Traffic Engineering 101 - The Basics

Understanding the basic principles and how these drive the decisions regarding traffic management in Louisiana
Traffic Engineering 101

• Purpose:
  – To provide an overview of engineering principles; guidelines & laws which govern traffic management in Louisiana
  – Discuss how DOTD’s decisions impact local communities
  – Facilitate feedback & questions from local agencies on state and local traffic engineering issues
• Federal policy
• All states must adopt
• Set minimums for traffic control devices such as
  – Signs
  – Pavement marking
  – And signals
Engineering Directives and Standard Manual (EDSM)

- DOTD policy
- Signed by Chief Engineer
- Provides additional requirements
Basic Principle of Traffic Engineering

“Everything is designed to meet Driver Expectancy”
TR Engineering 101

• Module:
  1. Introduction & Overview (3/22/10)
  2. Speed Management Overview (4/26/10)
  3. School Zones (4/26/10)
  4. Intersection Traffic Control (5/24/10)
  5. Traffic Signal (5/24/10)
  6. Roundabouts (5/24/10)
  7. Sign Selection & Installation (6/28/10)
  8. Work Zones (6/28/10)
  9. Access Management (7/26/10)
Intersection Traffic Control & Management

• Control options
  – Stop control
  – Traffic signals
  – Roundabouts

• Evaluation, selection and maintenance of each
Suggestions & Feedback

• Specific questions you have regarding the major topics:
  – DOTD’s traffic engineering staff & general program
  – Speed management decisions
  – Intersections
  – Traffic signals
  – Roundabouts
  – Signs
  – Access management
More Suggestions?

• Other traffic issues or questions?

• Contact Jody Colvin at Jody.Colvin@la.gov

• or Marie B. Walsh at mbwalsh@ltrc.lsu.edu
All Way Stop
Intersections
Multiway stop control can be useful as a safety measure at intersections if certain traffic conditions exist.
MUTCD Section 2B.07

Multiway stop control is used where the volume of traffic on the intersecting roads is approximately equal.

\[
\text{Volumes on Street A} = \text{Volumes on Street B}
\]
The decision to install multiway stop control should be based on an engineering study.
Engineering Study

- Count data
- Delay study
- Crash investigation
- Site investigation
Criteria to Install: Crashes

5 or more reported crashes in a 12 month period which include right- and left-turn collisions as well as right-angle collisions.
Criteria to Install: Volumes

In the same 8 hour period:

- Total of both major street approaches averages at least 300 vehicles per hour
- Total of both minor street approaches averages at least 200 units per hour
- An average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour
Criteria to Install: Optional

- The need to control left-turn conflicts;
- The need to control vehicle/pedestrian conflicts
- Sight Distance Issues
Installation

Size
Min. 24” X 24”  Oversize 48” X 48”

Location
• Right side of Road
• Close to the Intersection as practical
• See MUTCD 2003 Page 2A-10
Local Road Safety Program: Intersection Program

• Nominate Intersections
• Low Cost safety Improvement Packages
• Program website: https://www.ltrc.lsu.edu/ltap/lrsp.html
• Contact Marie Walsh 225 767-9184
Questions?

Contact:
Jody Colvin
(225) 242-4635
Jody.Colvin@la.gov
Roundabouts
Key Roundabout Characteristics

- Circular shape, yield control on entry, and geometric features that create a low-speed environment.
• Characteristics of Roundabouts
• Louisiana Roundabouts
• Benefits
Key Roundabout Characteristics

• Yield at entry
• No need to change lanes to exit
• Inscribed circle diameter much smaller than old traffic circles (110 ~ 150 ft)
• Operating speeds between 18~23 mph
• Channelized approaches (Splitter islands)
• Counterclockwise circulation
• Approximate capacities
  – Single lane ~ 25,000 veh/day
  – Double lane ~ 45,000 veh/day
Roundabout Category Comparison

Single-Lane Roundabout
“Non-Conforming Traffic Circle”

Alexandria, LA
• Characteristics of Roundabouts
• **Louisiana Deployment Status**
• Benefits of Roundabouts
Roundabouts in Louisiana

Louisiana Roundabouts Installed

• LA 59 @ LA 36 - Abita Springs
• LA 1067 @ Airport Road - Hammond
• LA 93 @ Ridge Road - Lafayette
• LA 92 @ Chemin Metairie Parkway - Lafayette metro (Youngsville)
• LA 89 @ Chemin Metairie Parkway – Lafayette metro (Youngsville)
Roundabouts in Louisiana

