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A City-Wide Safety Analysis of Mobile Speed Enforcement

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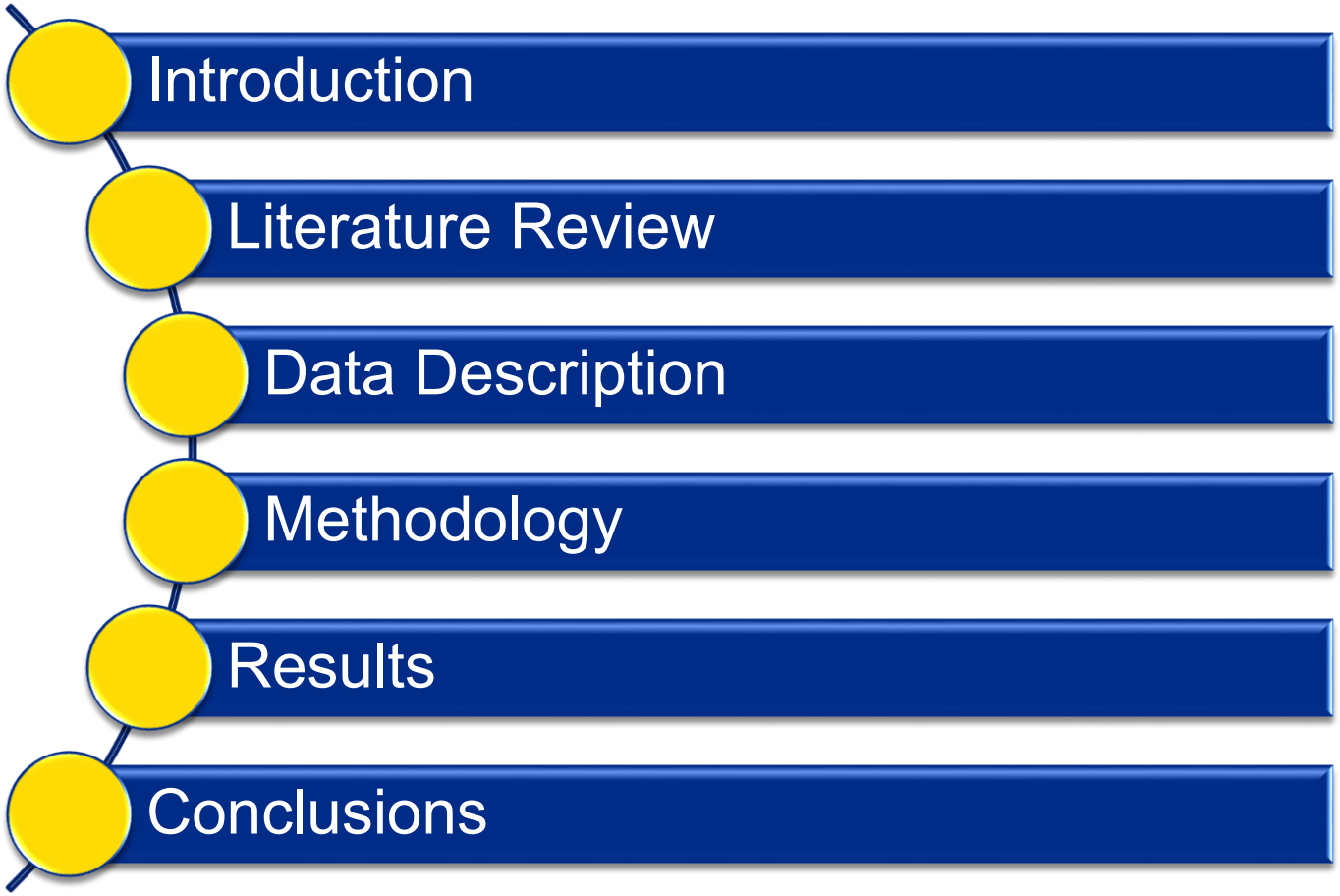
Outline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Introduction

Road Safety Problem

- Global Issue
  - **1.2 million** deaths, **50 million** injuries per year
  - **Young adults** (15~44) account for 59% of road traffic deaths

(WHO, 2013)

- In Canada
  - More than **2,000** deaths and more than **166,000** injuries in 2013
  - **$63 billion** social cost, 5% of GDP in 2007

(Transport Canada)

Improving Safety

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Education of children
Driver training
Public campaign

"More than 48% of fatal collisions due to traffic violations"

