

# Transportation Framework

## INTRODUCTION

Effective transportation systems are central to maintenance of the health, productivity, and safety of communities. The adequacy of a community's major street system has a tremendous impact on mobility, accessibility, safety, quality-of-life needs, and the pattern and rate of future growth.

The "New Direction" for Arnold places an emphasis on coordinating transportation facilities' design with the land uses they serve, so as to improve mobility choices. Like many cities across this country, Arnold's transportation system has historically been oriented to support auto-oriented land uses. While cars will continue to play a big role in how Arnolds' citizens move about the community, the community input process found significant support for expanding the range of transportation choices and making better connections.

### Framework Structure

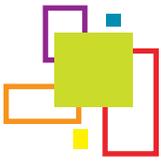
This Transportation Framework chapter identifies how Arnold will provide mobility choices to a broader group of users, aids in building a sustainable community, and makes recommendations on roadway character. Implementing mobility choices and enhancing roadway character involves the introduction of some familiar transportation and design components as well as some new components.

This Framework has been developed through an understanding of the planning context, existing conditions, and community input. It is based upon the *Arnold 2001 Transportation Master Plan*. This chapter includes the following:

- Existing Conditions Assessment
- Future Transportation System Recommendations



Example of traffic congestion.



## Arnold Transportation Master Plan

The City's *Transportation Master Plan* was updated in 2001. The intent of this plan was to address the Transportation Equity Act for the 21st Century (TEA-21) requirements to develop a plan that met the needs of Arnold.

The goals for this plan are to:

- Plan and develop a coordinated and comprehensive intermodal transportation system to provide for safe and efficient movement of people and goods within and through the community.
- Provide coordination with applicable land use and development plans in order to insure that the transportation system contributes to orderly development of the community.
- Identify policies to make more efficient use of the existing transportation system to accommodate existing and future travel demands.
- Integrate all forms of transportation, where possible, focusing in particular on alternative forms of transportation to the auto in order to reduce congestion and environmental impact, save energy and provide a reasonable alternative to driving.



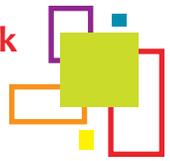
Bicycle accommodations should be included in roadway improvements.

Specific objectives of this plan include:

- Improve existing City streets to acceptable levels of service and safety.
- Provide interconnection of local streets with collector and arterial streets.
- Encourage subdivisions to upgrade their streets to a level acceptable for City maintenance.
- Provide for the interconnection of streets dead-ending within a few feet of each other.
- Discourage the development of streets and conditions which hinder local and City-wide circulation.
- Encourage a network of pedestrian and bicycle pathways throughout the City.



Parkway with Trail



# EXISTING CONDITIONS ASSESSMENT

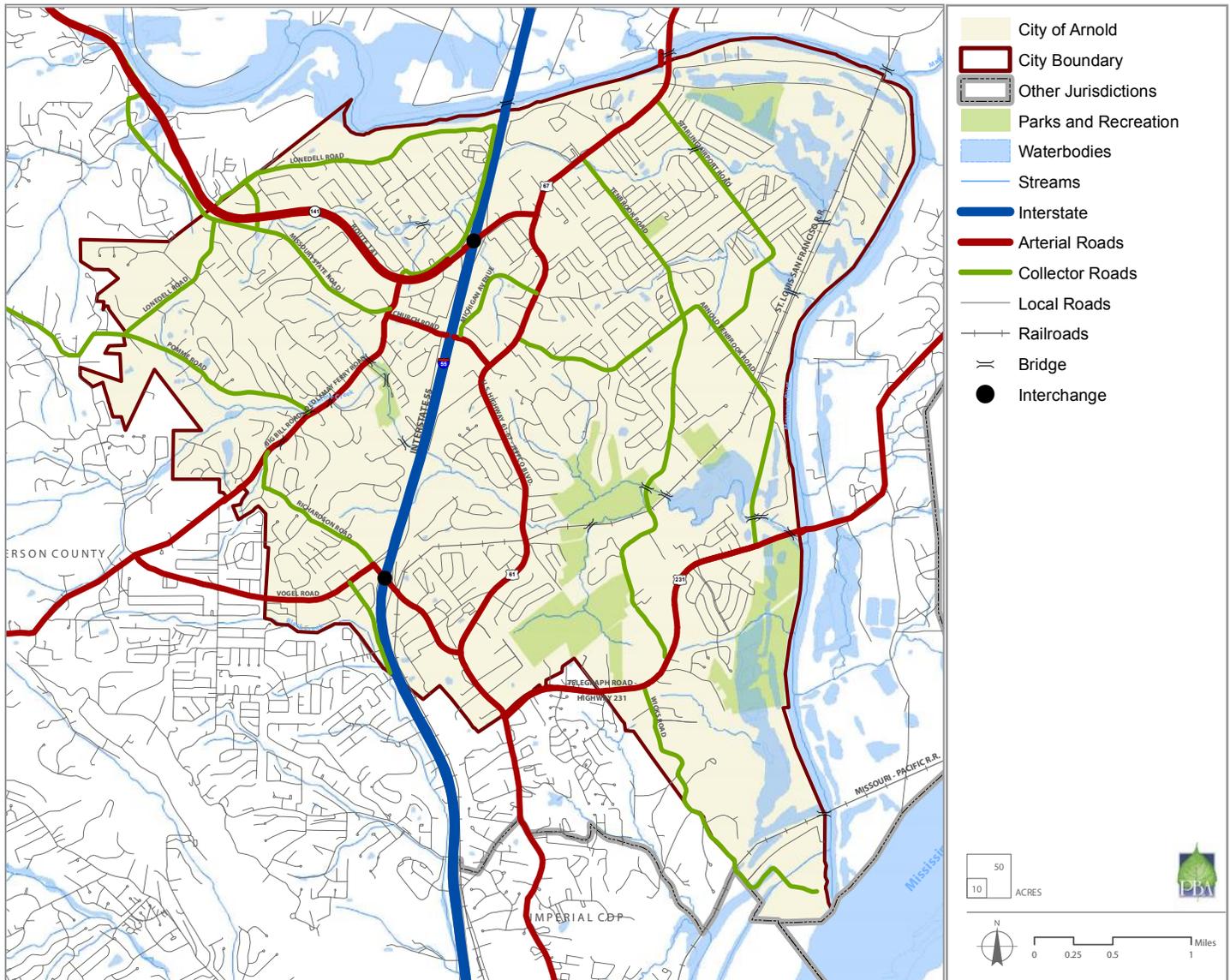
## Roadway System

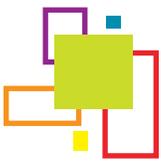
There are about 76.5 miles of roadways currently maintained by the City of Arnold. In addition, there are about 11.5 miles of highways within the City under the jurisdiction of the Missouri Department of Transportation (MoDOT). These MoDOT routes include I-55, M-141, US-61/67 (Jeffco Boulevard), and M-231 (Telegraph Road).

The Existing Roadway System Map depicts the functional classifications and locations of the thoroughfares within the Arnold study area.

## Existing Roadway System Map (2011)

Figure: 26 Existing Roadway System Map



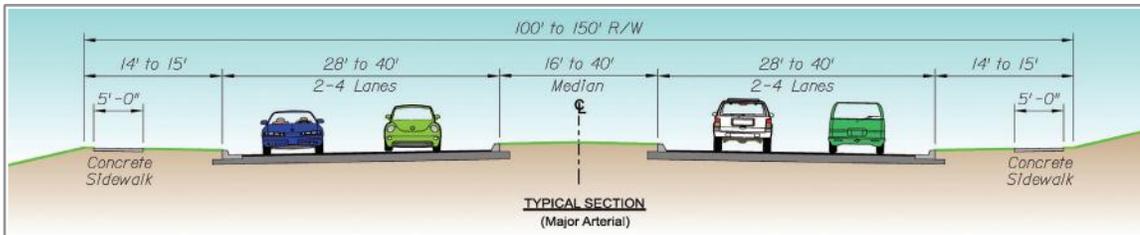


## Functional Classification

The roadway system consists of four basic classifications of thoroughfares. The classifications are defined by the function that each road performs.

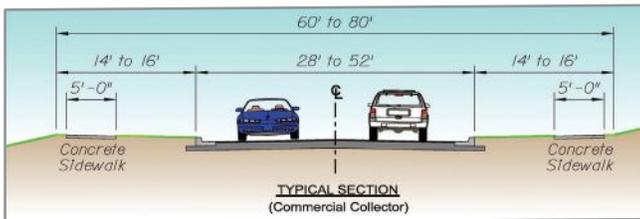
- **Interstate Freeways** - The highest functional classification is the interstate freeways, whose primary role is to provide high speed movement of vehicles throughout the country. I-55 performs this function, as well as providing commuter service for residents of Arnold who work throughout the St. Louis metro area.
- **Arterial Routes** - The next highest functional classification of roadways is the arterial routes. The primary role of arterial routes is to serve vehicle trips that are longer than one mile in length. The arterial routes in Arnold include limited access expressways, such as M-141, and urban roads which provide access to abutting land uses. The urban arterial routes include 2-lane roadways such as M-231 / Telegraph Road and Old Lemay Ferry Road; 4-lane roadways such as most of US-61/67 / Jeffco Boulevard; 5-lane roadways such as Church Road, Vogel Road, and

Richardson Road; and some median-divided roadways such as Jeffco Boulevard and Vogel Road north and south of Richardson Road.



Arterial Street.

- **Collector Streets** - Collector streets are the next tier in the functional classification system. These streets collect traffic from the local residential and commercial streets and carry it to the arterial routes. Collector streets are often designed to accommodate parking and bike lanes and some direct access to homes. Most vehicular trips on collectors should be less than one mile in length. If collector streets are designed as long continuous routes, then they often are used by motorists as high-speed arterial routes.



Collector Street.

- **Local Streets** - The final, most common functional street classification is the local street. This type of roadway is intended primarily to provide direct access to residential and commercial driveways. They are intended for low speed travel due to the predominance of driveway movements, parking maneuvers, and activity of pedestrians of all ages.

Although the functional classification of streets is defined by vehicular travel, pedestrian and bicycle travel must be also be accommodated by each of the functional classifications except interstate freeways. Sidewalks and trails and on-street lanes, as well as roadway features such as raised medians should be provided to keep our roadways from becoming barriers which restrict or even discourage pedestrian and bicycle travel between land uses and intermodal transit facilities.



### Roadway System: Traffic Volumes

As part of this study, traffic volume data was compiled from several existing sources. These include the 2001 Arnold Comprehensive Plan, the 2008 Jefferson County Transportation Plan, and Annual MoDOT traffic count maps from 2000 through 2009. As part of the existing conditions analysis, available data for historical traffic volumes and Year 2020 and 2030 traffic projections was assimilated including traffic volumes and projections for the major thoroughfares in the City of Arnold. The traffic volumes range from over 100,000 vehicles per day (VPD) on I-55 to about 2000 VPD on some City collector streets. Most local streets would be expected to be serving in the range of 200 to 1000 VPD. See Foundation of Fact Report, Transportation Conditions, for more information.

### Roadway System: Levels of Service

Operating conditions on the City’s thoroughfares are described by the Levels of Service (LOS) which can be assigned to each route segment. These LOS are determined according to methods prescribed in the Highway Capacity Manual (HCM) prepared by the Transportation Research Board of the National Research Council. The LOS of road segments are generally related to the speeds of travel and the expectations of motorists as related to the functional classification of the roadway.

