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CPBS

Center for Pedestrian and Bicyclist Safety

A Tier-1 University Transportation Center

Pedestrian Level of Traffic Stress (PLTS) Application and Validation

July 2025

A Report From the
Center for Pedestrian and Bicyclist Safety

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About the Center for Pedestrian and Bicyclist Safety (CPBS)

The Center for Pedestrian and Bicyclist Safety (CPBS) is a consortium of universities committed to eliminating pedestrian and bicyclist fatalities and injuries through cutting-edge research, workforce development, technology transfer, and education. Consortium members include: The University of New Mexico; San Diego State University; The University of California Berkeley; The University of Tennessee Knoxville; and The University of Wisconsin Milwaukee. More information can be found at: https://pedbikesafety.org

Disclaimer

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16. Abstract

In this Year 2 project, we use three complementary approaches to assess how well our Year 1 CPBS Pedestrian Level of Traffic Stress (PLTS) method works in practice and how well it represents stress reported by survey participants. First, we received feedback from more than two dozen practitioners who attended PLTS presentations or applied the Year 1 PLTS in their own communities. They generally had positive comments about the PLTS method but also made several helpful suggestions for improvement. Second, we collected the required inputs and calculated PLTS ratings along roadway corridors in three case study communities and compared intersection crossing stress ratings from our CPBS PLTS method with an alternative Safe Streets PLTS method. Both methods provided PLTS ratings that generally matched our expectations. We also found general agreement between how the CPBS PLTS and Safe Streets PLTS methods ranked intersections from low to high stress, but the CPBS method tends to generate higher stress ratings at specific intersections. Third, we developed an online PLTS National Survey that asked participants to rate the stress that they would feel as a pedestrian when crossing roadways and walking along segments based on videos, pictures, and descriptions. Our preliminary analysis of nearly 1,800 responses showed that survey respondent stress ratings are similar to the CPBS PLTS rating for the baseline crossing scenario but lower than the CPBS PLTS rating for the baseline segment scenario. All three types of assessment will help us create a refined PLTS Version 2.0.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

Pedestrian Level of Traffic Stress (PLTS) Application and Validation

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Acronyms, Abbreviations, and Symbols

AADT	Annualized Average Daily Traffic
ADA	Americans with Disabilities Act
LTS	Level of Traffic Stress
ODOT	Oregon Department of Transportation
PHB	Pedestrian Hybrid Beacon
PLTS	Pedestrian Level of Traffic Stress
WSDOT	Washington State Department of Transportation

Abstract

In this Year 2 project, we use three complementary approaches to assess how well our Year 1 CPBS Pedestrian Level of Traffic Stress (PLTS) method works in practice and how well it represents stress reported by survey participants. First, we received feedback from more than two dozen practitioners who attended PLTS presentations or applied the Year 1 PLTS in their own communities. They generally had positive comments about the PLTS method but also made several helpful suggestions for improvement. Second, we collected the required inputs and calculated PLTS ratings along roadway corridors in three case study communities and compared intersection crossing stress ratings from our CPBS PLTS method with an alternative Safe Streets PLTS method. Both methods provided PLTS ratings that generally matched our expectations. We also found general agreement between how the CPBS PLTS and Safe Streets PLTS methods ranked intersections from low to high stress, but the CPBS method tends to generate higher stress ratings at specific intersections. Third, we developed an online PLTS National Survey that asked participants to rate the stress that they would feel as a pedestrian when crossing roadways and walking along segments based on videos, pictures, and descriptions. Our preliminary analysis of more than 1,900 responses showed that survey respondent stress ratings are similar to the CPBS PLTS rating for the baseline crossing scenario but lower than the CPBS PLTS rating for the baseline segment scenario. All three types of assessment will help us create a refined PLTS Version 2.0.

Executive Summary

This report describes follow-up research to apply and validate a PLTS method that our University of Wisconsin-Milwaukee research team developed through a Year 1 CPBS UTC project. Our Year 2 research team expanded to include Safe Streets Research & Consulting and Muse Community + Design.

The Year 1 PLTS project report presented a series of tables that can be used to assign PLTS scores of 1 (low stress) to 4 (high stress) for roadway segments and crossings based on the following inputs (Swift, Schneider, and Nelson 2024).

Traveling along roadway segments (segment PLTS):

- Posted speed limit of adjacent roadway
- Motor vehicle traffic volume of adjacent roadway
- Sidewalk width
- Paved shoulder width
- Buffer width between motor vehicle travel lane and pedestrian space

Crossing roadways (crossing PLTS):

- Posted speed limit of roadway being crossed
- Number of lanes being crossed
- Motor vehicle traffic volume of roadway being crossed
- Presence of traffic signal or pedestrian hybrid beacon (PHB) at the crossing
- Presence of stop sign at the crossing
- Presence of raised refuge island at the crossing
- Presence of curb extension(s) at the crossing
- Presence of rapid flashing beacons at the crossing
- Presence of high visibility crosswalk marking at the crossing
- Presence of accessible curb ramps at the crossing

In this Year 2 project, we use three complementary approaches to test how well our Year 1 CPBS PLTS method works in practice and how well it represents pedestrian traffic stress. First, we received feedback from practitioners who attended PLTS presentations or applied the Year 1 PLTS in their own communities. Second, we collected the required inputs and calculated PLTS ratings along roadway corridors in three case study communities and compared intersection crossing stress ratings from our CPBS PLTS method with an alternative Safe Streets PLTS method. Third, we created and implemented an online PLTS National Survey. As a part of this process, we established specific definitions of PLTS ratings 1-4 and asked participants to rate the stress that they would feel as a pedestrian when crossing roadways and walking along segments based on videos, pictures, and descriptions.

We received helpful feedback about our Year 1 CPBS PLTS from several dozen practitioners after the CPBS PLTS report was first posted in July 2024. Most comments were made in person during and after public presentations at conferences, but several were also provided by e-mail. Practitioners generally had positive feedback about our PLTS method. Still, they suggested several ways that our PLTS framework could be refined (e.g., potentially include additional input variables, such as raised crosswalks) and suggested several ideas to integrate into the validation process (e.g., conduct in-person engagement with people with disabilities and others who were unable to participate in the online national survey).

We applied our Year 1 CPBS PLTS to a total of 617 crossings and 431 segments in the Milwaukee, Albuquerque, and Seattle case study corridors. We also applied the Safe Streets PLTS to the 617 crossings for comparison. It took the student data collectors approximately two hours per mile to gather the PLTS inputs manually from aerial and street-level images and find the correct PLTS ratings from the tables. Therefore, data availability is an important consideration for applying the current version of our CPBS PLTS.

We mapped the CPBS and Safe Streets PLTS ratings for each intersection in the three case study communities. These maps showed a range of PLTS ratings that generally matched the initial expectations of the research team. Intersections along arterial streets with more automobile traffic, more lanes, higher posted speeds, and no traffic control tended to have higher PLTS ratings. We also found general agreement between how the CPBS PLTS and Safe Streets PLTS methods ranked intersections from low to high stress, but the CPBS method tends to generate higher stress ratings at specific intersections.

We distributed the PLTS National Survey publicly between June 9 and July 7, 2025 using a snowball sampling approach. After data cleaning, our final dataset included 1,915 survey responses from 956 unique zip codes in 49 states and the District of Columbia (we received no responses from Alabama). The most responses came from Wisconsin (433), followed by California (125). Oregon, New York, Maryland, Pennsylvania, Colorado, and Illinois all provided at least 60 responses. The greatest concentration of responses came from the Milwaukee metro region, which is not surprising given the origin of the snowball sampling method.

Importantly, 1,210 (63%) of the 1,915 survey respondents had pedestrian safety experience. Still, 497 (26%) had never attended meetings or done professional work about pedestrian issues or street safety. 208 participants did not respond to this question (11%).

Most participants found out about the survey from professional colleagues, but many others found out through social media and other personal networks. Of the 1,697 participants who responded to this question, 853 (50%) received the survey from a professional colleague, 291 (17%) from a social media post, 229 (13%) from a friend, 122 (7%) from a family member, and 52 (3%) from a website.

The survey results facilitated initial comparisons between respondent perceptions of traffic stress and CPBS PLTS ratings. We analyzed the distribution of perceived stress ratings reported by all survey respondents to the first crossing scenario. According to the Year 1 CPBS method, the crossing is PLTS 2, and more respondents chose "Low stress (I would feel comfortable and not mind crossing here)" (PLTS 2) than any other stress rating. These data were consistent with expectations, but there was a range of stress ratings, including nearly one-third of respondents reporting PLTS 3. Respondents with pedestrian or safety experience, as a whole, rated the segment as slightly less stressful than those without experience.

We also analyzed the distribution of perceived stress ratings reported by all respondents to the first segment scenario (S.A2). According to the Year 1 CPBS method, the segment is PLTS 3, which should correspond with "Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)." However, more respondents chose PLTS 2 than any other stress rating, and the response distribution centered around PLTS 2 both for respondents without pedestrian or safety experience and for respondents with experience. In this scenario, respondents with pedestrian or safety experience, as a whole, rated the segment as slightly more stressful than those without experience. Since there was a clear discrepancy between the survey respondent ratings and the CPBS PLTS rating for this segment, this scenario should be examined more closely and the CPBS PLTS rating could potentially be reduced from PLTS 3 to PLTS 2.

Future Year 3 CPBS funding would allow us to conduct more detailed analyses of the PLTS National Survey data, discuss specific PLTS ratings with local practitioners, and collect PLTS ratings from pedestrians with disabilities and other groups underrepresented in our online survey. Building on our current work, these efforts will establish a validated, practical PLTS Version 2.0 method that agencies across the country can use to assess stress for pedestrians in various contexts, leading to safer and more enjoyable walking and rolling conditions.

Introduction

The University of Wisconsin-Milwaukee (UWM) research team developed an initial Pedestrian Level of Traffic Stress (PLTS) method to evaluate the suitability of roadway segments and crossings for pedestrians with support from a Year 1 Center for Pedestrian and Bicyclist Safety University Transportation Center (CPBS UTC) grant (Swift, Schneider, and Nelson 2024). This report describes follow-up research supported by a Year 2 CPBS UTC grant to apply and validate the PLTS method. Our Year 2 research team expanded to include Safe Streets Research & Consulting and Muse Community + Design.

We developed our PLTS method because there was no consensus around such a method in the US and because many of the existing methods to evaluate pedestrian suitability require a large number of inputs, some of which are not available in typical roadway inventory data (e.g., pavement condition, on-street parking coverage, heavy vehicle proportion), making them impractical for most agencies to apply. Some of these methods also require statistical modeling expertise or specialized software to run, further putting them out of reach for many agencies. Our PLTS method can be used to map the most and least pedestrian-friendly parts of a roadway network, recommend comfortable walking routes, help prioritize locations for pedestrian infrastructure improvements, and show project- and system-level changes in pedestrian accommodation over time.

The Year 1 PLTS project report presented a series of tables that can be used to assign PLTS scores of 1 (low stress) to 4 (high stress) for roadway segments and crossings based on the following inputs (Swift, Schneider, and Nelson 2024).

Traveling along roadway segments (segment PLTS):

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- Presence of raised refuge island at the crossing
- Presence of curb extension(s) at the crossing

- Presence of rapid flashing beacons at the crossing
- Presence of high visibility crosswalk marking at the crossing
- Presence of accessible curb ramps at the crossing

These PLTS inputs and ratings are based on previous practical PLTS methods (Oregon DOT 2020; Washington State DOT 2020; Montgomery County 2020) and an extensive review of academic research pedestrian perceptions of comfort around motor vehicle traffic (Swift, Schneider, and Nelson 2024). While the PLTS method is based on the best available professional knowledge, it requires testing to determine how well the PLTS tables and ratings match the perceptions of actual pedestrians. This report describes the first phase of our application and validation testing process and outlines next steps to refine the PLTS method.

We ask the following research questions:

- What feedback do practitioners have about the PLTS method after they apply it in their own communities?
- How easy is it to apply the PLTS method to roadway corridor segments and intersections in case study communities?
- What is an effective and efficient method to gather perceptions of pedestrian traffic stress from the general public?
- Do specific roadway crossing and segment characteristics influence PLTS ratings in the ways suggested by our Year 1 PLTS tables?
- What PLTS method inputs or ratings should be modified to create an updated PLTS Version 2.0?

Additional work proposed for our Year 3 CPBS project includes discussing PLTS ratings with local practitioners and collecting PLTS ratings from pedestrians with sensory or mobility limitations, older adults, and other groups underrepresented in our online survey at real-time PLTS data collection events in several communities. While it is still beyond the scope of this Year 2 CPBS report, our ultimate goal is to establish a validated, practical PLTS Version 2.0 method that agencies across the country can use to estimate suitability and stress for pedestrians in various contexts, leading to safer and more enjoyable walking and rolling conditions.

Literature Review

We reviewed prior research on pedestrian traffic stress definitions and validation of active transportation suitability assessment methods.

