



Pennsylvania
Transportation Advisory Committee

USE OF ZIPPER MERGE IN WORK ZONES

OCTOBER 21, 2026

Agenda

- Task Force Opening Remarks
- What is the zipper merge?
- Project Purpose and Outcomes
- Study Approach
- Work Zone Safety
- PA Zipper Merge History and Current Practice
- National Research
- Driver Behavior, Signs, Communication
- Key Findings and Recommendations

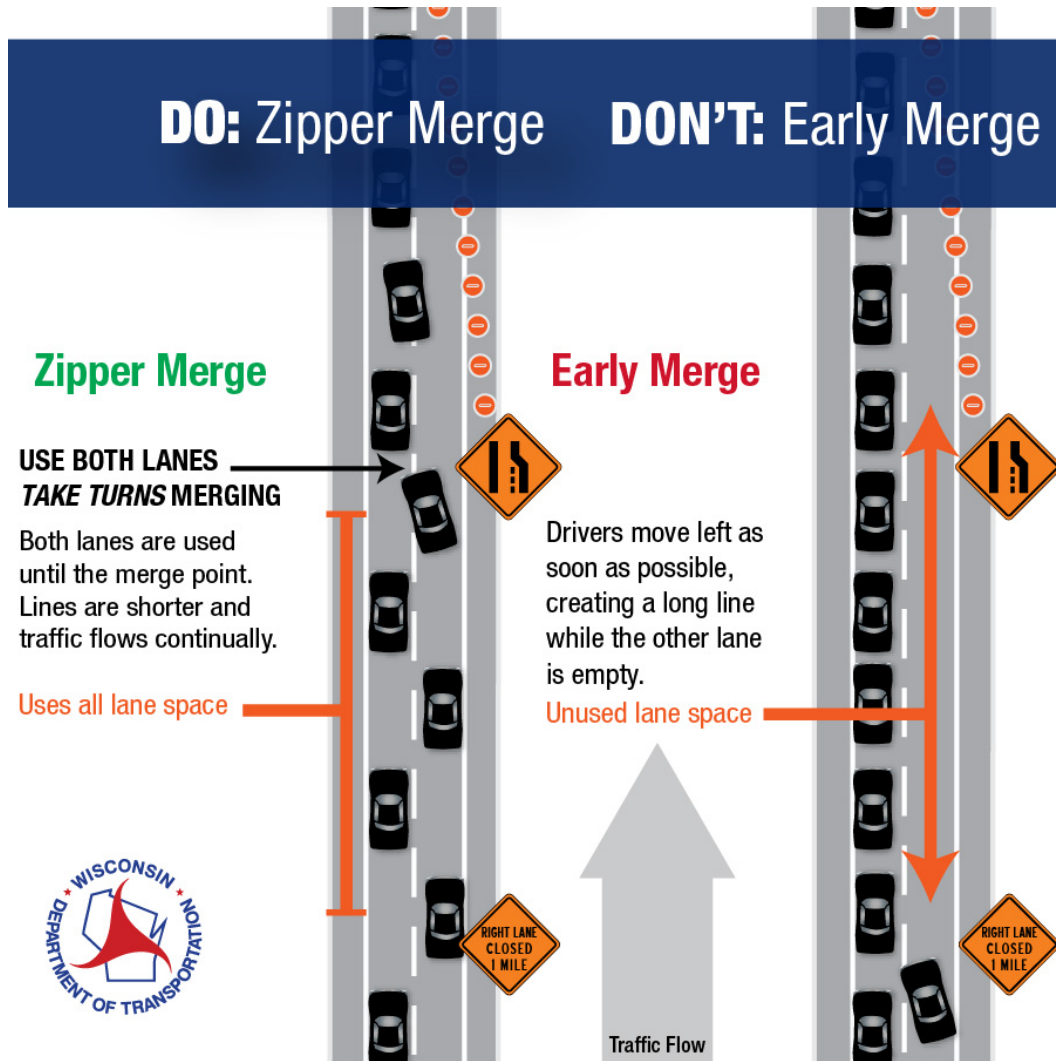
**MERGE
LIKE A
ZIPPER**



Source: British Columbia Ministry of Transport and Transit



What is the zipper merge?