There are six LOS ratings named by the letters A through F. LOS A represents the best operating condition where motorists are free to adjust speeds and maneuver as necessary. LOS E is the maximum capacity of a roadway and LOS F represents the condition where traffic flow is severely congested and vehicle are often not moving, but stacked up in long queues.

In general, the capacity of an urban street can be related to the number of lanes that the roadway provides. A 2-lane street can be expected to carry up to about 12,000 VPD or about 1200 vehicles per hour (vph). A 4-lane street should be able to serve about 12,000 to 24,000 VPD. A 6-lane street should be expected to serve about 24,000 to 36,000 VPD. These general capacities are significantly affected by the number of left and right turning movements which are made to and from the particular street segment and whether there are separate left turn and right turn lanes provided for these movements.

According to the 2008 Jefferson County Transportation Plan and a review of the current traffic volumes, it appears that most of the major thoroughfares in the City are operating at LOS C or D. A few streets such as Old Lemay Ferry Road and Tenbrook Road appear to be at or near their practical capacity (LOS E).

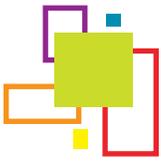
It should be noted that there are about 25 traffic signalized intersections in the City which also affect the LOS at these critical points and even affect the overall travel speeds and LOS of some routes such as Jeffco Boulevard (US-61/67). Only eight of these traffic signals appear to be under the jurisdiction of the City of Arnold, with the remaining 17 on Missouri State Highways. It was observed that during peak hours many of these traffic signals appear to be operating at LOS E or F, at least for some critical movements through these intersections.



Depending on the intensity, roadways through commercial or industrial development may operate at 4 or more lanes. The arterial shown above has dedicated crosswalks for multi modal users, landscaped medians and lighting.

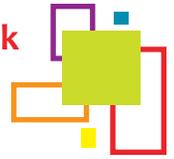


Roadways through medium density residential can operate as 2 or 3 lanes, with the third lane possibly being a left turn lane into the development.



## Six Levels of Service

- **LEVEL-OF-SERVICE A**  
Represents free flow. Users are typically unaffected by the presence of others in the traffic stream. Freedom to select speeds and maneuver is extremely high and the comfort and convenience provided to motorists, passengers, bicyclists, or pedestrians is excellent.
- **LEVEL-OF-SERVICE B**  
is in the range of stable traffic flow. The presence of other traffic begins to be noticeable. The freedom to maneuver and the level of comfort and convenience are somewhat less.
- **LEVEL-OF-SERVICE C**  
is in the range of stable flow, but it marks the beginning of the range of flow in which traffic operations are significantly affected by the presence of others. The general level of comfort and convenience declines noticeably.
- **LEVEL-OF-SERVICE D**  
Represents high density but stable flow. Speed and freedom to maneuver are severely restricted and the user experiences a poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems.
- **LEVEL-OF-SERVICE E**  
Represents operation conditions at or near capacity level. All speeds are reduced to a low but relatively uniform value. Freedom to maneuver is extremely difficult and must rely on the courtesy of others users. Comfort and convenience are poor and operations at this level are usually unstable because small increases in flow or minor incidents will cause breakdowns in the traffic flow.
- **LEVEL-OF-SERVICE F**  
is used to define forced or breakdown flow. This condition exists where the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the flow of traffic are characterized by stop-and-go movements.



## 2001 Arnold Comprehensive Transportation Plan

The last City comprehensive plan included a comprehensive analysis of the City’s thoroughfare system. The *2001 Arnold Comprehensive Transportation Plan* included the identification and prioritization of many thoroughfare improvements, as well as pavement condition evaluations and ratings. A review of the recommended thoroughfare system improvements indicates that many have been completed and some yet remain to be implemented.

### Recommended improvements and their implementation status:

- |   |                  |
|---|------------------|
| • <b>I-55 &amp; M-141 interchange improvements</b>  | <b>Completed</b> |
| • <b>Church Road widening</b>   | <b>Completed</b> |
| • <b>Jeffco Blvd. &amp; Michigan Ave. Improvements</b>  | <b>Completed</b> |
| • <b>Jeffco Blvd. &amp; Richardson Road improvements</b>  | <b>Completed</b> |
| • <b>Ridge Road improvements</b>  | <b>Not Done</b>  |
| • <b>Lemay Ferry Road widening</b>  | <b>Partial</b>   |
| (Intersection at Lemay Ferry Road, Church Road, and Missouri State Road improved, but widening on Lemay Ferry Road west from Church to Vogel Road is not done.) |                  |
| • <b>Jeffco Blvd. &amp; Church Road improvements</b>  | <b>Completed</b> |
| • <b>Lemay Ferry Road and Church Road improvements</b>  | <b>Completed</b> |
| • <b>Michigan Ave. / Ridgecrest Road extension</b>  | <b>Not Done</b>  |
| • <b>Richardson Road &amp; Richardson Square</b>  | <b>Completed</b> |
| • <b>St. John’s Church Road improvements</b>  |                  |
| • <b>Realignment of Arnold Tenbrook Road</b>  | <b>Completed</b> |
| • <b>Tenbrook Road &amp; Telegraph Road improvements</b>  | <b>Completed</b> |
| • <b>Signalization of Michigan Ave. &amp; Church Road</b>   | <b>Not Done</b>  |
| • <b>Other Projects</b>   |                  |
| – Jeffco Blvd... Corridor Improvement Study   | Not Done         |
| – I-55 Sound Wall / Aesthetic Improvement Study   | Not Done         |
| – Raise Jeffco Blvd. out of 100-year Floodplain at bridge   | Completed        |
| – Upgrade Tenbrook Road to Collector Standards  | Not Done         |
| – Raise Tenbrook Road out of 50-year Floodplain   | Completed        |
| – Upgrade Missouri State Road to Collector Standards  | Not Done         |
| – Upgrade Starling Airport Road to Collector Standards  | Not Done         |
| – Upgrade Arnold Tenbrook Road to Collector Standards   | Not Done         |
| – Upgrade Pomme Road to Collector Standards   | Not Done         |
| – Upgrade Lonedell Road to Collector Standards  | Not Done         |
| – Upgrade Astra Way to Collector Standards  | Not Done         |
| – Upgrade Wicks Road to Collector Standards   | Not Done         |



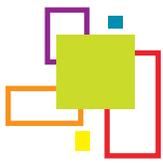
I - 55 looking south.



Arnold Tenbrook Road.



Jeffco Blvd.



### Roadway System: Safety History

The traffic crash record data for the City of Arnold was obtained from the State records through MoDOT. These records were obtained for the years 2005 through September, 2010. See “Number of Crashes by Severity” and “Number of Reported Crashes”. This traffic crash data is summarized below by year and route as well as by crash severity.

The records indicate that about 30% of the crashes were recorded along I-55. Just over 25% of the crashes were reported along Jeffco Boulevard (US-61/67), which only carries about 20% as much traffic as I-55. M-141 accounts for about 17.5% of the crashes and Richardson Road recorded about 13% of the 2005 – 2010 crashes.

### Number of Reported Crashes

Figure: 27 Number of Reported Crashes

Number of Reported Crashes							
Route	Total	2005	2006	2007	2008	2009	2010*
M-141	615	102	137	120	105	106	45
M-231	47	10	8	4	6	16	3
I-55	1021	207	203	159	196	177	79
US-61/67	911	185	163	169	173	146	75
Arnold Tenbrook	17	2	2	5	2	2	4
Astra Way	26	2	1	6	8	8	1
Bill Bill Blvd	24	4	7	4	3	3	3
Church Rd	21	3	2	5	2	5	4
Lonedell Rd	25	2	7	6	4	4	2
Michigan Ave	60	8	8	13	16	11	4
Missouri State Rd	26	5	2	2	9	6	2
Old Lemay Ferry Rd	15	2	2	1	3	5	2
Richardson Rd	453	102	87	72	77	84	31
Starling Airport Rd	10	4	2	1	3	0	0
Tenbrook Rd	76	19	15	13	14	8	7
Vogel Rd	13	0	0	1	1	6	5
<b>All other routes</b>	<b>147</b>						
<b>Total</b>	<b>3507</b>						

\* 2010 crashes from January 1 through September 30, 2010

### Number of Crashes by Severity

Figure: 28 Number of Crashes by Severity

Number of Crashes by Severity		
Fatal	19	( 0.5% )
Disabling Injury	96	( 2.7% )
Minor Injury	719	( 20.5% )
Property Damage Only	2673	( 76.3% )
<b>Total</b>	<b>3507</b>	



Ample sight distance is important for the safety of drivers and pedestrians.



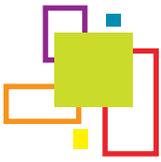
## Number of Reported Crashes Map (2011)

Figure: 29 Number of Reported Crashes Map



### Crash Data:

The records indicate that about 30% of the crashes were recorded along I-55. Just over 25% of the crashes were reported along Jeffco Boulevard (US-61/67), which only carries about 20% as much traffic as I-55. M-141 accounts for about 17.5% of the crashes and Richardson Road recorded about 13% of the 2005 – 2010 crashes.



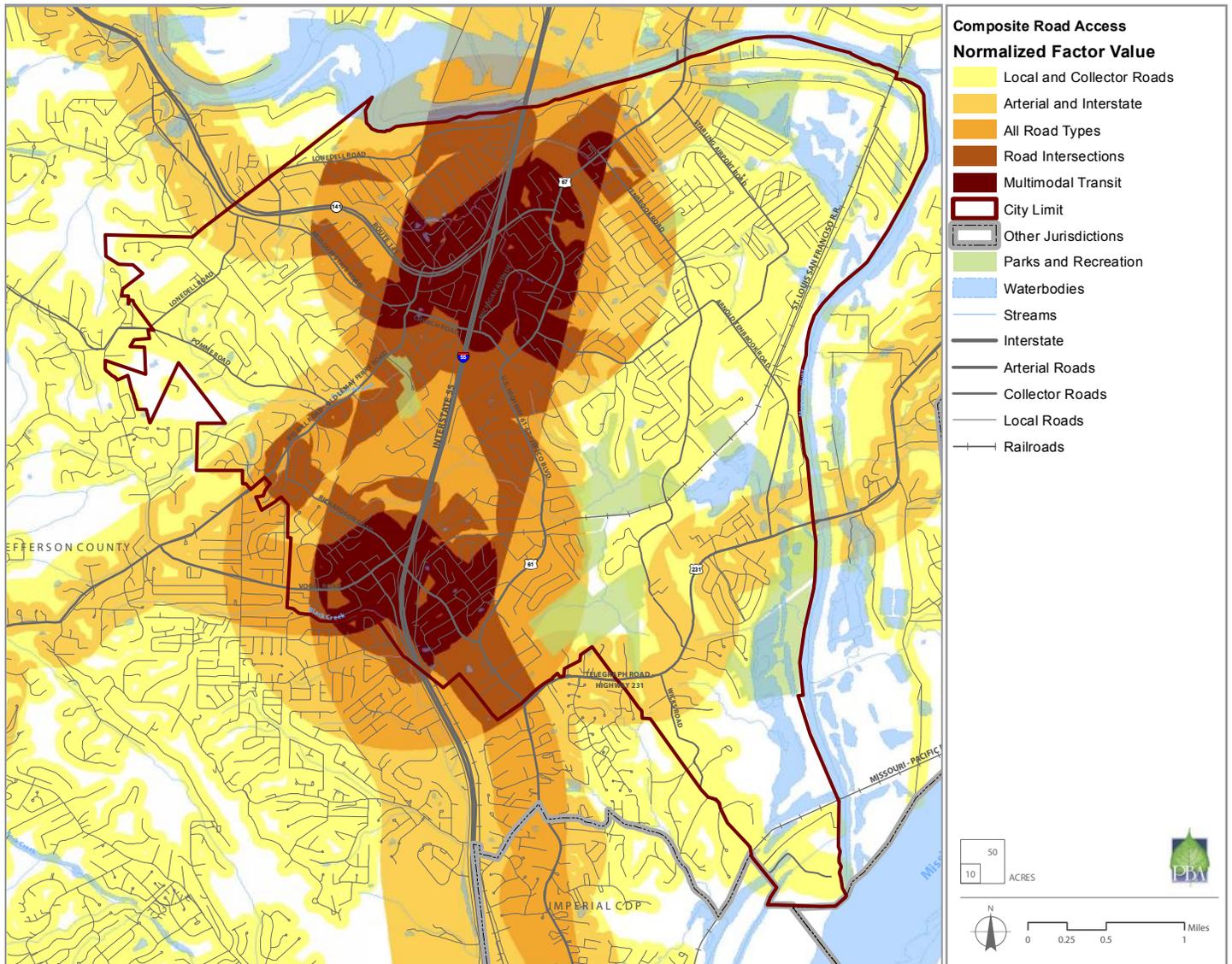
### Roadway System: Access Analysis

The Consultant Team utilized a Susceptibility to Change analysis to assess the urban growth potential of the City. Five factors of road access, projected growth areas, water and sewer infrastructure, location of parks and trails, and land cover were ranked based on attributes; all composite factor scores are then combined. The higher values represents ideal conditions for change and lower values represent conditions less likely to change.