Pedestrian Traffic Stress Definitions

A crucial first step in our Year 2 PLTS refinement process was to establish a clear and intuitive definition of traffic stress categories that would correspond to stress levels reported by actual pedestrians. Therefore, we gathered pedestrian traffic stress definitions from previous work. For example, our Year 1 PLTS report defined four PLTS categories for roadway segments and for roadway crossings (Swift, Schneider, Nelson 2024, p. 12):

PLTS 1: Little to no stress; requires little attention to the traffic situation

- *Generally comfortable for all users*
- *Children and people with mobility and sensory limitations face few challenges using these facilities*

PLTS 2: Little stress; requires moderate attention to the traffic situation

- *Generally comfortable for children over 10 years old and adults*
- *Children and people with mobility and sensory limitations may experience some challenges using these facilities*

PLTS 3: Moderate stress; requires sustained attention to the traffic situation

- *Somewhat uncomfortable for able-bodied adults*
- *Children and people with mobility and sensory limitations may experience significant challenges using these facilities*

PLTS 4: High stress; requires sustained attention to the traffic situation and special ability to navigate safely

- *Uncomfortable for most users*
- *Children and people with mobility and sensory limitations will typically want to avoid these facilities*

Our initial pedestrian traffic stress construct was similar to the frameworks used by the Oregon Department of Transportation (ODOT) (2020) and Washington State Department of Transportation (WSDOT) (2020). ODOT stated that PLTS 1 “represents little to no traffic stress and requires little attention to the traffic situation. This is suitable for all users including children 10 years or younger, groups of people and people using a wheeled mobility device” (e.g., walkers, wheelchairs) and that PLTS 4 “represents high traffic stress. Only able-bodied adults with limited route choices would use this facility.” WSDOT adopted the ODOT definitions.

Montgomery County’s Pedestrian Level of Comfort (2020) defined its four comfort levels as “undesirable (score = 4), uncomfortable (score = 3), somewhat comfortable (score = 2), and very comfortable (score = 1).” Their guidance also emphasized the difference between the concepts of safety and comfort: “‘Comfort’ as a concept should be thought of differently from ‘safety’. While safety will always be the bedrock principle of the transportation system, this analysis is a tool to create a pedestrian environment in Montgomery County that is more than safe – one that is enjoyable and comfortable for people of all ages. In situations where comfort and safety may appear to diverge, safety is paramount.”

Participant-based studies have used a variety of constructs to represent pedestrian suitability. Landis et al. (2001) asked study participants to assess “how safe and comfortable they felt as they traveled each segment” on a six-point, A (best) to F (worst) scale. Baltes and Chu (2002) also requested participants to use an A through F scale to assess their perceived crossing difficulty, which was defined as the “risk of being hit by a vehicle, the amount of time to wait for a suitable gap in traffic, presence of a median or other refuge, parked cars, lack of an acceptable (wide enough) traffic gap, or anything else that may affect crossing safety.” Petritsch et al. (2005) used a similar A through F scale and instructed participants to “Circle the letter grade that best describes how well you feel the intersection accommodates and serves your needs as a pedestrian.” Rodriguez-Valencia et al. (2022) had participants rate their stress level by reacting to the statement, “Walking on this sidewalk is stressful” using a scale from 0 (“totally disagree”) to 10 (“totally agree”). LaJeunesse et al. (2024) included the following statements on their survey of pedestrian perceptions at uncontrolled crossings: ‘‘I felt like I might get hit by a car when crossing here’’ and “I felt safe crossing here”. Both were rated on a 4-point scale from strongly disagree to strongly agree.

Validation of Active Transportation Suitability Assessment Methods

One broad category of pedestrian suitability assessment approaches includes research and tools developed directly from participant perceptions (Landis et al. 2001; Baltes & Chu 2002; Petritsch et al. 2005; LaJeunesse at al. 2021; Rodriguez-Valencia et al. 2022; LaJeunesse et al. 2024). If the sample of participants in these studies has characteristics, backgrounds, and experiences that are representative of the broader population, they inherently reflect public perceptions of pedestrian traffic stress. This is more likely in a large-sample study such as Rodriguez-Valencia et al. (2022), which had more than 1,000 participants, than in other studies. In addition to perception surveys, several researchers have used physiological measures to quantify pedestrian stress. LaJeunesse et al. measured pedestrian skin conductance and found that high-volume, arterial streets were more stressful to walk along than other streets (LaJeunesse et al. 2021). However, street crossings did not have a significant relationship with skin conductance in that study. Dash et al. (2024) measured heart rate variability, finding that there was higher pedestrian stress when interacting with scooters, high volumes of other pedestrians, and poorly lit roadway crossings. Still, few of these studies have been tested by follow-up research to determine if their results reflect perceptions of the general public beyond the set of original participants.

Another broad category of suitability analysis tools includes methods that are based on previous academic research and expert opinion (Oregon DOT 2020; Washington State DOT 2020;

Montgomery County 2020; Richardson, TX 2023; Swift, Schneider, and Nelson 2024; Tennessee DOT 2025). One example of validating this type of tool is to compare pedestrian stress levels with pedestrian crashes. Safe Streets Research & Consulting compared their version of PLTS for street crossings with pedestrian crossing crashes and found relatively close correspondence between the highest PLTS category and fatal and severe pedestrian crashes in San Diego, CA (Schoner and Almdale 2024). However, we are not aware if any of these expert-based tools have been tested to determine if their specified stress levels match the reported stress levels of actual pedestrians.

Several validation studies have been conducted on bicycle suitability analysis methods. Ferenchak and Marshall (2020) compared parent perceptions of pictured street scenarios where they would be comfortable letting their children bicycle with Bicycle LTS (BLTS) ratings from Mekuria, Furth, and Nixon (2012). They found general consistency for low-stress segments (BLTS 1) and high-stress segments (BLTS 4) but also that some BLTS 2 and 3 segments were deemed to be comfortable for children. Dill and McNeil (2016) conducted a national survey to compare participant perceptions of bicycling stress in different hypothetical situations (e.g., on a trail, in a protected bike lane, in a standard painted bike lane, in a shared lane) with the "four types of cyclists" that generally correspond with the BLTS stress level framework. Participant stress ratings tended to fit well with the bicycle facility characteristics that are considered as BLTS inputs.

In addition to directly rating roadway scenarios, bicycle suitability ratings have been tested using crowdsourced ratings of routes ridden by bicyclists (Harvey, Fang, and Rodriguez 2019), bicyclist crash rates (Huertas, et al. 2020), stated preference surveys (Cabral and Kim 2022), and physiological factors (e.g., skin temperature and skin conductance) (Rodrigues, da Silva, and Teixeira 2022).

Our review revealed that there is no single construct used to represent pedestrian traffic stress. Further, while BLTS and other bicycle suitability methods have been tested against a variety of validation measures, very few pedestrian suitability tools have been tested after their initial development. This study helps address this research gap and promotes validation as an important step in the process of developing and improving pedestrian analysis tools.

Data and Methodology

This section describes three complementary approaches that we used to test how well the PLTS method in our Year 1 report works in practice and how well it represents pedestrian traffic stress. First, we received feedback from practitioners who attended PLTS presentations or applied the original PLTS in their own communities. Second, we collected the required inputs and calculated PLTS ratings along roadway corridors in three case study communities. Third, we created and implemented an online PLTS National Survey that asked participants to rate the stress that they would feel as a pedestrian when crossing roadways and walking along segments based on videos, pictures, and descriptions.

Feedback from Practitioners

Our first assessment method was to review feedback from practitioners who had attended research team member PLTS presentations or started to apply the PLTS from our Year 1 report. We presented the PLTS method as a part of a CPBS national webinar in November 2024, at the Pedestrian Committee Meeting at the Transportation Research Board Annual meeting (Washington, DC) in January 2025, and in a workshop and walking tour during the AAA Foundation for Traffic Safety Safe Mobility Conference (Madison, WI) in April 2025. In addition, a local practitioner contacted the research team and provided their feedback on aspects of the method that worked well, as well as other aspects that could be improved.

PLTS Corridor Applications

We applied our Year 1 PLTS method to specific roadway corridors in Milwaukee, WI; Albuquerque, NM; and Seattle, WA to gain a better understanding of how much variation there would be in PLTS ratings at different locations. We also used these case study applications to determine whether or not the PLTS ratings made intuitive sense to local practitioners.

We chose arterial, collector, and local roadways in different parts of each community as our case study corridors. We used local knowledge and commercially available aerial imagery to select specific corridors that had a variety of cross-sections, traffic characteristics, and pedestrian crossing facilities. In Milwaukee, we collected data along arterial and collector roadways plus the parallel local streets on either side of the main roadway.

Members of the research team used commercially available aerial and street-level imagery to collect the necessary PLTS inputs and then calculated PLTS ratings for each segment and intersection in the study corridors. Our PLTS method can potentially be used to assess pedestrian stress separately for all crosswalks at an intersection or for each side of the roadway. However, we simplified our approach and assigned the highest stress rating from any crosswalk to represent the overall intersection PLTS rating. Therefore, intersection PLTS ratings typically represented crossings of the higher-volume main roadway rather than crossings of lower-volume side streets. Some roadway segments were not symmetrical (e.g., sidewalk on only one side), so we assigned the rating for the more stressful side as the segment PLTS.

Comparison with an Alternative PLTS Method

For the intersection crossings we also compared our Year 1 CPBS PLTS method with a separate PLTS method developed by Safe Streets Research & Consulting ("Safe Streets"). This helped provide additional insights about the advantages and disadvantages of both PLTS methods.

The Safe Streets method is similar to our Year 1 CPBS PLTS method, but with a greater priority on using readily available data that can be relatively easily applied across a city or region. Safe Streets' method collects the following variables for PLTS crossing ratings, using the values from the largest street at the intersection:

- AADT
- Posted speed limit
- Total number of lanes
- Directionality (one-way or two-way)
- Presence of a centerline
- Presence of on-street parking
- Presence of a pedestrian crossing island
- Type of intersection control

By prioritizing simplicity, Safe Streets' methods lacks some of the detailed data our Year 1 CPBS method collects. This difference in the two methods allows for a comparison and potential integration, informed by the results of this project's national survey, to create a revised method that maximizes fidelity to pedestrians' perceptions and ease of application.

PLTS National Survey

Our most extensive method of assessing PLTS during this Year 2 study was creating and implementing a national online survey to gather perceptions of pedestrian stress while crossing or walking along roadways. It took approximately five months to develop and pilot test the survey prior to its launch in June 2025. The survey method was approved by the University of Wisconsin-Milwaukee Institutional Review Board, and the text of the survey instrument is included in Appendix A. We entered the survey instrument into Qualtrics software and pilot tested the survey with students in the University of Wisconsin-Milwaukee Pedestrian and Bicycle Transportation class, co-workers, professional colleagues in Milwaukee, and colleagues at other CPBS UTC universities in April and May 2025. Their feedback helped streamline the survey structure, improve wording, and ensure that the pictures and video recordings contained in the survey displayed correctly on different types of devices. We distributed the final survey using a snowball sampline approach between June 9 and July 7, 2025.

Survey Content

The overarching goal of our online PLTS national survey was to gather perceptions of pedestrian stress in different community contexts from a broad cross-section of the general public. We designed the survey so that it would take a typical participant approximately 10 minutes to complete. The survey instrument included four main sections:

- Introduction with IRB-required human subjects consent form and a Completely Automated Public Turing test to tell Humans and Computers Apart (CAPTCHA).
- Six roadway crossing scenarios.
- Three roadway segment scenarios.
- Demographic, socioeconomic, and other participant background questions.

Roadway Crossing and Segment Scenarios

The core sections of the survey included videos, pictures, and bullet-point descriptions of six roadway crossing scenarios and three roadway segment scenarios. These scenarios were communicated to participants using a static picture (for crossings only), a video, and bullet-point descriptions of key traffic and roadway characteristics. All participants were presented with the same scenarios of one roadway crossing and one roadway segment to create a reference point to compare PLTS ratings across individuals. The other five roadway crossing scenarios were drawn randomly from a pool of 39 crossing scenarios that included arterial, collector, and local roadway crossings. The other two roadway segment scenarios were drawn randomly from a pool of 19 segments along arterial, collector, and local roadways.[1]

Since five of the roadway crossing scenarios and two of the roadway segment scenarios were selected randomly, different participants responded to different sets of scenarios. We targeted a large sample size of participants so that we would have a large number of ratings for each roadway crossing and segment scenario. Selected characteristics of the full database of crossing scenarios are shown in Table 1 and Table 2, and selected characteristics of the full database of segment scenarios are shown in Table 3 and Table 4.

Note that the first roadway crossing scenario and first roadway segment scenario (presented to all participants), were selected to have ratings in the middle of the PLTS scale, according to our Year 1 CPBS PLTS (the crossing scenario was PLTS 2, and the segment scenario was PLTS 3). We chose these locations as the baselines so that participants would theoretically have room to rate the next scenarios that they viewed as either higher or lower stress.

[1] We used the number of vehicles, number of roadway lanes, and traffic control visible in the video to determine roadway classification.

We chose the final 40 roadway crossing scenarios and 20 roadway segment scenarios used in the survey through a careful process. Between January and May 2025, research team members gathered pictures and videos at 99 potential crossing locations and 39 potential segment locations in four different states. We avoided collecting images when there was rain or snow cover. We narrowed the pool of potential scenarios to our final sets of crossings and segments by:

- Selecting locations with videos that had adequate lighting and showed relevant street and traffic characteristics while removing locations with videos that showed drivers not stopping or yielding to pedestrians, roadway construction, or abnormal traffic flow for a location (e.g., a six-lane roadway with very few vehicles in the video).
- Selecting a set of locations with a range of PLTS ratings according to the Year 1 PLTS tables.
- Selecting a set of locations with a range of values for the PLTS input variables.
- Selecting a set of locations with a range of roadway context variables (e.g., land uses, building types, cloud cover, foliage, noise).

