TRAFFIC STUDY GUIDELINES

Clarksville Street Department

9/1/2009

Introduction

Traffic studies are used to help the city determine potential impacts to the operation of the surrounding roadway network. Two types of traffic studies are described in these guidelines including, Traffic Assessment and Traffic Impact Study. These studies are required by the City Code and Access Ordinance.

The reviewing agency is the Clarksville Street Department (CSD). Written recommendations will be provided from the Traffic Engineer or Street Department Engineering Manager to the Regional Planning Commission.

A Traffic Assessment (TA)is designed to be a preliminary look at the potential impacts of a new zoning request but requires only a limited amount of effort to produce. This study will assist the planning commission and the Street Department in determining the amount of potential impact that exists for a proposed zoning change.

A Traffic Impact Study (TIS) is a more detailed document, requiring additional investigation and analysis. The TIS is required at the time of construction plan approval. Both of these levels of study are described to assist a developer or consultant.

Both studies are required to be performed and stamped by a Licensed Professional Engineer with experience in Traffic Engineering.

Traffic Assessment Policy for Rezoning Applications

A Traffic Assessment should be required for all rezoning submittals if such rezoning request is equal to or exceeds the minimum acreage for the following zone districts, as listed below. Traffic Assessments may be required if determined by the City Street Department, Regional Planning Commission or City Council due to location of the site to be rezoned even if the thresholds described in this section are not met. **Table 1** shows the size for a site being rezoned that would require a Traffic Assessment.

The developer or land owner may request a waiver from the traffic assessment requirement in a written request to the planning commission. The City with input from the planning commission may waive the requirement based on engineering judgment or knowledge of the surrounding area.

Prior to conducting a Traffic Assessment, the Traffic Engineering performing the study shall meet with the CSD in a Scoping Meeting. The purpose of the meeting will be to determine the specifics of the study assumptions, including types of land uses to assume for trip generation, any access concerns, and availability of traffic counts.

Table 1 – Minimum Development Size Requiring a Traffic Assessment

ZONE DISTRICT BEING REQUESTED	MINIMUM ACREAGE OR UNITS
R-1/RM-1	70 ACRE
R-1A/RM-2	60 ACRE
R-2	42 ACRE
R-2D	13 ACRE OR 150 UNITS
R-3	13 ACRE OR 150 UNITS
R-4	5 ACRE OR 150 UNITS
MLUD	1 ACRE
PUD	13 ACRE OR 150 UNITS
E-1/EM-1	210 ACRE
E-1A/EM-1A	105 ACRE
C-1	NO REQUIREMENT
C-2	1 ACRE
C-3	1 ACRE
C-4	ANY REQUEST
C-5	1 ACRE
M-1	20 ACRES
M-2	50 ACRES

Source: Clarksville Street Department and Planning Commission
Note: Traffic Assessments may be required at the discretion of the Planning Commission and Street Department if they deem the project in an area of safety concern or high traffic congestion

Traffic Assessment is typically a short 3-5 page report and shall include the following sections:

- General Site Description
- Trip Generation
- Roadway Conditions and Access Potential
- Conclusions

General Site Description – This section should describe the size of the site requesting to be rezoned and details of the surrounding land uses and roadway access. This section should also state the specific zoning change requested including existing zoning of the property in question and the proposed zoning. If preliminary plans are known they can be presented here.

Trip Generation – This section should calculate the Average Daily Traffic, morning peak hour traffic and afternoon peak hour traffic that could potentially be generated by full development of the land use change. The maximum density allowed by the proposed zoning classification should be used when calculating the number of potential generated trips. The Traffic Engineering Professional conducting the study shall use information and procedures described in the book produced by the Institute of Transportation Engineers (ITE) Trip Generation, 8th Edition or latest edition.

Often the proposed or likely plans for development of this site may be substantially less than the full development allowed within the current zoning ordinance. This can be considered by the

Planning Commission and Street Department in their review of the information. However, the traffic assessment shall present at a minimum the trips generated by the maximum development allowed.

Table 2 shall be used to determine the appropriate land use to use for trip generation calculations. The Street Department may allow a lower generation rate if engineering judgment deems it reasonable.

Roadway Conditions and Access Potential – This section should determine the classification of all the roadwaya surrounding the site as defined by the City Access Ordinance found in the City Code. In addition, if requested by the CSD then a roadway segment level of service should be calculated using the methods described in the latest edition of the Highway Capacity Manual for two lane or multi-lane highways. Traffic volumes may be acquired from CSD or TDOT annual counts.

Table 2 – ITE Land Use Code to be used for zoning categories

ZONE DISTRICT BEING REQUESTED	ITE Lane Use Code
R-1/RM-1	210
R-1A/RM-2	210
R-2	210
R-2D	220
R-3	220
R-4	220
MLUD	**
PUD	220
E-1/EM-1	210
E-1A/EM-1A	210
C-1	814
C-2	820
C-3	820 and/or 932**
C-4	934 and/or 853**
C-5	814 and/or 932**
M-1	110
M-2	120

Source: Clarksville Street Department
*Note: ** TBD by CSD Traffic Engineer*

Any potential safety hazard or access concern should be identified. If requested by the CSD or Planning Commission, additional analysis may be required such as intersection LOS calculations or sight distance calculations. LOS calculations should again follow the procedures described in the Highway Capacity Manual. Sight distance should be calculated based on the approach speed on the adjacent road and procedures described in the AASHTO book, A Policy on Geometric Design of Highways and Streets for both intersection sight distance and stopping sight distance.

Conclusions – This section must offer an engineering opinion of the ability of the surrounding street network to support the potential traffic generated by the proposed land use change.

Other traffic studies may be required if determined by the City Street Department, Regional Planning Commission or City Council including but not limited to Signal Warrant Analysis, Speed Study or Signalized Intersection Level of Service. Additional studies may be required at the development phase (preliminary plat/site plan) as well.

Traffic Impact Study Requirements and Procedures

Traffic Impact Studies are performed to determine the impacts of development proposals on the transportation network and to present measures for mitigating those impacts. The study assists the City's planners, public works department and reviewers in evaluating appropriate land uses, intensities, and mitigation measures for a project based on the impacts to the transportation system in the area. Based on this evaluation recommendations to the transportation network in the vicinity of the project site can be analyzed to ensure adequate mobility will be maintained after the proposed development is constructed.

