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Traffic Engineering Basics

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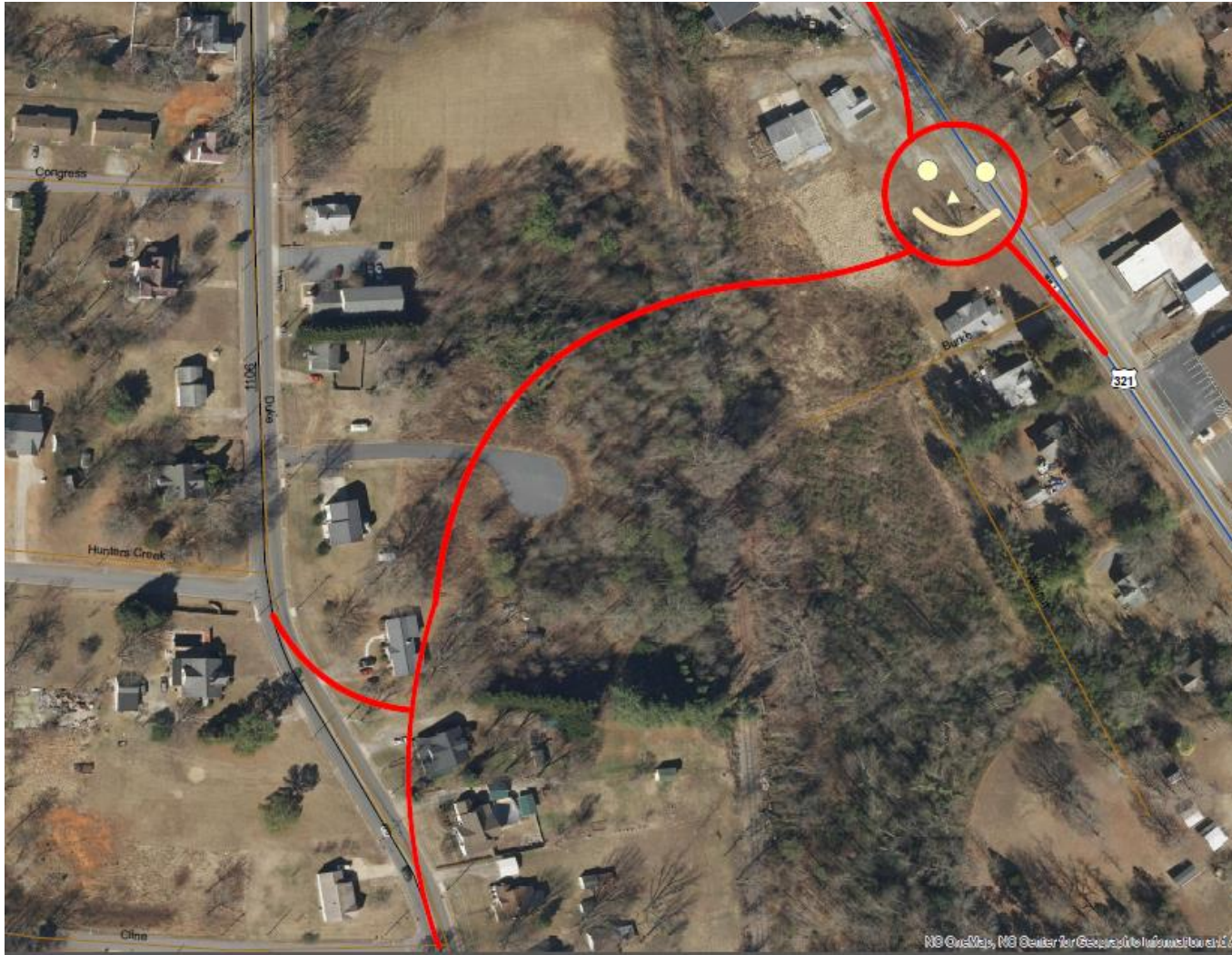
INTRODUCTION



PLANNERS	TRAFFIC ENGINEERS
Livability	Efficiency
Uniqueness (i.e. Place-making)	Uniformity
People	Vehicles
Vision	Standards
Potential	Solving a Problem



Planners and Engineers Working Together!



The Purpose of Traffic Engineering

- Getting people where they are going.
- Getting them there safely.
- Getting them there efficiently.



