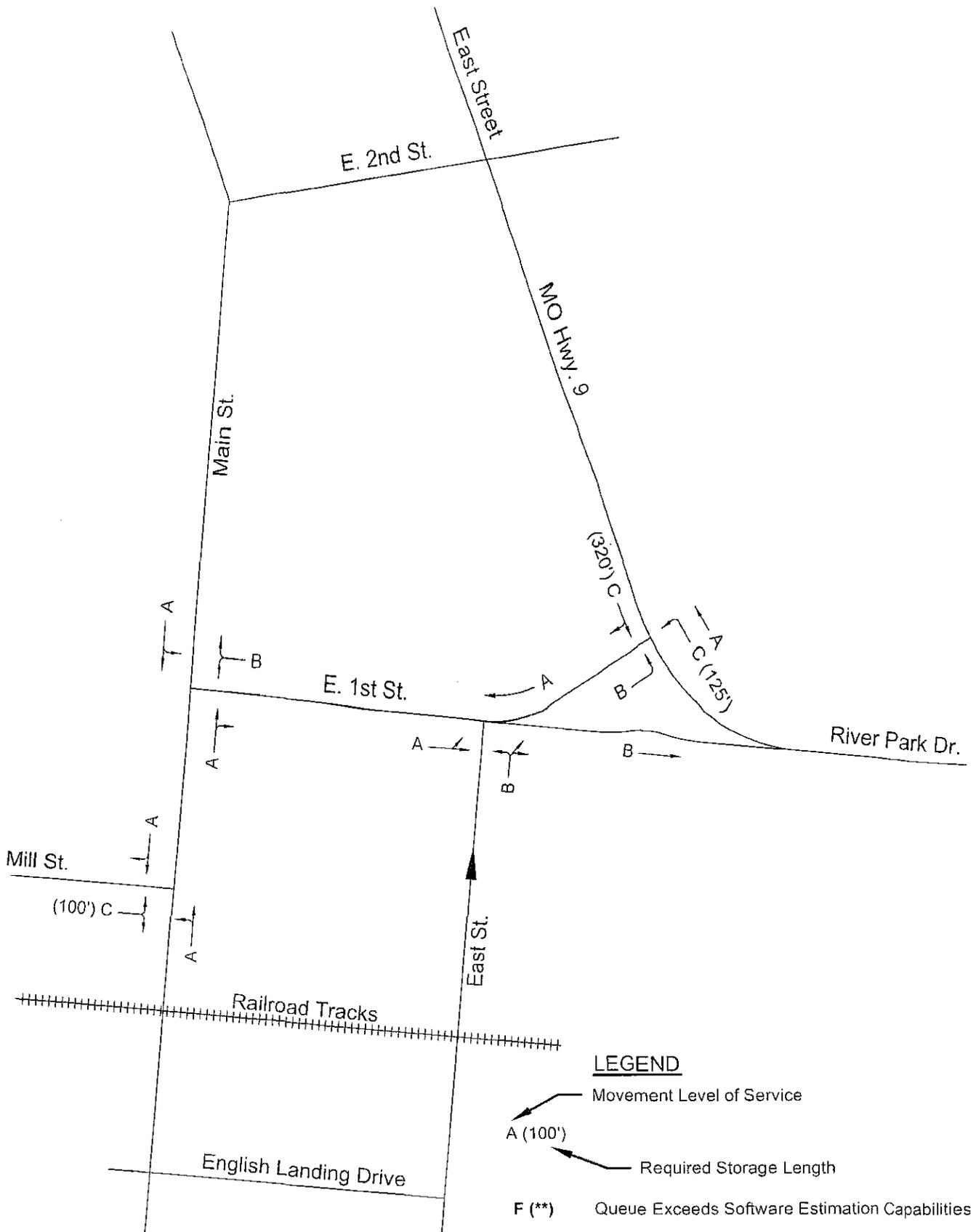


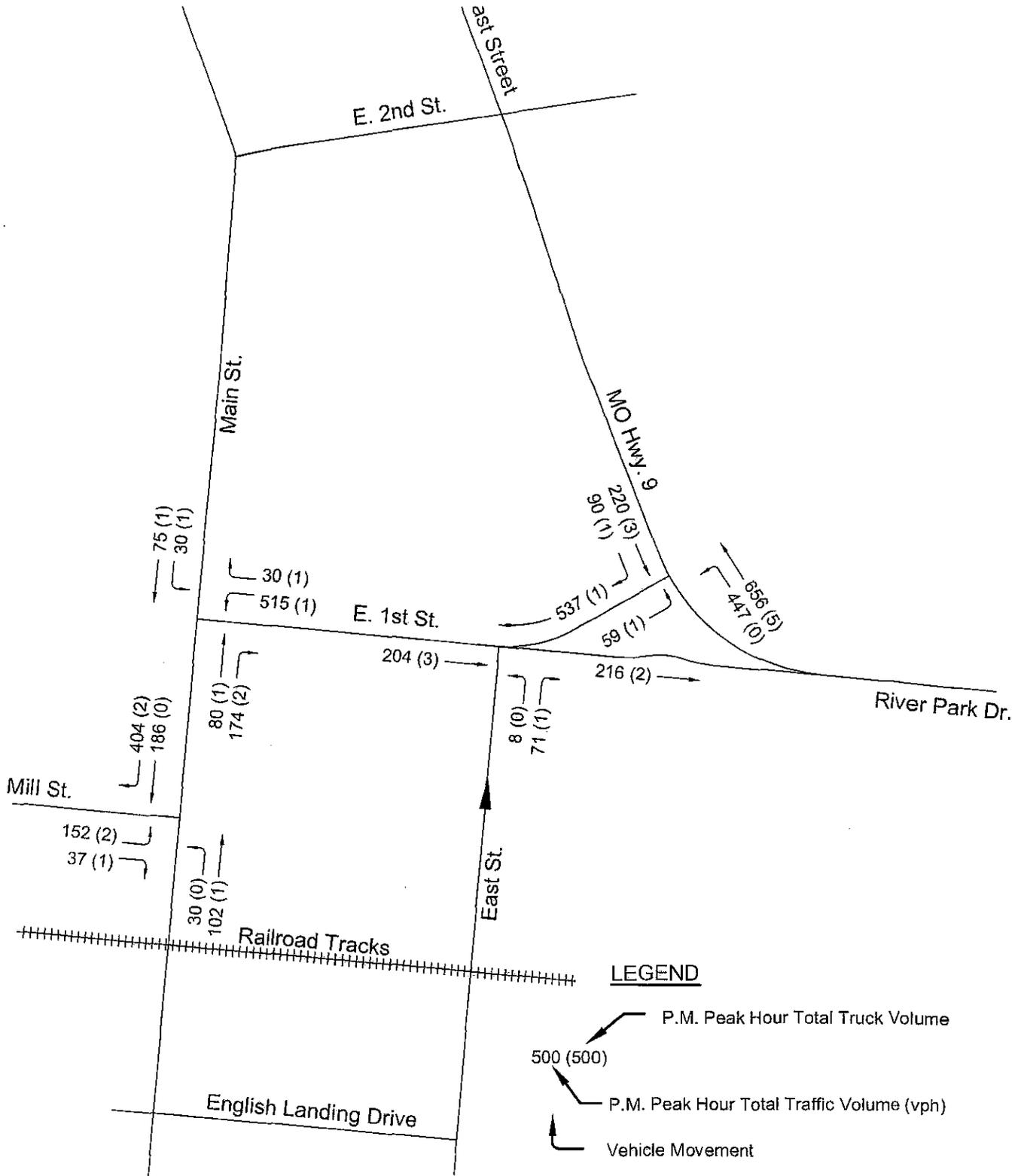


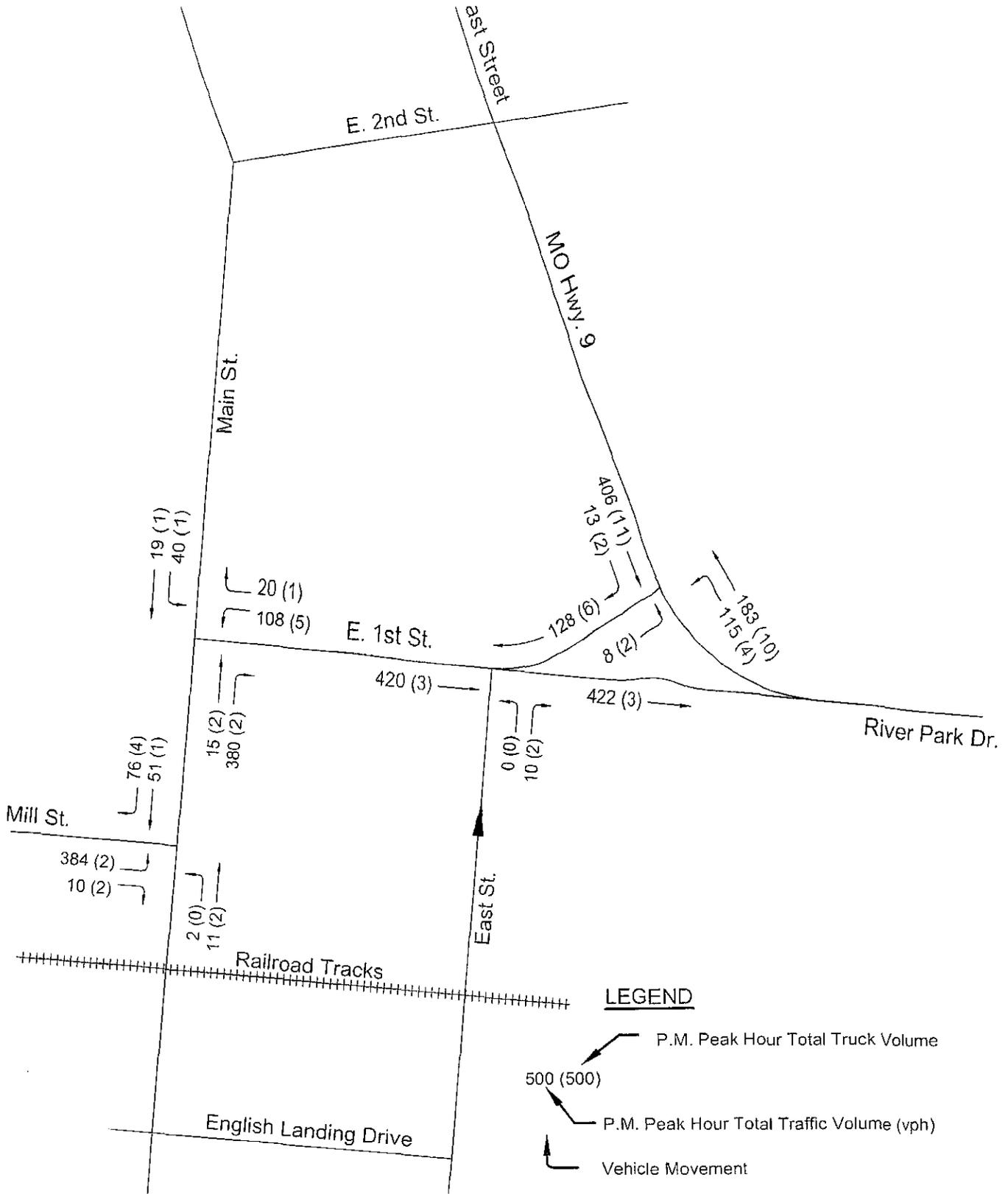