The Traffic Impact Study shall be prepared under the supervision of a professional engineer registered in the State of Tennessee with specific training and experience in traffic engineering. The cover page should be stamped by the licensed engineer responsible for all of the work presented in the report.

The Traffic Impact Study should fully document the methodologies, findings, conclusions and recommendations of the study, including the basis for all assumptions and traffic parameters utilized. The report should be presented in a logical format which includes tables and figures in order to clearly and accurately convey the data, analysis, and results of the study. These guidelines provide a general framework on which a Traffic Impact Study should be based. All Traffic Impact Studies should utilize and reference the appropriate data sources, tables, figures, and analysis worksheets.

Level of Traffic Impact Study

The following conditions will require a Traffic Impact Study:

- New developments that will generate over 1,000 Average Daily Trips (ADT) or over 100 trips per peak hour. The trip generation should be calculated based on the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.
- In situations when a project site is within a congested area, near or within an area of high growth or near an intersection with a high number of crashes, the City may decide that a study is necessary. This condition is determined by the CSD.
- If a smaller portion of a larger development is submitted, the City may require a study based on the size of the larger project. This condition is determined by the CSD.

The amount of traffic expected to be generated by the new development will determine the level of study required. The level of study required is detailed in **Table 3**. As shown, a Level I study is required if the expected ADT is over 500 but less than 3,000. A Level II study is required for a project with an expected ADT of over 3,000 but less than 6,000 and a Level III study is required for all projects with an expected ADT of over 6,000.

Table 3 - Level of Traffic Impact Study Required

Level of Study	Criteria	Study Area
I	<3,000 ADT	All site access points, adjacent roadways, and major intersections. All signalized intersections on each street serving the site within ¼ mile.
II	3,000<6,000 ADT	All site access points, adjacent roadways, and major intersections. All signalized and major unsignalized intersections on each street serving the site within ¼ mile.
III	>6,000 ADT	All site access points, adjacent roadways, and major intersections. All signalized and major unsignalized intersections on each street serving the site within ½ mile.

Source: Clarksville Street Department

Waiver for Traffic Impact Study

The CSD, with input from the Planning Commission, may grant a waiver for a Traffic Impact Study if the applicant shows that the impact of the development on the transportation network is insignificant. A waiver may also be granted if the CSD and the applicant agree that the impacts of the traffic generated by the development are negligible. The waiver request shall be made in writing and shall include the data and analysis necessary to support the request. If a waiver is granted, the CSD will notify the applicant in writing.

Scope of Traffic Impact Study

Before beginning a Traffic Impact Study, the traffic engineering professional performing the study must meet with the CSD to determine the scope of the study. The scoping meeting should be set up with the CSD's Traffic Engineer or Engineering Manager. The CSD will work with the developer's consultant to determine the appropriate parameters and assumptions for the study.

The following items should be discussed in the scoping meeting:

- The level of detail needed for the study
- Identification of study area and key intersections
- Trip generation data to be used
- Assumptions for pass-by and internal trip reductions
- Any roadway improvement projects in the vicinity of the site
- Approved, but unconstructed development projects to be included in the study
- Assumptions for background growth
- Analysis periods and the typical peak hours for the proposed land use
- Consideration of pedestrian and bicycle accommodations
- Analysis software to be used

The minutes of the scoping meeting shall be prepared by the traffic engineering professional performing the study. The minutes shall be submitted to the CSD's Traffic Engineer. Approval from the CSD's Traffic Engineer shall be obtained prior to initiating the Traffic Impact Study.

Field Data Collection

Manual peak hour traffic volumes should be collected at the intersections within the study area. The count data must be no more than 24 months old. A Traffic Impact Study will also require field data collection. The required data to be collected include sight distance measurements, posted speed limit, identification of bicycle and pedestrian facilities, lane usage and lane width for roadways and intersections. Also, the functional classification of the roadway should be identified. In addition, driveways across from or adjacent to the site should be located. Finally, the traffic control at intersections should be identified as well as traffic signal phasing and timings.

Traffic Impact Study Report Requirements

The Traffic Impact Study shall address the following information:

I. Project Description

a) Describe the purpose and objectives of the study.
b) Describe the specific location of the project and include an area map locating the project site.
c) Identify the current zoning of the site and if the site must be rezoned in order for the proposed development to be constructed.
d) Describe the current development on the site, if any, and the proposed use for the project site.
e) Identify the size of the project site and the size of the proposed development, i.e. if residential, the number and type of dwelling units; if retail, the square footage, etc. Include a detailed site plan for the proposed project.
f) Identify the specific location of all project accesses, including proposed roads and driveways. The distances between adjacent driveways, as well as the distances from existing intersections, shall be specified.
g) Identify the size of each phase of development if it will be developed in more than one phase. The proposed timing for the development of phases should be specified.

II. Existing Setting

a) Describe all roadways located within the study area, including the number of lanes, lane usage at intersections, lane widths, roadway classification, and speed limit. Identify if sidewalks and bike facilities are present. The study area will be determined by the scoping meeting and will be documented in the meeting minutes.
b) Describe all intersections within the study area including the type of traffic control device, traffic signal phasing if applicable, and the lane usage for each approach.

III. Existing Traffic Volumes

a) Specify the time and location for all manual traffic counts.
b) Identify the specific AM and PM peak hour determined by the traffic counts.
c) Show the existing turning movement peak hour traffic volumes on a figure. (See Figure 2 in Appendix)
d) Provide any 24-hour traffic count information in a table.

IV. Evaluation of Current Traffic Operations

a) Perform capacity analysis for the roadway segments and intersections using the current Highway Capacity Software (HCS+), or equivalent software package.

b) List the Level of Service (LOS) for the overall intersection for signalized intersections and the LOS for all critical turning movements for unsignalized intersections.
c) The LOS calculations should be based on the latest version of the Highway Capacity Manual. Acceptable software programs for conducting capacity analysis are the latest version of the McTrans Highway Capacity Software (HCS+ or latest version), SIDRA and Synchro. In addition, use of software packages such as Sim Traffic, CORSIM, Passer 2, Passer 3, Transyt 7F or Synchro that performs traffic signal coordination or micro-simulation may be required in addition to the capacity analysis software in order to evaluate traffic operations. Any other software to be used in any analysis must be approved by the CSD Traffic Engineer prior to submittal of the report.

