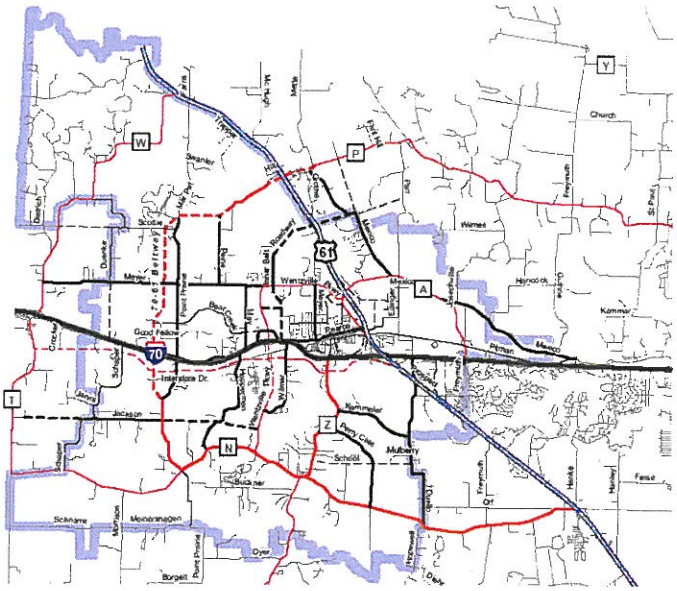
TRANSPORTATION MASTER PLAN



Wentzville
Missouri - USA
The Crossroads Of The Nation

Developed by:
City of Wentzville, Missouri, and
HNTB Corporation
November 25, 2003

Transportation Master Plan Summary

The City of Wentzville, Missouri has prepared the following Transportation Master Plan. The purpose of the plan is to provide guidelines for the city to use to identify transportation improvements that will be needed to support future growth. The Master Plan is presented in a series of Technical Memoranda as follows:

Technical Memorandum #1 – Validation Plan and Future Forecast Review

This report covers a number of items. The street functional classifications for the Wentzville area are defined and illustrated. Also included are recommended typical sections and roadway design standards.

The report also includes information on possible modifications to the regional transportation road network and transportation analysis zone system that can be recommended to the East-West Gateway Coordinating Council. Also included is a listing of long-range future roadway projects and projects listed in the short-range.

Technical Memorandum #2 – Access Management Standards

Access management involves determining the control of side access in order to maintain or preserve the capacity and function of the road. Access management involves determining appropriate signal spacing, median openings and driveway/side street spacing distances. Recommendations for access management of Wentzville's arterials and collectors are described in this report.

Technical Memorandum #3 – Traffic Impact Study Standards

Traffic impact studies are reports typically prepared in advance of approving a zoning change or a site plan that would result in a discernable traffic impact to the adjacent street system. In this section, guidelines are provided regarding when a traffic study should be requested to be completed by the developer and what the report should address.

Technical Memorandum #4 – Traffic Counting Program Guidelines

This section of the Master Plan discusses the type of traffic counts, methods to collect traffic data and potential locations for traffic counts. This information can be used by the City as it establishes a traffic counting program.

Technical Memorandum #5 – Traffic Signal Warrant Guidelines

Often requests are made for traffic control signals to be placed at an intersection. Signals can cost between $80,000 to $130,000 to install depending on the complexity of the intersection. The placement of signals also can impede arterial traffic flow. For these reasons, signal warrants have been developed and have be published in a report entitled *Manual of Uniform Traffic Control Devices (MUTCD)*. These guidelines and a listing of potential locations now and in the future for which to complete a signal warrant analysis are listed in this section of the Transportation Master Plan.

Technical Memorandum # 6 – Guidelines for Bicycle and Pedestrian Facilities

This section of the Transportation Master Plan describes design standards for pedestrian and bicycle facilities such as sidewalks, paths and trails.

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Validation Plan and Future Traffic Forecast Review

Wentzville
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City of Wentzville, Missouri

Technical Memorandum #1
Validation Plan and Future Traffic Forecast Review

The City of Wentzville completed a Comprehensive Plan entitled *A Community's Vision* that was prepared by the City throughout 1998 and 1999 and amended in October 2001. The Comprehensive Plan included a long-range consideration of a number of elements including land use, utilities, community facilities, parks, capital financial plans and transportation. The purpose of this memorandum is to review the transportation element of the Comprehensive Plan and to provide additional detail related to the definition of roadways, design standards, analyze future year growth forecasts prepared by East-West Gateway Coordinating Council (EWGCC) and re-define future roadway transportation improvement projects.

This memorandum reviews the City of Wentzville's transportation network by defining and illustrating the functional classifications for the Wentzville area. Also included are recommended typical sections and roadway design standards.

The report also provides information on possible modifications to the regional transportation road network and transportation analysis zone system that will be recommended to the regional Metropolitan Planning Organization. Also included is a listing of long-range future roadway projects and projects listed in the short-range Capital Improvement Program.

1.0 Transportation System Overview

1.1 Existing System Description

The City of Wentzville is located on the western edge of the St. Louis metropolitan area. It is located at the crossing of I-70 and US-61. I-70 is a freeway and US-61 is a freeway/expressway. Improvements to I-70 are being studied that would ultimately result in a widening to six lanes. US-40/61 is being upgraded as a fully limited access route and will be redesignated as I-64 from I-70 to the south.

The established portion of Wentzville is located north of I-70 and west of US-61. This area is served by a network of streets. Access to this area from I-70 is provided at Route Z and at the Wentzville Parkway. Access from US-61 is provided at Wentzville Parkway and Business Route US-61.

The City of Wentzville is also served by a network of Missouri state routes. MoDOT lettered routes were originally designated as rural collectors that provided access to rural properties. As development continues to occur, the capacity of these rural routes will become insufficient and roadway improvements will be necessary to upgrade or supplement many of these routes.

1.2 Goals and Objectives

Goals and objectives for transportation were developed as part of *A Community Vision*. The transportation goal and objectives are re-stated here and were used to guide the development of information prepared as part of the Transportation Master Plan.

Transportation Goal: Provide an inter modal transportation system, i.e. airways, highways, railways, bikeways, and walkways within diverse land uses, that enables safe and efficient movement (congestion free) of people and goods by any or all means from all points of origin to all destinations.

Objective: To construct an airport near Wentzville as an identified need by the Integrated Plan of Systems Airports.

Objective: To preserve presence of Norfolk Southern Rail and other rail systems through the heart of Wentzville and maintain a good relationship with the railroad enterprise.

Objective: To enhance traffic carrying potential and safety on I-70 within the Wentzville planning area through cooperation with the Missouri Highway Transportation Department.

Objective: To upgrade Highway 40/61 to a controlled access highway (including service roads) within the Wentzville planning area through cooperation with the Missouri Highway Transportation Department.

Objective: To improve or create interchanges of state or regional roadway systems with existing or proposed community arterial road systems.

Objective: To improve or create arterial collector roads to serve Wentzville, with good connections to state or regional highway systems.

Objective: To promote bicycling as an alternative means of transportation from home to work, to school, to places of worship, to shop, or for pleasure.

Objective: To encourage walking as an alternative form of transportation or for pleasure.

2.0 Functional Classification

2.1 Introduction

The classification of streets and highways is a process of categorizing roadways based upon the type and function the roadway serves. This functional classification uses a hierarchical structure to describe how traffic movements take place between trip origins and destinations.

The hierarchy of road types includes arterials, collectors and local streets. The differentiation between road classifications is generally based upon the level of through traffic movement and the level of desired access to adjacent land.

Roadway functional classifications were developed as part of *A Community Vision.* The classifications were reviewed and modified as part of this Transportation Master Plan.

2.2 Roadway Classification Definitions

A roadway network serves the flow of traffic. Each street by design provides a level of access to the adjacent properties and a level of traffic mobility; however, access and

mobility are competing functions, so roadway classifications are developed to define the amounts of mobility, access and the role of each street.

There are three basic roadway classes: arterials, collectors and local streets. Arterials have the highest travel mobility but low access to abutting lands. Conversely, local streets have the lowest mobility but allow frequent access to the adjacent properties. Other criteria are also used to further distinguish roadway classifications such as design speed, operational standards, travel distance and traffic volumes. By using these criteria, this document subdivides the three basic classes and defines specific roadway classifications.

The terms defined below will be referred to throughout this document when describing the City's roadways. The corresponding classifications titles from *A Community's Vision* are shown in brackets.

Major arterial [Urban primary arterial] – A roadway providing the highest traffic mobility but carefully controls and limits access to adjacent properties. Major arterials typically serve the largest amounts of traffic for long trip lengths and at a high operating speed. Left turn lanes, right turn lanes and medians are desirable to minimize interference to through movement traffic. Major arterials usually flow through the urban area and connect to major destinations and other cities.

Minor arterial [Urban arterial] – A roadway with a middle range traffic mobility and access that serves moderate levels of traffic volumes, trip lengths and operating speeds. Minor arterials link traffic between major arterials and collector streets. Access to adjacent properties is usually limited only to consolidated, shared or larger-scale land uses. Minor arterials typically provide connections between adjacent communities and activity centers. Left and right turn lanes are desirable to preserve the roadway function and operation.

Major collector [Arterial collector] – A roadway with a low range of traffic mobility and access that serves lower levels of traffic volumes, shorter trip lengths and lower operating speeds as compared to arterial streets. Major collectors link traffic between arterials, other collectors and local streets. Major collector streets distribute traffic to smaller areas, like neighborhoods, and allow more land access to and from the street. Turn lanes are desirable on major collectors adjacent to large developments and at intersections with arterial streets.

Minor collector [Minor collector and commercial streets] – Similar to major collectors, they are roadways with a low range of traffic mobility and access that serves lower levels of traffic volumes, shorter trip lengths and lower operating speeds as compared to arterial streets. Minor collectors usually allow only two lanes for traffic but are typically wide enough to permit on-street parking. Turn lanes are also desirable on minor collectors adjacent to large developments. As an internal practice, the City of Wentzville recommends this roadway class only when the roadway serves predominately commercial and/or industrial areas.

Urban local street [Local residential street or rural residential street] – A roadway carrying the lowest traffic mobility and lowest traffic volumes. Trip lengths on these streets are typically very short and at slow operating speeds. Local streets provide immediate traffic access to and from abutting properties not favoring through movement

traffic. Urban local streets usually provide curbs, gutters and enclosed drainage. Rural local streets typically offer no curb and gutter and instead use open drainage or ditches along the pavement. Local streets connect blocks within a neighborhood and connect to collector streets. As an internal practice, the City of Wentzville prefers the urban local street classification and no longer recommends the rural local street classification.

2.3 Functional Classification Evaluation

A review of the function of the street system was completed. The City's Comprehensive Plan currently classifies its roadway system as shown in Figure A-1 in the Appendix. Revisions to the functional classification of roads were based on a review of information on existing and future land uses, traffic volumes, capacity, planned improvements and access between roadways and adjacent properties. Table I-1 below represents the recommended functional classifications for the City's roadway system. Figure I-1 graphically represents the recommendations.

Table I-1 Recommended Functional Classifications

Freeway/ Interstate	Major Arterial	Minor Arterial	Major Collector	Minor Collector
Interstate 70, Highway 61, Highway 40/61	Wentzville 70/61 Beltway, Route N, Route Z	Route A, Route P, Route T, Route W, Interstate Drive, Wentzville Parkway, Business Highway 61	Duello Rd, East Service Road, Hepperman Rd, Inner Belt Roadway (Great Oaks Blvd), Jackson Rd, Mexico Rd, West Meyer Rd, Meyer Rd, Peine Rd, Wilmer Rd, Pearce Blvd, May Rd, Pointe Prairie Rd, South Service Rd, Perry Cate Blvd, Carlton Glen Blvd (Kammeier Rd), Dueneke Rd, Scotti Rd	Blumhoff (ext.), Industrial Park Access, Whisper Creek Dr (School Rd), S. Callahan Rd, Church St, Corporate Pkwy, Edinger Rd, Linn St, Northview Ave, Wall St, Prospect Rd, Pitman Ave, Schaper Rd, Main St, Bear Creek Dr

Source: City of Wentzville Public Works Department, 2003.

2.4 Typical Roadway Sections

This document offers a brief review of the City's typical roadway sections outlined in the Comprehensive Plan by comparing them to other transportation system standards. First, an assessment was made of the City's typical sections for each of the defined functional classification categories. The City's original street typical sections are listed in Table No.16 of the City's Comprehensive Plan shown as Figure A-2 in the Appendix. The City's sections evolved from St. Louis County standards. Since the time the City's Comprehensive Plan was written, St. Louis County has revised its standard drawings and numbers, and St. Charles County has adopted its own roadway typical sections derived from St. Louis County standards. So, the updated standards from both counties and some other resources were collected to review the City's typical sections presented in the City Comprehensive Plan. Results of the data collection are given below in Table I-2. In general, there are minor differences between the City's cross sections and the resources used for comparison. Wentzville's cross sections typically favored more conservative (wider) right-of-way widths but retained the same pavement widths.

Minor typical section revisions were made based on current practices implemented by City Public Works Director and application of the access management standards presented later in the Transportation Master Plan. Figure I-2 presents typical sections recommended for approval and use by the City of Wentzville. Wider pavement was recommended on the major arterials to better accommodate center medians. Wider pavement on the minor collectors was recommended for wider parking. The rural residential section was removed based on recommendations from the City Public Works Director.

Table I-2 Typical Section Comparisons

Source	Attribute	Freeway/ Interstate	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Urban Residential	Rural Residential*
AASHTO (pp 388,429, 452,508-509)	ROW Width	No standard	No standard	No standard	No standard	No standard	No standard	No standard
	Pavement Width	76-120'(4-6)	40' (2 lanes)	34'-36' (2)	34'-36' (2)	30'-32' (2)	30'-32' (2)	22'-26' (2)
	ADT/Capacity	ALL	>2000	1500-2000	1500-2000	400-1500	400-1500	<400
APWA	ROW Width	No standard	100'-150'	80'	60'-80'	60'	50'	40'
	Pavement Width	No standard	28'-40'(4-6)	40'-52'(3-4)	28'-52'(2-4)	37' (3 lanes)	28' (2 lanes)	25'-28' (2)
	ADT/Capacity	No standard	No standard	No standard	No standard	No standard	No standard	No standard
MoDOT (Fig.4.04-1)	ROW Width	250'	150' - 250'	150'	120'	80'	80'	50'
	Pavement Width	114'-128'(4)	44' (2 lanes)	40' (2 lanes)	40' (2 lanes)	32' (2 lanes)	32' (2 lanes)	26' (2 lanes)
	ADT/Capacity	ALL	1700	1700	1700	400-1700	400-1700	400
St. Charles Co. (20.30)	ROW Width	No standard	Case by case	Case by case	54'	48'	42'	42'
	Pavement Width	No standard	By County	By County	38' (3 lanes)	32' (2 lanes)	26' (2 lanes)	26' (2 lanes)
	ADT/Capacity	No standard	Engineer	Engineer	No standard	No standard	No standard	No standard
St. Louis Co. (20.10~30)	ROW Width	No standard	84'	72'	60'	70'	50'	50'+12' esmt
	Pavement Width	No standard	63' (5 lanes)	51' (4 lanes)	39' (3 lanes)	24' (2 lanes)	26'(2 lanes)	26' (2 lanes)
	ADT/Capacity	No standard	No standard	No standard	No standard	No standard	No standard	No standard
Wentzville Comp. Plan	ROW Width	No standard	100'	80'	70'	60'	50'	50'+10' esmt
	Pavement Width	No standard	63' (5 lanes)	51' (4 lanes)	39' (3 lanes)	32' (2 lanes)	26' (2 lanes)	26' (2 lanes)
	ADT/Capacity	No standard	8,000-35,000	5,000-24,000	2,000-10,000	1,000-8,000	< 2,000	< 2,000

* City of Wentzville no longer supports a rural residential typical section. City rural residential values shown are from the City Comprehensive Plan. Sources listed within table, 2002.

2.5 Design Standards

Beyond cross sectional widths, city maintained streets have used engineering design criteria created by other agencies such as MoDOT, St. Louis County and more recently St. Charles County. Like typical sections, engineering design criteria differ according to functional class. The following table lists the recommended basic horizontal, vertical and clear zone criterion for the City of Wentzville roadways for each functional classification category. Similar to past City practices, the design standards were derived from St. Charles County and St. Louis County roadway specifications. When comparing the City standards listed below to other outside resources such as MoDOT, the City standards are usually more conservative, especially for collectors and local streets.

Table I-3 Recommend Roadway Design Standards

Jurisdictional Agency	City of Wentzville, Missouri*				
Description	**Major Arterial****	**Minor Arterial****	**Major Collector**	**Minor Collector**	**Local Street**
Average Daily Traffic***	8,000-35,000	5,000-24,000	2,000-10,000	1,000-8,000	< 2,000
Design Speed (mph)	45	45	35	30	25
Posted Speed (mph)	40	40	30	25	25
Clear Zone					
Clear Zone Slope	None	None	None	None	None
Clear Zone (width) (min.)	None	None	None	None	None
Horizontal Alignment					
Assumed Horizontal Terrain	Rolling	Rolling	Rolling	Rolling	Rolling
Maximum Superelevation	No standard	No standard	No standard	No standard	No standard
Degree of Curvature (max.)	6°00'	6°00'	15°00'	15°00'	150 ft R min
Vertical Alignment					
Assumed Horizontal Terrain	Rolling	Rolling	Rolling	Rolling	Rolling
Maximum Gradient	6%	6%	6%	6%	8%
Minimum Gradient	2%	2%	2%	2%	2%
Minimum Curve Length	135 ft	135 ft	105 ft	90 ft	75 ft
Minimum "k" crest	120	120	55	35	25
Stopping Sight Distance	510 ft min	510 ft min	345 ft min	275 ft min	230 ft min
Minimum "k" Sag	90	90	50	35	25
Vertical Clearance	16'-6"	16'-6"	15-6"	15'-6"	15-6"

Source: St. Louis County and St. Charles County roadway specifications, 2002.

* Represents recommended city design standards based on St. Louis County and St. Charles County roadway specifications.

** Design standards based on St. Louis County roadway specifications, St. Charles County requests approval of standards on a case by case basis.

*** Depending on functional class, ADT assumes maximum range of 4,000 to 9,000 vehicles per day per lane (i.e. collectors and arterials assumed to carry maximum range of 400 to 900 vehicles per lane per hour and peak hour volume is 10% of ADT).

3.0 Regional Transportation System

3.1 Introduction

This section of the report includes a summarization of future year land use and traffic forecasts prepared by the region's Metropolitan Planning Organization (MPO), the East-West Gateway Coordinating Council (EWGCC). East-West Gateway maintains the region's transportation system model for the current year and 20 years or more in the future. The purpose of this section is to:

- Review the EWGCC model and future traffic forecasts regarding Wentzville.
- Review the boundaries and socio-economic information of the Traffic Analysis Zones (TAZ).
- Provide input into EWGCC process so that the model can be modified to reflect comprehensive growth in Wentzville.
- Recommend additions or modifications to the EWGCC roadway network.

The regional roadway network maintained by EWGCC contains information regarding functional class, number of lanes and right-of-way widths. The transportation network and land use information are files that are input in the travel demand forecasting process. The output of this process is future year traffic forecasts. This information is presented in Table A-1 in the Appendix.

3.2 Land Use and Transportation Analysis Zone (TAZ) Information

The analysis of future transportation needs and the definition of future roadway functional classification considers the type, location and intensity of expected future growth. The type and location of future growth is represented in land use maps. Land uses include residential, commercial, industrial, institutional, office, park and agricultural uses. Existing land uses shown in Figure I-3 reflect current types of development and zoning classifications that exist in the year 2003.

Future anticipated land uses were prepared by the City of Wentzville and are consistent with the Comprehensive Plan. The future land use map is shown in Figure I-4. This map indicates the type and location of land uses that are envisioned over the next 20 to 30 years. The future land use plan shows an expansion of the industrial area located east of US-61 and north of I-70. It also shows an increase in commercial activity along the Wentzville Parkway, along Interstate Drive and adjacent to the proposed interchange of I-70 at the proposed 70-61 Beltway. Single family residential areas are shown to expand to the west of US-61 on both the north and south sides of I-70.

Travel demand models, like the one used by EWGCC represent the movement of vehicles between areas called Transportation Analysis Zones (TAZ). The size of the TAZ areas has an impact on the level of detail and accuracy of the traffic forecasts produced by the travel model. The current EWGCC TAZ boundaries are shown in Figure I-5. Also shown in that graphic are the US Census block group boundaries. A representation of the socio-economic data the TAZ's contain for the year 2000 and the year 2025 are presented in a report supplement separate from this Transportation Master Plan.

3.3 Future Transportation Projects

Given the information described above, future transportation projects were identified. A number of projects are currently being planned by the City of Wentzville and other jurisdictional agencies such as MoDOT and St. Charles County. Additional projects were identified based on the information investigated as part of this Transportation Master Plan such as the regional travel demand model, traffic volumes, land use patterns and growth trends in the community.

The following table lists the transportation improvement projects listed in the City of Wentzville's current five year capital improvement plan (fiscal years 2002-2006). Capital improvement plans contain items for planning, right-of-way purchases, engineering design and construction. The following table only lists the construction elements of the plan because their implementation will directly impact the City's transportation network.

Table I-4 Planned Capital Improvements

Year Planned	Planned Capital Improvement	Description
2002	Pearce Blvd/Wentzville Pkwy intersection improvements	Reconstruct with turn bays and improve safety
2004	Route Z at I-70 interchange	Reconstruct to full access diamond interchange
2004	North Service Road from Pearce Blvd to Church St	Relocate and reconstruct 2 lane roadway
2004	Peine Road from Meyer Rd to first bend	Widen from 2 to 3 lanes
2004	West Meyer Road from Peine Rd to Wentzville Pkwy	Widen from 2 to 5 lanes
2005	Interstate Drive from Hepperman Rd to Wilmer Rd	Construct 5 lane road on new alignment
2006	Interstate Drive II from Route Z to Prospect Rd	Construct 5 lane road on new alignment

Source: City of Wentzville Five Year Capital Improvement Plan, Fiscal Years 2002-2006, 2002.

As a long range planning effort, the Transportation Master Plan and the City's Comprehensive Plan lists future transportation projects recommended as support to the community beyond the projects listed above in the capital improvement plan. Additional long range projects are listed in the following table.

Table I-5 Future Transportation Projects

Future Transportation Project	Description
Projects within MoDOT jurisdiction	
I-70 throughout city limits (Foristell to Lake St. Louis)	Widen from 4 to 6 lanes
I-70 / Hwy 40/61 interchange	Directional ramp improvements
Highway 40/61south of I-70	Upgrade to access controlled freeway
Highway 61 from I-70 to Point Prairie Road	Upgrade to access controlled freeway
Route Z from I-70 to Route N	Widen from 2 to 4 lanes
North service road from Pearce to Bus. Hwy 61	Realign from Pearce Blvd. to Route Z and extend to Bus. Hwy 61
Highway 40/61 / Prospect Road interchange	Reconstruct as an access controlled interchange
I-70 / 70-61 Beltway interchange	Construct new full access interchange
Highway 61 / Route W interchange	Reconstruct as an access controlled interchange
Route N from Schaper Road to Hwy 40/61	Widen from 2 to 4 lanes
Projects within City of Wentzville jurisdiction	
Interstate Drive from Route T to Hepperman	Construct 5 lanes on new alignment
Whisper Creek Dr (School Road) from Route Z to Duello Rd	Construct 4 lanes on new alignment
Jackson Road from Route T to Wilmer Rd*	Construct 3-4 lanes on new alignment as extension
Wentzville Parkway from I-70 to Wilmer Rd	Construct 5 lanes on new alignment
Wilmer Road from Wentzville Pkwy to Route N	Widen from 2 to 5 lanes as Wentzville Parkway
70-61 Beltway from South Point Prairie Rd to Hwy 61	Construct 5 lanes on new alignment
West Meyer Rd from Route W to Peine Rd	Widen from 2 to 5 lanes
Scotti Road from Route W to Dueneke Rd (includes parts of Foristell)	Construct 3 lanes on new alignment as extension
Dueneke Road from North Outer Rd at I-70 to Meyer Rd (includes parts of Foristell)	Construct 3 lanes on new alignment as extension
Peine Road from Meyer Rd to 70-61 Beltway	Widen from 2 to 3 lanes
Inner Belt Roadway from Pearce Blvd to Parr Rd	Construct 4 lanes on new alignment (crosses Wentzville Pkwy & Hwy 61)
Blumhoff from South of Wentzville Pkwy to West Service Rd	Construct 3 lanes on new alignment as extension
Industrial Park Access from Route A to Edinger Rd and Pearce Ext.	Construct 3 lanes on new alignment
East Service Rd from Inner Belt Rdwy to Route A	Construct 3 lanes on new alignment
Mexico Road from Inner Belt Rdwy to Route P (includes parts of Flint Hill)	Construct 3 lanes on new alignment as extension

Sources: *A Community's Vision*, City of Wentzville Comprehensive Plan, 1999, amended 2001.
City of Wentzville Public Works Department, 2003.

* Jackson extension from Pointe Prairie to Hepperman would impact right-of-way from recently developed subdivisions near the Golf Club at Wentzville.

The above planned improvement projects accommodate the city-wide growth issues Wentzville is experiencing. Much smaller, localized transportation projects can be identified by performing more detailed planning studies to gather site specific data. Figure I-6 graphically represents the future transportation projects listed in Tables I-4 and I-5.

3.4 Recommended Additions to the Transportation System Model

Recommended modifications to the EWGCC model network are shown in Figure I-7. The solid lines show the network included in the current EWGCC model. Based on the transportation plans being pursued in the region, the dashed lines represent roadways that are not part of EWGCC's current or future transportation system model that could be added to provide a consistency with this Transportation Master Plan. They are as follows:

- The future 70-61 Wentzville Beltway that currently has corridor preservation plans is recommended to be added to EWGCC future model as a major arterial. (Further study may shift its northern alignment from what is presented in the figures.)

- Interstate Drive, Meyer Road and West Meyer Road are recommended for classification upgrades to a minor arterial and major collectors, respectively. They currently are coded as a collector and local streets. In addition, future planned extensions to Interstate Drive west of Wilmer should be included in EWGCC's regional model.

- Route Z interchange improvements from half access to full as outlined in the City's capital improvement plan is recommended as an addition to the regional model.

- Other roadways recommended as model additions include: Wentzville Parkway extension to Route N, Inner Belt Roadway from the Wentzville Parkway to Highway 61, Parr Road from Mexico Road to Route P, Mexico Road from Route A to I-70, and Pitman Road from Highway 61 to I-70.

For more detailed forecasting than what is provided from a regional model, other roadway additions can be requested if a separate city-wide or corridor study model were to be developed. These roadways include: Scotti Road and its planned extension to Route W, Jackson Road and its planned extensions from Route T to the Wentzville Parkway, Interstate Drive extension from Route Z to Highway 40/61, Mexico Road extension from Route A to Route P, and Duello Road from Highway 40/61 to Route N. These additions are not shown on Figure I-10 because they represent refinements beyond EWGCC's regional network. If these roadways were to be added, modifications to other parameters such as TAZ zones would also be needed to more accurately forecast traffic on these roadways.

3.5 Recommended TAZ Boundaries

One of the objectives of this study is to recommend adjustments to the TAZ zone structure for consideration by EWGCC in future model updates. Recommendations are included in Figure I-8 that show how the existing TAZ areas could be further split to provide more detailed representation of land use activity in the EWGCC model. The TAZ splits follow block group definitions and additional splits provide more consistency with the future land use map recently developed as part of the 2001 Comprehensive Plan. This level of detail will improve the quality of traffic forecasts at a regional level. Additional refinement would likely be needed to provide traffic forecasts on the minor arterial routes and collector routes. More refined TAZ areas would likely be provided if a city-wide or corridor study model were to be developed.