Drink driving
Seat belt usage
Speed enforcement

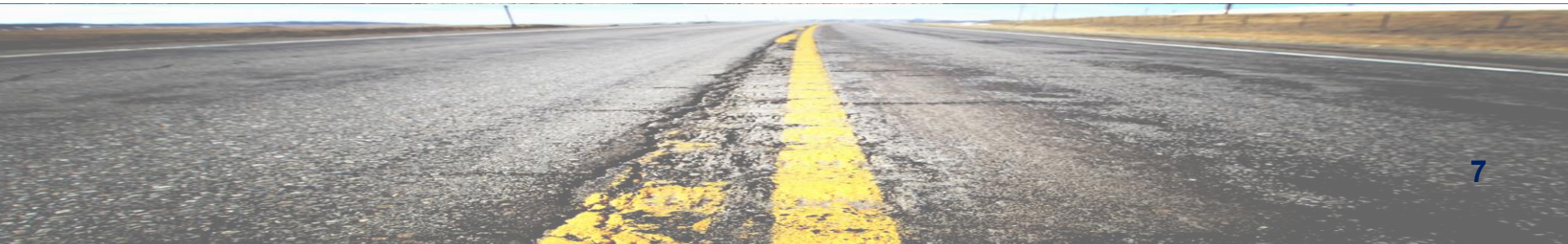
Road design
Road engineering
Vehicle technology

Speed Enforcement

- Types of Speed Enforcement
  - Conventional speed enforcement
  - Automated speed enforcement
    - Fixed photo enforcement
    - Mobile photo enforcement

Objectives

- Examine the long-term impacts of enforcement on collisions
- Calculate the marginal collision reduction effects of deployment hours and number of issued tickets



Literature Review

France

- 1823 fixed and 933 mobile cameras were installed from 2003 to 2010
- Interrupted time-series analyses (ARIMA)
- 21% reduction in the fatality rate per 100,000 vehicles
- the reduction in non-fatal injuries dropped from 26.2% in 2003 to only 0.8% in 2010

(*Carnis & Blais, 2013*)

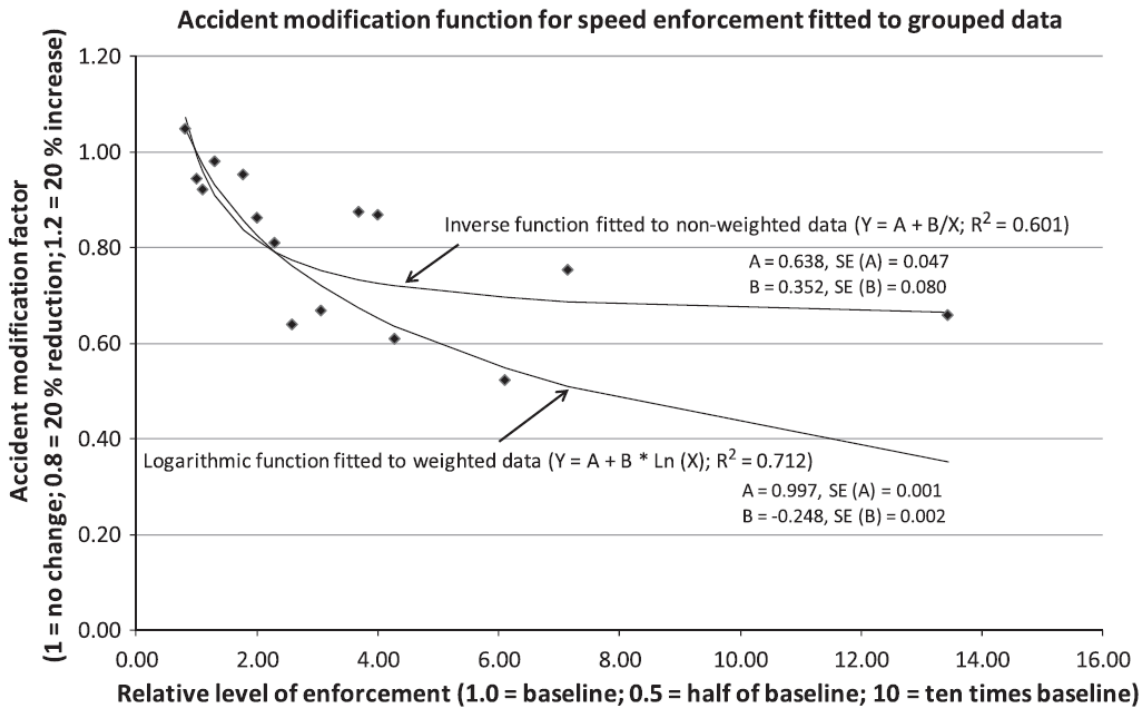
Queensland, Australia

- Randomized schedule method --- unpredictable
- Collision reductions were evaluated to adjust the program
- Largest reduction was found in fatal collisions at 31%
- Non-fatal collision reduction was revealed to increase with time
- Benefit-cost ratio for the program was estimated to be 55:1

