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Office of the Director
of Public Service and Safety
(937) 335-1725

MEMORANDUM

TO: Mayor Robin I. Oda and Members of Troy City Council

FROM: Patrick E. J. Titterington, Director of Public Service and Safety

DATE: February 12, 2026

SUBJECT: **INEFFECTIVENESS OF RECTANGULAR RAPID-FLASHING BEACONS IN DOWNTOWN SAFETY, STREETSCAPE, AND UTILITIES IMPROVEMENT PROJECT**

During the January 5, 2026 City Council meeting, Councilman Schilling repeated his concerns regarding Rectangular Rapid-Flashing Beacons (RRFBs) not being installed as part of the upcoming Downtown Streetscape, Safety, and Utilities Improvement Project. He made several statements, some incorrect, that were attributed to me or that were based on his personal observations or conversations. To view his concerns, see https://youtu.be/70dcujoJ7zc?si=t4lF87ssuiDAi2uU&t=3940. Those concerns were as follows:

1. Mr. Schilling stated that, during an earlier presentation, the "Oda Administration" claimed that studies have shown RRFBs to be less than effective. He then claimed (incorrectly) that the "Oda Administration" recently stated that no such studies exist. Not only is his statement incorrect but staff has compiled an extensive list of research studies and guidance papers (Exhibit A attached). Those studies indicate that RRFBs are not a universal solution and their effectiveness in low-speed, complex areas such as Troy's downtown is negligible at best and highly dependent on many factors. In fact, this research recommends the exact design elements that are included in our preliminary construction drawings. These elements include well-marked crosswalks, splitter islands, shortened crossing distances, and low driving speeds. These elements are more effective solutions that minimize visual clutter and driver distractions;
2. Mr. Schilling claimed that, based on his personal observations at Heywood Elementary School and on W. Water St. behind Troy Kettering Hospital, RRFBs at the downtown roundabout crosswalks would be effective. However, as the studies in Exhibit A indicate, in addition to the research conclusions described in #1 above, RRFBs may even be counterproductive in downtown areas as compared to other pedestrian crossing areas;
3. Mr. Schilling reported speaking with a sales representative of an RRFB manufacturer, asking whether she was familiar with any studies that would discredit the effectiveness of the product she sells. Her negative response is not surprising but Exhibit A's compendium of 16 different studies raises legitimate questions and concerns about installing RRFBs in Troy's downtown; and,
4. Mr. Schilling wondered if the safety of the downtown crosswalks would be compromised by not having RRFBs installed now compared to later installation. Exhibit B (attached) shows pedestrian crash data for the past seven and half years throughout Troy, which total 45 incidents. Of those 45 incidents, four occurred near the downtown roundabout and another four occurred at non-downtown locations with RRFBs. Several of the research studies referenced in Exhibit A identify cognitive visual overload as a serious concern related to RRFBs.

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Other key points from the 16 studies outlined in Exhibit A include:

A. The addition of traffic control devices and flashing lights in areas (such as Troy's downtown) with high visual complexity, business district storefront signage, dense on-street parking activity, pedestrians, decorative lighting, and wayfinding elements, can create cognitive visual overload. This creates serious distractions for drivers from recognizing the most critical information, such as the presence of a pedestrian in the crosswalk (Sources 1, 2,3, 5, 8, and 14);
B. Splitter islands, short crossing distances, low operating speeds, clear pavement markings, and standard static pedestrian signage (such as our being designed with Troy's streetscape project) are foundational best practices and often provide sufficient awareness of pedestrian proximity. RRFBs are considered supplemental tools that should be installed only when documentation shows other passive pedestrian treatments are inadequate (Sources 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, and 13);
C. Overly complicated, unjustified or poorly designed traffic control installations, such as RRFBs, can lead to vehicle stacking at roundabout entries and exits. Single-lane roundabouts are especially sensitive to interruption from RRFB activation as there is no way to bypass stopped traffic (Sources 7, 8, 10, 11, and 16);
D. These poorly designed traffic control installations at roundabouts can increase rear-end crashes because roundabouts function best when there are simpler treatments and consistent and predictable cues. RRFBs, when activated, can negate the fundamental design objective of free-flow yield conditions causing stop-and-go movement instead (Source 7); and,
E. The presence of RRFBs can create a false sense of security for pedestrians, given that a percentage of drivers do not detect the device and pedestrian safety behavior prior to crossing was not significantly changed by the introduction of RRFBs (Sources 9 and 15).