- Use both lanes up to the merge
- Merge at the designated point
- Take turns, one vehicle at a time

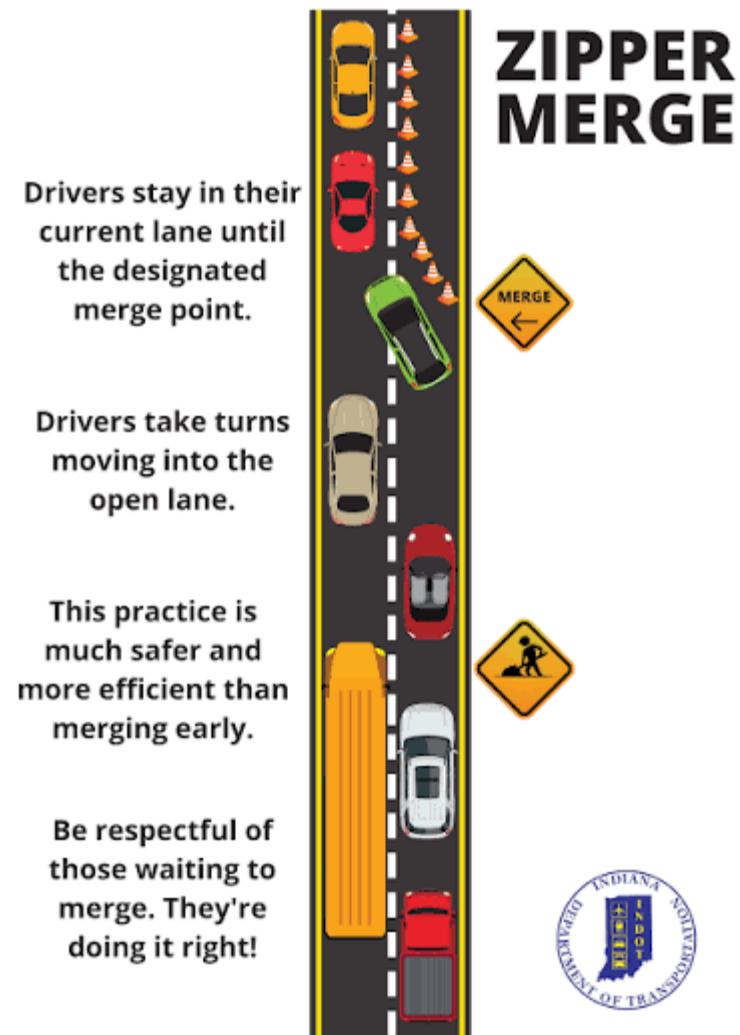


Source: Wisconsin DOT



Project Purpose and Outcomes

- Evaluate the effectiveness and applicability of zipper merge strategies for work zones in Pennsylvania
- Examine Pennsylvania-specific factors that may influence zipper merge effectiveness and driver behavior



Source: Indiana DOT



Study Approach

- Task Force to guide the project
 - Chaired by John Kashatus
 - 3 meetings between July and October
- Targeted literature and state-of-the-practice review:
 - Published research
 - Federal and state guidance
 - DOT practices from other states
 - Work-zone signing examples
 - Educational materials



Source: Minnesota DOT



Study Approach

- Conducted interviews with:
 - PennDOT District 1
 - Pennsylvania Motor Truck Association (PMTA)
 - Colorado Department of Transportation (CDOT)
- “Quick-hitting” white paper