(*Newstead, Cameron, & Leggett, 2001*)

Accident Modification Function

- Doubled enforcement intensity would further reduce injury collisions by 20%



(Elvik, 2011)

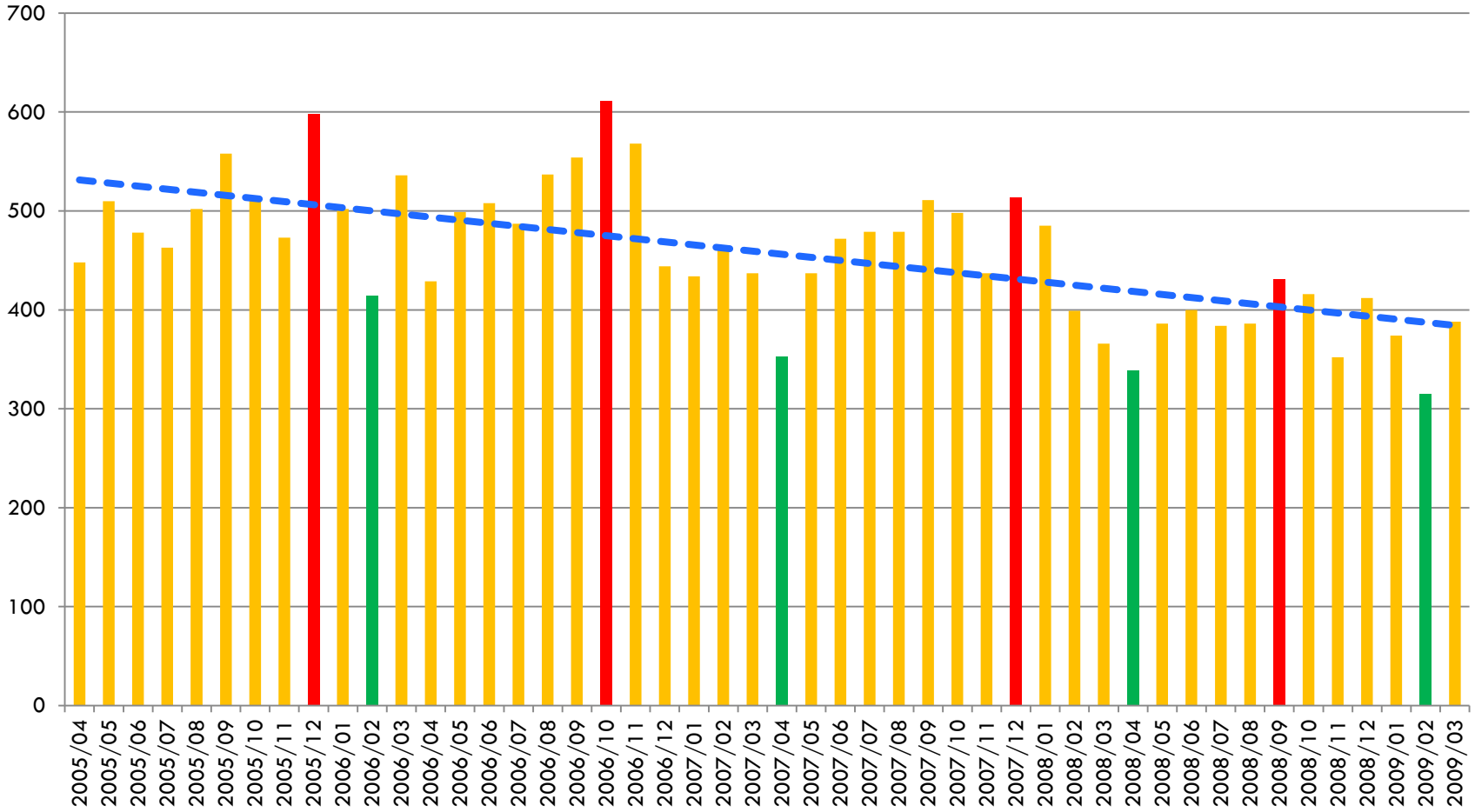
Data Description

Data Description