Guiding Principles

- It's all about conveying appropriate information.
- It's all about gaps.
- It's all about saying no.



BASIC TRAFFIC ENGINEERING CONCEPTS

- Capacity
- Signal Warrants
- Signal Phasing



Capacity

The capacity of a facility is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.

ITE Traffic Engineering Handbook, 5th Edition



Capacity

Capacity analysis is, therefore, a set of procedures for estimating the traffic-carrying ability of facilities over a range of defined operational conditions. It provides tools for the analysis of existing facilities and for the planning and design of improved or future facilities.

ITE Traffic Engineering Handbook, 5th Edition



How Do We Measure Capacity?

Facility	Measure of Performance
Highway	Flow
Arterial	Speed
Intersection	Delay



What Affects Capacity?

ROADWAY FACTORS

- Number of Lanes
- Lane Width
- Grade
- Parking
- Area (Intersections, Driveways, Etc.)



What Affects Capacity?

TRAFFIC FACTORS

- Types of Vehicles
- Types of Drivers
- Lane Utilization
- Turning Traffic
- Pedestrian Movements
- Parking/Bus Stops
- Peak Hour Factor



What Affects Capacity?

TRAFFIC CONTROL FACTORS

- Signal Control or Stop Control
- Signal Phasing
- Signal Timing (Departures)
- Signal Coordination (Arrivals)



The Real Questions for Planners

How much capacity do we need?

How much of the day are we willing to live with a facility being near or over capacity?

What are we willing to trade to increase capacity?



TRAFFIC SIGNAL WARRANTS



Traffic Signal Warrants

Good News or Bad News?

NCDOT plans to install a new traffic signal between your home and your office.



Traffic Signal Warrants

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BAD NEWS



Traffic Signal Warrants

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NCDOT plans to install a new traffic signal between your home and your office.

It is at an intersection where you turn left.



Traffic Signal Warrants

Good News or Bad News?

NCDOT plans to install a new traffic signal between your home and your office.

It is at an intersection where you turn left.

Good News!



Traffic Signal Warrants

- Defined by FHWA's Manual on Uniform Traffic Control Devices.
- Attempt to balance benefits of traffic signals with negatives of traffic signals.



Traffic Signal Warrants

Benefits

- Allow sidestreet traffic to enter
- Allow pedestrians to cross
- Potentially reduce some crash types
- Potentially reduce delay for sidestreet traffic
- Creates gaps downstream

Negatives

- Increases some crash types
- Increases mainline delay



Traffic Signal Warrants

- Traffic volume warrants are based on a combination of mainline traffic and sidestreet traffic
- Are there enough gaps in mainline traffic to allow sidestreet traffic to enter?



Traffic Signal Warrants

“If you don’t put up a stoplight,
somebody’s gonna get killed.”



Traffic Signal Warrants



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Traffic Signal Warrants

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Traffic Signal Warrants

Crash warrant requires 5 or more
“correctable” crashes in a one-year period.



