JANUARY 20, 2025

City of Kirkwood Safe Streets and Roads for All (SS4A) Speed Limit Study

Final Report

Prepared for:

City of Kirkwood

139 S Kirkwood Rd

Kirkwood, MO 63122

Prepared by:

Lochmueller Group

411 N 10th St

Suite #200

St. Louis, MO 63101

Table of Contents

Introduction 3
Data Collection 3
Policy and Best Practices Research 5
Existing Applicable Policy 6
Best Practices 11
Identified Locations for Improvements 17
High Injury Network Corridors 17
City-Owned Roadway Locations 19
Conclusions 27

Introduction

Lochmueller Group (Lochmueller) has completed a speed limit study for the City of Kirkwood, Missouri (City) as a part of a larger Safe Streets and Roads for All (SS4A) grant project. The study included 75 locations within the municipality boundaries for data collection and analysis.

The purpose of this project was to provide the City with an understanding of vehicle speeds within the municipality boundaries in order to: 1) evaluate whether existing speed limits are appropriate, and 2) identify and prioritize locations for improvements that aim to reduce speeds and increase safety. The following report documents the data collection process, policy and best practice research, identified locations for countermeasure recommendations, and a prioritization process to determine the order to address the identified locations.

Data Collection

In total, 75 locations were selected for speed data collection for the speed limit study. These locations were based upon several factors including crash history, facility type, pedestrian activity, frequent citizen calls, and more. Locations for data collection were also chosen to cover the high injury crash network and high equity score zones which were established as part of the City of Kirkwood's 2021 Vision Zero plan. Speed data were collected at each location over a five-day period of a typical week (i.e. school in session, favorable weather) in May of 2024. The locations and identification numbers of all collected data are listed below with the locations mapped in **Figure 1**.

1. Big Bend east of Forest
2. Big Bend west of Milwaukee
3. Kirkwood south of Kirkwood Commons
4. Woodbine west of Kirkwood
5. Geyer north of Woodbine
6. Geyer south of Adams
7. Adams west of Clay
8. Adams east of Taylor
9. Kirkwood south of Monroe
10. Kirkwood north of Washington
11. Kirkwood north of Jefferson
12. Essex east of Clemmons
13. Dougherty Ferry west of Chopin
14. Kirkwood north of Hollywood
15. Craig west of Craigwoods
16. Adams east of Woodlawn
17. Taylor north of Quan
18. Rose Hill west of Kirkwood
19. Madison west of Kirkwood
20. Wood south of Alfred
21. Rose Hill west of Andrews
22. Anne west of Nelda
23. Ballas north of Thursby
24. Clay north of Sarah
25. Geyer north of Jewell
26. Meacham east of Milwaukee
27. Lindemann south of Lynkirk
28. Lockett north of Lin Manor
29. Holmes south of Scott
30. Orleans north of Alsobrook
31. Milwaukee south of Meacham
32. Fillmore south of Thomas
33. Nirk east of George
34. Manchester west of Geyer
35. Manchester east of Dickson
36. Big Bend west of Sams Club
37. Kirkwood north of Rose Hill
38. Ballas north of Dougherty Ferry
39. Big Bend west of NB 270 ramps
40. Geyer south of Ashwood
41. Big Bend west of Kirkwood
42. Manchester west of Bernice
43. Manchester east of Clay
44. Kirkwood south of Huntleigh

45. Jefferson between Clay and Kirkwood
46. Kirkshire east of Ormond
47. Chester east of Kirkwood
48. Washington between Taylor and Kirkwood
49. Adams east of Sugar Creek Road
50. Woodgate north of Manchester
51. Couch south of Woodbine
52. Woodbine west of Magnolia
53. Adams east of Couch
54. Big Bend west of Marjean Ct
55. Woodlawn south of Adams
56. Woodlawn south of Manchester
57. Geyer north of Manchester
58. Argonne between Clay and Kirkwood
59. Woodlawn south of Fairway
60. Ballas north of Pinecrest Manor
61. Argonne west of Woodlawn
62. Essex east of Clay
63. Harrison north of Rose Hill
64. Essex east of Chopin
65. Clay south of Clinton Pl
66. Longview east of Greenleaf
67. E Essex west of Woodlawn
68. E Bodley 400 Block
69. Grandview east of Old Big Bend
70. W Glenwood east of Ferncliff
71. E Glenwood north of Big Bend
72. Forest south of Big Bend
73. S Ballas north of Boaz
74. Kirkwood south of Jewell
75. Geyer north of Windsor Spring

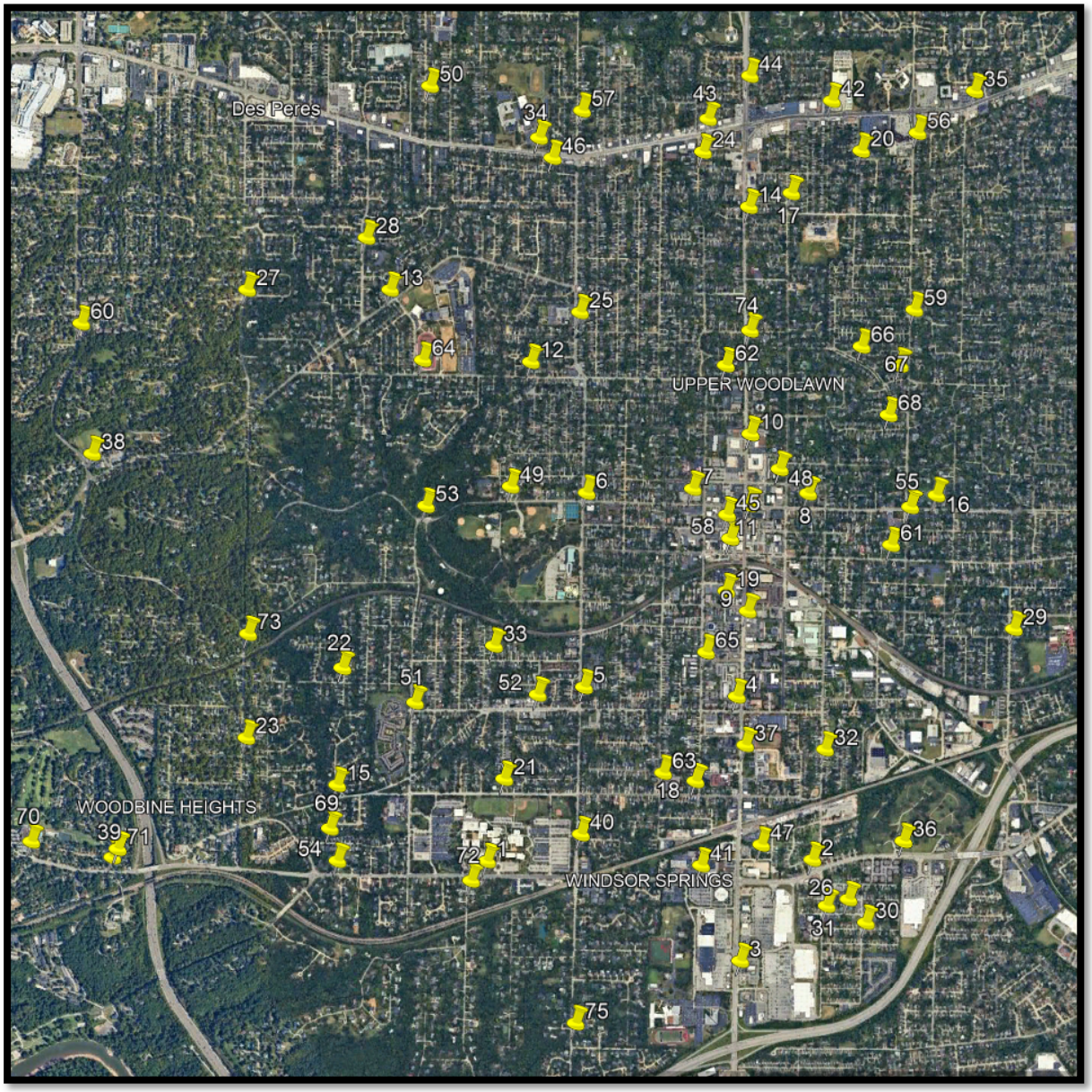

Figure 1. Data Collection Locations

Policy and Best Practices Research

As part of the speed limit study, research was conducted on applicable local, county, and state policies as they relate to setting speed limits on the City's roadways. Research was also conducted on best practices for setting speed limits and speed management plans. The following sections summarize the applicable policies and practices.

