VILLAGE OF BELLWOOD: TECHNICAL ASSISTANCE SAFETY PLANNING

25th Avenue
and Illinois Prairie Path

KEY RECOMMENDATIONS MEMORANDUM

3/22/2022

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1. Introduction

Project Overview

Safety studies take a proactive approach to understanding and addressing unmet traffic safety needs of residents. As communities like the Village of Bellwood grow and evolve, transportation facilities and movement patterns follow suit, and so must their plans to achieve safe operations. By leveraging contemporary traffic safety research, historical safety performance data, and the valuable insights of the stakeholders who drive, walk, bike, live on, and work near these facilities every day, this safety study aims to identify practical goals for the intersection of 25th Avenue and the IPP.

The intersection of 25th Avenue and the IPP should not only be made safer, but it should support the evolving needs of the Village of Bellwood and the various types of travellers who use it. In addition to addressing the types of crashes that have already occurred at this intersection, the broader goals of this project include:

- Expanding safe and attractive mobility for all ages, abilities and modes of travel including pedestrians, bicyclists, those with mobility challenges, older adults, families with children and those who access the nearby Pace bus stops.
- Ensuring that the intersection safely serves the economic development goals in the area, which include attracting retail and dining uses that serve users of the IPP and area residents, planning for increased cycling connections along 25th Avenue which is designated as a north-south bicycle route in the West Central Municipal Conference bicycle plan, and planning for increased truck traffic near and through this intersection as industrial and logistics uses increase in the area.

Document Purpose

In the process of developing the Village of Bellwood's Safety Action Plan for 25th Avenue and the IPP, four major documents were created:

1) Outreach Plan
2) Existing Conditions Report (ECR)
3) Key Recommendations Memorandum (KRM)
4) Safety Action Plan

After the Outreach Plan and Existing Conditions Report were completed, the Key Recommendations Memorandum was developed to begin to explore options for addressing the issues identified in the ECR stakeholder interviews. This document defines a set of traffic safety improvement options which may be developed in the Safety Action Plan, which is the primary deliverable for this project. This document will provide a high-level overview of the key recommendations that were developed through extensive data analysis and community engagement.

2. Emphasis Areas and Concern Categories

Emphasis Areas (EAs) are a tool used in traffic safety analysis to help capture the unique needs of a study area in a few defined categories. Each EA – Pedestrians and Bicyclists, Speeding/Aggressive Driving, and Heavy Vehicles – is defined based on patterns of crashes; driver behaviour patterns associated with crashes; patterns of environments involved in crashes; or specific needs that are expected in the future. They help analysts and stakeholders to focus on the practical steps that can be taken to improve safety by targeting individual EAs. For example, if an EA of Speeding/Aggressive Driving is identified, countermeasures should be chosen which can target this EA, such as traffic calming or increased enforcement at critical speeding locations.

The following three EAs and one concern category were chosen specifically for the intersection of interest based on the unique attributes and crash history of the intersection. They were determined based on a number of factors: a comprehensive crash analysis performed during the Existing Conditions Report; priorities expressed during the stakeholder interviews; and by the Jacobs project team. Countermeasure recommendations will be made which specifically target these identified EAs.

Pedestrians & Bicyclists

With fatalities of vulnerable road users on the rise across the United States, many agencies are exploring opportunities to make their cities more pedestrian- and bike-friendly through safer infrastructure, increased connectivity, and the separation of pedestrian transportation modes, as walking, biking, and public transit re becoming an essential form of movement. The community members and stakeholders of Bellwood have identified the pedestrian and bicyclist experience as a primary area of emphasis for the Safety Action Plan. By proactively identifying and addressing risk factors, the KRM can help to curb safety issues and create a more walkable and bikeable environment.

Countermeasures for this EA include:

- High-Visibility Pedestrian Crossing
- Implement Leading Pedestrian Interval with Pedestrian Countdown Signals
- Construct New, Wider Sidewalks
- Improved Signing and Guidance/Wayfinding on the IPP
- Re-routing Pedestrians and Bicyclists
- Grade Separated Crossing

Speeding/Aggressive Driving

Most severe crashes involve faster vehicle speed or some type of aggressive driving behavior. Faster driving speeds foster an increase in crash severity, especially when vulnerable road users are involved. To improve safety performance, speed management and reducing aggressive driving must be a focus for the Safety Action Plan. Speed management can be achieved through infrastructure improvements, such as lane narrowing, traffic calming, and more, which guide motorists toward safer speeds that are in accordance with posted speed limits. Enforcement treatments may be considered based on identified needs, community input, and research-based assessment of existing facilities.

Countermeasures for this EA include:

- Speed Feedback Devices and Automated Speed Enforcement
- High Visibility Enforcement Campaigns
- Traffic Calming Features

Heavy Vehicles

With recent and future growth of the industrial and commercial facilities surrounding the study area, heavy vehicle traffic volumes are expected to increase. The addition of more buses, tractor-trailers, and single-unit trucks presents challenging issues. The most concerning change would be the significant disparity in heavy vehicle size compared to pedestrian and bicyclists. Additionally, heavy vehicles require a significantly longer stopping distance compared to passenger vehicles.

When compiling countermeasures related to heavy vehicles, it is common to discuss strict laws and regulations related to length, weight, speed limit, and hours-logging. However, some additional topics have been identified for our study area.