Traffic Signal Warrants

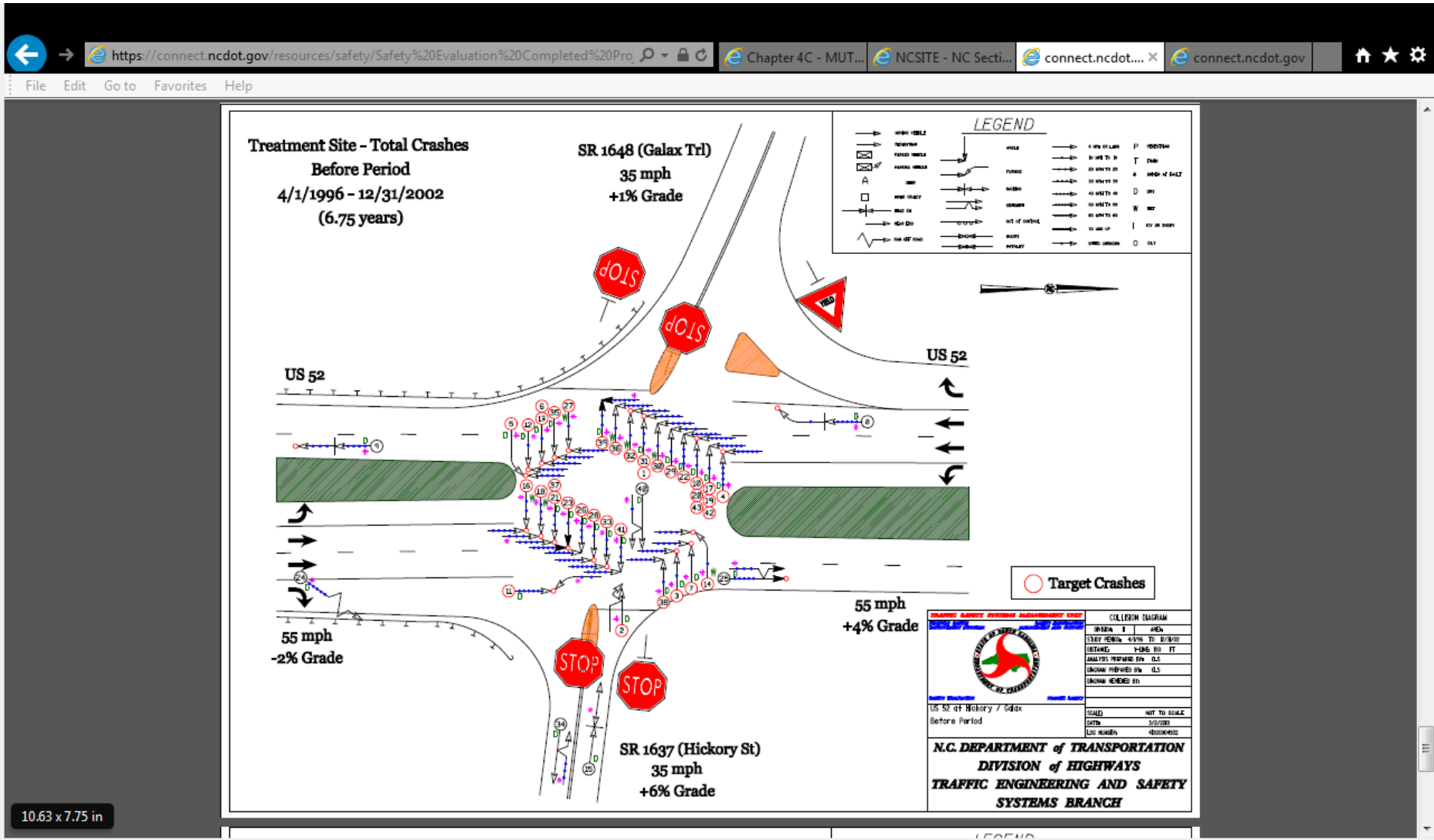
Crash warrant a traffic signal to be considered if the number of reported angle and pedestrian crashes exceed certain thresholds,

. . . and . . .

still has volume requirements.