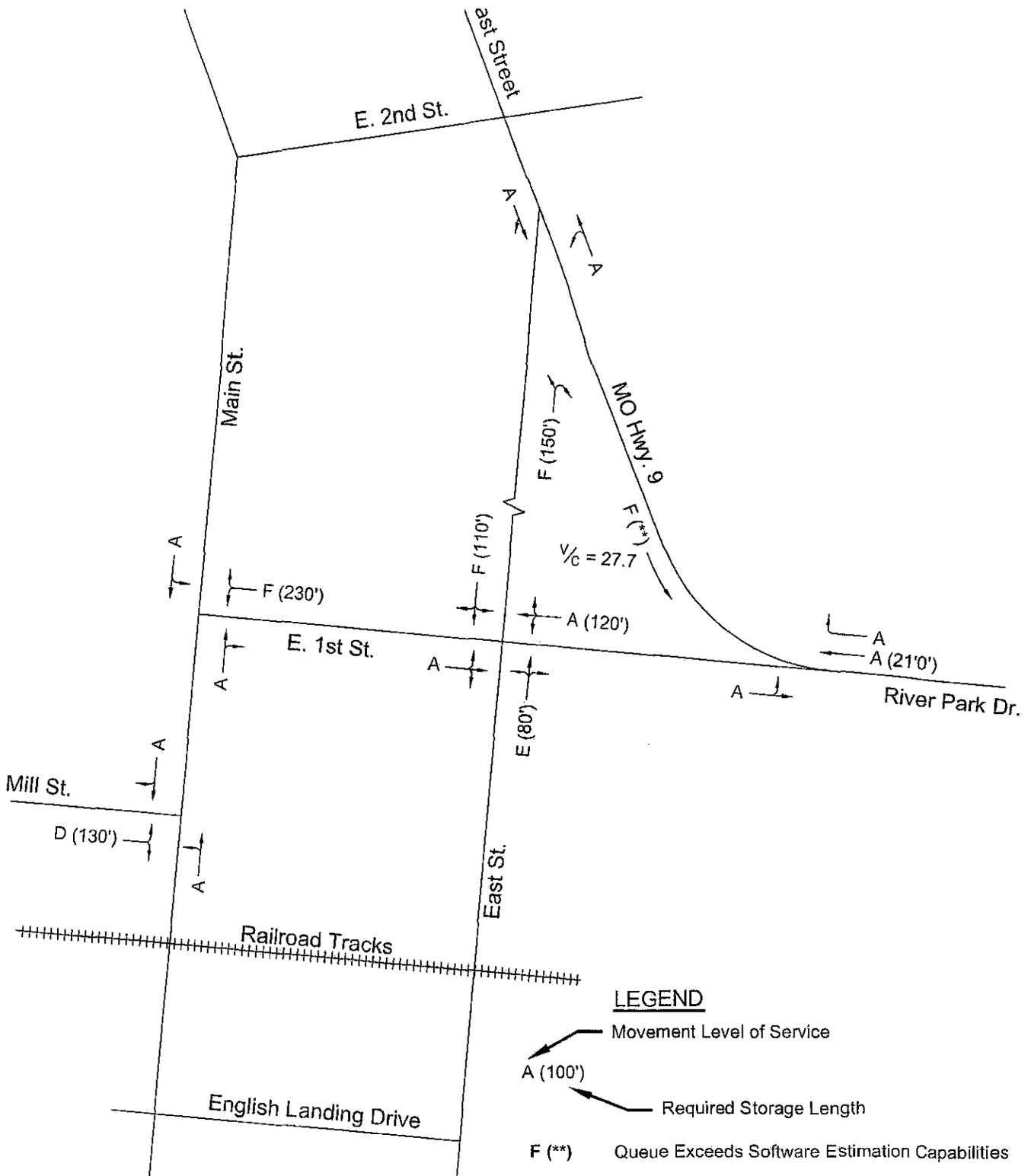
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