Countermeasures for this EA include:

- Improving Visibility + Access Control/AIternative Routes
- Educational Programs

Intersection Improvements

The intersection of two or more streets creates the potential for collisions, such as left-turning traffic conflicting with incoming traffic or right-turning traffic conflicting with a pedestrian crossing. The safety performance of these intersections can often be improved by reducing the number of conflict points present through innovative intersection designs or by reducing the probability or severity of crashes by using other safety treatments. Though intersections are commonly designed to maximize operational performance—i.e., traffic through-put—they may not yet be optimized for safety performance and may exhibit opportunities for further safety improvement. By combining concerns voiced in the stakeholder interview process with proven safety countermeasures, several crashes may be prevented in the future, making intersections and Bellwood, as a whole, a safer place.

To learn about countermeasures and policies related to this EA, check out the following sections:

- Restrict Right-Turn-on-Red (RTOR)
- Modify Signal Phasing for Left-Turning Movements
- Traffic Signal Upgrades
- Install Advanced Warning Signs
- High-Friction Surface Treatment

3. Recommended Countermeasures

A model for approaching infrastructure improvements known as the Safe System approach will be introduced along with several key infrastructure safety countermeasures. These countermeasures were selected based on an analysis of the intersection network and historic safety performance as well as extensive input from community members and stakeholders.

Each recommendation includes a summary with a few helpful attributes. These attributes include the following:

- The EA(s) addressed by the recommendation
- The relative expected cost [low (<$10,000), medium ($10,000 - $100,000), high ($100,000-$1M), or very high ($1M+)]
- The relative average crash reduction effectiveness level
- The relative priority level based on contemporary research and local policy
- The implementation timeline (short/medium/long-term)
- The relative level of invasiveness of the countermeasure (e.g., how much it may impact existing road user experience).

Unless otherwise specified, all strategies shared in this memorandum are recommended for all areas of the intersection.

A Safe System Approach

Moving beyond the traditional approach to traffic safety, the Safe System approach is human-centered, focusing on creating a forgiving environment which anticipates and accommodates for human error through robust, modern infrastructure. A Safe System acts as a safety net for all road users, even in the face of mistakes and errors in judgement, reducing or eliminating opportunities for crashes and minimizing the severity of crashes that do occur. This approach recognizes the value of pursuing behavioral changes in road users through enforcement, education, and policy, but views these as opportunities to further improve the safety of an already safe and forgiving roadway system.

The use of a Safe System approach is especially crucial when patterns of distracted or aggressive driving have been identified. These are behaviors which cannot directly be influenced by roadway design features; however, they can be accounted for through a comprehensive, forward-looking, and safety-driven design. Similarly, at locations which feature higher volumes of pedestrian and bicycle traffic – such as schools, train stations, and central business districts – additional infrastructural considerations must be made to ensure that these road users are protected while minimizing impacts to connectivity and convenience.

Pedestrian and Bicyclist Recommendations

High-Visibility Pedestrian Crossings

Emphasis Area	Pedestrians & Bicyclists
Cost	Low
Priority	High
Implementation Timeline	Short-Term
Target Facilities	All legs of the intersection
Crash Reduction	Low/Medium
Invasiveness	Low

All four legs of the intersection have parallel line crosswalks. These existing parallel line crosswalks can be replaced with designs that have higher visibility, like the 'zebra' design shown in Figure 3-1.

Figure 3-1. Comparison of Deteriorated Parallel Lines to High-Visibility 'Zebra' Pedestrian Crossing

Strategy Benefits. Compared to standard parallel lines, this pavement marking design is more eye-catching to an approaching vehicle and is distinct from other pavement markings. It is meant to increase driver awareness of the presence of pedestrian and bicyclist crossings and improve yielding rates. High-visibility pedestrian crosswalks are an inexpensive safety countermeasure that can be deployed widely and easily within an urban or suburban area. Additionally, these can withstand deterioration over time, staying visible even after normal wear due to roadway use. By appropriately spacing the pavement marking outside of the wheel path, this reduces the wear, increasing the lifespan.

Implementation. All legs of the intersection are candidates for this countermeasure. As of November 2021, the existing crosswalk pavement markings needed replacement, so this improvement could become part of the normal maintenance cycle. At a minimum, if the high-visibility crosswalk designs are not implemented, it is suggested that the existing parallel designs be refreshed.

It is common to implement this countermeasure systemically – identifying a large batch of candidate locations based on infrastructure characteristics, or lack thereof, and improving them concurrently, often under a single contract. This approach could be implemented at all signalized intersection along 25th Avenue or Madison Street/South Maywood Drive, regardless of there being a history crashes that involved pedestrians or bicyclists. This would be considered a proactive, systemic approach.

The general comment of updating the striping at the intersection was mentioned several different times during the stakeholder interview process, with several of these comments specifically mentioning crosswalk that deserve attention. Simultaneously, the stop bars along each leg could be refreshed so further influence drivers to leave a safe distance between their vehicles and the crosswalk users.

Implement Leading Pedestrian Interval (LPI) with Pedestrian Countdown Signals

Emphasis Area	Pedestrians & Bicyclists
Cost	Low
Priority	Medium
Implementation Timeline	Short-Term
Target Facilities	All legs of the intersection
Crash Reduction	Medium
Invasiveness	Low

Pedestrian and bicyclist crashes at signalized intersections commonly involve vehicles making turns. To mitigate the potential of that encounter, a leading pedestrian interval (LPI) is a potential traffic signal timing treatment. It involves a small modification to the beginning of a traffic signal cycle, giving pedestrians and bicyclists a 3-7 second head start on their crossing movement when entering an intersection relative to the corresponding green signal phase in the same direction of vehicular travel. The countdown signal displays the number of seconds remaining to cross the crosswalk and is displayed with the "WALK" signal. The countdown starts at the onset of the WALK phase.