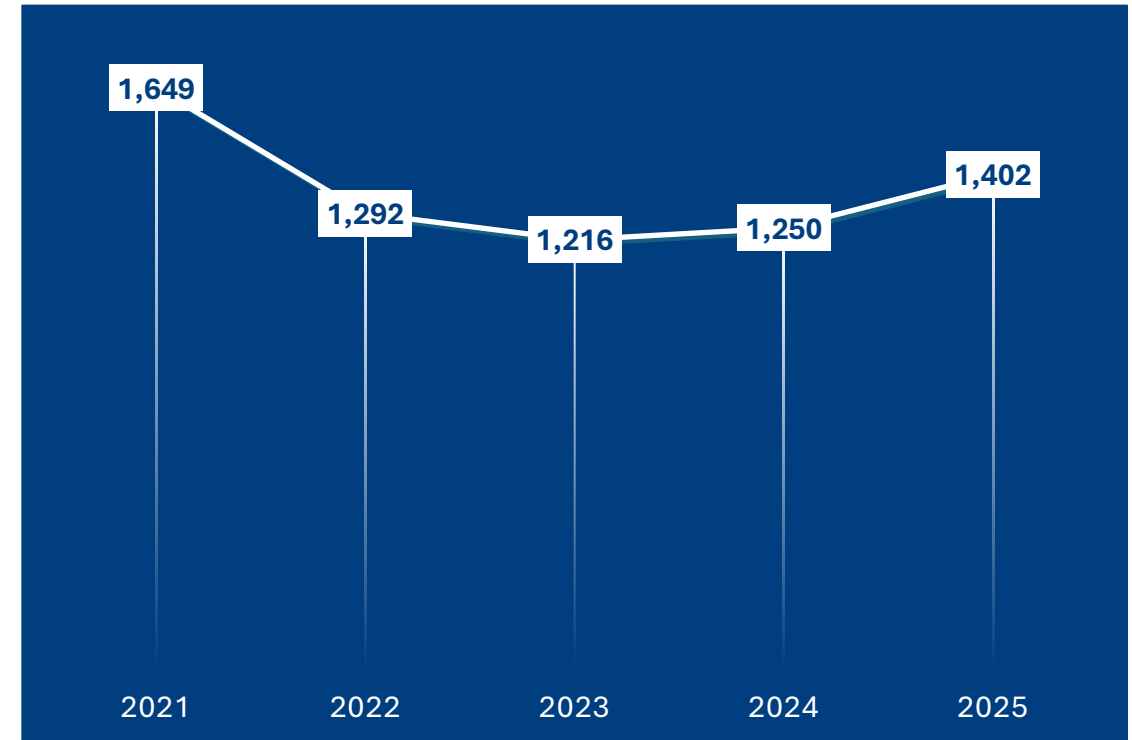


Source: FHWA



Work Zone Safety

- Work zone safety is a significant concern nationally and in Pennsylvania
- In Pennsylvania there were 20 fatal crashes in work zones in 2024
- Work zone safety is a safety focus area of PennDOT's Strategic Highway Safety Plan