Table 1. Selected Traffic and Land Use Characteristics of the 40 Roadway Crossings used in the PLTS Survey[1]

ID	Crossing PLTS rating from video	City	Video Date	Sky	Functional class based on video[2]	Total pedestrians per minute[3]	Total vehicles per minute[3]	Stories in tallest building	A commercial land use is visible[4]	A residential land use is visible[4]	An industrial land use is visible[4]	A park is visible[4]	A school or university campus is visible[4]
C.A1	2	Milwaukee, WI	6/2/2025	Clear	Arterial	0	32	4	0	1	0	0	1
C.A2	2	Milwaukee, WI	6/2/2025	Clear	Arterial	0	21	5+	1	1	0	0	0
C.A3	2	Milwaukee, WI	5/13/2025	Partly Cloudy	Arterial	11	27	4	0	1	0	1	1
C.A4	3	Chicago, IL	2/2/2025	Cloudy	Arterial	4	18	5+	1	1	0	0	0
C.A7	2	Wauwatosa, WI	5/10/2025	Clear	Arterial	0	28	2	0	1	0	0	0
C.A9	3	Milwaukee, WI	5/13/2025	Clear	Arterial	4	21	5+	1	1	1	1	0
C.A10	3	Milwaukee, WI	4/11/2025	Clear	Arterial	0	111	5	1	0	0	0	0
C.A12	3	Milwaukee, WI	1/30/2025	Clear	Arterial	0	26	5+	1	1	1	0	0
C.A15	4	Milwaukee, WI	4/4/2025	Cloudy	Arterial	0	28	3	1	1	0	0	1
C.A20	4	Northbrook, IL	4/13/2025	Cloudy	Arterial	0	33	5+	1	0	0	0	0
C.A22	3	Chicago, IL	2/2/2025	Cloudy	Arterial	7	30	5+	1	1	0	0	0
C.A23	3	Milwaukee, WI	5/13/2025	Clear	Arterial	0	51	5+	1	1	0	0	0
C.A26	2	Chicago, IL	2/2/2025	Cloudy	Arterial	57	67	5+	1	1	0	0	0
C.A27	4	Chicago, IL	2/2/2025	Cloudy	Arterial	7	39	5+	1	1	0	0	0
C.A28	4	Louisville, KY	3/18/2025	Clear	Arterial	0	125	0	0	1	0	0	0
C.A30	3	Glenview, IL	4/13/2025	Cloudy	Arterial	0	141	2	1	1	0	0	0
C.A33	4	Milwaukee, WI	4/11/2025	Partly Cloudy	Arterial	0	40	4	1	1	1	0	0
C.A35	2	Lexington, KY	4/18/2025	Clear	Arterial	4	51	5+	0	0	0	1	1
C.C13	2	Chicago, IL	2/2/2025	Cloudy	Arterial	0	25	5+	1	1	0	0	1
C.C2	2	Milwaukee, WI	3/21/2025	Clear	Collector	4	17	5+	1	1	0	1	0
C.C3	1	Lexington, KY	4/18/2025	Clear	Collector	0	9	5+	1	1	0	1	0
C.C5	2	Milwaukee, WI	5/23/2025	Clear	Collector	0	19	3	0	1	0	0	1
C.C6	1	Milwaukee, WI	1/3/2025	Clear	Collector	0	12	2	1	1	0	0	1
C.C8	2	Milwaukee, WI	4/10/2025	Cloudy	Collector	0	17	3	1	1	0	0	0
C.C11	2	Milwaukee, WI	5/13/2025	Cloudy	Collector	0	10	3	0	1	0	0	1
C.C15	1	Whitefish Bay, WI	5/10/2025	Clear	Collector	8	4	2	0	1	0	0	0
C.C17	2	Milwaukee, WI	3/19/2025	Clear	Collector	0	4	5+	1	1	0	0	0
C.C19	2	Chicago, IL	2/2/2025	Cloudy	Collector	8	15	5+	1	1	0	1	1
C.C20	2	Wauwatosa, WI	5/11/2025	Clear	Collector	0	17	2	0	1	0	0	0
C.C21	1	Chicago, IL	5/11/2025	Clear	Collector	0	10	2	1	1	0	0	0

ID	Crossing PLTS rating from video	City	Video Date	Sky	Functional class based on video[2]	Total pedestrians per minute[3]	Total vehicles per minute[3]	Stories in tallest building	A commercial land use is visible[4]	A residential land use is visible[4]	An industrial land use is visible[4]	A park is visible[4]	A school or university campus is visible[4]
C.C22	1	Whitefish Bay, WI	5/10/2025	Clear	Collector	0	9	1	0	1	0	0	0
C.L14[4]	2	Chicago, IL	2/2/2025	Cloudy	Collector	0	6	5+	0	1	0	0	0
C.L3[5]	3	Louisville, KY	4/17/2025	Cloudy	Collector	0	18	2	0	1	0	0	0
C.L1	2	Louisville, KY	4/19/2025	Cloudy	Local	0	0	3	0	1	0	1	0
C.L10	1	Milwaukee, WI	3/26/2025	Cloudy	Local	5	0	3	0	1	0	0	0
C.L13	1	Milwaukee, WI	3/21/2025	Clear	Local	0	0	5+	1	1	0	0	0
C.L15	1	Milwaukee, WI	4/10/2025	Cloudy	Local	0	4	2	0	1	0	0	0
C.L4	1	Lexington, KY	4/18/2025	Clear	Local	0	0	3	1	1	0	0	0
C.L7	2	Milwaukee, WI	4/10/2025	Cloudy	Local	0	0	3	0	1	0	0	0
C.L9	1	Chicago, IL	2/2/2025	Cloudy	Local	0	4	4	1	1	0	1	1

1) Total vehicles per minute is the only variable from this table that was listed in the survey scenarios.

1) Roadways with more than 20 vehicles per minute, with 4+ lanes, or with traffic signal control are classified as “arterial”; 6-20 vehicles per minute are classified as “collector”; and 5 or fewer vehicles per minute are classified as “local”.

2) Total pedestrians per minute and vehicles per minute are based on traffic visible in the video recording, not on other traffic counts.

3) For these variables, 1 = yes and 0 = no.

4) Crossing C.L14 was the first crossing scenario in the survey, and it was presented to all participants.

5) Crossing C.L3 has a PLTS rating of 3 because it lacks accessible curb ramps. With accessible curb ramps, it would have a PLTS rating of 2.

Table 2. Selected Roadway and Crossing Characteristics of the 40 Roadway Crossings used in the PLTS Survey[1]

ID	Crossing PLTS rating from video	Number of accessible curb ramps at crossing	Signal control	Stop control	Posted speed limit	Number of lanes[2]	One-way street[3]	Pedestrian hybrid beacon[3]	Rapid flashing beacons[3]	Number of curb extensions[4]	Median or median island[3,5]	Raised crosswalk[3]	In-street pedestrian warning sign[3]	Yellow crosswalk warning sign is visible in video[3]	Sides of street with on-street parking
C.A1	2	2	0	0	25	3	0	0	0	0	1	0	0	0	2
C.A2	2	2	0	0	25	2	1	0	0	2	0	0	0	1	2
C.A3	2	2	0	0	25	2	0	0	0	2	0	1	0	1	2
C.A4	3	2	1	0	30	6	0	0	0	0	1	0	0	0	0
C.A7	2	2	0	0	25	2	0	0	1	0	0	0	0	1	2
C.A9	3	2	0	0	30	4	0	1	0	2	0	0	0	0	2
C.A10	3	1	1	0	30	5	0	0	0	0	1	0	0	0	2
C.A12	3	2	0	0	30	3	0	0	0	1	0	0	0	0	2
C.A15	4	1	0	0	30	4	0	0	0	0	1	0	0	1	0
C.A20	4	2	1	0	35	5	0	0	0	0	0	0	0	0	0
C.A22	3	2	1	0	30	4	0	0	0	0	1	0	0	1	2
C.A23	3	2	0	0	35	4	0	1	0	0	1	0	0	1	0
C.A26	2	2	1	0	30	2	0	0	0	0	0	0	0	0	2
C.A27	4	2	0	0	30	4	0	0	0	0	1	0	0	0	2
C.A28	4	2	1	0	45	5	0	0	0	0	0	0	0	0	0
C.A30	3	2	1	0	45	7	0	0	0	0	1	0	0	0	0
C.A33	4	0	0	0	30	4	0	0	0	0	0	0	0	0	0
C.A35	2	2	1	0	25	2	1	0	0	0	0	0	0	0	2
C.C13	2	2	0	0	30	2	0	0	0	2	0	0	1	1	2
C.C2	2	2	0	1	25	2	0	0	0	0	0	0	0	0	2
C.C3	1	2	0	0	25	2	1	0	0	1	0	0	0	1	2
C.C5	2	2	0	0	25	3	0	0	0	0	1	0	0	0	1
C.C6	1	2	0	0	25	2	0	0	0	2	0	0	0	0	2
C.C8	2	2	1	0	25	2	0	0	0	0	0	0	0	0	2
C.C11	2	2	0	0	30	2	0	0	0	0	0	1	0	1	2
C.C15	1	2	0	0	25	2	0	0	0	0	1	0	1	0	2
C.C17	2	2	1	0	30	3	0	0	0	2	0	0	0	0	2
C.C19	2	2	0	1	20	2	0	0	0	0	0	0	0	0	2
C.C20	2	2	0	0	30	2	0	0	1	0	0	0	0	1	2
C.C21	1	2	0	1	20	2	0	0	0	1	0	0	0	0	2
C.C22	1	2	0	0	20	2	0	0	1	0	1	0	0	1	0
C.L14[6]	2	2	0	0	30	2	0	0	0	0	0	0	0	1	2

ID	Crossing PLTS rating from video	Number of accessible curb ramps at crossing	Signal control	Stop control	Posted speed limit	Number of lanes[2]	One-way street[3]	Pedestrian hybrid beacon[3]	Rapid flashing beacons[3]	Number of curb extensions[4]	Median or median island[3,5]	Raised crosswalk[3]	In-street pedestrian warning sign[3]	Yellow crosswalk warning sign is visible in video[3]	Sides of street with on-street parking
C.L3[7]	3	0	0	1	20	2	0	0	0	0	0	0	0	0	1
C.L1	2	2	0	0	25	2	0	0	0	0	0	0	0	0	2
C.L10	1	2	0	1	25	1	1	0	0	0	0	0	0	0	1
C.L13	1	2	0	1	25	2	0	0	0	0	0	0	0	0	2
C.L15	1	2	0	0	30	2	0	0	0	0	0	0	0	0	2
C.L4	1	2	0	1	25	2	0	0	0	0	0	0	0	0	1
C.L7	2	2	0	0	25	1	1	0	0	0	0	0	0	0	1
C.L9	1	2	0	1	30	2	0	0	0	1	0	0	0	0	2

1) Information about all variables shown in this table except the PLTS rating and yellow crosswalk warning sign was listed in the survey scenarios presented to participants.
2) Total number of lanes includes straight and turning lanes but excludes bike lanes and parking lanes.
3) For these variables, presence of the facility is indicated by 1 = yes and 0 = no.
4) Number of curb extensions at the crossing. The curb extensions can be concrete or paint and post.
5) Median or median island is present at or within 50 feet of the crossing. The median can be concrete or paint and post.
6) Crossing C.L14 was the first crossing scenario in the survey, and it was presented to all participants.
7) Crossing C.L3 has a PLTS rating of 3 because it lacks accessible curb ramps. With accessible curb ramps, it would have a PLTS rating of 2.

Table 3. Selected Traffic and Land Use Characteristics of the 20 Roadway Segments used in the PLTS Survey[1]

ID	Segment PLTS rating from video	City	Video Date	Sky	Functional class based on video[2]	Total pedestrians per minute[3]	Total vehicles per minute[3]	Stories in tallest building	A commercial land use is visible[4]	A residential land use is visible[4]	An industrial land use is visible[4]	A park is visible[4]	A school or university campus is visible[4]	Average building setback (feet)[5]
S.A1	4	Northfield, IL	4/13/2025	Cloudy	Arterial	0	33	1	0	1	0	0	0	50
S.A3	4	Milwaukee, WI	5/13/2025	Partly-Cloudy	Arterial	0	120	0	0	0	0	0	0	n/a
S.A4	4	Milwaukee, WI	4/4/2025	Cloudy	Arterial	0	47	2	1	1	0	0	0	10
S.A5	3	Milwaukee, WI	5/13/2025	Foggy	Arterial	8	45	3	1	0	1	0	0	49
S.A6	4	Northbrook, IL	4/13/2025	Cloudy	Arterial	0	22	5+	1	0	0	0	0	40
S.A7	4	Louisville, KY	3/18/2025	Partly Cloudy	Arterial	0	90	0	0	0	0	0	0	n/a
S.A8	4	Lexington, KY	4/18/2025	Partly Cloudy	Arterial	0	113	3	0	1	0	0	1	20
S.A9	3	Glenview, IL	4/13/2025	Cloudy	Arterial	0	300	2	1	0	0	0	0	80
S.C8	2	Lexington, KY	4/18/2025	Clear	Arterial	7	27	5+	1	1	0	1	0	0
S.C1	2	Milwaukee, WI	6/3/2025	Clear	Collector	6	12	3	0	1	0	0	1	22
S.C3	2	Louisville, KY	4/19/2025	Cloudy	Collector	0	8	3	0	1	0	0	0	5
S.C5	2	Chicago, IL	5/11/2025	Clear	Collector	7	13	5	1	1	0	0	0	0
S.C7	2	Chicago, IL	5/11/2025	Clear	Collector	0	17	3	1	1	0	0	0	0
S.A2[6]	3	Northfield, IL	4/13/2025	Cloudy	Collector	0	20	2	0	1	0	0	0	50
S.L1	3	Northfield, IL	4/13/2025	Cloudy	Local	0	0	2	0	1	0	0	0	40
S.L2	3	Boston, MA	5/12/2025	Clear	Local	12	0	4	0	1	0	0	0	0
S.L5	1	Milwaukee, WI	5/13/2025	Cloudy	Local	0	0	5+	0	1	0	0	0	10
S.L6	1	Louisville, KY	4/19/2025	Cloudy	Local	0	0	3	0	1	0	1	0	20
S.L7	3	Lexington, KY	4/18/2025	Clear	Local	0	0	4	0	1	0	1	0	0
S.L9	1	Louisville, KY	4/19/2025	Cloudy	Local	0	0	3	0	1	0	0	0	22

1) Total vehicles per minute is the only variable from this table that was listed in the survey scenarios.
2) Roadways with more than 20 vehicles per minute, with 4+ lanes, or with traffic signal control are classified as "arterial"; 6-20 vehicles per minute are classified as "collector"; and 5 or fewer vehicles per minute are classified as "local".
3) Total pedestrians per minute and vehicles per minute are based on traffic visible in the video recording, not on other traffic counts.
4) For these variables, 1 = yes and 0 = no.
5) Average building setback distance is measured along the block visible in the video. Distance is measured from outside edge of the sidewalk to the front of the building.
6) Segment S.A2 was the first segment scenario in the survey, and it was presented to all participants.