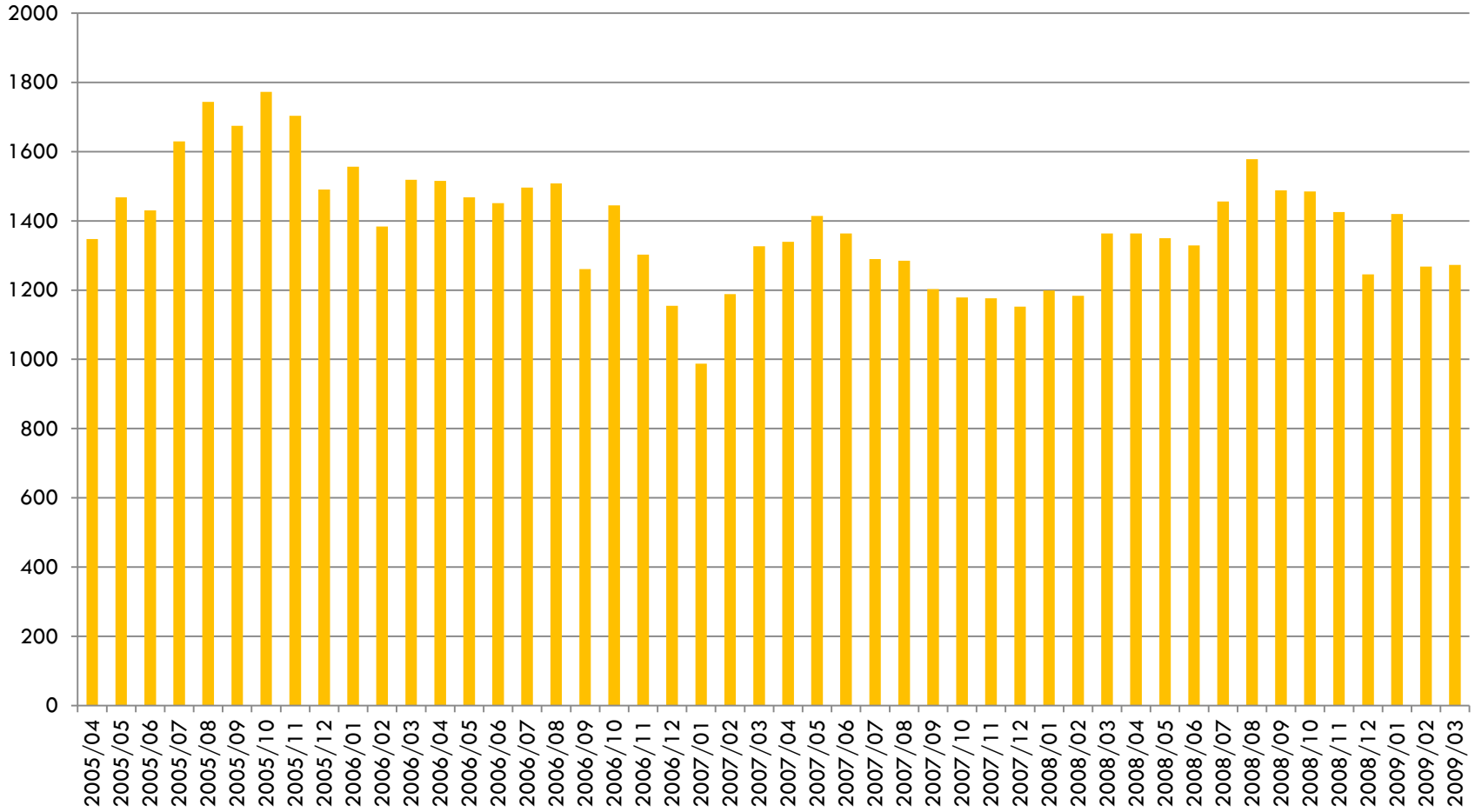
- Study Period: April 2005 – March 2009

- City-Wide Monthly Data:
  - Severe Collision Data (fatal + injury)
  - Enforcement Statistics (deployment hour, number of issued tickets)
  - Employment Rate (socio-economic factors)