The final designs and engineering are nearing completion and will be submitted to Council for authorization to bid in the near future. The proposed design will have the foundational traffic control elements discussed in the research studies, including mid-crosswalk pedestrian refuge (splitter) islands, retroreflective thermoplastic crosswalk striping, appropriate standard pedestrian signage, and geometric features such as extended curbing "bump outs". These foundational treatments should control speeds, shorten crossing distances, and increase visibility, without the expense and potential visual cognitive overload and other limitations of RRFBs.

As always, I am available at Patrick.titterington@troyohio.gov or (937)875-2642 for any additional questions.

attachments

Exhibit A

Evaluation & Research of Rectangular Rapid-Flashing Beacons (RRFB) Applicability

Evaluation:

Research indicates that Rectangular Rapid Flash Beacons (RRFBs) are not a universal solution and may even be counterproductive in low-speed, visually complex environments where basic crosswalks perform well. In FHWA-HRT-15-041 (2015)[1], driver yielding ranged from 22 to 98 percent at treated crossings, demonstrating that RRFBs do not reliably resolve pedestrian conflicts. The study emphasized the need for "dark time" so drivers can read signs and see pedestrians. RRFBs are recommended as supplemental tools while clear pavement markings and standard pedestrian signs remain the foundation of pedestrian safety. Thriving businesses, holiday decorations throughout the year, wayfinding signage, on-street parking activity, etc. make downtown Troy a unique situation. There is substantially less visual clutter on McKaig near Heywood than there is entering or exiting the square. Research does not suggest installing RRFBs in a downtown roundabout because:

- **RRFBs increase visual clutter while passive options do not:** Attention-seeking devices in urban environments increase visual clutter and can dilute driver focus[2] reducing the likelihood of identifying the most critical information[3]. Driver yielding depends on simplicity and manageable cognitive workload[4]. Well-marked crosswalks with standard signage often provide adequate yielding in lower speed environments[5]. Passive treatments were effective in reducing speeds and improving visibility[6]. The MUTCD (2023)[7] warns that unnecessary signals and beacons can increase delays and crashes.
- **Roundabouts show high pedestrian safety performance without RRFBs**: FHWA[8] and NIH simulator research[9] found that splitter islands, short crossing distances, and low operating speeds simplify pedestrian crossings. Frequent activation of RRFBs at roundabouts led to vehicle queuing and congestion of circulating traffic. Research confirmed that roundabout capacity is sensitive to interruptions[10] and supplemental pedestrian treatment should be used only when clearly warranted[11]. Studies do not identify low-speed, compact urban settings as contexts requiring RRFBs, nor do they suggest that flashing beacons are necessary where the pedestrian crossing task is simplified[12].
- **National and state guidance cautions against default use of RRFBs**: Researchers caution users from installing RRFBs without comparing the sample roads, which were often multilane suburban areas, to the proposed roadway, a single lane roundabout in an urban business district[13]. USDOT explicitly warns that unnecessary signals and beacons can increase delay and crash risk[7]. ODOT frames flashing beacons, including RRFBs, as optional and situational treatments[14]. Both state RRFBs and like treatments should only be installed as supplemental pedestrian treatments.