Table 4. Selected Roadway Characteristics of the 20 Roadway Segments used in the PLTS Survey[1]

ID	Segment PLTS rating from video	Posted speed limit	Number of lanes[2]	One-way street[3]	Sides of street with on-street parking	Sidewalk width (feet)	Buffer width between travel lane & sidewalk (feet)[4]	Grass in buffer area[3]	Shrubbery in buffer area[3]	Street trees in buffer area[3]	Street light poles in buffer area[3]	Utility poles in buffer area[3]	Standard bike lanes[3]	Protected bike lanes[3]
S.A1	4	35	2	0	0	0	0	1	1	1	1	1	0	0
S.A3	4	30	4	0	0	7	0	0	0	0	0	0	0	0
S.A4	4	30	4	0	0	6	4	1	0	0	0	0	0	0
S.A5	3	30	4	0	0	8	0	0	0	0	1	0	0	0
S.A6	4	35	5	0	0	5	7	1	0	1	1	1	0	0
S.A7	4	45	4	0	0	5	4	1	0	0	0	0	0	0
S.A8	4	25	5	0	0	4	3	1	0	0	0	1	0	0
S.A9	3	45	6	0	0	5	15	1	1	1	0	0	0	0
S.C8	2	25	3	1	1	8	16	0	0	1	1	0	1	0
S.C1	2	25	3	0	1	6	4	1	0	1	1	0	1	0
S.C3	2	35	2	0	2	8	8	0	0	0	0	0	0	0
S.C5	2	20	2	0	1	6	20	0	0	1	1	0	0	1
S.C7	2	20	2	0	2	5	16	0	0	0	1	0	0	1
S.A2[5]	3	35	2	0	0	5	10	1	1	1	1	1	0	0
S.L1	3	20	2	0	0	0	0	1	1	1	0	0	0	0
S.L2	3	20	1	1	0	4	3	0	0	1	1	0	0	0
S.L5	1	25	2	0	1	6	0	0	0	0	1	1	0	0
S.L6	1	25	2	0	2	6	12	0	1	1	0	1	0	0
S.L7	3	25	1	1	1	4	3	1	1	0	0	0	0	0
S.L9	1	25	2	0	2	6	11	1	0	1	1	1	0	0

1) Information about all variables shown in this table except the PLTS rating was listed in the survey scenarios presented to participants.
2) Total number of lanes includes straight and turning lanes but excludes bike lanes and parking lanes.
3) For these variables, presence of the item is indicated by 1 = yes and 0 = no.
4) Buffer width is measured from the outside of the travel lane to the street side of the sidewalk or shoulder. It includes the width of the on-street parking lane. Regularly-spaced tree boxes along the sidewalk should be treated as a buffer, even if there is concrete in between them.
5) Segment S.A2 was the first segment scenario in the survey, and it was presented to all participants.

For each roadway crossing scenario, we included a static picture of the approach to the crossing from the driver's perspective, taken approximately 50-100 meters upstream from the crossing. This picture captured the entire roadway cross-section at the crossing location. The picture was taken from the right edge of the street close to where adjacent automobile traffic would be approaching the crosswalk.

We included a roadway crossing video under the picture, which was 10-20 seconds long and was captured using the following protocol. Stand at the top of a curb ramp with camera looking directly at the crosswalk at a height of approximately 5 feet for 1 second; pan left for 2-3 seconds to view approaching traffic from left; pause 1 second; pan back right for 4-5 seconds to view traffic approaching from right; pause 1 second; pan back to center for 2-3 seconds; end looking directly at the crosswalk for 1 second.[2]

The video was followed by text listing the specific characteristics of the street being crossed:

- Posted speed limit (miles per hour)
- Number of lanes
- Average vehicles per minute
- Traffic control (e.g., traffic signal, stop sign, or pedestrian hybrid beacon)
- Pedestrian crossing facilities (included a list of all crossing facilities that were present, such as raised refuge island, curb extensions, rapid flashing beacons, raised crosswalk, high visibility crosswalk markings, or accessible curb ramps)

Finally, participants were asked to report the level of stress that they would experience crossing the roadway as a pedestrian for the specific scenario:

Please rate how much stress you would feel as a pedestrian around automobile traffic ***when crossing this street.***
1) Little to no stress (I would feel very comfortable and like crossing here)
2) Low stress (I would feel comfortable and not mind crossing here)
3) Moderate stress (I would feel uncomfortable and wish the crossing felt safer than it does)
4) High stress (I would feel very uncomfortable and wish the crossing felt much safer than it does)
5) I do not have enough information/I prefer not to answer

For roadway segment scenarios, we did not include pictures at the top since they were very similar to the view from the video. The roadway segment videos were each 5-10 seconds and were captured using the following method. Stand with camera looking up the sidewalk at a height of

[2] Several videos were collected by panning to the right first. We included a variable in our analysis database to test whether or not this affected participants' PLTS ratings.

five feet on the right side of the roadway (oriented in direction of adjacent traffic flow) for 1 second; pan left 45 degrees for 2-3 seconds; pause 1 second; pan back right for 2-3 seconds; end looking up the sidewalk for 1 second.[3]

The video was followed by text listing the specific characteristics of the street segment:

- Posted speed limit (miles per hour)
- Average vehicles per minute
- Sidewalk width (feet)
- Buffer between travel lane and pedestrian space (provided the buffer width in feet and a list of characteristics within the buffer, such as on-street parking, grass, landscaping, trees, and utility poles)

Finally, participants were asked to report the level of stress that they would experience as a pedestrian walking along the roadway for the specific scenario:

Please rate how much stress you would feel as a pedestrian around automobile traffic ***when traveling along this street.***
1) Little to no stress (I would feel very comfortable and like traveling here)
2) Low stress (I would feel comfortable and not mind traveling here)
3) Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)
4) High stress (I would feel very uncomfortable and wish I felt much safer from traffic)
5) I do not have enough information/I prefer not to answer

Additional Survey Components

For the baseline roadway crossing and roadway segment scenarios (presented to all participants), we also asked participants to report their perceived stress level while walking with a six-year-old child and while walking at night.

Near the end of the survey, we asked participants whether or not they have ever attended meetings or done professional work about pedestrian issues or street safety. This question was crucial for differentiating between participants who may be aware of existing research on pedestrian crash risk and stress and participants from the general public. Perceptions from both of these groups are valuable, but it is also important to analyze them separately because they may provide different insights about pedestrian traffic stress.

[3] Several videos were collected from the left side of the roadway. We included a variable in our analysis database to test whether or not this affected participants' PLTS ratings.

We collected audio with all of the roadway crossing and roadway segment videos. Including audio in the videos and asking participants whether or not they took the survey with audio gave us the option to test the effect of traffic noise on their perceived stress levels.

We provided opportunities for open-ended comments after the baseline roadway crossing and roadway segment scenarios, after the five randomly selected roadway crossing videos, after the two randomly selected roadway segment videos, and at the end of the survey after the participant background questions. These open-ended responses provide the opportunity to qualitatively analyze reasons why participants rated certain scenarios as high or low stress.

Contextual Control Variables

While the characteristics listed in the roadway segment and roadway crossing scenario section above were displayed to participants, we also collected several other attributes of each street crossing and street segment from the videos. We compiled these additional variables to identify and control for other contextual characteristics that may also affect pedestrian perceptions of stress.

These additional characteristics included:

- Number of vehicles that can be distinguished in any direction
- Number of large vehicles that can be distinguished in any direction (Semis and other freight vehicles; buses; SUVs/large passenger trucks)
- Number of vehicles passing the crossing from both directions (*crossing videos only)
- Number of large vehicles passing the crossing from both directions (*crossing videos only)
- Number of pedestrians that can be distinguished in any direction
- Number of pedestrians crossing in the crosswalk (*crossing videos only)
- Speed of vehicles (estimated percentage higher than posted speed; estimated percentage about at posted speed; estimated percentage lower than posted speed)
- Horizontal curve in roadway within 150 meters of crossing (anything that would affect sight-distance between driver and pedestrians) (yes; no)
- Vertical curve in roadway within 150 meters of crossing (anything that would affect sight-distance between driver and pedestrians) (yes; no)
- Time between start of video and when the first vehicle crosses the crosswalk from left (or passes the sidewalk location from behind)
- Time between start of video and when the first vehicle crosses the crosswalk from right (or passes the sidewalk location from ahead on opposite side of street)
- Type of bicycle lane present (protected; painted; none)
- On-street parking present on either side of street being crossed (yes; no)

- Landscaping features in the buffer area between sidewalk and street (select all that apply: grass, shrubbery, street trees, light poles, utility poles, benches, utility boxes, etc.)
- Presence of buildings within 50 feet (15 meters) of either side of the crosswalk (yes; no)
- Presence of commercial land use in the video (yes; no)
- Prescence of residential land use in the video (yes; no)
- Presence of industrial land use in the video (yes; no)
- Number of stories in tallest building within 50 feet of either side of the crosswalk (0, 1, 2, 3, 4, 5+)
- Average building setback distance along the street being crossed (measured from outside edge of sidewalk to front of building)
- Sky condition (clear; partly cloudy; cloudy)
- Leaves on trees (yes; no)
- Street tree canopy (estimated percentage of street segment area covered by street tree canopy when viewed from above: 0%; 1-24%; 25-49%; 50-74%; 75-100%)
- Any honking or tire screeching noise (yes; no)
- Crosswalk is located at a mid-block location (yes; no)
- Noise level based on average and maximum decibel level recorded from computer speakers (noise category: 1 = low; 2 = medium; 3 = high)

Survey Distribution

We used a snowball sampling approach to distribute the online survey link with brief instructions to a broad, national audience between June 9, 2025 and July 7, 2025. We hoped to obtain a sample of participants with many different demographic and socioeconomic backgrounds, including older adults, parents with children, and pedestrians with disabilities. An example of a baseline social media post to advertise the survey is included in Appendix B. Members of the research team posted the survey announcement on social media (e.g., LinkedIn, Threads) and e-mailed it to professional and personal contacts, including:

- Colleagues across the CPBS UTC
- Colleagues at State DOTs
- Colleagues at other local, regional, and state transportation, planning, and public health agencies
- The CPBS UTC e-mail list
- Other organization e-mail lists (e.g., Association of Pedestrian and Bicycle Professionals, National Association of City Transportation Officials, Pedestrian and Bicycle Information Center)
- Coworkers

- Family members
- Friends

Our launch led to the survey link being shared between individuals as well as by other organizations. For example, several state and local agencies and active transportation organizations told the research team that they had distributed the survey instructions to their own lists. While we initially listed the survey deadline as June 25, 2025 and the research team stopped posting messages and sending e-mails about the survey after this date, we did not fully close the survey until after July 7, 2025. This allowed more than 100 additional participants to submit responses (Figure 1).

Initially, we considered conducting a field survey at specific street segment and crossing locations using yard signs with QR codes in several of our case study communities. However, local practitioners in Milwaukee had experimented with this approach but received fewer responses than expected, so we changed to the online survey.