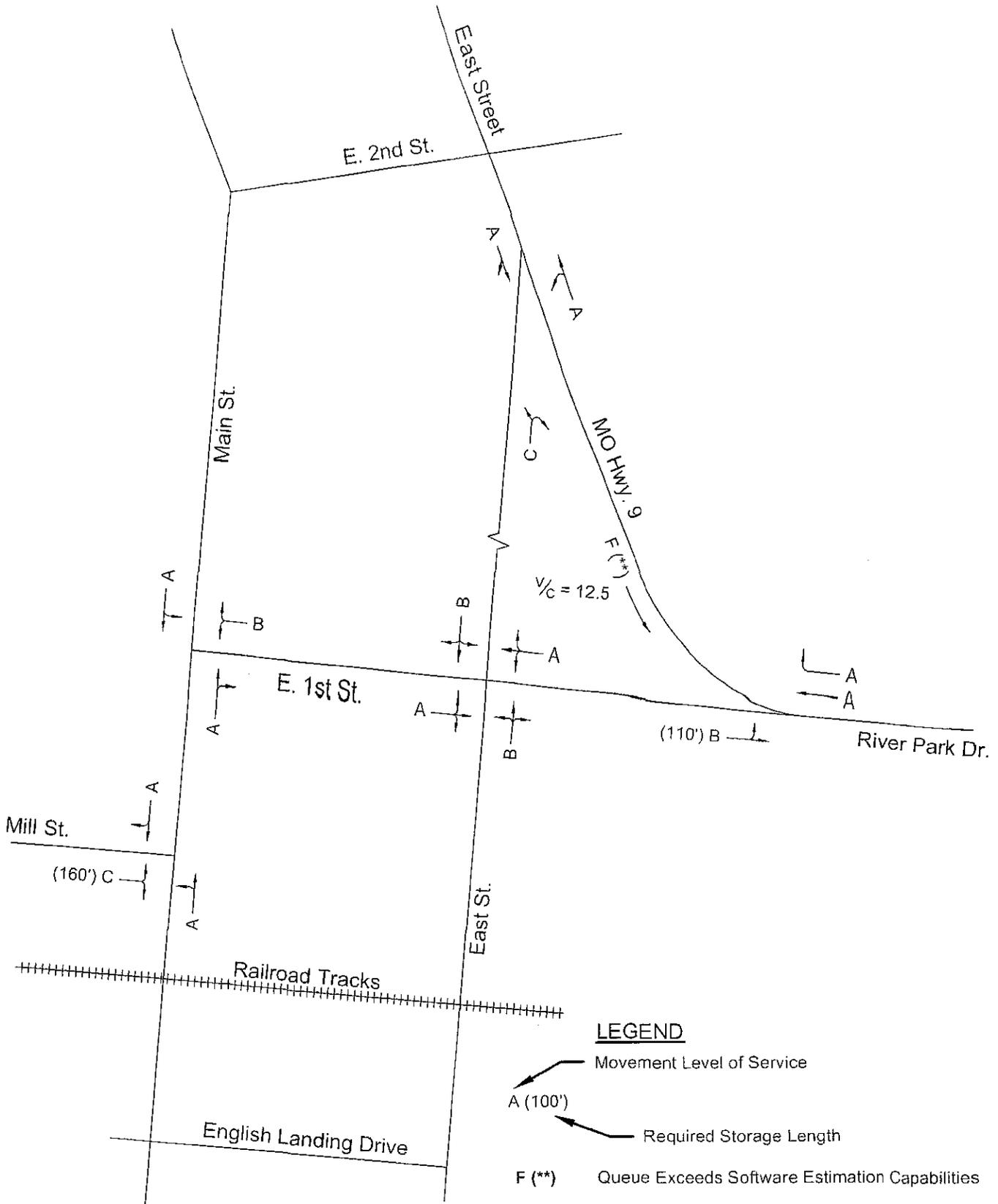
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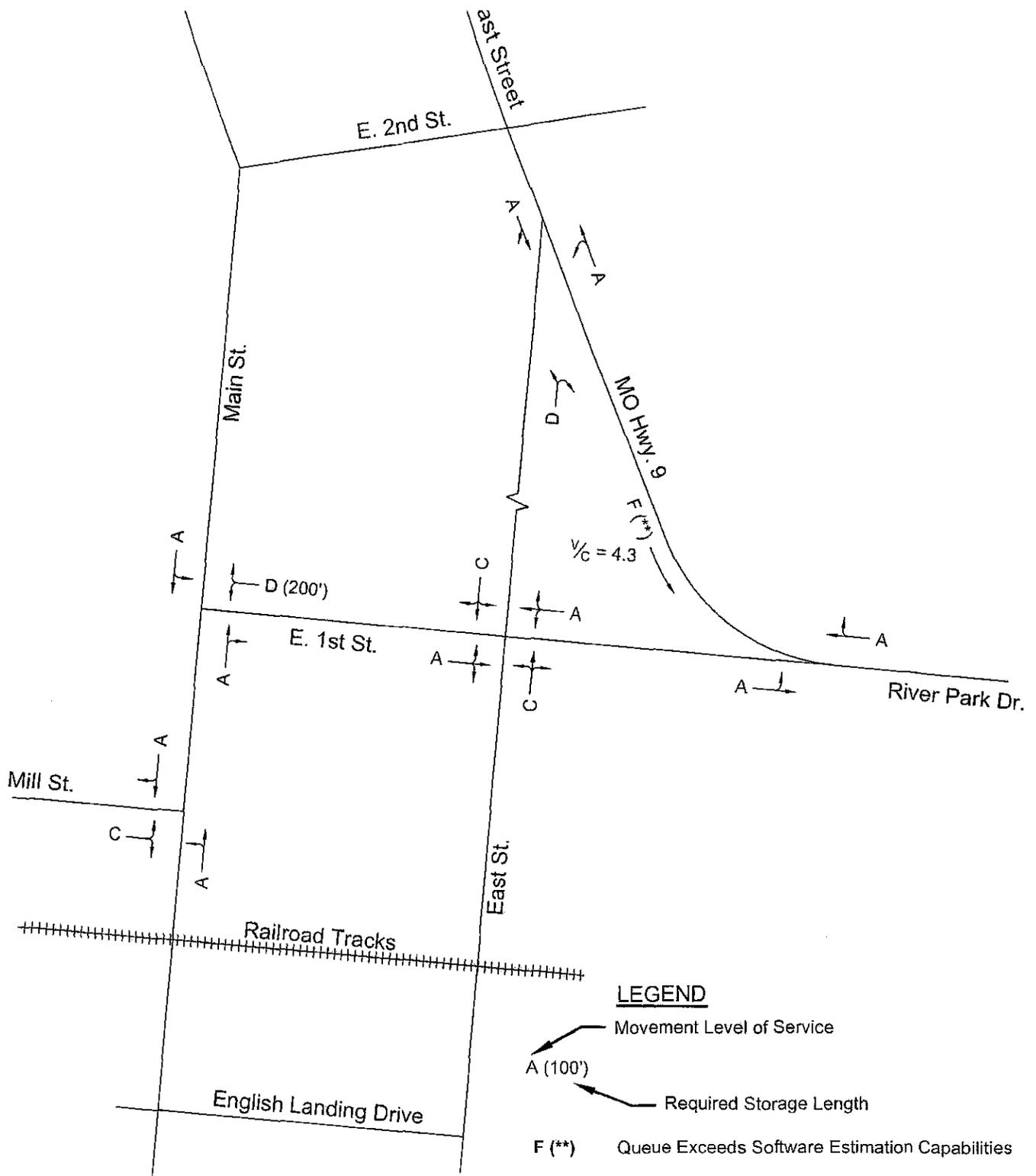