Existing Applicable Policy

As a first step, the existing speed management policies of the local city, county, and state were examined to determine the governing policies currently in place.

City of Kirkwood Policy

Under existing City of Kirkwood policy, there are several division codes related to vehicle speed and speed management. The City also contains a provision noting the authority of the City Traffic Engineer to utilize signal timings to reduce speeds as needed.

Section 14-177: Applicability of state speed laws; exception

- The state traffic laws regulating the speed of vehicles shall be applicable upon all streets within the City, except as otherwise provided in this division, and it shall be unlawful for any person to drive a vehicle at a speed in excess of any speed so declared when signs are in place giving notice thereof.

Section 14-178: Maximum speed limits

- No person shall operate a vehicle in the City of Kirkwood at a rate of speed of more than 25 miles per hour, except where the rate of speed is otherwise posted, and it shall be unlawful to drive a vehicle at a speed in excess of the posted speed.

Section 14-396: Schedule F: Speed Limit Designations

- No person shall operate a vehicle on any street in the City of Kirkwood at a rate of speed in excess of the posted speed limit. Vehicles traveling upon the streets described below shall be subject to the speed limits as indicated.
- The code goes on to list each posted speed limit of roadways within the City limits.
- The code states all unposted streets or portions of street no otherwise described in 14-396 are set at a maximum speed limit of 20 miles per hour.

Section 14-60: Timing of traffic signals to regulate speed

- The Traffic Engineer is authorized to regulate the timing of traffic signals so as to permit the movement of traffic in an orderly and safe manner at speeds slightly at variance from the speeds otherwise applicable within the district or at intersections and shall erect appropriate signs giving notice thereof.

The City also contains several other ordinances related to maximum speeds within construction zones, limitations to unnecessarily slow speeds, and a ban on racing.

St. Louis County Policy

St. Louis County (County), the county Kirkwood is located within, has an ordinance for a uniform maximum speed limit of 25 miles per hour on any roadway or alleyway except on highways or roadways with clearly posted limits. The County also provides guidelines for school zones to be set no less than 25 miles per hour or not more than 10 miles per hour below the posted speed limit. The remaining County ordinances relate to highways and federal interstates.

Section 1204.030 - General Speed Limit on Roadways and Alleyways.

- No person shall operate a motor vehicle on any roadway or alleyway used by the general motoring public, at a rate of speed in excess of twenty-five (25) miles per hour, except on highways or in zones otherwise provided for by ordinance.

Section 1204.010 - Speed Limits to be Posted with Signs

- All portions of highways and roadways on which a speed limit has been established shall be marked by signs erected at least at the beginning of such designated portions of highways and roadways.

Section 1204.080 - Special Speed Limits for School Zones,

- Special speed limits for school zones shall be set no less than twenty-five (25) m.p.h., or at a rate of speed not more than ten (10) m.p.h. below the speed limit established by ordinance for the portion of the roadway in which the school zone is located and is set forth and described in Schedule III. All special speed limits for school zones shall be in effect for intervals determined by the Director, provided such intervals shall be between the hours of 6:30 a.m. and 6:30 p.m., Mondays through Fridays. No special speed limit for school zones shall be established by the Director for portions of roadways for which the County Council has, by ordinance, established a speed limit.

Section 1204.020 - Speed Limits on Highways.

- No person shall operate a motor vehicle upon the portions of State highways described in Schedule II of this code in excess of the speed limits indicated for each portion. The County Council may, by ordinance, limit speed on all portions of highways as engineering investigations show the necessity for such limitations with the concurrence of the State Highway and Transportation Commission.

Section 1204.025 - Minimum Speed Limit on Federal Interstate Highways.

- All portions of highways and roadways on which a speed limit has been established shall be marked by signs erected at least at the beginning of such designated portions of highways and roadways.

St. Louis County policy also includes additional provisions for certain zones such as parking lots and construction zones as well as provisions for certain situations such as impeding traffic for unnecessarily slow driving and minimum limits for advertising vehicles.

Missouri State Policy

The laws regarding vehicle speeds for the State of Missouri (State) are documented in the Missouri Revised Statutes. As it relates to municipal regulation, the Missouri Revised Statutes (RSMo) have several statutes to address the distinction and ability of municipalities to set speed limits. These are all found within Chapter 304 which relate laws for traffic regulations in the state. As shown below, RSMo Section 304.120 grants authority to municipalities to establish reasonable speed regulations within municipality limits. The adjustment of any State roads and highways within a municipality must have approval by the State. Speed limit reductions should not impede expedited traffic flow of state roadways and cannot be designed to primarily produce revenue for the agency.

RSMo Section 304.120. Municipal regulations — owner or lessor not liable for violations, when.

1. Municipalities, by ordinance, may establish reasonable speed regulations for motor vehicles within the limits of such municipalities.
2. Municipalities, by ordinance, may:
    a. Make additional rules of the road or traffic regulations to meet their needs and traffic conditions;

RSMO Section 304.010. Definitions — maximum speed limits — cities, towns, villages, certain counties, may set speed limit, how set — slower speeds set, when — violations, penalty

4. Notwithstanding the provisions of Section 304.120 or any other provision of law to the contrary, cities, towns and villages may regulate the speed of vehicles on state roads and highways within such cities', towns' or villages' corporate limits by ordinance with the approval of the State Highways and Transportation Commission. Any reduction of speed in cities, towns or villages shall be designed to expedite the flow of traffic on such state roads and highways to the extent consistent with public safety. The Commission may declare any ordinance void if it finds that such ordinance is:
    b. Not primarily designed to expedite traffic flow; and
    c. Primarily designed to produce revenue for the city, town or village which enacted such ordinance.

In addition to the laws and statutes listed in the Missouri Revised Statutes, the Missouri Department of Transportation (MoDOT) also maintains an engineering policy guideline known as the MoDOT EPG. This resource works in tandem with the laws of the Missouri Revised Statues and lists the specific engineering policies. The MoDOT EPG provides specific engineering guidelines for speed limit determination and posting.

To summarize, the MoDOT EPG provides specific guidelines for how to set speed limits on roadways with engineering backing. The EPG advises the prevailing speed determination should be set one of three ways: 85th percentile speed, upper limit of the 10 mph pace (10 mph range containing the most vehicles), or average test run speed. The setting of the prevailing speed based upon one of these three methodologies helps ensure a credible speed limit is set based upon current behavior of motorists. One of the purposes of this study was to investigate alternative safe-systems based approaches to setting speed limits.