A study on 25-mph campus streets (Porter et al., 2016)[15] shows the limited added value of RRFBs in such contexts. Overall driver yielding was already high (~75–80%) before installation, and, despite their cost, RRFBs did not significantly increase yielding or improve the percentage of pedestrians who looked for traffic before crossing. Pedestrian and driver behavior were influenced more by roadway geometry, medians, and basic crossing design than by the beacons themselves. Research consistently indicates that low-speed, compact roundabout and downtown environments with short, visible crossings, acceptable driver yielding rates, clear pavement markings and standard pedestrian signage, do not warrant the use of RRFBs or other flashing pedestrian devices. Maintaining simple, well-designed crosswalk treatments with standard signage is consistent with national best practices and takes into consideration the human factor of cognitive workload.

Research Sources:

1. Fitzpatrick, K., et al. *Comparison of Driver Yielding for Three Rapid-Flashing Patterns Used With Pedestrian Crossing Signs.* FHWA Publication No. FHWA-HRT-15-041 (2015).

   This study evaluated how different RRFB flash patterns influenced driver yielding behavior at pedestrian crossings. The study showed that yielding rates varied from 22-98%, meaning RRFBs do not always solve pedestrian conflicts. The study highlights that RRFB are attention-based devices whose effectiveness is influenced by surrounding roadways and environmental conditions. FHWA's interpretation emphasizes the importance of "dark time" so drivers can read signs and see pedestrians, explicitly acknowledging that excessive flashing can interfere with visual processing, particularly at night or in visually complex environments, like a downtown area.

   In locations already characterized by high visual complexity, with storefront signage, on-street parking activity, pedestrians, decorative lighting, and wayfinding elements, the addition of RRFBs can increase cognitive and visual workload rather than clarify pedestrian priority. Drivers in turn experience divided attention or delayed recognition, further reducing the consistency of yielding behavior. The study frames RRFBs as a supplement, not a requirement, reinforcing that clear crosswalk markings and standard pedestrian signage remain the foundational elements of pedestrian safety. Given these findings, the passive treatments, which provides constant and predictable information without adding visual distraction, are better aligned with expectations in a low-speed, high-activity downtown setting.

2. Transportation Research Board. *Human Factors Guidelines for Road Systems.* National Cooperative Highway Research Program (NCHRP). Report 600 Second Edition (2012).

   Chapters 9 and 18 emphasized that driver behavior at non-signalized crossings is strongly influenced by expectancy, familiarity, and cognitive workload. Drivers are more likely to detect and respond appropriately to pedestrian crossings when the treatments are consistent with standard, commonly encountered designs. Chapter 9 highlights that adding devices that differ from expected roadway cues can increase cognitive demand and may not improve driver response where crossings are already visible and understood. Driver attention is limited and introducing additional attention-seeking elements can compete with other critical information and reduce the overall clarity of the traffic control environment rather than enhance safety.

   Chapter 18 reinforced these findings by explaining that effective signing depends on legibility, simplicity, and rapid comprehension within limited viewing time. From a human-factors perspective, standard pedestrian crossing signs and pavement markings, when properly designed, placed, and maintained, often provide sufficient communication of pedestrian priority. These chapters support a context-sensitive approach in which existing static signage and crosswalk markings are retained where they function effectively, and the addition of flashing devices such as RRFBs is not warranted without clear evidence of need.

3. Yang, K. *Visual Clutter Study for Pedestrian Using Large Scale Naturalistic Driving Data.* Purdue University (2016).

   This paper examined how excessive signage, signals, and visual stimuli affect both pedestrians and drivers in real-world roadway environments. The study found that visual clutter can negatively

impact driver decision-making, slow reaction times and reducing the likelihood that drivers will correctly identify the most critical information in the roadway. Flashing devices, while attention-grabbing, can contribute to this clutter.

The research supports a more restrained approach to pedestrian treatments, emphasizing that simpler, static signs and clear pavement markings often perform better in terms of comprehension and predictability. The study provides justification for avoiding unnecessary flashing beacons, especially where pedestrian demand is moderate and driver compliance is already acceptable, as additional visual stimuli can reduce rather than improve overall crossing safety.