Wentzville, Missouri

Transportation Master Plan

Figure I-1

Recommended Functional Classification

- Interstate
- Freeway
- Major Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local Roads
- Study Area

Miles: 0 0.5 1 2

Further Study May Shift Alignment

Farris, Mc Hugh, Mette, Trapper, Hill, Flint Hill, Church, Freymuth, St Paul, Parr, Grothe, Mar Pat, Dietrich, Scottie, Duenke, Meyer, Point Prairie, Peine, Roadway, Inner Belt, Wentzville, Pkwy, Meyer, Mexico, Josephville, Hancock, Guthrie, Kemmar, Edinger, Bear Creek, May, Pearce, Good Fellow, Crocker, Schaper, Interstate Dr., Hepperman, Wentzville Pkwy, Wilmer, Pitman, Prospect, Jarvis, Jackson, Carlton Glen Blvd., Perry Cate, Whisper Creek, Mulberry, Buckner, Schnarre, Morrison, Meinershagen, Point Prairie, Dyer, Borgelt, Hopewell, Diehr, Duello, Orf, Henke, Hanley, Feise

W, P, Y, A, T, Z, N, 61, 70, 70-61 Beltway

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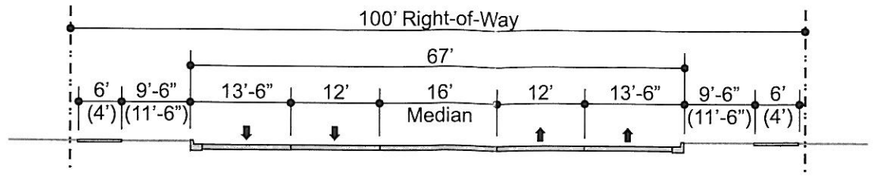

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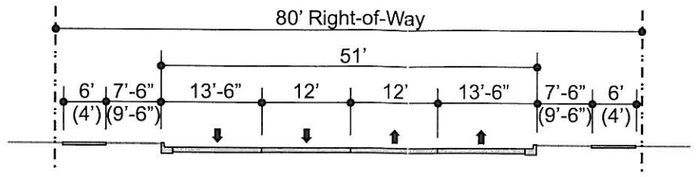

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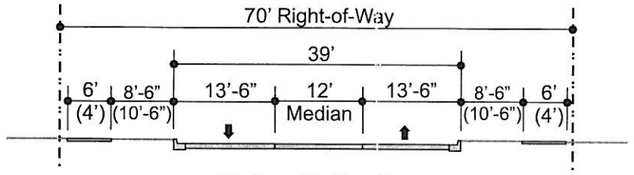
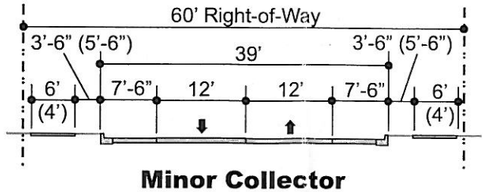
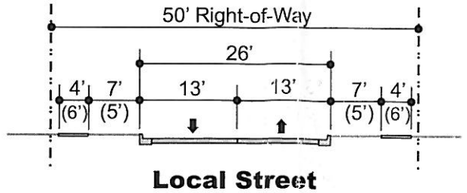


3 **Major Collector**



4 **Minor Collector**



5 **Local Street**

Wentzville, Missouri

Transportation Master Plan

Figure I-2

Typical Sections

1 5 Lanes
Minimum ℄ Radius 955'
Speed Limit 40-50 MPH
ADT Range =
8,000 – 35,000

2 4 Lanes
Minimum ℄ Radius 955'
Speed Limit 40-45 MPH
ADT Range =
5,000 – 24,000

3 3 Lanes
Minimum ℄ Radius 382'
Speed Limit 30 MPH
ADT Range =
2,000 – 10,000

4 2 Lanes
Minimum ℄ Radius 382'
Speed Limit 25 MPH
ADT Range =
1,000 – 8,000

5 2 Lanes
Minimum ℄ Radius 150'
Speed Limit 25 MPH
ADT Range = < 2,000

Wentzville, Missouri

Transportation Master Plan

Figure I-3

Existing Land Use

- Single-Family Res.
- Multi-Family Res.
- Commercial
- Industrial
- Institutional
- Office
- Park
- Agricultural
- New Projects

Existing Road Class.

- Interstate
- Major arterial
- Minor arterial
- Major collector
- Minor collector
- Local Roads

Miles
0 0.5 1 2

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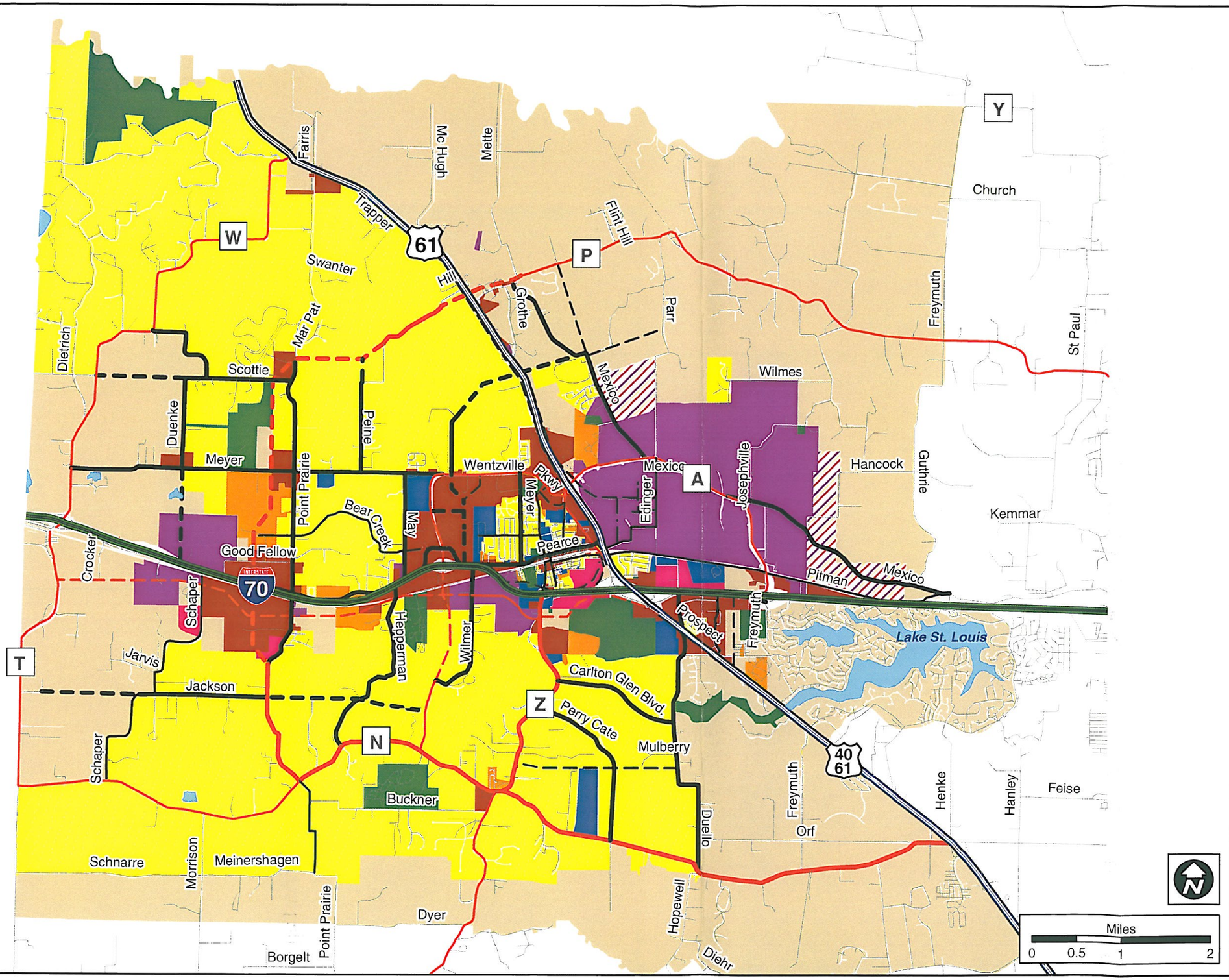
Wentzville, Missouri

Transportation Master Plan

Figure I-4



FutureLandUse

- Single-Family Res.
- Multi-Family Res.
- Commercial
- Industrial
- Institutional
- Office
- Park
- Agricultural
- Transitional

Recom. Future Class.

- Freeway
- Interstate
- Major Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Local Roads

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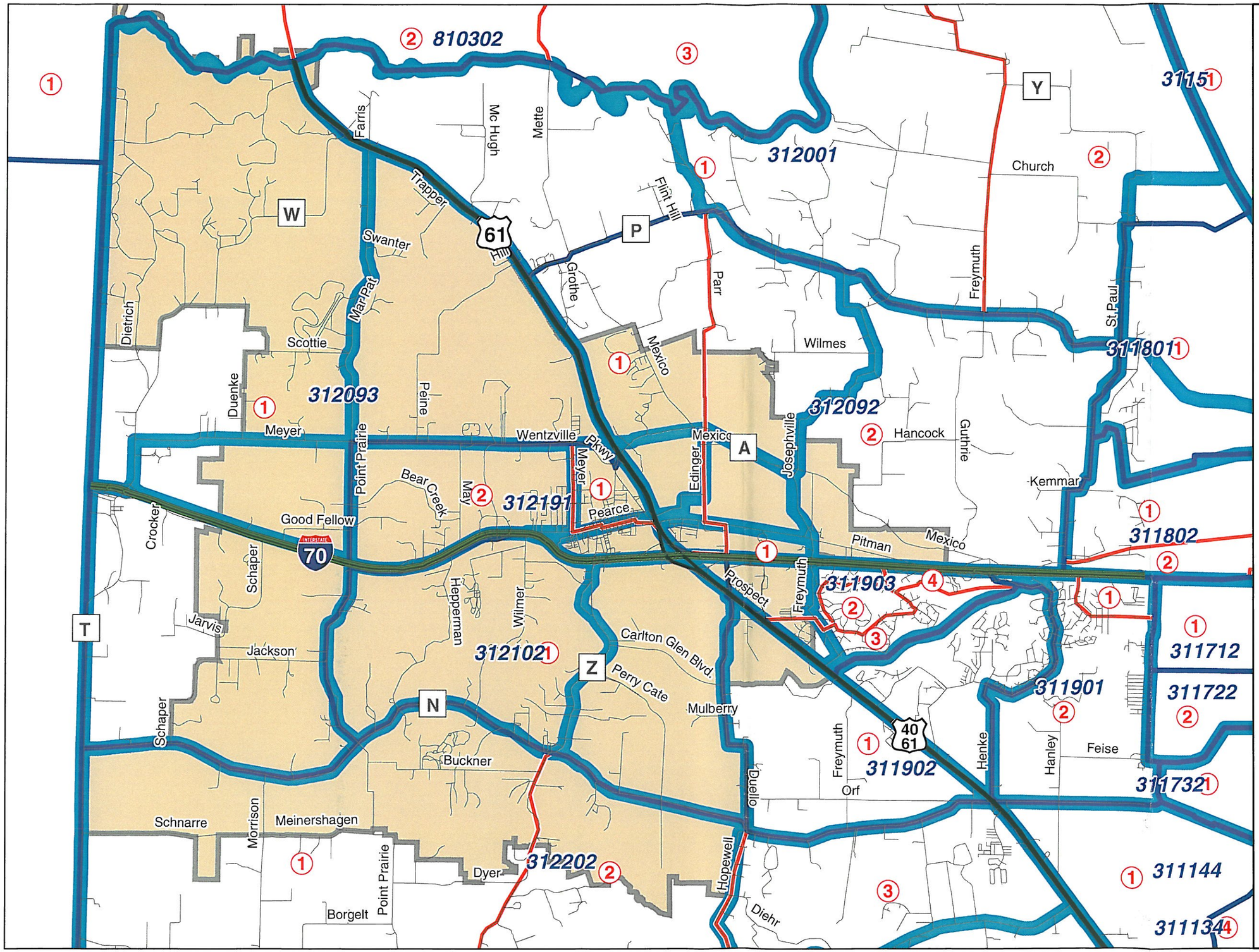
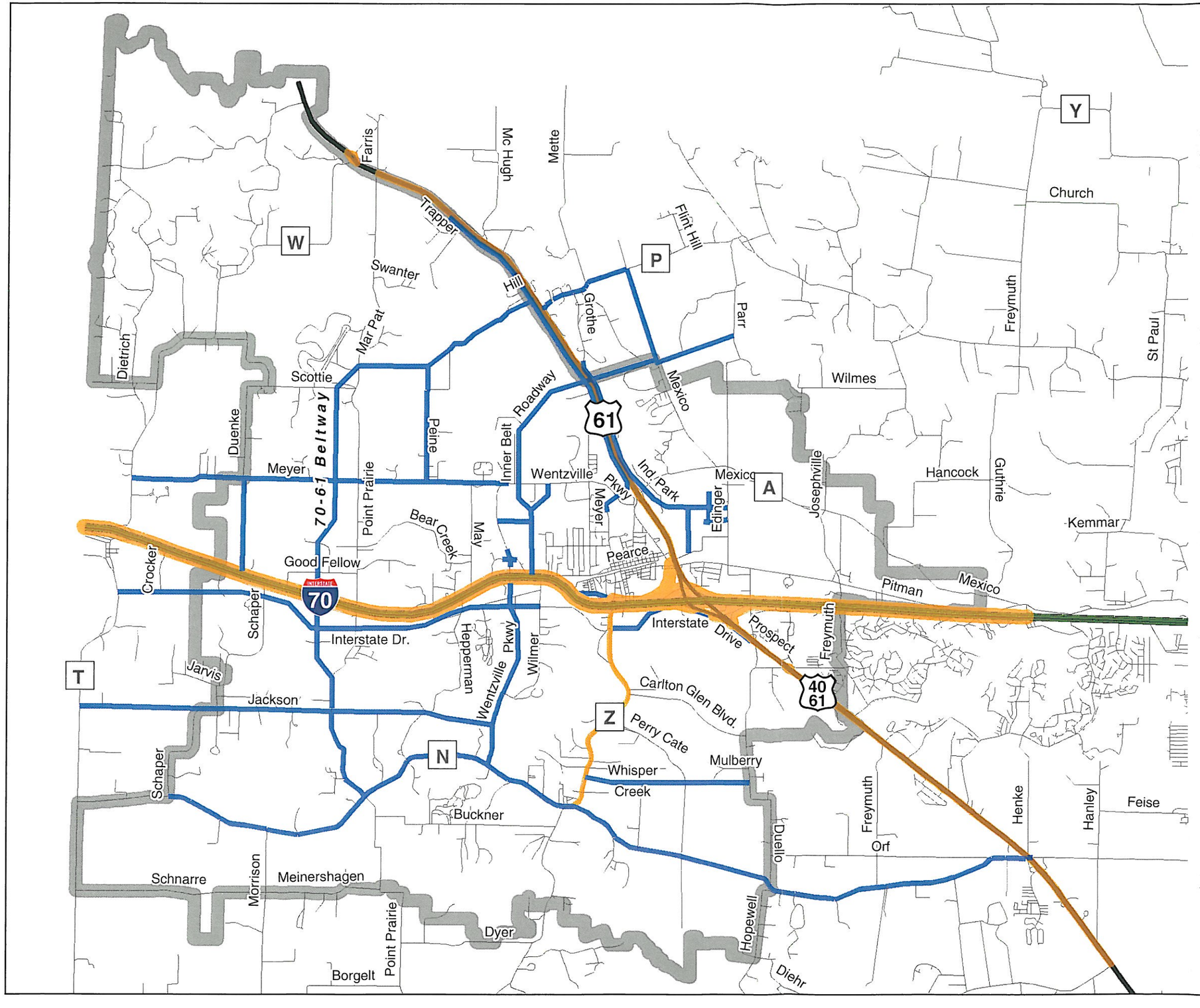


Wentzville, Missouri

Transportation Master Plan

Figure I-5



Wentzville, Missouri

Transportation Master Plan

Figure I-6

Future Transportation Projects

- Wentzville LRP
- MODOT LRTP

N

Miles

0 0.5 1 2

Wentzville, Missouri

Transportation Master Plan

Figure I-7

EWGCC Model and Recommended Transportation System Model

- Existing Network
- Recom. Additions

Miles
0 0.5 1 2

Farris
Mc Hugh
Mette
Trapper
Flint Hill
Church
Freymuth
St Paul
Swanter
Mar Pat
Grothe
Parr
Dietrich
Scottie
Roadway
Mexico
Wilmes
Duenke
Peine
Inner Belt
Meyer
Wentzville
Pkwy
Point Prairie
Bear Creek
May
Edinger
Josephville
Hancock
Guthrie
Kemmar
Good Fellow
Pearce
Pitman
Crocker
Schaper
Interstate Dr.
Hepperman
Wentzville Pkwy
Wilmer
Prospect
Jarvis
Jackson
Carlton Glen Blvd.
Perry Cate
Mulberry
Buckner
Duello
Henke
Hanley
Feise
Orf
Schnarre
Morrison
Meinershagen
Point Prairie
Dyer
Hopewell
Borgelt
Diehr
70-61 Beltway
W
P
Y
A
T
N
Z
61
70
40
61

\\Know001\Planacad\36672 Wentzville\GIS\Working\ESRI Project Files\Map Docs\Fig I7 EWGCC Model.mxd

Wentzville, Missouri

Transportation Master Plan

Figure I-8

Recommended TAZ Boundaries

Traffic Analysis Zones

Addtnl. Zone Definition

Census Block Groups

Census Tracts

Miles
0 0.5 1 2

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TRANSPORTATION MASTER PLAN

Technical Memorandum #2
Access Management Standards

City of Wentzville, Missouri

Technical Memorandum #2
Access Management Standards

Access management involves determining the control of side access in order to maintain or preserve the capacity and function of the road. It involves determining appropriate signal spacing, median openings and driveway/side street spacing distances. Recommendations for access management of Wentzville's arterials and collectors are described in the following sections.

1.0 Purpose and Authority

1.1 Purpose

The purpose of these standards is to establish criteria to promote the safe and efficient movement of people and goods and to preserve the investment in the roadway system in the City of Wentzville and the surrounding community.

1.2 Authority

The criteria and procedures described in this document are established pursuant to the State of Missouri enabling legislation regarding access management guidelines.

2.0 Definitions

Access connection - a driveway, intersection, turnout or other means of providing for vehicles to move between the public roadway and abutting private property. The minimum distance between access connections on the same side of the roadway is measured from center-to-center of adjacent access connections.

Auxiliary lane - that portion of adjoining the traveled way for speed change, turning, decelerating, accelerating, or other purposes supplementary to through traffic movement.

Band width – the time in seconds that traffic can flow uninterrupted through a coordinated traffic control system.

Change in use – a change in the use of a property causing the trip generation of the property to increase by more than 100 vehicles in any 60-minute interval or to increase by more than 10%, whichever is less. Or, resulting in a change in the mix of passenger vehicles and large vehicles of more than 10%. Or, resulting in the direction from which vehicles entering or leaving the site to change by more than 20%.

City Engineer or City Public Works Department – the Public Works Director or City Engineer of the City of Wentzville.

Corner clearance - the distance from an access connection to the nearest intersection. The distance is measured from center-to-center from the intersecting roadway to the adjacent access connection.

Corridor plan – a plan identifying the location and features of access connections to a specific section of public roadway. The plan will show the following: (1) access connections to be retained, existing access connections to be modified or closed and new access locations, (2) the location of existing traffic signals and proposed future signals, including those to be relocated, (3) the type and width of any median, (4) the location and type (full or directional) of all median openings including existing openings to be retained, modified or closed and proposed future openings.

Directional median opening - an opening is a nontraversable median that is designed to accommodate a specific movement, such as a left-turn or u-turn, and prohibit all other movements.

District – the City of Wentzville resides in District 6 of the Missouri Department of Transportation.

District Engineer - the Engineer in charge of District 6 of the Missouri Department of Transportation.

Full median opening - an opening in a nontraversable median that permits all movements, i.e., left-turns from the roadway, left-turns from an access connection or cross road and crossing movements from one side of the roadway to the other.

Functional intersection area – the distance traveled during the driver's perception-reaction time plus the distance to brake to a stop plus the distance for storing a queue of stopped vehicles.

Intersection - a junction of two public roads.

Intersection sight distance – the distance required by a driver, traveling at a given speed approaching an intersection, to perceive the presence of potential conflicts and adjust their speed or come to a stop, as appropriate, to avoid a collision. It consists of the distance traveled during perception-reaction time plus the distance used while braking to adjust their speed or come to a stop.

Left-turn lane, Left-turn bay - an auxiliary lane to permit a driver making a left-turn to clear the through traffic lane before decelerating to a stop.

Large vehicle - any vehicle having more than two axles or dual wheels on any axle.

Minimum connection spacing - the minimum distance between access connections on the same side of the roadway as measured from center-to-center of adjacent access connections.

Nonconforming lot – a property that has frontage that is less than the access connection spacing due to topographic or other aloud conditions.

Perception – reaction time – the time needed by a driver to perceive a situation or condition plus the time to identify the specific situation or condition plus the time needed to evaluate and decide upon a specific course of action plus the time to initiate that action.

Sight triangle – specified 3-sided area, which should be clear of obstructions, with sides that follow along two adjacent intersection approaches that connect at a shared corner and connect to a third side placed across the corner. Distances along the triangles are based on drivers traveling at a given speed and the size of the intersection.

Signal spacing - the distance between signalized access connections or intersections as measured center-to-center of the intersecting roadways.

Stopping sight distance – the distance required by a driver, traveling at a given speed, to come to a stop. It consists of the distance traveled during perception-reaction time plus the distance used while braking to a stop.

Traveled way - that portion of a roadway for the movement of vehicles, exclusive of shoulders or auxiliary lanes.

3.0 Access Category Standards

Described below is a proposed major thoroughfare system and access management standards that is based on roadway functional classification. The system describes for each roadway classification the roadway function, desired level of access, desired emphasis of through movement, and typical speed ranges.

3.1 Purpose and Use

(1) The number, spacing, type and location of access and traffic signals have a direct and often significant effect on the capacity, speed, and safety of a roadway and are limited in a hierarchical method by this category system. The location, operation and design standards within each category are necessary to ensure that the roadway will continue to function at the level (category) assigned.

(2) The standards in this section have been written so that the safety and operations of the complete general street system will be considered when determining access to the arterial roadway.

(3) The "Functional Characteristics and Category Assignment Criteria", subsection of each category is intended to describe the existing or future function of roadways for which that category is most appropriate. The access category assigned to a roadway segment may consider the extent of the development on the abutting land, as it exists at the time the access category is assigned. Three levels of development are considered in the assignment of an access category to a roadway segment. These are:

(a) **Sparsely developed** – the abutting land is sparsely developed and there is considerable flexibility as to the location and design of future access;

(b) **Partly developed** – some development abutting the roadway segment has already developed but there is flexibility in the location of additional access; and

(c) **Fully developed** – the abutting land is heavily developed, numerous access connections already exist and access to any additional development will be highly influenced by the existing development pattern. However, opportunities to improve

the access spacing and design may occur as abutting properties are redeveloped over a long period of time. The paramount objective for roadway segments categorized as 'fully developed' is to prevent further deterioration in the quality of service and to improve safety as may be practical. The purpose of spacing standards for this access category is to provide a 'vision' that might be obtained over a period of many years or several decades.

Roadway segments shall be classified based on as sparsely developed, partially developed or fully developed at the time an access category is assigned. The degree of development will be based on development already in place, a building permit has been issued, an application for a building permit has already been made, or a subdivision plat has been approved.

The existing design of the roadway is not required to meet the design standards at the assigned category at the time it is assigned. A proposed access that may be allowed under the standards set forth in this section, but fails to meet the design or safety criteria of the City of Wentzville, may be permitted if a design waiver is approved by the Public Work Director or City Engineer of the City of Wentzville or by the St. Charles County Engineer or the District Engineer of the Missouri Department of Transportation if located beyond the municipal limits and extraterritorial jurisdiction of the City of Wentzville.

(4) Traffic signals and their installation are also regulated by the *Manual on Uniform Traffic Control Devices, (M.U.T.C.D.)*. Nothing in this section is intended or shall be interpreted as requiring the City of Wentzville, St. Charles County or the Missouri Department of Transportation authorize a traffic signal or a left-turn movement at any location. No traffic signal shall be authorized without the completion of an analysis of traffic signal system operation, construction feasibility, and safety study as required by the City Engineer of the City of Wentzville or, if outside of jurisdiction of the City, by the St. Charles County Engineer or by the District Engineer of Missouri Department of Transportation as well as meeting the *M.U.T.C.D.* signal warrants.

The City of Wentzville, St. Charles County or the Missouri Department of Transportation may at its discretion in consideration of granting an access permit, require design and operational modifications as it considers necessary, restrict one or more turning movements, or deny the access so long as such discretion does not violate law.

3.2 Functional Classification Categories

The proposed system of classifying roadways is consistent with the conventional system included as part of the City of Wentzville Transportation Master Plan and *A Community's Vision*, the City of Wentzville's Comprehensive Plan. Typical speed ranges have been included with Table II-1.

Table II-1 Functional Classification System Description for Access Management

Functional Class	Level of Mobility	System Access	Level of Accessibility
Freeway or interstate (Category 1)	Connects all urban sub regions together, connects urban and rural service areas with metro major activity centers; connection to outside cities.	To other freeways, major arterials, and selected minor arterials; no direct land access.	Long trips at high speed within and through the metro area; express transit trips. Typical speed ranges between 55 and 70 m.p.h.
Major arterial (Category 2)	Connects two or more sub regions; provides secondary connections outside cities; complements freeways in high volume corridors.	To freeways, other major arterials, and major collectors; no direct land access except major traffic generators.	Medium distance to long trips at high to moderate speeds within the urban area; express transit trips. Posted speeds typically range from 35 to 55 m.p.h.
Minor arterial (Category 3)	Connects adjacent sub regions and activity centers within sub regions.	To freeways, major arterials, minor arterials, major collectors and minor collectors; restricted direct land access.	Medium to short trips at moderate to low speeds; local transit trips. Posted speeds typically range from 35 to 55 m.p.h.
Major and minor collectors (Category 4)	Connects neighborhoods within and between sub regions.	To major and minor arterials, other collectors and local streets; direct land access.	Primarily serves collection and distribution function for the arterial system at low speeds; local transit trips. Posted speeds typically range from 25 to 40 m.p.h.
Local streets (includes urban and rural) (Category 5)	Connects blocks within neighborhoods and specific activities within homogeneous land use areas.	To major and minor collectors and other local streets; direct land access.	Almost exclusively collection and distribution; short trips at low speeds.

Source: City of Wentzville Public Works Department, 2003.

3.3 Access Standards Overview

The following table can be used to quickly reference the access standards described in the sections below. The table should supplement and not replace the detailed descriptions. More detail regarding the flexibility of each standard can not be interpreted by the summary table but is described in the text. Spacing distances and corner clearances are measured as the minimum distance from center-to-center between access connections on the same side of the roadway.