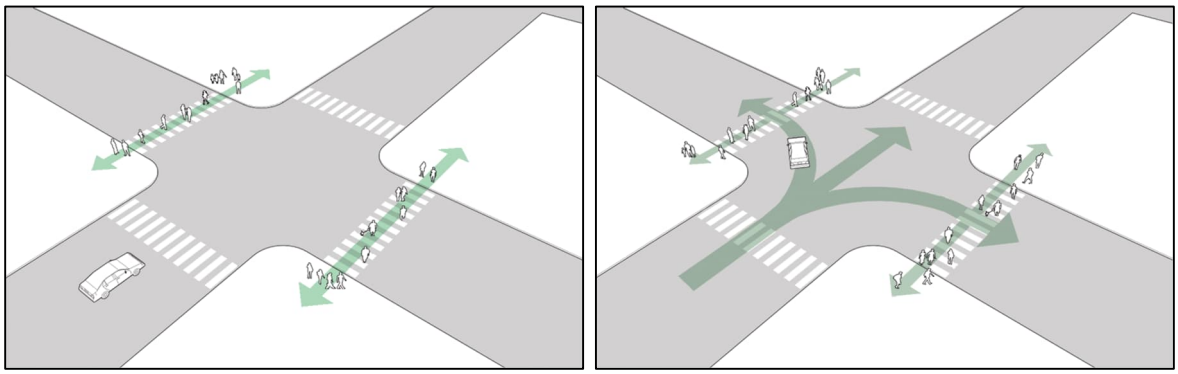

Figure 3-2. Leading Pedestrian Interval Phases (source)

Strategy Benefits. The left half of Figure 3-2 shows a single vehicle with multiple pedestrians in the crosswalk. The vehicle intends to make a left turn, but prior to starting that movement the pedestrians are provided a "WALK" signal. By providing pedestrians with a head start in crossing, an LPI increases pedestrians' visibility within the crosswalk, increasing the likelihood the left-turning vehicle yield or wait for a gap, as shown in the right half of Figure 3-2. This has been shown to significantly reduce pedestrian-vehicle collisions, improving safety and comfort for vulnerable road users. The countdown provides pedestrians with information on how much time they have to cross the street, so that they have more confidence to cross before the "WALK" phase ends.

Implementation. LPIs are only applicable at signalized intersections and require a pedestrian crossing indicator, which are present at 25th and Madison Street/S. Maywood Drive.

Based on Google Street View observations, pedestrian signal heads may not be working at each corner of the intersection and there is no pedestrian countdown signal/push-button for crossing the Maywood Drive leg of the intersection. For consistency, pedestrian signals should be placed on all legs of the intersection and updated to include pedestrian countdown signals.

Based on the findings of the Existing Conditions Report and initial input from stakeholders, both LPIs and pedestrian countdown signals would be well received.

Signal phasing diagrams were provided by the Village team. However, upon inspection of the materials, it was found that the files were dated in the 1980s. If vehicle volumes have increased significantly since, one can also assume the signal timings have changed. For that reason, the materials that were provided were not used in the analysis. Review the current signal timing and update as necessary to reflect the LPI recommendation.

Construct New, Wider Sidewalks

Emphasis Area	Pedestrians & Bicyclists
Cost	Medium
Priority	Medium
Implementation Timeline	Short/Medium-Term
Target Facilities	All legs of the intersection
Crash Reduction	Low
Invasiveness	Medium

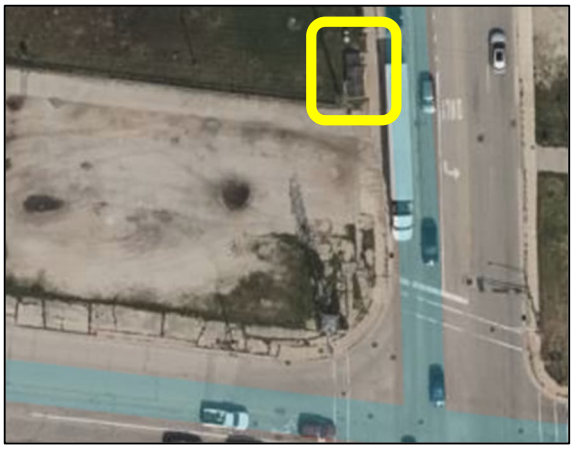

Figure 3-3. Northwest Quadrant of Intersection

Sidewalks are currently located on all four legs of the intersection. The 2018 Illinois Accessibility Code requires sidewalks to be at least five feet wide to provide spaces to pass other pedestrians. However, five feet is not wide enough for pedestrians to comfortably share the sidewalk with bicyclists.

Strategy Benefits. Installing new, wider sidewalks provides users with more space when traveling in opposite directions. This is particularly important on the northwest quadrant of the intersection where the IPP meets the sidewalk, along with the Pace bus depot being positioned on the west side of 25th Avenue, just north of the IPP, as shown by the yellow box in Figure 3-3.

Additionally, installation of new sidewalks can offer an opportunity to provide new ramps compliant with the American Disabilities Act (ADA) and other features which offer greater accessibility to all road users.

The southwest quadrant of the intersection serves as a good example for the setback of the sidewalk from the street's curb. On this corner, there is a buffer of about 4-5 feet of grass between the curb and the edge of the sidewalk, creating a forgiving space for both errant vehicles and wandering bicyclists.