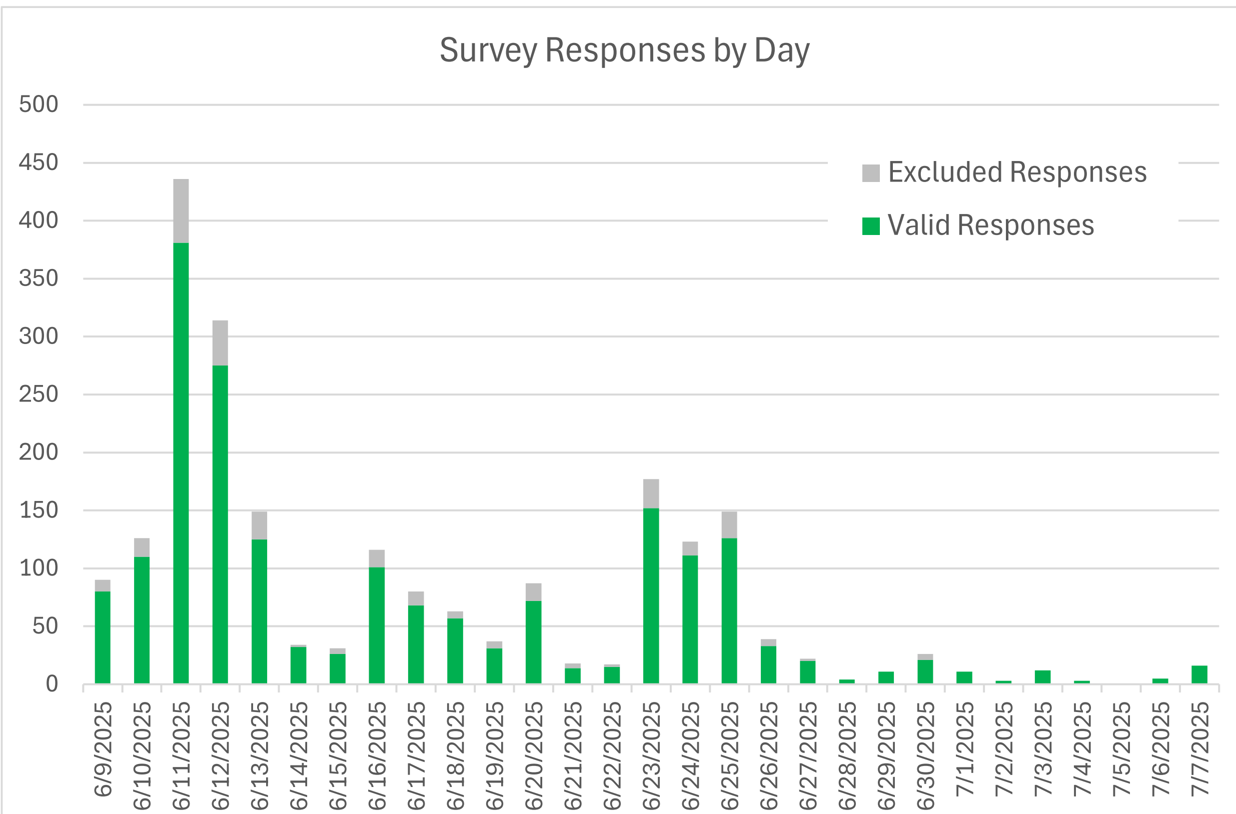

Figure 1. PLTS National Survey Responses by Day

Survey Analysis

As a follow-up task, we will analyze the survey responses quantitatively and qualitatively. Our main quantitative analysis will summarize the distribution (mean, median, standard deviation) of PLTS ratings (1-4) for each scenario across all participants. We will then compare the participant perception ratings with the PLTS ratings based on research and expert opinion. We will also test if there are any differences between the daytime conditions illustrated in the scenarios and hypothetical conditions when traveling as a pedestrian at night or with a six-year-old child. Finally, we will apply ordered logistic regression models to the full set of scenarios to identify associations between specific roadway and participant characteristics and PLTS ratings.

Our qualitative analysis will identify common themes across the set of responses and code the themes found in each response. We will select quotes that represent each theme and discuss how the qualitative themes relate to the statistically-significant roadway and respondent characteristics identified through the quantitative analysis.

Results

This section summarizes insights that we gained from our three approaches to assess the Year 1 PLTS method.

Practitioner Feedback

We received helpful feedback about our Year 1 CPBS PLTS from several dozen practitioners after the CPBS PLTS report was first posted in July 2024. Most comments were made in person during and after public presentations at conferences, but several were also provided by e-mail.

Overall, most practitioners recognized the value of this type of simple pedestrian suitability analysis tool and liked the framework that our research team developed. However, practitioners also provided helpful suggestions. We designed the PLTS method with a small number of inputs so that the data could be collected easily and the PLTS would be simple to apply using lookup tables. Still, many comments suggested including more variables to represent additional factors that affect pedestrian traffic stress. These included:

- Roadway lighting at night.
- Additional pedestrian crossing facilities, such as raised crosswalks or neighborhood traffic circles.
- Volume of motor vehicles turning across crosswalks.
- Types of features in the buffer area between travel lanes and the sidewalk, including street trees, on-street parking, and other barriers.
- Number of other pedestrians nearby.
- Shade during the day. This factor is likely to affect pedestrian comfort, but it is not directly related to pedestrian safety around traffic.
- Traffic noise. This factor is likely to affect pedestrian comfort, but it is not directly related to pedestrian safety around traffic.

Other comments provided suggestions for our PLTS validation and refinement process.

- Additional data collection is needed to understand the needs of pedestrians with disabilities. They are likely to have different levels of stress than the general population, and different data collection methods may need to be tailored to solicit their input about PLTS.
- The shared street table (Table 4) does not account for traffic volumes. Therefore, our original PLTS may not represent sufficient stress on slow-speed, high traffic volume segments. There should be an updated version of Table 4 that assigns a PLTS 4 to segments without sidewalks when traffic volumes are high.
- Consider adding a PLTS 5 for the absolutely most stressful roadway crossings and segments.

- Consider revising the crossing PLTS and segment PLTS ratings so that they are on different scales. Crossings tend to be more closely associated with pedestrian crashes than walking along the roadway, so they may be systematically more stressful.
- Future applications of PLTS could be disaggregated by hour or other periods within a day. In reality, pedestrian traffic stress for any given segment or crossing location changes throughout a day, week, or year. One reason for this is traffic fluctuations. PLTS guidelines specify using AADT, which represents the 24-hour traffic volume for an average day throughout the year. We use AADT because it is often available in local roadway datasets. However, peak periods within each day have higher traffic volumes, so they are likely to have higher segment and crossing stress for pedestrians than off-peak periods. Another likely reason for pedestrian stress levels to change is daylight versus darkness. We collected data about perceptions of stress at night in our national survey. Therefore, hourly traffic volumes and lighting conditions could be used to develop more precise PLTS tables.

Some comments identified parts of the method that were unclear.

- The sidewalk and buffer widths listed in the tables are only given to the closest whole foot. Therefore, it is unclear which PLTS score to give to a sidewalk that is in between the width categories (e.g., should a 7.5-foot sidewalk be in the 5-7 foot category or the 8-10 foot category?). We should update the instructions to tell users to round to the nearest whole foot prior to assigning a PLTS score.
- Add shoulder width to the instructions for collecting PLTS inputs.
- There is a typo in the title of Table 13 ("<7,500 AADT" should be ">7,500 AADT").

Corridor PLTS Applications

We applied our Year 1 CPBS PLTS to a total of 617 crossings and 431 segments in the Milwaukee, Albuquerque, and Seattle case study corridors. We also applied the Safe Streets PLTS to the 617 crossings for comparison. It took the student data collectors approximately two hours per mile to gather the PLTS inputs manually from aerial and street-level images and find the correct PLTS ratings from the tables. Therefore, data availability is an important consideration for applying the current version of our CPBS PLTS.

We mapped the CPBS and Safe Streets PLTS ratings for each intersection in the three case study communities (Figure 2, Figure 3, and Figure 4). These maps showed a range of PLTS ratings that generally matched the initial expectations of the research team. Intersections along arterial streets with more automobile traffic, more lanes, higher posted speeds, and no traffic control tended to have higher PLTS ratings. However, there were several differences between the CPBS and Safe Streets PLTS ratings at individual intersections, as shown by different colors of larger circles (CPBS PLTS) and smaller circles (Safe Streets PLTS) on the maps.

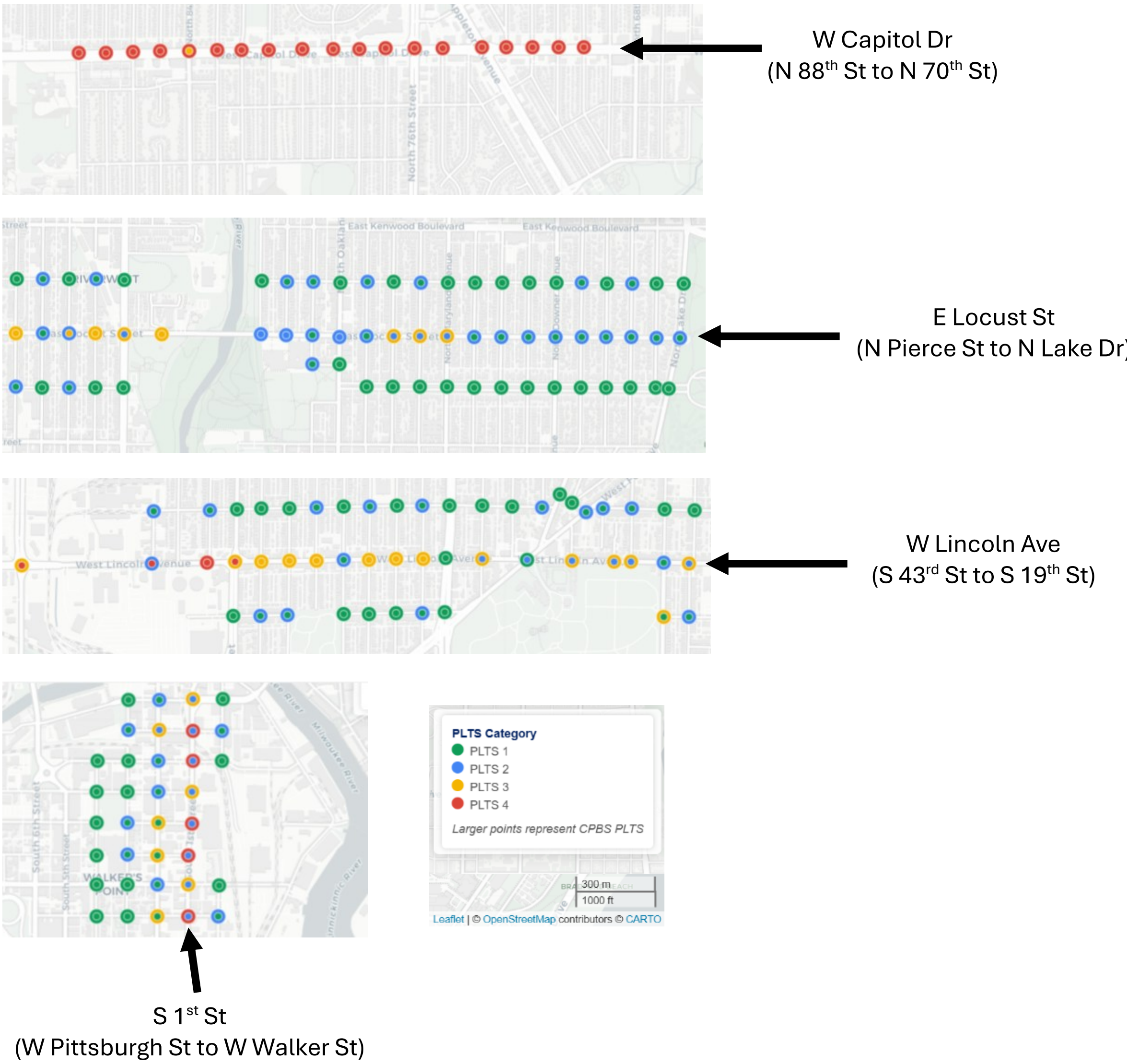

Figure 2. Intersection PLTS Ratings for Selected Milwaukee Corridors (Image credits: Safe Streets Research & Consulting)