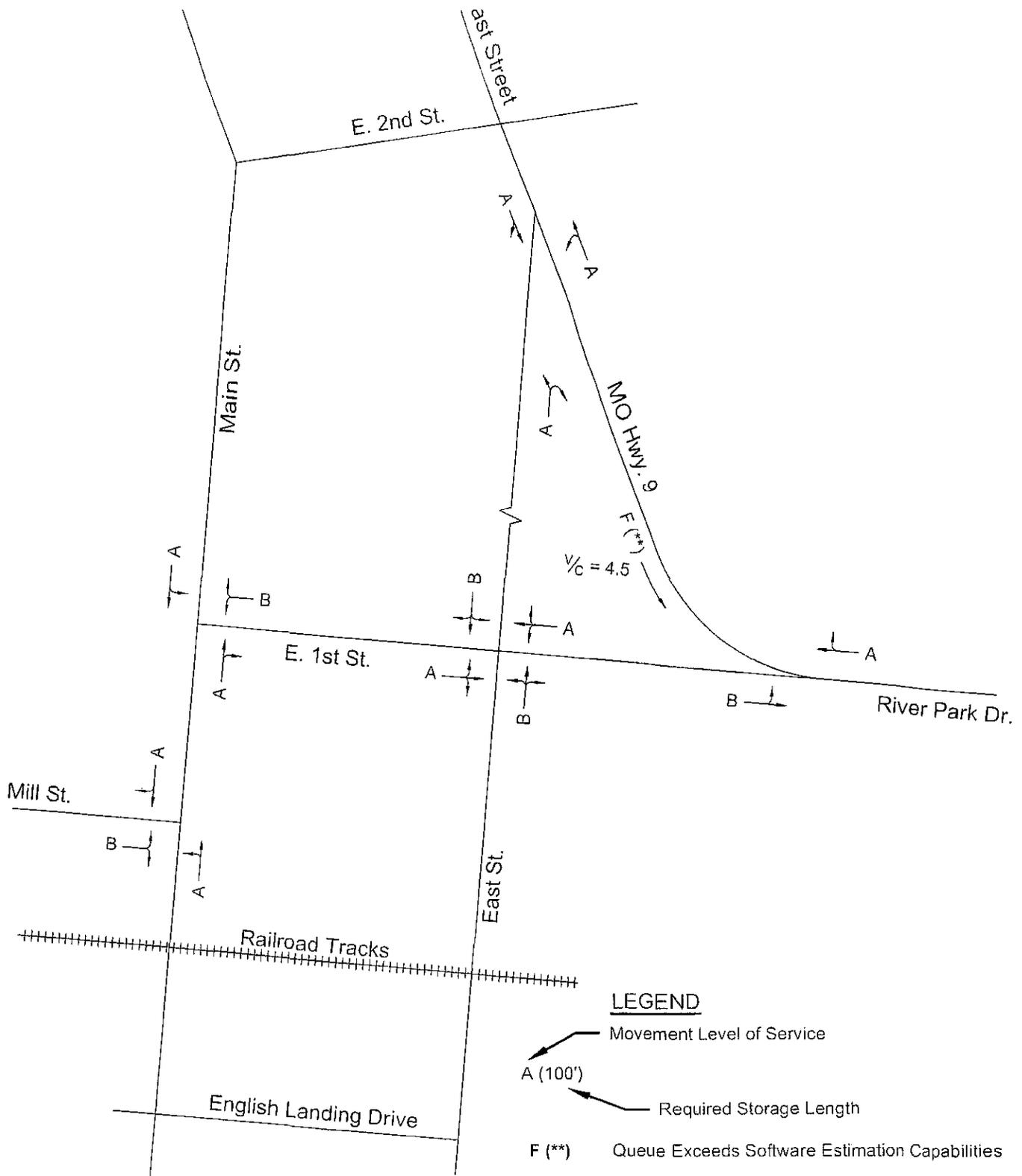


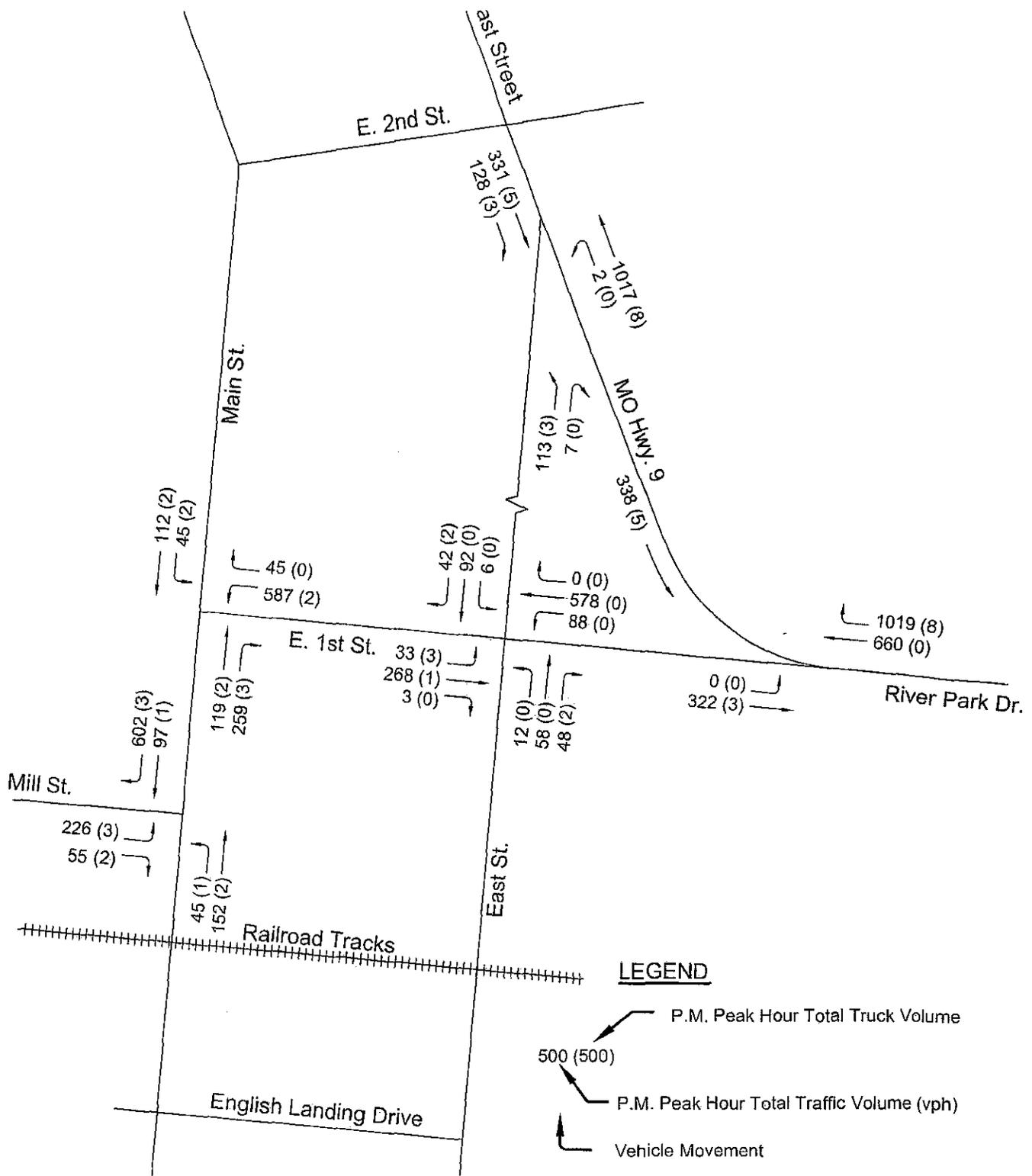