Louisiana Roundabouts
Under Construction

• LA 1091 @ Brownswitch Road - Slidell
• US 11 @ Cleo - Slidell
• LA 1067 @ Airport Road - Hammond
Roundabouts in Louisiana

Louisiana Roundabouts Under Consideration

- Lafayette urban area – Over 120 intersections identified

- Baton Rouge urban area – US 190 @ Juban and Eden Church Rd
  - US 190 @ Juban
  - US 190 @ Eden Church Rd

- North Shore
  - US 51 Bus @ I-12
  - LA 1077 @ LA 1085
Roundabouts in Louisiana

LA 93 (Rue De Belier) @ LA 342 (Ridge Rd)
Roundabouts in Louisiana

LA 92 @ Chemin Metairie Parkway
Roundabouts in Louisiana

LA 59 @ LA 36
Presentation Outline

• Characteristics of Roundabouts
• Louisiana Deployment Status
• Benefits of Roundabouts
Benefits of Roundabouts

• Traffic Safety
  – Reduce total crashes by 35% and injury crashes by 76%
  – Reduce fatalities over 90%

• Pedestrian Safety
  – Reduced vehicle speeds, focus on one traffic stream
  – May cause issues for visually impaired pedestrians

• Traffic Calming
  – Reduce vehicle speeds using geometric design
Benefits of Roundabouts (Continued)

- **Operational Performance**
  - Lower overall delay than other controlled intersections
  - Specific users do not receive priority

- **Ongoing Operations and Maintenance**
  - Lower operating and maintenance costs than a traffic signal
  - Lower life cycle cost

- **Aesthetics**

- **Approach Roadway Width**
  - May not require lengthy turn lanes
“Roundabouts First” policies

- New York
- Virginia
- Washington
- Wisconsin
- Maryland
- …and growing number of municipalities
Conclusion

• Roundabouts are substantially different from the older “traffic circles” or “rotary” intersections

• Roundabouts provide superior safety and operational benefits compared to other types of intersections

• Louisiana is leaning forward in the deployment of roundabouts
References

• Transportation Research Board. *Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities*. 2010.


For More Information

- LTAP/LMA Roundabout webinar on August 23, 2010. 2:00 PM

- DOTD Roundabout EDSMs:
  - “Roundabout Study and Approval” (VI.1.1.5)
  - “Roundabout Design” (VI.1.1.6)

- Visit FHWA’s intersection safety web site for more information on Roundabouts:

  http://safety.fhwa.dot.gov/intersection
Traffic Signal

Intersections
MUTCD Part 4
Highway Traffic Signals

- Chapter 4A  General
- Chapter 4B  Signals – General
- Chapter 4C  Signals – Needs Studies
- Chapter 4D  Features
- Chapter 4E  Pedestrian Features
MUTCD Signal Installation

• An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.
A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.
MUTCD- Warrants

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Volume.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal System.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.
The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.
MUTCD Signal Installation

A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.
MUTCD Signal Study Counts

• At least a 24 hour vehicle count on a Tues, Wed or Thurs for all approaches entering the intersection

• Peak hour vehicle and pedestrian counts for at least the highest hours in the A.M. and the P.M.

• Peak hour counts for any period that can be considered a secondary peak.
MUTCD Signal Study Data

- The posted or statutory speed limit or the 85th percentile speed on the uncontrolled approaches to the location

- A condition diagram showing the physical layout of the intersection

- A collision diagram showing crash experience at or near the intersection.
All new signals shall:

i. Meet Warrant 1a (100%) or Warrant 7 from the MUTCD, and

ii. Be spaced at least $\frac{1}{2}$ mile from an adjacent signal, and

iii. Service a public road on at least one minor approach
Applies to all new signals on state highways.

Including signal permits, construction projects and DOTD installed.
Why only 2 warrants?

- Study conducted internally
- Main volume warrant
- Crash warrant

Why ½ mile spacing?
Better coordination between signals for:

- Better traffic flow
- Consistent speeds
DOTD – Signal Design Manual

Defines DOTD’s process for:
Signal studies
Left turn phasing
Timing Analysis
Pole layouts
Head placement
Controller placements
Detection types and layout
Sign placements
Material types
... And much more!
DOTD – Signal Design Manual

Located on the DOTD Traffic Engineering website

Currently in the process of being updated
Existing Signals
Unwarranted Signals

Removal of unwarranted signals can reduce all types of crashes by 24%
Existing Signal Upgrades

• DOTD policy memorandum signed by the Chief Engineer and the Assistant Secretary of Operations

• States no upgrades on existing signals can be performed without a traffic study

• If warrants are not met and/or there is no engineering justification for the signal then a signal removal study must be performed
A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.
Signal Removal Study

• The signal will be flashed for 30 days.