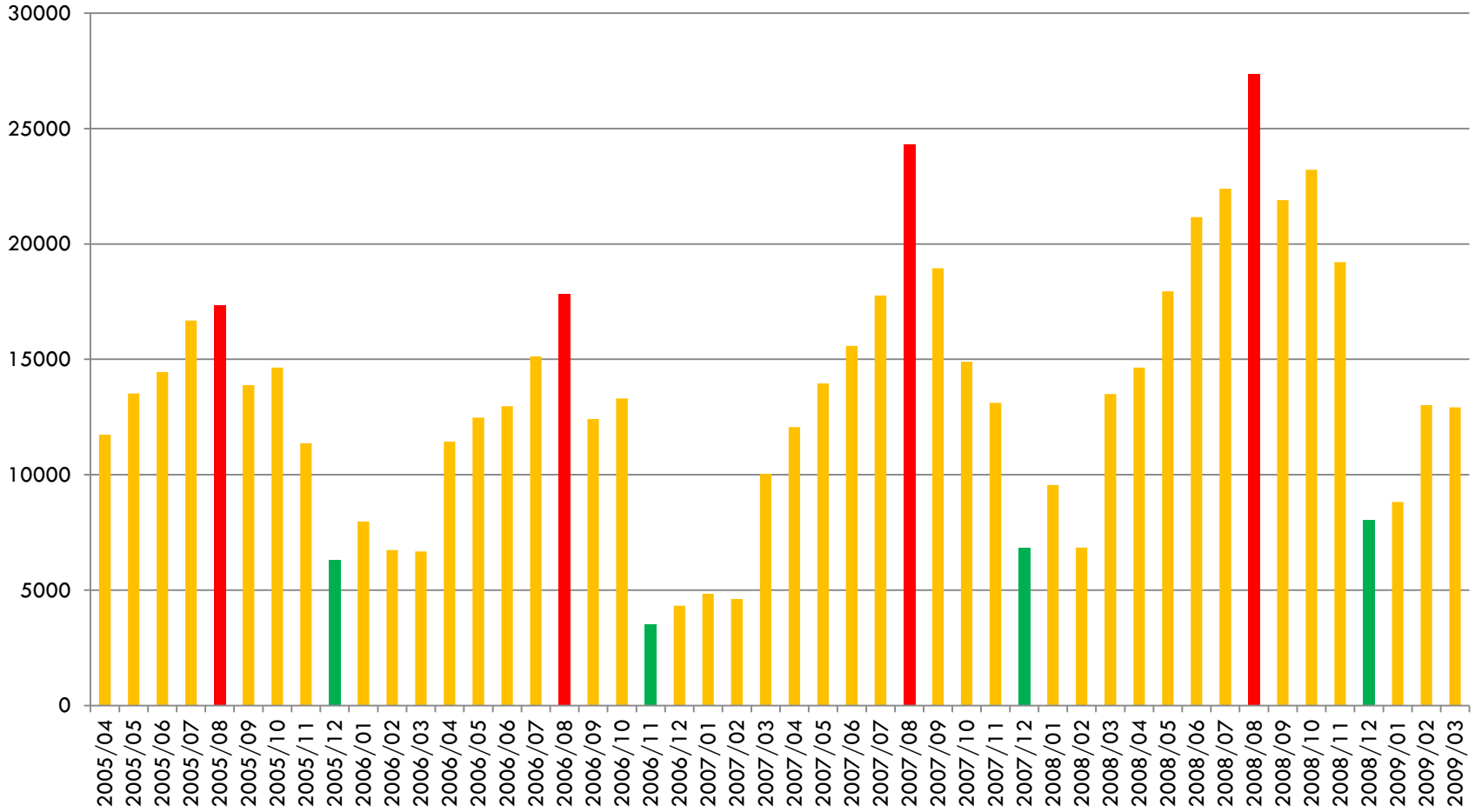
Number of Severe Collisions



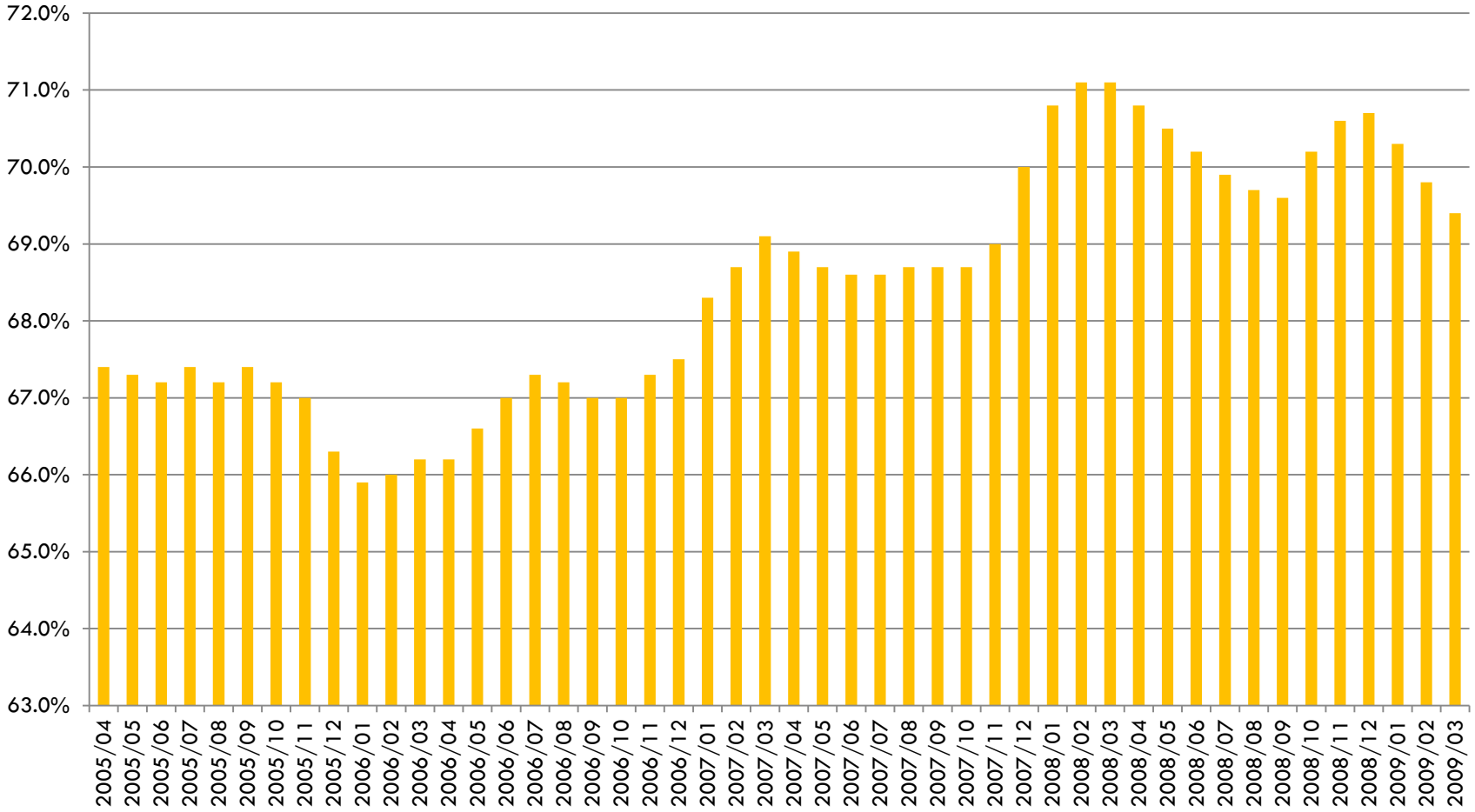
Number of Deployment Hours



Number of Issued Tickets



Employment Rate



Methodology

Methodology

Generalized Linear Model

Model Form:

$$\ln(\mu) = \beta_0 + \beta_1 Hours + \beta_2 Tickets + \beta_3 Employment + \beta_4 Trend + \beta_{5-15} Monthly\ Dummies$$

Model Distribution: Poisson Distribution (low dispersion parameter)

Model Calibration: SAS GENMOD procedure (maximum likelihood estimation)

Marginal Effect: $\frac{\partial E(\mu|x_j)}{\partial x_j} = \mu \cdot \beta_j$

Results

Results

- Parameter Estimation Results

	Intercept	January	February	March	April	May
Estimate	7.8961	-0.0611	-0.1835	-0.0381	-0.1551	0.0353
P Value	0.000	0.063	0.000	0.276	0.000	0.417
	June	July	August	September	October	November
Estimate	0.0709	0.089	0.1987	0.1911	0.1926	0.011
P Value	0.130	0.078	0.001	0.000	0.000	0.761
	Employment	Trend	Hours (1,000)	Tickets (10,000)		
Estimate	-0.02	-0.0034	-0.1131	-0.148	Significant at 95% filled with yellow color	
P Value	0.034	0.004	0.049	0.000		