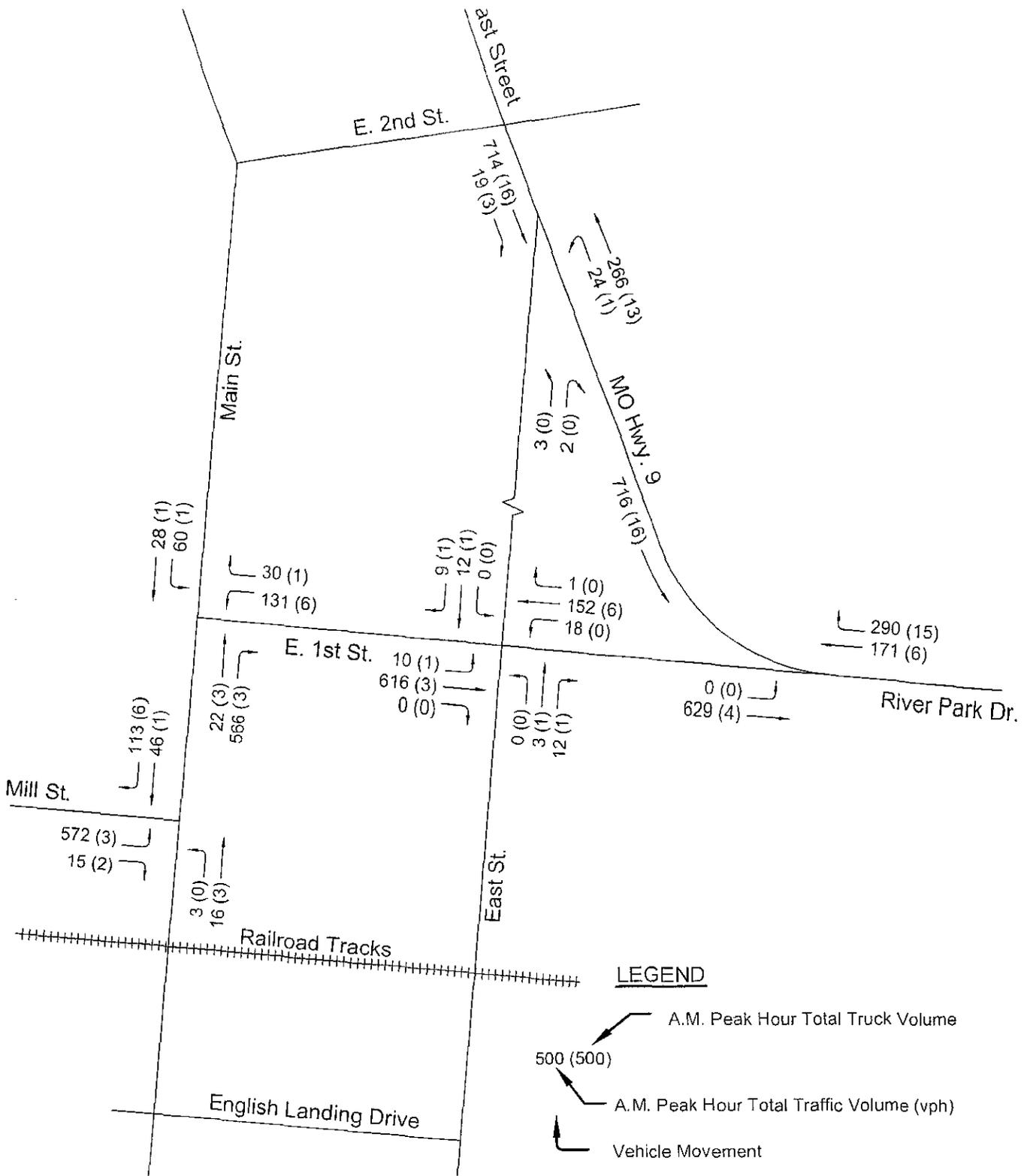


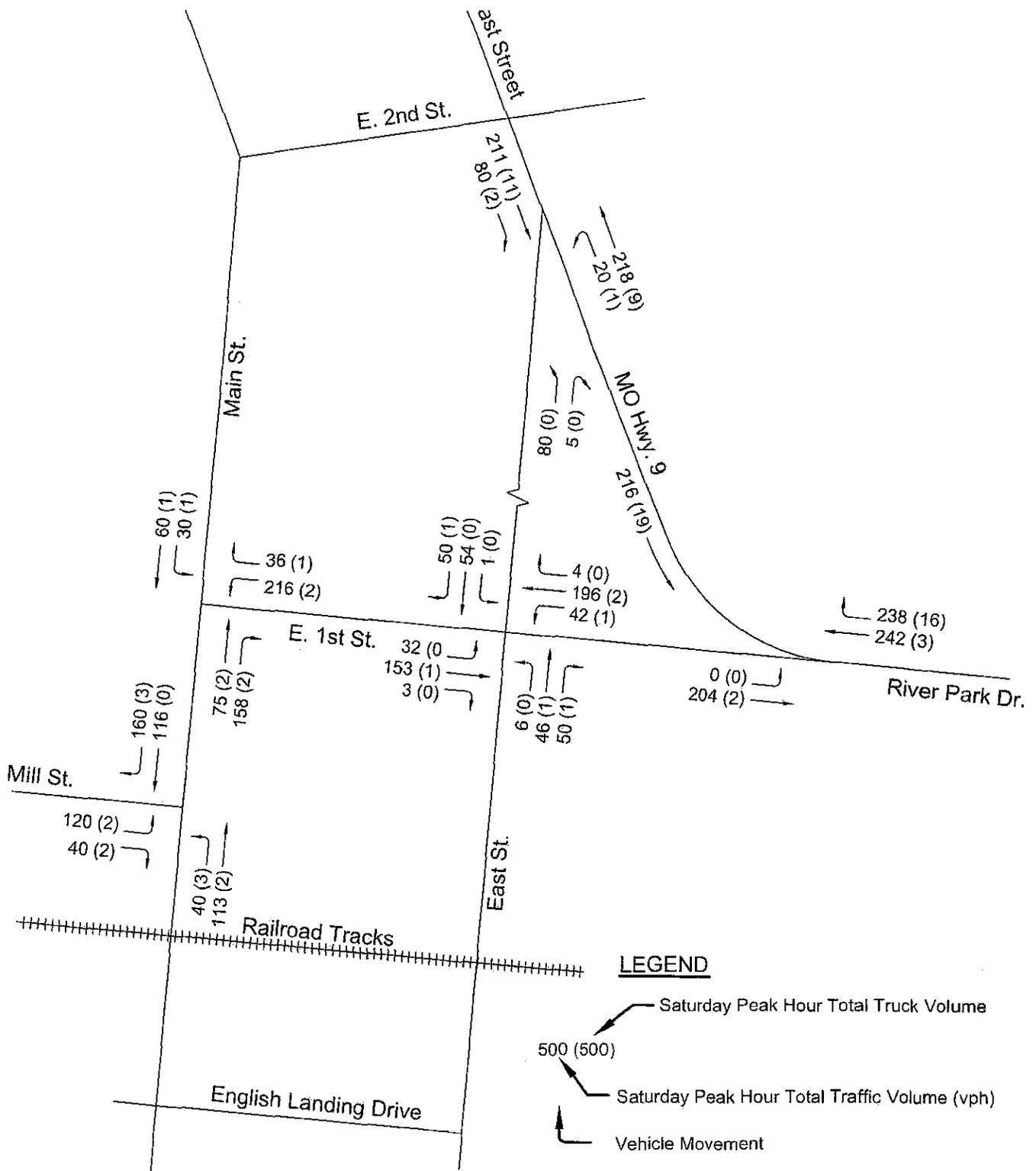


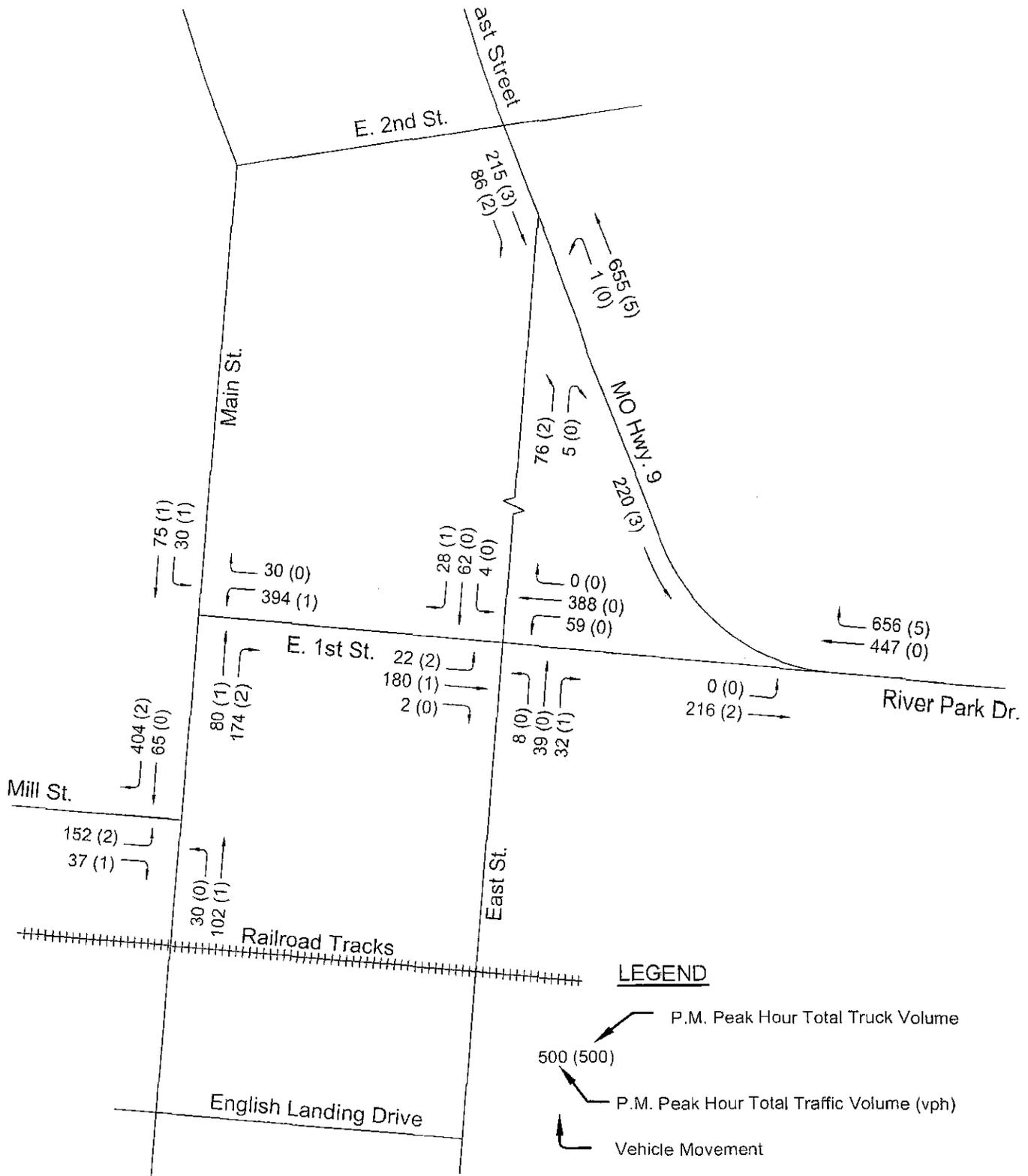