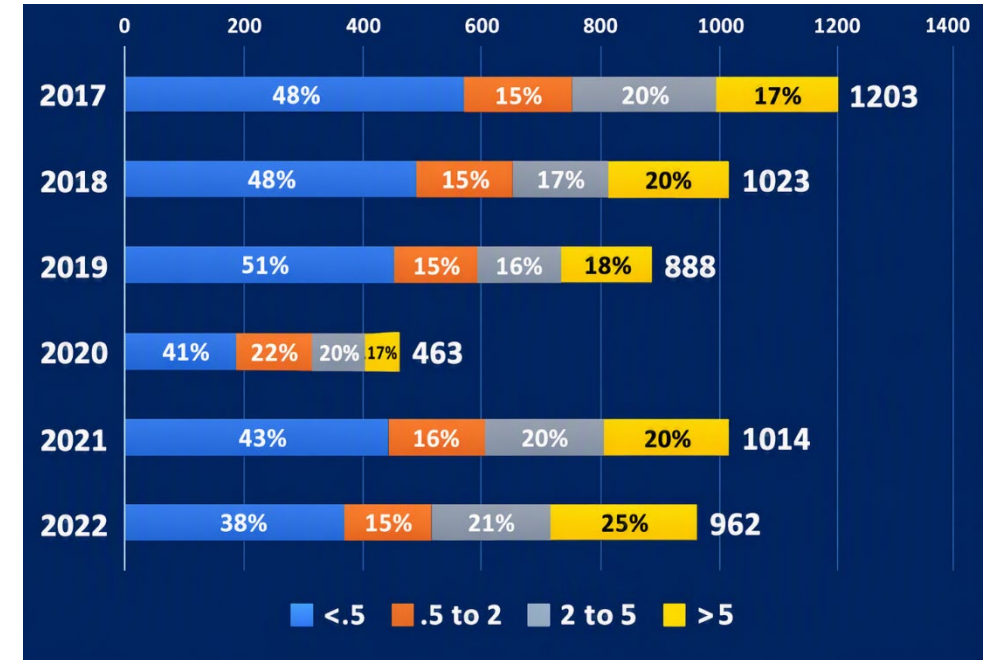


Pennsylvania Work Zone Crashes, 2021-2025



Work Zone Safety

- Approaches to work zones remain higher-risk areas for crashes
- These findings support evaluating strategies that improve advance warning, manage queues, and promote more orderly merging



Work Zone Congestion Crashes by Distance from Work Zone (Miles)

Source: PennDOT, TSMO Performance Report, 7th Edition



PA Zipper Merge History and Current Practice

- f) Give attention to speed zone restrictions to ensure that the restriction only applies to the area of need. For example, if the speed limit is to improve safety for workers, confine the restriction to the active work area and not throughout the limit of work or during those times when workers are not present. Therefore, it will be necessary to both cover and uncover speed limit signs, or to include special provisions in the contract to require remotely-activated speed limit signs.

Late Merge Concept

- a) The “late merge” concept uses a unique traffic control setup on freeway construction projects when it is necessary to close a travel lane. Instead of encouraging motorists a mile or more before the lane closure to form a single lane, this setup encourages motorists to use both travel lanes up to the merge point.
- b) Potential benefits of the “late merge” concept include the following:
 - 1. Queued vehicles can stack in two lanes thus making the length of any queue shorter. This may eliminate backups through nearby interchanges, thereby reducing delays for entering and exiting traffic.
 - 2. Studies performed by a consultant and the University of Nebraska suggest that the capacity of a lane reduction may be up to 15 percent greater with the late merge concept, as opposed to using the conventional traffic control. If this is universally true, the “late merge” should reduce any queues to less than 50 percent of the queue length in a normal lane closure.
 - 3. The potential to reduce road rage caused by some motorists passing the queue and butting in line. This allows motorists to drive at a more relaxed and uniform speed.
- c) [Exhibit 6-11](#) is a suggested traffic control plan for the “late merge” concept.

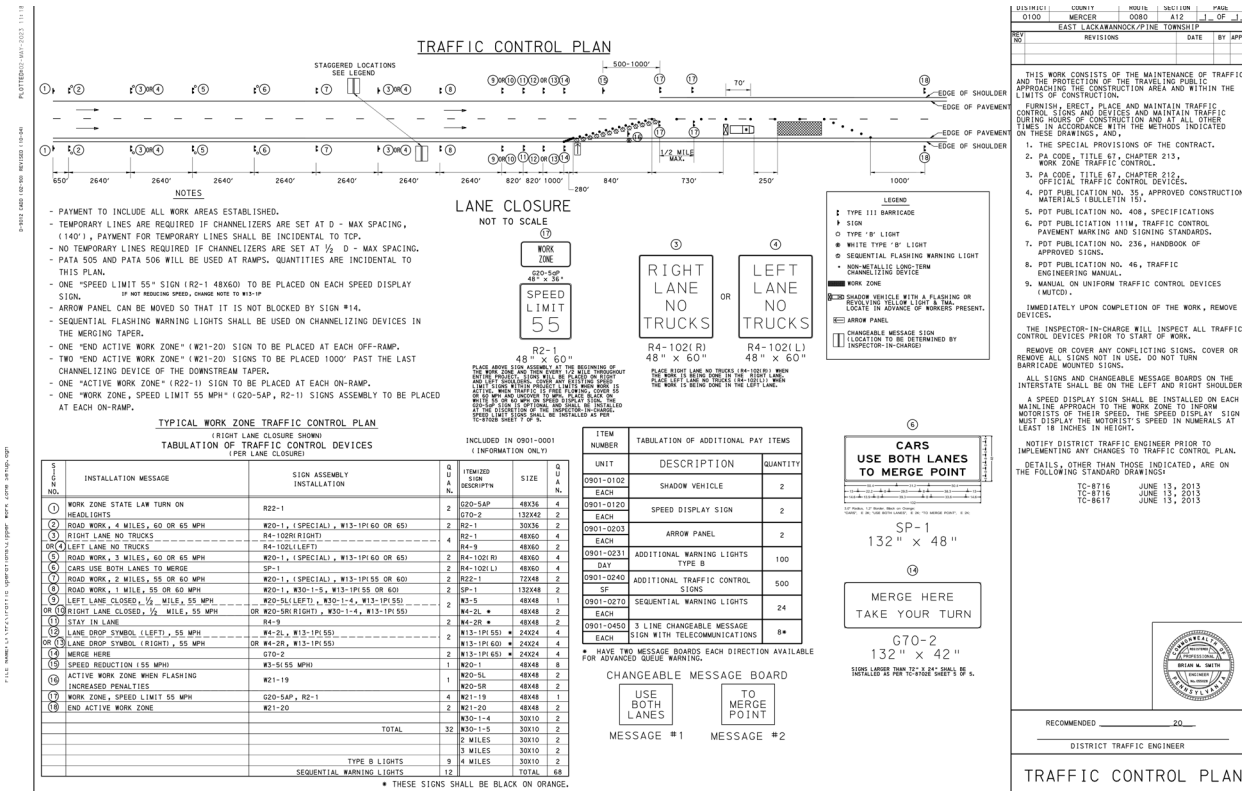
NOTE: Field experience in Pennsylvania has showed mixed results with the late merge concept across the state. In some cases it has worked well and in others it has not. There does not seem to be any apparent pattern as to the success of implementing the late merge concept. It has been tried in both urban & rural settings as well as different geographical regions of the state. Districts are still encouraged to consider this approach wherever the throughput capacity may be an issue, while at the same time taking into account past experience as to where the late merge concept has worked and where it has not. Experience has shown that the late merge concept is not as beneficial in areas with typical free flow conditions.