Figure 3-4. Sidewalks with a Width of 7 Feet

Implementation. Installing new, wider sidewalks of at least 7 feet would improve all four legs of the intersection, as Google Street View shows the existing sidewalks with many major cracks and severe settlement. Based on the feedback of the Existing Conditions Report and initial input from residents, the most pressing location for this improvement would be the west side of 25th Avenue, north of Madison Street. This is where Pace riders wait for the bus and encounter bicyclists on the narrow sidewalk.

Some features of the intersection act as a deterrent to this improvement, as there are a considerable number of fixed objects (utility poles, fire hydrants, light poles, etc.) located along the edge of the existing sidewalk.

Improved Signing and Guidance/Wayfinding on the IPP

Emphasis Area	Intersections/Pedestrians/Bicyclists
Cost	Low
Priority	High
Implementation Timeline	Short-Term
Target Facilities	All legs of the Intersection and IPP
Crash Reduction	Low
Invasiveness	Low

Currently, there is no signage like what is shown in Figure 3-5 to indicate the best and safest route to continue along the IPP. The multiuse path on the IPP intersects with 25th Avenue at a 90-degree angle. Users of the IPP who are unfamiliar with its route may not be aware that the preferred route is shown in green in Figure 3-7. Users of the IPP would be unsure to turn right, turn left, or cross 25th Avenue in order to continue their trek. The jaywalking route is shown in red in Figure 3-7.

Strategy Benefits. Eye-catching signage providing directional guidance for IPP users, as shown in Figure 3-6, could prevent jaywalking across 25th Avenue. If users are informed that the correct crossing location is the signalized intersection about 70 feet to the south, this provides them with the knowledge of where the safest crossing should occur.

Another type of signage can transfer non-wayfinding information to the users of the IPP, similar to what is shown in Figure 3-6. This might include a map of the IPP as it stretches through Bellwood, connecting to its neighboring Villages. This informational map or signage could include locations of green space/parks, water fountains, public art displays, bathrooms, coffee shops, convenient stores, and other useful pieces of information to prevent users from unknowingly wandering.

Figure 3-5. Signage for Bike Route

Figure 3-6. Informational Signage for IPP Bike Route

Implementation. Signage would ideally be located where the IPP meets the sidewalks adjacent to 25th Avenue, on both sides.

Re-Routing Pedestrians and Bicyclists

Emphasis Area	Pedestrians & Bicyclists
Cost	Medium/High
Priority	High
Implementation Timeline	Medium/Long-Term
Target Facilities	For IPP at 25th Avenue
Crash Reduction	Medium
Invasiveness	High

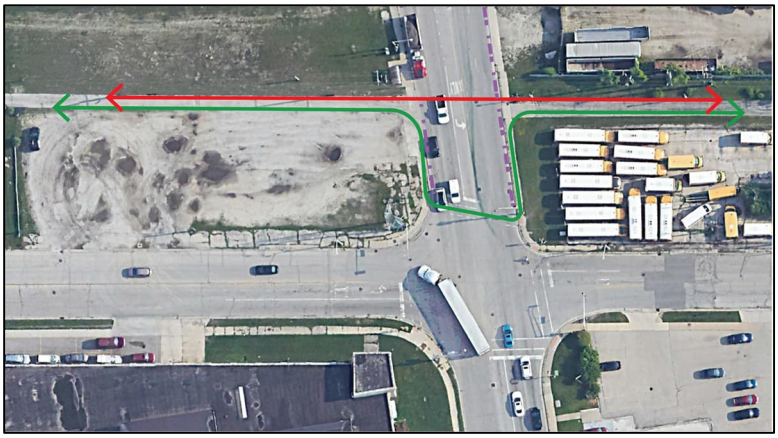

Figure 3-7. Current Crossing Paths

Trail users have two possible options for continuing along the IPP. The first option—which is not recommended—is show by the light red line where the users cross 25th Avenue at the point in which it intersects with the IPP. The second option, shown by the green line in Figure 3-7, is to take a short detour about 70 feet south towards the signalized intersection to cross 25th Avenue using the crosswalk and then head north back to the IPP.

A re-route of the IPP on the west side of 25th Avenue would naturally direct pedestrians and bicyclists to the signalized intersection to cross 25th Avenue at the crosswalk, ideally preventing any jaywalking or jaybiking movement.

Another way of guaranteeing pedestrians and bicyclists use the crosswalk at the intersection is to create a rigid barrier, such as metal fencing along the curb line that prevents jaywalking and jaybiking. This feature would help prevent unsafe crossings but adds a lengthy fixed object along the curb line, potentially creating a safety hazard for vehicular users.

Strategy Benefits. Both re-routing countermeasures briefly mentioned above lead IPP users to the signalized intersection, which would reduce the number of midblock crossings by bringing trail users directly to the crosswalk.

Figure 3-8. Proposed Re-Route of the IPP on the West Side of 25th Avenue

Implementation. The IPP would ideally be rerouted further east and further west from 25th Avenue to provide a shift in the alignment, creating a natural flow to the crosswalk for the trail user. Due to lack of space and right-of-way constraints on the east side of 25th Avenue, a reroute of the IPP roughly 550 feet west of 25th Avenue is suggested, as shown in Figure 3-8. This figure also shows the current location of the path on the west side of 25th Avenue in the white/black striped area.

Realigning the IPP would entail rebuilding the sidewalk to IPP standards, which would be roughly twice the width of the existing sidewalk. Utilities, such as the power line running along the north side of Madison Street, would need to be assessed for interference in the sidewalk expansion. Any utilities prohibiting the expansion of the sidewalk would need to be relocated, incurring additional cost. Furthermore, future development will need to be considered in the area before implementation.