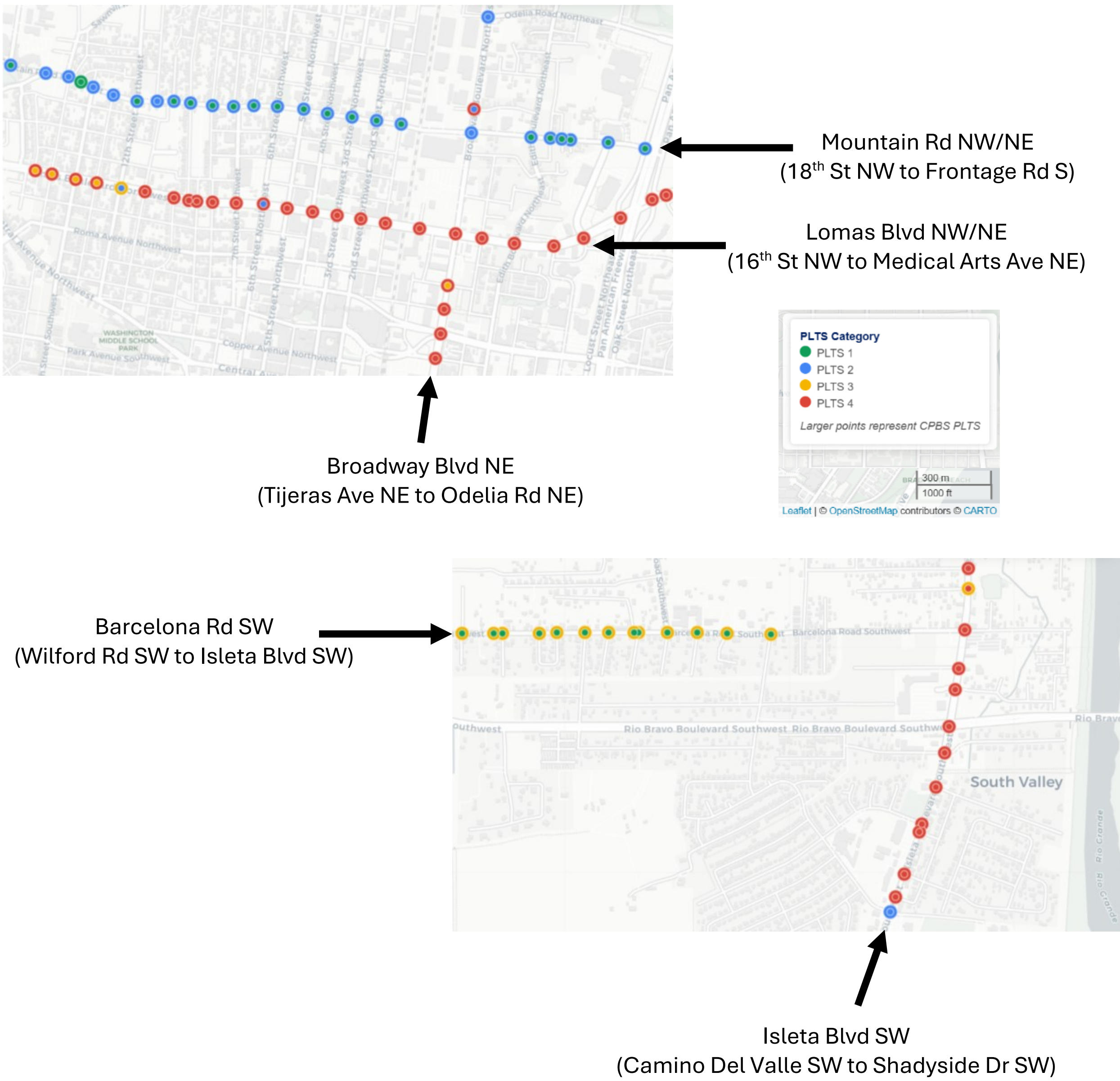

Figure 3. Intersection PLTS Ratings for Selected Albuquerque Corridors (Image credits: Safe Streets Research & Consulting)

Figure 4. Intersection PLTS Ratings for Selected Seattle Corridors (Image credits: Safe Streets Research & Consulting)

Further, we examined differences between the CPBS and Safe Streets PLTS results more closely. Comparing each PLTS rating category showed that the two methods showed a large amount of agreement about which intersections were the most stressful (PLTS 4) (Table 5). However, the Safe Streets method rated more intersections as lower stress than the CPBS method (below the diagonal in the table).

Table 5. Comparison of CPBS and Safe Streets PLTS Intersection Ratings

		Safe Streets PLTS					
		1	2	3	4	CPBS PLTS Totals	CPBS PLTS Percentage
CPBS PLTS	1	133	1			**134**	**22%**
	2	185	27	2	1	**215**	**35%**
	3	43	60	33	3	**139**	**23%**
	4		10	33	86	**129**	**21%**
	Safe Streets PLTS Totals	**361**	**98**	**68**	**90**	**617**	**100%**
	Safe Streets PLTS Percentage	**59%**	**16%**	**11%**	**15%**	**100%**	

A preliminary review of the PLTS ratings by specific intersection characteristics showed several potential reasons for the differences between the CPBS method and the Safe Streets method. Overall, the Safe Streets method had consistently lower stress ratings than the CPBS method across each of the main PLTS inputs.

- Speed limit. The Safe Streets method rated nearly all crossings of 25 mph roadways as PLTS 1, but the CPBS method rated about half of these roadways as PLTS 1 and half as PLTS 2. Similarly, the Safe Streets method only rated about one-third of 30 mph roadways as higher-stress (PLTS 3 or 4), but CPBS method rated more than three-quarters of these roadways as higher-stress.
- Number of lanes. The Safe Streets method rated most (more than 80%) two-lane roadway crossings as PLTS 1, but the CPBS method rated many (more than 65%) of these as PLTS 2 or 3.
- Traffic volume. The Safe Streets method rated most low-volume (<5,000 AADT) roadway crossings as PLTS 1, but the CPBS method rated a majority of these as PLTS 2 or 3.
- Traffic control. The Safe Streets method rated a majority of signalized roadway crossings as PLTS 1 or 2, but the majority of CPBS ratings at signalized intersections were PLTS 2 or higher. Almost half of the uncontrolled crossings were rated as PLTS 1 by the Safe Streets method, but almost none of them were rated PLTS 1 by the CPBS method.

A follow-up task will be to discuss the intersection PLTS results with practitioners in Milwaukee, Albuquerque, and Seattle.

We also mapped the CPBS PLTS ratings for street segments in the three case study communities (Figure 5). Additional maps are not shown in this report, but the results generally matched our research team expectations. Arterial streets with more automobile traffic, higher posted speeds, and narrower buffers between the travel lanes and sidewalk received higher PLTS ratings. We will also discuss these segment ratings with local practitioners.

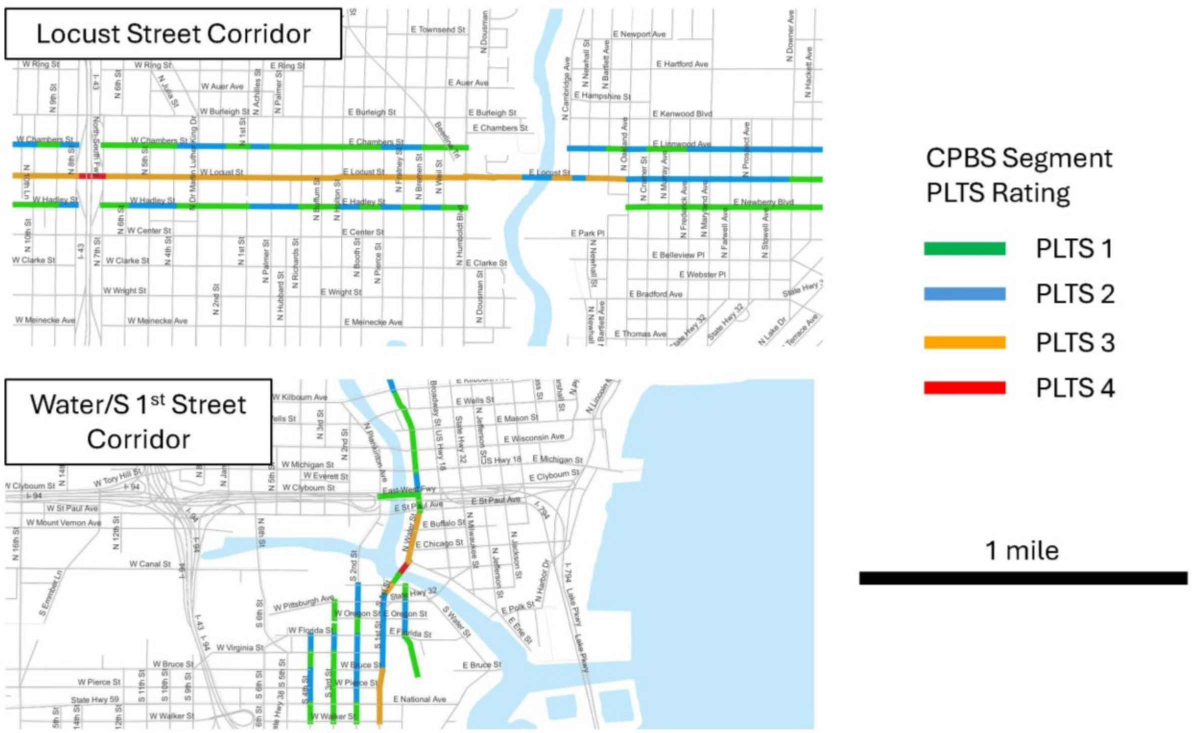

Figure 5. Segment PLTS Ratings in Selected Milwaukee Corridors

Initial PLTS National Survey Responses

We received 2,199 raw responses to our PLTS National Survey between June 9 and July 7, 2025.

To clean the data, we removed responses that:

- Did not provide consent to participate in the survey (0)
- Did not answer any question about perceived traffic stress (this may include people who did not pass the CAPTCHA question) (277)
- Provided a zip code or postal code from outside of the US (6)
- Were likely to be duplicates, as indicated by computer number and nearly-identical responses (a research member reviewed these responses by hand) (1)

After data cleaning, we established a final dataset with 1,915 valid survey responses. Our dataset included participants from 956 unique zip codes in 49 states and the District of Columbia (we received no responses from Alabama). The most participants were from Wisconsin (433), followed by California (125). Oregon, New York, Maryland, Pennsylvania, Colorado, and Illinois all had at least 60 participants. The greatest concentration of participants came from the Milwaukee metro region, which is not surprising given the origin of the snowball sampling method.

Importantly, 1,210 (63%) of the 1,915 survey participants had pedestrian safety experience. Still, 497 (26%) had never attended meetings or done professional work about pedestrian issues or street safety. 208 participants did not respond to this question (11%).

Most participants found out about the survey from professional colleagues, but many others found out through social media and other personal networks. Of the 1,697 participants who responded to this question, 853 (50%) received the survey from a professional colleague, 291 (17%) from a social media post, 229 (13%) from a friend, 122 (7%) from a family member, and 52 (3%) from a website.

Survey Participant Sociodemographic Characteristics

This section summarizes the sociodemographic characteristics of survey participants by age, gender, income, race, number of children, and disability status. Detailed participant sociodemographic information is provided in tables in Appendix C.

Survey participants represented all age ranges, but there were more younger adults than older adults. Of the 1,695 participants who provided their age category, 977 (58%) were younger than age 45. Only 183 (11%) were older than age 64. The 2023 American Community Survey (ACS) one-year estimates show that 46% of the US population is younger than 45 and 23% is older than age 64 (US Census Bureau 2025).

Approximately half (50%) of the 1,677 survey participants who reported their gender were men and 47% were women. Forty (2%) of participants were gender non-binary, and three (0%) were another gender identity. Notably, participants with pedestrian or safety experience were more likely to be men (54% men, 44% women, 2% gender non-binary, 0% another gender identity), but participants who did not have this experience were more likely to be women (41% men, 56% women, 3% gender non-binary, 0% another gender identity).

The survey captured participants from a wide range of household income levels, but participants tended to have higher incomes than the US population. Of the 1,525 participants who reported their household income, 48 (3%) earned less than $25,000 per year and 83 (5%) earned between $25,000 and $49,999. In contrast, 995 (65%) of respondent households earned $100,000 or more per year. According to the 2023 ACS, 15% of US households had annual incomes of less than $25,000 and 39% had annual incomes of $100,000 or more (US Census Bureau 2025).

The survey sample had a higher proportion of participants whose racial identity was White/Caucasian compared to the US population. Of the 1,630 participants who responded with their race or ethnicity, 1,417 (87%) were White/Caucasian only, 56 (3%) were Asian/Pacific Islander only, 40 (2%) were Hispanic only, 28 (2%) were Black or African American only, and 1 (0%) was American Indian or Alasa Native only. Seventy-two (4%) participants were two or more races, and 16 (1%) selected the "other" category. In 2023, the US population was 57% White, 19% Hispanic, 12% Black, 6% Asian, 4% two or more races, and 1% other categories (US Census Bureau 2025).

Most participants did not have any children younger than 18 in their household. Of the 1,677 people who shared their number of household children, 1,156 (69%) had zero, 200 (12%) had one, 225 (13%) had two, and 96 (6%) had three or more. Approximately 29% of US households have at least one child younger than 18, so this is similar to the survey population (US Census Bureau 2025).

We were particularly interested in perceptions of pedestrian traffic stress from people with disabilities, but they were underrepresented in the survey. Of 1,697 participants who shared their disability status, 111 (7%) reported having a disability. Approximately 14% of the US population reported having a disability in 2023 (US Census Bureau 2025).

Perceived Stress for Baseline Crossing Scenario

We analyzed the distribution of perceived stress ratings reported by all respondents to the first crossing scenario (C.L14). This crossing scenario had the most responses since it was presented to all respondents. According to the Year 1 CPBS method, the crossing is PLTS 2. Indeed, more respondents chose "Low stress (I would feel comfortable and not mind crossing here)" (PLTS 2) than any other stress rating (Table 6). However, there was a range of stress ratings, including nearly one-third of respondents reporting PLTS 3. Further, respondents without pedestrian or safety experience (the general public), as a group, tended to rate the crossing as slightly more stressful than respondents with experience (professionals).

Table 6. Summary of Perceived Stress for Baseline Crossing Scenario (C.L14)

	Respondent Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
PLTS	n	% of valid	n	% of valid	n	% of valid	n	% of valid
1	205	17%	86	17%	40	20%	331	17%
2	607	50%	233	47%	97	48%	937	49%
3	370	31%	159	32%	59	29%	588	31%
4	27	2%	19	4%	8	4%	54	3%
Not enough info	1		0		2		3	
No answer	0		0		2		2	
Total	1210		497		208		1915	
Valid	1209	100%	497	100%	204	100%	1910	100%
Median PLTS	2		2		2		2	
Mean PLTS	2.18		2.22		2.17		2.19	

Perceived Stress for Baseline Segment Scenario

We also analyzed the distribution of perceived stress ratings reported by all respondents to the first segment scenario (S.A2). This segment scenario also had a large number of responses since it was presented to all respondents, but it had fewer valid responses, likely because it was presented later in the survey. According to the Year 1 CPBS method, the segment is PLTS 3, which should correspond with "Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)." However, more respondents chose PLTS 2 than any other stress rating (Table 7) and the response distribution centered around PLTS 2 for respondents without pedestrian or safety experience and respondents with experience. In this scenario, respondents with pedestrian or safety experience, as a whole, rated the segment as slightly more stressful than those without experience.