V. VI. Background Traffic Operations

a) Typically a growth rate should be applied to existing volumes to obtain background traffic conditions for the study horizon year (the build-out year of the proposed project). The growth rate to be used should be based on historical traffic count information, with additional consideration given to the likelihood for future growth in the study area. The historical traffic growth rate can be based on ADT counts located in the vicinity of the project. The background growth rate should be pre-approved by the CSD's Traffic Engineer.
b) Based on the expected build-out of the project, apply the growth rate to the existing peak hour traffic volumes for each year of the expected build-out time.
c) Show the background peak hour traffic volumes on a figure. (See Figure 3 in Appendix)
d) Include peak hour traffic assignments for any approved, but unconstructed projects that will result in traffic increases on the roadways and intersections within the study area.
e) Show the peak hour traffic assignments for the approved, but unconstructed projects on a separate figure. Where applicable these traffic assignments should be added to the background peak hour traffic volumes to obtain total background peak hour traffic volumes. These total background traffic volumes should be shown on a separate figure.

VI. Trip Generation

a) Determine the daily, AM, and PM peak hour trip generation for the project based on the trip generation data listed in the latest edition of the ITE Trip Generation.
b) Show the trip generation calculations for each proposed land use and for all phases of the project.
c) Determine if the proposed land uses justify the inclusion of pass-by and/or internal trip reductions. Document all assumptions, calculations and conclusions.
d) Use the latest edition of the ITE Trip Generation Handbook, to determine the percentage of trips to be reduced for pass-by and/or internal trips.

e) Present the results of the trip generation in a table.

VII. Trip Distribution

Determine the directional distribution of the new trips generated by the proposed project. The directional distribution should be based on the gravity model or other acceptable trip distribution model, counts at a similar, nearby location, or analysis of population and employment data within the influence area of the project.

a) If the proposed project is a mixed-use development, each land use may justify a separate trip distribution.
b) Include figures showing the directional distribution for each land use and/or phase. (See Figure 4 in Appendix)
c) Trip distribution percentages shall be submitted and approved prior to initiation of any capacity or level of service analysis

VIII. Traffic Assignment

a) Based on the directional distribution and the trip generation calculations, determine the traffic assignment for the proposed project.
b) Include the traffic assignment for each land use and/or phase on separate figures. (See Figure 5 in Appendix)
c) If pass-by traffic is assumed, include a figure showing the pass-by traffic assignment. The percentage of pass-by trips must be pre-approved by the City's Traffic Consultant.
d) As identified above, the traffic assignment for each land use and/or phase should be presented on a separate figure. Also include the total traffic assignment generated by the entire proposed project on a figure. This figure should be labeled "Total Site Generated Traffic."

IX. Analyses of Projected Peak Hour Traffic

a) Include a figure showing the projected peak hour traffic volumes based on the background peak hour traffic volumes plus the total site generated traffic volumes. (See Figure 6 in Appendix)
b) Determine the LOS for roadway segments and intersections during the AM and PM peak hours, based on the existing roadway geometrics and traffic control.
c) The results of the capacity analyses should be presented in a tabular format showing LOS and delay for each approach and critical movement. The LOS should be shown for each critical turning movement for unsignalized intersections.
d) Utilize the capacity analyses to determine if any improvements are required to obtain a minimum LOS D for signalized intersections. In addition, all movements should be maintained at LOS E or better.

e) For any unsignalized intersections operating at LOS E or F, determine if there are feasible measures to improve the traffic operations to LOS D or better.
f) Use M.D. Harmelink's Volume Warrants for Left-Turn Storage Lanes at Unsignalized Intersections found in the TDOT Roadway Design Guidelines to determine if left turn lanes are needed at unsignalized intersections.
g) Evaluate and discuss the need for right turn deceleration lanes at intersections and driveways within the study area.
h) Determine the LOS for roadway segments and intersections, for the projected conditions with the recommended improvements.
i) The results of the capacity analyses with the recommended improvements should be presented in a table.
j) Evaluate whether or not the proposed site plan design conforms to the City's Access Ordinance, as well as the design requirements of the Subdivision Regulations. If certain design parameters do not meet the City requirements, assess the feasibility and desirability of conforming to the access requirements.
k) Address any sight distance issues based on the intersection sight distance and stopping sight distance as described in the AASHTO book, A Policy on Geometric Design of Highways and Streets.
l) If the land use is such that trucks will be utilizing the project accesses, evaluate the truck turning radii based on the turning radii listed in the AASHTO's, A Policy on Geometric Design of Highways and Streets. In most cases the WB-50 will be the size truck that should be used for the analyses. Clearly state all assumptions for truck access and truck sizes.
m) If a signal is proposed for an intersection, signal warrant analyses must be performed using the volume-related signal warrants listed in the latest edition of the Manual on Uniform Traffic Control Devices.

X. Conclusions and Recommendations

a) Identify any recommended roadway improvements, including roadway widening, left turn lanes, right turn deceleration lanes, new roadway connections, turn lane extensions, etc. Specify turn lane storage lengths, taper and transition lengths, and lane widths.
b) Include any modifications to existing or additions of new traffic control devices.
c) Include a list of site access evaluations and recommendations.
d) Include recommended improvements to pedestrian and bicycle facilities.
e) Include improvements that are scheduled to be performed by the city, state, or county. Clearly identify the funding sources for these improvements.
f) Timing for the completion of the recommendations should be stated. This timing should be based on logical construction phasing and when improvements are needed.
g) Include the recommendations on a figure which clearly illustrates the necessary improvements. This figure should be a scaled drawing that demonstrates the feasibility of all recommended improvements. (See Figure 7 in Appendix)

XI. **Appendices**

a) Include all manual peak hour traffic counts and any 24-hour counts conducted.
b) Include the capacity analyses worksheets.
c) Include trip generation worksheets.
d) Include all calculations for pass-by and internal trip reductions.
e) Include left turn lane warrant analyses.
f) Include any turning radii analyses.
g) Include any other information needed to support the analyses performed in the Traffic Impact Study.