Analysis values for road access were calibrated at seven levels from “No road” to “areas within 1/2 mile of an interchange”. Areas identified as highly susceptible to change, colored brown on the map, have excellent road access. The light yellow areas illustrate those areas not adjacent to any road greater than a local road.

### Roadway Access Analysis Map

Figure: 30 Roadway Access Analysis Map





**Transit**

A review of transit options in the City indicates that the “Jeffco Express” system is comprised of two interconnected routes. A “City of Arnold” route and “Cross County” route. The City of Arnold contributes significant funding toward the Arnold portion of the sytem.



Jeffco Express.

**Railroads**

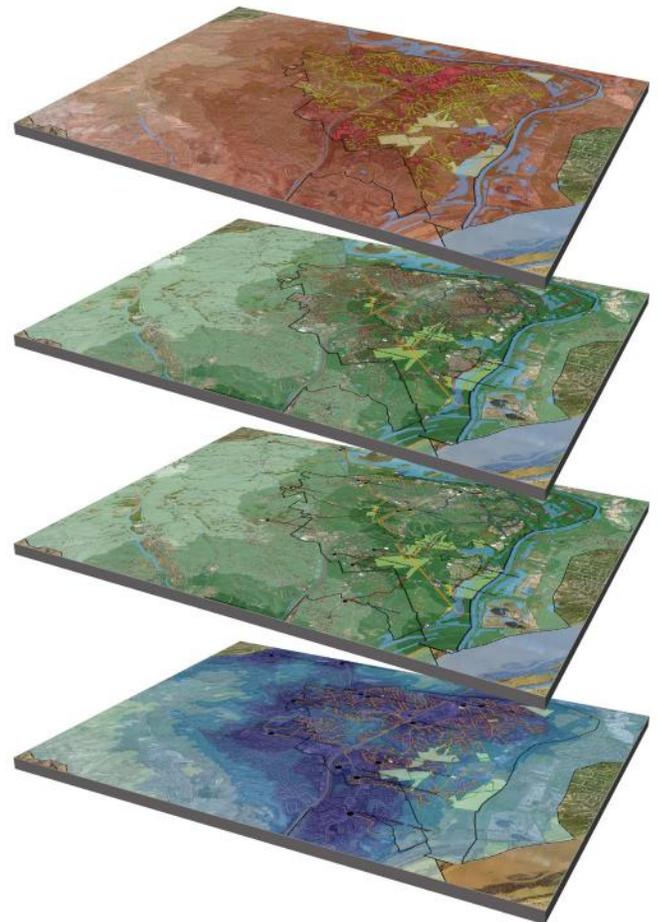
The City of Arnold is currently served by the St. Louis – San Francisco Railroad which enters the City along the east side of I-55 and then turns to cross to the east side of the City just after it crosses under Richardson Road. Most crossings of major thoroughfares are grade-separated. One notable exception is the at-grade crossing with Arnold Tenbrook Road in the industrial district of the City.

**Pedestrians & Bicycles**

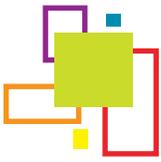
The primary mode of transportation in Arnold is by car. Arnold is served by a variety of interstate highways, state highways and City streets. Other transportation options become increasingly important throughout the planning process, such as the ability of residents to walk or bike throughout the community.

One of the chief problems identified in the *2001 Arnold Comprehensive Transportation Plan* is the general lack of sidewalks and trails for pedestrians and bicycles. Recommendations were made to add sidewalks on all new streets and on existing streets as they are improved to meet standards or to increase the capacity of the routes.

Research suggests that individuals are willing to walk up to one-quarter mile within urban environments. Living within one-eighth (1/8) mile of neighborhood retail establishments increases the likelihood of walking compared with living at least one-half (1/2) mile from retail. The community as a whole can be made walkable by incorporating street design that encourages walkability and makes it a pleasurable experience.



Walkability Analysis Levels.

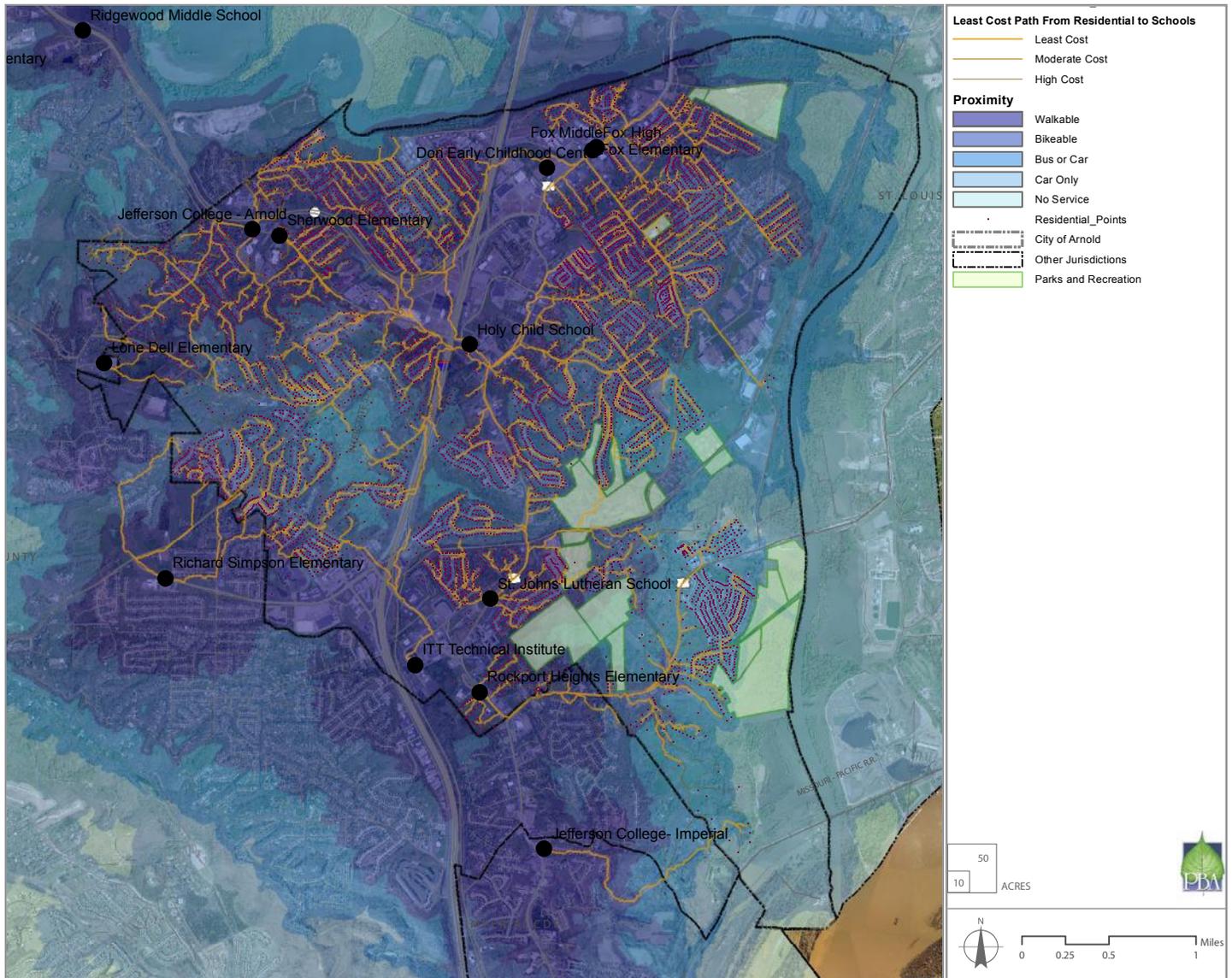


## Residents to Schools

The map graphic (below) indicates areas well served by schools in dark blue and the least cost path of travel from residential units to schools in orange. Areas in light blue are not well served by schools and dark line segments indicate a difficult travel path.

