CUTR
CENTER for URBAN TRANSPORTATION RESEARCH

NCTR at CUTR
National Center for Transit Research

FDOT

Evaluation of Rear-end Collisions and Identification of Possible Solutions

William P. Morris and Christopher P. DeAnnuntis

CUTR Webcast • May 29, 2014

Purpose

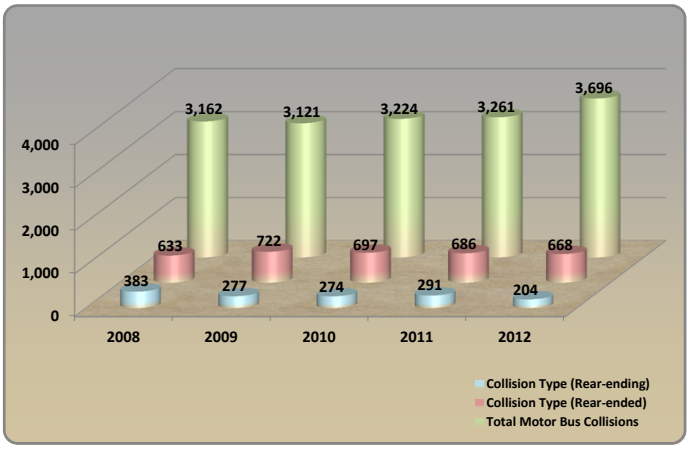
- Determine if rear-end collisions are increasing
- Conduct an assessment to ascertain the prevalence of rear-end collisions
- Identify conditions that exist when rear-end collisions occur
- Identify mitigation strategies for agencies that have identified rear-end collisions as a major issue
- Assess impact of Yield to Bus and pull out bays on rear-end collisions
- Identify solutions and/or strategies to reduce rear-end collisions
- Examine bus safety legislation in other states and assess whether Florida's current statutes need to be revised

Major Incident Report – National Transit Database

- NTD Database for Major Incidents
  - Compiles data from all reporting agencies in all 50 states and territories
  - Starting in 2008, included “rear-ended” and “rear-ending” as collision types
- Data was aggregated by FTA Region
- For analysis and comparison, rear-ended and rear-ending collisions as a percentage of total collisions were compiled.
- For comparison, collisions per 100,000 miles was used as a leveling data set for analysis.

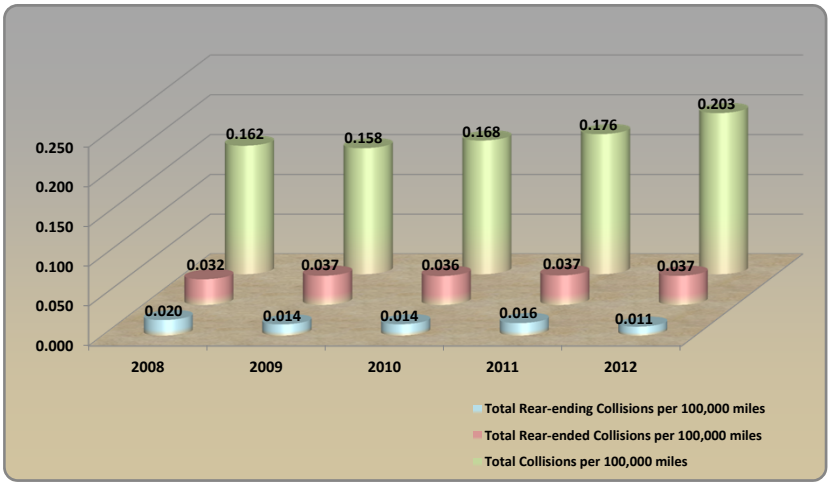
3

Total Annual Motorbus Collisions with Rear-ended and Rear-ending (2008-2012)