• The DTOE will observe the location to determine if there are any safety or operational issues.

• If no issues then the signal heads and signs will be removed.

• After 3 months the poles and cabinet will be removed.
Questions?

Contact:
Jody Colvin
(225) 242-4635
Jody.Colvin@la.gov
Traffic Signal Installation & Maintenance
DOTD – TSI

Traffic Signal Inventory
Each signal has a unique TSI number
Includes a layout of the intersection and signal equipment
Tracks updates and maintenance
Records Operation of signal such as:
  o red, yellow and green time
  o phasing
  o timing plans
  o emergency operations
DOTD – TSI

![Image of traffic signal inventory](image)

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**TRAFFIC SIGNAL INVENTORY**

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OFFSET 62 sec

PLANNED CYCLE 30 sec
# DOTD – TSI

**Traffic Signal Inventory**

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**Intersection:** LA 659 (E. Park Ave.) @ LA 3007 (Prospect Blvd.)

**City:** Houma

**Parish:** Terrebonne

**Type Signal:** Actuated Controller

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**Hours of Flashing Special Emergency:**

- **Time SEC:** 6.0, 5.0, 10.0
- **FO SEC:** 62, 62
- **YP SEC:** 62, 62

**SPLDL SEC:**

- **14:** 36, 36
- **36:** 12, 12
- **28:** 28
- **28:** 28

**Plan:**

- **Cycle Length:**
  - **Times of Operation:**
    - Off Set: 90
    - Times of Operation: All Day

- **Split SEC:**

  - **Cycle Length:**
    - **Times of Operation:**

- **Split SEC:**

  - **Cycle Length:**
    - **Times of Operation:**

**Maneuver:**

- **1:** 1
- **2:** 2
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**Traffic Signal Inventory Details**

- **Signal Phases:**
- **Hours of Flashing Special Emergency:**
- **Cycle Length:**
DOTD – TSI

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RECALL FUNCTIONS
- MON: MEMORY ON
- MOF: MEMORY OFF
- MIN: MINIMUM
- MAX: MAXIMUM
- PMIN: PEDESTRIAN AND MINIMUM
- PMAX: PEDESTRIAN AND MAXIMUM

Note 1:
Note 2:
Note 3:
Maintenance

Annual Inspections for:

- Equipment
- Signing
- Striping
- Timing
**Inspection Sheets**

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</tr>
<tr>
<td>KENTRON RFA 200</td>
<td>MARBELLITE M30</td>
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</tr>
<tr>
<td>NAZTEC TSI</td>
<td>MARBELLITE M41</td>
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<tr>
<td>SVA 367</td>
<td>BEACON</td>
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<tr>
<td>TRAFFIC CONTROL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CONFLICT MONITOR TYPE</td>
<td>POLE LAYOUT</td>
<td></td>
</tr>
<tr>
<td>BOXED</td>
<td>DIAGONAL</td>
<td>MAST ARM</td>
</tr>
<tr>
<td>POLE TYPES</td>
<td>SINGLE</td>
<td>DOUBLE</td>
</tr>
<tr>
<td># OF MAST ARM</td>
<td>12345</td>
<td>12345</td>
</tr>
<tr>
<td>METAL</td>
<td>WOOD</td>
<td>UTILITY POLE</td>
</tr>
<tr>
<td># OF MAST ARM</td>
<td>12345</td>
<td>12345</td>
</tr>
<tr>
<td>DETECTION</td>
<td>LOOPS: YES</td>
<td>NO</td>
</tr>
<tr>
<td>TOTAL # OF CAMERAS</td>
<td>12345</td>
<td>RADAR</td>
</tr>
<tr>
<td>12345</td>
<td>12345</td>
<td>12345</td>
</tr>
</tbody>
</table>