### Residents to Schools Cost Distance Map

Figure: 31 Residents to Schools Cost Distance Map



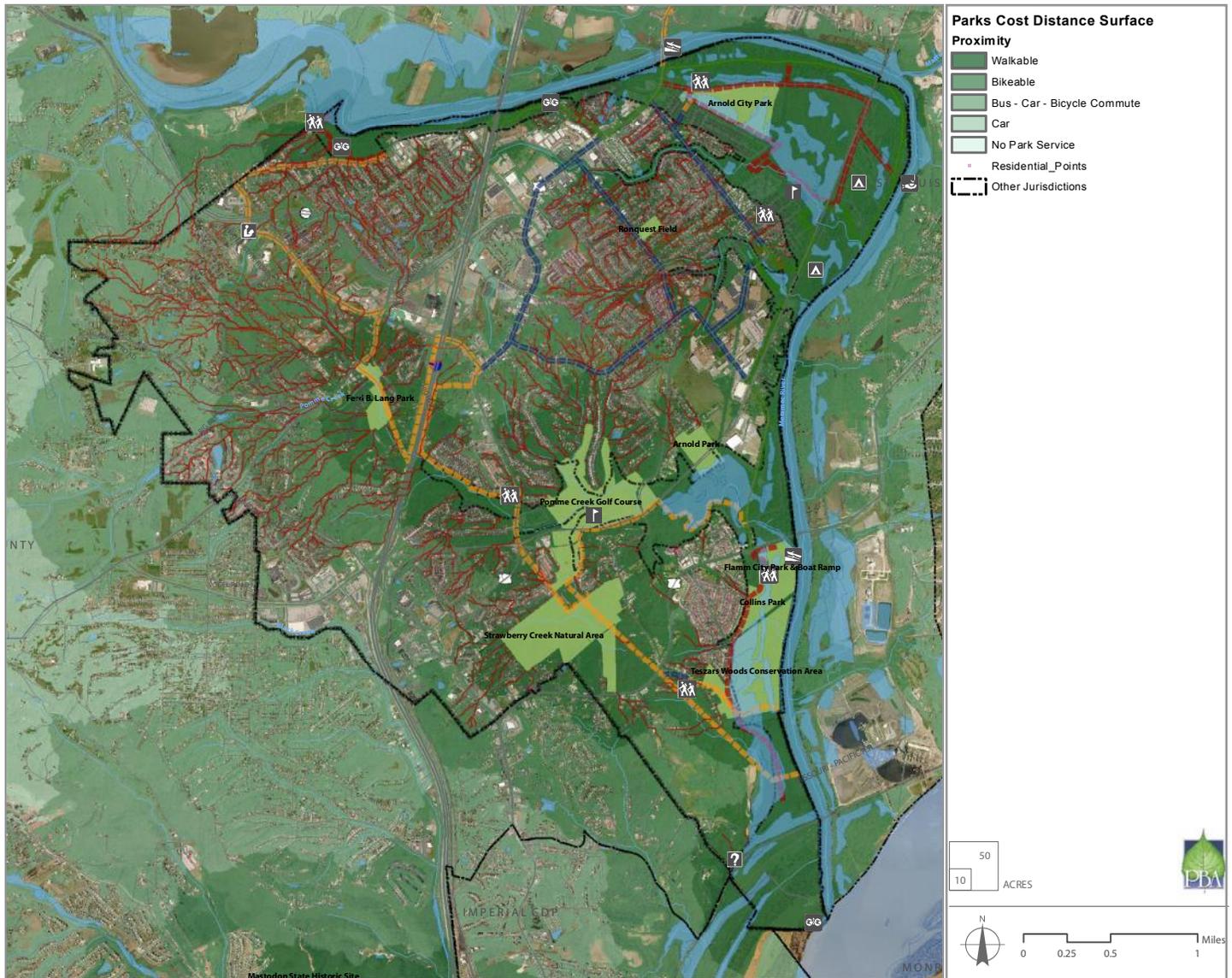


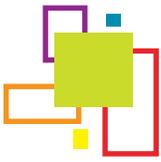
**Residents to Parks**

The map graphic (below) indicates areas well served by parks in dark green and the least cost path of travel from residents to parks as a red line. Areas in light green and brown lines indicate areas not well served by parks or residential units with a more difficult path of travel to a park.

**Residents to Parks Cost Distance Map**

Figure: 32 Residents to Parks Cost Distance Map



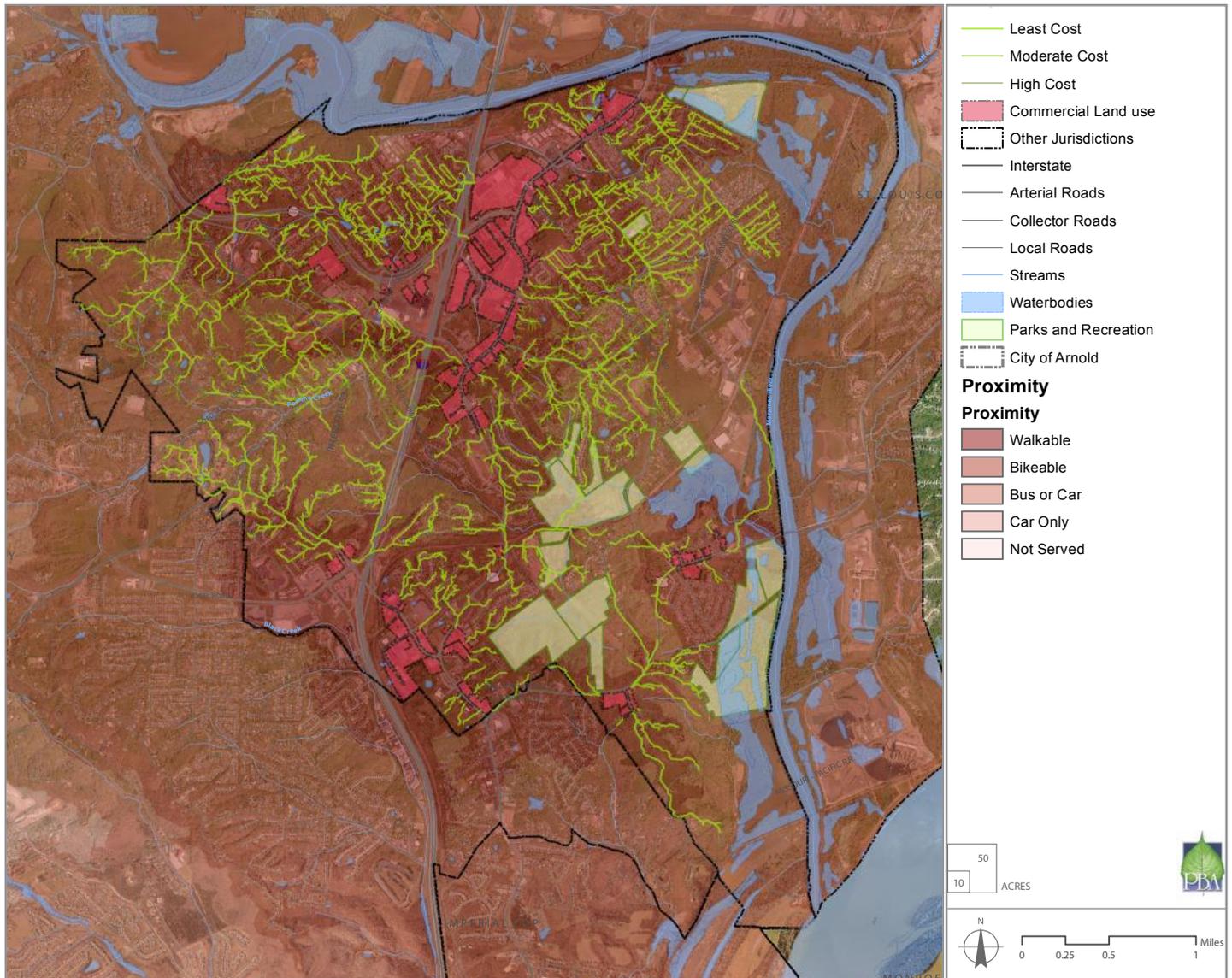


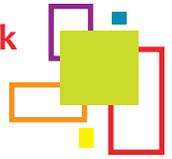
## Residents to Commercial

The map graphic (below) indicates areas well served by commercial in dark red and the least cost path of travel from residential units to commercial in green. Areas in light orange are poorly served by commercial.

### Residents to Commercial Cost Distance Map

Figure: 33 Residents to Commercial Cost Distance Map



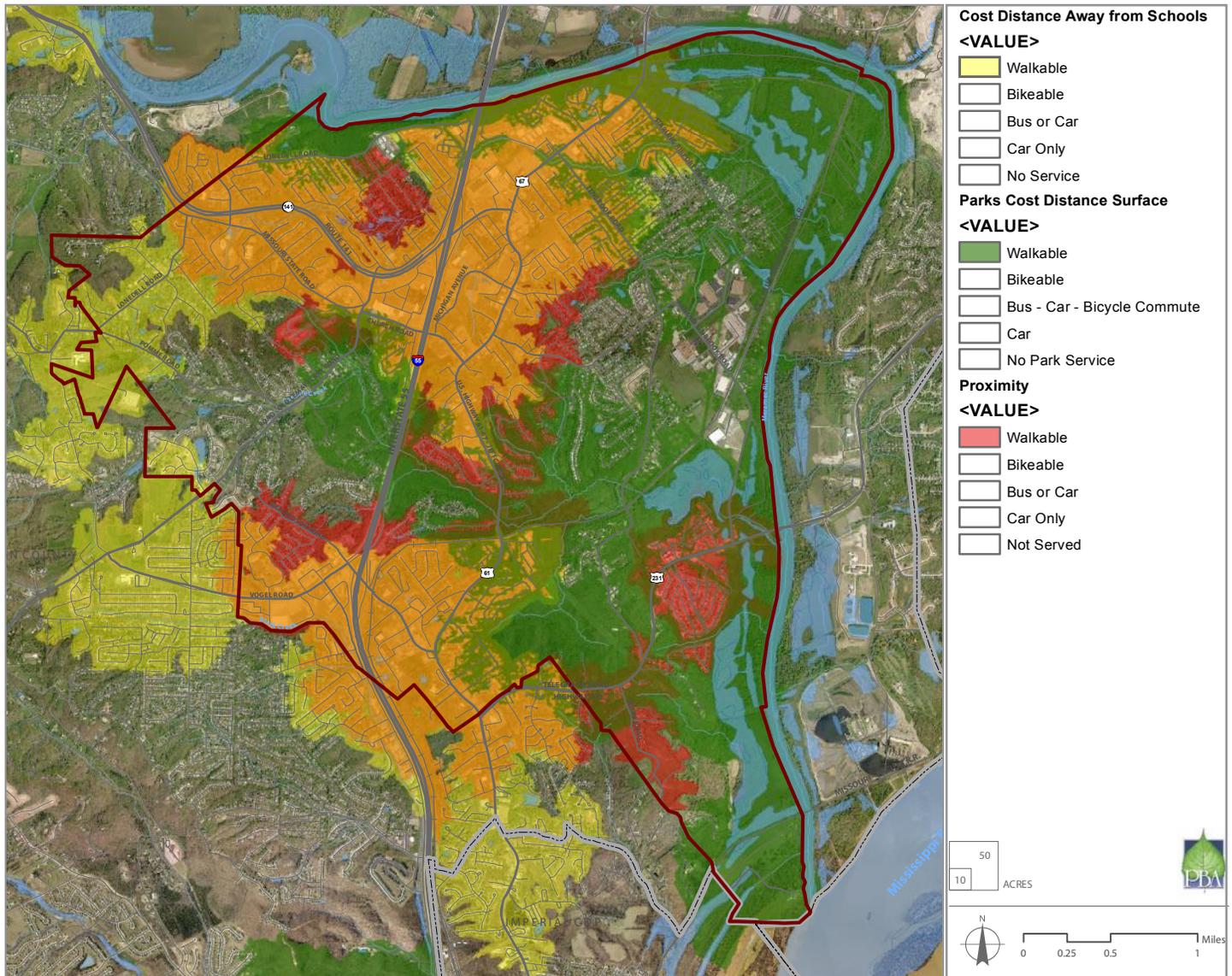


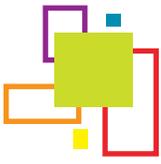
**Parks, Schools, Commercial Walkability**

The map graphic (below) indicates areas well served by parks in dark green, areas well served by commercial in dark red, and areas well served by schools in dark yellow. Orange areas are well served by both schools and commercial. Brown areas are well served by parks and commercial.

***Parks, Schools, Commercial Walkability Overlay Map***

Figure: 34 Parks, Schools, Commercial Walkability Overlay Map





# Future Transportation System

## Transportation

### Strategy:

The “New Direction” for Arnold places an emphasis on providing mobility choices to a broader group of users, aiding in building a sustainable community, getting more out of the existing street system, managing maintenance costs and enhancing transportation options.

## Introduction

The “New Direction” for Arnold places an emphasis on providing mobility choices to a broader group of users, aiding in building a sustainable community, getting more out of the existing street system, managing maintenance costs and enhancing transportation options. Fundamental to achieving this “New Direction” will be the reinvestment in Arnold’s existing network to increase connectivity, enhance pedestrian, biking, trails, future transit, and maintaining mobility for commerce. This strategy will be achieved through two primary components: Connecting Corridors and Recommended Network Enhancement Tools.