While these prevailing speed determinations determine what most drivers perceive to be a safe speed to travel, the EPG allows for the chosen metric to be adjusted for certain factors. These other factors include reductions for:

1. Fatality and Disabling Injury Crash Rate
    a. 5% reduction for a fatal and disabling crash rate greater than 1.5x the statewide rate
    b. 10% reduction for a fatal and disabling crash rate greater than 2x the statewide rate
2. Total Crash Rate
    a. 5% reduction for a fatal and disabling crash rate greater than 1.5x the statewide rate
    b. 10% reduction for a fatal and disabling crash rate greater than 2x the statewide rate

3. Pedestrian Traffic
    a. Prevailing speed may be reduced by 5% when sidewalks are not provided adjacent to a route and pedestrian traffic exceeds 10 per hour for 3 hours of any 8-hour period
4. Parking
    a. 5% reduction where parking is permitted adjacent to the traffic lane
5. Adjacent Development
    a. Significant adjacent development with residential and commercial access points can be cause to reduce the prevailing speed.
    b. A driveway conflict number can be derived given the number of private, minor and major commercial entrances, shopping centers, and public streets. The prevailing speed may be reduced by 5% or 10% depending on the driveway conflict number of the location.

A combination of the above reductions may be applied to the prevailing speed, but the prevailing speed should not be reduced below the 50th percentile speed.

905.2.14.2 Prevailing Speed Determination

- Prevailing speed determination is the starting point to setting speed limits in incorporated and unincorporated areas, pursuant to the aforementioned state statutes. The prevailing speed of free-flowing traffic shall be determined using one or more of the three criteria below:
    - 85th percentile speed;
    - Upper limit of the 10 mph pace;
    - Average test run speed.
    - The selected speed limit (in 5 mph increments) should not exceed the established prevailing speed by more than 3 mph.
- The following factors may allow for reduction of the prevailing speed. The prevailing speed shall not be reduced below the 50th percentile (average) speed using these factors.
    1. Fatality and Disabling Injury Crash Rate
    2. Total Crash Rate
    3. Pedestrian Traffic
    4. Parking
    5. Adjacent Development
    6. Physical Roadway Conditions
- 905.2.14.2.1 Fatality and Disabling Injury Crash Rate
    - If either the fatal or disabling injury crash rates, based on reportable crashes within the proposed area, are 50% higher than the statewide average crash rate for the same roadway type, prevailing speed may be reduced by 5%.
    - If the fatal or disabling crash rate is more than twice the statewide rate for the roadway type, the prevailing speed may be reduced by 10.

- 905.2.14.2.2 Total Crash Rate
  - If the overall crash rate, based on reportable crashes within the proposed area, is 50% higher than the statewide average crash rate for the same roadway type, prevailing speed may be reduced by 5%.
  - If the crash rate is more than twice the statewide rate for the roadway type, the prevailing speed may be reduced by 10.
- 905.2.14.2.3 Pedestrian Traffic
  - Where sidewalks are not provided adjacent to the route and a total pedestrian traffic along the route exceeds 10 per hour for 3 hours of any 8-hour period, the prevailing speed may be reduced by 5 percent. Pedestrians crossing the route may only be counted if the point of crossing is not protected by a traffic control device.
- 905.2.14.2.4 Parking
  - Where parking is permitted adjacent to the traffic lane, the prevailing speed may be reduced by 5 percent.
- 905.2.14.2.5 Adjacent Development
  - Where significant adjacent development includes residential and commercial access points, the prevailing speed may be reduced to account for driveway conflicts. If necessary, this effect on the prevailing speed may be determined as outlined below.
  - The effect of driveway entrances can be determined by using a Driveway Conflict Number. For this purpose, a private or field entrance should have a Driveway Conflict Number of 1. Minor commercial entrances should have a number of 5. Major commercial entrances, shopping centers or industrial plant entrances that generate relatively high volumes of traffic, and public streets should have a number of 10. If the total Driveway Conflict Number exceeds a rate of 40 per mile through the proposed zone, the prevailing speed may be reduced by 5 percent. If the total number exceeds a rate of 60 per mile, the prevailing speed may be reduced by 10 percent. However, before a reduction is made due to the Driveway Conflict Number, the Poisson Curve should be used to determine if the crash reduction is statistically significant.

MUTCD – Section 2B.13 Speed Limit Sign

The Manual on Uniform Traffic Control Devices (MUTCD) provides guidance on the setting of speed limits. The manual recommends agencies evaluate non-statutory speed limits where segments of roadways have undergone a change in roadway characteristics or surrounding land use. The manual states a speed limit should be set within 5 miles per hour of the 85th percentile speed of free-flowing traffic. However, the manual also lists other factors for establishing a speed limit:

1. Road characteristics, shoulder condition, grade, alignment, and sight distance
2. The pace speed
3. Roadside development and environment
4. Parking practices and pedestrian activity
5. Reported crash experience for at least a 12-month period

The manual also notes changeable signs can be used to provide appropriate speed limits at proper times as well as changeable signs to display approaching driver speeds.

In summary, the MUTCD recommends but does not require speed limits to be set within 5 miles per hour of the 85th percentile collected speed data. Other factors like roadway geometry, context of the surrounding land use, vulnerable user activity, and crash experience can be factored into the setting of the speed limit.

Best Practices

FHWA Guidelines – Safe System Approach for Speed Management

The Federal Highway Administration (FHWA) published the Safe System Approach for Speed Management in May of 2023. This comprehensive document outlines many best practices for speed management that align with the Safe System approach. Additionally, the document provides a number of case studies for various agencies and the subsequent outcomes.

This document is rooted in the Safe System principles which aim to eliminate fatal and serious injury crashes for all users. Safe Systems acknowledges that humans make mistakes which will inevitably lead to crashes. As humans are physically vulnerable, it is imperative that the entire system of our transportation network recognizes the vulnerability of the human body. Safe System takes a holistic approach to management of roadway safety by considering five elements: safe road users, safe vehicles, safe speeds, safe roads, and post-crash care. These elements pull together a comprehensive approach to eliminating fatal and serious injury crashes.

The Safe System Approach for Speed Management utilizes the five elements of the Safe System to create speed management plans to achieve the goals of Safe System:

- Safe Speeds – Humans are vulnerable to severe injury and death at high speeds. Reducing speeds can help to accommodate low injury tolerances.
- Safe Vehicles – Vehicles can be designed to better accommodate low injury tolerances with the latest technology by limiting occurrence and severity of collisions. Safe vehicle technologies that encourage safe driving speeds can increase speed limit compliance and reduce risk of injury in crashes.
- Safe Road Users – Addresses the safety of all road users. Those who walk, bike, ride transit, and use other alternate modes can also highlight the need of transportation safety equity.
- Safe Roads – Roads need to be designed to accommodate mistakes and injury tolerances. The built environment of the infrastructure can encourage and reinforce safe driving speeds.

Source: FHWA

- Post-Crash Care – When injuries occur, they rely on first responders to provide immediate care and transportation to medical facilities. Speed management can be built to reduce the time and effort it takes for first responders to reach injured individuals decreasing the chances of sustained injury or death.

The Safe System Approach for Speed Management has a five-stage framework to establishing a speed management plan.

1. Establishing a vision and building consensus for speed management

The first step in establishing a vision for a speed management program is understanding the legal constraints and sociopolitical factors in the jurisdiction. The first section details the governing policies of the city, county, and state. Understanding which roadways fall under which agency ownership will determine which policies are applicable to those roadways. The policy research conducted shows: the City of Kirkwood has authority to set speed limits on roadways which they own; St. Louis County has guidelines for minimum and maximum speed limits for particular roadway facility types, but does not have a set methodology to determine new speed limits if desired to do so; MoDOT provides specific guidelines for speed limit setting in the MoDOT EPG which are centered on 85th percentile speeds; and finally the EPG does provide a series of reasons to lower the speed limit based upon crash history and contextual elements of the roadway, but largely centers the setting of speed limits on 85th percentile speed data. Understanding of the ownership and policy of the roadway owners will help aid in identification and prioritization of roadway segments for speed limit changes.