4. Georgia Department of Transportation. *Pedestrian and Streetscape Guide.* Update 1.2 (2021).

   The GDOT *Pedestrian and Streetscape Guide* strongly promotes context-sensitive design and engineering judgment when selecting pedestrian treatments, emphasizing that no single countermeasure is universally appropriate. The guide stresses that pedestrian safety in urban and downtown environments is best achieved through a combination of lower speeds, geometric design, pedestrian refuge islands, and clear, predictable crossings, rather than default reliance on active warning devices.

   Marked crosswalks with appropriate signage are identified as a best practice, while RRFBs are optional tools requiring an engineering study, not default installations. GDOT also highlights that streetscapes inherently contain multiple visual elements, and that simplicity and legibility are key to maintaining driver awareness. In a downtown roundabout setting, maintaining standard pedestrian crossing signs and pavement markings aligns with guidance to minimize unnecessary visual clutter, reinforce consistent driver expectations, and support yielding behavior without introducing flashing stimuli that may compete with other downtown visual cues.

5. Guo, H., et al. *The Impact of Crosswalk Design on Driver Performance: Implication for Pedestrian Safety.* University of Washington & Toyota Collaborative Safety Research Center (2019).

   This study evaluated how different crosswalk treatments influence driver attention, yielding behavior, and overall performance. The findings suggest that basic, well-marked crosswalks combined with standard pedestrian signage are often sufficient to communicate pedestrian priority, particularly in lower-speed or familiar roadway environments. Drivers demonstrated clear recognition of pedestrian crossings when pavement markings were visible and predictable, indicating that enhanced treatments such as flashing beacons are not universally necessary to achieve compliance.

   Importantly, the research notes that increasing the number or intensity of visual treatments does not always result in improved safety outcomes. In some cases, additional devices can dilute driver's attention or create uncertainty about which cues are most important, especially when crossings are already clearly delineated. The study supports the idea that consistency and simplicity in crosswalk design improves driver expectancy, reinforcing the effectiveness of

maintaining standard crosswalk markings and signage rather than introducing RRFBs where crash history, volumes, or speeds do not warrant them.

6. Bushell, M., et al. *Costs for Pedestrian and Bicyclist Infrastructure Improvements: A Resource for Researchers, Engineers, Planners, and the General Public*. UNC Highway Safety Research Center. (2013).

   This is a national reference for pedestrian and bicycle infrastructure treatments, emphasizing cost-effectiveness and appropriateness of design choices rather than default use of active control devices. While RRFBs and other flashing beacons are included as one of many possible pedestrian crossing treatments, the report places them alongside, not above, basic crosswalks, striping, medians, curb extensions, and geometric traffic-calming measures. The report highlights that many pedestrian safety improvements with proven benefits are low-cost, passive treatments that work by reducing speeds, shortening crossings, and improving visibility rather than by adding signals or flashing lights.

   Notably, the report does not recommend or prioritize flashing beacons for compact, low-speed, or downtown roundabout environments, nor does it frame RRFBs as a necessary baseline treatment. Instead, it emphasizes that geometry-based solutions such as splitter islands, curb extensions, and roundabouts themselves often deliver safety benefits for all users.

7. U.S. Department of Transportation. *Part 4: Highway Traffic Signals.* MUTCD 11th Edition (2023).

   The MUTCD explicitly cautions that traffic control devices are often treated as a cure-all, and that unjustified or poorly designed installations can increase delay, disobedience, route diversion, and rear-end crashes. Section 4B.03 emphasizes that even when signal criteria are met, agencies should consider alternatives such as signing, pavement marking changes, speed management, geometric revisions, lighting, or median refuge islands rather than defaulting to active control devices.