## Connecting Corridors

Connecting Corridors are important transportation corridors linking destinations and activities. They increase mobility choice, improve the aesthetics of surrounding development, and accommodate the flow of goods, services, and people.

- **Connecting Corridors:** May link open space, neighborhoods, centers, and destinations together within a community. Are most important to creating positive and negative perceptions of an area. They help set the “tone” of the area by establishing visual and aesthetic standards.

## Connecting Corridors Map

The Connecting Corridors Map, on the adjacent page, is developed from the *2001 Transportation Master Plan*, which designates streets by their functional classification. Several catalytic corridors are highlighted using Connecting Corridor typologies that the City can strategically target investments based upon the community input process. The priority catalytic corridors include:

- **Jeffco Blvd. - Thoroughfare and Main Street**
- **Vogel Road - Thoroughfare**
- **Richardson Road - Thoroughfare and Local Link**
- **Tenbrook Road - Local Link**
- **Old Lemay Ferry- Local Link**
- **Church Road - Local Link**
- **Missouri State Road - Local Link**
- **Londell Road - Local Link**

This approach deviates from conventional street designs that emphasize automobile mobility and speed to the exclusion of other users and adopts aspects of the Institute of Transportation Engineer’s Recommended Practice for Walkable Urban Thoroughfares. The transition to “Complete or Livable” streets will occur in strategic locations incrementally as roads are re-designed. As outlined in this chapter, these typologies are based on a “complete or livable streets” philosophy that supports not just cars, but also pedestrians,



# Recommendations

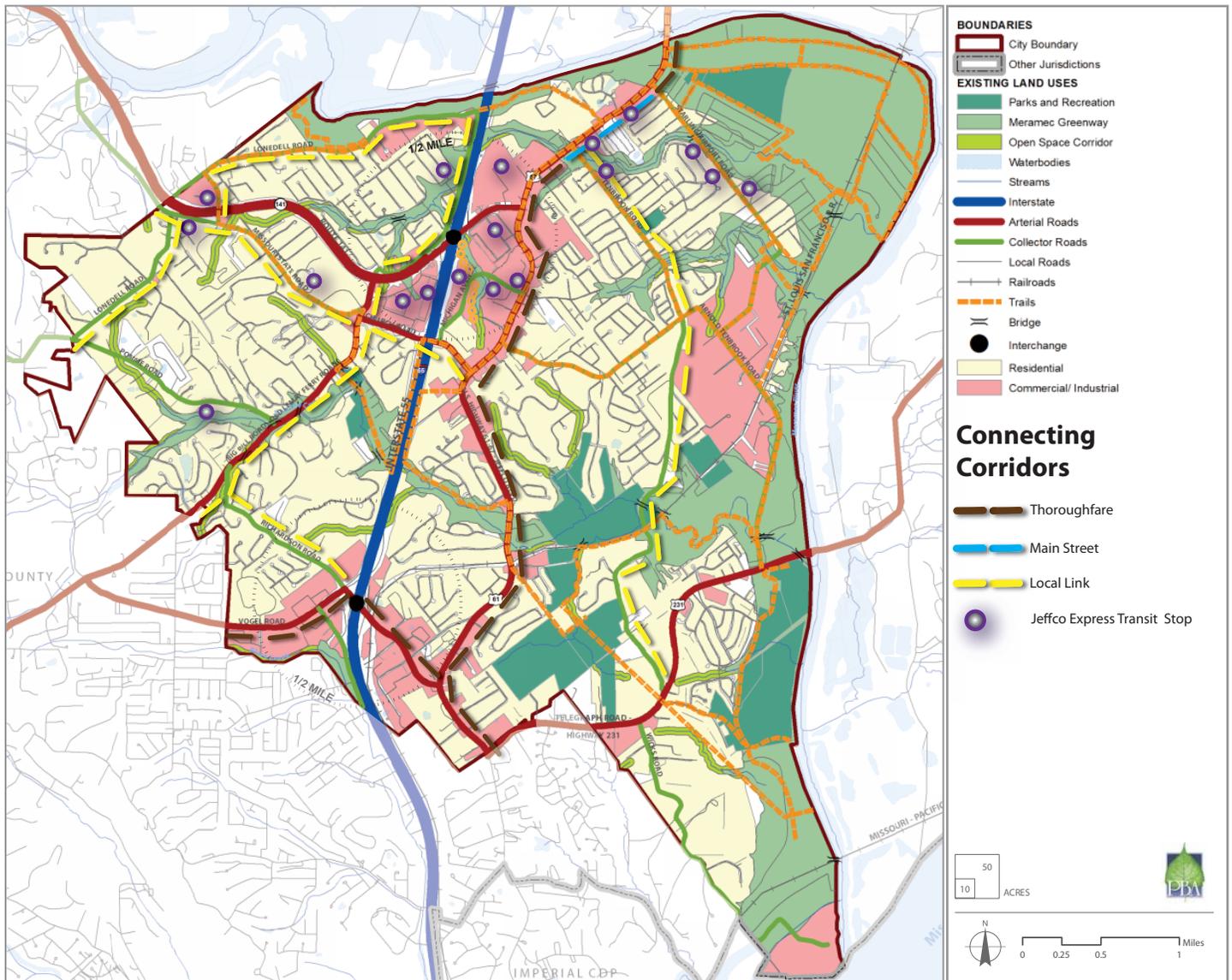
bicyclists, bus and future transit. Recommendations made for interstate and state highways are subject to separate transportation studies by the Missouri Department of Transportation (MoDOT) and will necessitate a collaborative partnership to achieve the long-term goals of this Plan. Long-term, it is recommended that the City conduct a “complete” or “livable” streets analysis of all major thoroughfares to determine what measures can be implemented to manage travel speeds and accommodate pedestrians and bicycles.

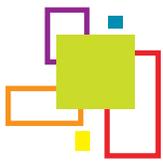
## Future Planning:

The transition to “Complete or Livable” streets will occur in strategic locations incrementally as roads are re-designed.

### The Connecting Corridors Map

Figure: 35 Connecting Corridors Map





## Connecting Corridor Typologies

In lieu of an existing “complete or livable” streets analysis, this Plan recommends the use of typologies, which are a way of classifying catalytic corridors to get more out of the existing street system, manage maintenance costs, and enhance transportation options better. These catalytic corridors reflect their surroundings and the types of users traveling on them.



Example Parkway road section with Trail

### Typology Benefits Include:

- Flexible Street Sections that better respond to surrounding land uses, future development goals, and the needs of the community.
- Mobility choices that support bicycle, pedestrian, and future transit users.
- Road Diets, where feasible, that reduce the number of lanes or right-of-way width.

These street typologies attempt to strike a balance between functional classification, adjacent land use, the competing travel needs. The transition to “Complete or Livable” streets will occur in strategic locations incrementally as roads are re-designed.

### Typology Typical Sections:

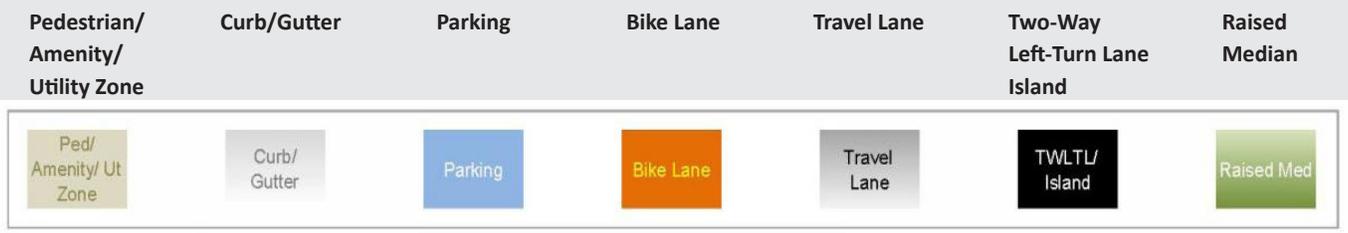
The typologies will allow the City much more flexibility in implementing catalytic corridors in the short-term. Each of the Corridor Typologies has a unique context and intent, and a series of applicable typical sections. The choice of the appropriate section is a function of other contextual parameters and may vary by segment. The graphics which follow illustrate the typical sections, with widths (in feet) shown for elements within the section, as well as the overall right-of-way for each section.

The street typologies include:

- Thoroughfare Streets
- Main Streets
- Local Links

### Typical Section Legend:

The typical section legend includes, from left to right:



# Thoroughfare

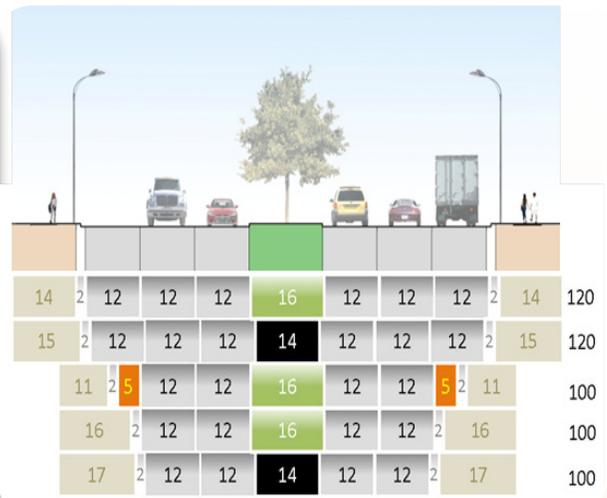
## Characteristics

The most widespread commercial street type is the strip commercial arterial or thoroughfare. These thoroughfares typically serve commercial areas that contain many small retail strip centers with buildings set back from front parking lots. Because of this, strip commercial thoroughfares have many intersections and driveways that provide access to adjacent businesses. Historically, this type of street is highly auto-oriented and tends to discourage walking and bicycling. On-street parking is infrequent.

Thoroughfare streets are designed with multiple lanes divided by a landscaped median or a continuous two-way left turn lane in the center. Thoroughfare streets are designed to balance traffic mobility with access to nearby businesses. However, because there are so many intersections and access points on thoroughfare streets, they often become congested. Improvements to these streets should come in the form of access management, traffic signal timing and creative intersection lane capacity improvements.