Next, it is critical to identify appropriate target speeds for roadway designs. The goal of a speed management plan is to achieve operating speeds at the target speeds for prioritized locations. It is important to note a target speed reduction is unlikely to be reached on speed limit changes alone. Drivers often misjudge their speed with research showing drivers operate vehicles 30% higher than their perceived speed in low-speed limit areas. Drivers will subconsciously operate their vehicle at a speed that feels appropriate in the built environment context. Changes to the built environment to reinforce the posted and target speed are the most effective ways to affect driver behavior.

2. Collecting and Analyzing Speed and Safety Data

It is crucial to use quality data to inform the process of speed management plan development. Data collection not only provides the basis for analysis, but also provides a secondary benefit in earning public buy-in. Data collection can easily demonstrate the areas in which unsafe speeding is occurring and build public trust in solutions that would lower speeds and increase safety in those areas.

In addition to speed data, it is also helpful to collect data on the built environment of the roadway network. This can include things such as facility type, number of lanes and lane width, intersection geometry, on-street parking presence, pedestrian and bicycle facilities, and many others. The built environment data can provide more context to the analysis and help an agency understand which improvements are most beneficial.

Crash history is another great contextual dataset to include in speed management. This can help prioritize locations for improvements by selecting locations that are located in high injury networks. It can also help provide context on specific crash types which can be targeted with specific improvements to reduce speeds and improve safety.

Lastly, equity indicators and metrics can also provide valuable context in the speed management plan. One of the key elements of Safe Systems is recognizing all roadway users. Equity indicators such as zero-car households, transit locations, income levels, and other factors can indicate density of people walking or riding bikes in an area or those with little equity access to transportation. These factors provide insight into the density of vulnerable roadway users in an area and can help inform prioritization of locations for speed management.

3. Prioritizing Locations for Speed Management Proactively

A proactive approach to safety is a core principle of the Safe System Approach. Utilizing a proactive approach mitigates risk and prevents severe crashes and injuries before they happen. While locations with recent crashes need to be addressed, a speed management plan should also proactively look to improve locations that share similar characteristics to those locations which have experienced a high number of severe crashes. Depending on the type of countermeasures used, it can be more effective to proactively implement several targeted low cost projects across a broader group of locations rather than expensive improvements for a small number of hot spots.

4. Selecting Speed Management Countermeasures

Reducing speed in an area of a high injury network can greatly decrease the severity outcomes of future crashes. Setting an appropriate speed to match the desired target speed must be done with context of the roadway and consistency in mind. A speed limit that is artificially lowered in a roadway segment where the built environment does not promote lower speeds is unlikely to reach target speed levels. The speed limits must also be consistent within the network area to provide the highest compliance rate. Roadways of similar facility types, access, volumes, and other factors should have consistent speed limits so drivers are familiar with similar target speeds and roadway conditions.

Once appropriate speed limits for targeted locations have been determined, the agency should engage with the public to inform of the benefits and build public support. Public engagement should focus on the benefits of promoting the increased safety of reduced speed limits where applicable and the promotion of multimodal safety around lower vehicles speeds. Public buy-in on the safety improvements of targeted locations and speed limits can smooth over any perceived issues of longer vehicle travel times with lower speed limits.

Following these steps, the agency can then look to identify the specific treatments of the targeted locations to match the speed limit changes. As previously mentioned, the most effective behavioral change occurs when the built environment is improved to match the desired outcome and target speed. There are many traffic calming and speed management countermeasures that can be utilized to reach desired outcomes. **Table 1**, shown on the next page, from the Safe System Approach for Speed Management details several common countermeasures, the effective speed reduction after implementation, and the associated crash reduction observed after implementation. Many other traffic calming measures can be utilized for effective speed management applications.

Table 1. Countermeasures from the Safe System Approach for Speed Management

Treatment	Speed Reduction	Crash Reduction
Speed Feedback Sign	3 mph reduction in 85th percentile speed	70% reduction in crashes
Roundabouts	6 mph reduction in 85th percentile speed	75% reduction in crashes
Raised Intersections	5 mph reduction in 85th percentile speed	40% reduction in casualty crashes
Horizontal Deflection (e.g., curb extensions)	Up to 3 mph reduction in speed	30% reduction in pedestrian crashes
Perceptual Countermeasures (e.g., painted speed bars that make drivers feel they need to slow down)	8 mph reduction in 85th percentile speed from perceptual narrowing Up to 5 mph reduction in 85th percentile speed from markings that give appearance of travelling faster on the approach to an intersection	Variable
Transverse Rumble Strips	Up to 3 mph reduction in speed	30% reduction in fatal and serious injury crashes
Reduce Excessive Sight Distance at Roundabouts	Up to 12 mph reduction in 85th percentile speed at roundabouts	Up to 40% reduction in crashes
Lower Speed Limits	4 mph reduction in 85th percentile speed. Note that this various greatly depending on environment.	25% reduction in casualty crashes
Variable Speed Limits	Evidence of overall reductions in speed	8% reduction in casualty crashes
Changeable Message Signs	1 mph reduction in mean speed	10% reduction in injury crashes
Speed Humps	10 – 20 mph at placed countermeasure	40% reduction in injury crashes

In addition to the example roadway improvements listed above, there are many behavioral treatments that can be instituted such as increased speed limit sign density, speed feedback signs, traditional law enforcement, and automated enforcement. One case study from the report noted high rates of compliance following education-forced law enforcement.

5. Ongoing Monitoring, Evaluation, and Adjustment

A speed management plan needs to incorporate an iterative process of monitoring, evaluation, and adjustment to be most effective in achieving the goals of the plan. The process should be treated as a cycle rather than a linear process with a start and end point.

As an agency implements countermeasures and speed limit changes to targeted areas, safety performance will change in those areas over time. Speeding behavior may also shift to other areas of an agency's network. As behaviors and safety performance change, an agency should implement a cycle of ongoing monitoring, evaluation, and adjustment to meet the needs of the network. An agency should

set performance measures so the ongoing process can constantly evaluate the effectiveness of the speed management plan.

Data collection and monitoring should be taken following the implementation of the speed management plan's targeted countermeasures in order to measure the effective outcomes of those treatments. An agency may find certain countermeasures are more effective than others in their given jurisdiction. This provides valuable insight into which countermeasures should be implemented at future locations and which locations need supplemental treatment to reach target speeds. Collection of both speed and crash data on a regular basis allows the agency to monitor if target speeds are being achieved and the safety outcomes of the changes in speed due to targeted treatments.

Enforcement is another key component of a speed management plan and active evaluation of its effectiveness. As previously discussed, drivers will operate vehicles based on their perception of safety and the context of the built environment. Effective enforcement aids in lowering speeds where a driver's perceived safe operating speed is higher than that of the posted and target speed limit. Automated speed enforcement cameras can be a valuable tool for this application, but they must be placed with the sole transparent purpose of improving roadway safety. Locations should be carefully chosen near areas such as schools and other high density of vulnerable user areas so drivers understand the cameras are expressly for safety benefit. Another option for public perception-friendly enforcement is educational targeted location enforcement stops. In this case, the police department can target the key areas for traffic speeding and safety violations, but the stops are made with education enforcement in the forefront. The goal is not to punish and ticket drivers but rather to educate drivers on their speed and driving behavior and how to increase safe operations in the targeted area. This version of targeted enforcement can provide better public perception outcomes as drivers are transparently given the notion the enforcement is to increase safety in the targeted area.

