

AN INTELLIGENT SAFETY-BASED SIGNAL DESIGN TO PREVENT REAR-END COLLISIONS AND ANGLED CRASHES **Traffic Safety and Operations Lab** By Dr. G.L. Chang Zgang@umd.edu

Introduction

- Many suburban high-speed intersections are plagued by: Angled crashes
 - rear-end collisions
- By integrated intelligent intersection control system (III-CS), most
 - Angled crashes can be prevented with the dynamic all-red extension system
 - Rear-end crashes can be prevented with the dynamic green termination system
- Objectives:
 - dynamic green-termination (DGT) • Develop a strategy to reduce rear-end collisions at signalized intersections.
 - Integrating the DGT control with dynamic all-red extension (DAE) algorithm to constitute a safetybased intersection signal system.



System Configuration

Key components of the system:

- Wide-range sensor
- In-cabinet computer
- Controller
- Communication hardware





Control Logic





STATE HIGHWAY ADMINISTRATION

Dynamic Green Termination (DGT)

Terminate the Green beyond the initial green interval at the **min-risk gap**—before reaching the **max. green**

- Executes prior to the max-outs
- Measure the risk of collisions in real time and estimate the risk level over **the projected time** horizon up to Gmax:
- # vehicles trapped in the **indecision zone** over each projected time point up to Gmax

Dynamic All-red Extension (DAE)

Results of **field deployment**: US 40 @ Western Maryland Pkwy • All red-light running vehicles are detected (100% detection rate)

ΜΟΕ	Value
Red-light-running rate (#/100 cycles)	1.6
Extension call %	31.7%
Detection rate	100%
False alarm rate	30.1%

Conclusions

Intersections with an advanced actuated controller can significantly reduce both the rear-end collisions and angled crashes by employing the proposed intelligent control

• Side-angled crash: prevented with the dynamic all-red extension module (proven with the field deployments at Elkton, Hagerstown, and North East, MD)

• **Rear-end collisions**: minimized with the two-stage Dynamic Green Termination algorithm:

 supported by the simulation experiments with field data

 to be deployed at suburban intersections near Bowie, Forestville, and Waldorf, MD for field test.