Grade Separated Crossing

Emphasis Area	Pedestrians & Bicyclists
Cost	Very High
Priority	High
Implementation Timeline	Long-Term
Target Facilities	For IPP at 25th Avenue
Crash Reduction	Medium
Invasiveness	High

Figure 3-9. Overpass Bridge of the IPP in Algonquin, IL

A footbridge or bike bridge, as shown in Figure 3-9, is a grade separated structure that would take users from one side of 25th Avenue to the other side, keeping users safe from the traffic below. Similarly, an underpass would provide the same protection to its users, as seen in Figure 3-10.

Strategy Benefits. An overpass or underpass separates vehicles from pedestrians and bicyclists, resulting in safer crossings. An overpass or underpass would also enhance access of the IPP to pedestrians and bicyclists who may be too intimidated to cross a street shared with vehicles. Additionally, removing pedestrian and bicyclists from the intersection would increase the efficiency of the traffic signal.

The City of Broadview was recently awarded Local Transportation Alternatives Program funding to build a shared-use path along 25th Avenue, which lies roughly ½ mile from this study area. Providing a major infrastructural change like these provides Bellwood residents with a greater opportunity when utilizing their regional bicycle network.

Figure 3-10. IPP Tunnel in Crystal Lake, IL

Implementation. An overpass would cross 25th Avenue at the current intersection with the IPP, as shown in the rendering of Figure 3-11. Ramps over 25th Avenue would begin far enough to the west and east of the intersection to allow for a comfortable change in elevation for the trail user and provide enough vertical clearance for the traffic underneath. This type of improvement comes along with many potential obstacles. There are utilities adjacent to where the bridge would be. Additionally, land acquisition may be necessary to allow for the proper width of the overpass.

Figure 3-11. Rendering of IPP Overpass Bridge at 25th Avenue

Speeding/Aggressive Driving Recommendations

Speed Feedback Devices and Automated Speed Enforcement

Emphasis Area	Speed Management
Cost	Medium
Priority	High
Implementation Timeline	Short/Medium-Term
Target Facilities	All legs of intersection
Crash Reduction	Medium
Invasiveness	Low

Dynamic speed feedback signs measure the speed of approaching on a digital sign board, offering immediate feedback to motorists, as shown in Figure 3-12. These are often installed along with other guidance such as speed limit signs for comparison, pedestrian crossing signs, and school zone signs. Speed limit signs indicating 30MPH are located along 25th Avenue north and south of the IPP, while the east/west leg has a 25MPH speed limit The juxtaposition of these signs provides a narrative to motorists which encourages driving within the speed limit and actively considers how their speed may impact their and other road users' safety. This is especially important to heavy vehicles who take longer to come to a complete stop.

These feedback signs can be paired with some type of camera or video recording device to act as an automated enforcement feature. If a vehicle exceeds the speed limit, a photo or video is taken, which is then shared with the registered owner of the vehicle. A fine or some type of monetary punishment is typically associated with the speeding behavior. It should be noted that use of these kinds of enforcement devices varies by municipality throughout Illinois.

Figure 3-12. Speed Feedback Sign

Strategy Benefits. Similar to general traffic calming measures, speed feedback signs attempt to promote safe driving behaviors without actively using enforcement or changing the operational characteristics of the roadway. They are also inexpensive to implement and have very little impact on the function of the roadway or the aesthetic of the location.

Implementation. Speed feedback signs are best implemented on relatively low-volume, two-lane roads where sensors can provide feedback to individual drivers. They are most commonly installed along collector roads within or around neighborhoods, minor arterial roads, or roads surrounding schools and parks.

Based on stakeholder feedback, a speed feedback sign may be most beneficial for northbound traffic on the southern leg of the intersection and westbound traffic on the eastern leg of the intersection.

High Visibility Enforcement Campaigns

Emphasis Area	Various
Cost	Low/Medium
Complexity	Low
Implementation Timeline	Short-Term
Target Partner	Enforcement, Educators
Crash Reduction	Low
Priority	Medium

High Visibility Enforcement (HVE) is a universal traffic strategy approach designed to create a deterrence and change unlawful traffic behavior (source). HVE techniques and approaches can vary depending on the EA that is being targeted. However, the most common enforcement campaigns target impaired, distracted, speeding, and aggressive drivers. Though some common enforcement tactics are not advertised to the public, the deliberate use of highly visible elements and publicity strategies to engage and educate the public has been shown to promote voluntary compliance with the law.

Strategy Benefits. HVE campaigns can produce a noticeable impact on driver behavior in a relatively short amount of time, reducing instances of dangerous driver behavior in critical locations. The framework for this type of program can be evaluated from the early planning stages to eventually a quantitative analysis of citation, arrest, and crash data, as well as survey data from local communities. Social media can also contribute to promoting such programs to keep the public aware of what efforts are being made to ensure safe travel for all road users.

Implementation. HVE campaigns are most effectively implemented where existing patterns of speeding or impaired driving have been detected and where reducing speeding violations are most crucial to vulnerable road users, such as near schools, park, or multi-use paths. Based on feedback from the stakeholder interviews, the study area would be a good candidate for HVE campaigns.