**ATTACH MARKED UP TSI WITH NORTH ARROW, SIGNAL HEAD #S, LANE #S, AND LANE TYPES**
**Inspection Sheets**

**Traffic Signal Preventive Maintenance Report**

**Work Order Number:**

**Location:**

**Intersection #:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Operating Properly</th>
<th>Adjusted</th>
<th>Cleaned</th>
<th>Repaired</th>
<th>Replaced</th>
<th>Referred</th>
<th>Removed</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual inspection of cabinet &amp; miscellaneous equipment</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Documentation present</td>
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<tr>
<td>Cabinet prints present</td>
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<tr>
<td>Controller operating properly</td>
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<td></td>
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<tr>
<td>Controller programming</td>
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<td></td>
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<tr>
<td>Inspect contacts (electromechanical)</td>
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<tr>
<td>Detectors operating properly</td>
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<tr>
<td>Conflict monitor tested for conflict</td>
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<tr>
<td>Conflict monitor tested for absent Ind.</td>
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<tr>
<td>Conflict monitor tested for voltage mon.</td>
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<tr>
<td>All wiring connections check for tightness</td>
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<td></td>
<td></td>
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<tr>
<td>Signal heads, alignment and unobstructed</td>
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<td></td>
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<tr>
<td>Signal lamps operational</td>
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<tr>
<td>Signal lens, visual inspection</td>
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<tr>
<td>Signal heads, clearance from roadway</td>
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<tr>
<td>Visual inspection of signs</td>
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<tr>
<td>Sign(s), straight and mounting tight</td>
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<tr>
<td>Visual inspection of signal cable</td>
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</tr>
</tbody>
</table>
## Traffic Signal Preventive Maintenance Report

**Work Order Number:**

**Page 2 of 2**

### Location:

<table>
<thead>
<tr>
<th>Intersection #:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### Activity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Operating Properly</th>
<th>Adjusted</th>
<th>Cleaned</th>
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<th>Replaced</th>
<th>Referred</th>
<th>Removed</th>
<th>Not Applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Inspection of span cable</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Pedestrian detector tested</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Loops inspected for physical damage</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Span attachments and hardware tight</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Signal support poles</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Service disconnect visual inspection and locked</td>
<td></td>
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</tr>
</tbody>
</table>

### Signature of Technician Performing Maintenance:

_________

**Date:**

_____
Maintenance

Update TSI when any changes are made
District 08 Stats

Signals & Flashing Beacons: 271

Flashing Beacons: 88
Signals: 183

Signal Electricians: 7 (2 man crews)

Engineering Technicians: 3

Traffic Engineers: 3
Signal Costs

Installation costs: $150,000

Utility Costs:  
- w/ LED $17/month  
- w/ Bulbs $148/month

District 08
Maintenance Call Outs per month:
- 66 signal calls during working hours
- 18 signal call after working hours
Questions?

Contact:
David Backstedt
(318) 561-5105
David.Backstedt@la.gov
Photo Enforcement and DOTD
Photo Enforcement

Highway Safety
Existing Installations
Legislation
Future Installations
Highway Safety

Engineering
Enforcement
Education
Highway Safety

Engineering
Enforcement
Education

Photo Enforcement
Highway Safety

- FACT: Photo Enforcement is a tool that has been proven to improve compliance with laws and therefore can improve safety.
- 2010 HSM: Photo enforcement can reduce angle crashes by 26%
Engineering tools that can reduce crashes

Photo Enforcement – 26% Angle +18% rear ends
Lighting – 38% nighttime injury
Remove unwarranted signal – 24%
Convert signal to roundabout – 48%
Protected Only – 99% left turn crashes
Existing Red Light Installations in Louisiana

- New Orleans
- Jefferson Parish
- Baton Rouge
- Lafayette
Existing Speed Vans in Louisiana

- Lafayette
- Baker
- Zachary
- Livingston Parish
- Gretna
- Westwego
Existing Installations Approved by DOTD in 2008

- Lafayette –
  - Red light running
  - Speeding
- Baton Rouge –
  - Red light running
First year’s performance for Lafayette

Effectiveness of Red-Light Cameras for Reducing the Number of Crashes at Intersections in the City of Lafayette

Submitted to:
Dan Magri
LADOTD

By:
Dr. Helmut Schneider
Associate Dean for Research and Economic Development
Ouroboros Family Distinguished Professor of Information Systems and Chairman of Information Systems and Decision Sciences at Louisiana State University
Ph: 225-578-2516
Fax: 225-578-2511
Homepage: http://info.bus.lsu.edu
LA Traffic Crash Reports http://ltc.rsc.lsu.edu

Acknowledgment. The report was prepared with the help of Cory Hutchinson (HSRG) and Christian Raschke (HSRG). The research was supported through a grant from the Louisiana DOTD.
# First year’s performance for Lafayette

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Right Angle</th>
<th>Rear End</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before</strong></td>
<td>Jan 07 - Dec 07</td>
<td>45</td>
<td>66</td>
<td>15</td>
</tr>
<tr>
<td><strong>After</strong></td>
<td>Apl 08 - Mar 09</td>
<td>30</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td><strong>Percent Change</strong></td>
<td><strong>-33%</strong></td>
<td><strong>-2%</strong></td>
<td>0%</td>
<td><strong>-13%</strong></td>
</tr>
</tbody>
</table>