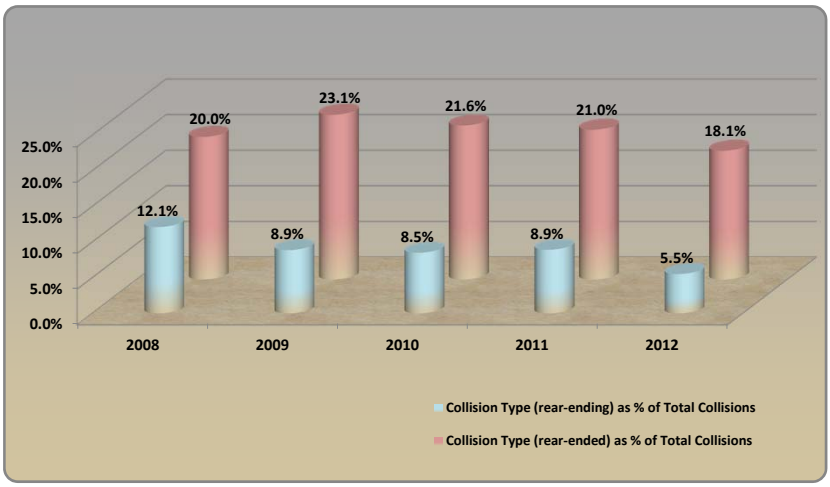
4

Total Annual Motorbus Collisions per 100,000 miles - 2008-2012



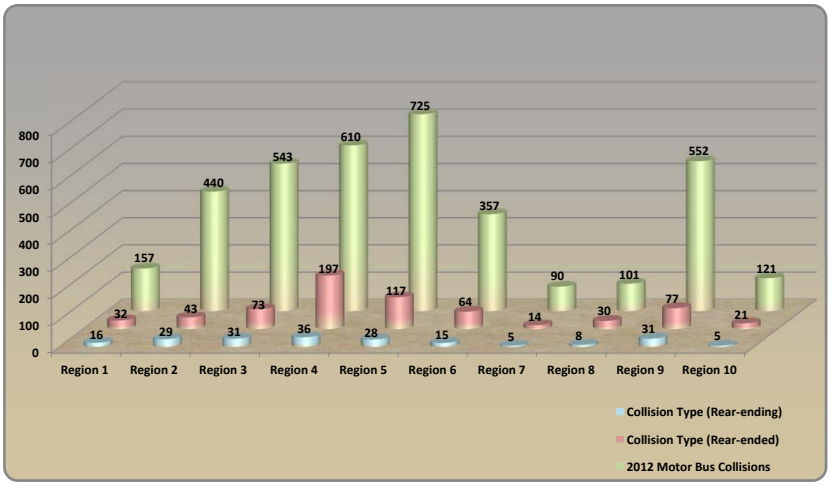
5

Rear-ended and Rear-ending as a Percentage of Total Collisions – 2008-2012



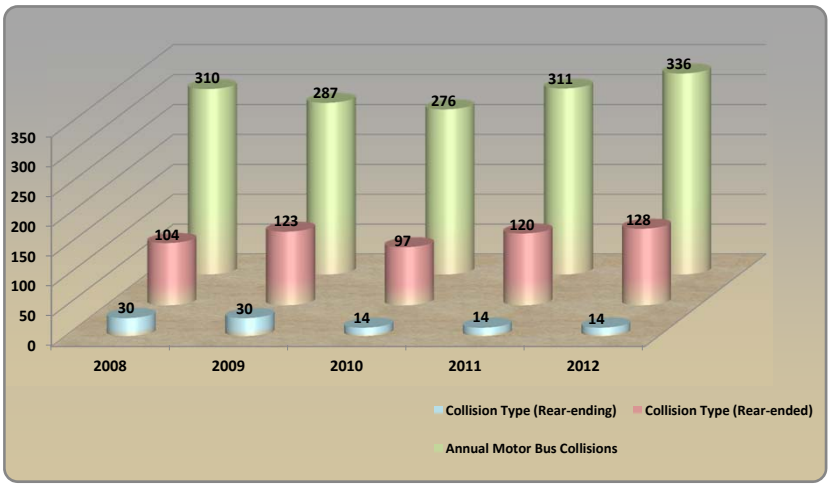
6

Total Collisions with Rear-ended and Rear-ending by FTA Region - 2012



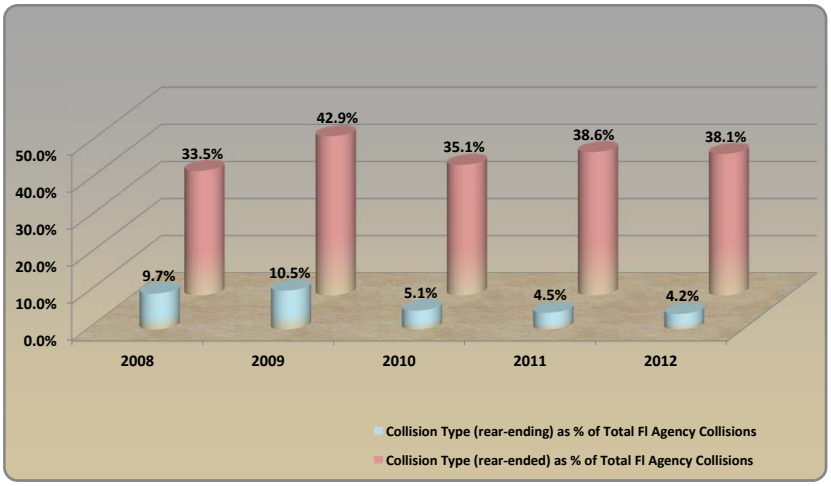
7

Annual Motorbus Collisions, All Florida Agencies, 2008-2012



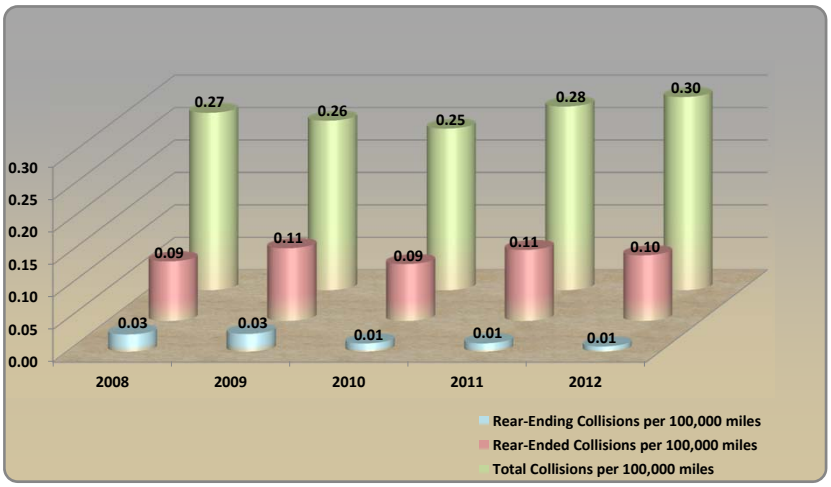
8

Annual Motorbus Collisions by Collision Type as a Percentage of Total Florida Transit Agency Collisions, 2008-2012