Table II-2 Access Standards Reference Table

Functional Class	Signal Spacing*	Unsignalized Median Opening Spacing*	Access Connection Spacing and Corner Clearance*	Auxiliary Lanes
Freeway or interstate (Category 1)	MoDOT jurisdiction and access standards.			
Major arterial (Category 2) Sparsely Developed	2640 feet	1320 feet with auxiliary lanes per Section 4.2	660 feet when 50 mph or less	Left and right-turn bays desired at all signalized intersections. Right-turn bays are encouraged at all unsignalized access connections. City may require left and right-turn bays at any access connection.
Major arterial (Category 2) Partially Developed	2640 feet	1320 feet with auxiliary lanes per Section 4.2	660 feet when 45 mph or less	
Major arterial (Category 2) Fully Developed	2640 feet desired, 1320 feet at City discretion	Spacing is case by case per Section 4.2	Not less than 300 feet at 30 mph 350 feet at 35 mph 405 feet at 40 mph	
Minor arterial (Category 3) Sparsely Developed	2640 feet	1320 feet with auxiliary lanes per Section 4.2	660 feet when 45 mph or less	Left and right-turn bays desired at all signalized intersections. Right-turn bays are encouraged at all unsignalized access connections. City may require left and right-turn bays at any access connection.
Minor arterial (Category 3) Partially Developed	2640 feet	1320 feet with auxiliary lanes per Section 4.2	660 feet when 40 mph or less	
Minor arterial (Category 3) Fully Developed	2640 feet desired, 1320 feet at City discretion	Spacing is case by case per Section 4.2	Not less than 300 feet at 30 mph 350 feet at 35 mph 405 feet at 40 mph	
Major and minor collectors (Category 4)	1320 feet	Two way middle turn lanes are typically allowed without an access control median.	Not less than 255 feet at 25 mph 300 feet at 30 mph 350 feet at 35 mph 405 feet at 40 mph	Left-turn bays are desired at signalized intersections. City may require left and right-turn bays at any access connection.
Local streets (includes urban and rural) (Category 5)	Signals are typically not warranted.	Access control medians are typically not used.	One access connection per property with less than 200 feet of frontage. At City discretion, two access connections per property with more than 200 feet of frontage.	Left and right-turn bays are typically not used. City may require left and right-turn bays at any access connection.

* Spacing distances and corner clearances are measured as the minimum distance from center-to-center between access connections on the same side of the roadway. Speed references convey posted speed limits.

Sources: Research completed by Vergil G. Stover
National Highway Institute Course No. 15255 Access Management, Location and Design.
City of Wentzville Public Work Department, 2003.

3.4 Access Categories and Standards

Property Access Standards

Regardless the quantity of access connections, all adjacent commercial zoned properties shall develop alternative access and interconnect to adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

When adjacent properties (residential lots or other land uses) have frontage less than the access connection spacing or when one connection per parcel violates the access connection spacing standards, the City Public Works Department shall strongly encourage property owners to implement access connection plans so their public access connections conform to the spacing guidelines. Such plans and solutions could include property owners consolidating driveways, replacing individual driveways with shared access drives, developing alternative access and interconnecting to adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

Access to a corner property located at the intersection of two roadways of different functional classification shall be to the roadway having the lower functional classification unless the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, find that access on both frontages will improve safety or the traffic operations on the public roadway system. Where a corner property fronts on two roadways having the same functional classification, the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, shall specify the street to which access is to be provided. Access to a corner property shall be located near the property line most distant from the intersection.

The same spacing standards and criteria for durations apply to public roadways and private access connections.

Freeway or Interstate, Category 1

Freeways and interstates within the City of Wentzville are under the maintenance and jurisdiction of the Missouri Department of Transportation. Access management standards shall be in accordance with the Missouri Department of Transportation's current practices and standards.

Major Arterial, Category 2

Major arterials are second only to freeways and interstates in providing movement throughout the City of Wentzville-St. Charles County metropolitan region. This category is appropriate for roadways that have extensive continuity and that carry high volumes at relatively high speed in an efficient and safe manner. In accordance with the current practices of the Public Works Department of the City of Wentzville, no direct land access, except major traffic generators, is provided to this category of roadway. Directional traffic on major arterials should be separated by a non-traversable median. Access points should be constructed only if they meet the spacing criteria described in the following sections.

Access Category 2a
Major Arterial, Abutting Land is Sparsely Developed

Signal spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized, is 2640 feet center-to-center. Exceptions to this 2640 feet standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve a 2640 feet interval, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the City Engineer of the City of Wentzville if the proposed location is within the City of Wentzville or its territorial jurisdiction or to the St. Charles County Engineer or District Engineer of the Missouri Department of Transportation (MoDOT) if outside the city's territorial jurisdiction.

Where its not feasible to meet the 2640 feet spacing interval, a full signalized median opening may be permitted where a traffic signal progression analysis acceptable to the City Engineer of the City of Wentzville, or the St. Charles County Engineer or to the MoDOT District Engineer if outside the City's territorial jurisdiction, demonstrates that, at a minimum, traffic progression with at least 45% efficiency can be achieved for both peak and off-peak conditions.

Where topography or other existing conditions make 2640 feet intervals inappropriate or not feasible, location of the access will be determined with consideration given to topography, established property ownerships, unique physical limitations and/or unavoidable or pre-existing historical land use patterns and physical design constraints with every attempt to achieve a spacing of 2640 feet center-to-center. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the roadway. In selecting locations for full movement intersections, preference will be given to public roads.

Unsignalized median openings

Where a nontraversable median exists, unsignalized median openings may be permitted at a distance 1320 feet center-to-center from a signalized intersection provided that: (1) the opening is designed as a directional opening for left-turns and u-turns from the major arterial, and (2) an auxiliary lane for the left-turns/u-turns in accordance with the procedure and criteria given in Section 4.2.

If the roadway is undivided or has a continuous two-way left-turn lane, left-turns will be permitted unless an operational or safety problem is identified.

Access connection spacing

Direct land access at locations that do not conform to the signalized intersection spacing interval of 2640 feet is discouraged. When permitted, the spacing standard is 660 feet center-to-center on roadways where the posted speed is 50 mph or less. Major arterials under City of Wentzville jurisdiction are not expected to be posted greater than 50 mph. The access shall be limited to right-in/right-out only unless it is located directly across from a directional median opening.

Where it is not feasible to comply with the above-stated spacing standards, and alternative access is not available, a deviation where the proposed location is within ± 150 feet the standard spacing interval will be considered to be a minor deviation.

Auxiliary lanes

All median openings, signalized and unsignalized, shall have a left-turn lane in accordance with the provisions of Section 4.2 that will permit left-turning vehicles to clear the through traffic lane at a speed not more than 10 mph less than the speed of through traffic and come to a stop before reaching the end of the longest expected queue based on a 95% probability of storing all left-turning vehicles. The length of the turn bay shall be analyzed for both the peak and off-peak conditions and designed for whichever is the longest. Dual left-turns are encouraged where the expected left-turn volume exceeds 200 vehicles per hour.

A right-turn deceleration lane should be provided at all signalized locations. Auxiliary lanes for right-turns are encouraged at all unsignalized access connections and will be required at all connections where the volume in the outside (curb) traffic lane exceeds 350 vehicles per hour.

Right-turn acceleration lanes may be required by the City Engineer (or St. Charles County Engineer or MoDOT District Engineer).

Development subsequent to classification of a roadway segment

No additional access rights shall accrue upon the splitting or dividing of existing parcels of land or contiguous parcels under or previously under the same ownership or controlling interest. All access to newly created properties shall be provided internally from any existing access or a new access determined by the above design standards.

Access Category 2b
Major Arterial, Abutting Land is Partially Developed

Signal spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized is 2640 feet measured center-to-center.

Exceptions to this 2640 feet standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve the 2640 feet, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the City Engineer of the City of Wentzville or the St. Charles County Engineer or the MoDOT District Engineer if not within the jurisdiction of the City of Wentzville is completed in accordance with Section 4.1.

Unsignalized median openings

Where a nontraversable median exists, unsignalized median openings may be permitted at a desired distance 1320 feet center-to-center from a signalized intersection. Where a nontraversable median exists, an unsignalized median opening may deviate from the 1320 feet spacing provided that (1) it is designed as a directional opening and (2) an auxiliary lane for left-turns is provided in accordance with Section 4.2.

Access connection spacing

Access connections may be permitted if the junction spacing intervals 660 feet center-to-center where the posted speed is 45 mph or less. Major arterials under City of Wentzville jurisdiction are not expected to be posted greater than 50 mph.

Where it is not feasible and alternative access is not available, a deviation of 100 feet from the standard spacing interval will be considered to be a minor deviation.

Access Category 2c
Major Arterial, Abutting Land is Fully Developed

This access category is applicable where the abutting land is heavily developed, numerous access connections already exist and there is little opportunity to achieve long and uniform access spacing. The guiding principles for access management on these roadway segments is to: (a) keep the safety and operations from deteriorating further, (b) increase access spacing and improve access design as opportunities arise and as abutting properties are redeveloped, and (c) encourage property owners to consolidate driveways, replace individual driveways with shared access drives, to develop alternative access and to interconnect adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

Signal spacing

The ideal signal spacing on category 2c roadways is the same as for category 2b. Where development precludes such spacing, a uniform interval of 1320 feet center-to-center may be adopted. At the very minimum, no additional signal will be permitted where it would degrade traffic progression speeds or efficiency.

Unsignalized median openings

Unsignalized median openings on category 2c roadways that have a nontraversable median, or when a nontraversable median is constructed, may be permitted where: (1) the median is of sufficient width to be designed as a directional opening and (2) a left-turn lane can be provided in accordance with Section 4.2.

Access connection spacing

The principle objective is to avoid further degradation in the safety of operation of a category 2c roadway.

When properties develop, redevelop or change use, marginal access spacing should not be less than the stopping sight distance for the 85th percentile, off-peak speed (adjusted to represent center-to-center distances): 300 feet of 30 mph, 350 feet of 35 mph and 405 feet of 40 mph. Major arterials under City of Wentzville jurisdiction are not expected to be posted less than 30 mph. Where access connections already exist and if spacings are less than these intervals, increased spacing and improved design shall be implemented, to the extent feasible, where abutting properties are consolidated or redeveloped. Alternative access shall also be encouraged when development occurs. Consolidation of two or more existing access connections, or relocation of an access connection to improve safety or questions, is encouraged even though the consolidation, or relocation, will result in a spacing that is less than the above spacings based on speed.

Auxiliary lanes

Auxiliary lanes for left-turns and right-turns are encouraged at all signalized intersections and higher volume access connections. Local constraints may require that these auxiliary lanes will be much shorter than the standard design.

Minor Arterial, Category 3

Minor arterials constitute a large portion of major roadway system in Wentzville-St. Charles County metropolitan region. This category is appropriate for roadways that have extensive continuity and that carry high volumes at relatively high speed in an efficient and safe manner. The major difference between major arterials (access category 2) and minor arterials (access category 3) is in the number of through traffic lanes. In accordance with current practices of the City of Wentzville Public Works Department, direct land access is restricted. Directional traffic on minor arterials should be separated by a non-traversable median. Access points should be constructed only if they meet the spacing criteria described in the following sections.

Access Category 3a
Minor Arterial, Abutting Land is Sparsely Developed

Signal spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized, is 2640 feet measured center-to-center. Exceptions to this 2640 feet standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve a 2640 feet interval, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the City Engineer of the City of Wentzville if the proposed location is within the City of Wentzville or its territorial jurisdiction or to the St. Charles County Engineer or to the District Engineer of the Missouri Department of Transportation (MoDOT) if outside the city's territorial jurisdiction.

Where its not feasible to meet the 2640 feet spacing interval, a full signalized median opening may be permitted where a traffic signal progression analysis acceptable to the City Engineer of the City of Wentzville, or the St. Charles County Engineer or to the MoDOT District Engineer if outside the City's territorial jurisdiction, demonstrates that, at

a minimum, traffic progression with at least 45% efficiency can be achieved for both peak and off-peak conditions.

Where topography or other existing conditions make 2640 feet intervals inappropriate or not feasible, location of the access will be determined with consideration given to topography, established property ownerships, unique physical limitations and/or unavoidable or pre-existing historical land use patterns and physical design constraints with every attempt to achieve a spacing of 2640 feet center-to-center. The final location should serve as many properties and interests as possible to reduce the need for additional direct access to the roadway. In selecting locations for full movement intersections, preference will be given to public roads.

Unsignalized median openings

Where a nontraversable median exists, unsignalized median openings may be permitted at a distance 1320 feet center-to-center from a signalized intersection provided that: (1) the opening is designed as a directional opening for left-turns and u-turns from the major arterial, and (2) an auxiliary lane for the left-turns/u-turns in accordance with the procedure and criteria given in Section 4.2.

If the roadway is undivided or has a continuous two-way left-turn lane, left-turns will be permitted unless an operational or safety problem is identified.

Access connection spacing

Direct land access at locations that do not conform to the signalized intersection spacing interval of 2640 feet center-to-center is discouraged. When permitted, the spacing standard is 660 feet center-to-center on roadways where the posted speed is 45 mph or less. Minor arterials under City of Wentzville jurisdiction are not expected to be posted greater than 45 mph. The access shall be limited to right-in/right-out only unless it is located directly across from a directional median opening.

Where it is not feasible to comply with the above-stated spacing standards, and alternative access is not available, a deviation where the proposed location is within $\pm$ 150 feet the standard spacing interval will be considered to be a minor deviation.

Auxiliary lanes

All median openings, signalized and unsignalized, shall have a left-turn lane in accordance with the provisions of Section 4.2 that will permit left-turning vehicles to clear the through traffic lane at a speed not more than 10 mph less than the speed of through traffic and come to a stop before reaching the end of the longest expected queue based on a 95% probability of storing all left-turning vehicles. The length of the turn bay shall be analyzed for both the peak and off-peak conditions and designed for whichever is the longest. Dual left-turns are encouraged where the expected left-turn volume exceeds 200 vehicles per hour.

A right-turn deceleration lane should be provided at all signalized locations. Auxiliary lanes for right-turns are encouraged at all unsignalized access connections and will be

required at all connections where the volume in the outside (curb) traffic lane exceeds 350 vehicles per hour.

Right-turn acceleration lanes may be required by the City Engineer (St. Charles County Engineer or MoDOT District Engineer).

Development subsequent to classification of a roadway segment

No additional access rights shall accrue upon the splitting or dividing of existing parcels of land or contiguous parcels under or previously under the same ownership or controlling interest. All access to newly created properties shall be provided internally from any existing access or a new access determined by the above design standards.

Access Category 3b
Minor Arterial, Abutting Land is Partially Developed

Signal spacing

The standard for the spacing of all intersecting public ways and other accesses that will be full movement, or are or may become signalized is 2640 feet measured center-to-center.

Exceptions to this 2640 feet standard will not be permitted unless the proposal documents that there are no other reasonable alternatives to achieve the 2640 feet, there is a documented necessity for the intersection at the proposed location, and a signal study acceptable to the City Engineer of the City of Wentzville, or to the St. Charles County Engineer or to the MoDOT District Engineer if not within the jurisdiction of the City of Wentzville, is completed in accordance with Section 4.1.

Unsignalized median openings

Where a nontraversable median exists, unsignalized median openings may be permitted at a desired distance 1320 feet center-to-center from a signalized intersection. Where a nontraversable median exists, an unsignalized median opening may deviate from the 1320 feet spacing provided that (1) it is designed as a directional opening and (2) an auxiliary lane for left-turns is provided in accordance with Section 4.2.

Access connection spacing

Access connections may be permitted if the junction spacing intervals 660 feet center-to-center where the posted speed is 40 mph or less. Minor arterials under City of Wentzville jurisdiction are not expected to be posted greater than 40 mph.

Where it is not feasible and alternative access is not available, a deviation of 150 feet from the standard spacing interval will be considered to be a minor deviation.

Access Category 3c
Minor Arterial, Abutting Land is Fully Developed

This access category is applicable where the abutting land is heavily developed, numerous access connections already exist and there is little opportunity to achieve long and uniform access spacing. The guiding principles for access management on these roadway segments is to: (a) keep the safety and operations from deteriorating further, (b) increase access spacing and improve access design as opportunities arise and as abutting properties are redeveloped, and (c) encourage property owners to consolidate driveways, replace individual driveways with shared access drives, to develop alternative access and to interconnect adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

Signal spacing

The ideal signal spacing on category 2c roadways is the same as for category 2b. Where development precludes such spacing, a uniform interval of 1320 feet measured center-to-center may be adopted. At the very minimum, no additional signal will be permitted where it would degrade traffic progression speeds or efficiency.

Unsignalized median openings

Unsignalized median openings or category 2c roadways that have a nontraversable median, or when a nontraversable median is constructed, may be permitted where: (1) the median is of sufficient width to be designed as a directional opening and (2) a left-turn lane can be provided in accordance with Section 4.2.

Access connection spacing

The principle objective is to avoid further degradation in the safety of operation of a category 2c roadway.

When properties develop, redevelop or change use, marginal access spacing should not be less than the stopping sight distance for the 85th percentile, off-peak speed (adjusted to represent center-to-center distances): 300 feet at 30 mph, 350 feet at 35 mph and 405 feet at 40 mph. Minor arterials under City of Wentzville jurisdiction are not expected to be posted less than 30 mph. Where access connections already exist and if spacings are less than these intervals, increased spacing and improved design shall be implemented, to the extent feasible, where abutting properties are consolidated or redeveloped. Alternative access shall also be encouraged when development occurs. Consolidation of two or more existing access connection, or relocation of an access connection to improve safety or questions, is encouraged even though the consolidation, or relocation, will result in a spacing that is less than the above spacings based on speed.

Auxiliary lanes

Auxiliary lanes for left-turns and right-turns are encouraged at all signalized intersections and higher volume access connections. Local constraints may require that these auxiliary lanes will be much shorter than the standard design.

Major and Minor Collector Streets, Category 4

This category of roadway provides direct land access as well as the collection – distribution of traffic. Lower traffic volumes, slower speeds and driver expectation permit more closely spaced access connections than provided on arterial roadways. A speed differential of more than 10 mph between turning vehicles and through traffic may be acceptable.

Access Category 4a
Major or Minor Collector, Abutting Land is Sparsely Developed or Partly Developed

Signal spacing

The standard signal spacing is 1320 feet measured center-to-center. Where it is not feasible to achieve the 1320 feet interval, a traffic signal may be permitted if traffic progression with at least 35% can be achieved during off-peak periods. Traffic progression during peak periods is not usually expected.

Access connection spacing

Stopping sight distance is the principal criterion for access connection spacing. This will enable drivers to clear an access connection before the need to possibly respond to an event at another connection. Based on posted speed limits, minimum spacings are (adjusted to represent center-to-center distances): 255 feet at 25 mph, 300 feet at 30 mph, 350 feet at 35 mph and 405 feet at 40 mph.

Auxiliary lanes

A left-turn bay is required at all signalized access connections unless the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, finds that one is not justified. The City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, may require a left-turn bay and/or a right-turn bay at any access connection – signalized or unsignalized.

Urban and Rural Local Streets, Category 5

Local streets serve direct land access and provide connection with collector roadways. Properties having less than 200 feet of frontage shall be limited to one access connection unless the City Engineer, St. Charles County Engineer or the District Engineer based on jurisdiction, finds that two connections will improve traffic operations or safety on the roadway system. At the discretion of the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, two access connections may be considered where the abutting property has 200 feet or more frontage on the local roadway.

4.0 Deviations

4.1 Signal Spacing

Where its not feasible to meet the signal spacing interval, a signalized intersection may be permitted where a traffic signal progression analysis acceptable to the City Engineer, St. Charles County Engineer or the District Engineer if outside the City's territorial jurisdiction, demonstrates that, at a minimum, traffic progression efficiency specified for the access category of the roadway segment can be achieved for both peak and off-peak conditions. The minimum progression efficiency shall not be less than that given in Table II-3. The City Engineer (or St. Charles County Engineer or the District Engineer based on jurisdiction) will specify, (1) the cycle length(s) and progression speed(s) for the a.m. and p.m. peaks, (2) the cycle lengths, and progression speed(s) for the midday period and any other off-peak period(s) to be analyzed, (3) the section of roadway to be used in the analysis, (4) traffic volumes, (5) the computer model to be used, and (6) any other conditions as may be appropriate.

Table II-3 Minimum Progression Efficiency

Functional Class	Access Category	Progression Efficiency Peak Periods	Off-Peak
Major arterial	2a	45%	50%
	2b	40%	45%
	2c	(1)	(1)
Minor arterial	3a	40%	50%
	3b	35%	45%
	3c	(1)	(1)
Major and minor collector	4a	(2)	35%
	4b	(2)	30%
	4c	(2)	(1)

(1) No decrease in progression efficiency shall be permitted.
(2) Traffic progression usually not provided.
Sources: Research completed by Vergil G. Stover
National Highway Institute Course No. 15255 Access Management, Location and Design.

4.2 Unsignalized Median Openings

An unsignalized median opening may deviate from the spacing standard if the location will not interfere with the safety or operation of a nearby signalized intersection. The following procedure will be used in this evaluation.

Step 1: Determine the functional distance (distance traveled during perception-reaction plus maneuvering distance plus queue storage) of the signalized intersections.

Step 2: Determine the space available for an unsignalized opening by subtracting the sum of the functional intersection distances from Step 1 from the distance between the two signalized intersections.

Step 3: Determine the functional distance (distance traveled during perception-reaction time plus maneuver distance plus queue storage) of the proposed unsignalized median opening.

Step 4: Compare the distance needed for the unsignalized opening from Step 3 with the distance available from Step 2.

Step 5: The unsignalized opening may be provided if the space available (Step 2) is longer than that needed (Step 3).

4.3 Nonconforming Properties

A property that has frontage that is less than the access connection spacing, or that due to topographic or other aloud conditions will be considered to be a nonconforming lot. Such lots will be permitted one access connection. Vehicle use limitations included as a condition of the access permit will include volume limitation in accordance with the following equation.

$$V = 50 + \frac{L + R^2}{2S} 100$$

Where:

- V = Permissible peak hour vehicular trips (total to and from the lot).
- L = Left distance between the lot centerline and either the centerline of the next adjacent non single-family residential lot, the centerline of the adjacent side street for a corner lot, or one-half of the major roadway frontage plus one-half of the minor side street frontage for a corner lot with alternative access. The maximum distance for L cannot exceed S.
- R = Right distance measured similar to L above. The maximum distance for R cannot exceed S.
- S = Spacing distance, based on the posted speed limit and access connection spacing for category 4a above (i.e. minimum spacings, adjusted to represent center-to-center distances, of: 255 feet at 25 mph, 300 feet at 30 mph, 350 feet at 35 mph and 405 feet at 40 mph).
- A = Acreage of the lot, but no greater than 3.0 acres on category 2 and 3 segments and 2.0 acres on category 4 roadway segments.

The Director of Public Works or City Engineer shall increase the permissible peak-hour vehicular use (V) by a 15 percent bonus if a lot has either (a) or (b) below. There is a maximum of two bonuses ($V_{max} = 1.3V$) for those lots having both of the following features.

(a) Shared access with another lot. Motorist must be able to drive directly between the two lots.
(b) Alternative access to a street other than a Category 2 or 3 roadway. On divided roadways, two one-way access points may be substituted for a two-way access point.

TRANSPORTATION MASTER PLAN

Technical Memorandum #3
Traffic Impact Study Standards

City of Wentzville, Missouri

Technical Memorandum #3
Traffic Impact Study Standards

Traffic impact studies are reports typically prepared in advance of approving a zoning change or a site plan that would result in a discernable traffic impact to the adjacent street system. In this section, guidelines are provided regarding when a traffic study should be requested to be completed by the developer and what the report should address.

1.0 Traffic Impact Study (TIS) Purpose and Responsibility

A Traffic Impact Study assesses the impact on the transportation system caused by a change in use of property, proposed development, or zoning change. If the impacts cause deficiencies, improvements and mitigation measures are then recommended. The TIS is a tool to:

- Maintain the function and operation of the transportation network so it is not adversely affected by the change in use.
- Identify transportation impacts or problems associated with the property, especially its access to the transportation system.
- Identify solutions to potential impacts and adverse effects.
- Recommend internal and external improvements to be included into the property's proposed development.

The property owner, developer or traffic consultant has the responsibility for performing the Traffic Impact Study associated for the proposed change in use or redevelopment. The City Engineer and City Public Works Director serve as the reviewing agency and should determine the warrants and scope of the study.

Traffic signal warrants, site plan reviews, permit reviews and other City studies or reviews are separate from a TIS.

2.0 Definitions

Access connection - a driveway, intersection, turnout or other means of providing for vehicles to move between the public roadway and abutting private property. The minimum distance between access connections on the same side of the roadway is measured from center-to-center of adjacent access connections.

Access street – a public roadway providing an access connection for vehicles to move between the public roadway and abutting private property or proposed site.

Auxiliary lane - that portion of adjoining the traveled way for speed change, turning, decelerating, accelerating, or other purposes supplementary to through traffic movement.

Average Daily Traffic (ADT) – a unit defined as the average amount of vehicles per day that pass a specific point. It is usually used to describe the amount of traffic using a roadway segment or performing a specific traffic movement.

Band width – the time in seconds that traffic can flow uninterrupted through a coordinated traffic control system.

Change in use – a change in the use of a property causing the trip generation of the property to increase by more than 100 vehicles in any 60-minute interval or to increase by more than 10%, whichever is less. Or, resulting in a change in the mix of passenger vehicles and large vehicles of more than 10%. Or, resulting in the direction from which vehicles entering or leaving the site to change by more than 20%.

City Engineer or City Public Works Department – the Public Works Director or City Engineer of the City of Wentzville.

Corner clearance - the distance from an access connection to the nearest intersection. The distance is measured from center-to-center from the intersecting roadway to the adjacent access connection.

Corridor plan – a plan identifying the location and features of access connections to a specific section of public roadway. The plan will show the following: (1) access connections to be retained, existing access connections to be modified or closed and new access locations, (2) the location of existing traffic signals and proposed future signals, including those to be relocated, (3) the type and width of any median, (4) the location and type (full or directional) of all median openings including existing openings to be retained, modified or closed and proposed future openings.

Directional median opening - an opening is a nontraversable median that is designed to accommodate a specific movement, such as a left-turn or u-turn, and prohibit all other movements.

District – the City of Wentzville resides in District 6 of the Missouri Department of Transportation.

District Engineer - the Engineer in charge of District 6 of the Missouri Department of Transportation.

Full median opening - an opening in a nontraversable median that permits all movements, i.e., left-turns from the roadway, left-turns from an access connection or cross road and crossing movements from one side of the roadway to the other.

Functional intersection area – the distance traveled during the driver's perception-reaction time plus the distance to brake to a stop plus the distance for storing a queue of stopped vehicles.

Intersection - a junction of two public roads.

Intersection sight distance – the distance required by a driver, traveling at a given speed approaching an intersection, to perceive the presence of potential conflicts and adjust their speed or come to a stop, as appropriate, to avoid a collision. It consists of the distance traveled during perception-reaction time plus the distance used while braking to adjust their speed or come to a stop.

Large vehicle - any vehicle having more than two axles or dual wheels on any axle.

Left-turn lane, Left-turn bay - an auxiliary lane to permit a driver making a left-turn to clear the through traffic lane before decelerating to a stop.

Minimum connection spacing - the minimum distance between access connections on the same side of the roadway as measured from center-to-center of adjacent access connections.

Nonconforming lot – A property that has frontage that is less than the access connection spacing due to topographic or other aloud conditions.

Peak hour traffic – the 60-minute interval of highest traffic volumes on roadways within a study area and/or the 60-minute interval of highest traffic volumes of trips generated by a property.

Perception – reaction time – the time needed by a driver to perceive a situation or condition plus the time to identify the specific situation or condition plus the time needed to evaluate and decide upon a specific course of action plus the time to initiate that action.

Sight triangle – specified 3-sided area, which should be clear of obstructions, with sides that follow along two adjacent intersection approaches that connect at a shared corner and connect to a third side placed across the corner. Distances along the triangles are based on drivers traveling at a given speed and the size of the intersection.

Signal spacing - the distance between signalized access connections or intersections as measured center-to-center of the intersecting roadways.

Stopping sight distance – the distance required by a driver, traveling at a given speed, to come to a stop. It consists of the distance traveled during perception-reaction time plus the distance used while braking to a stop.

Study area (TIS study area) – an area within limits as defined by the City Engineer or City Public Works Director.

Study horizon or horizon year – the future year as defined by the City Engineer or City Public Works Director that the Traffic Impact Study should evaluate when analyzing the property's no-build condition (or other baseline alternative condition) and the build condition. There can be more than one event horizon as determined by the City Engineer or City Public Works Director.

Traveled way - that portion of a roadway for the movement of vehicles, exclusive of shoulders or auxiliary lanes.