Education is a key part of the ongoing monitoring, evaluation, and adjustment of a speed management plan. Agencies should strive to cultivate a culture of safe speeds and safe driving behavior. Public engagement to establish a relationship with citizens is invaluable in this process. Public engagement helps to create a safety culture where drivers operate at safe speeds for the sake of community safety rather than only out of legal obligation. This is another form of proactive speed and safety management. Through the continued collection of data, enforcement of posted speed limits, and public education, an agency can create a highly effective long-term process to achieve the goals of their speed management plan. The agency can analyze the effectiveness of the process by completing these steps on a time based schedule such as every three to five years. This provides enough time to see the changes in driver behavior in targeted areas as well as any shifts in undesired behavior to other locations in the network.

City Limits - Setting Safe Speed Limits on Urban Streets

Published by the National Association of City Transportation Officials (NACTO), City Limits provides a framework to safe speed management in urban areas. The document contends that the 85th percentile methodology often cited for speed limit determination poses several issues in the modern world. As a methodology based on 85th percentile is rooted in existing driver behavior, the metric becomes a moving target which shifts in favor of higher speed drivers. The City Limits document proposes methodologies for speed management that do not rely on 85th percentile speeds as the prevailing metric of determination.

City Limits describes three different tools to use for safe speed management. The first is Default Speed Limits. The setting of a low default speed limit ensures consistency in safe posted speeds across the entirety of a municipality. The City Limits provides a set of default speed limits as a starting point for safe operating speeds given surrounding conditions. The document recommends 10 miles per hour for shared streets and alleys, 20 miles per hour for minor streets, and 25 miles per hour for major streets with a provision to consider up to 35 miles per hour if vulnerable users are well protected. The default speed should be listed as in place unless otherwise posted on signs upon entrance to the city.

The second tool is Slow Zones. Slow Zones help designate particular areas of concern with uniform safe speeds. These can be school zones, areas of high pedestrian traffic, or particular neighborhoods or districts of the city. Slow Zones should be properly signed at gateways into the designated area.

The third tool is Corridor Speed Limits. This involves the setting of speed limits on high priority major streets utilizing a safe speed study. This helps determine a safe speed along a major route through a city which often experiences speed and injury outcome issues. The process includes collecting speed data, analyzing existing conditions, determining the best options for speed management, and conducting an evaluation. This approach utilizes a cross reference of collected data combined with risk for vulnerable users to determine a safe operating speed on a major corridor. This approach also helps recommend speed management measures to reinforce desired speed outcomes.

The City Limits document provides a variety of approaches and tools for municipalities to manage speeds in urban areas. The City of Kirkwood currently implements many of these strategies for speed management. The City has a default unposted speed limit of 20 miles per hour which is lower than the that recommended by City Limits. The City also has many different speed zones within its boundaries, many of which are for schools and utilize speed limits of 15 miles per hour. Many of the speed limits currently set within the City boundaries fall under those recommended by the City Limits document. Lastly, the City of Kirkwood conducts studies such as the previous Vision Zero plan and current Toward Zero Safe Streets For All supplemental planning activities which include analysis of existing speeds and safety conditions to identify and remedy problem areas.

NCHRP Research Report 966 – Posted Speed Limit Setting Procedure and Tool

Published by the Transportation Research Board, NCHRP 966 outlines procedures to set posted speed limits and is recommended for use by FHWA. The research behind the study examined a breadth of approaches for setting speed limits. The typical methodology for speed limits often utilizes the 85th percentile speed as the basis for determination. This is also the basis for speed limit setting outlined by the MoDOT EPG. However, there are notable issues with this approach as drivers can and often operate at speeds higher than the true safe operating speed of a given area. Additionally, much of the research which was used as the basis for 85th percentile speed limit setting utilized mainly rural roadways bringing into question the effectiveness in urban and suburban areas. The research team behind NCHRP utilized additional data for suburban and urban roads to fill this data gap.

The report provides a tool based on the research methodologies studied in the research of the project. The tool does not provide a procedure for setting school, work zone, variable, or advisory speeds. The tool utilizes the Expanded Functional Classification System (Expanded FCS) to aid in determination of speeds. This includes roadway context with five settings: rural, rural town, suburban, urban, and urban core. This helps to fill the contextual gap which the 85th percentile-based methodology does not account

for. The Expanded FCS also considers roadway facility types: interstate/freeways/expressways, principal arterials, minor arterials, collectors, and locals. The report also notes the importance of roadway development context with consideration for four types of development: limited-access, undeveloped, developed, and full access. Utilizing the setting, facility type, and development context, the research report creates a matrix with 25 distinct combinations with similar characteristics. For each group, decision rules for speeds are determined by variables such as access density, number of lanes, traffic volumes, lane width, crash history, pedestrian and bicyclist activity, and many others. The variables used for decisions in each group are specific to that group type. For example, areas with the Developed and Full-Access area tags consider more multi-modal variables.

The tool developed as a final product of the research report utilizes an excel based spreadsheet program. Taking into account the land context, roadway characteristics, and collected data detailed above, the tool provides suggested speed limits for the user's target roadway. This is a valuable tool to provide a data driven approach to setting non-statutory speed limits that accounts for more factors than collected speed data.

USLIMITS2 – A Tool to Aid Practitioners in Determining Appropriate Speed Limit Recommendations

This is another FHWA recommended tool for determination of speed limits which provides more data context than collected speed data. This tool was based upon NCHRP Project 3-67. The tool considers collected speed data, traffic volume, roadway characteristics, land development, crash history, on-street parking, pedestrian and bicyclist activity, and more. Similar to the NCHRP 966 tool, USLIMITS2 is not applicable for school zones, construction zones, variable speed limits, or other specific applications. USLIMITS2 is a web-based tool.

Identified Locations for Improvements

Locations for improvements were identified and categorized into two different categories: High Injury Network (HIN) corridors and City-owned roadway locations.

High Injury Network Corridors

Safety is the main goal of a speed management plan. High speeds result in greater injury severity and higher injury and fatality rates. Building upon the City's Vision Zero Action Plan, areas which are located on the identified HIN should be prioritized for speed management practices if applicable. The HIN within the municipal boundaries is largely concentrated on three main corridors: Manchester Rd, Kirkwood Rd, and Big Bend Blvd. These three corridors are the heaviest traveled in Kirkwood and account for a large portion of the number of vehicular crashes. These corridors also have experienced high crash rates leading to their inclusion in the HIN.

These corridors share similar characteristics throughout their lengths and with each other. These characteristics include arterial classification, multiple lanes in each travel direction, heavy vehicular traffic volumes, higher speed limits compared to local roadways, and largely signal controlled

intersections. As these corridors have similar characteristics throughout their length, recommendations on speed management can be applied on a corridor level basis.

The collected speed data and comparison to posted speed limit are shown below in **Table 2**. The locations are sorted from largest to smallest based upon the percent at which 85th speed is over the posted speed limit.

