

FOREWORD

This document is addressed to Transportation Agencies and designers looking to learn more about highway warning gate safety considerations.

As a sustaining member of the Transportation Research Board (TRB) Roadside Safety Committee (AFB020), Versilis advocates for highway worker and motorist safety. Versilis' goal is to lead the development and deployment of safer highway access control solutions through innovation and quality engineering. -Our dedication to safety and quality guides our development efforts from research to deployment.

Readers should feel free to contact Versilis for more information: info@versilis.com or 1-844-837-7454.

SAFETY BASICS FOR HIGHWAY ACCESS CONTROL

This document summarizes the 3 key components of a safe highway access control solution. In the absence of clear national industry standards related to highway warning gates, this document aims to provide critical safety guidance for Traffic Engineers and Transportation Agencies.

The 3 key components of a safe highway access control solution include:

1. Automation
2. Crashworthiness
3. Visibility

1. AUTOMATION

Highway access control automation is key to reduce worker exposure to live traffic.

Pennsylvania Turnpike Commission (PTC) and Florida DOT recently deployed Versilis automated gates to reduce worker exposure to live traffic and increase traffic operations efficiency.



PTC Tuscarora Tunnel - training session (May 2019)



FDOT Miami I-95 Express Lanes - training session (June 2018)

2. CRASHWORTHINESS

Highway warning gate crashworthiness is key to reduce risk of motorist fatality or serious injury in the event of a crash.

2.1 WHY IS CRASHWORTHINESS IMPORTANT?

TOP 3 REASONS:

- Safety matters: U.S. Department of Transportation's (US DOT) Safety Council has identified safety culture as a top priority across the Department.
- The FHWA's longstanding policy is that all roadside safety hardware installed on the NHS be crashworthy*.
- Understanding the performance of roadside safety hardware begins in a controlled, sterile laboratory environment using crash test scenarios and standards set and maintained via AASHTO's Manual on Assessing Safety Hardware (MASH)**.

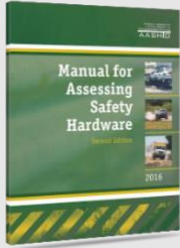
* Ref: FHWA Memorandum 04092018

** Ref: FHWA website (Countermeasures that Reduce Crash Severity)



2.2 WHAT IS CRASHTESTING ABOUT?

- MASH and NCHRP Report 350 represent uniform guidelines used to conduct full-scale crash tests.
- The documents' purpose is to provide a basis for consistency in crash testing and evaluation.
- The 3 principal evaluation criteria include: occupant risk, vehicle trajectory, and device structural adequacy.



Manual for Assessing Safety Hardware (Second Edition 2016)



Versilis Horizontal Warning Gate (HSG-40CW) MASH Crash Testing at Texas A&M Transportation Institute's Certified Laboratory.

Example of an Unsuccessful Crash Test Result



After crash - extensive windshield damage



Important quantity of glass fragments into occupant compartment

Example of a Successful Crash Test Result (Versilis Gate HSG-40CW MASH Crash Test # 3-72)



After crash - minor windshield damage



Minimal quantity of glass fragments into occupant compartment

Versilis is the only manufacturer offering crash tested highway warning gates on the market.

- HSG-18CW (gate arm up to 18') - introduced in 2010
- HSG-22CW (gate arm up to 22') - introduced in 2018
- HSG-40CW (gate arm up to 40') - introduced in 2018

Horizontal SwiftGates (HSG) listed above are Crashworthy (CW): they have successfully passed certified crash tests according to the approved national standards (NCHRP-350 and MASH).

Florida DOT, Texas DOT, and many other Transportation Agencies require warning gates to be crash tested by a certified laboratory



FDOT Miami I-95 Express deployment (since June 2018)



TXDOT IH-30 Reversible Lane deployment (since June 2016)

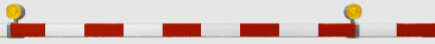


3. VISIBILITY

Highway access control visibility is key to send a clear message to motorists that an access is closed. A clear message translates to increased motorist safety and compliance. Visibility includes 2 important design components: 1) warning gate arm visibility and 2) gate layout.

3.1 Highway warning gate Arm and visibility

Highway environments warrant increased visibility. This requirement is often described by the quantity of retroreflective sheeting surface per gate arm linear foot

WARNING GATE ARM VISIBILITY COMPARISON

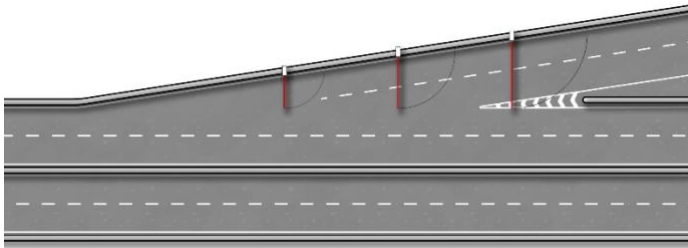
Gate Arm Illustration	Retroreflective Sheeting Surface (RSS)
	Railway type gate RSS = 36 in² / linear foot <i>Note: added flag or banner not included in calculation as it is not retroreflective sheeting and offers variable results, especially in windy conditions.</i>
	Versilis HSG-18CW RSS = 80 in² / linear foot + chevron: 390 in²
	Versilis HSG-22CW and HSG-40CW RSS = 120 in² / linear foot + chevron: 1000 in²

3.2 Highway Access Control Gate Layout

Gate layouts will vary from one location to the next depending on travel speed, roadway configuration etc. A good gate layout is critical for safety and compliance.

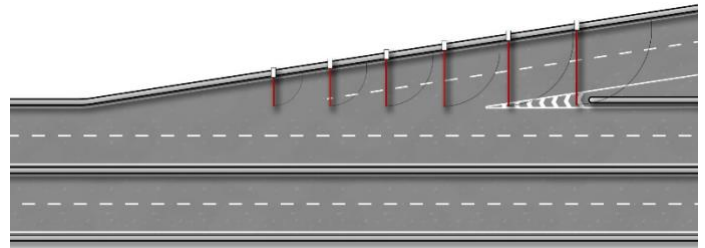
Note: In the absence of clear industry standards on gate numbers and spacing, experience has shown that a gate layout should try to reflect State Maintenance of Traffic Standard. Gate arm length also needs to be specified, based on roadway configuration and lane markings.

Non-Adequate Gate Spacing



Few gates / approx. gate spacing: 350 ft to 400 ft

Adequate Gate Spacing



Multiple gates / approx. gate spacing: 100 ft to 150 ft

Examples of operational challenges resulting from lack of warning gate solution visibility



Supplemental barricades required to signal lane closure



Law enforcement required to ensure motorist compliance

List of US transportation agencies that have adopted Versilis' products for their visibility and crashworthiness



- Florida DOT
- Texas DOT
- Pennsylvania DOT
- Pennsylvania Turnpike Commission
- Massachusetts DOT
- Metropolitan Transportation Authority
- California DOT
- Wisconsin DOT
- Louisiana DOTD
- Maryland DOT