Traffic Calming Features

Emphasis Area	Speed Management
Cost	Low/Medium
Priority	Medium
Implementation Timeline	Medium/Long-Term
Target Facilities	All legs of intersection
Crash Reduction	Low/Medium
Invasiveness	Low/Medium

The width of the road often dictates how fast a driver goes, despite what the posted speed limit may enforce. Traffic calming involves the use of relatively low-impact design features and modifications to the roadway and the surrounding environment to indirectly slow down vehicle traffic and create a more friendly environment for non-motorized road users. By altering the appearance or feel of a roadway environment, conditions can be created where drivers naturally drive slower and yield to pedestrians and other vulnerable road users. This can be done through environmental design methods such as planting more trees, adding supplemental signing, or installing sidewalk features like benches and planters. These alter motorists' perception of the facility, slowing them down closer to what the appropriate speed limit is. Traffic calming should be designed for the specific location being targeted to ensure greatest effect.

Figure 3-13. Traffic calming examples

Strategy Benefits. By reducing average driving speeds and improving attentiveness, traffic calming helps to create more pedestrian-friendly and multi-modal environments. This creates lasting safety improvements for vulnerable road users and makes walking and biking more attractive options for community members. Lower vehicle speeds reduce the frequency of pedestrian collisions and significantly reduces the severity of crashes when they do occur. Additionally, landscaped features and attractive designs associated with traffic calming often offers unique aesthetic benefits.

Implementation. Stakeholder comments encouraged creating an environment around the trail that would make pedestrians and bicyclists feel safe and comfortable using the IPP. Due to a limited roadway cross section, traffic calming measures for this location could consist of changing the area around the roadway rather than changing features of the roadway itself. Traffic calming measures such as landscaping (trees,

benches, water fountains, statues, planters, etc.) would signal to all road users that the area is pedestrian- and bicycle-friendly. Traffic calming would be beneficial along both sides of 25th Avenue north of the intersection, near the Pace bus stop, and IPP.

Heavy Vehicle Recommendations

Improving Visibility + Access Control/Alternative Routes

Emphasis Area	Turning, Angle, Rear-End, Pedestrian, Bicyclists Crashes
Cost	Medium
Priority	Medium
Implementation Timeline	Medium/Long-Term
Target Facilities	High-Volume, Heavy Vehicle Locations
Crash Reduction	Low
Invasiveness	Low

A common issue with suburban/urban areas and locations with high volumes of heavy vehicle traffic is providing the necessary visibility and space for truck drivers to make all their necessary maneuvers in a safe manner. This topic was brought up during the stakeholder interviews. Tractor-trailers backing into the Borg Warner loading/unloading dock have difficulty making this maneuver. The path of the reverse maneuver is shown in Figure 3-14. When trucks approach the Borg Warner property from the north, they are required to pass the loading/unloading docks in order to reverse the trailer with enough of a turning radius.

Figure 3-14. Reversing Path of Tractor-Trailer Into Borg Warner Docks

The act of reversing a tractor-trailer on a route with consistent traffic causes concerns surrounding visibility.

Additionally, suburban and urban areas frequently have structures and buildings that are located closely to each other. This can cause issues for heavy vehicles due to their size.

A solution to the concerns listed above is to create a safer, easier route for deliveries to take place, particularly at the Borg Warner property, that gives heavy vehicle driver better visibility.

Strategy Benefits. Removing the need for trucks to engage deliveries or pick-ups from 25th Avenue would be beneficial to reducing the frequency and severity of all the crash scenarios mentioned above.

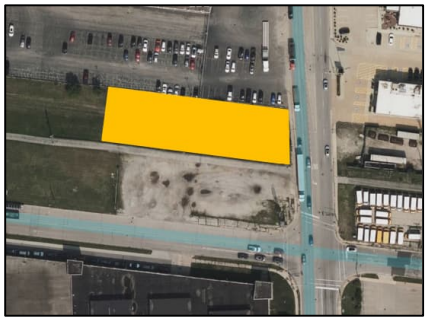

Figure 3-15. Potential for Borg Warner Parking Expansion

Implementation. Stakeholder interviews discussed the possibility of Borg Warner purchasing the plot of land just

north of the IPP and just south of the Borg Warner property, as shown in the orange area in Figure 3-15. This would provide the opportunity to rearrange the loading/unloading docks, removing the need for heavy vehicles to do any reversing movement on 25th Avenue.

Alternatively, the use of 28th Avenue to access the rear of the industrial properties can prove to be another way for preventing undesirable interactions between heavy vehicles and other roadway users.

Educational Programs

Emphasis Area	All Crashes
Cost	Low
Priority	Low
Implementation Timeline	Short-Term
Target Facilities	All legs of the intersection
Crash Reduction	Low
Invasiveness	Low

Educational programs aim to increase the awareness of concerns involved with driving or to provide drivers with the physical skills needed to safely operate their vehicle.

Strategy Benefits. All roadway users can benefit from being more mindful of the expectations needed to travel safely. When it comes to heavy vehicles operating in areas with frequent exposure of pedestrians and bicyclists, emphasis is placed on being aware of those vulnerable users. If bicyclists and pedestrians are a top focus or priority, the frequency of crashes between heavy vehicles and these vulnerable users are ideally minimized.

Implementation. Giving helpful reminders to heavy vehicle drivers can be done in a variety of ways. As loads are delivered or picked up, part of the departure process for the trucks can include businesses reminding truckers to look twice for people along the sidewalks as they make their turns onto 25th Avenue. Similarly, businesses can post signage in break rooms, warehouse areas, and/or delivery bays to refresh the thought of keeping an eye out for pedestrians and bicyclists.