Table 2. High Injury Network Corridor Speed Data (in mph)

Row Number	Location ID No.	Location	Speed Limit	Mean Speed	85th Percentile Speed
1	74	Kirkwood south of Jewell	30	37	43.4
2	14	Kirkwood north of Hollywood	30	38	42.5
3	39	Big Bend west of NB 270 ramps	30	35	41.1
4	36	Big Bend west of Sams Club	35	41.5	46.5
5	35	Manchester east of Dickson	35	40.5	46
6	3	Kirkwood south of Kirkwood Commons	35	38	46
7	37	Kirkwood north of Rose Hill	30	33	39
8	10	Kirkwood north of Washington	30	32.5	38.5
9	1	Big Bend east of Forest	35	39.5	44
10	43	Manchester east of Clay	35	38.5	44
11	44	Kirkwood south of Huntleigh	35	39.5	44
12	54	Big Bend west of Marjean	35	38	43.9
13	2	Big Bend west of Milwaukee	35	37	43.5
14	34	Manchester west of Geyer	35	36.5	42.5
15	42	Manchester west of Bernice	35	36.5	41.5
16	41	Big Bend west of Kirkwood	35	34	39.3
17	9	Kirkwood south of Monroe	30	27	32
18	11	Kirkwood north of Jefferson	30	18	25

On these major corridors, certain countermeasures are not appropriate given the land use and facility type of the roadways. These include countermeasures like speed bumps or other vertical deflection countermeasures which can impede emergency vehicle routes. Broad scale changes to these roadways can yield significant speed reduction outcomes without impeding emergency vehicles or causing significant traffic congestion. These countermeasures include the likes of narrowing lane width markings to change driver perception of space. Wide swaths of pavement can increase driver comfortability with higher speeds. Several stretches of roadway along Big Bend Blvd have two lanes in each direction with a two-way-left-turn-lane median creating a five-lane roadway with a large amount of open pavement. The addition of medians within sections of the two-way-left-turn-lane can reduce the width of drivable pavement and narrow the driver perception of a comfortable speed. Except for a small portion of Kirkwood Road in Downtown, Kirkwood, on-street parking is largely not available on these three corridors, but there are sections of Manchester Road with wider shoulder widths. These wider shoulders can be converted to bump out curbs with extended width sidewalks to narrow a driver's perception of the roadway and increase pedestrian safety. Lane reductions and road diets are another effective tool for decreasing excessive pavement width. Underutilized lane capacity leaves excessive width of roadway available to drivers often leading to higher speeds. Road diets and lane reductions remove lanes of

vehicle traffic in order to promote traffic calming. Special consideration for the minimum capacity of the roadway should be studied before implementing a road diet or lane reduction.

Speed feedback signs are a non-invasive countermeasure that inform drivers of their current speed. These signs can help slow drivers who are subconsciously speeding. Changes to the signal timing progression is another option to affect driver speeds without the need for physical roadway changes. This can come in the form of planned stops during off peak hours to slow drivers at selected points. This can also be achieved by designing the progression with green bands that align with the posted speed limit in turn slowing drivers who are speeding between signalized intersections.

Intersection design can also play a key role in reducing speed on these major corridors. Changes to the intersections such as increased markings for pedestrian walkways, pavement markings to warn of approaching intersections, and implementation of different control types such as roundabouts can help significantly slow vehicles as they approach intersections. Decreased radii of the curb line at intersections can also slow drivers as they approach an intersection to make a turn.

City-Owned Roadway Locations

Identification of City-owned locations for improvement is another important category to address. The HIN corridors represent the locations with the overall highest concentration of injury crash rates, but these corridors do have ownership hurdles to making improvements. Manchester Rd is owned by MoDOT, portions of Kirkwood Rd are also owned by MoDOT, and Big Bend Blvd is owned by St. Louis County. While all agencies are focused on safety, differing ownership does require a collaborative process to make changes. Therefore, this project sought to also identify specifically City-owned locations for improvements as the City is able to independently make improvements at these locations.

In order to determine which locations to include in consideration for improvements, a threshold for inclusion was created. Mean speed and 85th percentile speed were the key factors in determining this threshold. The mean speed is an important factor as it addresses if the average driver is driving at unsafe speeds on a roadway. The 85th percentile speed is also critically important as it addresses if the top end speeders are excessively speeding on a roadway. Higher speeds are directly related to higher injury and fatality rates making it critical to address both the average driver and higher speed drivers.

In reviewing the data and talking with City staff, it was determined to include all locations where the 85th percentile speed was 20% or more above the posted speed limit. At this 85th percentile speed, many of the locations show mean speeds very near to the posted speed limit and there was a natural break in the data. Additionally, the 85th percentile speed is often at the edge of noticeable speeding and increased injury rates when at or above 20% over the posted speed limit. For these reasons, this metric was used as the dividing line for locations prioritized for improvement. When sorting for this metric threshold, 39 City-owned locations met the criteria.

It should be noted that after further discussions with the City, two of the 39 City-owned locations were ultimately excluded from the prioritization and countermeasure recommendation lists due to improvements made in the time between data collection and creation of this report. These were locations #6: Geyer south of Adams and #40 Geyer south of Ashwood. These locations were included in the Geyer Road resurfacing project completed in the summer of 2024. The project included curb extensions at several intersections, an RRFB implemented at Geyer and Jefferson, significant

improvements to the curb ramps and pedestrian facilities on the corridor, and replacement of the signal at Geyer and Argonne, among other improvements. These improvements impact driver perception, calm vehicle speeds, decrease pedestrian crossing distances, and bring additional attention to pedestrian crossings addressing the speeding and safety concerns previously experienced on the corridor.

City-Owned Location Speed Limit Analysis

Once the locations for improvements were identified, the posted speed limits were analyzed to determine if a lower speed limit should be applied. From the best practices research, the City of Kirkwood has the authority to reasonably change posted speed limits on City-owned roadways. Changes in posted speed limits should still have analytical backing to ensure appropriate speed limits are set. Utilizing the methodology from the MoDOT EPG would not result in any lower speed limits as any reductions for crash history, roadway context, and other prevailing factors are not allowed to reduce the prevailing speed below the collected mean speed. Several other tools were considered for this analysis to better take into account external factors and determine if speed limits should be lowered at any of the City-owned locations.

The resulting tool from the NCHRP 966 research report and USLIMITS2 were both considered for this analysis. Ultimately, the NCHRP 966 tool was determined to best fit the needs of the project as it accounts for more of the prevailing factors of the location settings. The tool takes into account facility type, surrounding development, access to the roadway, vehicular volume, pedestrian activity, crash history, and other factors when determining an appropriate speed limit.

The NCHRP 966 tool was utilized for all 39 City-owned locations. The results of this analysis show nearly all locations are currently set at an appropriate speed with only two locations recommended for lower speed limits. The first location identified for potentially lowering the speeds limits was Jefferson between Clay and Kirkwood which was recommended to be lowered to 15 miles per hour from the current 20 mile per hour limit. The second location identified was Monroe west of Kirkwood recommended for a 20 mile per hour from the current 25 mile per hour limit. All other City-owned locations resulted in a recommended speed limit that matched the existing posted speed limit.

The best practice research shows the lowering of the speed limit by itself is not the most effective way to increase driver compliance with the speed limit. Drivers will operate their vehicles at a speed that they perceive to be safe. If the built environment of the roadway does not reinforce the posted speed limit, drivers will subconsciously perceive a higher speed to be safe on that roadway. The most effective way to reach target speeds on a roadway is to change the built environment to affect driver perception.

City-Owned Location Prioritization

Once the locations for recommendations were compiled, a prioritization methodology was developed to determine the order of locations to first address. In keeping with the principles of Vision Zero, the locations were given a weighted score based upon several safety and equity factors. The five factors detailed below were given 20 points respectively resulting in a cumulative score of 100. The inclusion of speed data, HIN presence, and pedestrian and bicyclist crash history puts a heavy emphasis on safety in improving areas currently struggling with high speeds and existing crash issues. The inclusion of equity zones adds another lens of weighting for roadway users located in zones of lower transportation equity.

This approach aligns with the goals of both Vision Zero and Safe Systems as it prioritizes safety of all roadway users.