Traffic Impact Study Report Outline

The Traffic Impact Study should follow the following outline:

EXECUTIVE SUMMARY

1. Site Location and Study Area
2. Development Description
    a. Land Use and Intensity
    b. Site Plan/Subdivision Plat
    c. Zoning
    d. Phasing and Development Plan
3. Planned Public or Private Transportation Improvements
4. Findings
5. Conclusions and Recommendations

I. INTRODUCTION

A. Purpose of Report
B. Study Objectives

II. PROJECT DESRIPTION

III. EXISTING SETTING

A. Regional and Local Access
    1. Area Roadway Network
    2. Intersections within Study Area
    3. Existing Traffic Volumes and Conditions
    4. Transit Service
    5. Bicycle and Pedestrian Facilities

IV. PLANNED PUBLIC OR PRIVATE TRANSPORTATION IMPROVEMENTS

A. Description of Improvements
B. Responsible Party for Improvements
C. Timing for Improvements

V. BACKGROUND TRAFFIC VOLUMES

A. Historical Growth Rate
B. Non-site Traffic for Other Approved Developments in Study Area
    1. Method of Projections
    2. Traffic Assignment

VI. PROJECTED TRAFFIC

A. Site Traffic
    1. Trip Generation (New Trips, Pass-by Trips, Internal Trips)
    2. Trip Distribution and Assignment
        a. New Trip Distribution
        b. Pass-By Trip Distribution
        c. Modal Split
        d. Trip Assignment
B. Total Future Traffic (Total Traffic Conditions, including background and project traffic)

VII. TRAFFIC ANALYSIS

A. Site Access (Median Openings, Driveway Spacing, Left and Right Turn Deceleration Lanes, Throat Lengths, Queue Analysis)
B. Capacity and Level of Service at Study Roadways and/or Intersections
C. Traffic Signal Warrant Analyses
D. Traffic Safety (Qualitative Site Observations and Future Conditions Issues)
E. Sight Distance (Based on Field Observations and Measurements)
F. Site Circulation and Parking (Automobile and Truck Access and Circulation)
G. Pedestrian and Bicycle Accessibility
H. Improvements Needed to Accommodate Site Traffic, Status of Improvements Already Funded, Programmed or Planned (Capital Improvement Programs and Transportation Improvement Programs)
I. Schedule of Needed Improvements

VIII. CONCLUSIONS & RECOMMENDATIONS

A. Summary of Analysis
B. Summary of Needed Improvements
C. Schedule of When Improvements Will Be Needed

IX. TYPICAL FIGURES

A. Project Location
B. Existing Peak Hour Traffic Volumes (all intersections to be shown on one figure)
C. Background Peak Hour Traffic Volumes (all intersections to be shown on one figure).
D. Directional Distribution of Traffic Generated by the Site (distribution should be carried through all intersections within study area)
E. Assignment of Traffic Generated by the Site (assignment should be carried through all intersections within study area)

F. Total Projected Peak Hour Traffic Volumes (all intersections to be shown on one figure)
G. Recommended Roadway and Traffic Control Improvements (Drawn to Scale)

X. TYPICAL TABLES

A. Existing Peak Hour Levels of Service
B. Background Peak Hour Levels of Service
C. Trip Generation of Proposed Site
D. Projected Peak Hour Levels of Service With Existing Geometries & Traffic Control
E. Projected Peak Hour Levels of Service With Recommended Improvements
F. Traffic Signal Warrant Analysis

XI. TYPICAL APPENDICES

A. Traffic Counts
B. Capacity and Level of Service Analysis Worksheets
C. Historical and Background Growth Data
D. Trip Generation Calculations
E. Additional Volume Figures (If needed)
F. Left Turn Lane Calculations

8. Submission and Review of Traffic Impact Study

Three (3) copies of the Traffic Impact Study should be submitted to the Clarksville Street Department together with the development plans. **The Traffic Impact Study must be sealed and signed by the professional engineer responsible for the preparation of the study.**

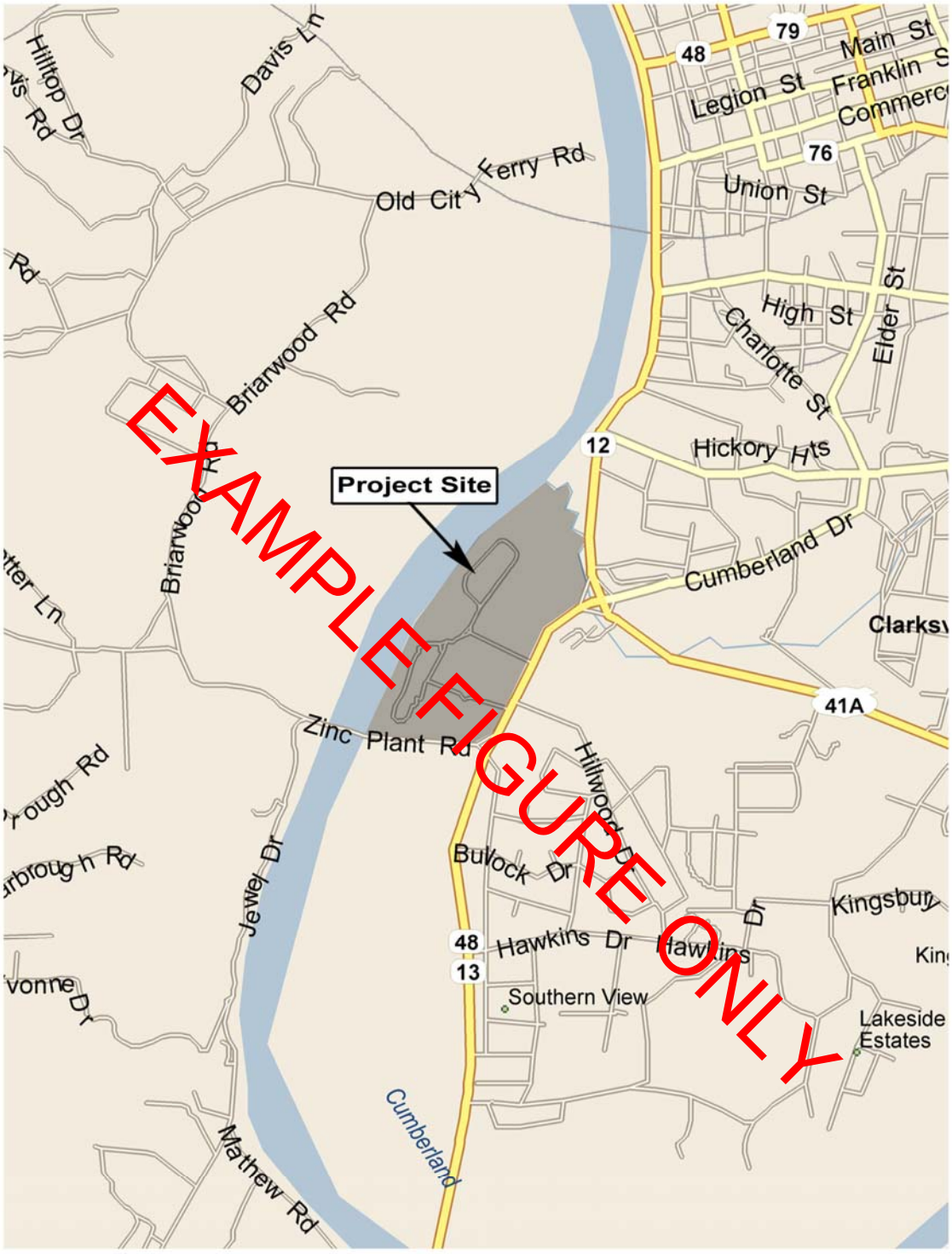
The City of Clarksville and the City's Traffic Consultant will review the Traffic Impact Study with the development plat/site plan submittal. If the Traffic Impact Study does not contain all the information discussed in the scoping meeting, the applicant will be notified, and a revised study will need to be submitted. The CSD Traffic Engineer will review the study within 15-days or submittal.