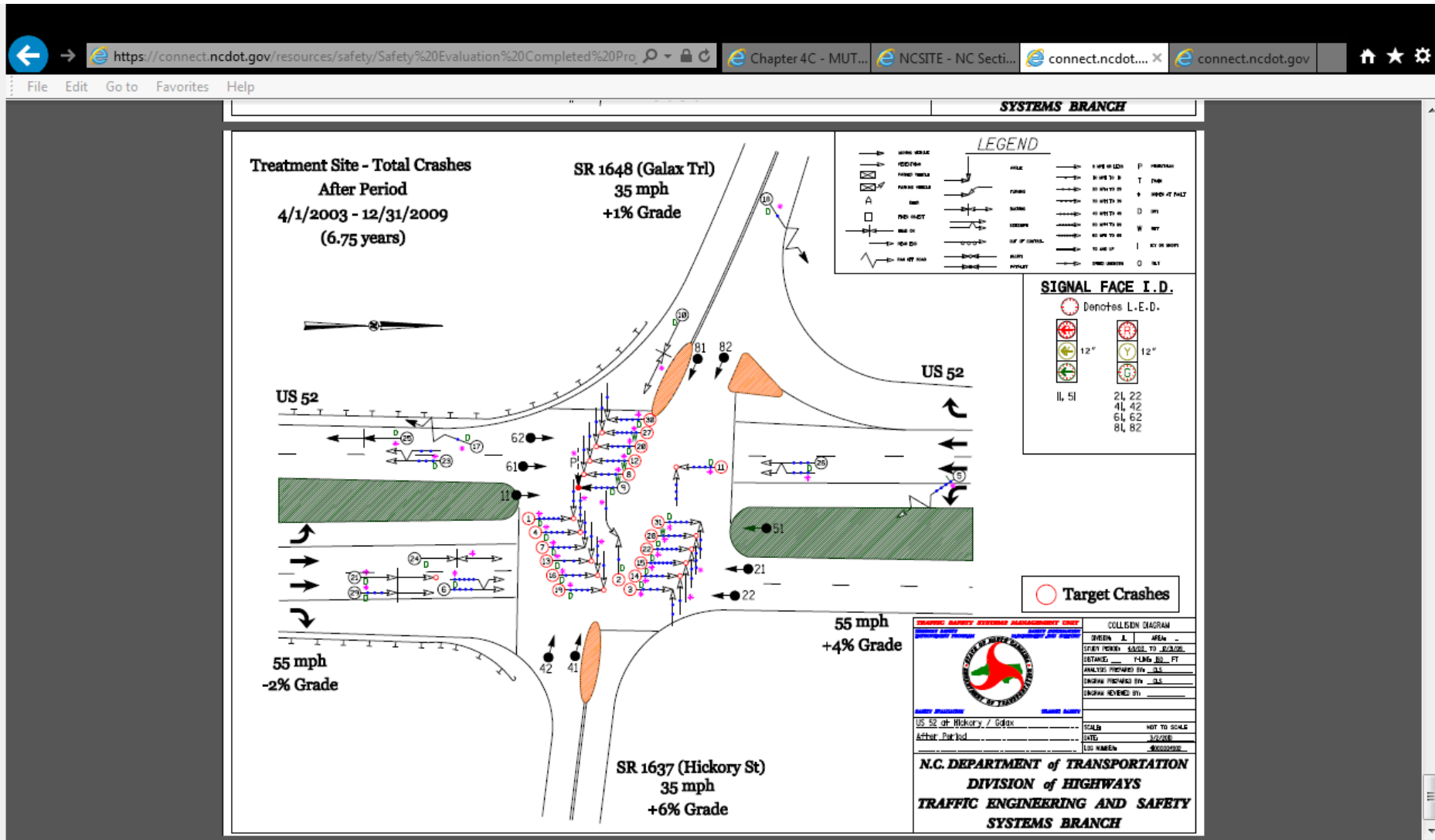


Crash Pattern Before Signal Installation



10.63 x 7.75 in

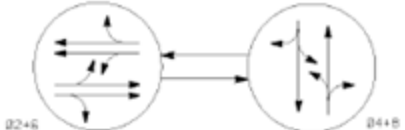
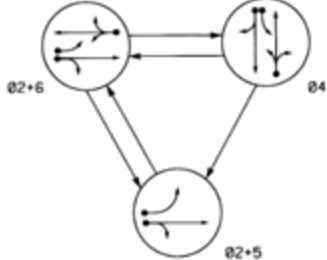
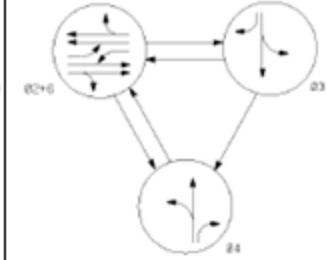
Crash Pattern After Signal Installation