- PennDOT was likely the first state DOT to implement the zipper merge
- Several Districts began implementing in the early 2000s, with little success



PA Zipper Merge History and Current Practice

- District 1 began implementing the strategy again around 2013
- Improved signing
- Implemented lessons learned from other states
- Reached out to construction contractors and inspectors



PA Zipper Merge History and Current Practice

- Today, District 1 uses zipper merge on all long-term interstate construction projects lasting 3 or more days
- Advance signing begins four miles before the work zone—extended from two miles at truck-driver request
- Play educational videos on rest stop TVs

Key lesson:

Consistency matters.

Drivers learn what to expect when the strategy is used the same way across similar projects.



National Research

**Forced merge
conflicts**

↓ **≈ 75%**

Lane straddling

↓ **≈ 30%**

Queue length

↓ **≈ 40%**

- Safety benefits appear more consistent than travel time benefits
- Travel time benefits tend to vary by location
 - In Michigan, the zipper merge reduced travel time through a work zone by 15 to 25 minutes
- Most beneficial at merge points with congestion and long queues

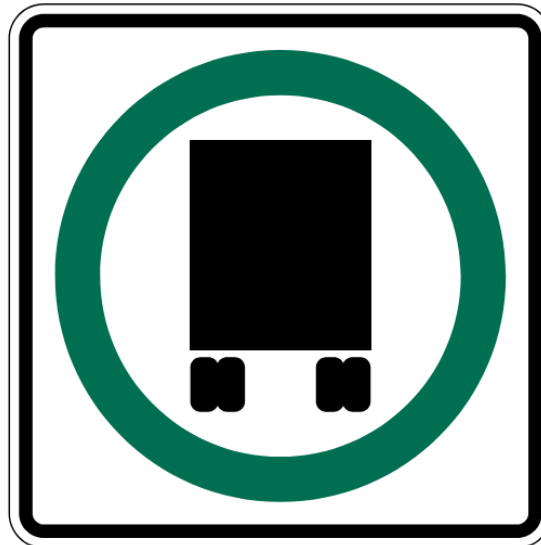


Driver Behavior, Signs, Communication

- Consistent signing layouts and simple messages
- Portable changeable message signs (PCMS) to reinforce instructions
- Early lane guidance for trucks