After reviewing the completed Traffic Impact Study, the CSD's Traffic Engineer will provide written comments to the Regional Planning Commission Office.

If the proposed development's land use or size is significantly altered after the CSD has reviewed the Traffic Impact Study, the study will need to be revised to address the changes. If the development is not constructed within two years, the study will need to be revised to include updated traffic count data and other transportation related changes in the study area.

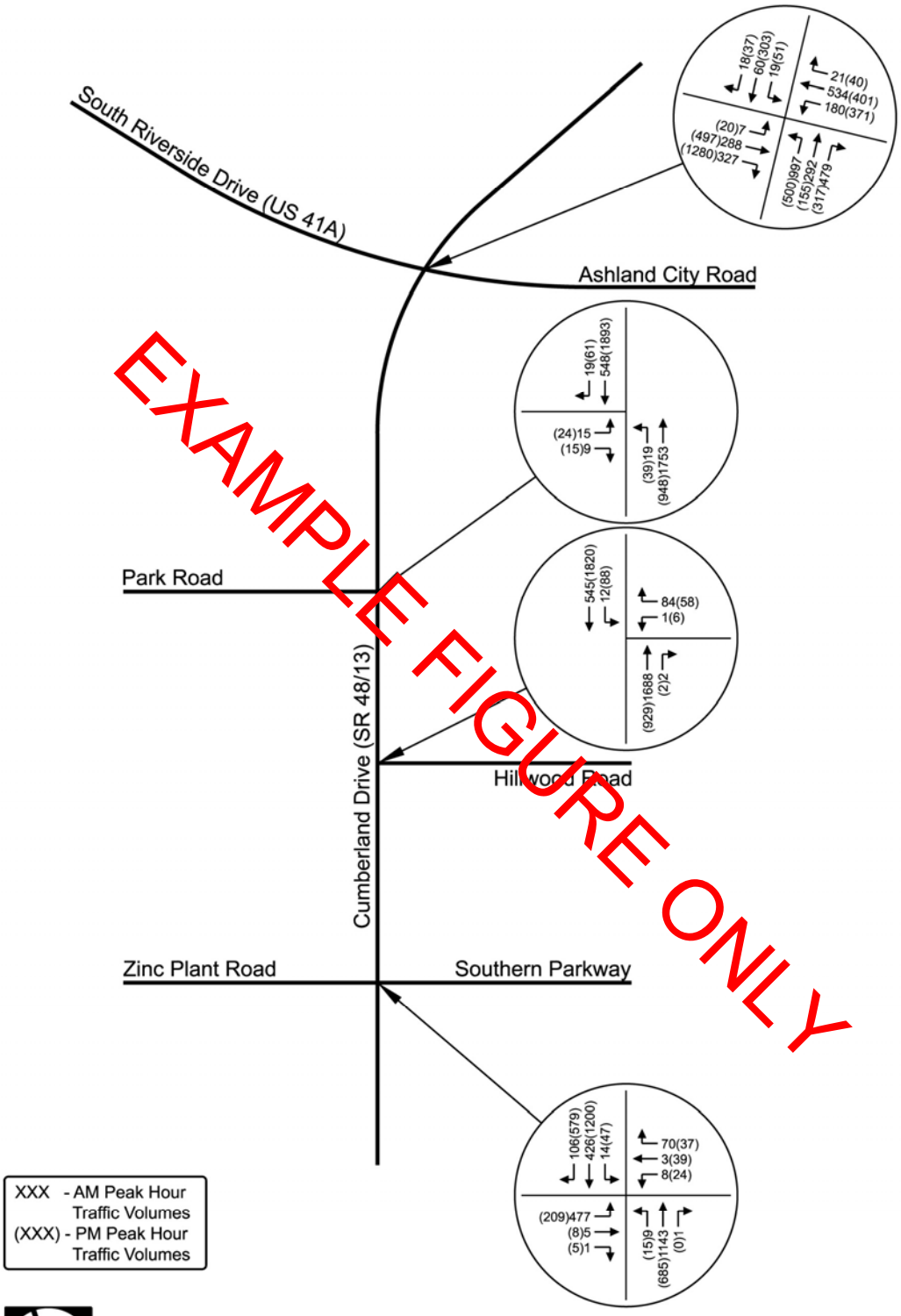
Please note that changes to the site plan including driveway locations, number of driveways, size of development, types of land uses included, or anything affecting the total number of trips generated by the site may require the revision of an approved traffic study.