   For pedestrian hybrid beacons (PHBs) and RRFBs, the MUTCD makes clear that these devices are to be installed only based on an engineering study considering pedestrian volumes, vehicle speeds, roadway width, gaps, and pedestrian delays. This regulatory framing supports the conclusion that if existing crossings function adequately with standard crosswalk markings and pedestrian signs, agencies are fully justified to maintain simpler treatments and avoid unnecessary flashing devices that introduce operational and safety drawbacks without demonstrated benefit.

8. Schroeder, B., et al. *Evaluation of Rectangular Rapid-Flashing Beacons (RRFB) at Multilane Roundabouts.* FHWA Publication No. FHWA-SA-15-069 (2015, Updated 2020).

   FHWA's roundabout research consistently emphasized that pedestrian safety at roundabouts is achieved primarily through geometry and speed control. Splitter islands, short crossing distances, and single-lane approaches are repeatedly cited as the features that "simplify the crossing task" and reduce pedestrian exposure. The study found that several roundabout approaches experienced very low intervention rates even before considering RRFB activation, indicating that passive design alone can provide adequate pedestrian safety.

Relevant to downtown settings, the guide acknowledges RRFB limitations and cautions against over-controlling roundabout environments in ways that may undermine their core safety mechanisms. By reinforcing that roundabouts function best when drivers rely on consistent, predictable cues, the guidance supports maintaining passive treatments over adding flashing devices that introduce additional visual stimuli. In areas where driver yielding is higher and speeds are low, the introduction of RRFBs can contradict the fundamental roundabout design objective of free-flow yield conditions causing stop-and-go movement. Frequent RRFB activation led to vehicle queues forming at roundabout entries, increasing travel time and vehicle congestion within the roundabout.

Additionally, the report documented confusion among pedestrians, including those who are blind, regarding RRFB operation, reinforcing that more devices do not necessarily translate to greater safety. This supports the conclusion that well-designed, passive crossings with predictable layouts and clear markings is preferable to flashing devices in compact downtown roundabouts.

9. Salamati, K., et al. *Simulator Study of Driver Responses to Pedestrian Treatments at Multilane Roundabouts.* Institute for Transportation Research and Education & North Carolina State University. National Institutes of Health (NIH) Pubic Access (2012).

   This simulator study evaluated driver yielding behavior at roundabout exit-leg crossings using eye-tracking and compared a base crosswalk, crosswalk relocation, RRFBs, and PHBs. While both RRFBs and PHBs improved yielding compared to the base scenario, the study found that the eye-tracking analysis showed some drivers failed to visually acquire the pedestrian or treatment entirely, indicating that flashing devices are not fail-safe in complex driving environments. Geometric and signing-only treatments may be preferable in lower-risk environments. Pedestrian reliance on flashing devices can create a false sense of security, since a portion of drivers may never detect the device.

10. Schroeder et al. *Toward Roundabout Accessibility- Exploring the Operational Impact of Pedestrian Signalization Options at Modern Roundabouts.* Institute for Transportation Research and Education, North Carolina State University, (2008).

    This study evaluated how pedestrian signals at one- and two-lane roundabouts affect operation, particularly pedestrian-caused delay and queuing. They tested several pedestrian activated signals and crossing geometries under a range of pedestrian and vehicle volumes. Findings showed that introducing pedestrian signals at roundabout entries can significantly increase vehicle delay and queue lengths, and in some configurations create a risk of exit lane back up into the circulating lane as flows approach theoretical capacity.

    Although the motivation is to improve accessibility, the authors stress that signalizing roundabout crossings is operationally costly and should be pursued selectively, where there is a strong, documented need. They highlight that improved crossing geometry can mitigate delay without relying solely on signalization.

11. Hellinga, B., Sindi, A. *Analytical Method for Estimating Delays to Vehicles Traversing Single-Lane Roundabouts as a Function of Vehicle and Pedestrian Volumes.* University of Waterloo. (2012).