Highway Safety Manual: Photo enforcement can reduce angle crashes by 26% and increase rear end crashes by 18%.
Legislation
2001; HB 1591 – Municipalities – Failed in House
2001; SB 1059 – Municipalities – died in committee
2004; HB 1078 – Municipalities – Failed in House
2004; SB 612 – Municipalities – died in House
2005; SB 168 – New Orleans – withdrawn
2005; HB 368 – New Orleans – died in House
2008; SB 396 – Municipalities – Failed in Senate
2009; HB 254 – Statewide – died in committee
2009; HB 480 – Prohibit – died in committee
HB 159 – Require vote of people – withdrawn
HB 160 – Prohibit - deferred
HB 283 – Court oversight - ?
HB 374 – Limits fines - held in committee
HB 383 – Require vote of people - ?
HB 786 – Justice of Peace oversight- ?
HB 859 – Prohibit – held in committee
HB 1149 – Railroad crossings – passed House
HB 1147

Allows the installation of photo enforcement at railroad grade crossing and allocates fees:

- 1/3 of fees to local government
- 1/3 of fees to rail safety fund
- 1/3 of fees to new passenger rail fund
• Red Light Enforcement at DOTD owned signals (Sites will be selected based on safety.)
• Speed vans on state highways will require permits from DOTD.
Future Installations and New DOTD Policy

- Cooperative effort between Louisiana Municipal Association and DOTD.
- Sets statewide standards.
- Permits for DOTD owned signals and for speed enforcement vans/trailers.
- DOTD receives no money.
MEMORANDUM

TO: Mr. Richard Savoie, PE
DOTD Chief Engineer

FROM: Mr. Peter A. Allain, PE, PTOE
Traffic Engineering Division Administrator

SUBJECT: Photo Enforcement Permits

DATE: March 31, 2010

The purpose of this memorandum is to request approval to allow the Department to issue permits for the installation of photo enforcement systems on the state highway network. This office has determined that it would be in the best interest of the safety of our highways to allow local governments to operate photo enforcement equipment in the state owned highway right-of-way.

Through the attached policy, the Department will regulate the site selection, installation, and operation of these permits to ensure that the photo enforcement systems function to improve safety. The policy was developed as a joint effort between the Department and members of the Louisiana Municipal Association to provide statewide consistency in the use of photo enforcement.

This policy replaces all other policies and memorandums issued on this subject. This memorandum and policy will be attached to all new permits and become part of the permit conditions. Copies of this policy will be forwarded to all districts. Copies will also be sent to the cities of Lafayette and Baton Rouge, which hold existing permits.

Attachment
cc: Louisiana Municipal Association
Secretary Sherri LeBas
Ms. Connie Standige
Each District Administrator
Each District Traffic Operations Engineer
New DOTD Policy

- Definitions
- Purpose
- Permits - Authority, Location, Tolerances, Engineering Reports, Plans, Signing
- System Operation
- Removal
New DOTD policy details

- **Definitions**
  - Requires violations be at stop bar

- **Purpose**
  - Enhance safety
  - Grandfathers existing systems for 18 months.
New DOTD policy details

- Permits
  - Outlines permit process
  - DOTD Traffic Control Device Permit
  - Documented authority
  - Must have at least 5 crashes in 12 months
  - Speed tolerances of 6-10 mph
  - Red Light tolerance of 0.4 seconds
New DOTD policy details

• Permits (continued)
  • Requires engineering report
  • Clearance interval (**yellow light**)
  • Field inspection of intersection
  • Detailed plans
  • Minimum signing
  • Test plan
  • Annual **reporting**
New DOTD policy details

- System Operation
- Removal
  - If yearly report indicates an increase in crashes.

- Will begin accepting permits
  - August 1, 2010.
“...ensure that photo enforcement systems function to improve safety”

Traffic Signals

Speed Vans
New DOTD Policy

Does not address

- Legality of photo enforcement
  - Due process
  - Civil vs. Moving violations
  - Appeals
- Amount of fees or fines
  - How the fines are spent
Thank you

Contact Information:

Peter Allain, PE, PTOE

(225) 242-4631

peter.allain@la.gov
Traffic Engineering 101

Thank You!

See you on June 28th at 2:00PM for:

• Sign Installation and Maintenance
• Work Zones