APPENDIX – EXAMPLE FIGURES



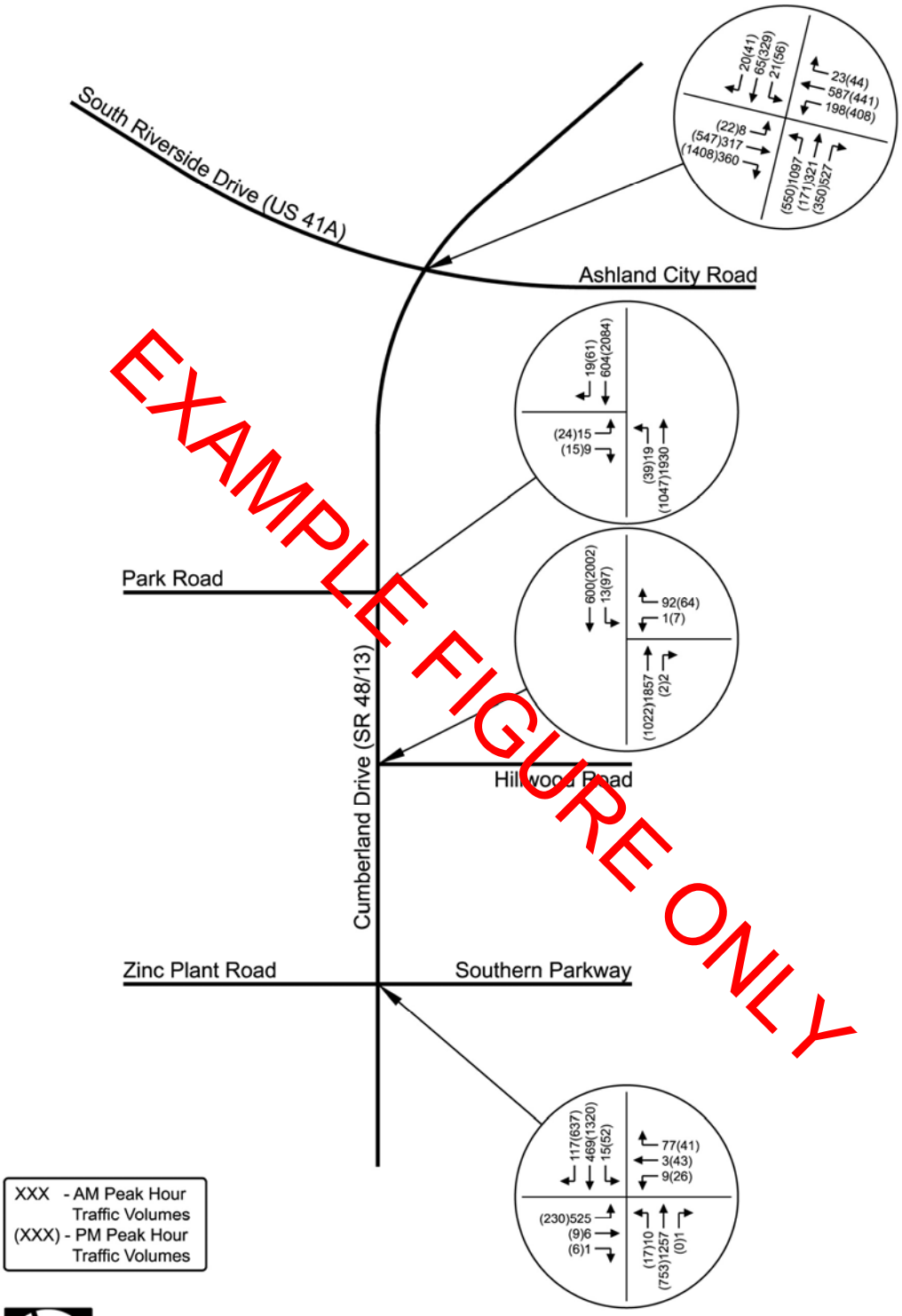
Location of the Project Site
(Not to Scale)

Figure 1.



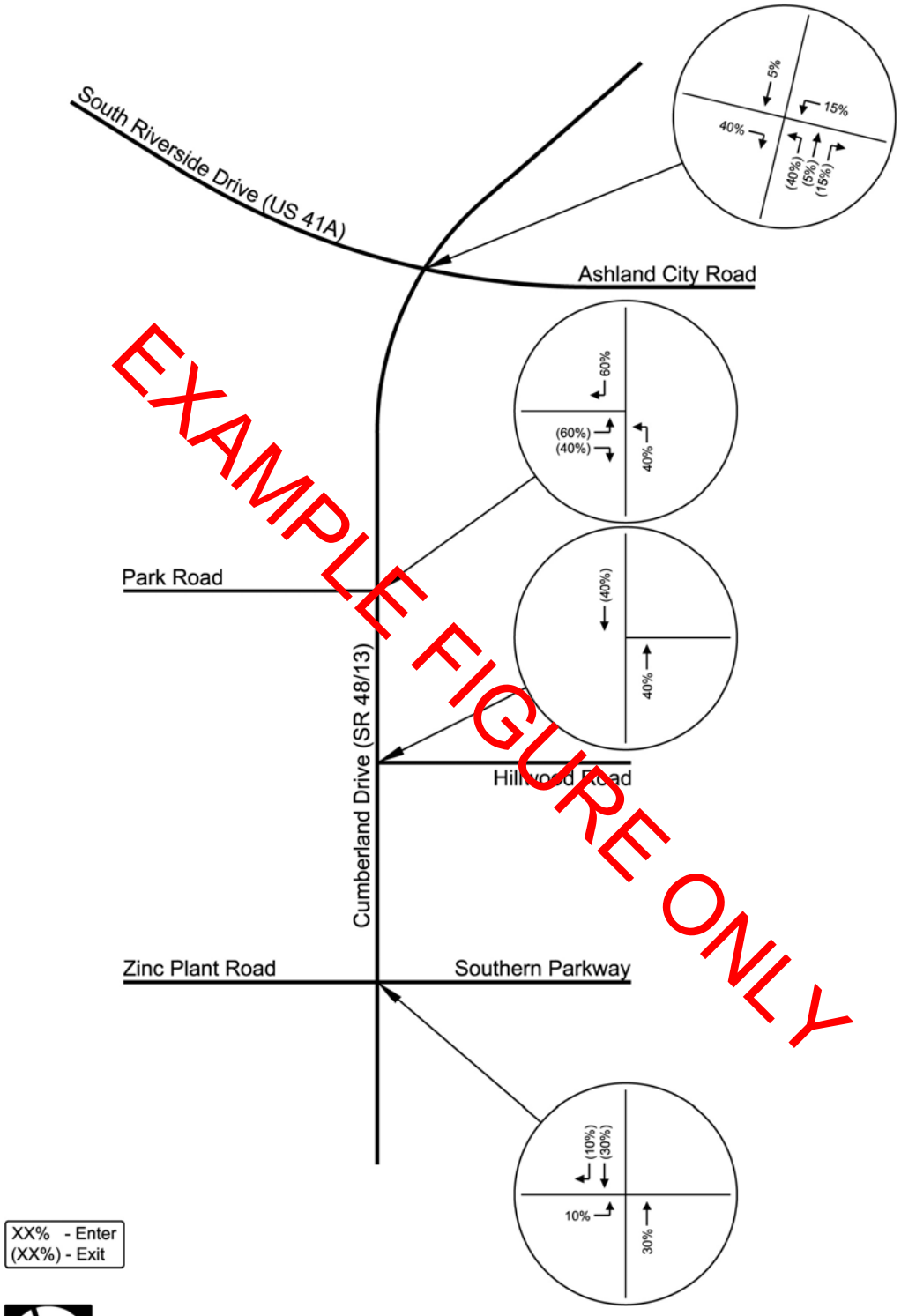
Existing Peak Hour Traffic Volumes
(Not to Scale)

Figure 2.