Overall, the response analysis suggests that the CPBS rating for this segment scenario should be examined more closely and potentially reduced from PLTS 3 to PLTS 2.

Table 7. Summary of Perceived Stress for Baseline Segment Scenario (S.A2)

	Respondent Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
PLTS	n	% of valid	n	% of valid	n	% of valid	n	% of valid
1	314	26%	153	31%	5	26%	472	27%
2	561	47%	228	46%	9	47%	798	46%
3	299	25%	105	21%	4	21%	408	24%
4	32	3%	9	2%	1	5%	42	2%
Not enough info	4		2		0		6	
No answer	0		0		189		189	
Total	1210		497		208		1915	
Valid	1206	100%	495	100%	19	100%	1720	100%
Median PLTS	2		2		2		2	
Mean PLTS	2.04		1.94		2.05		2.01	

Discussion

Our study gathered useful insights about how well the initial Year 1 CPBS PLTS works. Practitioners generally had positive feedback about our PLTS method. Still, they suggested several ways that our PLTS framework could be refined (e.g., potentially include additional input variables, such as raised crosswalks) and suggested several ideas to integrate into the validation process (e.g., conduct in-person engagement with people with disabilities and others who were unable to participate in the online national survey). Applying both the CPBS and Safe Streets PLTS methods to case study corridors in Milwaukee, Albuquerque, and Seattle showed that both methods generally provided intuitive representations of pedestrian stress levels. However, our CPBS method tended to assign higher stress ratings to intersection crossings than the Safe Streets PLTS method. Moving forward, we will consider tradeoffs between the possible improved accuracy that additional PLTS inputs may provide and the practical costs of requiring data that many agencies do not currently have.

Our online PLTS national survey generated more than 1,900 valid responses. These responses allow us to compare perceived stress reported by people with previous experience with traffic safety and pedestrian issues versus people without this type of experience. An initial review of the baseline crossing scenario showed fairly close correspondence between the CPBS method rating (PLTS 2) and respondent ratings. Yet, the survey respondents generally suggested that baseline segment scenario was less stressful than the CPBS method rating (PLTS 3).

We will continue our application and refinement process by analyzing the national survey responses in greater depth, including running ordered logit models to identify specific factors associated with perceived pedestrian stress. We will also share our maps and ratings with local practitioners in the three case study communities to gather their insights about where the PLTS method works well and where it should be refined.

Given early findings from this Year 2 study, we will explore adding inputs such as traffic volume for shared roadway scenarios and raised crosswalks to the crossing tables. We will also consider changing some PLTS ratings in our tables, especially for roadway segments since perceived traffic risk may be systematically lower for pedestrians walking along than crossing roadways. We look forward to engaging with people with disabilities and other underrepresented groups from the national survey as a part of follow-up validation testing.

Our validation approaches were limited in several ways. First, we received unsolicited feedback about how well our PLTS method was working in several communities. This provided valuable insights, but we did not conduct a scan of practitioners or use other systematic method to gather input about how many communities had tried to use the PLTS method and how it was working in their local context. This type of approach could be applied in the future.

We collected PLTS in three example communities, but there are likely to be many other types of roadway corridors that are not represented in our case studies. Therefore, we encourage practitioners to share feedback with our research team about how well PLTS is working when it is applied in a variety of other local contexts.

We used a snowball survey distribution approach to collect a convenience sample, so it is unlikely to represent all types of pedestrians. While we can compare subsets of respondents based on characteristics such as age group, gender, race, disability, income, and participation in pedestrian safety meetings, some of these groups have small sample sizes. Small sample sizes tend to have more variance in responses to specific pedestrian crossing and pedestrian segment scenarios, making it difficult to draw conclusive results for those groups. We also received feedback that the survey was not accessible for some members of the disabled community – a limitation we hope to address in our next phase of this research. Future surveys should target groups that were not represented sufficiently in this online survey.

Conclusions and Recommendations

Our study assessed the Year 1 CPBS UTC PLTS method by gathering practitioner feedback, applying PLTS to roadway segments and intersections along corridors in three case study communities, comparing CPBS and Safe Streets PLTS ratings, and implementing an online PLTS National Survey. Key insights from this assessment include generally positive feedback about the PLTS method from practitioners but several good suggestions for improvement; general agreement between the CPBS PLTS method and an alternative Safe Streets PLTS method, though the CPBS method tends to generate higher stress ratings; and national survey respondent stress ratings that are similar to CPBS PLTS rating for the baseline crossing scenario but lower than the CPBS PLTS rating for the baseline segment scenario. We will use this information to further assess and refine our PLTS method.

We recommend the following next steps to assess the original CPBS PLTS framework.

- Compare ratings from the online PLTS National Survey results with the original PLTS report tables. This will involve analyzing subsets of respondents separately, such as people who reported attending a meeting about pedestrian safety (professionals) versus people who have never attended one of these meetings (the general public).
- Solicit local practitioner feedback about PLTS ratings for street intersections and segments in their local communities. One of our immediate next steps is to discuss our initial corridor PLTS application maps with agency staff in Milwaukee, Albuquerque, and Seattle.
- Compare PLTS ratings to police-reported pedestrian crash data at street intersections and segments. We plan to conduct this comparison along case study community corridors in Milwaukee, Albuquerque, and Seattle. Our analysis should analyze fatal, severe, and total pedestrian crashes separately. This analysis can help show the strength of the relationship between perceived pedestrian stress and pedestrian crashes in different roadway contexts. Ultimately, we hope that PLTS can be used as a systemic screening tool to identify locations across roadway networks that may have a high risk of pedestrian crashes.
- Conduct real-time PLTS data collection events in three communities that can be attended by people who were underrepresented in the online survey, especially people with vision and mobility limitations. We have proposed in-person PLTS events in Milwaukee, Albuquerque, and Portland, OR. These events would be supported by a Year 3 CPBS UTC grant.

While more testing and validation is still needed, a refined PLTS Version 2.0 will be a relatively simple and useful tool for pedestrian safety analysis. We hope that it will help practitioners and local community members identify high-stress roadway crossings and segments within corridors and neighborhoods and prioritize projects for pedestrian safety improvements.

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Appendix A. Pedestrian Level of Traffic Stress National Survey: Survey Instrument

This appendix includes the text used in the online PLTS National Survey that was distributed during June 2025. We used Qualtrics survey software to implement the survey.

SECTION 1

Consent page
University of Wisconsin–Milwaukee
Consent to Participate in Online Research

Study Title: Pedestrian Level of Traffic Stress National Survey

Researcher: Robert Schneider, PhD, Professor of Urban Planning, University of Wisconsin-Milwaukee

Thanks for your interest in our research survey! This survey is completely voluntary. There are no negative consequences if you don't want to take it, and you can stop at any time.

What is the purpose of this study?
This survey aims to gather pedestrians' perceived stress levels around automobile traffic while walking along or across roadways. The data will be used to validate and potentially refine a tool called Pedestrian Level of Traffic Stress (PLTS), which is a method of assessing how comfortable pedestrians feel on specific roadways. This survey is only for participants over 18 years old in the United States, and it may only be taken once.

What will I do?
If you agree to participate, you will be asked to complete a survey that will take approximately 10 minutes. The questions will ask about your perception of stress around traffic while traveling as a pedestrian along or across roadways with specific characteristics.

Risks
Risks to participants are considered minimal. Collection of data and survey responses using the internet involves the same risks that a person would encounter in everyday use of the internet, such as breach of confidentiality. While the researchers have taken every reasonable step to protect your confidentiality, there is always the possibility of interception or hacking of the data by third parties that is not under the control of the research team. We're minimizing this risk in the following ways:

- Data is anonymous. If you enter any identifiable information (e.g., name, birthdate, specific address, etc.) in an open-ended response, we will remove it from the data before we do our analysis.
- We'll store all electronic data on a password-protected, encrypted computer.

Possible benefits
There are no costs for participating, nor will you benefit directly from participating, though the knowledge gained could potentially result in better methods to assess pedestrian stress and safety and ultimately create more pedestrian-friendly communities.

Estimated number of participants: The survey is being distributed through e-mail and social media to all people who are interested and willing to participate. We estimate that the survey will be completed by more than 1,000 participants.

How long will it take? Approximately 10 minutes.

Costs: None.

Compensation: None.

Future research: De-identified data (with identifying information removed) may be shared with other researchers. You won't be told specific details about these future research studies.

Where will data be stored? On the servers for the online survey software (Qualtrics) and on the researchers' computers.

How long will it be kept? Data will be retained on the Qualtrics website server through September 2025. Data transferred from the survey site will be de-identified and saved on a password protected computer for perpetuity, or as long as deemed necessary for our Pedestrian Level of Traffic Stress research. The US Department of Transportation also asks us to make a de-identified version of our survey responses public so other researchers can use it. The Institutional Review Board at UW-Milwaukee or appropriate federal agencies like the Office for Human Research Protections may also review this study's records.

Who can see my data?

- We (the researchers) will have access to the data so that we can conduct the study.
- Other researchers using the public version of the dataset available through the US Department of Transportation.
- Agencies that enforce legal and ethical guidelines, such as:
    - The Institutional Review Board (IRB) at UWM
    - The Office for Human Research Protections (OHRP)
- We may share our findings in publications or presentations. If we do, the results will be de-identified (no names, birthdate, specific address, etc.). If we quote you, we'll use pseudonyms (fake names).

Questions about the research, complaints, or problems: Contact Robert Schneider (UWM Department of Urban Planning) at 414-977-7740 / rjschnei@uwm.edu.

Questions about your rights as a research participant, complaints, or problems: Contact the UWM IRB (Institutional Review Board) at 414-662-3544 / irbinfo@uwm.edu.

Please print or save this screen if you want to be able to access the information later.
IRB #: 25.211

IRB Approval Date: April 8, 2025

Agreement to Participate: Your participation is completely voluntary, and you can withdraw at any time. **To take this survey, you must be at least 18 years old, be in the United States, and have not already taken the survey.**

If you meet these criteria and would like to take the survey, please answer the question below to start.

Thank you!
Dr. Robert Schneider and Pedestrian Level of Traffic Stress research team

Q0. Do you understand the information above and agree to participate in the survey?
1) Yes, I understand and agree to participate
2) No, I do not agree to participate
If Q0 is 2) No, then Skip To End of Survey

Questions

QCaptcha. Please indicate that you are human.
Insert: Captcha feature designed to filter out bots.

SECTION 2

In this section, you will be presented with pictures and descriptions of 6 roadway crossings. For each scenario, please rate how much stress you would feel as a pedestrian around automobile traffic **when crossing the street.**
Note: you are a pedestrian if you are walking, traveling in a wheelchair, or using a walker, cane, or other assistive device but not if you are riding a bicycle, kick scooter, or e-scooter.

Scenario C

Please review the following photo and video before answering a few questions at the bottom of the page *(view the video one time and with sound, if available)*.

Picture of the crossing from the driver's perspective:
[Static picture of the crossing from the driver's perspective]

Video of the crossing from the pedestrian's perspective:
*(View the video once. Rate the crossing that is shown at the **start** and **end** of the video, not any other crossings)*
[Video of the crossing from the pedestrian's perspective]

Characteristics of street being crossed:
- Posted speed limit =
- Number of lanes =
- Average vehicles per minute =
- Traffic control at crossing location =
- Pedestrian crossing facilities at crossing location =

QC1. Please rate how much stress you would feel as a pedestrian around automobile traffic **when crossing this street.**
1) Little to no stress (I would feel very comfortable and like crossing here)
2) Low stress (I would feel comfortable and not mind crossing here)
3) Moderate stress (I would feel uncomfortable and wish the crossing felt safer than it does)
4) High stress (I would feel very uncomfortable and wish the crossing felt much safer than it does)
5) I do not have enough information/I prefer not to answer

QC2. Please share any reasons why you selected your answer. *(optional)*

QC3. How much stress would you feel as a pedestrian crossing this street with a 6-year-old child?
1) Little to no stress (I would feel very comfortable and like crossing here)
2) Low stress (I would feel comfortable and not mind crossing here)
3) Moderate stress (I would feel uncomfortable and wish the crossing felt safer than it does)
4) High stress (I would feel very uncomfortable and wish the crossing felt much safer than it does)
5) I do not have enough information/I prefer not to answer

QC4. How much stress would you feel as a pedestrian crossing this street at night?
1) Little to no stress (I would feel very comfortable and like crossing here)
2) Low stress (I would feel comfortable and not mind crossing here)
3) Moderate stress (I would feel uncomfortable and wish the crossing felt safer than it does)
4) High stress (I would feel very uncomfortable and wish the crossing felt much safer than it does)
5) I do not have enough information/I prefer not to answer

QC5. Please share any reasons why you selected your answers about crossing with a 6-year-old child or at night. *(optional)*

[REPEAT QC1 5 MORE TIMES WITH 5 RANDOMLY-SELECTED CROSSING SCENARIOS OUT OF A POOL OF 39 CROSSINGS.]