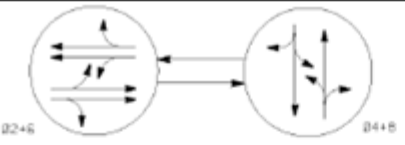
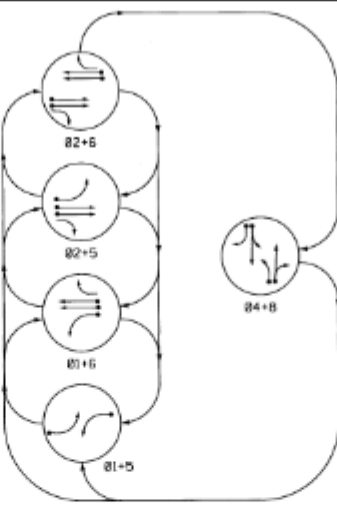
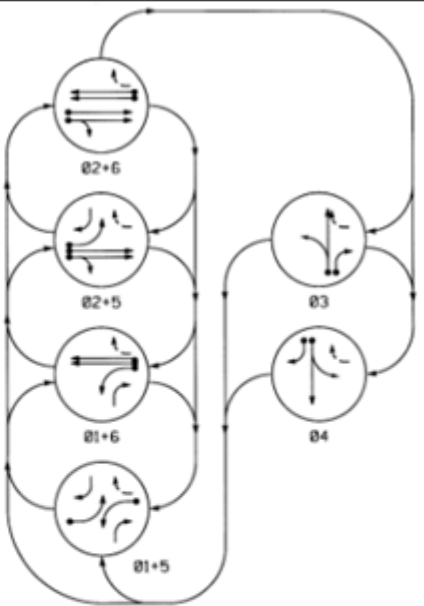
TRAFFIC SIGNAL PHASING



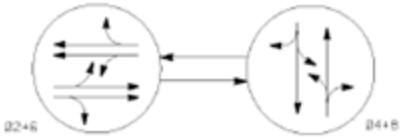
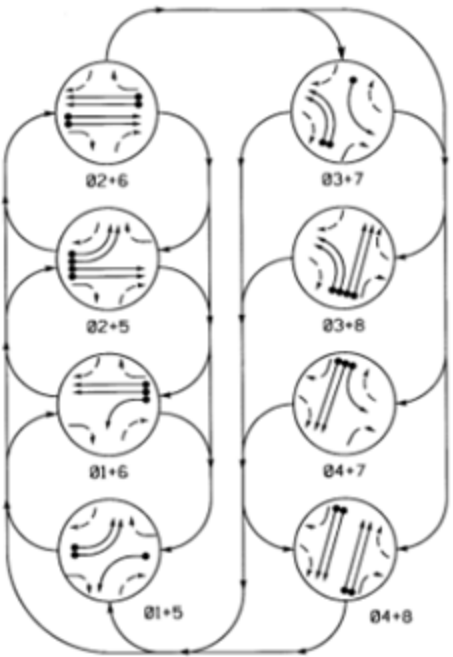
Traffic Signal Phasing

			
Phasing	2-Phase Operation	3-Phase Operation	3-Phase Split <u>Sidestreet</u>
Cycle Length	60 Seconds	75 Seconds	90 Seconds
Main Street Green Time	35 Seconds	35 Seconds	40 Seconds
Main Street Percent of Green Time	58%	46%	44%

Traffic Signal Phasing

			
Phasing	2-Phase Operation	5-Phase Operation	6-Phase Split <u>Sidestreet</u>
Cycle Length	60 Seconds	90 Seconds	120 Seconds
Main Street Green Time	35 Seconds	40 Seconds	50 Seconds
Main Street Percent of Green Time	58%	44%	41%

Traffic Signal Phasing

		
Phasing	2-Phase Operation	8-Phase Operation
Cycle Length	60 Seconds	120 Seconds
Main Street Green Time	35 Seconds	60 Seconds
Main Street Percent of Green Time	58%	50%

Traffic Signal Phasing



Traffic Engineering FAQ's

- Signs
 - Speed Limits
 - Warning Signs
 - Directional Signs
- Pavement Markings
 - Crosswalks
 - Bike Lanes/Sharrows



Signs



Signs/Pavement Markings

To be effective, a traffic control device should meet five basic requirements:

- Fulfill a need;*
- Command attention;*
- Convey a clear, simple meaning;*
- Command respect from road users; and*
- Give adequate time for proper response.*



Do These Signs . . . ?

- *Fulfill a need;*
- *Command attention;*
- *Convey a clear, simple meaning;*
- *Command respect from road users;*
and
- *Give adequate time for proper response.*



Do These Signs . . . ?