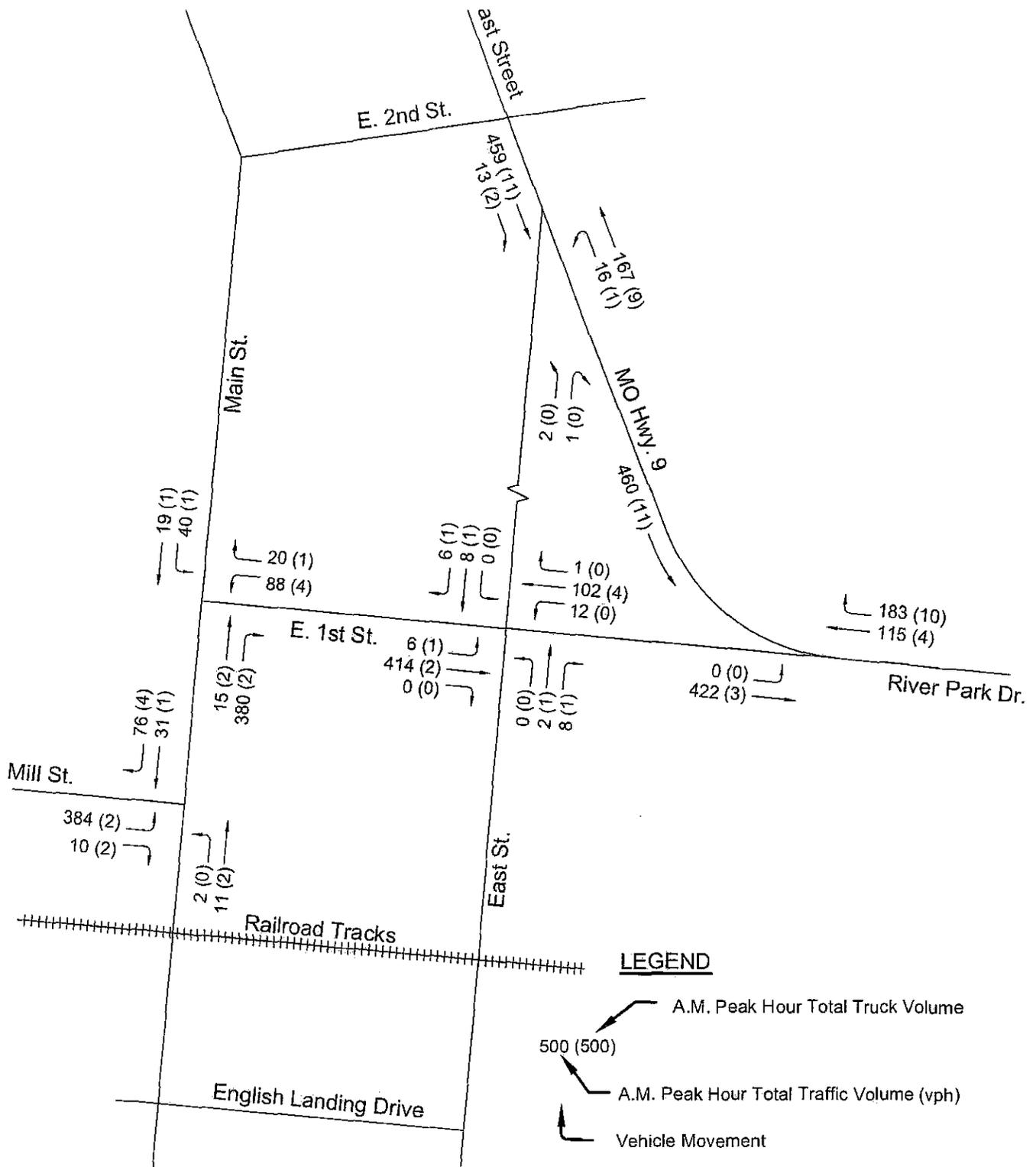


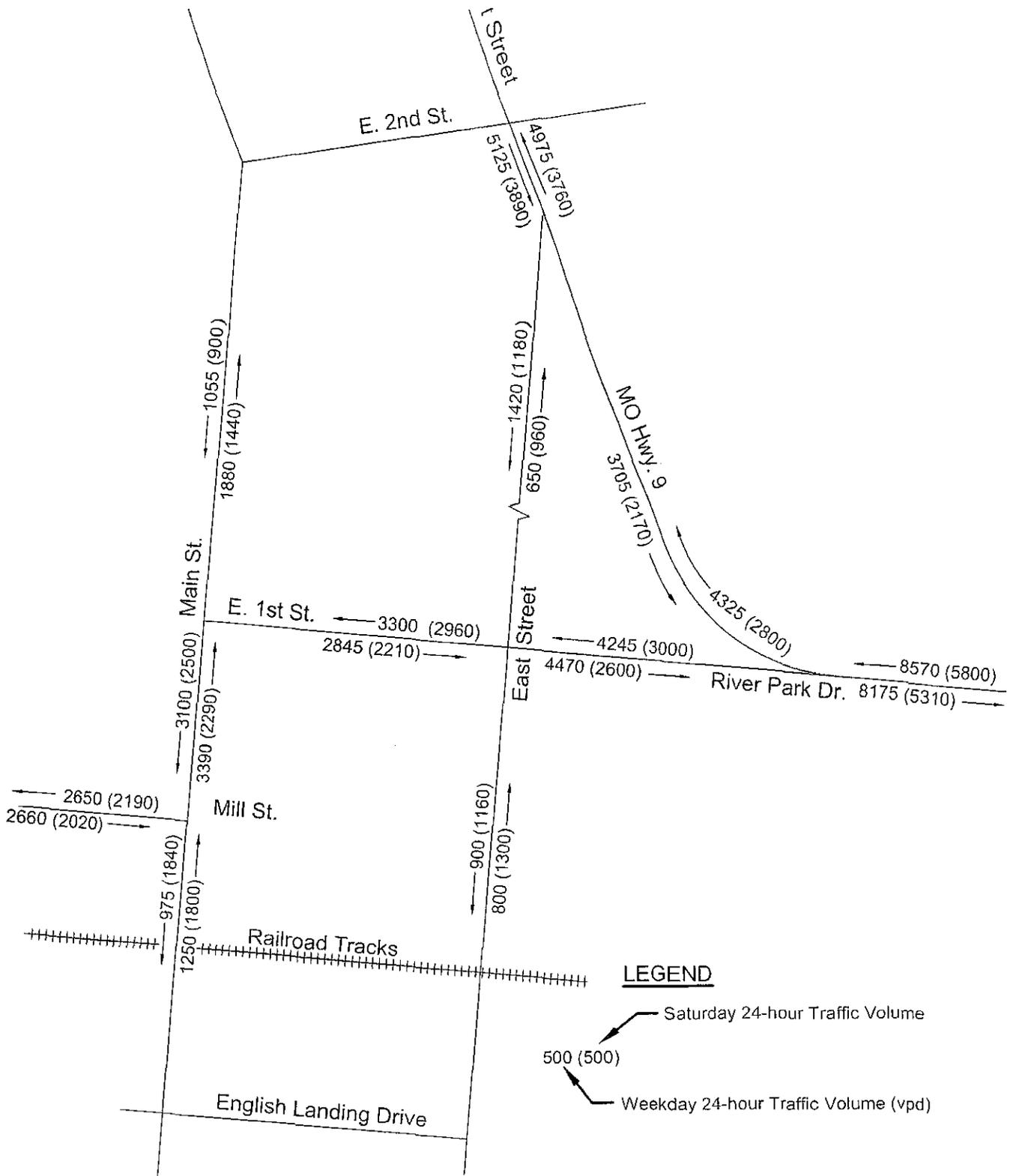