3.0 Traffic Impact Study (TIS) Warrants

A Traffic Impact Study is typically warranted when one of the following is satisfied:

- The development causes the trip generation of the property to increase by more than 1,500 vehicles in a day.
- The development causes the trip generation of the property's new trips, not pass by trips, to increase by more than 100 vehicles in any 60-minute interval.
- A development where a proposed residential subdivision with 200 or more lots (or units) is expected.
- The property is near streets and intersections previously identified as having poor levels-of-service such as LOS E or LOS F.

A traffic signal warrant may still be requested by the City Engineer or City Public Works Director even when a Traffic Impact Study is not. Traffic signal warrants, site plan reviews, permit reviews and other City investigations or reviews are separate from a TIS.

Typical developments that cause the trip generation of the property to satisfy the above warrants are shown in the following table for use as examples. The City should reference *Trip Generation* by the Institute of Transportation Engineers when investigating TIS warrants.

Table III-1 Typical Land Uses Satisfying TIS Warrants

Land use category	Description or criteria
Gasoline station	More than eight pumps
General light industrial use	215,000 square feet and/or 500 employees
Apartments	225 units and/or housing 450 people
Hotel	180 rooms and/or 105 employees
Golf course	300 acres and/or 40 holes
Movie theater	20,000 square feet and/or seven screens
Middle school	27,000 square feet and/or 220 students
Office	64,000 square feet and/or 210 employees
Medical or dental center	27,000 square feet and/or 94 employees
Fast food restaurant	2,000 square feet
Bar or lounge	6,500 square feet
Car lot	40,000 square feet
Electronics store	22,500 square feet
Pharmacy or drug store	11,000 square feet
Drive-in bank	1,850 square feet and/or eight employees

Source: *Trip Generation*, Institute of Transportation Engineers, 1997.

4.0 Scope of a TIS

In advance of a Traffic Impact Study, the property owner and/or traffic consultant should discuss with the City Engineer or City Public Works Director to understand the study's scope. This will help ensure the TIS is properly prepared, and that the recommendations made are realistic and feasible. Contact between the preparer and reviewer is encouraged throughout the preparation of the TIS. Often the City Public Works Department can provide data to the preparer such as land use, zoning and traffic counts if requested.

4.1 TIS Study Area Limits

The City Engineer or City Public Works Director should determine the limits of the TIS study area. The TIS study area boundaries shall include:

- Major and minor roadways adjacent to the site.
- The first encountered signalized intersections adjacent to the property on the logical travel path between the site and the City's major roadway transportation network.
- Additional intersections on the logical travel path between the site and the City's major roadway transportation network as determined by the City Public Works Director or City Engineer.
- Critical intersections, access connections and driveways rationally identified to receive impact.
- Railroad crossing intersections and bicycle, pedestrian and transit crosswalk locations rationally identified to receive impact.
- Existing and future traffic impacts of other nearby planned developments known at the time that rationally have a traffic impact on part of the TIS study area, the study corridor or impact a specific intersection under evaluation as determined by the City Public Works Director or City Engineer.

4.2 Study Horizon

The City Engineer or City Public Works Director should determine the study horizon or the future year to be studied for the no-build condition (or other baseline alternative condition) and the build condition. The City Engineer or City Public Works Director can require more than one study horizon. The study horizon is usually determined as one or more of the following:

- A scheduled year for completion of the property's change in use.
- A year as determined using the City's Comprehensive Plan.

4.3 Additional Elements

The Traffic Impact Study Standards are to serve as general guideline for the preparation and review of a property's traffic impact on the City's transportation system, public roadways or right-of-way. Since it cannot cover all situations, some studies will require additional report elements or unique analytical methods that should be discussed in advance with the City Engineer or City Public Works Director and included in the scope. Additional elements could include:

- Approval of the trip generation and trip distribution methodology.
- Approval of the traffic analysis methodology and/or software.
- Alternative horizon year conditions other than the no-build condition.
- More than one study horizon (horizon year).
- Acceptable and unacceptable level-of-service determination.
- Number and location of traffic counts to be performed.
- Intermediate construction phases and temporary conditions to be analyzed (typically done if transportation improvements are not complete in initial construction phase regardless of the duration the property remains in an intermediate phase).
- Application of traffic safety measures and traffic calming measures.
- TIS schedule milestones and Traffic Impact Study completion date if atypical.

Traffic signal warrants, site plan reviews, permit reviews and other City studies or reviews are separate from a TIS

5.0 Traffic Impact Study (TIS) Contents

This section lists a typical table of contents of a Traffic Impact Study to serve as a guideline for preparation of the document. A TIS is often data intensive, so graphics and diagrams in each section are often desired to communicate findings rather than text descriptions.

A. Executive Summary
Description of existing and proposed future property development
Description of scope, contacts, site location and TIS study area
Findings, LOS and conclusions (graphics and figures desired)
Mitigation and improvement plan summary

B. Property and Site Description
Description of existing and proposed land use, zoning and type of project
Size of project in units such as square footage, area by type, density
Description of project phasing and stages to study horizon
Socio-economic characteristics of the property users if atypical of the development
Description of other major existing and future property developments in TIS study area
Description of existing transportation facilities and other transportation modes if impacted
Document coordination with known capital improvements, City Comprehensive Plan implementation, known transportation plans, other planned external improvements and traffic impact studies
Typical graphics and/or tables include:

- Location map relative to the City limits or region
- TIS study area map showing property location and area of influence
- Existing and proposed land use map of TIS study area
- Existing transportation map including major and minor roadways adjacent to the site plus roadway, bicycle, pedestrian and transit access
- Site plans showing:
  - Location of site relative to adjacent roadways and parcels
  - Access connections to public roadways and adjacent parcels or sites
  - Internal access and circulation control if impacting operations of public roadways or right-of-way

C. Existing Condition
Used for comparison purposes in evaluation. As determined by the City Public Works Director or City Engineer, this section shall consider the existing traffic impacts of other zoned or land uses that are part of the TIS study area, that have a traffic impact on the study corridor or impact a specific intersection under evaluation.
Description of site access and external circulation
Document items for roadways, intersections and signals within TIS study area such as:
Existing traffic volumes, ADT, truck or large vehicle percentages, peak hour volumes for streets and properties
Existing traffic counts should not be older than two years of the TIS date.
Volume to capacity (V/C) and level-of-service (LOS) analysis (include LOS of intersections, intersection approaches and turning movements)
Gap acceptance analysis along public roadways for points of egress (LOS for stop control)

Travel characteristics of streets within the TIS study area such as:

- Sight distance limitations on the roadway and at access connections
- Pavement width or right-of-way (ROW) width limitations if impacting operations
- Horizontal or vertical alignment deficiencies if impacting operations

Typical graphics and/or tables include:

- Figures of existing roadways, street corridor plans, intersection diagrams, dimensions, number of lanes, lane uses, and configurations in the TIS study area
- Figures of existing traffic volumes, V/C, LOS, ADT, truck or large vehicle percentages, and peak hour volumes and turning movements for streets, intersections and properties in the TIS study area
- Information that shows sight distance measurements at ingress and egress points in the TIS study area (and crash statistics if available)

D. No-Build (or other baseline alternative) Condition at Study Horizon Year

Analysis assumes property's change in use (proposed site) is not part of TIS study area in the future year. As determined by the City Public Works Director or City Engineer, this section shall consider the future traffic impacts of other zoned or future land uses that are part of the TIS study area, that have a traffic impact on the study corridor or impact a specific intersection under evaluation.

Description of future site access, access connections, and external circulation if different than existing conditions

Application of trip generation of other known future projects in the TIS study area

Document items for roadways, intersections and signals within TIS study area such as:

- Forecasted traffic volumes, ADT, truck or large vehicle percentages, peak hour volumes for streets and properties
- Volume to capacity (V/C) and level-of-service (LOS) analysis (include LOS of intersections, intersection approaches and turning movements)
- Gap acceptance analysis along public roadways for points of egress (LOS for stop control)
- Analysis of other planned transportation improvements complete by study horizon
- Anticipated travel impacts of streets within the TIS study area such as:
  - Sight distance limitations on the roadway and at access connections if impacting operations
  - Pavement width or right-of-way (ROW) width limitations if impacting operations
  - Horizontal or vertical alignment deficiencies if impacting operations

Typical graphics and/or tables include:

- Anticipated roadways, street corridor plans, intersection diagrams, dimensions, number of lanes, lane uses, and configurations impacting public roadways or right-of-way in the TIS study area
- Forecasted traffic volumes, V/C, LOS, ADT, truck or large vehicle percentages, and peak hour volumes and turning movements for streets, intersections and properties in the TIS study area
- Information that shows sight distance measurements at ingress and egress points impacting public roadways or right-of-way if different than existing conditions in the TIS study area

E. Build Condition at Study Horizon Year

Analysis assumes property's change in use (proposed site) is integrated in the TIS study area in the future year. As determined by the City Public Works Director or City Engineer, this section shall consider the future traffic impacts of other zoned or future land uses that are part of the TIS study area, that have a traffic impact on the study corridor or impact a specific intersection under evaluation. Traffic impacts on the public roadway or right-of-way shall include existing traffic, other future traffic growth, the forecasted property traffic and traffic of other known developments.

Estimate and apply trip generation, average vehicle trips per day, peak hour volumes of streets, peak hour volumes of property, directional distribution, volume assignments impacting the public roadway or right-of-way

Apply other trip generations of external projects in the TIS study area

Document unique conditions that vary travel demand if any

Description of proposed site access, access connections and external circulation

Evaluate and document application of the City Access Management Standards

Document items for public roadways, intersections and signals within TIS study area such as:

- Volume to capacity (V/C) and level-of-service (LOS) analysis (include LOS of intersections, intersection approaches and turning movements)
- Gap acceptance analysis for points of egress (LOS for stop control)
- Inclusion of external planned transportation improvements complete by study horizon
- Anticipated sight distances, turning movement conflicts and other possible hazards impacting public roadways or right-of-way

Analyze impacts to public roadways or right-of-way of temporary conditions related to construction staging and phasing (typically done only if transportation improvements are not complete in initial construction phase regardless of the duration the property remains in an intermediate phase)

Typical graphics and/or tables include:

- Anticipated impacts to public roadways or right-of-way, street corridor plans, intersection diagrams, dimensions, number of lanes, lane uses, and configurations in the TIS study area
- Anticipated directional distribution and turning volumes of the property's trip generation on the transportation network, public roadways or right-of-way in the TIS study area
- Total forecasted traffic volumes, V/C, LOS, ADT, truck or large vehicle percentages, and peak hour volumes and turning movements for streets, intersections and properties in the TIS study area
- Information that shows anticipated sight distance measurements at proposed ingress and egress points impacting public roadways or right-of-way in the TIS study area

F. Recommendations, Mitigation Plan, Additional Analysis

This section identifies the mitigation measures to the public roadway and right-of-way in areas where the proposed site causes an adverse effect. All roadways and intersections showing a LOS below C should be provided with specific recommendations for the elimination of the transportation deficiencies to achieve LOS C or above.

Describe recommendations and mitigation measures to counterbalance impacts for traffic or other factors impacting public roadways or right-of-way to achieve LOS C or above such as:

- Application of turn prohibitions or traffic channelization by identifying turning movement conflicts
- Access connection location and design improvements impacting public roadways or right-of-way

- External transportation improvements along street frontage and other roadways affecting roadway design, intersection design, traffic signal installation, signal operation and timing, roadway signage
- Other planned transportation improvements including recommendations to other travel modes if any

Document how recommendations change:

- Volume to capacity (V/C) and level-of-service (LOS) analysis to achieve LOS C or above
- Travel safety such as conflict points, sight distances and possible hazards if any

Provide implementation schedule of recommendations, mitigations, improvements and modifications

Typical graphics and/or tables include:

- Proposed improvements, dimensions and configurations used as mitigation measures impacting public roadways and right-of-way
- Information that shows the mitigated changes in V/C, LOS for streets, intersections and property access connections impacting public roadways and right-of-way
- Information that shows mitigated sight distance measurements at ingress and egress points impacting public roadways and right-of-way

G. Appendix

Description of analysis method, assumptions and limitations
Data collection items, demographics, traffic counts etc.
Calculations and work sheets from analysis
References

6.0 Reviewing Guidelines

This section describes reviewing considerations of a TIS that can be used to further describe some areas of the contents.

6.1 Formal Review

Traffic Impact Studies should be reviewed by the following:

- The City Engineer
- The City Public Works Director

The formal review after submittal of the Traffic Impact Study should include the following:

- Lists of acceptable and unacceptable analysis and conclusions
- Acceptability of recommendations, provisions, roadway improvements, site access and external circulation that impact public roadways and/or right-of-way
- List of required improvements that could mitigate impacts of the property's change in use
- List of requested study revisions or a letter of acceptance of the study to submit to the preparer

Requests for study revisions should identify the findings of the formal review and the specific additional information required. The revisions performed by the preparer can be included as an addendum to the original study, or a revised TIS may be requested by the reviewer.

6.1 Considerations During TIS Review

This section describes in more detail typical rules of thumb to apply when reviewing a Traffic Impact Study. Since some factors may not apply to all situations, it is up to the discretion of the reviewer to decide when to apply or require certain guidelines. In general, the following factors should given special focus during review:

Safety Considerations

Stopping sight distances should meet American Association of State Highway and Transportation Officials (AASHTO) guidelines at all ingress and egress points. The stopping sight distance for the 85th percentile, off-peak speed are: 155 feet at 25 mph, 200 feet at 30 mph, 250 feet at 35 mph and 305 feet at 40 mph. Deviation should be noted and approved by the City Engineer or City Public Works Director.

If available, existing crash statistics can be reviewed. Sometimes crash data can aid the identification of existing condition or no-build condition areas in need of improvement. Often crash data is not available, so consideration should be given toward access control measures, sight distances and other factors to promote travel safety.

Trip Generation Considerations

The estimated site trip generation should be determined in units of ADT and peak hours. The site trip generation volumes should be calculated using data and methods from various studies such as:

- *Trip Generation*, published by the Institute of Transportation Engineers, which contains rates based on development type, size, etc.
- By making counts of turning movements at an existing project or property with similar characteristics, calculating the trip generating rates in terms of an appropriate unit, such as vehicles per 1,000 feet of gross leasable floor area or vehicles per maximum number of patrons and employees, and then applying those rates to the proposed property.
- Other studies approved by the City Engineer in accordance with what is considered the industry standard and best practices by transportation professionals.

The Traffic Impact Study should determine the directional distribution of trips impacting public roadways and right-of-way. The analysis should allocate trips generated and traffic volumes to access connections based on directions of approach and departure. By relating this information to existing roadway traffic volumes a basis is provided for selecting access connection designs, identifying turning movement conflicts and applying turn prohibitions or traffic channelization recommendations. Alternatively, population and employment distribution by census block group, or simpler geographic area, may be allowed as approved by the City Public Works Director or City Engineer.

The existing, no-build (or other baseline alternative) and build conditions should include an estimation of specific turning movements by combining trip generation results with directional distribution of trips. These estimates are important tools to determine the cumulative effect upon street capacities and levels-of-service within the TIS study area caused by the development proposals.

Traffic Operational Considerations

The peak hour LOS should not drop more than one level at any one location when comparing the build condition to the no-build condition (or other baseline alternative condition). The reviewer may ignore this consideration if the LOS of the location is still acceptable (LOS C or above) by the City Engineer or City Public Works Director. Recommendations and mitigation to achieve LOS C or above should otherwise be given in the TIS.

The LOS of a street segment or of an intersection approach within the TIS study area should not drop below LOS C in the build condition. Recommendations and mitigation to achieve LOS C or above should otherwise be given in the TIS.

The ADT of any street in the build condition should not be greater than 33% above the ADT of the street in the no-build condition (or other baseline alternative condition). The reviewer may ignore this consideration if the LOS or volume to capacity of the street is still considered acceptable by the City Engineer or City Public Works Director.

Street capacities and traffic volumes in the TIS study area should include the cumulative effects of other planned developments known at the time when performing the Traffic Impact Study that should be determined and agreed upon when defining the scope of a TIS.

The Traffic Impact Study should evaluate potential conflicts with street traffic or traffic on other public roadways or right-of-way in the TIS study area. The TIS should examine:

- Potential conflicts created along the access street(s), public roadway(s) or right-of-way
- Impacts of ingress and egress turning movements, particularly left turning movements if impacting public roadways or right-of-way
- Determine the need for transportation improvements adjacent to the property, i.e. left-turn and right-turn bays, access control measures according to the City's Access Management Standards, medians, driveway islands, sidewalks, bicycle lanes, etc.
- Describe and analyze the "downstream" impacts at critical intersections and other access connections and assess the needs for improvement in the TIS study area.
- Operational analysis should include techniques from the *Highway Capacity Manual* and other methods approved by the City Engineer in accordance with what is considered the industry standard and best practices by transportation professionals.

Site Considerations

Access connection (driveway) locations and spacings should be designed using the City's Access Management Standards. Measurements and dimensions should be called out. Deviations should be shown to fit the needs and uses of the property as determined and approved by the City Engineer.

Access connections and/or driveways should be placed so queuing vehicles do not block the connection resulting in congestion along the public roadways or right-of-way.

Circulation between adjacent properties should be provided in the site plan so vehicles can travel between sites without needing to exit and reenter along the access street(s). Access connections along the access street(s) can serve more than one property or site, so internal

circulation between adjacent properties should be provided per the City's Access Management Standards:

- Regardless the quantity of access connections, all adjacent commercial zoned properties shall develop alternative (cross) access and interconnect to adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

- When adjacent properties (residential lots or other land uses) have frontage less than the access connection spacing or when one connection per parcel violates the access connection spacing standards, the City Public Works Department shall strongly encourage property owners to implement alternative access connection plans so their public access connections conform to the spacing guidelines. Such plans and solutions could include property owners consolidating driveways, replacing individual driveways with shared access drives, developing alternative access and interconnecting to adjacent parcels so that pedestrians and vehicles can circulate between them without using the abutting public roadway.

- Access to a corner property located at the intersection of two roadways of different functional classification shall be to the roadway having the lower functional classification unless the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, find that access on both frontages will improve safety or the traffic operations on the public roadway system. Where a corner property fronts on two roadways having the same functional classification, the City Engineer, St. Charles County Engineer or District Engineer based on jurisdiction, shall specify the street to which access is to be provided. Access to a corner property shall be located near the property line most distant from the intersection.

Phasing Considerations

Study and analysis of the temporary build conditions or construction phasing of the property should be preformed with detail similar to the analysis performed for the ultimate build condition. In some cases, intermediate build phases of the property could generate poor safety and traffic conditions before the property's transportation improvements are complete. Where possible, transportation improvements that are part of the site plan should be completed prior to the time when impacts from the property's change in use are expected. Any deviations shall be approved by the City Engineer or Public Works Director.

TRANSPORTATION MASTER PLAN

Technical Memorandum #4
Traffic Counting Program Guidelines

City of Wentzville, Missouri

Technical Memorandum #4
Traffic Counting Program Guidelines

This section of the Master Plan discusses the type of traffic counts, methods to collect traffic data and potential locations for traffic counts. This information can be used by the City as it establishes a traffic counting program.

1.0 Traffic Counting Program (TCP) Purpose

Traffic counts and traffic data are an important resource for growing communities to assess transportation network operations. As traffic data is collected over time, the function and operation of existing streets can be monitored in order to better identify the need for street maintenance and improvement and to balance the traffic impacts of future growth. A Traffic Counting Program provides a systematic approach to:

- Determine Annual Average Daily Traffic (AADT) and peak time volumes for strategic locations within the community
- Identify transportation trends and changes within the community
- Make frequently requested traffic information available to public and private agencies
- Coordinate with other agencies to expand the traffic data resources for the region

The purpose of these guidelines are to identify roadway traffic counting locations, a counting schedule, traffic count type, duration and frequency for the City of Wentzville transportation system.

2.0 Review of City Resources

The City of Wentzville currently has eight Hi-Star portable traffic counters model NC-97 by Nu-Metrics. At this time, a one person crew that also maintains the pavement management system is involved with running the traffic counting program. The counters are between five and ten years old. The counters are basically a large electronic card that is placed in the middle of a traffic lane. Each card counts one lane of traffic. Depending upon intersection geometry, between four and sixteen counters are needed to count a single intersection. Midblock counts require between two and four counters.

The city would need more counters in the future to count large intersections that have turn bays at one time. It is recommended the city work toward acquiring eight more counters over the next five years. Purchasing the Hi-Star NC-97 counters are recommended to match the existing resources, so the methods and formats for data collection remain the same.

The city would also benefit from tube counters in locations where only roadway segment data is desired. Independent research has shown that tube counters, when properly maintained and installed, yield confident results similar to electronic card counters. The major providers of tube counters are JAMAR Technologies, Inc., MetroCount and International Road Dynamics, Inc. It is recommended the city work toward acquiring two road tube counters over the next five years. Each tube counter should be capable of attaching two to four road tubes at a time increasing its effectiveness.

Purchasing the JAMAR TRAX RD counters and software is recommended. Both JAMAR and MetroCount types perform similar counting functions and have outperformed the International Road Dynamics, Inc. tube counters in independent studies. The MetroCount 5600 counters

and software may be less costly compared to JAMAR, but lack the adaptability to different tube types and wide spread use in the United States. The City has also purchased other transportation equipment from JAMAR in the past. It is recommended the City contact both providers for product, accessory, software and support cost estimates to determine which model is the most cost effective at the time of purchase and investigate if advancements have been made and changing market conditions.

3.0 Traffic Count Types

The City of Wentzville should collect vehicle count data including date, time, weather and location for types such as:

- Intersection counts
- Arterial and collector segment counts
- Large vehicle and truck counts as a percentage of the total traffic
- Pedestrian, bicycle and transit counts
- Atypical counts for special cases such as traffic during sporting events, special events, parades, traffic incidents or construction periods

4.0 Traffic Count Duration

Typically, vehicle counts should be collected on a Tuesday, Wednesday, or Thursday for a 48-hour period for each requested location. For intersections, all approaches and movements should be counted. Counts for each approach and movement in the intersection should be summarized in fifteen-minute intervals during peak periods and hourly intervals during off-peak times. Counts for roadways segments should be summarized in hourly intervals. Counts for areas other than intersections or roadway segments are usually performed by field inspection in hourly intervals during peak periods unless specified otherwise by the City Engineer.

The Hi-Star equipment used by the City of Wentzville is able to determine the vehicle class, i.e. passenger car or large vehicle, and that data should be included with each data collection. Tube counters are also able determine vehicle class information if desired.

When using traffic data to determine typical trends such as AADT, it is desirable for vehicle counts to occur during times that avoid recreational spikes in traffic such as weeks with holidays and especially the holiday period from mid November through early January. Counts can be made during those times, but judgments should be made by the analyst to validate the data.

5.0 Traffic Count Frequency

In general, vehicular counts at each of the chosen locations should occur on an annual or bi-annual basis according to the recommended schedule given later in the guidelines. Conversely, traffic counts on less traveled minor collectors and local streets can occur less frequently as recommended by the City Engineer.

6.0 Traffic Count Locations and Schedule

6.1 Intersection Count Locations

Intersection counts can be obtained using two primary methods. One method is to use the electronic traffic counting cards and place the individual cards in each approach lane. This method provides for data for the length of time the counters are in place. A second method is a manual method where an individual uses an electronic counting board or uses a paper marking method to record counts during a shorter period, often a 1 ½ to two hour peak period. For higher volume locations, often two people are required. Such counts may be taken in both a.m. and p.m. peak periods. Pedestrian crossing movements may also be noted in higher pedestrian locations where pedestrian travel could affect intersection capacity.

When taking intersection counts, all approaches and movements should be counted. Counts for each approach and movement are typically summarized in fifteen-minute intervals during peak periods and hourly intervals during off-peak times. Intersection counts outside the City jurisdiction should be performed with the consent of the appropriate jurisdictional agency. Freeway counts should be performed by MoDOT or other appropriate jurisdictional agency and data made available to the City of Wentzville by request. Table IV-1 shows the recommended count locations and desired frequency. These intersections should be counted because they are expected to handle large traffic volumes and represent points where two roadways with high functional class cross.

Table IV-1 Recommended Intersection Count Locations

East-west roadway	North-south roadway	Desired Frequency	Jurisdiction
Major arterials			
Route N	Point Prairie Road (70/61 Wentzville Beltway)	Annual especially after Beltway construction	MoDOT/Wentzville
Route N	Route Z	Annual	MoDOT
Route N	Duello Road	Annual	MoDOT/Wentzville
Minor arterials			
Pearce Boulevard	Wentzville Parkway	Annual or more often	Wentzville
West Meyer Road	Wentzville Parkway	Annual or more often	Wentzville
Wentzville Parkway	Meyer Road	Annual	Wentzville
Wentzville Parkway	Route A/Bus. Hwy 61	Annual	Wentzville
Route A	Mexico Road west of Parr Road	Annual	MoDOT/Wentzville
Route A	Parr Road	Annual or less often	MoDOT/Wentzville
Route A	Josephville Road	Annual or less often	MoDOT/Wentzville
Wilmer Road	Interstate Drive	Annual	Wentzville
Business Highway 61	Wall Street	Annual or less often	Wentzville
Major collectors			
West Meyer Road	Point Prairie Road	Annual	Wentzville
West Meyer Road	Peine Road	Annual	Wentzville
Pearce Boulevard	Meyer Road	Annual	Wentzville
Pearce Boulevard	Allen Street	Annual	Wentzville
Pearce Boulevard	Linn Street	Annual	Wentzville
Pearce Boulevard	Wall Street	Annual or less often	Wentzville
Northview Avenue	Meyer Road	Annual or less often	Wentzville
Duello Road	Callahan Road	Annual or less often	Wentzville
Minor collectors			
Northview Avenue	Linn Street	Annual or less often	Wentzville
Main Street	Linn Street	Annual	Wentzville
Pitman Avenue	Linn Street	Annual or less often	Wentzville
Prospect Road	Corporate Parkway	Annual or less often	Wentzville

Source: City of Wentzville Public Works Department, 2003.

6.2 Roadway Segment Count Locations

For segments, all lanes and directions of travel should be counted. Counts for each direction should be summarized in hourly intervals per segment. Roadway segment counts outside the City jurisdiction should be performed with the consent of the appropriate jurisdictional agency. Freeway segments or interchange ramp counts are often performed by MoDOT or other appropriate jurisdictional agency and data made available to the City of Wentzville by request. Table IV-2 shows the recommended count locations and desired frequency.

6.3 Large Vehicle Count Locations

Any vehicle having more than two axles or dual wheels on any axle is considered a large vehicle. The amount of large vehicles in the traffic stream has an impact on traffic operations and fatigue on the roadway. When evaluating traffic operations, the *Highway Capacity Manual* uses adjustment factors based on percentage by type, (percentage of heavy vehicles, percentage of recreational vehicles, etc.) to compensate for large vehicle impacts.

The Hi-Star equipment used by the City of Wentzville is able to determine the vehicle class, i.e. passenger car or large vehicle, and that data should be included with each data collection. Tube counters are also able determine vehicle class information if desired.

In some cases, it may be desirable to perform additional large vehicle counts annually. This can be used to assess large vehicle traffic levels at locations of potentially high truck traffic use such as on roadways serving industrial or large commercial areas. These roadways usually have the largest percentage of large vehicles in the traffic stream. Possible locations include:

- Wentzville Parkway north of Pearce Boulevard
- Route A east of Parr Road
- Pearce Boulevard east of Linn Street
- Corporate Parkway and/or Callahan Road south of Mall Parkway
- Edinger Road or East Pearce Boulevard between Highway 61 and Route A

The duration of the large vehicle counts should be in hourly intervals during peak periods. The objective is to determine the percentage and type of the large vehicles of the total traffic, so the total traffic volume should also be recorded.