Mean Speed

20 points – the location mean speed is in the top quartile of percent over the posted speed limit

- 15 points – the location mean speed is in the third quartile of percent over the posted speed limit
- 10 points – the location mean speed is in the second quartile of percent over the posted speed limit
- 5 points – the location mean speed is in the lowest quartile of percent over the posted speed limit

85th Percentile Speed

- 20 points – the location 85th percentile speed is in the top quartile of percent over the posted speed limit
- 15 points – the location 85th percentile speed is in the third quartile of percent over the posted speed limit
- 10 points – the location 85th percentile speed is in the second quartile of percent over the posted speed limit
- 5 points – the location 85th percentile speed is in the lowest quartile of percent over the posted speed limit

High Injury Network Presence

- 20 points – the location is within the high injury network
- 0 points – the location is not within the high injury network

Equity Zone Presence

- 20 points – the location is within the highest equity composite score zone identified in the Vision Zero plan
- 0 points – the location is not within the highest equity zone identified in the Vision Zero plan

Pedestrian and Bike Crash Presence

- 20 points - the location is near a recent pedestrian or bike crash occurrence
- 0 points – the location is not near a recent pedestrian or bike crash occurrence

The prioritized list of City-owned locations is located in **Table 3** on the next page.

Table 3. City-Owned Location Prioritization List

Row Number	Location ID No.	Location	Speed Limit	Mean Speed	85th Percentile	Prioritization
1	4	Woodbine west of Kirkwood	15	26.5	31	80
2	52	Woodbine west of Magnolia	25	32	37	80
3	30	Orleans north of Alsobrook	25	31	38.7	80
4	18	Rose Hill west of Kirkwood	25	30	34	70
5	51	Couch south of Woodbine	25	30	34.5	70
6	20	Wood south of Alfred	20	22	27.5	65
7	47	Chester east of Kirkwood	20	28	33.6	60
8	14	Kirkwood north of Hollywood	30	38	42.5	60
9	15	Craig west of Craigwoods	25	32.5	37.5	60
10	37	Kirkwood north of Rose Hill	30	33	39.02	60
11	74	Kirkwood south of Jewell	30	37	43.4	60
12	25	Geyer north of Jewell	15	24.5	30	60
13	48	Washington b/w Taylor and Kirkwood	25	27	33.25	60
14	75	Geyer north of Windsor Spring	25	31	35	60
15	5	Geyer north of Woodbine	25	27.5	31.5	55
16	21	Rose Hill west of Andrews	30	36.5	42.5	55
17	31	Milwaukee south of Meacham	25	28	33.88	50
18	13	Dougherty Ferry west of Chopin	30	31.5	37	50
19	19	Monroe west of Kirkwood	25	23.5	30	50
20	22	Ann west of Nelda	25	28	33.8	50
21	32	Fillmore south of Thomas	25	30	34.9	50
22	45	Jefferson b/w Clay and Kirkwood	20	18	24.4	50
23	57	Geyer north of Manchester	25	30	34.8	50
24	62	Essex east of Clay	25	29	33.5	50
25	12	Essex east of Clemmons	25	26.5	33.5	40
26	17	Taylor north of Quan	25	26	33.5	40
27	27	Lindemann south of Lynkirk	30	33	38.7	40
28	64	Essex east of Chopin	25	27	32.7	40
29	10	Kirkwood north of Washington	30	32.5	38.5	35
30	29	Holmes south of Scott	25	30	34.6	30
31	65	Clay south of Clinton Pl	25	30	34.3	30
32	55	Woodlawn south of Adams	25	28	32.7	25
33	67	E Essex west of Woodlawn	25	28	32.8	25
34	50	Woodgate north of Manchester	25	27	32.4	20
35	59	Woodlawn south of Fairway	30	34	38.6	20
36	61	Argonne west of Woodlawn	25	27	32	15
37	66	Longview east of Greenleaf	25	26	30.7	10

City-Owned Location Prioritization Recommendations

The best practice research shows the lowering of the speed limit by itself is not the most effective way to increase driver compliance with the speed limit. Drivers will operate their vehicles at a speed that they perceive to be safe. If the built environment of the roadway does not reinforce the posted speed limit, drivers will subconsciously perceive a higher speed to be safe on that roadway. The most effective way to reach target speeds on a roadway is to change the built environment to affect driver perception. This section details which countermeasure(s) should be implemented to achieve target speeds in areas of speeding.

Countermeasures for recommendation were compiled from the City of Kirkwood Traffic Calming Guidance, Safe System Approach to Speed Management, and other leading sources. In order to determine which countermeasures may be most effective, each City-owned location was individually evaluated. Context factors such as roadway facility type, roadway access, surrounding development, vehicular volume, pedestrian activity, and posted speed limit were utilized to determine which countermeasures were appropriate given the surrounding context and use of the roadway. Certain countermeasures are meant for different contextual settings. Vertical deflection countermeasures such as Speed Tables and Speed Dips should be applied to low volume, low speed local and collector roadways. Other countermeasures like Lateral Shifts and Curb Extensions are not limited by the same factors and can be applied to a broader range of settings.

Geometric and operational considerations such as roadway width, lane width, presence of on-street parking, presence of bike lanes, and presence of midblock crossings were also key factors in determining which countermeasures were recommended at the City-owned locations. Certain countermeasures such as Median Islands, Lateral Shifts, and Chicanes require wider roadways for implementation. Other countermeasures like RRFBs are applicable on roadways with midblock crossings and Raised Crosswalks are applicable on roadways with stop-controlled approaches.

Location specific recommendations are shown below in **Table 4.** It should be noted the recommendations for each City-owned location are not an exhaustive list of countermeasures which can apply to that location. Additionally, multiple countermeasures are listed at each of the locations, but each individual countermeasure can be implemented without the need for all listed recommendations at that location.

Table 4. City-Owned Location Recommended Countermeasures

Row Number	Location ID No.	Location Name	Weighted Score	Recommendations
1	4	Woodbine west of Kirkwood	80	Median Islands, Lateral Shift/Chicane and Raised Crosswalk/Intersection at stop-controlled intersections
2	52	Woodbine west of Magnolia	80	Median Islands, Curb Extensions, and Speed Feedback Signs
3	30	Orleans north of Alsobrook	80	Median Islands, Lateral Shift, and Speed Tables
4	18	Rose Hill west of Kirkwood	70	Lateral Shift/Chicanes, Curb Extensions, and Speed Feedback Signs

Row Number	Location ID No.	Location Name	Weighted Score	Recommendations
5	51	Couch south of Woodbine	70	Lateral Shift/Chicanes, Curb Extensions, and Raised Crosswalks/Intersections at stop-controlled intersections
6	20	Wood south of Alfred	65	Speed Feedback Signs and Speed Tables
7	47	Chester east of Kirkwood	60	Speed Feedback Signs and Speed Tables
8	14	Kirkwood north of Hollywood	60	Speed Feedback Signs and Narrow Lane Widths
9	15	Craig west of Craigwoods	60	Lateral Shift/Chicane, Narrow Lane Markings, and Speed Feedback Signs
10	37	Kirkwood north of Rose Hill	60	Speed Feedback Signs and Narrow Lane Widths
11	74	Kirkwood south of Jewell	60	Speed Feedback Signs and Narrow Lane Widths
12	25	Geyer north of Jewell	60	Median Islands, Lateral Shift/Chicane, and RRFB at midblock crossings
13	48	Washington b/w Taylor and Kirkwood	60	Curb Extensions and Raised Crosswalks/Intersections at stop-controlled locations
14	75	Geyer north of Windsor Spring	60	In-Lane Pavement Markings and RRFB at midblock crossings
15	5	Geyer north of Woodbine	55	Median Islands, Lateral Shift/Chicanes, and Speed Feedback Signs
16	21	Rose Hill west of Andrews	55	Curb Extensions, Speed Feedback Signs, and RRFB at midblock crossings
17	31	Milwaukee south of Meacham	50	Curb Extensions, Raised Crosswalks at stop-controlled intersections, and Speed Feedback Signs
18	13	Dougherty Ferry west of Chopin	50	Median Islands, Lateral Shift/Chicanes, and RRFB for mid-block crossings
19	19	Monroe west of Kirkwood	50	Speed Feedback Signs and Raised Crosswalks/Intersection at stop-controlled locations
20	22	Ann west of Nelda	50	Curb Extensions and Speed Feedback Signs
21	32	Fillmore south of Thomas	50	Speed Feedback Signs, Speed Tables, and RRFB at midblock crossings
22	45	Jefferson b/w Clay and Kirkwood	50	Curb Extensions and Raised Crosswalks/Intersection at stop-controlled locations
23	57	Geyer north of Manchester	50	Speed Feedback Signs and In-Lane Pavement Markings