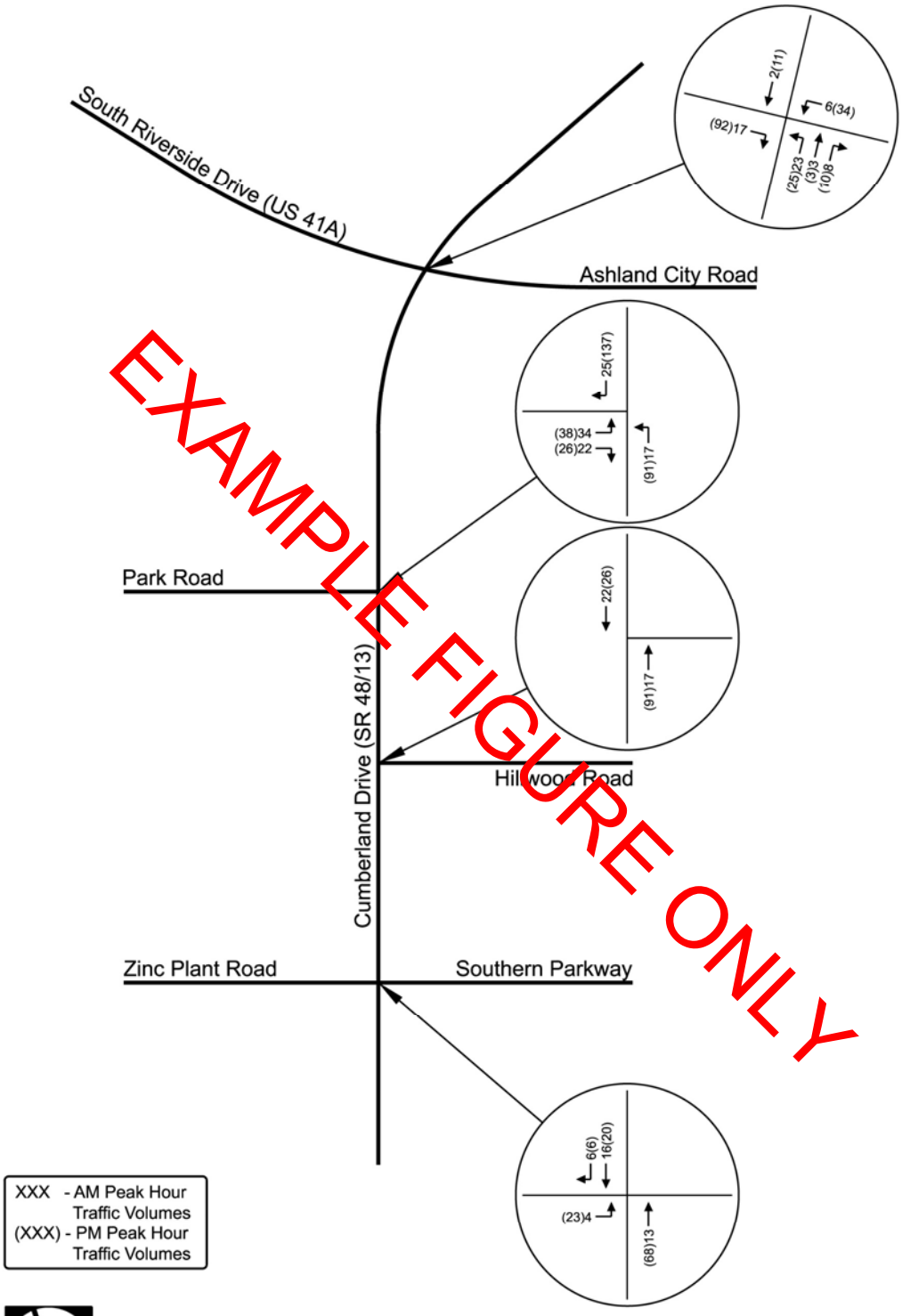


Background Peak Hour Traffic Volumes
(Not to Scale)