Table IV-2 Recommended Roadway Segment Count Locations

Roadway	Location	Desired Frequency	Jurisdiction
Major arterials			
70/61 Wentzville Beltway	South of I-70	Annual after Beltway construction	Wentzville
70/61 Wentzville Beltway	North of I-70	Annual after Beltway construction	Wentzville
70/61 Wentzville Beltway	North of West Meyer Road	Annual after Beltway construction	Wentzville
70/61 Wentzville Beltway	East of North Point Prairie Road	Annual after Beltway construction	Wentzville
Route Z	South of I-70	Annual with permission or by others	MoDOT
Minor arterials			
Route A	East of Highway 61	Annual	MoDOT
Route A	North of I-70	Annual with permission or by others	MoDOT
Interstate Drive	West of Route Z	Annual	Wentzville
Interstate Drive	East of Route Z	Annual after Interstate Drive construction	Wentzville
Route W	North of Dueneke Road	Annual by others	MoDOT
Route W	West of Hwy 61	Annual by others	MoDOT
Major collectors			
Mexico Road	West of Guthrie Road	Annual	St. Charles County/Gilmore
West Meyer Road	Near Dueneke Road	Annual	Wentzville
Duello Road	South of Prospect Road	Annual	Wentzville
Hepperman Road	South of South Service Road	Annual	Wentzville
Hepperman Road	North of Route N	Annual	Wentzville
May Road	North of Pearce Boulevard	Annual	Wentzville
Peine Road (70/61 Wentzville Beltway)	West of Hwy 61	Annual especially after Beltway construction	Wentzville
South Point Prairie Road	South of South Service Road	Annual	Wentzville
Point Prairie Road	West of Hwy 61	Annual	Wentzville
South Outer 40 Road (Interstate Drive)	West of Duello Road	Annual after Interstate Drive construction	Wentzville
Minor collectors			
Dueneke Road	Between Scotti and Meyer	Annual	Wentzville
Scotti Road	Between Dueneke and Point Prairie	Annual	Wentzville
Bear Creek Drive	East of Point Prairie Road	Annual	Wentzville
Bear Creek Drive	West of May Road	Annual	Wentzville
North Service Road	West of Point Prairie Road	Annual	Wentzville
Pearce Boulevard	West of May Road	Annual	Wentzville
Pearce Boulevard	Near Campus Drive	Annual	Wentzville
East Pearce Boulevard	East of Highway 61	Annual	Wentzville
Edinger Road	North of Sachs Bus. Pkwy	Annual	Wentzville
Pitman Avenue	East of Highway 61	Annual	Wentzville
Church Road	North of I-70	Annual	Wentzville
Schaper Road	South of South Service Road	Annual	Wentzville
Wilmer Road	North of Route N	Annual	MoDOT
Jackson Road	West of Point Prairie Road	Annual	Wentzville
Buckner Road	East of Point Prairie Road	Annual or less often	Wentzville
Buckner Road	West of Route Z	Annual or less often	Wentzville
Callahan Road	North of North Outer 40 Road	Annual	Wentzville
Corporate Parkway	North of North Outer 40 Road	Annual	Wentzville
I-70 South Service Road	East of Corporate Parkway	Annual	Wentzville
I-70 South Service Road	East of Hepperman Road	Annual	Wentzville
I-70 South Service Road	East of Point Prairie Road	Annual	Wentzville

Source: City of Wentzville Public Works Department, 2003.

6.4 Pedestrian, Bicycle and Transit Count Locations

The City equipment is designed for vehicular counts, so any pedestrian and bicycle counts could be performed by field observations by request of the City Engineer. Transit vehicles are classified as large vehicles and should be included in the large vehicle, intersection and roadway segment counts as such. Typically bicycle or pedestrian counts on separate bicycle or pedestrian facilities are not conducted as part of a systematic counting program. These counts are typically taken in response to a specific issue, at a specific time as part of a separate individual study. In areas of high or moderate pedestrian volume, pedestrian counts are often recorded when taking manual hourly traffic counts.

Roadways, routes and other pathways near local schools, community centers and recreational areas usually have the highest amounts of bicycle and pedestrian traffic. Field observations and counts to discover the magnitude and patterns of these modes could be conducted if pedestrian – bicycle – vehicle conflict issues arise. Possible locations include:

- Meyer Road, Wentzville Parkway and Wall Street near Progress Park and the Wentzville Ice Arena
- West Meyer Road near Rotary Park
- Pearce Boulevard, Northview Avenue, Campus Drive and Route N near Wentzville Middle and High Schools
- Route Z and Interstate Drive near Quail Ridge Park
- Peace Boulevard, Allen Street, Main Street and Linn Street near historic downtown areas
- Other school crossings and major intersections where pedestrian and bicycle modes are expected

Duration of bicycle and pedestrian counts are usually during peak periods determined by the school operating hours or on weekends and late weekday afternoons near recreational areas. Seasonal weather changes also affect what time of year counts should be performed. Common sense judgments should be used by the analyst and City Engineer to determine the count parameters so that the peak period is recorded.

6.5 Atypical Counts Locations

If needed for independent study, the City Engineer should recommend atypical counts to evaluate special cases such as traffic during sporting events, holiday events, parades, traffic incidents or construction periods. Often traffic impact studies would also require atypical counts. Possible locations include:

- Point Prairie Road and Scotti Road to collect data on Mid America Raceway events
- Roadways that provide spectator access to annual parades, holiday events and festivals
- Roadways logically affected by new developments performing traffic impact studies

The duration of atypical counts vary but usually occur in hourly intervals during peak periods. The objective is to study special cases, so analyst and City Engineer judgments are needed to define parameters that satisfy the purpose and need for the data collection.

7.0 Traffic Data Review and Analysis

7.1 Data Validation

First the data must be reviewed for validity and a resolution determined if any errors are suspected. Validity concerns are usually focused in three basic areas: machine malfunction, the intended use of the data and context of the data.

Machine malfunction

Equipment malfunction is usually easiest to detect because if any data was collected by the malfunctioning unit, it would be in an usual pattern such as zero recordings or large and random volumes atypical of the count location. The analyst and equipment users must make sure the equipment is maintained well, calibrated according to the manufacturer specifications and repairs made when malfunctions occur. Testing and calibrating the equipment for errors should be performed before any count. Equipment should be checked for routine maintenance according to a schedule. A typical schedule includes checking the equipment for function, damage and routine maintenance every other month when not in use and weekly during high use times. Storage of equipment while not in use should be according to the manufacture specifications. Electronic equipment should be stored indoors in a climate controlled facility.

General validation of machine operations can also be performed by examining the data collected. Analysts can use the field data from the counters compared to their knowledge of the traffic count location, objective expectations and field observations to assess equipment validity. For example, field observation and historic knowledge of a location's directional distribution during morning and afternoon peak hours can be used for comparison to the data collected. If a similar directional distribution correlation exists, then confidence in the equipment can be assumed. Usually field observations and analyst judgments are used most often to validate proper function of the equipment.

Intended use of the data

Some counts are performed under atypical conditions to monitor specific patterns or traffic during short-term time periods. These counts should be labeled and retained but not used to approximate the average daily or annual average daily traffic summaries for that location. By excluding such counts out of the reports, summaries and statistics, the validity of the results for that location can be held in higher confidence. The atypical counts are still important because they can be used in traffic studies. Analyst judgment should be used based on how the counts were obtained to make decisions on how the counts should be applied.

Data context

As traffic data is retained over time, opportunities develop to compare new data to validated historic counts at the same location or other counts at locations nearby. By making a comparison, traffic trends can be evaluated for acceptable and unacceptable variations. Deciding what variations are valid is up to the judgment of the analyst. For example, if land uses have changed near a count location, variations between the historic and the new data should be expected. Another validation check can involve the analyst applying volume thresholds to newly collected counts. General rules of thumb can apply maximum hourly volume thresholds to roadways and intersections based on number of lanes or intersection

configuration. By comparing new data to the thresholds, the data's validity can be established, or suspicious variations can be investigated further. Typical maximum hourly thresholds are included in the table below.

Table IV-3 Typical Maximum Hourly Capacity Thresholds

Functional Classification	Typical Maximum Hourly Capacity
Freeway	1800 to 2200 pcphpl
Major arterials	1000 to 1800 pcphpl
Minor arterials	600 to 1500 pcphpl
Collectors	500 to 900 pcphpl
Local streets	< 500 pcphpl

Pcphpl = passenger cars per hour per lane
Source: *Highway Capacity Manual*, 2000.

Since the City of Wentzville does not use permanent counters which can count and report traffic continuously throughout the year, all of the data to be collected would be considered short-term and site specific. More detailed guidelines for editing, summarizing and reporting traffic data can be found in publications such as the *Traffic Monitoring Guide* published by the Federal Highway Administration and the *AASHTO Guidelines for Traffic Data Programs.*

7.1 Traffic Data Summaries

After confirming the unadjusted data's validity, all reports and summaries produced should include a description of the traffic count type, date, time, weather and location. Specifics other items to include are described as follows.

Intersection Count Summaries

All approaches and movements should be counted. Counts for each approach and movement should be summarized in fifteen-minute intervals during peak periods and hourly intervals during off-peak times. Intersection counts outside the City jurisdiction should be performed with the consent of the appropriate jurisdictional agency. Freeway or interchange terminal counts should be performed by MoDOT or other appropriate jurisdictional agency and data made available to the City of Wentzville by request.

Roadway Segment Summaries

All lanes and directions of travel should be counted. Counts for each direction should be summarized in hourly intervals per segment. Roadway segment counts outside the City jurisdiction should be performed with the consent of the appropriate jurisdictional agency. Freeway or interchange ramp counts should be performed by MoDOT or other appropriate jurisdictional agency and data made available to the City of Wentzville by request.

7.2 Traffic Data Analysis

With each location, the following traffic information should be calculated and included in the summary.

Average Daily Traffic (ADT) – The average total traffic volume occurring in a 24-hour period for a location, segment or specific movement. ADT is calculated by taking the total traffic volume during a given period (more than a day and less than a year) divided by the number of

days in that time period. For example using a 48-hour count, ADT is the total traffic volume for the 48-hours divided by two.

Annual Average Daily Traffic (AADT) – The estimate of the typical daily traffic at a location, segment or specific movement regardless of the day of the week or time of year. AADT is calculated by using count data from a period not less than 24-hours and applying axle correction factors and seasonal correction factors. These other factors are defined later in this section. After determining the appropriate factors, AADT is calculated by using the equation below.

AADT = [24-hour volume] x [axle correction factor] x [daily adjustment factor] x [seasonal adjustment factor]

Axle correction factors – Factors that adjust the raw count data to reflect vehicles volumes not axle impulses. Axle impulse data occurs when using tube counters. An axle correction factor is usually calculated estimating an average of axles per vehicle by field inspection. The Hi-Star NC-97 electronic cards currently used by the City of Wentzville already adjusts the data to reflect vehicle volumes by classification and not axles, so axle correction factors are not needed to calculate AADT. If tube counters are purchased by the city in the future, axle correction factors would be used dependent upon the specifications of the tube counter. Tube counters can be programmed for axle correction so 1 data count equals a predetermined amount of axle impulses. The methods the traffic program performs axle correction should be determined by traffic analyst and City Engineer discretion. MoDOT's axle correction factors are shown below if ever needed by the analyst.

Table IV-4 Axle Adjustment Factors by Axle Factor Group (AFG)

Axle Factor Group	Jan.	Feb.	Mar.	Apr.	May	June
AFGID 001 Rural interstate	0.35	0.34	0.35	0.35	0.37	0.36
AFGID 002 Rural major arterial	0.43	0.44	0.44	0.44	0.44	0.44
AFGID 006 Rural minor arterial	0.46	0.46	0.46	0.46	0.46	0.47
AFGID 007 Rural minor collector	0.49	0.49	0.49	0.49	0.49	0.49
AFGID 008 Rural local	0.49	0.49	0.49	0.49	0.49	0.49
AFGID 011 Urban interstate	0.45	0.45	0.45	0.45	0.46	0.46
AFGID 012 Urban freeway	0.48	0.48	0.47	0.47	0.48	0.47
AFGID 014 Urban major arterial	0.49	0.49	0.49	0.48	0.48	0.48
AFGID 016 Urban minor arterial	0.49	0.49	0.49	0.48	0.48	0.48
AFGID 017 Urban collector	0.49	0.49	0.49	0.48	0.48	0.48
Axle Factor Group	July	Aug.	Sept.	Oct.	Nov.	Dec.
AFGID 001 Rural interstate	0.38	0.37	0.36	0.35	0.35	0.36
AFGID 002 Rural major arterial	0.44	0.44	0.43	0.44	0.44	0.45
AFGID 006 Rural minor arterial	0.47	0.47	0.47	0.46	0.46	0.46
AFGID 007 Rural minor collector	0.49	0.49	0.49	0.49	0.49	0.49
AFGID 008 Rural local	0.49	0.49	0.49	0.49	0.49	0.49
AFGID 011 Urban interstate	0.46	0.46	0.46	0.46	0.46	0.46
AFGID 012 Urban freeway	0.48	0.48	0.48	0.48	0.48	0.48
AFGID 014 Urban major arterial	0.46	0.47	0.47	0.47	0.47	0.47
AFGID 016 Urban minor arterial	0.46	0.47	0.47	0.47	0.47	0.47
AFGID 017 Urban collector	0.46	0.47	0.47	0.47	0.47	0.47

Source: Missouri Department of Transportation, 2003.
The City of Wentzville currently uses Hi-Star NC-97 equipment that compensates for vehicle classification, so axle adjustment factors can be ignored.
If above data is used, MoDOT axle factors should be multiplied by two because MoDOT tube counters report 1 data count = 2 axle impulses rather than 1 data count = 1 axle impulse.
Report values are rounded for more precise number, so totals may not add up.

Seasonal correction factors – Factors that are applied to the data to better represent a typical annual average. Calculations for AADT, Annual Average Weekday Traffic (AAWDT) or Annual Average Weekend Traffic (AAWET) each use a different set of seasonal factors. MoDOT uses the following seasonal correction factors shown below. These factors are recommended for use by the City to calculate AADT.

Table IV-5 Daily and Seasonal Adjustment Factors (SAF)

Factor	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
SAF	1.476	1.451	1.203	0.984	0.908	0.817	0.779	0.842	0.945	0.915	0.951	1.175
Sun.	1.176	1.231	1.250	1.106	1.077	1.083	1.054	1.058	1.104	1.139	1.167	1.070
Mon.	0.972	0.990	1.041	1.113	1.083	1.055	1.067	1.076	1.047	1.064	1.068	1.000
Tue.	0.994	1.084	1.014	1.095	1.071	1.050	1.081	1.088	1.044	1.049	1.057	1.094
Wed.	0.970	1.107	0.959	1.044	1.047	1.046	1.032	1.071	1.013	1.037	1.001	1.293
Thu.	0.978	0.970	0.928	0.989	1.026	0.997	1.016	1.010	0.997	0.992	1.054	1.028
Fri.	0.839	0.865	0.891	0.864	0.899	0.880	0.882	0.877	0.880	0.858	0.851	0.845
Sat.	1.052	0.909	1.090	0.896	0.878	0.946	0.925	0.902	0.972	0.950	0.948	0.878

Source: Missouri Department of Transportation, 2003.
MoDOT seasonal factor group 004 was used representing a rural area with moderate seasonal variation.
Report values are rounded for more precise number, so totals may not add up.

Design Hourly Volume (DHV) – The hourly volume used in the design of a new facility or roadway. It is usually the 30th highest hourly volume of the future horizon year of the design, if known. DHV can also be estimated as the forecasted typical peak hour volume of the future horizon year. Design Hourly Volumes can also be calculated using current traffic counts, applying calculated annual growth factors and estimations of the analyst to create a forecast for a given horizon year.

Peak Hour Traffic Percentage (K) – It is a measure of demand calculated by dividing the highest 1-hour traffic volume of the day by the 24-hour daily volume of traffic then multiplying the result by 100 to make a percentage. K values typically range from nine to ten percent. The equation to determine peak hour traffic percentage is given below.

K (as a percent) = 100 x [highest one-hour traffic volume of the day] / [24-hour daily volume of traffic]

Peak Hour Factor (PHF) – It is a measure of demand to account for spikes and fluctuations within an hourly traffic volume. PHF is calculated by dividing the total hourly volume of traffic by the highest 15-minute traffic volume of the hour and then dividing the result by 4. PHF usually ranges from 0.88 to 0.92. The equation to determine peak hour factor is given below.

PHF = [total hourly volume of traffic] / (4 x [highest 15-minute traffic volume of the hour])

Directional Split or Directional Distribution (D) – A factor used to show the amount of traffic that is headed in a particular direction during a peak period or peak hour. It is calculated as a decimal or percentage by dividing the volume of traffic in one direction by the total volume of traffic in both directions during the same period. The time of day and direction that the majority of traffic is heading is also documented with the D value. Typical directional splits range from 55% / 45% (0.55) to 65% / 35% (0.65). High directional splits range from 75% / 25% (0.75) to 90% / 10% (0.9).

Vehicle Miles of Travel (VMT) – Average Sunday through Saturday vehicle volume on a specific road segment multiplied by the length of the road segment. VMT is usually calculated in the form of daily and annual VMT. The equations to calculate VMT are given below.

Daily VMT = ADT x [length of the road segment in miles]

Annual VMT = AADT x [length of the road segment in miles] x 365

Vehicle Classifications – Additional traffic data can be summarized regarding the amount and type of large vehicles in the traffic stream. Typical summaries include the percentage of large vehicles during the peak hour or an average day.

Large Vehicle Weights – Data collection, field investigations and objective assumptions can be made regarding the average weight per axle per vehicle type. This data when used together with traffic volume and VMT data can correlate relationships to roadway fatigue and maintenance frequency. This analysis is often not very precise and not recommended unless trying to determine general overviews of large transportation networks. More information about vehicle weight analysis can be found in the *AASHTO Guidelines for Traffic Data Programs*.

Annual Growth Factors – An estimate of how much traffic at a location is changing year to year. The annual growth factor is calculated by taking the volume data of the current year and dividing it by its respective data from the previous year. Annual Growth Factors help assess historical trends of growth and decline at locations in the transportation network.

Rounding

In traffic summaries and calculations, rounding should occur to help prevent false senses of precision and alert users that the values represent typical traffic conditions not raw data. A typical rounding convention as shown in the table below should be used when calculating vehicle volumes. In general, fractions of a vehicle should be rounded to the nearest whole vehicle in calculations.

Table IV-6 Typical Rounding Convention

Volume	Round to Nearest
0-999	10
1,000-9,999	100
> 9,999	1,000

Source: *AASHTO Guidelines for Traffic Data Programs*, 1992.

7.3 Traffic Data Reporting

Automated reports are available from the City's traffic counting Hi-Star equipment and Nu-Metrics software. The two report types that are the most descriptive and should be kept on file by the City are the "Class/Volume Chart" report and the "Date/Time/Volume/Average Speed/Temperature" report. The "computer generated summary report" is helpful as a cover sheet to the volume reports. A brief summary provided by the field crew should also be documented and filed per location that includes a description of the traffic count type, date, time, weather, location and intersection sketch, estimated signal timing and any other information that may affect the validation of the data such as equipment damage that occurred or other special events.

If possible, all data should be recorded and organized electronically in the form of spreadsheets and document files so efficient access, copies and transmittals of data can occur. If electronic storage is not possible, original hard copies of the reports, summaries and analysis should be kept on file by location and date so the data can be used as conveniently as possible. Back-up copies of the originals is also recommended so data is not accidentally lost or discarded.

Traffic reports, summaries and analysis should be documented in a consistent format. Consistent terminology, labeling, acronyms and implementation practices should also be used. These items are important in developing a strong traffic monitoring program. Electronic file formats and templates are essential. The "Class/Volume Chart" and the "Date/Time/Volume/Average Speed/Temperature" reports are recommended as the desired volume report format for segment counts. For intersection counts a sample spreadsheet is provided and a format given in the Appendix for approval and use by the City of Wentzville. Also, a sample data collection sheet for use by the field crew is given in the Appendix for City approval.

Commitments to produce accurate labels, documents, reports, quality data, dependable sources and methods are key principals to the City's traffic counting program. Consistency also helps the traffic data program identify the qualitative and quantitative variations in the traffic data. These items help the end user make sound judgments and establish confidence in results.

7.4 Traffic Data Retention

Retention of the traffic data is important to the City's Traffic Counting Program. If possible, all data should be recorded and organized electronically in the form of spreadsheets and document files so efficient access, copies and transmittals of data can occur. Electronic data retention is the most efficient storage system because storage and memory on computers have become larger and more affordable. At this time, the resources of the City seem adequate to store the elements of the traffic program electronically. If the City resources become limited and the electronic storage is not cost effective or reasonable, then future efforts should be made towards achieving effective electronic storage of the data.

If electronic data retention is not possible, original hard copies of the reports, summaries and analysis should be kept on file by location and date so the data can be used as conveniently as possible. Back-up copies of the originals is also recommended so data is not accidentally lost or discarded.

The City of Wentzville should electronically retain the following data on record:

- Count type, duration, use, location, weather, circumstances
- Unadjusted volume data
- Validated/edited volume data
- Data summaries and reports
- Field observations
- Other supporting documentation such as special events or unusual circumstances at the time of the data collection

Retention time periods as recommended by the *AASHTO Guidelines for Traffic Data Programs* are shown in the following table.

Table IV-7 Data Retention Time Periods

Data Type	Recommended Retention Period
Permanent counts*	10 years to permanently
Short duration counts**	10 years
Research databases	10 years to permanently
Summaries and statistics	10 years to permanently

* The City of Wentzville does not have permanent count locations at this time.
** Includes all the count types currently performed by the City of Wentzville.
Source: *AASHTO Guidelines for Traffic Data Programs*, 1992.

The City's Information Access System (IAS), a Geographical Information System (GIS), can be a very useful tool for organizing and mapping traffic count data summaries. Shape files, tables and data can be created in the system for a variety of uses. At this time, the City IAS is focusing its resources on other functions besides the traffic data program. However, it is still important that the IAS be recognized as a tool to link up with the traffic counting program in the future. Since the data retained from the counting program is so extensive, it would be a burden on City time and resources to have all the data integrated into IAS. As a future goal, linking only traffic summary data to IAS is recommended as a step towards interconnecting IAS and the counting program. Data summaries such as average daily traffic volumes, peak hour volumes, directional distributions and annual growth factors are excellent resources to aid analysis, planning and decisions when using IAS. With some initial effort, data summaries can be formatted into database tables, identified with a label and joined to GIS/IAS shape files by technicians. As the interconnection process evolves, it would become more standardized and efficient.

As traffic counting equipment becomes more sophisticated, links between the counters, crews, global positioning systems (GPS) and GIS/IAS systems should become more seamless. In the future, the City Public Works Department should assess the relationships between the traffic counting program and the IAS for efficient coordination, gain benefits and provide opportunities. The traffic counting program and IAS are tools that can help satisfy city purposes and needs.

TRANSPORTATION MASTER PLAN

Technical Memorandum #5
Traffic Signal Warrant Guidelines

City of Wentzville, Missouri

Technical Memorandum #5
Traffic Signal Warrant Guidelines

The purpose of this section is to describe the process to be used in determining when a traffic signal may be warranted at a specific intersection location on City of Wentzville streets. A standard approach to evaluating the need and the applicability of traffic signals has been previously developed by the U.S. Department of Transportation in a report entitled the *Manual of Uniform Traffic Control Devices Millennium Edition (MUTCD 2000).* This section describes the *MUTCD* warrants and discusses how these guidelines can be used by the City.

1.0 Traffic Signal Warrant Purpose and Responsibility

Traffic signal warrants are separate from a traffic impact study or site plan review and have been standardized in detail in the *MUTCD.* The section that describes the warrants is in Part 4, Highway Traffic Signals, Chapter 4C, Traffic Control Signal Needs Studies. In that section, eight warrants for signals are described:

Warrant 1: Eight-Hour Vehicular Volume
Warrant 2: Four-Hour Vehicular Volume
Warrant 3: Peak Hour
Warrant 4: Pedestrian Volume
Warrant 5: School Crossing
Warrant 6: Coordinated Signal System
Warrant 7: Crash Experience
Warrant 8: Roadway Network

The *MUTCD 2000* Part 4 Chapter 4C serves as the recommended guidelines for traffic signal warrants for the City of Wentzville. Traffic signal warrant studies can be performed or recommended by the City Public Works Director or City Engineer.

Often requests are made for traffic control signals to be placed at an intersection. Signals can cost from $80,000 to $130,000 to install depending on the complexity of the intersection. The placement of signals also can impede arterial traffic flow. The decision when to perform traffic signal warrants often depends on field observation, the functional classification of the roadways involved, existing traffic volume data and available future traffic forecasts. The *MUTCD* 2000 Part 4 Chapter 4C should be referred to for more details when performing traffic signal warrant studies.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. It only provides the technical support. A traffic signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection. A traffic signal should not be installed unless one or more of the warrants described in this memorandum are met. An overview of each warrant is given below.

Warrants 1 and 2 are vehicle demand related for peak eight hour and four hour periods of the day. Volume thresholds for these warrants are shown in the Appendix Figures A-7 and A-8. At locations that are under development and where it is not possible to obtain existing traffic counts, hourly volumes, Warrant 3 - Peak Hour, should be estimated as part of an engineering

study for comparison with traffic signal warrants. Volume thresholds for this warrant are shown in the Appendix Figure A-9. Warrant 4 identifies pedestrian crossing demand and available vehicle gaps. Warrant 5 also identifies the pedestrian demand and available vehicle gaps but at school crossings. Warrant 6 is used to facilitate a coordinated signal system within a corridor in order to maintain proper platooning of vehicles. Warrant 7 investigates crash experiences and evaluates whether a signal would improve conditions. Warrant 8 is used to analyze future traffic demand using previously identified warrants in an attempt to encourage concentration and organization of traffic flow. The following paragraphs discuss the warrants in more detail.

Warrant 1: Eight-Hour Vehicular Volume – *MUTCD 2000*, Part 4, Section 4C.02
This warrant defines two conditions as principal reasons to consider installing a traffic control signal. Condition A, minimum vehicular volume, applies where a relatively large volume of intersecting traffic from a cross street conflicts with the major street traffic. Condition B, interruption of continuous traffic, applies where relatively heavy traffic volumes on the major street cause excessive delay or conflict for cross street traffic entering or crossing the intersection. Both conditions of the warrant evaluate each hourly volume of the major street and cross street during any eight hours of an average day. Criteria change depending on number of lanes on the intersection approaches, traffic speeds and whether the intersection is located in a community with low population. The traffic volume data is compared to standardized data tables in Figure A-7 in the Appendix (Section 4C.02 of the *MUTCD 2000*) to establish if the warrant is satisfied.

Warrant 2: Four-Hour Vehicular Volume – *MUTCD 2000*, Part 4, Section 4C.03
This warrant is similar to Warrant 1 because it also considers when volumes of the intersecting traffic exceed standardized thresholds as reason to consider installing a traffic control signal. The warrant evaluates each hourly volume of the major street and cross street during any four hours of an average day. Criteria can change depending on number of lanes on the intersection approaches, traffic speeds and whether the intersection is located in a community with low population. Traffic volume data is compared to standardized curve data in Figure A-8 in the Appendix (Section 4C.03 of the *MUTCD 2000*) to establish if the warrant is satisfied.

Warrant 3: Peak Hour – *MUTCD 2000*, Part 4, Section 4C.04
This warrant applies in special cases where the intersection is impacted by local facilities that attract or discharge large traffic volumes over a short time. The warrant is satisfied when for a minimum of one hour of an average day the minor street traffic suffers excessive delay when entering or crossing the major street. The warrant describes two categories, and either can be chosen to satisfy the warrant. Category A compares the delay time of the minor street and traffic volume data of both cross streets to a standardized threshold. Category B compares the traffic volume data of the cross streets to standardized curve data in Figure A-9 in the Appendix (Section 4C.04 of the *MUTCD 2000*). Criteria can change depending on number of lanes on the intersection approaches, traffic speeds and whether the intersection is located in a community with low population.

Warrant 4: Pedestrian Volume – *MUTCD 2000*, Part 4, Section 4C.05
This warrant considers installing a traffic control signal where relatively heavy traffic volume on a major street causes excessive delay for pedestrians intending to cross the street. The warrant requires two criteria to be satisfied. Criterion A compares the hourly pedestrian volumes to a standardized threshold. Criterion B compares the number the gaps in the traffic stream to a maximum limit. The warrant also considers the distance from the crossing to the

nearest existing traffic control signal, gaps in the traffic stream caused by nearby traffic signals and guidance measures for traffic coordination, traffic and pedestrian actuation and minimum sight obstruction distances. Criteria regarding volume thresholds can change based on the average crossing speed of the pedestrians.