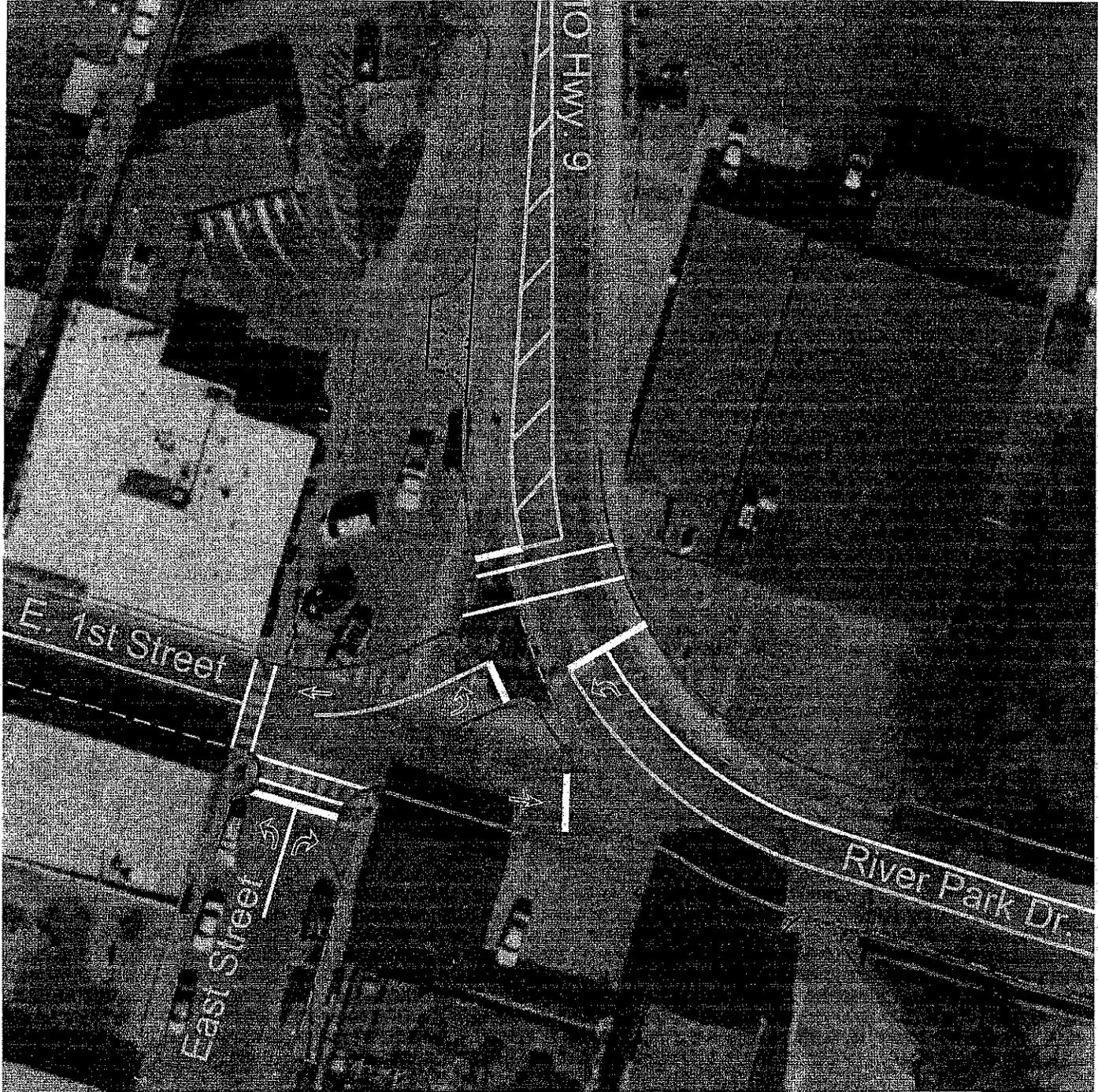






LEGEND

-  Saturday 24-hour Traffic Volume
-  Weekday 24-hour Traffic Volume (vpd)



LEGEND

- Existing Curb Lines
- Proposed Entrance
-  Proposed Curb Lines