### Priority Elements:

- Number and width of travel lanes
- Medians
- Transit accommodations
- Pedestrian facilities
- Bicycle facilities
- Tree lawns
- Two-way center left-turn lanes
- On-street parking
- Consolidated driveways
- Synchronization of traffic signals
- On-street parking
- Narrower travel lanes
- Reduced pedestrian crossing distances at intersections, using curb extensions, traffic islands, and other measures



Ideal Future Alternative Sections



112' - 124' Right-of-Way  
TMP Adopted Typical Street Section

Existing TMP

## Existing Conditions:

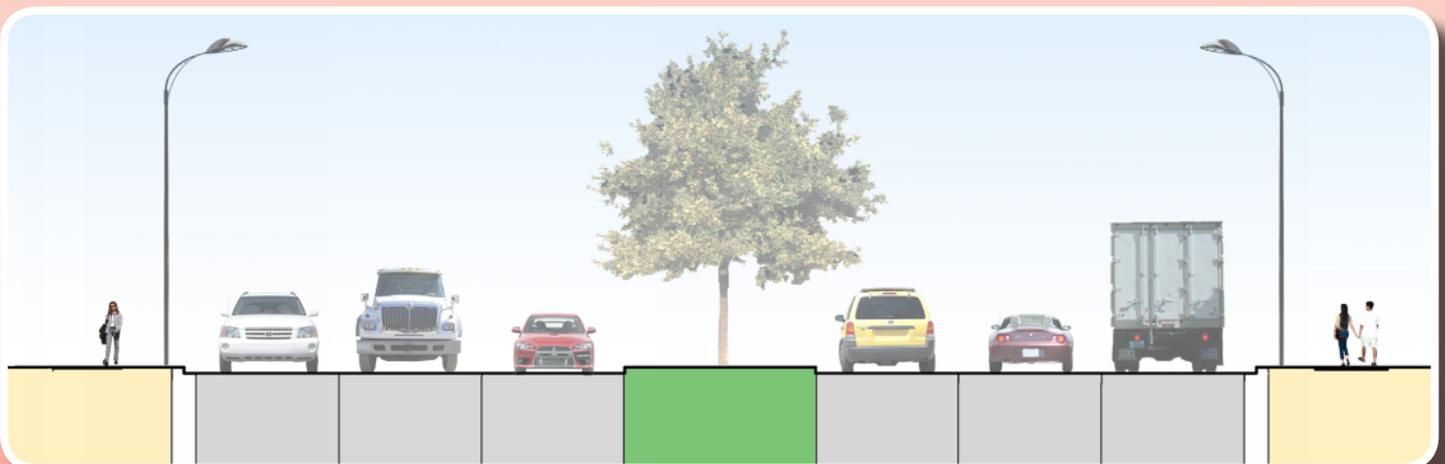
Existing conditions reflect the adopted 2001 Transportation Master Plan (TMP) Typical Street Sections.

## Typical Context:

Commercial areas with many small strip centers and pad sites with buildings typically set back behind front parking lots.

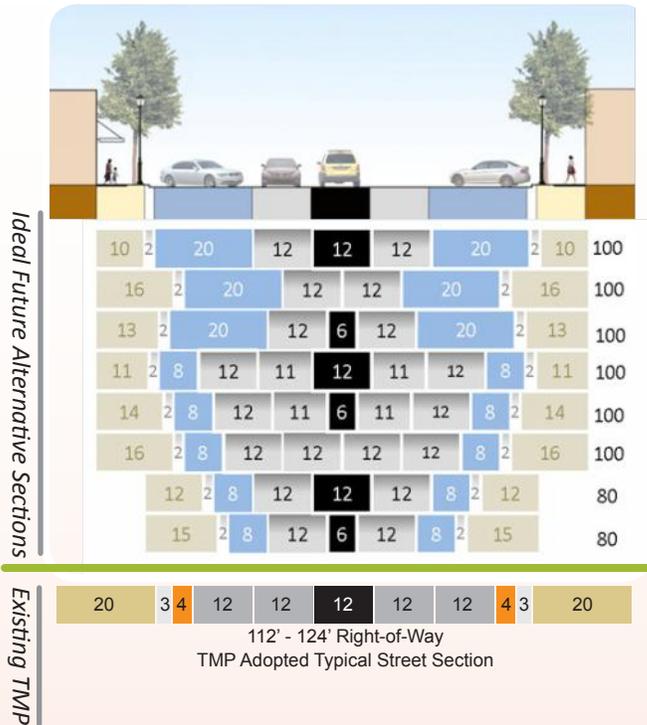
## Intent:

Emphasis placed on vehicular mobility and “through” or “destination” traffic.



**Thoroughfare Street Section.**

# Main Street



## Characteristics

Main streets serve the highest intensity retail and mixed land uses in Arnold such as the “New” downtown and in regional and neighborhood centers. Main streets are designed to promote walking, bicycling, and future transit within an attractive landscaped corridor. Generally, main street activities are concentrated along a two to eight block area, but may extend further depending on the type of adjacent land uses and the area served. Main streets can be designed with two to four travel lanes, although typically have only two lanes. On street parking usually is provided to serve adjacent land uses. Unlike typical strip commercial developments, main streets offer the ability to park-once and walk amongst various destinations, thus reducing arterial trip making. The key is to create convenient parking that is on street or provided in a shared public parking lot. In order to ensure the walkability of a main street, careful consideration must be made to the design elements and amount of parking lots. When emphasizing street frontage walkability and bike/pedestrian neighborhood connectivity, tree lawns and detached walks receive priority over travel lanes. Within the parking lane tree wells may be used to create a double row of street trees in combination with a tree lawn. To further create a pedestrian friendly atmosphere, main streets have wide sidewalks, street furniture, outdoor cafes, plazas, and other public spaces.

### Priority Elements:

- Wide sidewalks with pedestrian plazas, accommodates future transit
- Reduced pedestrian crossing distances at intersections, using curb extensions, traffic islands, and other measures
- Bicycle facilities
- Tree lawns
- On-street parking
- Width and number of travel lanes; Narrower travel lanes
- Alternative paving material
- Raised intersections; High-visibility crosswalks

## Existing Conditions:

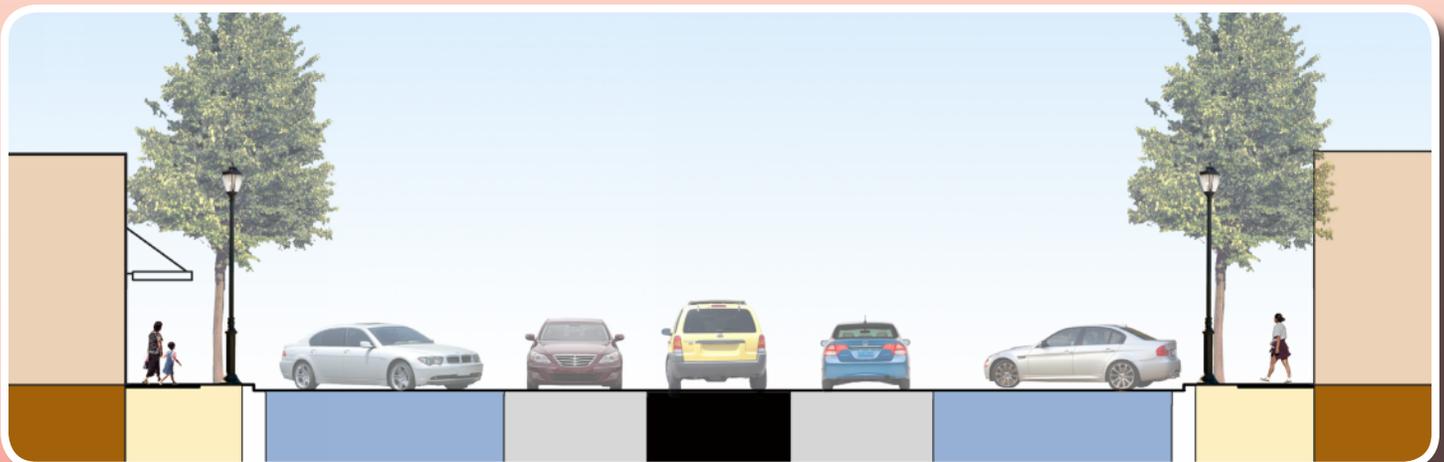
Existing conditions reflect the adopted 2001 Transportation Master Plan (TMP) Typical Street Sections.

## Typical Context:

Unique activity centers, often include a variety of land uses, most notably retail-oriented high intensity mixed-use.

## Intent:

Create a reduced emphasis on automobile traffic and heightened pedestrian environment.



**Main Street Section.**

# Local Link

## Characteristics

Local link streets strengthen neighborhood cohesion, promote alternative transportation, calm traffic and connect recreational destinations. They typically can be applied in two instances: in new residential neighborhoods, or as retrofits in existing residential or downtown streets that may be wide, but do not provide sufficient parking, bicycle and pedestrian accommodations or traffic calming measures. In both cases, Local link streets tend to be more pedestrian-oriented than commuter streets, giving a higher priority to landscaped medians, tree lawns, sidewalks, on-street parking, and bicycle lanes than to the number of travel lanes.

Local link streets consist of two to four travel lanes and place a much higher priority on pedestrian and bicycle-accessibility than on auto mobility.

### Priority Elements:

- Sidewalks
- Tree Lawns; Street trees
- On-street parking
- Landscaped medians
- Bike lanes on designated bicycle routes
- Number and width of travel lanes
- Pedestrian islands
- Narrower travel lanes
- Traffic circles and roundabouts
- Diverters
- Reduced pedestrian crossing distances at intersections, using curb extensions, traffic islands, and other measures



Ideal Future Alternative Sections



63' - 85' Right-of-Way  
TMP Adopted Typical Street Section

Existing TMP

## Existing Conditions:

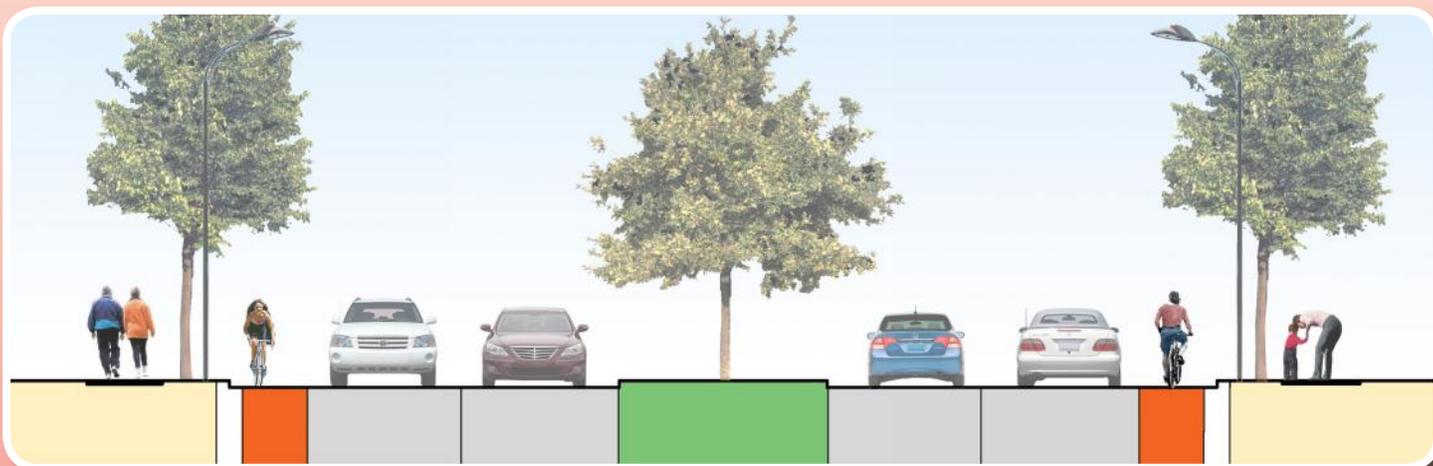
Existing conditions reflect the adopted 2001 Transportation Master Plan (TMP) Typical Street Sections.

## Typical Context:

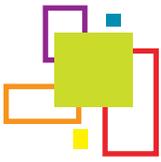
High-quality public spaces offering a variety of building types and land uses-particularly employment-oriented mixed-use-generating activity and diversity.

## Intent:

Form a highly interconnected network, dispersing "through" traffic and providing convenient routes for pedestrians, bicyclist, and future transit users.



## Local Link Street Section.



## Recommended Network Enhancement Tools

### Roadway Network

The City should develop plans to implement most of the *2001 Arnold Comprehensive Transportation Plan* recommendations that have not been done to date. (Based on reviews of conditions in the City, it is recommended that several of the recommendations not be implemented without much additional analysis.) These are:

### Access Management:

Access management guidelines include the proper spacing of interchanges, public road intersections, traffic signals and driveways. When access points are too closely spaced, it is difficult to provide efficient traffic signal progression and queuing or congestion results.