Warrant 5: School Crossing – *MUTCD 2000*, Part 4, Section 4C.06
Similar to Warrant 4, this warrant considers installing a traffic control signal at a crossing used by school children. Criteria are evaluated based on the number of adequate gaps in the traffic stream compared to the number and size of groups of school children intending to cross the street during the same period. Consideration should be given to other alternatives such as warning signs, flashers, school speed zones, school crossing guards, grade-separated crossings and the nearby location of other traffic control signals. Guidance measures for traffic coordination, traffic and pedestrian actuation and minimum sight obstruction distances are also provided in the *MUTCD 2000*.

Warrant 6: Coordinated Signal System – *MUTCD 2000*, Part 4, Section 4C.07
This warrant considers installing a traffic control signal to maintain the platooning of vehicles and progressive operation of existing coordinated signals even though the location may not otherwise warrant a traffic signal. Separate criteria are set based on the whether the location has predominately one-way traffic or two-way traffic. In either case, engineering studies are needed to evaluate the existing and expected improvements to vehicular platooning and progressive traffic operation. Consideration should also be given to the spacing between existing coordinated signals making sure the proposed spacing is not too short.

Warrant 7: Crash Experience – *MUTCD 2000*, Part 4, Section 4C.08
This warrant considers installing a traffic control signal because of the severity and frequency of crashes. Three separate criteria should be met before a traffic signal is considered. First, the use of other alternatives and enforcement should be shown to have not reduced the crash frequency. Second and third, records of the crash type, frequency, and volume data for traffic and pedestrians should be presented that exceed the standard thresholds described in Section 4C.08.

Warrant 8: Roadway Network – *MUTCD 2000*, Part 4, Section 4C.09
This warrant considers installing a traffic control signal at locations to encourage concentration and organization of traffic flow on the roadway network. This is the only warrant that considers future traffic volume forecasts along with existing traffic volume data. First, the location should be at a crossing of two or more major routes as defined by characteristics given in Section 4C.09 of the *MUTCD 2000*. Second, one or both of the following criteria should be satisfied. Criterion A is satisfied when the total existing, or immediately forecasted, entering traffic volume exceeds 1,000 vehicles per hour during the peak hour of a typical weekday. Plus, the 5-year forecasted traffic volumes for the location should meet one or more of Warrants 1, 2 and 3 listed above. Criterion B is satisfied when the total existing, or immediately forecasted, entering traffic volume exceeds 1,000 vehicles per hour for each of any five hours of a nonnormal business day such as a Saturday or Sunday.

2.0 Possible Future Locations of Traffic Signals

As city growth continues, new infrastructure is built and travel patterns change. As a result, the need for signal control at intersections slowly increases to promote safety and adequate traffic operations. The following locations listed in the table indicate where future traffic signal

warrants may need to be investigated by the City of Wentzville. The locations were identified based on evidence that one or more warrants may be met. The limited evidence that was used in the recommendation includes overviews of functional classification, existing traffic volume data and available future traffic forecasts. The following table only serves as a guideline. The City Public Works Director or City Engineer can perform or recommend traffic signal warrants at any location.

Table V-1 Potential Locations to Perform Traffic Signal Warrants

Roadway	Cross street	Existing traffic control	Jurisdiction	Possible warrant*
Major arterials				
Route N	Pointe Prairie Road (70/61 Beltway)	2-way stop	MoDOT/Wentzville	8
Route N	Wilmer Road	1-way stop	MoDOT/Wentzville	8
Interstate Drive	Route Z	1-way stop	MoDOT/Wentzville	1, 2, 3, 8
Minor arterials				
West Meyer Road	Wentzville Parkway	1-way stop	Wentzville	1, 2, 3, 8
Wentzville Parkway	Meyer Road	4-way stop	Wentzville	1, 2, 3, 8
Wentzville Parkway	Business Highway 61	1-way stop	Wentzville	1, 2, 3, 8
Wilmer Road	Interstate Drive	1-way stop	Wentzville	1, 2, 3, 8
Pearce Boulevard	Business Highway 61	4-way stop w/ flashing red	Wentzville	1, 2, 3, 8
Major collectors				
West Meyer Road	Point Prairie Road	4-way stop	Wentzville	8
West Meyer Road	Peine Road	1-way stop	Wentzville	8
West Meyer Road	May Road	1-way stop	Wentzville	8
Pearce Boulevard	Meyer Road	4-way stop	Wentzville	1, 2, 3, 4, 8
Pearce Boulevard	Linn Street	4-way stop w/ flashing red	Wentzville	1, 2, 3, 4, 8
Pearce Boulevard	Cheryl-Ann Road	4-way stop	Wentzville	1, 2, 3, 4, 5, 8
Minor collectors				
Main Street	Linn Street	3-way stop	Wentzville	1, 2, 3, 4, 8

* Findings only serves as a guideline. Traffic signal warrants were not performed. The City Public Works Director or City Engineer can perform or recommend traffic signal warrants at any location.

Source: City of Wentzville Public Works Department, 2003.

TRANSPORTATION MASTER PLAN

Technical Memorandum #6
Guidelines for Bicycle and Pedestrian Facilities

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

Technical Memorandum #6
Guidelines for Bicycle and Pedestrian Facilities

The following discussion illustrates the policy statements, general guidelines and design considerations to be consulted by the City as it addresses transportation challenges that include a bicycle and/or pedestrian modal component. Forthcoming sections orderly progress through relevant background information followed by policy-level directives and finally by specific design frameworks.

1.0 Background and Introduction

The City of Wentzville has historically considered the needs of bicyclists and pedestrians as important elements of the community's long rang planning efforts. Previous master planning efforts often cited bicycle and pedestrian activity as objectives of planning contexts such as land use and transportation system performance.

The core area of Wentzville, north of I-70 and west of Highway 61, has sidewalks and streets designed in a way that created a relatively safe bicycle and pedestrian environment. More recent suburban development patterns not always included sidewalks and in some cases, have indirectly discouraged non-vehicular use. The purpose of this memorandum is to examine standards and approaches to provide for safe bicycle and pedestrian travel in newer developing areas.

In terms of Federal transportation legislation, explicit requirements associated with bicycle and pedestrian planning were first introduced by the 1991 Intermodal Surface Transportation Efficiency Act. The current re-authorization of this legislation, enacted in 1998 and entitled the Transportation Equity Act for the 21st Century (TEA-21) added further attention to these modes by stating "Bicycle transportation facilities and pedestrian walkways shall be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation projects, except where bicycle and pedestrian use are not permitted."

Recognizing the importance of federal funding, such as that provided by the Enhancements Program, and therefore the adherence to federal regulations, the City has proactively addressed bicycle and pedestrian issues in its planning efforts, such as the City's 1999 Comprehensive Plan.

In line with such proactive planning, and as a clear indication that the City recognizes that "bikeability" and "walkability" are increasingly becoming barometers of a community's wellness, the City has developed the bicycle and pedestrian policy and design guidelines presented herein.

These guidelines are designed to assist transportation planners, designers and engineers in addressing the often difficult challenge of integrating bicycle and pedestrian facilities into roadway and off-street projects. The guidelines and associated recommendations, however, do not represent a substitute for sound engineering judgment and balance transportation system decision-making, which rightfully supersede these guidelines.

2.0 Why Bicycle and Walk?

The City of Wentzville understands that bicycle and pedestrian modes of travel are recognized across the nation as cost efficient ways to address mobility and air quality concerns. Furthermore, the City envisions bicycling and walking as sensible solution to a series of socially important issues including:

- The revitalization of downtown and older city areas.
- The public's desire to form integrated communities and neighborhoods.
- The community's concern over the environment.
- The importance and responsibility of providing a balanced transportation system.

Bicycling and walking are more than recreational modes. They are also utilitarian modes, in that their use is equally relevant to trips associated with everyday activities such as work, school, and traveling to the marketplace. Two miles is a distance that is easily covered by bicycle or walking. Two miles is also the distance from:

- The center of the residential area around the Bear Creek golf course to Crossroads Regional Hospital.
- The center of the residential area north of I-70 and west of Highway 61 to Wentzville Middle and High School, or to Progress Park, or to the Wentzville Ice Arena.
- The center of the residential area north of Route N and east of Route Z to Wentzville South Middle & High School.

Therefore, it is clear that increasing the number of persons bicycling and walking to work, to the marketplace, to school, and to other destinations, would in turn increase accessibility, connectivity, and overall well-being. For this purpose, the following policy guidance is incorporated into this transportation plan.

3.0 Policy Guidance

Bicycle and pedestrian master planning efforts around the country have resulted in a wide spectrum of policy-level recommendations. Unfortunately, some give such preference to the non-motorized modes that they alienate motorized-modes, or vice-versa. One of the most rational approaches is encapsulated in the United States Department of Transportation's *A US DOT Policy Statement on Integrating Bicycling and Walking into Transportation Infrastructure.* Because of its reasonable and balanced approach to the addressing of non-motorized and motorized transportation integration needs, the US DOT approach is hereby used as framework for this transportation plan.

The policy guidance is a result of the consideration of three (3) principles:

- That bicycling and walking facilities will be incorporated into all transportation projects unless exceptional circumstances exists;
- That the approach of the policies has been successful in a number of State and local agencies; and
- That the policy includes a series of specific action items that the agency can take for improving conditions for bicycling and walking.

In light of the above principles, the following four policy statements comprise the policy guidance for bicycle and pedestrian transportation in the City of Wentzville:

1. Bicycle and pedestrian ways shall be established in new construction and reconstruction projects in all urbanized areas unless one or more of three conditions are met:

    - Bicyclists and pedestrians are prohibited by law from using the public roadway or right-of-way. In this instance, a greater effort may be necessary to accommodate bicyclists and pedestrians elsewhere adjacent to the right-of-way or near the same transportation corridor.
    - The cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined as exceeding twenty percent of the cost of the larger transportation project.
    - Where sparsity of population or other factors indicate an absence of need. Sample factors could include severe topographic or natural resource constraints.

2. The following shared bicycle and pedestrian facilities is supported by the City of Wentzville Public Works Department and shall be implemented along newly constructed or reconstructed public roadways or right-of-way:

    - Use of six (6) foot wide off-street concrete multi-use (bicycle and pedestrian) paths on both sides of vehicular roadways within City maintained or public right-of-way as shown in the City's typical sections (Figure I-2).
    - Use of six (6) foot wide off-street concrete multi-use (bicycle and pedestrian) paths separated from City maintained right-of-way, but within the City's planning or urbanized area. Multi-use paths through common ground or green spaces behind homes or lots within a residential subdivision are typical applications.
    - Where federal money, county money, or outside agency grants are used to construct an independent or "stand alone" off-street multi-use facility, the facility shall use standards as specified later in Section 4.1, "Off-street paths outside City right-of-way". Typical applications include a shared off-street trail or path through a county park funded by federal grants.
    - Bicycle parking facilities such as bike racks shall be placed on and provided by all commercial, institutional and publicly owned or zoned properties.
    - The City shall proactively support multi-use off-street facilities on existing City maintained right-of-way, especially corridors that have wider right-of-way, lanes, paths or capacity to handle walking and biking interests.

3. Sidewalks, multi-use or shared use paths, street crossings (including over- and undercrossings), pedestrian signals, signs, street furniture, transit stops and facilities, and all connecting pathways shall be designed, constructed, operated and maintained so that all pedestrians, including people with disabilities, can travel safely and independently.

4. The design and development of the transportation infrastructure shall improve conditions for bicycling and walking through the following additional steps:

    - Planning projects for the long-term. Transportation facilities are long-term investments that remain in place for many years. The design and construction of new facilities should anticipate likely future demand for bicycling and walking facilities and not preclude the provision of future improvements. For example, a bridge that is likely to remain in place for 50 years, might be built with sufficient width for safe bicycle and pedestrian path use in anticipation that facilities will be available at either end of the bridge even if that is not currently the case.
    - Addressing the need for bicyclists and pedestrians to cross corridors as well as travel along them. Even where bicyclists and pedestrians may not commonly use a particular travel corridor that is being improved or constructed, they will likely need to be able to cross that corridor safely and conveniently. Therefore, the design of intersections and interchanges shall accommodate bicyclists and pedestrians in a manner that is safe, accessible and convenient.
    - Getting exceptions approved at a senior level. Exceptions for the non-inclusion of bikeways and walkways shall be approved by a senior manager, such as the Public Work Director, and be documented with supporting data that indicates the basis for the decision.
    - Designing facilities to the best currently available standards and guidelines. The design of facilities for bicyclists and pedestrians should follow design guidelines and standards set forth by the City of Wentzville, as well as other commonly used standards, such as the *AASHTO Guide for the Development of Bicycle Facilities*, AASHTO's *A Policy on Geometric Design of Highways and Streets*, and the Institute of Transportation Engineers' (ITE) recommended practice *Design and Safety of Pedestrian Facilities*.

Given the above policy recommendations, it follows that a series of design parameters be incorporated into this transportation plan, as illustrated in the following section.

4.0 Design Guidance

A logical result of the increase in attention to bicycling and walking that has occurred across the nation in the last 10 to 15 years has been the drafting of a number of design standards associated with non-motorized transportation facilities. In fact, it is often noted in the applicable literature that the hard decision to make is when to include bicycle and pedestrian facilities. Once that decision is made, specific information on the design of that facility is generally available.

For the benefit of providing standardization of treatments, as well as for the sake of using information that has been proven in other regions, it is appropriate to provide typical design parameters in this transportation plan and make reference to the use of nationally-recognized standards for more specific information. This design guidance is separated into a section for treatments related to bicycling facilities, and a section for treatments related to pedestrian facilities, as follows.

4.1 Facilities for Bicycling

Bicyclists use almost all types of roadway corridors, since different types provide connection to varying destinations. Therefore all public roadway right-of-way should be candidates for some treatment that provides access to the bicyclists. The national-standard document specific to the design of bicycle facilities is AASHTO's *Guide for the Development of Bicycle Facilities*, last published in 1999. Much of the design dimension information below is based on this guide. Off-street bicycling facilities and shared use paths with pedestrians are recommended in this transportation plan and presented in the following paragraphs.

Off-street paths within City right-of-way

The City proactively supports the use of six (6) foot wide off-street concrete multi-use (bicycle and pedestrian) paths on both sides of vehicular roadways within City maintained right-of-way. Shared use paths shall be provided along all newly constructed and reconstructed City maintained roadways as shown in the City's typical sections (Figure I-2). Design parameters that shall be implemented by the City as guidance include but are not limited to the following:

- One (1) foot of graded area should be maintained adjacent to both sides of the path.
- The path should be clear of trees, poles, fences, guardrails or other lateral obstructions or adequate space to maneuver around such obstructions should be provided.
- A buffer zone of four (4) to six (6) feet shall be provided to separate the path from the street. The buffer zone will vary according to the street type as shown in the City's typical sections (Figure I-2).
- Parking lanes and/or other shared paths can provide an acceptable buffer zone. The City supports a landscape strip or tree lawn as most suitable as shown in the City typical sections (Figure I-2).
- Eight (8) feet of vertical clearance to obstructions shall be maintained, rising to ten (10) feet for tunnels and areas where maintenance and emergency vehicles must operate.
- Grades greater than five (5) percent shall be avoided if possible, as they may make it difficult to climb for bicyclists, pedestrians, and specially individuals in wheelchairs.
- Sight distances should be checked during design or safety both on vertical and horizontal control as well as curvature. Design values regarding stopping sight distances vary depending on engineering judgment that considers variables such as bicycle design speed, reaction time, topography, friction factors, etc. More information is found in AASHTO's *Guide to the Development of Bicycle Facilities*.
- Given that poor drainage is most often the primary cause of degradation of the facility, a minimum cross slope of two (2) percent shall be implemented. A cross slope exceeding three (3) percent should be avoided since such slopes make the facility difficult to use by individuals in wheelchairs.
- The use of two (2) to four (4) inch thick concrete and granular base should be recommended to prevent degradation of the facility and maximize the benefit of longevity investment in the facility as compared to asphalt pavements. Lessening the concrete thickness is not recommended because the durability of the concrete may be adversely affected over time.

Because the paths are adjacent to a roadway, often their design parameters basically work within the parameters of the road according to its functional class and abide by the guidelines listed above.

Paved shoulders are no longer being constructed along the City's improved roads as shown in its typical sections (Figure I-2). The City proactively supports multi-use off-street paths on City maintained right-of-way, especially corridors that have wider right-of-way, lanes, paths or capacity to handle walking and biking interests.

Rumble strips are not recommended on pathways used by bicyclists unless there is a minimum clear path of four (4) feet in which a bicycle may safely operate.

Off-street paths outside City right-of-way

Outside City maintained right-of-way, off-street facilities, often called trails, bicycle paths, or shared-use paths, should not be seen as substitutes to other roadway corridor facilities but rather as complementary to a network of multi-modes. Off-street facilities work best when they are completely separated from the roadway so that the number of intersections and other conflict points with vehicular traffic are minimized.

Although off-street facilities are often recreational in use, they can be used for utilitarian purposes if no other alternatives exist. In the design of this type of facility, it should be understood that traffic on the paths is most often two-way, as opposed to other facilities paired on opposite sides of public right-of-way. Off-street facilities do not exist in a vacuum and thus should provide connectivity to the other elements of the non-motorized transportation system.

The City proactively supports the use of six (6) foot wide off-street concrete multi-use (bicycle and pedestrian) paths separate from City maintained right-of-way, but within the City's planning or urbanized area. Multi-use paths through common ground or green spaces behind homes or lots within a residential subdivision are typical applications. Design parameters for these facilities shall apply guidelines outlined in the above section 'Paths within public right-of-way". Care should be given to the design parameters of the stand alone paths, because they are not adjacent to roadways and not influenced by roadway typical sections or design standards.

Where federal money, county money, or outside agency grants are used to construct an independent or "stand alone" off-street multi-use facility, the facility shall use standards that deviate from other paths within the City's planning or urbanized area. Since these externally funded off-street facilities are "stand alone", and not adjacent to the roadway, their design is more open-ended, whereby factors such as topography, landscape, and others play a more significant role than on on-road facilities, which basically work within the parameters of the road. However, there are some design parameters that shall be implemented by the City as guidance, including:

- Minimum width of two-way facilities shall be ten (10) feet. Some construction cost savings may be gained in long-distance trail construction by designing the width to twelve (12) feet, which makes it compatible with paving equipment used for vehicular traffic lanes, in turn making the construction less of a manual process.
- Minimum width of twelve (12) feet shall be implemented for a two-way facility expecting a substantial use by bicycle, joggers, skaters, and pedestrians, and/or facilities were a significant grade is expected.
- Two (2) feet of graded area shall be maintained adjacent to both sides of the path.
- Three (3) feet of clear distance shall be maintained between the edge of the trail and trees, poles, walks, fences, guardrails or other lateral obstructions.

- Eight (8) feet of vertical clearance to obstructions shall be maintained, rising to ten (10) feet for tunnels and areas where maintenance and emergency vehicles must operate.
- Grades greater than five (5) percent shall be avoided if possible, as they may make it difficult to climb for bicyclists, pedestrians, and specially individuals in wheelchairs.
- Sight distances should be checked during design or safety both on vertical and horizontal control as well as curvature. Design values regarding stopping sight distances vary depending on engineering judgment that considers variables such as bicycle design speed, reaction time, topography, friction factors, etc. More information is found in AASHTO's *Guide to the Development of Bicycle Facilities.*
- Given that poor drainage is most often the primary cause of degradation of the facility, a minimum cross slope of two (2) percent shall be implemented. A cross slope exceeding three (3) percent should be avoided since such slopes make the facility difficult to use by individuals in wheelchairs.
- Striping and signage shall be provided per standards given in Part 9, Traffic controls for bicycle facilities, in the *Manual of Uniform Traffic Control Devices 2000 (MUTCD).*
- The use of four (4) to six (6) inch thick concrete and four (4) to eight (8) inch thick granular base should be recommended to prevent degradation of the facility and maximize the longevity benefit of investment cost as compared to asphalt pavements. Lessening the concrete thickness is not recommended because the facility may be subject to loadings from emergency or maintenance vehicles that could otherwise damage the facility from one use. More information is found in AASHTO's *Guide to the Development of Bicycle Facilities.*

Rumble strips are not recommended on pathways used by bicyclists unless there is a minimum clear path of four (4) feet in which a bicycle may safely operate.

4.2 Facilities for Walking

There are a number of positive consequences to a properly planned and engineered system of facilities for walking. Walking as a mode of transportation, or as a recreational activity, results in a reduction in traffic congestion, an improvement in the quality of life, a reduction in the dependency on auto ownership, and an increase in the economic vitality of communities. It is critical to also understand that facilities for walking also provide an accessible path of travel for those with disabilities or mobility challenges.

There are a number of guidelines available for the selection and design of facilities for walking. They include the Institute of Transportation Engineers' recommended practice *Design and Safety of Pedestrian Facilities*, *Designing Sidewalks and Trails for Access, Part I* by the Federal Highway Administration, and *Accessible Rights-of-Way: A Design Guide* by the U.S. Access Board and the Federal Highway Administration. The information presented herein is largely based on the Federal Highway Administration's *Pedestrian Facilities User Guide – Providing Safety and Mobility.*

A number of target areas exist for improving the pedestrian environment. The general characteristics of these target areas, important design considerations, and critical engineering dimensions and treatments are discussed in the following subsections as they relate to typical challenges to be met by transportation engineers and planners.

Sidewalks and walkways

Sidewalks and walkways in essence are the pedestrian lanes that allow the safe travel of individuals within the public right-of-way, while separating them from vehicular traffic. These facilities also provide safe travel for children to walk, run, skate, and play. Critical considerations in the design of sidewalks and walkways include:

- The City shall implement a minimum width of six (6) feet for a sidewalk or walkway, which allows two people to pass comfortably or to walk side-by-side. Deviations and use of a four (4) foot width may be used with approval from the City Engineer or Public Works Director such as on roadways with lower functional classification.
- Wider sidewalks should be installed near schools, at transit stops, in downtown areas, or anywhere high concentrations of pedestrians exist.
- Sidewalks should be continuous along both sides of a street and sidewalks should be fully accessible to all pedestrians, including those in wheelchairs.
- Sidewalks shall be made of concrete with a granular base to promote longevity. By approval of the City Engineer or Public Works Director, less costly walkways may be constructed of asphalt, crushed stone, or other materials if they are properly maintained and accessible (firm, stable, and slip-resistant).
- A buffer zone of four (4) to six (6) feet shall be provided to separate pedestrians from the street. The buffer zone will vary according to the functional class as shown in the City's typical sections (Figure I-2).
- Parking cars and/or other shared paths can provide an acceptable buffer zone. The City supports a landscape strip or tree lawn as most suitable as shown in the City typical sections (Figure I-2).
- Eight (8) feet of vertical clearance to obstructions shall be maintained, rising to ten (10) feet for tunnels and areas where maintenance and emergency vehicles must operate.
- Careful planning of sidewalks and walkways is important in a neighborhood or area in order to provide adequate safety and mobility. For example, there should be a flat sidewalk provided in areas where driveways slope to the roadway.
- Street furniture placement shall not restrict pedestrian flow.

Curb ramps

Curb ramps (wheelchair ramps) provide access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcarts, and also for pedestrians with mobility impairments who have trouble stepping up and down high curbs. Critical design considerations include:

- Curb ramps shall be installed at all intersections and midblock locations where pedestrian crossings exist and adjacent construction or reconstruction allows the opportunity for implementation.
- Wheelchair ramps shall have a slope of no more than 1:12 (must not exceed one (1) inch per foot or a maximum grade of 8.33 percent, with a maximum side slope of 1:10, and must be designed in accordance with the federal Americans with Disabilities Act (ADA) guidelines.
- Where feasible, separate curb ramps for each crosswalk at an intersection shall be provided rather than having a single ramp at a corner for both crosswalks. This provides improved orientation for visually impaired pedestrians. Similarly, tactile warnings will alert pedestrians to the sidewalk/street edge.

- While curb ramps are needed for use on all types of streets, priority locations are in downtown areas and on streets near transit stops, schools, parks, medical facilities, shopping areas, and near residences with people who use wheelchairs.

Marked crosswalks and enhancements

Marked crosswalks indicate optimal or preferred locations for pedestrians to cross and help designate right-of-way for motorists to yield to pedestrians. Crosswalks are often installed at signalized intersections and other selected locations described in Section 4.3, Junctions with vehicular crossings. Design considerations include:

- Marked crosswalks are desirable at some high pedestrian volume locations (often in conjunction with other measures) to guide pedestrians along a preferred walking path (see also Section 4.3, Junctions with vehicular crossings).
- In some cases, they can be raised and should often be installed in conjunction with other enhancements that physically reinforce crosswalks and reduce vehicle speeds.
- It is also sometimes useful to supplement crosswalk markings with warning signs for motorists. At some locations, signs can get "lost" in visual clutter, so care must be taken in placement (see also Section 4.3, Junctions with vehicular crossings).
- Pedestrians are sensitive to out-of-the-way travel, and reasonable accommodation should be made to make crossings both convenient and safe at locations with adequate visibility.
- It is important to ensure that crosswalk markings are visible to motorists, particularly at night.
- Crosswalks shall not be slippery or create tripping hazards.
- Even though granite or cobblestones are aesthetically appealing materials, they are generally not appropriate for crosswalks. One of the best materials for marking crosswalks is inlay tape, which is installed on new or repaved streets. It is highly reflective, long-lasting, and slip-resistant, and does not require a high level of maintenance.
- Although initially more costly than paint, both inlay tape and thermoplastic are more cost-effective in the long run. Inlay tape is recommended for new and resurfaced pavement, while thermoplastic may be a better option on rougher pavement surfaces. Both inlay tape and thermoplastic are more visible and less slippery than paint when wet.

Roadway lighting improvements

It is important to consider the quality and placement of lighting to enhance and protect the pedestrian environment. In commercial areas with nighttime pedestrian activity, streetlights and building lights can enhance the ambiance of the area and the visibility of pedestrians by motorists. It is best to place streetlights along both sides of arterial streets and to provide a consistent level of lighting along a roadway. Nighttime pedestrian crossing areas may be supplemented with brighter or additional lighting. This includes lighting pedestrian crosswalks and approaches to the crosswalks.

In commercial areas or in downtown areas, specialty pedestrian-level lighting may be placed over the sidewalks to improve pedestrian comfort, security, and safety. Mercury vapor, incandescent, or less expensive high-pressure sodium lighting is often preferred as pedestrian-

level lighting. Low-pressure sodium lights are low energy, but have a high level of color distortion.

Street furniture

Well-designed walking environments are enhanced by urban design elements and street furniture, such as benches, bus shelters, trash receptacles, and water fountains. Sidewalks and walkways shall be kept clear of poles, signposts, newspaper racks, and other obstacles that could block the path, obscure a driver's view or pedestrian visibility, or become a tripping hazard. Benches, water fountains, bicycle parking racks, and other street furniture shall be carefully placed to create an unobstructed path for pedestrians.