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and
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Speed Limits



Speed Limits

- The maximum safe driving speed is not necessarily the appropriate speed limit for a roadway.
- If a road is built for higher speeds, drivers will operate at higher speeds.
- It is difficult to control driver behavior with speed limit signs



Speed Limits

- Factors for Determining a Speed Limit
 - 85th Percentile Speed
 - Crash Patterns
 - Development Density and Type



Speed Limits

Unposted Rural Roads—the statutory speed limit is lesser of:

of 55 MPH

OR

Maximum Safe and Reasonable Speed



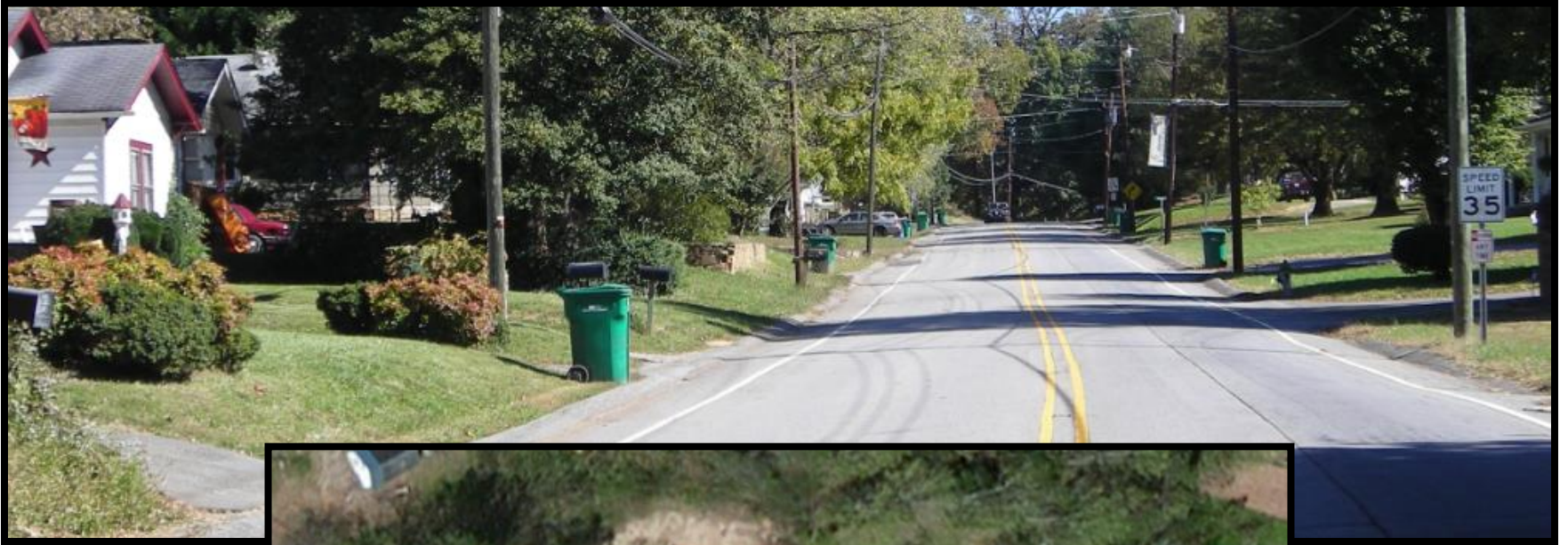
55 MPH Speed Limit



45 MPH Speed Limit



35 MPH Speed Limit



Speed Limits

Roadside development greater than 90 percent of roadway frontage—25 MPH



WARNING SIGNS



Quiz Time: What's Missing from this Picture?



Quiz Time: What's Missing from this Picture?





So, why isn't it there?

Warning Signs

- The overuse of warning signs diminishes their effectiveness.
- Warning signs are intended to warn unfamiliar drivers of an unexpected hazard.
 - People living in a neighborhood are not unfamiliar drivers.
 - Farm equipment is not an unexpected hazard on a road surrounded by farm fields.
 - Curves should not be unexpected hazards in mountainous areas.



DIRECTIONAL SIGNS



Directional Signs

- Drivers need limited amounts of information and enough time to process the information.
- Directional signs should be used only for major and moderate traffic generators.
- Directional signs are not intended for advertising, but to direct people to their already-chosen destination.