Intersection Improvement Recommendations

Restrict Right-Turn-on-Red

Emphasis Area	Intersections, Pedestrians & Bicyclists
Cost	Low
Priority	Medium
Implementation Timeline	Short-Term
Target Facilities	All legs of the intersection
Crash Reduction	Medium
Invasiveness	Low

At busy intersections with high volumes, like our study area, there are often many conflicting movements which create the possibility of crashes between vehicles or between a vehicle and a pedestrian/bicyclist. The right turning vehicle movement is among the movements most associated with pedestrian/bicyclist crashes. As motorists approach the intersection and are focused on identifying a gap in traffic to complete the turning maneuver, they may not take the time to look out for pedestrians/bicyclists within or entering the crosswalk.

For this reason, it is common to restrict drivers from turning right on red lights where pedestrians have a "WALK" signal to pass in front of them. This restricted movement is indicated by signage on signal mast arms, sometimes indicating enforcement times. Additionally, restrictions can be enforced through automated enforcement.

Figure 3-16. No Turn On Red Sign

Strategy Benefits. By restricting drivers from turning right on red lights, pedestrian crossing phases are offered additional protection, reducing the number of conflicts that pedestrians face when crossing the street during a "WALK" phase. Though the restriction may have some effect on traffic through-put, the safety benefits can be great, especially at facilities with high volumes of pedestrian or bicyclist traffic.

This particular countermeasure is often applied at many intersections within a municipality to normalize the safe behavior of yielding to pedestrian phases. Removing another variable in decision will be beneficial for all users.

Implementation. This countermeasure is most effective where regular volumes of pedestrians pass through an intersection and where turning traffic volumes are relatively high. Based on initial input from stakeholders, the southbound leg of 25th Avenue and the westbound leg of Maywood Drive were identified as possible candidates.

Modify Signal Phasing for Left-Turning Movements

Emphasis Area	Intersections
Cost	Low
Priority	High
Implementation Timeline	Short/Medium-Term
Target Facilities	East/westbound legs of the intersection
Crash Reduction	Medium
Invasiveness	Low

At many signalized intersections, it is common to allow drivers to make a left turn on a green light (i.e., a through traffic phase). In these cases, drivers must observe oncoming traffic, as well as pedestrians in the parallel crosswalk, and identify an appropriate gap to cross the opposing lanes of travel to complete the left turn. Left turning vehicles may be more concerned with finding a gap in oncoming traffic and miss the presence of pedestrians in the crosswalk. This maneuver is one that is often strongly associated with high-severity crashes, especially where left-turning or through traffic volumes are relatively high or where vision may be obstructed, making gap identification difficult and testing the patience of motorists who may choose to take risky moves to expedite the process.

To mitigate these risks, left turn phasing at the traffic light may be modified to offer greater protection to turning passenger vehicles, mass transit vehicles, and pedestrians/bicyclists. This can be done by implementing a protected left turn phase using a dedicated green arrow signal head, motioning when motorists can safely complete a left turn. This would be done in conjunction with pedestrian signals to ensure pedestrians have a "DON'T WALK" signal during protected left turns. This can be added as an additional phase while still allowing permissive left turns (i.e., left turns made during through traffic signals) during through traffic green signals, or such permissive turns may be restricted with a red arrow signal, requiring that all left turns only be made during the green arrow condition. A less restrictive version of this utilizes a flashing yellow arrow during through traffic phasing, allowing permissive left turns when a green arrow is present, but still alerting motorists of the need to yield to oncoming traffic and pedestrians. Restricting left turns with a red light allows protected time for pedestrians to use the crosswalk.

Figure 3-17 Protected left turn phasing

Strategy Benefits. Restricting permissive left turns essentially eliminates the potential for left turn-related crashes which tend to be severe and protects pedestrians using the crosswalk. This greatly improves the overall safety of a signalized intersection without greatly impacting traffic flow if appropriate left turn lanes are present to avoid backups of turning vehicles. Alternatively, if a protected left turn phase (i.e., a green arrow phase) is implemented while still allowing permissive left turns, a moderate safety improvement can still be realized by transferring a portion of left turns being made to the protected phase and restricting pedestrian crossing during the protected turn. Additionally, the implementation of a flashing yellow arrow, though a simple countermeasure, can achieve additional safety benefits without incurring additional cost if the required signal head is already in place.

Figure 3-18. Flashing yellow arrow (source)

Implementation. Restricting left turns to only protected phases is most appropriately implemented at signalized intersections of multilane roadways which are particularly challenging to cross; such intersections

should have existing left turn lanes to store turning vehicles during other phases, as is the case with our study area. Adding protected left turn phasings, while retaining permissive turning, may be appropriate at any signalized intersection which experiences regular left turning traffic volumes. All signalized intersections which have permissive left turn phasing are good candidates for flashing yellow arrows, and this countermeasure is often implemented across a jurisdiction as a policy. Based on the findings of the Existing Conditions Report and initial input from shareholders, the westbound and eastbound legs of the intersection at 25th Avenue would be ideal candidates for a protected left turn phases.

As mentioned earlier in the section that discusses LPIs, the signal phasing details were not known at the time of writing this report. If the traffic signal cycles already include any of the proposed turning movement phases, these countermeasures can be disregarded.