Row Number	Location ID No.	Location Name	Weighted Score	Recommendations
24	62	Essex east of Clay	50	Median Islands, Lateral Shift/Chicane, and RRFB at midblock crossings. Countermeasures should consider the impact of upcoming resurfacing project in the area.
25	12	Essex east of Clemmons	40	Median Islands and Speed Feedback Signs
26	17	Taylor north of Quan	40	Median Islands and Speed Feedback Signs
27	27	Lindemann south of Lynkirk	40	Median Islands, Narrow Lanes, and Speed Feedback Signs. Countermeasures should consider the impact of upcoming resurfacing project in the area which will add buffered bike lanes.
28	64	Essex east of Chopin	40	Curb Extensions and RRFB at midblock crossings
29	10	Kirkwood north of Washington	35	Speed Feedback Signs and Narrow Lane Widths. Countermeasures should consider the impact of upcoming resurfacing project in the area which will incorporate a road diet.
30	29	Holmes south of Scott	30	Narrow Lanes and Median Islands
31	65	Clay south of Clinton	30	Lateral Shift/Chicanes, Narrow Lane Markings, and Speed Feedback Signs. Countermeasures should consider impact of upcoming resurfacing project in the area
32	55	Woodlawn south of Adams	25	Lateral Shift/Chicane, Curb Extensions, and RRFB at midblock crossings
33	67	E Essex west of Woodlawn	25	Speed Tables and Raised Crosswalks/Intersection at stop-controlled locations
34	50	Woodgate north of Manchester	20	Curb Extensions and Speed Tables
35	59	Woodlawn south of Fairway	20	Narrow Lanes and Speed Feedback Signs
36	61	Argonne west of Woodlawn	15	Lateral Shift/Chicanes, Speed Feedback Signs, and Raised Crosswalks/Intersection at stop-controlled locations
37	66	Longview east of Greenleaf	10	In-Lane Pavement Markings and Speed Feedback Signs

The locations chosen for this study were selected based on several factors including crash history, facility type, pedestrian activity, frequent citizen calls, and more. Locations for data collection were also chosen to cover the high injury crash network and high equity score zones which were established as part of the City of Kirkwood's 2021 Vision Zero plan. While the data collection for this study covered a great deal of the city limits, it was not feasible to collect and analyze speed data on all roadways. In order to address other locations not covered by this study, a general applicability matrix was created which can be applied to other locations beyond those evaluated in this speed study.

The matrix displays which roadway facility type, speed limit range, and volume range is most appropriate for the list of countermeasures. This matrix can be used to evaluate locations that were not included in this study and recommend applicable countermeasures for implementation. Other locations of concern can utilize the location's contextual roadway information to select applicable countermeasures from the matrix. This provides a process for analysis and uniform recommendations of other locations. Additional details like roadway geometry and pedestrian and bicycle facilities should also be taken into account when considering the countermeasures at new locations. The countermeasure applicability matrix is shown below in **Table 5**.

Table 5. Countermeasure Applicability Matrix

Treatment	Functional Classification			Speed Limit (MPH)	Volume Range (ADT)
	Local	Collector	Arterial		
Curb Extensions	x	x	x	<45	No Limit
Choker	x	x		<=25	No Limit
Median Island	x	x	x	<45	No Limit
Lateral Shift	x	x	x	<=35	No Limit
Chicanes	x	x		<=35	No Limit
Speed Tables	x	x		<=30	<3,000
Offset Speed Tables	x	x		<=30	<4,000
Raised Crosswalk	x	x		<=30	<4,000
Speed Dip	x	x		<=30	<6,000
Speed Feedback Signs	x	x	x	25 to 45	No Limit
Raised Intersections	x	x		<=30	<4,000
Narrow Lane Markings	x	x	x	No Limit	No Limit
In-Lane Pavement Markings	x	x	x	No Limit	No Limit

Conclusions

Speed management is a vitally important component to maintaining safe roadways for all users. Higher speeds directly relate to higher rates of injury and fatalities, especially if a pedestrian or bicyclist is involved. A speed limit study is an effective first step in understanding speed problem areas in a given network and determining what can be done to counteract excessive speeding.

This study gathered speed data at 75 locations selected in the City of Kirkwood to represent a broad range of roadway facility types and contexts, including areas of high pedestrian activity, locations near schools, HIN corridors, areas within communities of special concern identified through the Vision Zero Action Plan's equity analysis, areas with frequent citizen calls, and several other factors. Data were collected in May of 2024.

Research was conducted on local, county, and state policies and guidelines that govern speed limit setting applicable to the City of Kirkwood. The policies and guidelines show the City is able to set limits at a reasonable speed on roadways that are owned by the City. It is recommended to use a tool for setting speed limits that incorporates contextual setting and user information such as the tool created for NCHRP 966 report. Best practices research shows speed limit changes alone are not the most effective way to reach target speeds in an area. Drivers will operate vehicles at a speed they perceive to be safe. Changes to the built environment will change driver perception and yield the best compliance to speed limits. Therefore, countermeasures for speed management should be applied where a reduction in driver speed is desired.

Locations for improvements were identified by two different categories: high injury corridors and City-owned locations. The majority of the high injury network is located on three major corridors: Manchester Rd, Kirkwood Rd, and Big Bend Blvd. These three corridors are the highest volume roadways and serve as the main thoroughfares through the City. Additionally, these three corridors are partially or wholly maintained by MoDOT and St. Louis County. Improvements on these three corridors would be a collaborative process with the maintaining agency.

Another set of locations for improvements was developed specifically for locations on City-owned stretches of roadway. The City is able to make improvements to these locations without the need for another agency's approval. A threshold was created to determine which of the City-owned intersections would be included for improvement recommendations. The threshold was set for roadways where the 85th percentile speed was 20% or higher than the posted speed limit. At this threshold, the speed data shows the mean speed is at or very near compliance with target speed and the 85th percentile speed is notably faster than the posted speed limit. By filtering through this metric, and removing two locations with recently constructed safety improvements, 37 of the 55 City-owned locations were included for recommendations. Each of these locations was first evaluated to determine if the existing posted speed limit is appropriate using a tool devised from NCHRP 966 research report which utilizes a number of volume, development, roadway setting, and crash history factors. All but two of the City-owned locations were found to be set appropriately.

A methodology was developed to determine the prioritization of the City-owned locations. Five factors were included in a weighted score: mean speed, 85th percentile speed, HIN presence, high equity zone presence, and pedestrian or bicyclist crash occurrence. Each of the five categories were weighted at 20 points for a cumulative score of 100. Finally, countermeasures for speed management were

recommended for the 37 City-owned intersections included in the analysis. These countermeasures were compiled from the City's traffic calming guidelines and the Safe System Speed Management report. Countermeasures were applied to each location based on the facility type, speed limit, volume range, contextual factors, and geometric considerations.