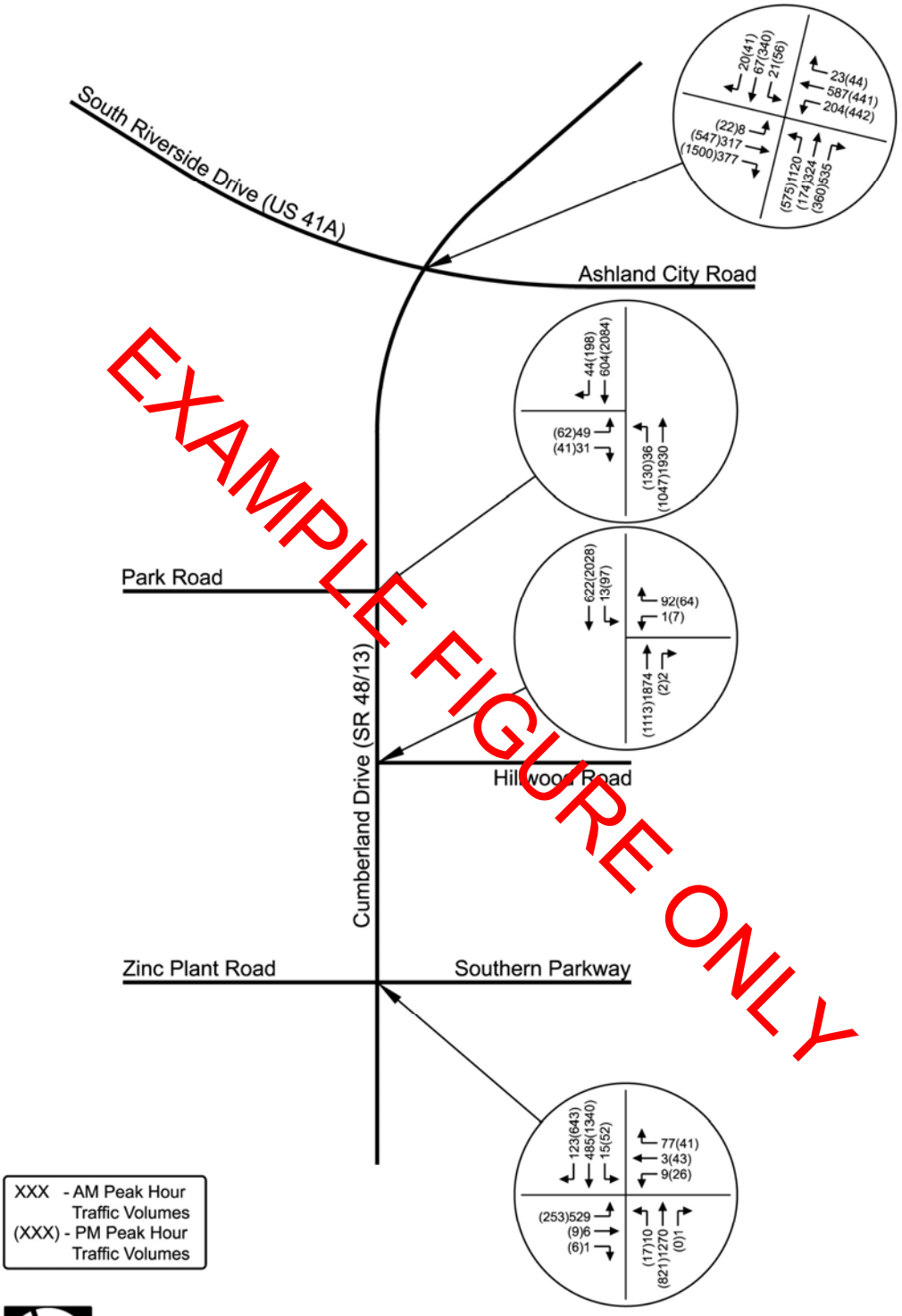
Figure 3.



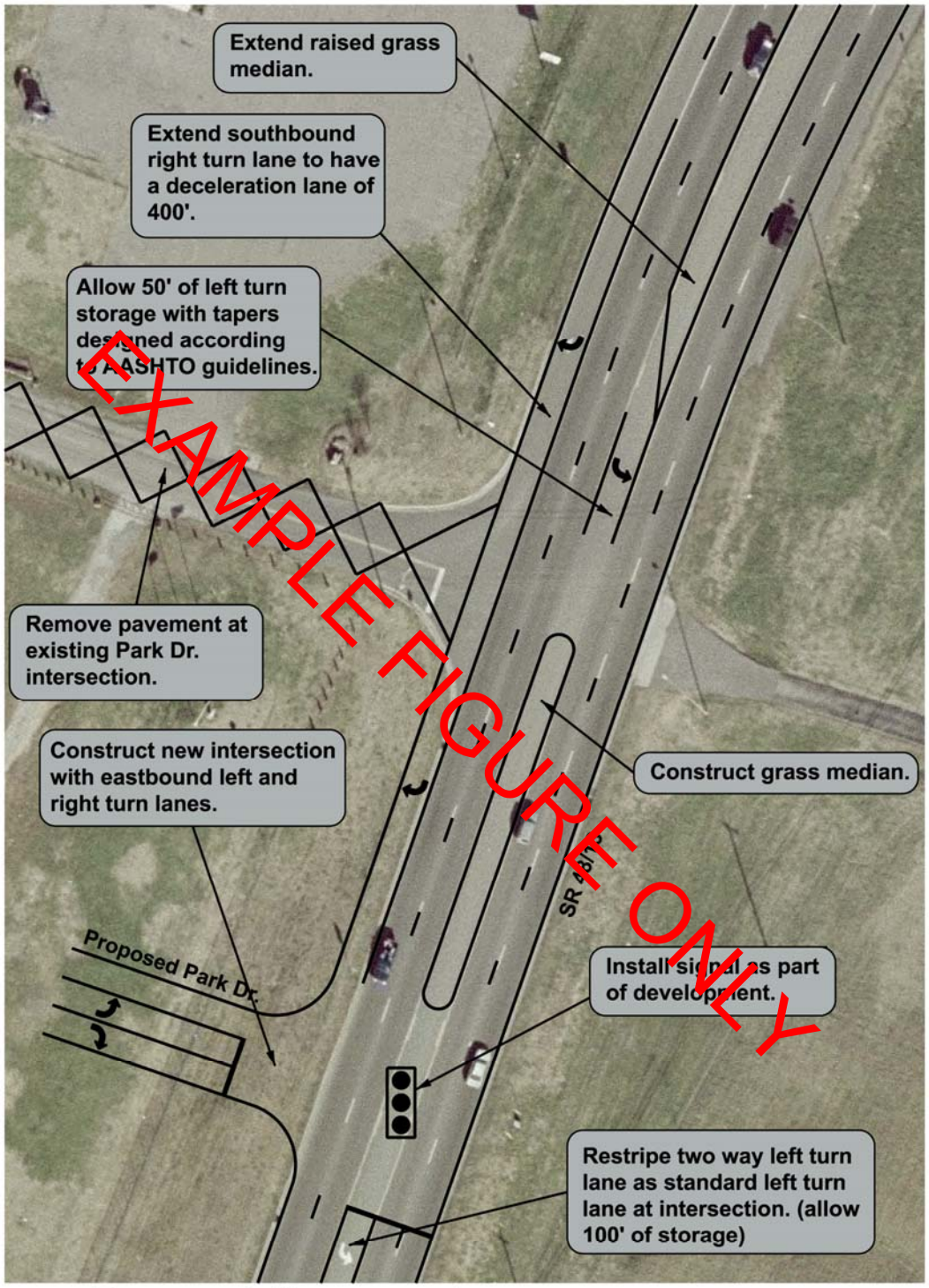
Distribution of Peak Hour Traffic Volumes
(Not to Scale) **Figure 4.**



Assignment of Peak Hour Traffic Volumes
(Not to Scale) **Figure 5.**



Total Projected Peak Hour Traffic Volumes
(Not to Scale) **Figure 6.**



Recommended Improvements
Intersection of SR48/13 & Park Dr.

GRAPHIC SCALE
0' 60' 120'

Figure 7.