Results

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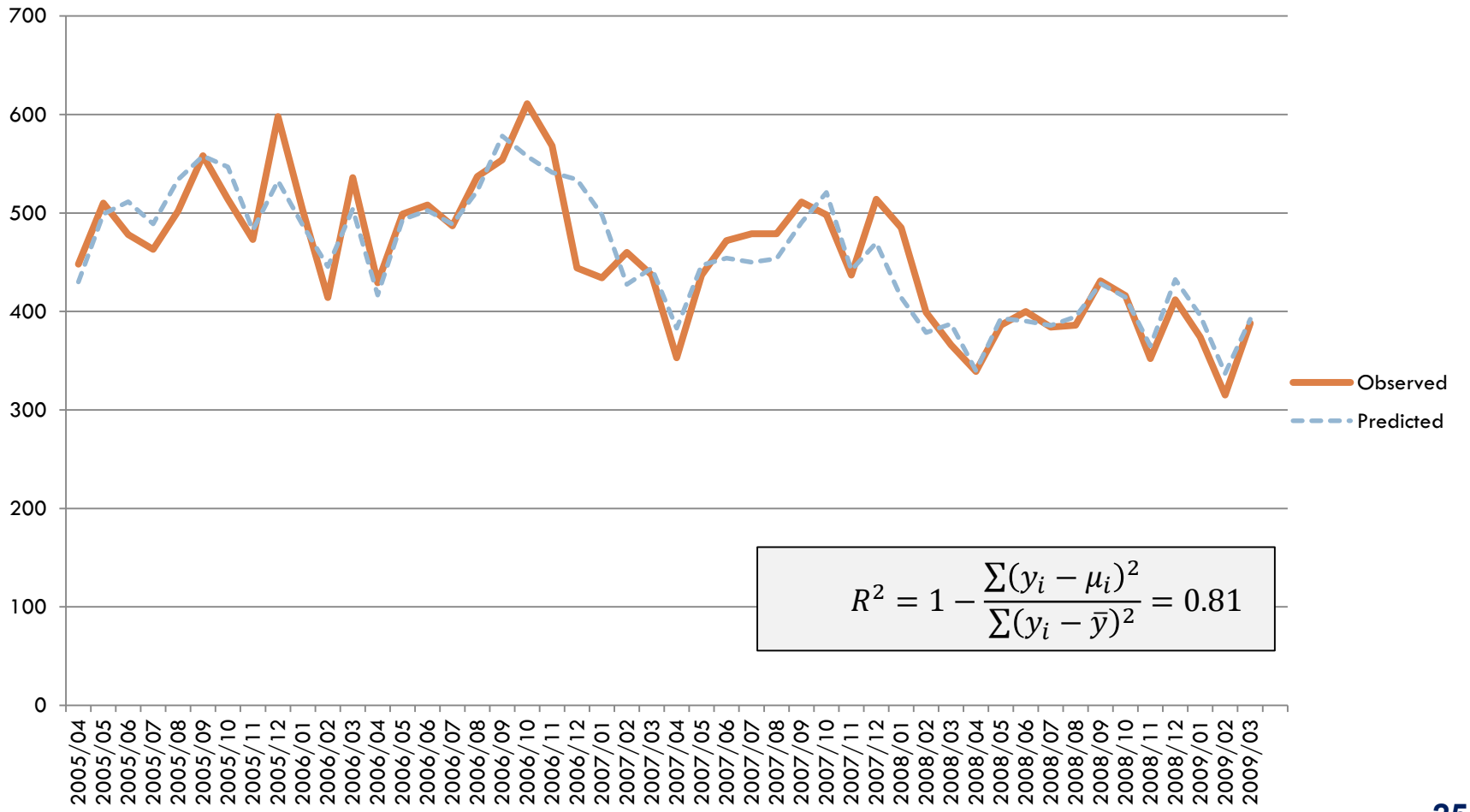
Goodness of Fit – R Squared