Source: New Mexico DOT

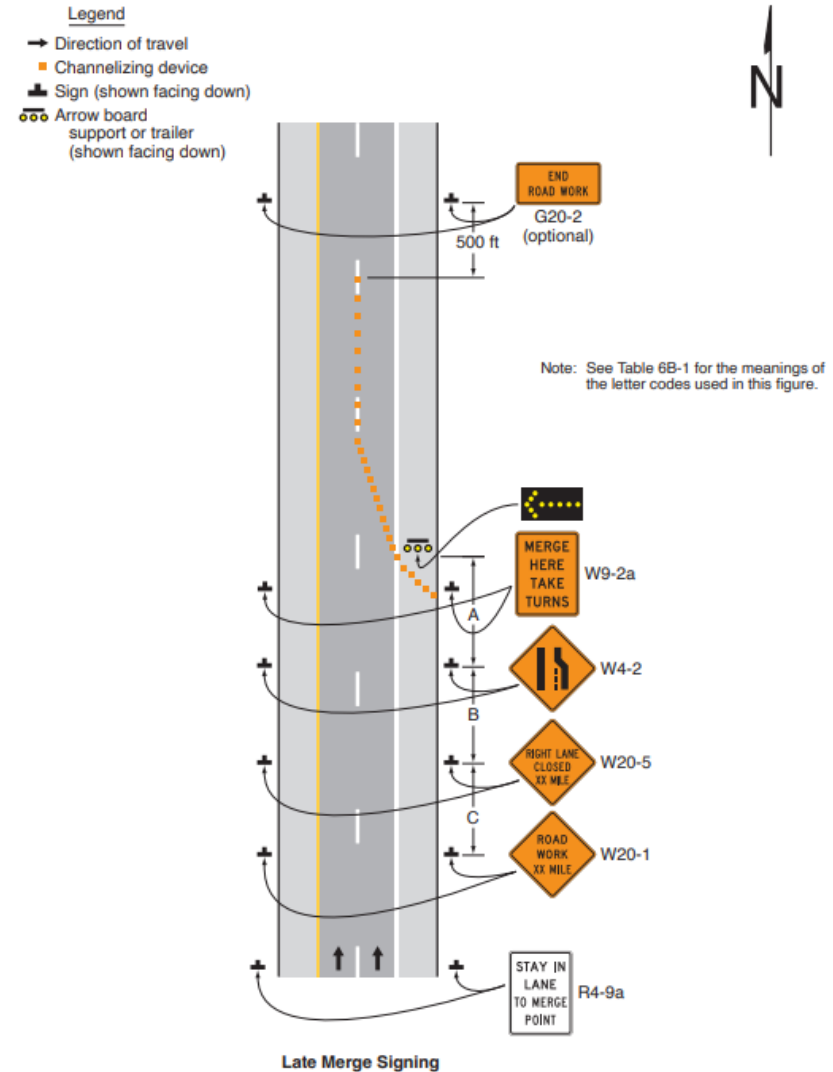


Source: MUTCD Figure 2B-31, 11th Edition



Driver Behavior, Signs, Communication

- Main barrier is driver unfamiliarity
- Many drivers are unfamiliar with zipper merge operations
- Social norms often favor “merge early,” causing drivers to see late merging as unfair
- Compliance depends on what other drivers are doing, not just what signs say



Driver Behavior, Signs, Communication

- Public education is **critical**
 - Zipper merge websites
 - Informational videos
 - Educational signs
 - Unique marketing