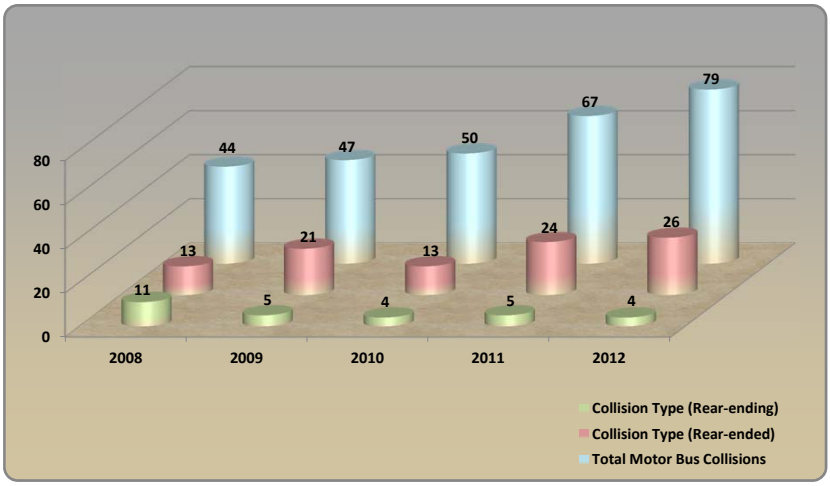
9

Annual Motorbus Collisions per 100,000 Miles, All Florida Agencies, 2008-2012



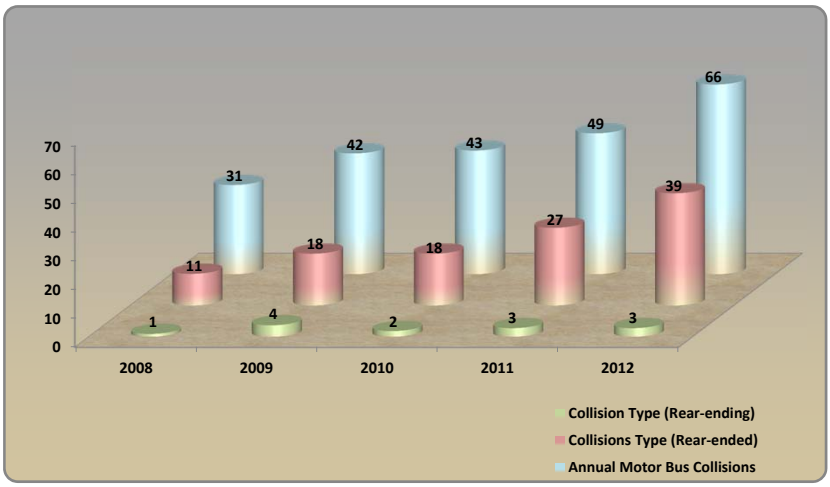
10

Broward County Transit Division: Motorbus Collisions, 2008-2012



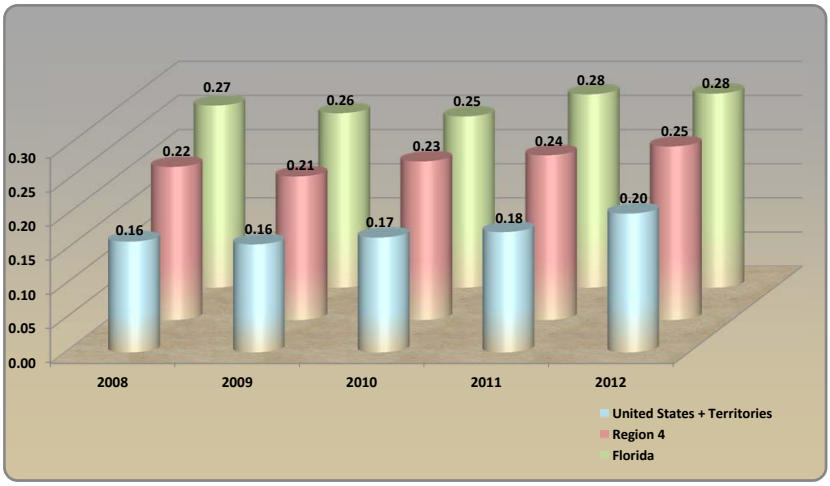
11

Central Florida Regional Transportation: Annual Motorbus Collisions, 2008-2012