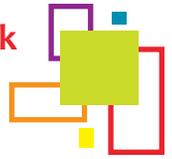
- **Michigan Ave. / Ridgecrest Road extension:** This improvement also does not appear to be feasible given the extent of the developed land uses along the Ridgecrest Road extension corridor.
- **Connect Ozark Drive to Rosedale Drive:** Given the character of these two streets with the existing residential development, this project would create unnecessary through traffic for the residents along a substandard street.

### Access Management

Some of the City's major thoroughfares are, or will soon be experiencing congestion related to capacity limitations. One thing that affects both the capacity and safety of thoroughfares is the type and number of access points. MoDOT has developed and adopted a set of *Access Management Guidelines* which are designed to improve safety, decrease delays, stimulate economic development, and decrease vehicle emissions.

These guidelines include recommended distances between adjacent intersections, driveways, and median breaks, as well as minimum sight distance requirements for traffic entering and exiting side streets and driveways. It is recommended that the City consider adopting these or similar guidelines when planning for future roadway improvements or new construction. During such thoroughfare improvement planning, consideration should be given to consolidating as many access points along such route as Jeffco Blvd... (US-61/67) to improve capacity and safety.

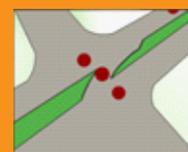
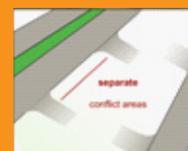
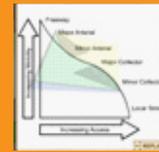
In many cases it appears that it will be difficult and expensive to widen thoroughfares to increase capacity. Therefore, other measures such as access management should be encouraged to maximize the capacity of available street widths. Recognizing the difficulty of widening many thoroughfares in the City, it is important to also consider development and improvement of parallel routes as well as encouraging the use of other modes of travel. This could even include the limitation of off street parking that would discourage single vehicle trips and minimize stormwater runoff. Shared parking should be encouraged wherever possible. MoDOT's *Access Management Guidelines* aim to improve safety for motorists and pedestrians, decrease delay through more efficient operations, stimulate economic growth, decrease emissions, and provide aesthetic improvements. The term "access" refers to the ability to enter or leave a business, residence, or land parcel from a public roadway via a connecting driveway. Recommended distances between driveways, signalized intersections and other roadways generate less traffic congestion and aid in traffic flow. Likewise, driveways or other openings where sight distance is insufficient are dangerous to both motorists and pedestrians. Access Management Guidelines provides these recommendations to ensure safety and maintain the functional hierarchy of roadways.

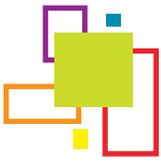


## Ten Principles of Access Management

The Transportation Research Board's (TRB) Access Management Manual identifies 10 principles:

- 1. PROVIDE A SPECIALIZED ROADWAY SYSTEM**  
 it is important to design and manage roadways according to the primary functions that they are expected to serve;
- 2. LIMIT DIRECT ACCESS TO MAJOR ROADWAYS**  
 Roadways that serve higher volumes of regional through traffic need more access control to preserve their traffic function;
- 3. PROMOTE INTERSECTION HIERARCHY**  
 An efficient transportation network provides appropriate transitions from one classification of roadway to another;
- 4. LOCATE SIGNALS TO FAVOR THROUGH MOVEMENTS**  
 Long, uniform spacing of intersections and signals on major roadways enhances the ability to coordinate signals and ensure continuous movement of traffic at the desired speed;
- 5. PRESERVE THE FUNCTIONAL AREA OF INTERSECTIONS AND INTERCHANGES**  
 The critical area is where motorists are responding to the intersection – i.e. decelerating, maneuvering into the appropriate lane to stop or complete a turn;
- 6. LIMIT THE NUMBER OF CONFLICT POINTS**  
 Drivers make more mistakes and are more likely to have collisions when they are presented with the complex driving situations created by numerous conflicts. Traffic conflicts occur when the paths of vehicles intersect and may involve merging, diverging, stopping, weaving or crossing movements;
- 7. SEPARATE CONFLICT AREAS**  
 Drivers need sufficient time to address one potential set of conflicts before facing another;
- 8. REMOVE TURNING VEHICLES FROM THROUGH-TRAFFIC LANES**  
 Turning lanes allow drivers to decelerate gradually out of the through lane and wait in a protected area for an opportunity to complete a turn, thereby reducing the severity and duration of conflict between turning vehicles and through traffic;
- 9. USE NONTRAVERSABLE MEDIANS TO MANAGE TURN MOVEMENTS**  
 They minimize left turns or reduce driver workload and can be especially effective in improving roadway safety; and
- 10. PROVIDE A SUPPORTING STREET AND CIRCULATION SYSTEM**  
 A supporting network of local and collector streets accommodate development, and unify property access and circulation systems.





Access management is a proactive step in anticipating and planning for the City’s future needs. These guidelines can be implemented into the initial planning and design stages of projects. As future improvements are made to the City’s street network, access management considerations can play an important role in improving safety and increasing capacity along Arnold’s roadways.



Some types of development would make bus transit more feasible.

## Transit

Presently, bus service is the only form of public transportation. The City should also investigate the feasibility of providing or encouraging bus transit operations to serve the existing / potential park & ride lots and other generators of significant traffic flows. Such activity centers as shopping centers, colleges, and industrial area would benefit from the availability of bus transit.

- **Park & Ride:** The City currently has one large park & ride facility adjacent to the intersection of Richardson Road and Vogel Road. Other locations should be identified where park & ride operations could be implemented, including existing lots where parking activity is limited or does not take place during normal business hours.

## Pedestrian and Bicycle Enhancements Tools

The future use of pedestrian and bicycle enhancements should focus on improving non-vehicular access to new centers and existing destinations. Priority locations for enhancements should be routes from neighborhoods to schools and along connecting corridors. These enhancements come in the form of better coordination between public works and private development to create a cohesive pedestrian and bicycle environment, complete sidewalk connections, reduce neighborhood street speeds with traffic calming and slow speed design and enhance and improve location and coordination of bus transit stops into new developments and public works projects.

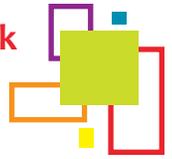


Pedestrian crossings on major roadways can be difficult but important.

## **Pedestrian Districts and Areas**

The level of pedestrian environment quality or standard should vary by the type of activity area. As an example, a high pedestrian performance level will be of greater importance in the “new” downtown than in outlying, lower density subdivisions with light vehicular and pedestrian traffic. The adjacent map illustrates existing and proposed pedestrian activity areas in Arnold. The following activity areas, with differing levels of quality, are proposed:

**Pedestrian Districts** - The primary areas within the City of Arnold that qualify as pedestrian districts include the “new” downtown, existing and proposed commercial/office centers, and Arnold Recreation Center/Library area. These areas include locations that residents of Arnold consider as places to go to, walk around, shop, eat, study, or conduct business. Pedestrian standards should be high in a downtown pedestrian district. In addition to the need for direct, continuous sidewalks where it is safe to cross the street, this area would require higher levels of visual interest and amenities to attract residents and visitors. Future pedestrian districts could be added to this designation where there are planned future mixed-use activity areas and districts.



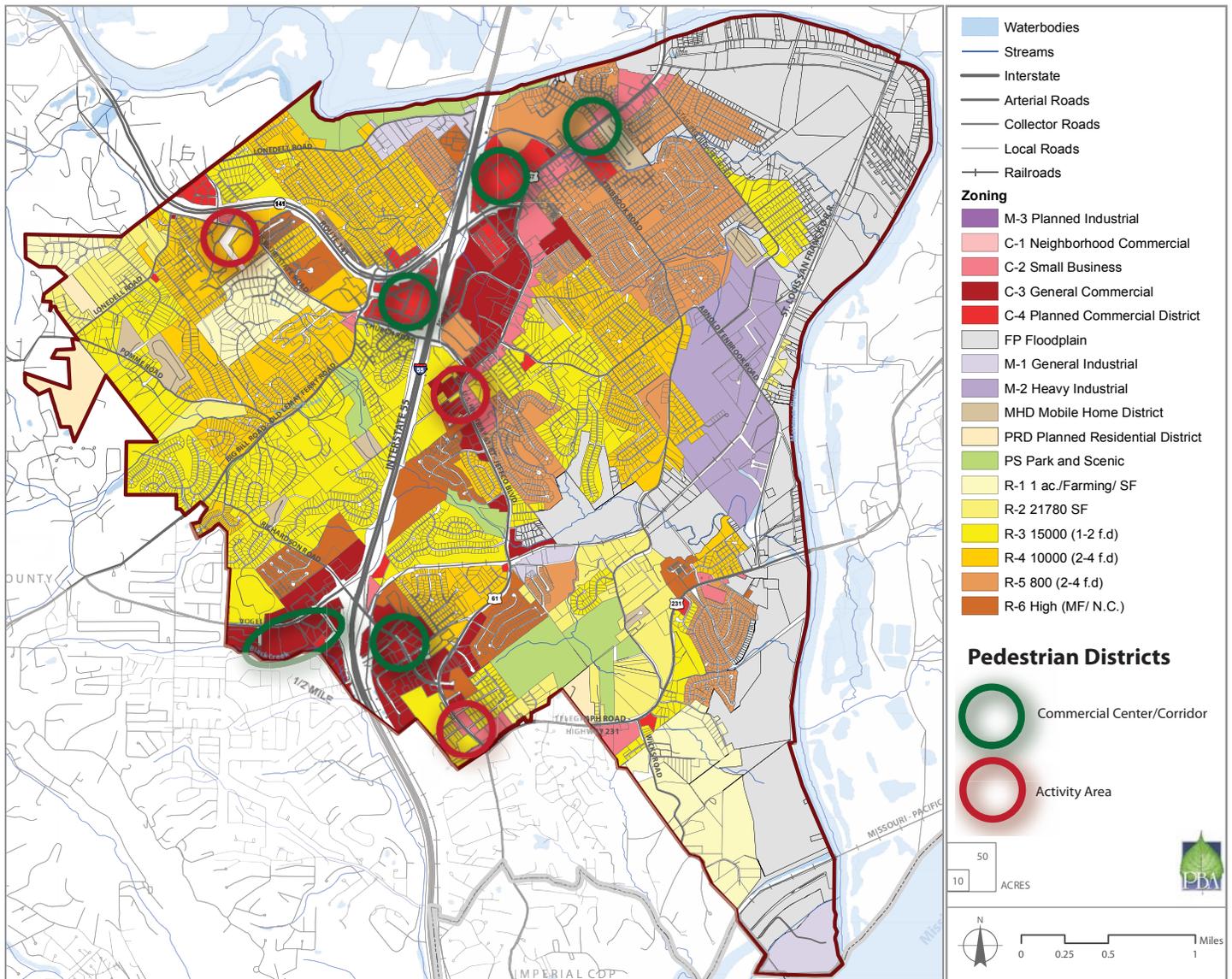
- Commercial Centers and Corridors** - These areas tend to be located along arterials and aggregated at various locations along the corridor, particularly where major arterials intersect. In the past, these locations have been more of the strip commercial and “L” shaped neighborhood shopping center style developments, which provide relatively poor pedestrian environments. Future goals include improving the directness and safety of the pedestrian network to, from, and within these locations.

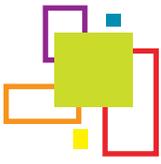


Importance of bicycle safety.