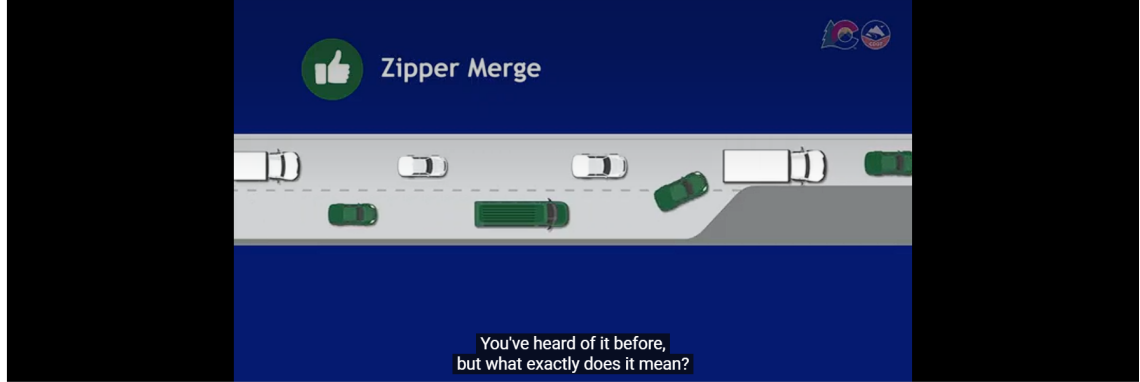


Source: North Carolina DOT

 **Travel**

[Home](#) | [Travel Center](#) | [The Zipper Merge](#) | [Tips to Keep Traffic Moving](#)

The Zipper Merge | Tips to Keep Traffic Moving



How the Zipper Merge Works

Merge points are specifically set up for vehicles to merge from two lanes into one lane in a zipper fashion. This keeps traffic flowing. Each car should alternate zipper fashion into the remaining open lane just before the point of closure.

When there is a lane closure ahead, drivers should continue to drive in both lanes equally. Just before the lane ends, cars should take turns filling in the open lane carefully and resume full speed. In a Zipper Merge, please be respectful of those who wait to merge until just before the lane ends; they are doing it correctly. Check out this short CDOT video on merging.

Source: Colorado DOT



Source: NC State University



Key Findings and Recommendations

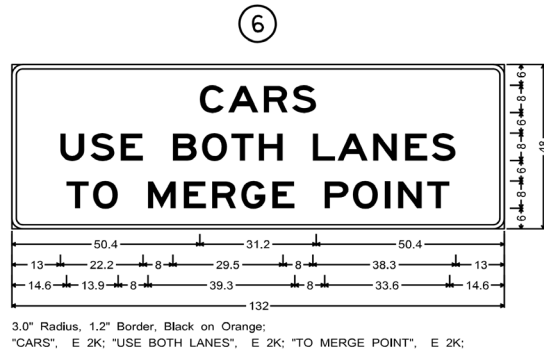
- Research and state agency experience consistently show that zipper merging improves safety and reduces queue lengths at congested lane closures.
- Driver behavior remains the primary barrier to implementation.
- Effective deployment requires consistent signing and coordinated public outreach.



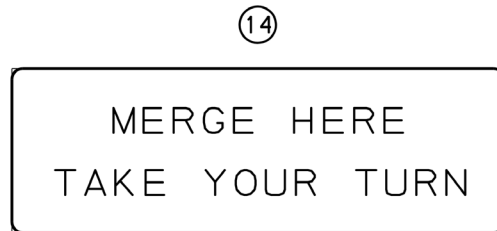
Source: American Automobile Association



Key Findings and Recommendations



SP-1
132" x 48"



SIGNS LARGER THAN 72" X 24" SHALL BE
INSTALLED AS PER TC-8702E SHEET 5 OF 5.

- Develop draft guidance for zipper merge in work zones
 - Long-term interstate work zones with lane closures
 - Consistent sign layout, including truck-specific guidance
- Allow District Work Zone Managers and Traffic Engineers to determine how to expand deployment
 - One urban and one rural work zone
 - Full deployment within the District
- Evaluate early deployments – crashes, travel time, maximum backups



Key Findings and Recommendations

- Finalize guidance:
 - Determine if specific criteria should be developed for using zipper merge
 - Refine draft guidance based on feedback
- Incorporate final guidance into Publication 46: Traffic Engineering Manual