    Hellinga and Sindi (2012) develop an analytical model to estimate vehicle delays at single-lane roundabouts, explicitly accounting for the effects of pedestrian crossings near the roundabout entries and exits. The study demonstrated that pedestrian activity introduces measurable delay by reducing the availability of acceptable gaps for entering vehicles. As pedestrian volumes increase, the resulting yielding behavior leads to exponential increases in vehicle delay and queue formation, particularly because roundabout capacity depends on continuous flow and short, frequent gaps rather than stop-controlled behavior. The authors emphasize that single-lane roundabouts are especially sensitive to interruptions, as there is no ability for vehicles to bypass stopped traffic.

    The findings are particularly relevant when considering enhanced pedestrian treatments such as RRFBs. While the model assumes standard yielding behavior, the results imply that any treatment that increases the frequency or duration of vehicle yielding will further degrade roundabout performance by increasing entry delay and reducing overall capacity. In a low-speed, low-lane environment where pedestrian crossings are already short and highly visible, introducing flashing beacons that prompt more frequent or longer stops would work against the fundamental operational objective of a roundabout: maintaining steady, low-delay traffic circulation. The study therefore supports maintaining simple pavement markings and static pedestrian crossing signage, which allows drivers to yield as needed without creating unnecessary or repeated stoppages that could lead to traffic backups and increased travel time.

12. Fitzpatrick et al. *Will You Stop for Me? Roadway Design and Traffic Control Device Influences on Drivers Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid-Flashing Beacon*. Report No. TTI-CTS-0010. Texas A&M Transportation Institute. (2016).

    Driver yielding at RRFB-controlled crosswalks is highly variable and strongly influenced by roadway geometry, speed, and context, rather than the beacon itself. Across multiple FHWA and state studies, yielding rates ranged from as low as 19 percent to as high as 98 percent. Statistical analysis showed that factors such as crossing distance, presence of medians, intersection configuration, posted speed limit, and traffic direction were consistently significant predictors of yielding, while RRFB design characteristics (shape, placement, and flash pattern) generally were not. These findings indicate that RRFBs do not provide uniform improvements in driver behavior. The report underscores that RRFBs are most often studied and deployed on higher-speed, multilane roadways, and the authors caution that complex traffic conditions may require other treatments. The study does not identify downtown roundabouts or low-speed urban settings as contexts requiring RRFBs, nor does it suggest that flashing beacons are necessary where geometry already simplifies the pedestrian crossing task. Instead, the results reinforce that short crossing distances, median refuge, and simpler roadway layouts can achieve high yielding without reliance on flashing devices, aligning with an approach that minimizes visual clutter and operational disruption.

13. Transportation Research Board. *Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments.* National Cooperative Highway Research Program (NCHRP). Research Report 841. (2017).

    The National Academies' report focuses on developing crash modification factors (CMFs) for treatments at uncontrolled pedestrian crossings, including Rectangular Rapid Flashing Beacons

(RRFBs), pedestrian hybrid beacons (PHBs), pedestrian refuge islands, and advanced yield or stop markings and signs. The study analyzed data from roughly 1,000 urban multi-lane sites to quantify relative effects of these treatments on crash risk. While all treatments were loosely associated with reductions in pedestrian crash risk compared to untreated locations, the report explicitly caution users to carefully review the summary statistics to "see how closely the site under consideration compares to sites in the research study". The data largely reflects suburban roadways with two to six travel lanes and higher travel speeds. As a result, the findings do not establish RRFBs as a preferred or necessary treatment for downtown roundabout settings and instead reinforce the importance of context-sensitive selection. In environments where crossings are short, speeds are low, and geometric features already simplify the pedestrian crossing task, passive treatments such as refuge islands or advanced yield or stop markings can provide the necessary safety benefits without introducing RRFBs.