## Pedestrian Districts Map

Figure: 36 Pedestrian Districts Map





## Arnold Comprehensive Plan

- **Schools** - Whereas it is not necessarily critical for routes to schools to be picturesque and visually captivating, for the future, there are basic pedestrian needs for the student, including a safe and secure continuous sidewalk with safe street crossings and direct connections to neighborhoods. Cities across Missouri have been participating in the federal “Safe Routes to School” program which funds studies that address these issues.
- **Other Areas** - Although all other areas within the City should have safe, secure, and reasonably direct pedestrian connections, the pedestrian trip-making characteristics of these areas are not as critical as the areas mentioned here.



Pedestrian walking along Jeffco Blvd

### Pedestrian Level of Quality Standards

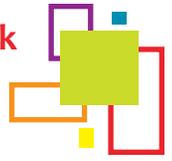
Arnold can be made more walkable by incorporating street design that encourages walkability and makes it a pleasurable experience. While roads have been designed to follow the Level of Service (LOS) standards that measures only how fast and free-flowing cars can move, Level of Quality (LOQ) standards measure walkability of streets, bicycle ability, and traffic calming, developed by Dan Burden of “Walkable Communities,” and Glattig Jackson. LOQ are meant to show graphically how some streets work better than others for access, safety and mobility of all modes. The level of quality in the charts which follow, grades the quality of sidewalks, main-streets, local streets, boulevards, and crossings from very poor to exemplary.



Pedestrian walking along Jeffco Blvd.



Pedestrian walking along Jeffco Blvd.



**GLATTING JACKSON KERCHER ANGLIN**  
we plan and design walkable communities

**walkable COMMUNITIES**

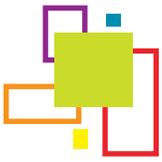
# Walking -- Levels of Quality

**A**   **B**   **C**   **D**   **E**   **F**

	Exemplary	Excellent	Good	Fair	Poor	Hall of Shame
<b>Sidewalks</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>Local Streets</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>Avenue/Boulevard</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>Crossings</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>

### Walking- Levels of Quality (LOQ):

LOQ are meant to show graphically how some streets work better than others for access, safety and mobility of all modes.



## Traffic Calming Tools

The Institute of Transportation Engineers describes traffic calming as changes in street alignment, installation of barriers, and other physical measures to reduce traffic speeds and/or cut-through volumes, in the interest of street safety, livability, and other public purposes. While traffic calming can occasionally use such physical measures to make traffic uncomfortable, thereby lowering traffic speeds, most traffic calming devices are meant to slow traffic in comfortable and often subtle ways.

Traffic calming measures should be considered at all pedestrian crossings to reduce vehicular speeds, increase driver awareness and help establish right-of-way for pedestrian users. Traffic calming measures, include but are not limited to alternative paving materials, on-street parking, lighting, landscaping, reduced land widths, choke points, traffic circles or any combination thereof that reduce apparent street width and protects pedestrians from moving traffic. Traffic calming is also recommended downtown to slow traffic, beautify and increase pedestrian safety and convenience. Using traffic calming at key corner locations in the “New” downtown will provide safer pedestrian crossings and better orientation for both pedestrians and drivers.



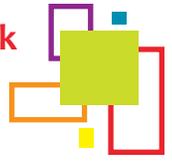
Participants preferred walking in their neighborhoods.



Pedestrian routes should be well-lit and sidewalks should be separated from the street.



Example roundabout including pedestrian and bicycle connections.



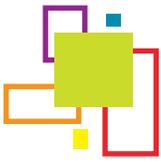
Traffic Calming -- Intersection Tools				Plan View
Tool Description	Added Benefits	Cost/ Other	Neighborhood	Plan View
<p><b>Curb Extensions</b></p> <p>Curb extensions are great tools for slowing speeds at intersections and midblock locations. They are often used in combination with other tools, such as refuge islands, or part of a modified intersection. They are very helpful to inset parking, meet ADA requirements and reduce pedestrian crossing times and distances.</p>	<p>Helps protect and preserve sight lines, eliminates illegal parking, helps assure emergency responder access to critical streets. Can be used for emergency responder operations area. Use to create chokers, chicanes, neckdowns.</p>	<p>Costs range from \$5-30,000 per corner. Costs are reduced if drainage is left open. This can increase maintenance costs, so these details must be worked out by a city/county team.</p>		
<p><b>Refuge Islands</b></p> <p>Refuge islands slow traffic in three ways. They visually tighten the road, slow turning speeds, and help create narrow channels. They separate conflicts, create 10' wide driving lane channels (when used with curb extensions), minimize pedestrian crossing conflict speeds.</p>	<p>Minimum preferred width 8.0 feet. Best when landscaping is used to help motorists see treatment in advance. Keep ADA ramps at grade or with light crown for drainage. Use full width ADA ramps, and create 45 degree bend, if midblock.</p>	<p>One of the most affordable tools. Does not affect drainage. Can be landscaped at added cost with or without irrigation. Used effectively in high pedestrian areas, such as schools, parks, stores.</p>		
<p><b>Modified Intersections</b></p> <p>Modified intersections take back unwarranted asphalt, returning it as green space. Often motorists turn too fast when curb radii were made too wide for safety. Some intersections can be turned into small parks, greatly increasing safety, beauty and a gateway appearance.</p>	<p>Vastly improves sight distances. Helps many motorists get into difficult or unsafe intersections. Can serve as a small neighborhood park or gathering place, thus increasing association and security of the neighborhood.</p>	<p>Very popular as a gateway to a neighborhood, or any place where excessive asphalt exists. Very high return on investment, especially where pedestrian crossings are risky. Avoid ugly temporary treatments.</p>		
<p><b>Raised Intersections</b></p> <p>Raised intersections provide a colorful vertical intersection effect. They slow traffic in three ways. First they create an attractive, distinct shape. Second, they create a vertical deflection forcing a low speed approach. Third, they highlight the area as a pedestrian space.</p>	<p>Can be used with very tight and narrow intersections. Used where roundabouts cannot fit. Highly attractive. Requires good coordination with engineering, landscaping and architectural specialists.</p>	<p>Very popular as a gateway to a neighborhood, or any place where excessive asphalt exists. Very high return on investment, especially where pedestrian crossings are risky.</p>		
<p><b>Roundabouts, Mini-Roundabouts</b></p> <p>Roundabouts and mini-roundabouts are the most effective and popular traffic calming feature. These horizontal deflection tools lower speeds to 15-20 mph, shorten pedestrian crossings to 12-14 feet at a time, decrease injury crashes about 90%, reduce noise and pollution, and increase area property values.</p>	<p>Roundabouts are excellent for entrances, intersections near schools, parks, gateways to downtowns, and many other locations. Always consider any time a signalized intersection is being funneled.</p>	<p>Great range in costs. Mini-roundabouts can be \$10-50,000, while roundabouts can be \$50-500,000 for many sizes. Greatest safety benefit of all traffic calming tools.</p>		

**Traffic Calming-Intersection Tools:**

These tools are meant to show graphically the added benefits and associated costs within the context of two conditions:

- Main Street
- Neighborhood





## Community-wide Greenway

This Plan also recommends the creation of a community-wide greenway. The greenway is intended to increase pedestrian travel, encourage active lifestyles and expand year-round park and recreation options for all ages. The implementation of a linear park system is an effective way to create a “preservation corridor” that provides multi-generational open space and recreational opportunities. Equally important is its ability to integrate the City’s natural areas with its urban areas and key traffic generators.

Trail locations and sidewalk improvements should link to the City’s roads, “new” downtown, schools, colleges, churches, businesses, recreational facilities and neighborhoods. The general location of recommended trails and greenways are shown in the Parks, Trails and Open Space Framework.



Bicycle parking should be in a secure location close to entrances.

- **Bike and Pedestrian Studies:** It is recommended that the City conduct a Bike and Pedestrian Study to identify and evaluate pedestrian and bicycle paths to and from strategic destinations.
- **Walkability Studies:** It is recommended that the City implement a policy of requiring that “Walkability” Studies, along with typical Traffic Impact Studies, be required when all new developments are considered. These Walkability Studies would identify and evaluate pedestrian paths to and from all likely destinations within one-quarter (1/4) to one-half (1/2 ) mile of each development and recommend improvements that must be made as part of the development agreement to accommodate pedestrians and bicycles.



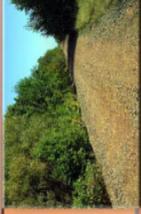


**GLATTING JACKSON KERCHER ANGLIN**  
we plan and design through communities

**walkable COMMUNITIES**

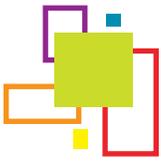
# Bicycling -- Levels of Quality

**A** **B** **C** **D** **E** **F**

	Exemplary	Excellent	Good	Fair	Poor	Hall of Shame
<p><b>Wide Curb Lanes</b></p> <p>Wide curb lanes increase comfort between motorists and bicyclists. Motorists desire to separate themselves 6.0 feet from bicyclists. Wide curb lanes give buses more space, and allow greater turning radii. Low speeds create greater comfort.</p>						
<p><b>Bike Lanes</b></p> <p>Bike lanes define and identify bicycling locations. Widths up to 6.0 feet are most comfortable. Colorization can help. Narrow widths next to parking are least comfortable. Speeds between 25-35 mph are most comfortable.</p>						
<p><b>Paved Shoulders</b></p> <p>Paved shoulders that are smooth and wide are most comfortable. Surfaces should be clean and smooth, with few driveways and other interruptions. Narrow shoulders can help, but are less comfortable.</p>						
<p><b>Multi-Use Trails</b></p> <p>Multi-use trails work well in paralleling high speed roads in access controlled environments. Trails can offer more scenic, quiet, and direct routes of travel. Widths can vary, but must be designed to accommodate many users and user types.</p>						
<p><b>Crossings</b></p> <p>Crossings with low volume streets, where there are frequent ramps, need slight distances, good lighting, and medians or refuge islands are best. In some cases signals are essential or other controls are essential.</p>						

### Bicycling - Levels of Quality (LOQ):

LOQ are meant to show graphically how some streets work better than others for access, safety and mobility of bicycling.



## FUNDING ALTERNATIVES:

Partnerships with local business groups and community organizations are essential to ensure that special streetscaping associated with connecting corridors and other infrastructure are properly maintained. The City should institute a variety of tools to allow business and residential property owners to assist in constructing and maintaining the infrastructure and amenities developed.

Local Improvement Districts (LIDs), Local Maintenance Districts, Business Improvement Districts (BIDs) and other special districts can be used to construct and maintain infrastructure such as streets, adjacent streetscaping, curb and gutters, water and drainage utility systems, sidewalks, and alleys. These programs usually require landowners to agree to a special property tax assessment, which are used to fund the improvements.

The ability to apportion the cost of improvements to more than one property owner and the ability to spread costs over time are two of the biggest advantages of improvement districts. In addition, these districts may be able to benefit from lower cost public financing (this may require voter approval). The larger, more expansive LIDs and BIDs also allow property owners who are unfamiliar with construction, contracting, engineering, or financing to rely on the City to undertake the process for them. The City can act as an agent to manage the project's design and construction.

In addition to these voluntary measures, demands for capacity improvements can be fulfilled through developer impact fees. This funding mechanism is commonly used to offset the costs required to serve new development. When new development comes to a community, a number of services are required to serve them; including roadways, water lines, sewer facilities, schools, parks, fire stations, libraries and police stations. Throughout Missouri, a number of cities are considering impact fees.



Roadway Maintenance.



Roadway Maintenance.