Pavement Markings



Pavement Markings

- Pavement markings provide guidance.
 - Daytime and nighttime visibility
- Pavement markings provide information.
 - Colors
 - Shapes
 - Words/Symbols
- Pavement markings provide instruction.
 - Line types

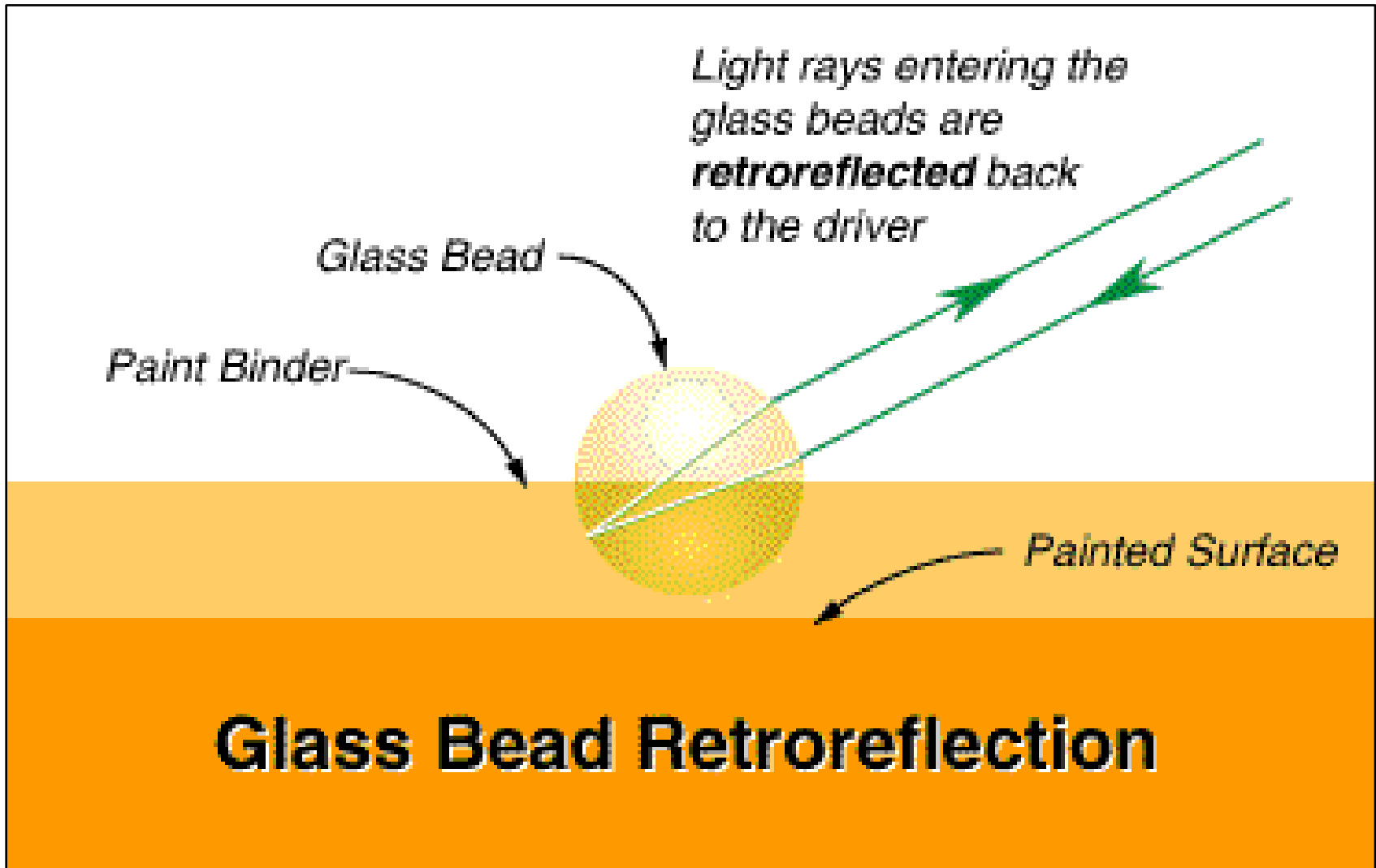


Pavement Markings

- Pavement markings are difficult to maintain.
- Pavement markings can be difficult to see in inclement weather.
- Pavement markings are often less visible to drivers than one would think due to the angle between the markings and the drivers' eyes.



Pavement Markings



Crosswalks

- Direct pedestrians to appropriate locations to cross roadway.
- Alert motorists to the possibility of pedestrians in the roadway.



This is not a joke.



Crosswalks



What you see.



Crosswalks

What the
driver sees.



Crosswalks



What you see.



Crosswalks



What the driver sees.

Bicycle Lanes and Sharrows



Questions