Traffic Signal Upgrades

Emphasis Area	Intersections
Cost	Low
Priority	Medium
Implementation Timeline	Short/Medium-Term
Target Facilities	All legs of the intersection
Crash Reduction	Medium
Invasiveness	Medium

Traditional traffic lights are framed with a non-reflective, black backplate which is not visible, especially at night when the signal blends into the dark background. To improve visibility of signals both during the day and at night, many agencies are installing retroreflective backplates to traffic signal heads. These upgraded backplates are yellow, providing high contrast to the rest of the signal, and are highly reflective, appearing to be illuminated at night, making the signals particularly eye-catching in dark conditions, as shown in Figure 3-19, when they are most likely to be missed. Additionally, upgrading the current 12-inch lens in the traffic signals to 12-inch LED will help with visibility of the signal lights.

Figure 3-19. Retroreflective traffic signal backplates

Strategy Benefits. Improved visibility of traffic signals increases driver compliance and reduces the number of crashes resulting from lack of driver attention or judgement errors due to not seeing the signal. The benefits are especially pronounced at night and can offer strong reductions to crashes in non-daylight conditions.

LED lights are brighter than incandescent lights and will improve visibility. (Reflectivity is not an issue with LED lights – incandescent reflects sunlight on traffic signals facing east and west causing the lights to look lit up when they are not. Lower electrical use/energy efficient.)

Implementation. The signalized intersection should be reviewed and considered for retroreflective backplate treatment and installation of 12” LEDs based on existing lighting features.

Install Advanced Warning Signs

Emphasis Area	Intersections/Pedestrians/Bicyclists
Cost	Low
Priority	Medium
Implementation Timeline	Short-Term
Target Facilities	All legs of the intersection
Crash Reduction	Low
Invasiveness	Low

Figure 3-20. Advanced Pedestrian/Bicyclist Warning Signage

Advanced warning signs inform motorists of potentially unexpected conditions in the roadway or along the side of the roadway that may not be readily apparent. Two types of advanced warning signs would be beneficial in the study area: advanced pedestrian crossing signs and advanced red light camera signs. The advanced pedestrian crossing sign, as shown in Figure 3-20, is used before a mid-block crosswalk or other location where pedestrians may not be expected to cross. Although a mid-block crosswalk is not advised, the placement of the trail now would make the mid-block crossing tempting. There are no advanced warning signs on the north leg of the intersection indicating to motorists that the IPP is ahead, so the trail is not readily apparent from the street.

Advanced warning signs for red light cameras are beneficial when placed in advance of the photo-enforced intersection. An example of this sign is shown in Figure 3-21. Currently, signs are installed at each traffic signal pole.

Figure 3-21. Red Light Camera Warning Sign

Strategy Benefits. On one hand, advanced signs inform drivers of changing conditions ahead. On the other hand, advanced pedestrian crossing signs alert the driver to the presence of a crossing area ahead. With the red-light camera advanced warning sign, the driver would be more alert to the changing of the signal ahead, so that they would have time to react accordingly.

Implementation. Advanced crosswalk signage would ideally be located in advance of the intersection both north and south of the IPP on 25th Avenue.

The advanced warning sign for the red-light camera would ideally be located in advance of the intersection on the north leg of the intersection, as this is the only leg with the red-light camera currently installed. Additionally, due to the limited information available on red-light citations, enhancing data collection from the camera is recommended. A few examples of data that would be beneficial in the data collection process would be including information on repeat offenders, time of day of citations, and vehicle make/model.

High-Friction Surface Treatment

Emphasis Area	All Crashes
Cost	Medium
Priority	Medium
Implementation Timeline	Medium/Long-Term
Target Facilities	All legs of the intersection
Crash Reduction	Low
Invasiveness	Low

High-friction surface treatments are intended to increase the friction between a vehicle's tire and the roadway surface, often reducing the necessary stopping distance.

Strategy Benefits. As mentioned in the Existing Conditions Report, more than 20 percent of all severity crashes occurred with a non-dry roadway surface and more than 37 percent of all crashes were rear-end crashes. Applying a high-friction surface treatment to the approaches of each leg of the intersection could help prevent crashes entirely, or reduce the severity, of all crashes, due to potential deficiencies in pavement friction. This improvement would be beneficial to heavy vehicles, who require longer stopping distances.

Implementation. As the north leg of the intersection services users of the IPP, this countermeasure would be prioritized for the north leg - where IPP users cross 25th Avenue. However, deploying the improvement on all legs would be ideal.

In terms of constructability, the existing pavement should be in need of minimal repair, free of any severe cracking, potholes, or rutting.

4. Conclusion

Several key recommendations have been introduced at a high-level to propose solutions the issues identified in the Existing Conditions Report and in the stakeholder interview process. These areas of concern are summarized in the following four categories: pedestrians and bicyclists, speeding/aggressive driving behavior, heavy vehicles, and intersection improvements. The recommendations provided in this memorandum, as shown in the bullets below, will be extended upon in the final deliverable: the Safety Action Plan.

Pedestrians and bicyclists

- High-Visibility Pedestrian Crossing
- Implement Leading Pedestrian Interval with Pedestrian Countdown Signals
- Construct New, Wider Sidewalks
- Improved Signing and Guidance/Wayfinding on the IPP
- Re-routing Pedestrians and Bicyclists
- Grade Separated Crossing

Speeding/aggressive driving behavior

- Speed Feedback Devices and Automated Speed Enforcement
- High Visibility Enforcement Campaigns
- Traffic Calming Features

Heavy vehicles

- Improving Visibility + Access Control/Alternative Routes
- Educational Programs

Intersection improvements

- Restrict Right-Turn-on-Red (RTOR)
- Modify Signal Phasing for Left-Turning Movements
- Traffic Signal Upgrades
- Install Advanced Warning Signs
- High-Friction Surface Treatment