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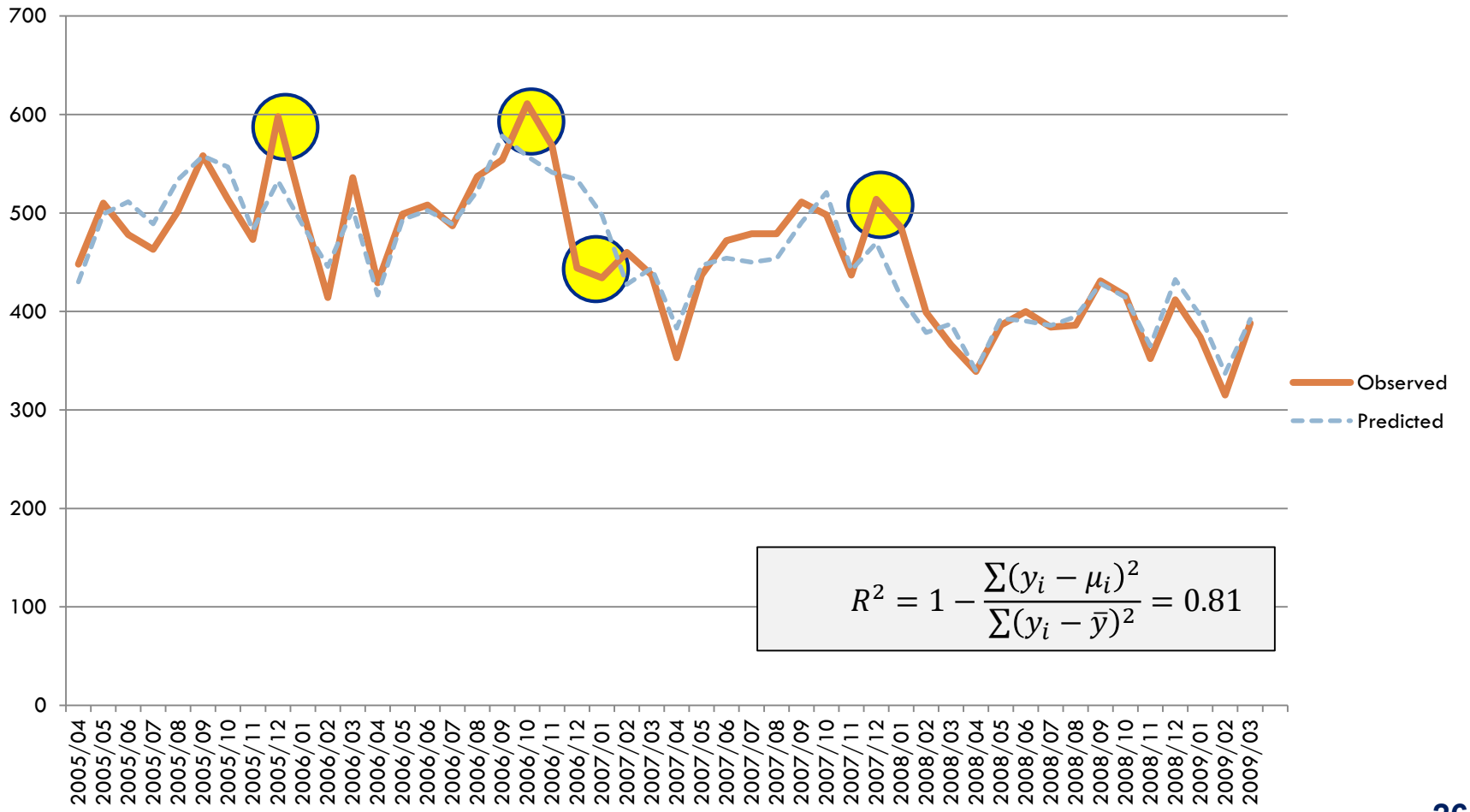

General Marginal Effects

$$\frac{\partial E(\mu|x_j)}{\partial x_j} = \mu \cdot \beta_j$$

1,000 deployment hours: **52** less severe collisions

10,000 issued tickets: **68** less severe collisions

Overall Collision Reduction per Month:

$$\frac{Hours}{1000} * ME_{Hour} + \frac{Tickets}{10000} * ME_{Tickets} = \mathbf{164}$$

45% of them are due to the deployment hours
55% of them are due to the issued tickets

Conclusions

Conclusions

- The significant negative sign of enforcement variables indicates that mobile photo enforcement led to severe collision reductions.
- The marginal effects of 1,000 deployment hours and 10,000 issued speed tickets were 52 and 68 less severe collisions, respectively.

Future Research

- Influences of other deployment variables (e.g., *number of enforcement sites*, *average deployment hours*)
- Distance halo effects of enforcement
- Drivers' attitude towards enforcement

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Thank You