14. Ohio Department of Transportation. *Multimodal Design Guide: Chapter 4.* (2025).

    Pedestrian safety in downtown and low-speed contexts should prioritize simple, legible, and predictable crossing designs rather than default use of attention-seeking devices. Chapter 4 consistently frames flashing beacons, including RRFBs, as optional and situational treatments, to be considered only where documented operational or safety concerns exist. The guide stresses that well-marked crosswalks, appropriate signage, short crossing distances, and low vehicle speeds are the primary tools for pedestrian accommodation in urban environments, particularly where driver expectancy and frequent pedestrian activity are already present.

    ODOT does not recommend or require RRFBs or any flashing pedestrian devices in downtown or compact roundabout crossings where crossings are short, visibility is good, and yielding behavior is acceptable. The guide highlights that introducing additional visual elements in complex urban streetscapes can increase clutter and cognitive load, potentially reducing driver comprehension rather than improving it. In roundabout contexts, the guidance focuses on utilizing geometry with no expectation of flashing lights as a standard treatment. This approach aligns with the guide's broader principle that flashing devices should not be used by default and should be avoided where basic, non-flashing treatments already function effectively.

15. Porter et al. *Investigating the Effects of Rectangular Rapid Flash Beacons on Pedestrian Behavior and Driver Yielding on 25 mph Streets: A Quasi-experimental Field Study on a University Campus.* Old Dominion University and University of Brasilia, Brazil, (2016).

    There were multiple quasi-experimental field studies on a university campus in Virginia that assessed whether RRFBs improve safe behavior at 25 mph crosswalks. They observed 2,454 pedestrians and 1,312 drivers at five different crosswalk sites. Overall, driver yielding was already high (~75-80%) before the RRFB installation and the presence or activation of RRFBs did not significantly increase the likelihood that drivers would yield to pedestrians. Yielding was better explained by factors such as vehicle type, presence of median, and pedestrian position rather than the RRFB treatment.

    The study also found that there was no significant effect on pedestrians' key safety behavior of looking for traffic before entering the roadway. Looking rates remained high (mid 80-90%) across both control and RRFB treatment sites. This behavior was more influenced by whether the

pedestrians stopped at the curb, whether they were walking alone or in a group, and site geometry. Interviews suggested some increase in perceived safety over time, but this was not clearly attributable to RRFBs. These findings indicate that on low-speed campus streets with already strong yielding, RRFBs provide little to no incremental safety benefit beyond marked crosswalks and static pedestrian signage.

16. Fitzpatrick, K. et al. *Investigating Improvements to Pedestrian Crossings with an Emphasis on the Rectangular Rapid-Flashing Beacon.* FHWA Publication No. FHWA-HRT-15-043 (2015).

    This large FHWA study compared RRFBs and circular rapid-flashing beacons (CRFBs) using staged crossings across multiple U.S. cities. While yield rates were often high when beacons were activated, the generalized linear mixed model found that treatment type (RRFB vs. CRFB) was not a statistically significant predictor of yielding, nor was calculated daily traffic volume. City-to-city differences were far more influential than the device itself, indicating that local driver culture and expectations matter more than installing flashing devices.

    The study also documented substantial variability in beacon brightness and installation quality and noted that pedestrians frequently failed to activate the devices even when provided, sometimes crossing within the crosswalk without using the beacon at all. On the flip side, when pedestrian traffic was low and the RRFB was activated, unnecessary vehicle delays occurred. The authors highlight future research needs around driver search patterns and glare effects, implying that the presence of bright flashing devices may distract drivers or change scanning behavior in unintended ways. These findings undermine the assumption that RRFBs are universally effective and suggest that environments with modest pedestrian volumes, good sight distance, and compliant driver behavior, conventional markings and signage are adequate without introducing complex active devices.