4.3 Junctions with vehicular crossings

At-grade crossings

Pedestrian and bicycle facilities that cross vehicular roadways are often only provided with an at-grade crossing at an intersection. Often the crossings are not formally designated with striped crosswalks or signage depending on its location and expected level of use. The City of Wentzville shall be practical in its placement of striped pedestrian and bicycle at-grade crossings. Possible locations of at-grade pedestrian and bicycle crossings shall adhere to the following guidelines:

- Striped crosswalks, signage and pedestrian signals shall be placed at all signalized intersections maintained by the City. Striped crosswalks and signage shall also be included 4-way stop intersections with flashers.
- Striped crosswalks and signage shall be placed at all at-grade crossings of arterials with arterials, arterials with major collectors and major collectors with other major collectors at intersections maintained by the City according to the functional classification of roadways given in Part 1 of this Transportation Master Plan (Figure I-1).
- Within the core area of Wentzville, bounded roughly by Wentzville Parkway, I-70 and Route 61, striped crosswalks and signage shall be placed at City maintained intersections along arterials and/or major collectors with all-way stop control. Functional classification of roadways is given in Part 1 of this Transportation Master Plan (Figure I-1).
- Mid-block striped crosswalks and signage shall be placed across roadways maintained by the City where high average daily use is experienced as determined by the City Public Works Director and City Engineer. High pedestrian and bicycle volumes is determined on an average day when 50 or more cross the roadway for each of any four hours or 100 or more cross during any one hour. As a traffic calming measure determined by the City Public Works Director and City Engineer, mid-block striped crosswalks and signage can be placed across roadways maintained by the City as needed.
- For areas around schools, striped crosswalks, signage and school zones shall be placed at intersections or mid-block according to school routes determined by the City Public Works Director and City Engineer.
- The City's and *MUTCD's* Traffic Signal Warrant Guidelines include warrants four and five for pedestrian and school crossings. Striped crosswalks and signage shall be used

at any signalized pedestrian or school crossing maintained by the City adhering to the *MUTCD* guidelines.

After the decision of where to provide an at-crossing is made, the City shall adhere to the guidelines provided by the *Manual of Uniform Traffic Control Devices 2000* (*MUTCD)* for striping, signage, signals and other treatments for bicycle and/or pedestrian crossings within City maintained right-of-way. Signage, striping and signal treatments for crosswalks are in *MUTCD* Parts 2B.39, 3B.17 and 4E, respectively. The *MUTCD* separates school crossings and treatments in Part 7, Traffic control for school areas. At-grade bicycle facility crossings are also separated in Part 9, Traffic controls for bicycle facilities. More detail is provided later in Section 6.0.

Grade separated crossings

Typically when the fourth traffic signal warrant for traffic signals for pedestrian volume is satisfied, a grade separated crossing is also considered as an alternative to a signalized at-grade crossing. The level of use that warrant overviews if grade separated bicycle and pedestrian crossings are practical is as follows:

- On an average day, 100 or more pedestrians and bicycles cross the roadway for each of any four hours, or
- On an average day, 190 or more pedestrians and bicycles cross the roadway during any one hour

Despite satisfying the warrant, often the cost of establishing grade-separated bikeways or walkways would be excessively disproportionate to the need or probable use when compared to at-grade crossings. Excessively disproportionate is defined as exceeding twenty percent of the cost of the at-grade solution or other reasonable baseline. In some instances, topographic features or modifying existing structures lend themselves as opportunities that can offset costs. The City Public Works Director or City Engineer can also recommend that grade-separations be placed and funded by property owners if the impact of a site creates a high use on an average day or high uses during special events. Such an example is a grade separation over a public roadway between a parking structure or lot and a ball field or sport arena.

Overpasses

Due to easier maintenance and supervision, overpasses are preferred to underpasses for grade separated pedestrian and bicycle facilities. Since pedestrian and bicycle overpasses are an obstruction to the roadway beneath them, they shall conform to the applicable roadway design standards such as vertical clearance and clear zone parameters provided by the City's roadway design standards in Part 1 of this Transportation Master Plan or AASHTO's *A Policy on Geometric Design of Highways and Streets.* Other overpass design parameters that shall be implemented by the City include but are not limited to the following:

- Minimum width of two-way facilities shall be eight (8) feet. One-way facilities are rare, but the minimum path width should remain at eight (8) feet for ease of maintenance and supervision.
- Minimum width of twelve (12) feet shall be implemented for a two-way facility expecting a substantial use by bicycle, joggers, skaters, and pedestrians.

- The path should be clear of trees, poles, fences, guardrails or other lateral obstructions or adequate space to maneuver around such obstructions should be provided.
- Barriers and/or fencing shall be provided along the overpass for safety of those on and below the structure.
- Eight (8) feet of vertical clearance above the overpass to obstructions shall be maintained, rising to ten (10) feet for areas where maintenance and emergency vehicles must operate.
- Grades greater than five (5) percent shall be avoided if possible, as they may make it difficult to climb for bicyclists, pedestrians, and specially individuals in wheelchairs.
- A minimum cross slope of two (2) percent shall be implemented to prevent poor drainage. A cross slope exceeding three (3) percent should be avoided since such slopes make the facility difficult to use by individuals in wheelchairs.
- Access to the overpass shall be designed in accordance with ADA standards.

Care should be given to the design parameters of the overpasses as stand alone paths, because they are not adjacent to roadways and not influenced by roadway typical sections or design standards.

If the overpass is underutilized because it is less convenient to users than a perceived at-grade crossing, barriers, signage or supervision should be considered to improve the level of use.

Underpasses

Pedestrian and bicycle underpasses often are only provided in areas where the cost is offset by tunnel structures serving other uses such as a waterway or atypical utility crossing. Topographic features and other opportunities may exist where existing or future underpasses could be used, widened or fitted for bicycle and pedestrian facilities. Underpass design parameters that shall be implemented by the City include but are not limited to the following:

- Minimum width of two-way facilities shall be eight (8) feet. One-way paths that are separated but operate together as a two-way facility in the underpass can each be reduced to six (6) feet in width.
- Minimum width of twelve (12) feet shall be implemented for a two-way facility expecting a substantial use by bicycle, joggers, skaters, and pedestrians.
- The path should be clear of trees, poles, fences, guardrails or other lateral obstructions or adequate space to maneuver around such obstructions should be provided.
- Barriers and/or fencing shall be provided along the structure above for safety of those in and above the underpass.
- Eight (8) feet of vertical clearance above the overpass to obstructions shall be maintained, rising to ten (10) feet for areas where maintenance and emergency vehicles must operate.
- Grades greater than five (5) percent shall be avoided if possible, as they may make it difficult to climb for bicyclists, pedestrians, and specially individuals in wheelchairs.
- A minimum cross slope of two (2) percent shall be implemented for adequate drainage. A cross slope exceeding three (3) percent should be avoided since such slopes make the facility difficult to use by individuals in wheelchairs.

- If possible, a buffer zone of four (4) to six (6) feet shall be provided to separate the path from other uses such as streams or utilities. The buffer zone can vary if barriers and/or fencing is used.
- If the underpass design does not provide a paved path because it originally serving other uses, the use of two (2) to four (4) inch thick concrete and granular base should be recommended to prevent degradation of the facility and maximize the benefit to cost of the facility through longevity as compared to asphalt pavements. Lessening the concrete thickness is not recommended because the durability of the concrete may be adversely affected over time.
- Access to the underpass shall be designed in accordance with ADA standards.
- Underpass shall be lighted as applicable for proper vision and user safety.

Care should be given to the design parameters of the underpasses as stand alone paths, because they are not adjacent to roadways and not influenced by roadway typical sections or design standards.

If the underpass is underutilized because it is less convenient to users than a perceived at-grade crossing, barriers, signage or supervision should be considered to improve the level of use.

5.0 Coordination with the City Comprehensive Plan

The City of Wentzville Comprehensive Plan recommends four roadways and a type of bicycle facility for each originating from the St. Charles County Bikeway Plan Development Map (St. Charles County Bikeway Plan). They are:

- Pearce Boulevard – stripe a bicycle lane and add signage.
- Wentzville Parkway – allow bicycles to share travel lanes with vehicular traffic such as the outside lane and add signage.
- Route A - allow bicycles to ride on paved shoulders or share travel lanes with vehicular traffic such as the outside lane and add signage.
- Business Highway 61 – add an eight (8) foot wide shared use off-street path and add signage.

The City Comprehensive Plan, within the land use chapter, supports off-street trail facilities within planned greenways and/or park property. These locations can be viewed in the Appendix as Figure A-10 and is Plan No. 15 of the October 2001 Comprehensive Plan's Land Use Plan.

The City of Wentzville Public Works Department evaluates and revises the City Comprehensive Plan typically on a yearly basis. As part of the next evaluation, future revisions to the bicycle facility components of the Comprehensive Plan shall incorporate the following statements enhancing the bicycle facilities listed above and other multi-modal interests of the City.

- Recommended goals for Pearce Boulevard shall include a shared use off-street path, improving existing concrete sidewalks and paths to six (6) feet minimum and adding signage as needed. Recommendations to enhance and stripe a "stand alone" bicycle path shall be investigated.

- Recommended goals for Wentzville Parkway shall include a shared use off-street path, improving existing concrete sidewalks and paths to eight (8) feet minimum and adding signage as needed.
- Recommended goals for Route A and Business Highway 61 shall remain the same as the current plan because the right-of-way is maintained by the Missouri Department of Transportation.
- Recommend goals for the City to examine existing and planned off-street facilities to work toward a more functional and beneficial network in the future.
- The City shall coordinate with proposed plans, such as Route A, and public right-of-way that lie in the City's planning or urbanized area but are not maintained by the City.
- The City shall proactively support the use of shared use off-street facilities within or external to City maintained right-of-way, especially corridors that have wider right-of-way, lanes, paths or capacity to handle walking and biking interests.
- The City shall incorporate goals and language that compliment the bicycle and pedestrian policies and standards of this Transportation Master Plan.

6.0 Other Factors Affecting Bicycling and Walking

There are a number of other factors that are relevant to the planning and design of bicycling and walking facilities. Some of the key factors that are worthy of consideration in this transportation plan are synthesized in the following sections.

6.1 Signing and Marking

The placement of standard signs and marking within the influence area of bicycling and walking facilities is an important component of properly planned and designed treatments. The most important elements of proper signing and marking are that they are standard, thus communicating a common message, and that they display concise information, thus communicating a clear message. Therefore, it is critical that signs and marking associated with these facilities are in close adherence to the *Manual of Uniform Traffic Control Devices* (*MUTCD*).

The Federal Highway Administration has developed a comprehensive series of standards for the design, application, and placement of traffic control devices and has encapsulated these in the *MUTCD*. Part 9 of the Manual describes signs, signals, and markings specifically designed for bicycling facilities. Some of the most critical elements of Part 9 include:

- The definitions used in the Manual and the signs and markings are consistent with the 1999 *AASHTO Guide for the Development of Bicycle Facilities*.
- Smaller sign sizes for use on off-street stand-alone shared use paths (trails).
- Refined usage of the pedestrian and bicycle crossing warning sign in conjunction with other signage.
- The pedestrian and bicycle crossing warning sign may have a fluorescent yellow-green background color.
- All new graphics showing appropriate placement and use of signs and markings.
- Guidance on the appropriate use of Stop and Yield signs at trail/roadway intersections.

Standard signing and markings for pedestrian facilities are not consolidated in the *MUTCD* into a specific chapter, but rather are scattered within multiple sections in the manual. Fortunately, the Federal Highway Administration's *Pedestrian Facilities User Guide – Providing Safety and*

Mobility does compile all the relevant information into Chapter 4: The Tools, Section F: Signals and Signs. The source, suggested here as the primary reference for this transportation plan, illustrates standard treatments for traffic signals, pedestrian signals, upgrading and modifying pedestrian signal timing, enhancing traffic signals, right-turn-on-red guidance, advanced stop lines, and the addition and/or modification of signing.

6.2 Measures to Protect Bicyclists and Pedestrians in Work Zones

There are three general situations which impact bicyclists, pedestrians, and disabled travelers during road construction activities:

- Work in the bikeway or walkway which forces bicyclists or pedestrians to compete with motor vehicles in a narrow car lane.
- Work which is not in the bikeway or walkway but which puts equipment, debris, or warning signs in the bikeway or walkway.
- Work which blocks the direction of travel without a clear, safe, and convenient detour for cyclists, pedestrians, or wheelchair travelers.

In addition, specific hazards for bicyclists, pedestrians, and disabled travelers include:

- Hazards to Bicyclists:
  Signs, equipment, or debris in the bikeway.
  Bikeway blocked without advance warning.
  Rough pavement or gravel without advance warning.
  Poor pavement transitions, especially when parallel to the line of travel.
  Inadequate time to pass through a signalized one-lane, two-way traffic control.
- Hazards to Pedestrians:
  Blocked or hazardous walkway which is not marked in a way that is visible in advance, especially at night.
  Alternate route or detour which is not negotiable by wheelchairs, strollers, carts, etc.
- Special Hazards to Visually Impaired Pedestrians:
  Blocked or hazardous walkway without a barrier which is solid enough to be discernible by guide dog or cane.
- Special Hazards to Wheelchair Travelers:
  Signs, equipment, or debris partially blocking the walkway.
  Sidewalk blocked with no curb cut or ramp to exit sidewalk, or advance warning to exit at a prior curb cut.
  Rough pavement, grooves, or gravel without advance warning. Rocks of 3" diameter or greater are especially hazardous because they may cause the wheelchair to stop abruptly and eject the occupant.

Therefore, it is recommended that the following guidelines be consulted to protect bicyclists and pedestrians in construction and maintenance work zones:

- Bicycle and pedestrian movement shall be disrupted as little as practicable.
- Pedestrians and bicyclists shall be provided with access and passage through, or around, the temporary traffic control zone at all times.
- Bicyclists and pedestrians shall be guided in a clear and positive manner while approaching and space traversing the temporary traffic control zone.

- If construction or signs must block the walkway, establish safe, well-signed detours for pedestrians which are accessible for wheelchairs, strollers, carts, etc.
- When one-lane, two-way traffic control is done by temporary traffic signals, timing should accommodate bicyclists, who will be slower than motor vehicles especially in the uphill direction.
- Consider push button signals for pedestrians and bicyclists or special loops detectors, if practical.
- Barriers or separators should include a portion low enough and solid enough to be easily discernible by a cane, guide dog, or child. If necessary, use flaggers to guide pedestrians.
- Whenever possible, construction warning signs should be placed out of the bikeway and walkway, so that the sign itself is not a barrier for bicyclists for wheelchair travelers. Remove construction signs promptly when construction pauses or ends.
- Any construction or sign which blocks the bikeway or walkway should have sufficient sight distance, including night-time visibility, to allow cyclists time to merge safely into the car lane.
- Any construction or sign which blocks the walkway should have prior warning to allow wheelchairs time to exit the walkway at a prior curb cut.
- For all construction where the bikeway or walkway is blocked, post "Share the Road" caution signs and construction markers or barriers to warn motorists to slow down and watch for bicyclists and pedestrians possibly on the street.
- Temporary pavement or metals plates installed during construction should have cold mix asphalt tapered at the edges for bicyclist, pedestrian and wheelchair safety. When locating metal plates, avoid placing edges in the middle of the bikeway. Debris in the bikeway or walkway should be cleared at the end of each workday.
- If no smooth surface is available for bicyclists, pedestrians, or wheelchairs, post signs warning "Rough Surface" or "Uneven Pavement" at the beginning of the work area. Keep signs posted at the end of the workday. Use reflective signage on barricades with flashers for night safety.
- Prior to "sign off" on projects, verify that the pavement in the bikeway and walkway is even.
- Overlay should be smoothed at drainage grates, manholes, and gutter pan, and after narrow trenching in the walkway or bikeway.

6.3 Maintenance

The operation, maintenance and policing of bicycle and pedestrian facilities, as well as the determination of the responsible jurisdiction, should be important components of the planning of these improvements. Furthermore, the cost to operate and maintain the facilities should be added to the construction cost to determine the total cost to improve.

A smooth surface, clear of debris and obstructions, is critical to the operation of bicycling and pedestrian facilities. In fact, due to significant differences between vehicular and non-motorized modes in their ability to negotiate surface irregularities and obstructions, such adequate conditions are more critical to the non-motorized user.

Glass, sand, litter and fallen leaves often accumulate on bikeways and walkways; therefore, regular sweeping is strongly encouraged. Pavement edges should be uniform and should not have abrupt drop-offs. Signs and pavement markings should be inspected regularly and kept in good condition.

Pedestrian areas should also be properly maintained and kept clear of debris, overgrown landscaping, tripping hazards, or areas where water accumulates. Snow removal is also important for maintaining pedestrian safety and mobility.

City ordinances and comprehensive planning can be used to support proper use and safety of pedestrian and bicycle facilities such as prohibiting undesirable or unwanted motorized vehicles, snow mobiles, ATV's etc, from using the facility.

Proper planning, engineering and design, as illustrated in previous sections of this transportation plan, will also enhance the ability of the community to maintain safe, efficient, and successful bicycle and pedestrian facilities.

7.0 Additional Resources

Not including the references used in the above technical memorandum, the following additional resources can be used for research purposes.

7.1 General

National Bicycling and Walking Study Final Report, FHWA, 1993.
National Bicycling and Walking Study Case Studies (24), FHWA, 1993.
Bicycle and Pedestrian Safety and Accommodations, a three-day training course available through the National Highway Institute, FHWA, 1996.
A Synthesis of Bicycle Safety-related Research, FHWA, 1994.
Pedestrian Crash Types: A 1990s Informational Guide, FHWA, 1997.
Bicycle Crash Types: A 1990s Informational Guide, FHWA, 1997.

7.2 Planning

Bicycle and Pedestrian Planning Under ISTEA: A Synthesis of the State of the Practice, FHWA, 1997.
Bicycle and Pedestrian Planning Under ISTEA: A Training Manual, FHWA, 1994.
Selecting Roadway Design Treatments to Accommodate Bicyclists, FHWA, 1992.
Bicycle Facility Planning: APA Planning Advisory Service Report 459, APA, 1995.
Making the Connection: Integrating Land-use and Transportation Planning for Livable Communities, 1000 Friends of Oregon, 1997.
A Bicycle-friendly City (video), Bicycle Federation of America, 1995, ($20).

7.3 Off-road Facilities

Guide to the Development of Bicycle Facilities, AASHTO, 1991.
Trails for the 21st Century: A Planning, Design and Management Manual for Multi-use Trails, Rails to Trails Conservancy, 1993.
Greenways, Flink and Searns, Conservation Foundation, 1993.
Trail Intersection Design Guidelines (Draft) prepared for Florida DOT by the University of North Carolina Highway Safety Research Center in 1996.
Rails with Trails: Sharing Corridors for Transportation and Recreation, Rails to Trails Conservancy, 1998.

7.4 On-road Facilities

Guide to the Development of Bicycle Facilities, AASHTO, 1991.
A Policy on Geometric Design of Streets and Highways, AASHTO, 1995.
Making Streets that Work, City of Seattle, 1996 (video and workbook).
Design of Pedestrian Facilities, Report of Recommended Practice, Institute of Transportation Engineers (ITE).
Residential Street Design and Traffic Control, ITE.
Traffic Calming. APA Planning Advisory Service Report Number 456, 1995.
The Pedestrian Environment, 1000 Friends of Oregon, 1993.

7.5 Education, Encouragement and Enforcement

Mean Streets: Pedestrian Safety and Reform of the Nation's Transportation Law. Environmental Working Group, 1997.
Share the Road: Let's Make America Bicycle-friendly. Environmental Working Group, 1997.
The Complete Guide to Police Cycling ($20), IPMBA.

7.6 Where to Obtain Additional Resources

FHWA Publications
National Bicycle and Pedestrian Clearing House
1506 21st Street NW, Suite 210
Washington, D.C. 20036
(800) 760-6272

Rails-to-Trails Conservancy
1100 17th Street, NW; 10th Floor
Washington, D.C. 20036
(202) 331-9696

Bicycle Federation of America
1506 21st Street, NW; Suite 200
Washington, D.C. 20036
(202) 463-6622

League of American Bicyclists
1612 K Street, NW; Suite 401
Washington, D.C. 20006
(202) 822-1333

Environmental Working Group
1718 Connecticut Avenue, NW; Suite 600
Washington, D.C. 20009
(202) 667-6982

Institute of Transportation Engineers
525 School Street, SW; Suite 410
Washington, D.C. 20024

American Planning Association
122 S. Michigan Avenue, Suite 1600
Chicago, IL 60603

American Association of State Highway and Transportation Officials
444 North Capitol Street, NW; Suite 225
Washington, D.C. 20001
(202) 624-5800

1000 Friends of Oregon
534 SW 3rd Avenue, Suite 300
Portland, OR 97204
(503) 497-1000

Florida Department of Transportation
Bicycle and Pedestrian Program
605 Suwannee Street, MS-82
Tallahassee, FL 32399
(850) 487-1200

Conservation Fund
1800 North Kent Street, Suite 1120
Arlington, VA 22209
(703) 525-6300

City of Seattle
Bicycle and Pedestrian Program
Seattle Engineering Department
600 4th Avenue, Room 708
Seattle, WA 98104

TRANSPORTATION MASTER PLAN

Appendix
Figure A-1
City of Wentzville Thoroughfare Plan
(Plan No. 6) from City Comprehensive Plan

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

LEGEND

- New Interchange

PROPOSED ROADS
- Proposed Arterial Roads
- Proposed Collector Roads

EXISTING ROADS
- Existing Arterial Roads
- Existing Collector Roads
- Existing Roads
- Railroad

Wentzville
Missouri - USA
The Crossroads Of The Nation

CITY OF WENTZVILLE
COMPREHENSIVE PLAN
THOROUGHFARE PLAN

8-2003
PLAN NO. 6

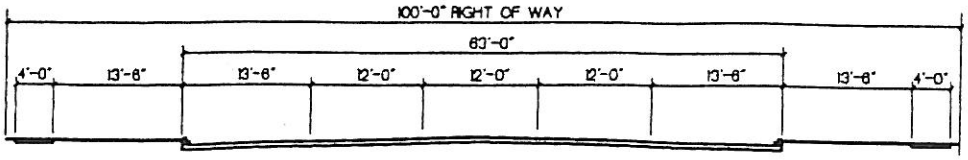
TRANSPORTATION MASTER PLAN

Appendix
Figure A-2

City of Wentzville typical sections
(Table No.16) from City Comprehensive Plan

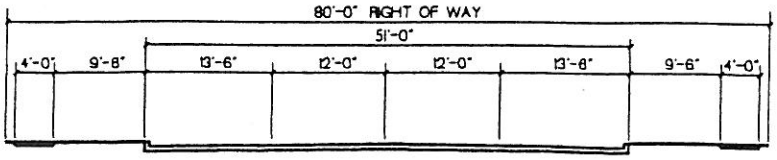
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri



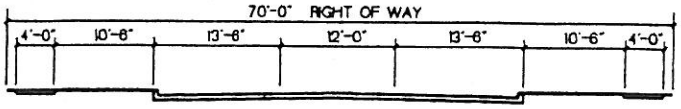
URBAN PRIMARY ARTERIAL

5 LANES
MINIMUM CENTER LINE RADIUS = 955'
ANTICIPATED SPEED LIMIT 40 MPH
ST. LOUIS COUNTY DETAIL C 203.63



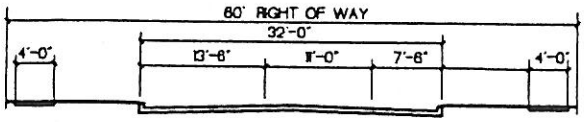
URBAN ARTERIAL

4 LANES
MINIMUM CENTER LINE RADIUS = 955'
ANTICIPATED SPEED LIMIT 40 MPH
ST. LOUIS COUNTY DETAIL C 203.92



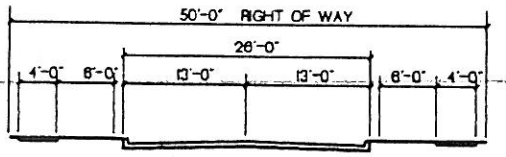
ARTERIAL COLLECTOR

3 LANES
MINIMUM CENTER LINE RADIUS = 575'
ANTICIPATED SPEED LIMIT 35 MPH
ST. LOUIS COUNTY DETAIL C 203.91



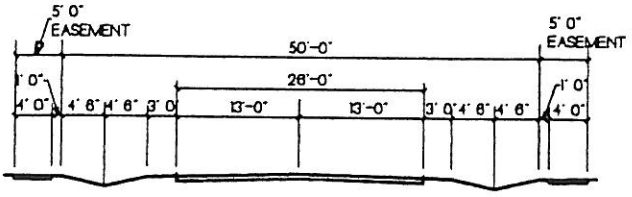
MINOR COLLECTOR AND COMMERCIAL STREETS

2 LANES
MINIMUM CENTER LINE RADIUS = 275'
ANTICIPATED SPEED LIMIT 30 MPH
ST. LOUIS COUNTY DETAIL C 203.82



LOCAL RESIDENTIAL STREET

2 LANES
MINIMUM CENTER LINE RADIUS = 150'
ANTICIPATED SPEED LIMIT 25 MPH
ST. LOUIS COUNTY DETAIL C 203.82



RURAL RESIDENTIAL STREET

2 LANES
MINIMUM CENTER LINE RADIUS = 275'
ANTICIPATED SPEED LIMIT 25 MPH
ST. LOUIS COUNTY DETAIL C 203.82

CITY OF WENTZVILLE
STREET CONSTRUCTION STANDARDS

04/16/98

TABLE NO. 16

FILE: STXSECT

TRANSPORTATION MASTER PLAN

Appendix
Table A-1
Roadway Inventory Data

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

Appendix Table A-1 Roadway Inventory Data

Roadway	Classification						Number of Lanes		Right-of-way (ROW) Width		Average Daily Traffic (ADT)				Basic Evaluations		
	Freeway	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local Street	Current	Planned	Current	Planned	Current 1999-2002	Forecasted 2004	Forecasted 2010	Forecasted 2025	Functional Class Check	Right-of-way Width Check	Current ADT Volume to Capacity Check**
Interstate 70	X (R)						4	same	>200' +/-	same	48,901-64,018	52,300-70,100	no data	77,200-119,300	no change	OK	**Near capacity (V/C > 0.8)**
Highway 61	F (R)	X					4	same	>100' +/-	same	29,264-30,112	33,200-43,000	no data	60,300-77,900	no change	OK	OK
Highway 40/61	F (R)	X					4	6	>100' +/-	>200' +/-	28,393-31,267	49,200-55,100	no data	67,300-81,100	no change	OK	OK
70-61 Beltway		F (R)					no data	5	no data	100'	no data	not modeled	not modeled	not modeled	no change	OK	no data
Blumhoff (Extension)				F	(R)		no data	3	no data	80'	no data	not modeled	not modeled	not modeled	lower to mnr col	OK	no data
Duello Road				X (R)			2	3	40'	80'	no data	not modeled	not modeled	not modeled	no change	**Need 70'**	no data
Dueneke Road (Extension)				F (R)			no data	3	no data	80'	no data	not modeled	not modeled	not modeled	no change	OK	no data
East Service Road (Highway 61)				F (R)			no data	3	no data	80'	no data	not modeled	not modeled	not modeled	no change	OK	no data
Hepperman Road (plus new bridge)				(R)	W		2	same	50'	38' wide bridge	no data	not modeled	not modeled	not modeled	raise to mjr col	**Need 70'**	no data
Highway A		W	STCC EW (R)				4	same	<150' +/-	same	4,920 (1995) 4,857 (2000)	3,100-13,400	no data	2,300-12,900	lower to mnr art	OK	OK
Highway N		W (R)		STCC EW			2	same	<100' +/-	same	3,206-4,476	1,200-9,900	14,110	4,900-9,000	no change	OK	OK
Highway P		W	(R)	STCC EW			2	same	<100' +/-	same	7,434	3,100-12,000	no data	4,900-12,200	lower to mnr art	OK	OK
Highway T		W	(R)	STCC EW			2	same	<100' +/-	same	6,356	1,500-10,700	1,919	3,100-10,000	lower to mnr art	OK	OK
Highway W		W	(R)	STCC EW			2	same	<100' +/-	same	1,494	2,200-5,200	1,363	4,100-10,000	lower to mnr art	OK	OK
Highway Z		W (R)		STCC EW			2	same	<150' +/-	same	7,074	2,700-6,300	10,650	5,400-13,900	no change	OK	OK
Industrial Park Access				F	(R)		no data	3	no data	80'	no data	not modeled	not modeled	not modeled	lower to mnr col	OK	no data
Inner Belt Roadway			F	(R)			no data	4	no data	80'	no data	not modeled	not modeled	not modeled	lower to mjr col	OK	no data
Interstate Drive			F (R)	EW W			3	4	68'	100'	2,100	300	no data	9,100	no change	**Need 80'**	OK
Jackson Road (Extension)			F	(R)			no data	3-4	no data	80'	no data	not modeled	not modeled	not modeled	lower to mjr col	OK	no data
Mexico Road				X (R)			2	3	40'	80'	no data	not modeled	not modeled	not modeled	no change	**Need 70'**	no data
W. Meyer Road		F (comp)		(R)	W (rdydb)	EW	2	5	40'	100'	1,700-5,000	400-4,700	no data	700-11,900	lower to mjr col	**Need 70'**	**Moderate (V/C > 0.5)**
Meyer Road				(R)	W	EW	2	same	40'	same	2,300	200	no data	1,400	raise to mjr col	**Need 70' ***	OK
Peine Road				F (R)	W		2	3	40'	80'	no data	not modeled	not modeled	not modeled	no change	**Need 70'**	no data
Whisper Creek Dr. (School Road)			F		(R)		no data	4	no data	80'	no data	not modeled	not modeled	not modeled	lower to mnr col	OK	no data
Scotti Road (Extension)				F (R)			no data	3	no data	80'	no data	not modeled	not modeled	not modeled	no change	OK	no data
Wentzville Parkway (Extension)		F	(R)				no data	5	no data	100'	no data	not modeled	not modeled	not modeled	lower to mnr art	OK	no data
Wentzville Parkway (North/East)		W	(R)			EW	5	same	100'	same	3,500-17,700	1,000-6,800	no data	3,200-15,600	lower to mnr art	OK	**Moderate (V/C > 0.5)**

Source: EWGCC, City of Wentzville Comprehensive Plan (comp) and roadway inventory database (rdydb), 2002.
X = Existing condition. F = Future planned condition if different from existing condition. (R) = Recommended condition based on Transportation Master Plan, 2003.
EW = Condition according to East-West Gateway Coordinating Council regional modeling database, 2002. STCC = Condition according to St. Charles County master plan, 1996.
W = Condition according to City of Wentzville comprehensive plan (comp) or city roadway inventory database (rdydb).
* = Adjacent properties have little space to widen street ROW. Additional ROW would be acquired slowly only when redevelopments occur.
** = Depending on functional class, V/C check assumes ADT maximum range of 4,000 to 9,000 vehicles per day per lane (i.e. collectors and arterials assumed to carry maximum range of 400 to 900 vehicles per lane per hour, and peak hour volume is 10% of ADT).