QC6. Please share any reasons why you selected your answers for the previous crossing scenarios. *(optional)*

SECTION 3

In this section, you will be presented with pictures and descriptions of 3 roadway segments. For each scenario, please rate how much stress you would feel as a pedestrian around automobile traffic **when traveling along this street.**
Note: you are a pedestrian if you are walking, traveling in a wheelchair, or using a walker, cane, or other assistive device but not if you are riding a bicycle, kick scooter, or e-scooter.

Scenario S

Please review the following video before answering a few questions at the bottom of the page *(view the video one time and with sound, if available)*.

Video of the segment from the pedestrian's perspective:
[Video of segment from the pedestrian's perspective]

Roadway segment characteristics:

- Posted speed limit =
- Average vehicles per minute =
- Width of sidewalk =
- Buffer between travel lane and pedestrian space =

QS1. Please rate how much stress you would feel as a pedestrian around automobile traffic **when traveling along this street.**
1) Little to no stress (I would feel very comfortable and like traveling here)
2) Low stress (I would feel comfortable and not mind traveling here)
3) Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)
4) High stress (I would feel very uncomfortable and wish I felt much safer from traffic)
5) I do not have enough information/I prefer not to answer

QS2. Please share any reasons why you selected your answer. *(optional)*

QS3. How much stress would you feel as a pedestrian walking on this segment with a 6-year-old child?
1) Little to no stress (I would feel very comfortable and like traveling here)
2) Low stress (I would feel comfortable and not mind traveling here)
3) Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)
4) High stress (I would feel very uncomfortable and wish I felt much safer from traffic)
5) I do not have enough information/I prefer not to answer

QS4. How much stress would you feel as a pedestrian walking on this segment at night?
1) Little to no stress (I would feel very comfortable and like traveling here)
2) Low stress (I would feel comfortable and not mind traveling here)
3) Moderate stress (I would feel uncomfortable and wish I felt safer from traffic)
4) High stress (I would feel very uncomfortable and wish I felt much safer from traffic)
5) I do not have enough information/I prefer not to answer

QS5. Please share any reasons why you selected your answers about walking on this segment with a 6-year-old child or at night. *(optional)*

[REPEAT QS1 2 MORE TIMES WITH 2 RANDOMLY-SELECTED SEGMENT SCENARIOS OUT OF A POOL OF 19 SEGMENTS.]

QS6. Please share any reasons why you selected your answers for the previous segment scenarios. *(optional)*

SECTION 4

The last few questions ask about you.

Q1. Do you have any disabilities or physical conditions that make walking difficult?
1) No
2) Yes
3) I prefer not to answer

If Q1 is 2) Yes
Q1.1. If you are comfortable sharing, please list any disabilities or physical conditions that make walking difficult. *(optional)*

Q2. What is your zip code?

Q3. How many children are in your household?
1) 0
2) 1
3) 2
4) 3 or more
5) I prefer not to answer

Q4. What is your age range?
1) 18-24
2) 25-34
3) 35-44
4) 45-54
5) 55-64
6) 65-74
7) 75-84
8) 85+
9) I prefer not to answer

Q5. Which gender best describes you? (Check all that apply.)
1) Woman
2) Man
3) Gender non-binary
4) Another gender identity not listed here (please describe on next page)
5) I prefer not to answer

If Q5 is 4) Another gender identity
Q5.1. If you are comfortable sharing, please describe your gender identity. *(optional)*

Q6. Which race or ethnicity best describes you? (Check all that apply)
1) American Indian or Alaskan Native

2) Asian / Pacific Islander
3) Black or African American
4) Hispanic
5) White / Caucasian
6) Other (please describe on next page)
7) I prefer not to answer

If Q6 is 6) Other
Q6.1. If you are comfortable sharing, please describe your race or ethnic identity. *(optional)*

Q7. Of these income groups, which best represents your total household income before taxes during the past 12 months?
1) Less than $25,000
2) $25,000 – $49,999
3) $50,000 – $74,999
4) $75,000 – $99,999
5) $100,000 – $149,999
6) $150,000 – $199,999
7) $200,000 or more
8) I prefer not to answer
9) I don't know/am not sure

Q8. Have you ever attended meetings or done professional work about pedestrian issues or street safety?
1) No
2) Yes

Q8.1. Did you have sound on when watching the videos in this survey?
1) No
2) Yes

Q8.2. What type of device did you use to take this survey?
1) Mobile phone
2) Tablet
3) Laptop computer
4) Desktop computer
5) Other

Q9. Who shared the link to this survey with you? How did you find the link to this survey? *(select all that apply)*
1) Friend
2) Family member

3) Professional colleague
4) Social media post
5) Website
6) Other

Q10. Is there anything else that you would like to share about stress that you have experienced as a pedestrian around automobile traffic? *(optional)*

Thanks for participating in this survey! Please share the survey link with others. You can copy the link directly and share it with friends, family, or colleagues.

Appendix B. Social Media Post for PLTS National Survey Distribution

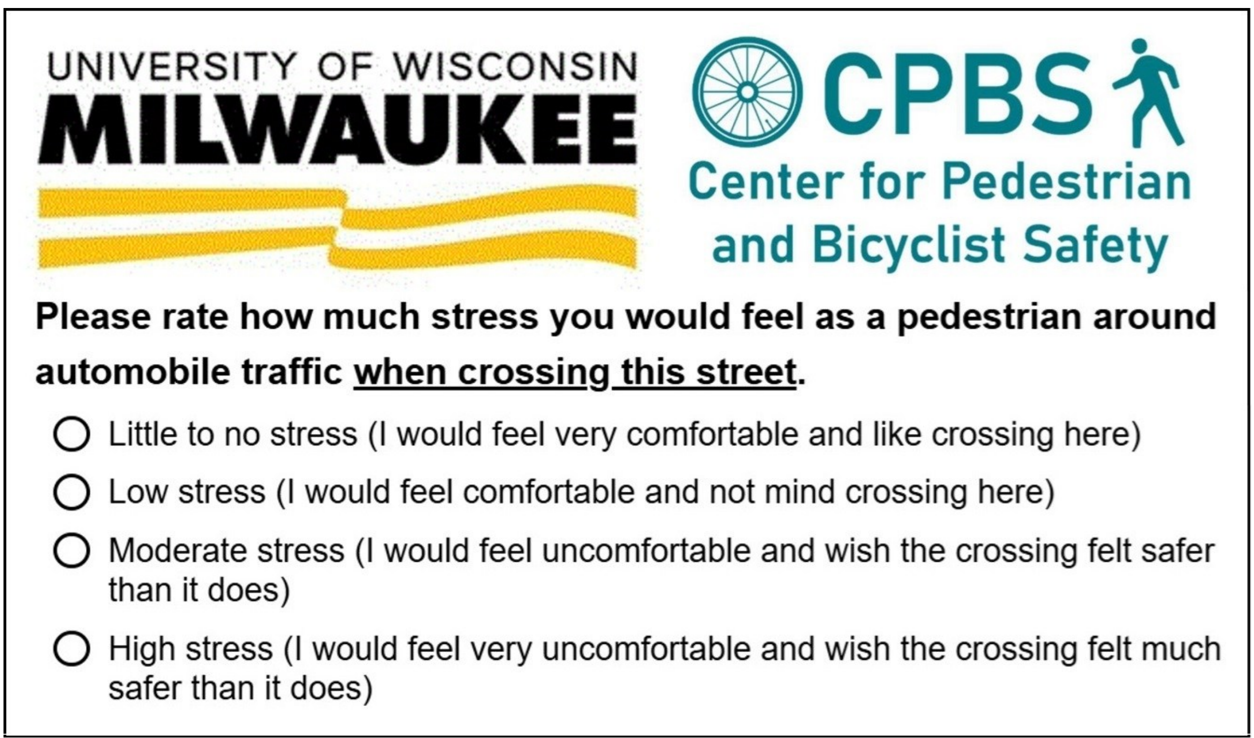
Below is a baseline version of social media post content used to advertise the PLTS National Survey. The research team also e-mailed a version of this information to professional and personal contacts during the survey distribution period (June 9 to June 28, 2025).

<u>Social Media Post</u>

How much stress do you feel around automobile traffic when walking along or crossing different types of streets? Your answers can help refine a tool that transportation agencies use to rate streets and choose pedestrian safety projects. We would love to hear from as many people as possible across the US.

1) Take our 10-minute national Pedestrian Level of Traffic Stress survey at: https://bit.ly/PLTS-Survey
[https://milwaukee.qualtrics.com/jfe/form/SV_efKmh0KVITIhx4y]
2) Share the survey link with your friends, family, and colleagues (survey closes June 25th).

Thanks! Dr. Robert Schneider & Pedestrian Level of Traffic Stress research team
[@Center for Pedestrian & Bicyclist Safety UTC @UWM]



Appendix C. Pedestrian Level of Traffic Stress National Survey: Participant Demographics

This appendix includes tables showing the demographic characteristics of the PLTS National Survey participants. The tables present survey participant age (Table 8), gender (Table 9), race/ethnicity (Table 10), disabilities (Table 11), household children (Table 12), and annual household income (Table 13).

Table 8. PLTS National Survey Participant Age Range

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Age range	n	% of valid	n	% of valid	n	% of valid	n	% of valid
18-24	72	6%	56	11%	0	0%	128	8%
25-34	320	27%	111	22%	0	0%	431	25%
35-44	324	27%	94	19%	0	0%	418	25%
45-54	215	18%	81	16%	0	0%	296	17%
55-64	163	14%	74	15%	2	100%	239	14%
65-74	75	6%	53	11%	0	0%	128	8%
75-84	29	2%	25	5%	0	0%	54	3%
85+	1	0%	0	0%	0	0%	1	0%
Prefer not to answer	11		3		0		14	
Blank	0		0		206		206	
Total	1210		497		208		1915	
Valid	1199	100%	494	100%	2	100%	1695	100%

Table 9. PLTS National Survey Participant Gender

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Gender	n	% of valid	n	% of valid	n	% of valid	n	% of valid
Man	639	54%	200	41%	1	50%	840	50%
Woman	518	44%	275	56%	1	50%	794	47%
Gender non-binary	26	2%	14	3%	0	0%	40	2%
Another gender identity	3	0%	0	0%	0	0%	3	0%
Prefer not to answer	23		8		0		31	
Blank	1		0		206		207	
Total	1210		497		208		1915	
Valid	1186	100%	489	100%	2	100%	1677	100%

Note: Each Participant was assigned one gender category. If a Participant selected "Prefer not to answer" and something else, they were classified as "Prefer not to answer". If a Participant selected "Another gender identity", it was assigned as their gender category. The next priority was "Gender non-binary", which if selected was assigned as their gender category.

Table 10. PLTS National Survey Participant Race/Ethnicity

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Race/Ethnicity	n	% of valid	n	% of valid	n	% of valid	n	% of valid
American Indian or Alaska Native	1	0%	0	0%	0	0%	1	0%
Asian/Pacific Islander	38	3%	18	4%	0	0%	56	3%
Black or African American	20	2%	8	2%	0	0%	28	2%
Hispanic	30	3%	10	2%	0	0%	40	2%
White/Caucasian	1004	87%	412	87%	1	100%	1417	87%
More than one race/ethnicity	49	4%	23	5%	0	0%	72	4%
Other	12	1%	4	1%	0	0%	16	1%
Prefer not to answer	52		21		0		73	
Blank	4		1		207		212	
Total	1210		497		208		1915	
Valid	1154	100%	475	100%	1	100%	1630	100%

Note: Each Participant was assigned one race/ethnicity category. People who chose more than one category were included in the "More than one" category except the Participant who chose both "Other" and "I prefer not to answer". This person was included in "Prefer not to answer".

Table 11. PLTS National Survey Participant Disability Status

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Disabilities	n	% of valid	n	% of valid	n	% of valid	n	% of valid
Yes	70	6%	40	8%	1	20%	111	7%
No	1128	94%	454	92%	4	80%	1586	93%
Prefer not to answer	12		2		0		14	
Blank	0		1		203		204	
Total	1210		497		208		1915	
Valid	1198	100%	494	100%	5	100%	1697	100%

Table 12. PLTS National Survey Participant Household Number of Children

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Household Children	n	% of valid	n	% of valid	n	% of valid	n	% of valid
0	797	67%	358	74%	1	50%	1156	69%
1	141	12%	59	12%	0	0%	200	12%
2	181	15%	44	9%	0	0%	225	13%
3 or more	70	6%	25	5%	1	50%	96	6%
Prefer not to answer	18		11		0		29	
Blank	3		0		206		209	
Total	1210		497		208		1915	
Valid	1189	100%	486	100%	2	100%	1677	100%

Table 13. PLTS National Survey Participant Annual Household Income Range

	Participant Has Pedestrian or Safety Experience							
	Yes		No		Blank		Total	
Household Income	n	% of valid	n	% of valid	n	% of valid	n	% of valid
Less than $25,000	29	3%	19	4%	0	0%	48	3%
$25,000-$49,999	42	4%	41	9%	0	0%	83	5%
$50,000-$74,999	106	10%	64	15%	0	0%	170	11%
$75,000-$99,999	151	14%	78	18%	0	0%	229	15%
$100,000-$149,999	301	28%	85	19%	0	0%	386	25%
$150,000-$199,999	239	22%	66	15%	1	100%	306	20%
$200,000 or more	219	20%	84	19%	0	0%	303	20%
Prefer not to answer	107		50		0		157	
Blank or don't know/not sure	16		10		207		233	
Total	1210		497		208		1915	
Valid	1087	100%	437	100%	1	100%	1525	100%