Exhibit B

2018-Present Pedestrian Crash Data

Case Number	Date/time	Location	At Fault
18TR15587	7/31/2018 16:00	Main W/Westbrook	vehicle
18TR22437	10/29/2018 05:00	Race 100 W	vehicle
18TR22657	11/1/2018 07:04	Nashville 1865	unknown (no citations)
19TR00722	1/10/2019 15:43	Market N/Water	pedestrian
19TR01025	1/15/2019 10:49	Dorset 539 S	unknown (no citations)
19TR11536	6/14/2019 12:22	Market S/Race	pedestrian
19TR14334	7/23/2019 22:10	Main W/Short	vehicle
19TR19161	9/27/2019 15:36	Main W/I75	unknown (no citations)
19TR19512	10/2/2019 17:07	Staunton E/Ohio	vehicle
19TR21792	11/4/2019 15:38	Market S/Race	vehicle
20TR00612	1/10/2020 16:57	Dorset 1260 S	pedestrian
20TR01507	1/22/2020 07:46	Market N/Ferguson	vehicle
20TR01362	1/22/2020 08:32	Stanfield S/Meadowpoint	vehicle
20TR15740	9/16/2020 08:00	Main W/Elm	vehicle
20TR17469	10/13/2020 15:57	Market N/Cricket	vehicle
21TR09447	5/24/2021 08:33	Grant/Race W	vehicle
21TR11295	6/20/2021 06:42	Main W/Weston	scooter at fault
21TR18307	9/30/2021 07:17	Market N/Ferguson	vehicle
21TR19493	10/18/2021 14:35	Main W/Elm	vehicle
22TR05196	3/19/2022 16:34	Main W/Troy Town	pedestrian
22TR06005	3/25/2022 07:30	Market N/Cricket	vehicle (hit/skip)
22TR18861	10/6/2022 15:33	Market N/Public Square	vehicle
22TR19153	10/10/2022 19:33	Market N/Foss Way	unknown (no citations)
22TR20709	11/2/2022 15:26	Cherry S/Terrace Place	pedestrian
23TR01854	1/30/2023 17:27	Market S/Race E	vehicle
	2/1/2023 14:30	Main W/Public Square	unknown (no citations)
23TR04051	3/8/2023 17:27	Dronfield 22	unknown (no citations)
23TR07410	5/3/2023 18:51	Market N/Public Square	unknown (no citations)
23TR11649	7/7/2023 23:57	Miami/Meadow	vehicle
23TR14262	8/16/2023 12:35	Water W/Cherry N	unknown (no citations)
23TR17137	9/29/2023 16:51	Main E/Mulberry S	pedestrian
23TR22047	12/16/2023 15:23	Elm N/Jefferson	pedestrian
24TR01040	1/16/2024 16:36	Market S/Canal E	vehicle
24TR02777	2/13/2024 07:13	Stanfield S/Stanfield W	vehicle
24TR06670	4/13/2024 14:23	Cameo Circle 24	pedestrian
24TR09868	5/29/2024 13:12	Main E/Mulberry	vehicle
24TR11416	6/20/2024 16:56	Walnut S/Race E	vehicle
24TR13143	7/15/2024 23:11	Main 1350 W	skateboard
24TR14784	8/8/2024 00:00	Market N/Water	vehicle
24TR19578	10/20/2024 12:20	Stephenson/Stonyridge	vehicle(hit/skip)
24TR19919	10/25/2024 19:41	Adams/Water W	vehicle
24TR20077	10/28/2024 15:57	Pennsylvania/Race	Scooter (stop sign)
25TR17795	9/10/2025 17:30	Canal 629 E	Scooter
25TR20713	10/22/2025 07:22	Adams/Water W	vehicle
25TR20796	10/23/2025 07:28	Adams 200 (Community Park)	vehicle
25TR22759	11/21/2025 17:30	Market N/Public Square	vehicle
25TR24424	12/16/2025 13:48	Market N/Staunton Rd W	unknown (hit/skip)

Notes:

Yellow = Pedestrian-involved crash at downtown roundabout (4)

Orange = Pedestrian-involved crash where RRFB is installed (4)