Appendix Table A-1 Roadway Inventory Data (continued)

Roadway	Classification						Number of Lanes		Right-of-way (ROW) Width		Average Daily Traffic (ADT)				Basic Evaluations		
	Freeway	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local Street	Current	Planned	Current	Planned	Current 1999-2002	Forecasted 2004	Forecasted 2010	Forecasted 2025	Functional Class Check	Right-of-way Width Check	Current ADT Volume to Capacity Check**
Wilmer Road (S. Service Rd to Wentzville Pkwy.)				X (R)			2	3	80'	same	no data	1,900-10,700	no data	8,800-19,000	no change	OK	no data
S. Wilmer Road (Wentzville Pkwy to Hwy N)		F	(R)	EW W			2	5	80'	100'	no data	1,900-10,700	no data	8,800-19,000	lower to mnr art	OK	no data
Business Highway 61		EW	(R)	W			2	same	50'	same	8,800-11,700	7,300-17,400	no data	2,300-31,700	raise to mnr art	**Need 80' ***	**Near capacity (V/C > 0.9)**
N. Callahan Road			W			(R)	2	same	30'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
S. Callahan Road			W		(R)	EW	2	same	50'	same	1,900	900-8,700	no data	5,000-9,400	lower to mnr col	**Need 60' ***	OK
Church Street			W		(R)	EW	2	same	50'	same	4,500	12,600	no data	6,700	lower to mnr col	**Need 60' ***	OK
Mall Parkway			W			EW (R)	2-4	same	80'	same	no data	7,900-11,200	no data	5,500-10,000	lower to local	OK	no data
Pearce Boulevard			EW W	(R)			3	same	60'	same	9,600-12,300	4,100-13,600	no data	7,900-19,900	lower to mjr col	**Need 70' ***	**Near capacity (V/C > 0.9)**
South Service Road (I-70)				W (R)			2	Same	no data	no data	no data	not modeled	not modeled	not modeled	no change	no data	no data
Schaper Road					W (R)		2	Same	no data	no data	no data	not modeled	not modeled	not modeled	no change	no data	no data
Main Street					(R)	W	2	Same	no data	no data	no data	not modeled	not modeled	not modeled	raise to mnr col	no data	no data
Carlton Glen Blvd. (Kammeier Road)				W (R)			2	Same	no data	no data	no data	not modeled	not modeled	not modeled	no change	no data	no data
Roadways below are from Wentzville roadway inventory database as arterial or collector but not in EWGCC model or City Comprehensive Plan.																	
W. Academy (Linn to Blumhoff)			W			(R)	2	same	50'	same	1,100	not modeled	not modeled	not modeled	lower to local	OK	OK
E. Academy (Linn to Carr)			W			(R)	2	same	60'	same	1,100	not modeled	not modeled	not modeled	lower to local	OK	OK
E. Academy (Carr to Wall)			W			(R)	2	same	50'	same	1,100	not modeled	not modeled	not modeled	lower to local	OK	OK
Ball Street			W			(R)	2	same	30'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Bear Fountain Run					W	(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Boles Avenue			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Carr Street					W	(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Corporate Parkway					W (R)		4	same	80'	same	2,700	not modeled	not modeled	not modeled	no change	OK	OK
Crosswinds Drive			W			(R)	2	same	60'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Edinger Road					W (R)		2	same	40'	same	1,000	not modeled	not modeled	not modeled	no change	**Need 60' ***	OK
Fairview Farm Circle			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Golf Club Drive			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Grand Canyon Drive			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Great Oaks Boulevard (subdivision start to EOP)					W	(R)	2	same	60'	same	800	not modeled	not modeled	not modeled	lower to local	OK	OK
Great Oaks Boulevard (Wentzville Pkwy to subdivision start)					W	(R)	2	same	40'	same	800	not modeled	not modeled	not modeled	lower to local	OK	OK

Source: EWGCC, City of Wentzville Comprehensive Plan (comp) and roadway inventory database (rdydb), 2002.
X = Existing condition. F = Future planned condition if different from existing condition. (R) = Recommended condition based on Transportation Master Plan, 2003.
EW = Condition according to East-West Gateway Coordinating Council regional modeling database, 2002. STCC = Condition according to St. Charles County master plan, 1996.
W = Condition according to City of Wentzville comprehensive plan (comp) or city roadway inventory database (rdydb).
* = Adjacent properties have little space to widen street ROW. Additional ROW would be acquired slowly only when redevelopments occur.
** = Depending on functional class, V/C check assumes ADT maximum range of 4,000 to 9,000 vehicles per day per lane (i.e. collectors and arterials assumed to carry maximum range of 400 to 900 vehicles per lane per hour, and peak hour volume is 10% of ADT).

Appendix Table A-1 Roadway Inventory Data (continued)

Roadway	Classification						Number of Lanes		Right-of-way (ROW) Width		Average Daily Traffic (ADT)				Basic Evaluations		
	Freeway	Major Arterial	Minor Arterial	Major Collector	Minor Collector	Local Street	Current	Planned	Current	Planned	Current 1999-2002	Forecasted 2004	Forecasted 2010	Forecasted 2025	Functional Class Check	Right-of-way Width Check	Current ADT Volume to Capacity Check**
Roadways below are from Wentzville roadway inventory database as arterial or collector but not in EWGCC model or City Comprehensive Plan.																	
Great Oaks Meadow Drive					W	(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Grizzly Hollow			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Highland Estates Boulevard					W	(R)	2	same	80'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Linn Street			W		(R)		2	same	50'	same	1,100	not modeled	not modeled	not modeled	lower to mnr col	**Need 60' ***	OK
Markoe Avenue			W			(R)	2	same	40'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
May Road				(R)	W		2	same	40'	same	no data	not modeled	not modeled	not modeled	raise to mjr col	**Need 70' ***	no data
W. Northview Avenue					W (R)		2	same	50'	same	800	not modeled	not modeled	not modeled	no change	**Need 60' ***	OK
Pearce Blvd (Bus. Hwy 61 to Edinger)					W (R)		2	same	50'	same	no data	not modeled	not modeled	not modeled	no change	**Need 60' ***	no data
Perry Cate Boulevard				W (R)			2	same	80'	same	900	not modeled	not modeled	not modeled	Lower to mjr col	OK	OK
Pic Parkway			W			(R)	4	same	80'	same	no data	not modeled	not modeled	not modeled	lower to mnr col	OK	no data
Picket Fence Drive					W	(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Pilgrim Avenue			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
N. Point Prairie Road (N. Service Rd to W. Meyer)				(R)	W		2	same	50'	same	no data	not modeled	not modeled	not modeled	raise to mjr col	**Need 70' ***	no data
S. Point Prairie Road (County maint. to south of bridge)				(R)	W		2	same	50'	same	600	not modeled	not modeled	not modeled	raise to mjr col	**Need 70' ***	OK
Sachs Business Parkway			W		(R)		2	same	60'	same	no data	not modeled	not modeled	not modeled	lower to mnr col	OK	no data
Verizon					W	(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	no change	OK	no data
Wall Street					W (R)		2	same	50'	same	no data	not modeled	not modeled	not modeled	no change	**Need 60' ***	no data
Whisper Creek Drive					W	(R)	2	same	60'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Woodhollow Drive (Meyer to taper)			W			(R)	2	same	60'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Woodhollow Drive (taper to Blumhoff)			W			(R)	2	same	50'	same	no data	not modeled	not modeled	not modeled	lower to local	OK	no data
Roadways below are from Wentzville traffic count database but not in EWGCC model, City Comprehensive Plan or in city roadway inventory database as arterial or collector.																	
Bear Creek Drive					W (R)		2	same	no data	no data	250-2,100	not modeled	not modeled	not modeled	no change	no data	OK
4th Street						W (R)	2	same	no data	no data	400-700	not modeled	not modeled	not modeled	no change	no data	OK
Prospect Road					W (R)		2	same	no data	no data	2,900	not modeled	not modeled	not modeled	no change	no data	OK
Allen Street						W (R)	2	same	no data	no data	1,100-1,900	not modeled	not modeled	not modeled	no change	no data	OK
W. Pitman Avenue E. Pitman Avenue					(R)	W	2	same	no data	no data	600 4,100	not modeled	not modeled	not modeled	raise to mnr col	no data	OK
pool entrance						W (R)	2	same	no data	no data	100	not modeled	not modeled	not modeled	no change	no data	OK
Marshall Drive						W (R)	2	same	no data	no data	200	not modeled	not modeled	not modeled	no change	no data	OK
Bank Street						W (R)	2	same	no data	no data	1,100	not modeled	not modeled	not modeled	no change	no data	OK

Source: EWGCC, City of Wentzville Comprehensive Plan (comp) and roadway inventory database (rdydb), 2002.
X = Existing condition. F = Future planned condition if different from existing condition. (R) = Recommended condition based on Transportation Master Plan, 2003.
EW = Condition according to East-West Gateway Coordinating Council regional modeling database, 2002. STCC = Condition according to St. Charles County master plan, 1996.
W = Condition according to City of Wentzville comprehensive plan (comp) or city roadway inventory database (rdydb).
* = Adjacent properties have little space to widen street ROW. Additional ROW would be acquired slowly only when redevelopments occur.
** = Depending on functional class, V/C check assumes ADT maximum range of 4,000 to 9,000 vehicles per day per lane (i.e. collectors and arterials assumed to carry maximum range of 400 to 900 vehicles per lane per hour, and peak hour volume is 10% of ADT).

TRANSPORTATION MASTER PLAN

Appendix
Figures A-3 to A-6
Traffic Counting Program Sample Formats

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

Traffic Counting Program
Field Notes

Start date: **Start time:** **Crew name:**

End date: **End time:** **Count interval:**

Location:

Site code:

Traffic count type (circle): intersection roadway segment

large vehicle/truck bicycle/pedestrian

other:

Weather: temperature:

ambient conditions:

conditions of pavement:

Intersection/roadway segment sketch: (show number of lanes, lane assignments, traffic control, signals, signage, striping, crosswalks, medians, approximate lane widths, approximate bay lengths, etc.)

Other notes/special circumstances:

Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000		North/south:	"North/south street name"	
Start date:	1/1/2003	Wed	Start time:	7:00 AM	East/west: "East/west street name"
End date:	1/2/2003	Thu	End time:	7:00 AM	Interval in minutes: 15

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
7:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80

Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000			North/south:	"North/south street name"	
Start date:	1/1/2003	Wed	Start time:	7:00 AM	East/west:	"East/west street name"
End date:	1/2/2003	Thu	End time:	7:00 AM	Interval in minutes:	15

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
4:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80

Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000			North/south:	"North/south street name"	
Start date:	1/1/2003	Wed	Start time:	7:00 AM	East/west:	"East/west street name"
End date:	1/2/2003	Thu	End time:	7:00 AM	Interval in minutes:	15

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
1:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
TOTALS	960	1920	960	960	1920	960	960	1920	960	960	1920	960	15360
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

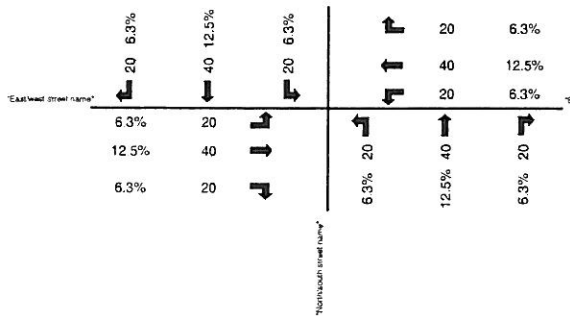
AM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	20	40	20	20	40	20	20	40	20	20	40	20	320
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

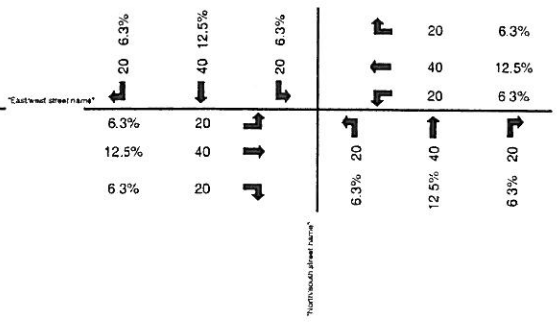
PM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	20	40	20	20	40	20	20	40	20	20	40	20	320
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

AM Peak Hour Movement



PM Peak Hour Movement



Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000			North/south:	"North/south street name"
Start date:	1/1/2003	Wed	Start time: 7:00 AM	East/west:	"East/west street name"
End date:	1/2/2003	Thu	End time: 7:00 AM	Interval in minutes:	60

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
7:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
11:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
12:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
1:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
2:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
TOTALS	240	480	240	240	480	240	240	480	240	240	480	240	3840
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code	0000000000			North/south:	"North/south street name"
Start date:	1/1/2003	Wed	Start time:	7:00 AM	East/west: "East/west street name"
End date:	1/2/2003	Thu	End time:	7:00 AM	Interval in minutes: 60

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS

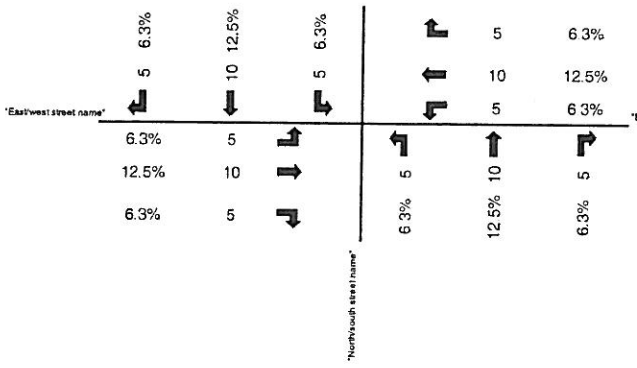
AM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	5	10	5	5	10	5	5	10	5	5	10	5	80
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

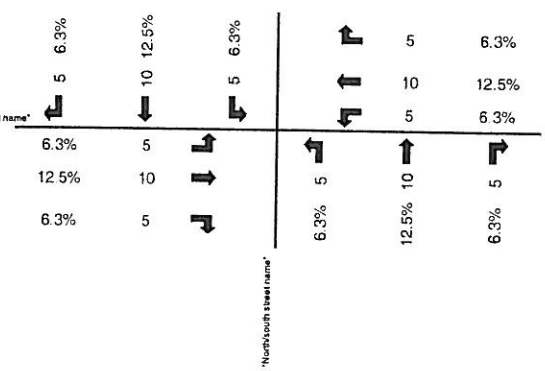
PM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	5	10	5	5	10	5	5	10	5	5	10	5	80
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

AM Peak Hour Movement



PM Peak Hour Movement



Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000			North/south:	"North/south street name"
Start date:	1/1/2003	Wed	Start time:	5:00 AM	East/west: "East/west street name"
End date:	1/1/2003	Wed	End time:	7:00 PM	Interval in minutes: 15

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
5:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:15 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:30 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
9:45 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
10:00 AM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
3:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
4:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
5:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
6:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:15 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:30 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
7:45 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
8:00 PM	5	10	5	5	10	5	5	10	5	5	10	5	80
TOTALS	210	420	210	210	420	210	210	420	210	210	420	210	3360
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

Intersection count for
"North/south street name" and "East/west street name"

NOTE: This sheet is to be used as a sample format for data collection.
Analyst must update values and formulas with blue shading per each data collection.

Site code:	0000000000			North/south:	"North/south street name"
Start date:	1/1/2003	Wed	Start time:	5:00 AM	East/west: "East/west street name"
End date:	1/1/2003	Wed	End time:	7:00 PM	Interval in minutes: 15

Period ending	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS

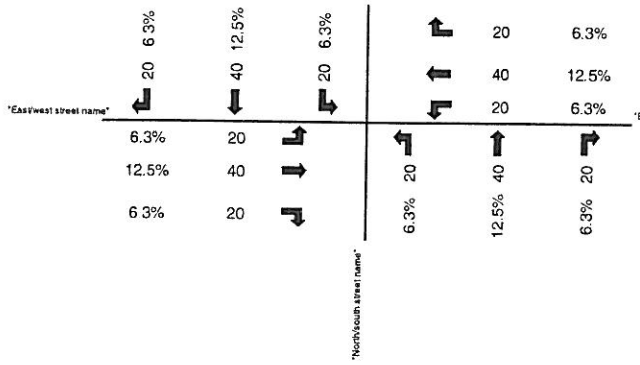
AM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	20	40	20	20	40	20	20	40	20	20	40	20	320
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

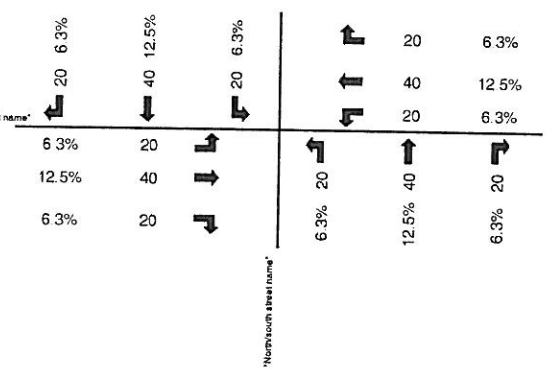
PM Peak Hour Movement

	"North/south street name" FROM NORTH			"East/west street name" FROM EAST			"North/south street name" FROM SOUTH			"East/west street name" FROM WEST			
	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TO LEFT	THRU	TO RIGHT	TOTALS
	20	40	20	20	40	20	20	40	20	20	40	20	320
APPRCH %	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	25.0%	50.0%	25.0%	
TOTAL %	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	6.3%	12.5%	6.3%	

AM Peak Hour Movement



PM Peak Hour Movement



TRANSPORTATION MASTER PLAN

Appendix
Figures A-7 to A-9

Warrants 1, 2 and 3 from the
Manual on Uniform Traffic Control Devices
(December 2000)

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

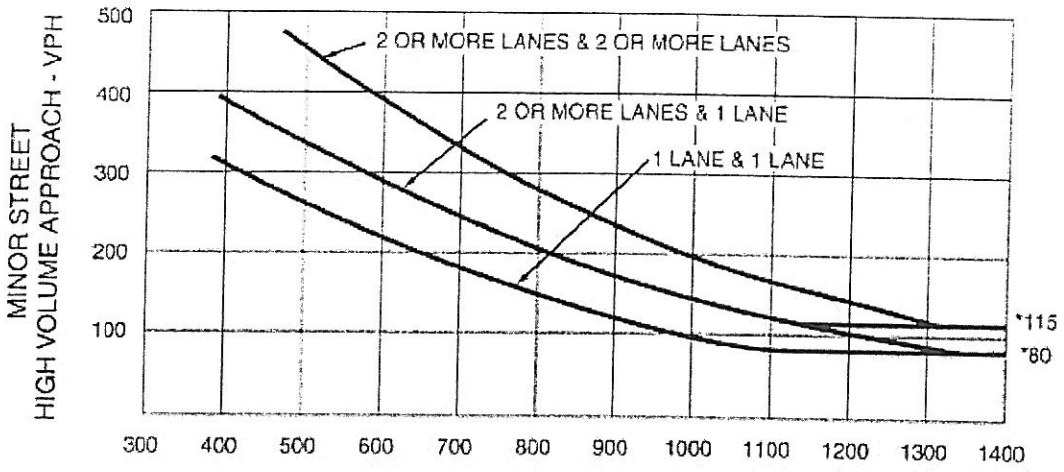
Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			-Vehicles per hour on higher-volume minor-street approach (one direction only)		
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	100%[a]	80%[b]	70%[c]
1.....	1.....	500	400	350	150	120	105
2 or more...	1.....	600	480	420	150	120	105
2 or more...	2 or more...	600	480	420	200	160	140
1.....	2 or more....	500	400	350	200	160	140

Condition B—Interruption of Continuous Traffic							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)		
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	100%[a]	80%[b]	70%[c]
1.....	1.....	750	600	525	75	60	53
2 or more...	1.....	900	720	630	75	60	53
2 or more...	2 or more...	900	720	630	100	80	70
1.....	2 or more....	750	600	525	100	80	70

[a] Basic minimum hourly volume.
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures.
[c] May be used when the major-street speed exceeds 70 km/h (40 mph) or in an isolated community with a population of less than 10,000.

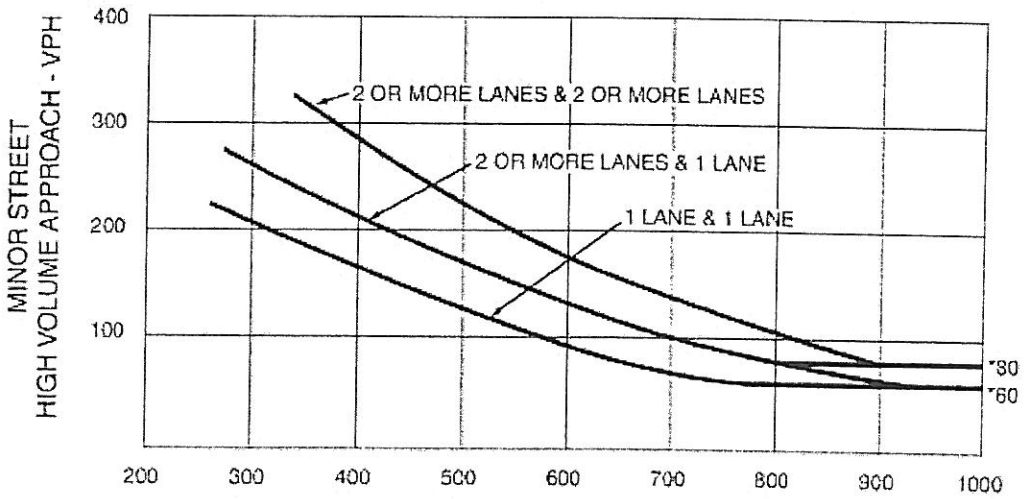
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

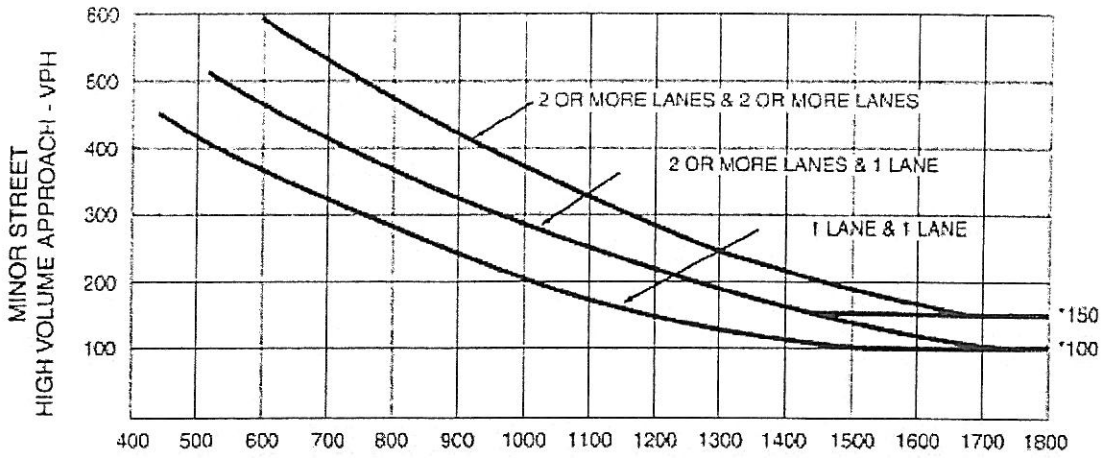
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

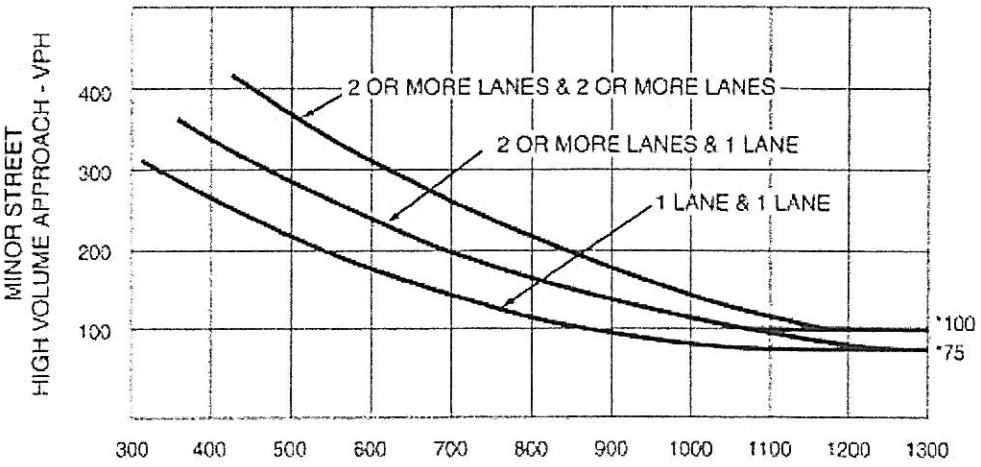
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

TRANSPORTATION MASTER PLAN

Appendix
Figure A-10

City of Wentzville Land Use Plan
(Table No.15) from City Comprehensive Plan

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville, Missouri

LEGEND

- New Interchange
- Existing Roads
- Proposed Roads
- Railroad
- Creeks
- Planning Area
- Flood Plain

FUTURE LAND USE

- COMMERCIAL
- OFFICE
- HIGH TECH DISTRICT
- INDUSTRIAL
- INSTITUTIONAL
- HIGH DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- LOW DENSITY RESIDENTIAL
- TRANSITIONAL
- PARK/OPEN SPACE/ RECREATIONAL/TRAILS
- PARCELS

Wentzville
Missouri - USA
The Crossroads Of The Nation

CITY OF WENTZVILLE COMPREHENSIVE PLAN LAND USE PLAN

10-2001
PLAN NO. 15

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