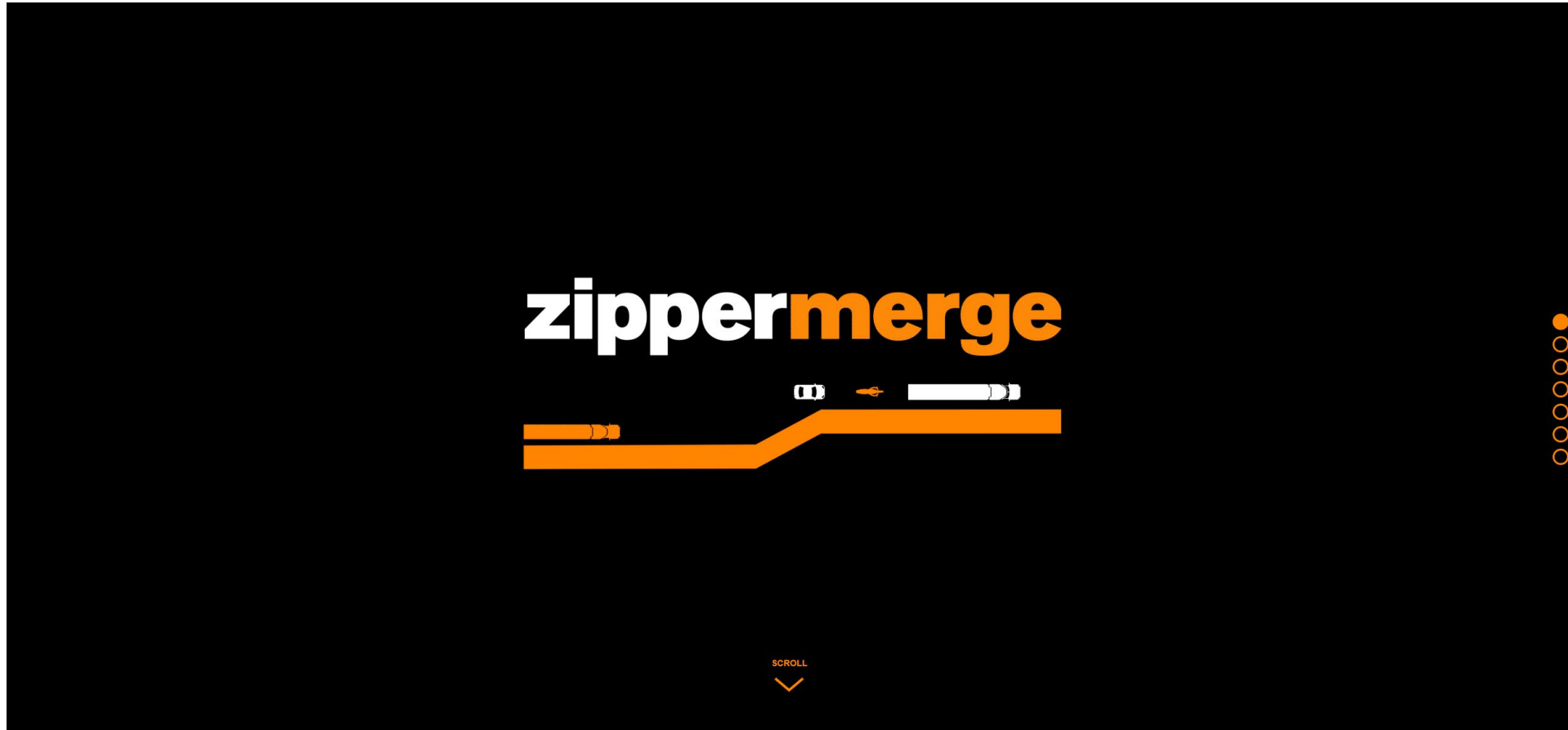


Key Findings and Recommendations

Public Outreach Strategy	Example
Digital outreach and social media	Establish a dedicated zipper merge page or section on PennDOT's website
Traditional media and public relations	Work with news outlets to share information with the public about how to navigate the zipper merge
Driver education and licensing resources	Add information about zipper merge operations to the New Driver Work Zone Safety Program
Project-specific outreach	Discuss the zipper merge with contractors during project kickoff meetings
Stakeholder and traveler outreach	Conduct zipper merge outreach with organizations representing truck drivers (including truck driving schools), construction contractors, and construction inspectors
Creative awareness and engagement tactics	Incorporate zipper-merge messaging into routine public and employee interactions, such as internal PennDOT communications



Discussion



Source: New Mexico DOT