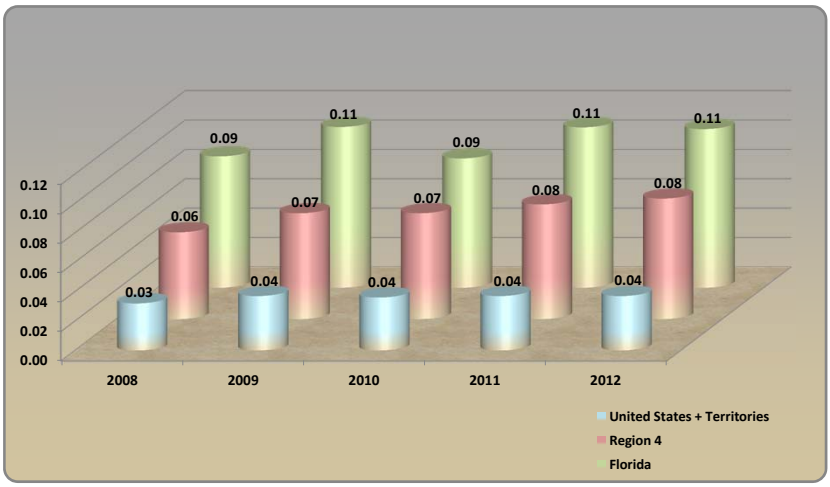
12

Aggregate Total Collisions per 100,000 miles for Florida, Region 4, and the United States plus Territories for the years 2008-2012



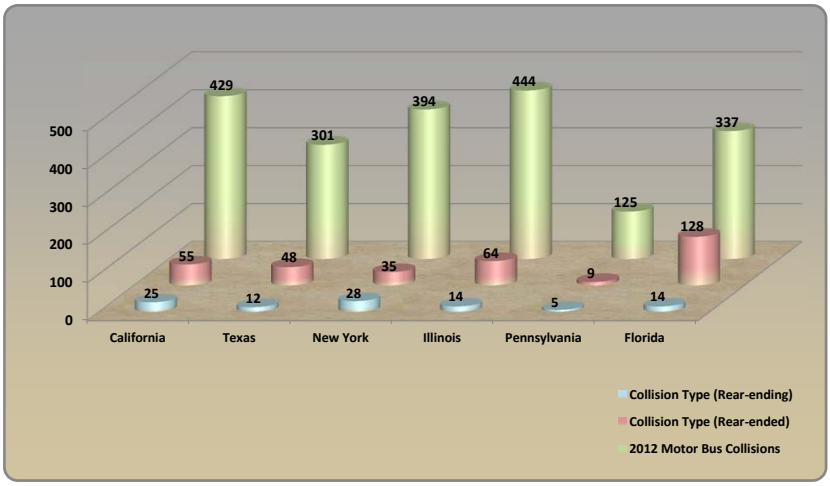
13

Aggregate Total Rear-ended Collisions per 100,000 miles for Florida, Region 4, and the United States plus Territories for the years 2008-2012



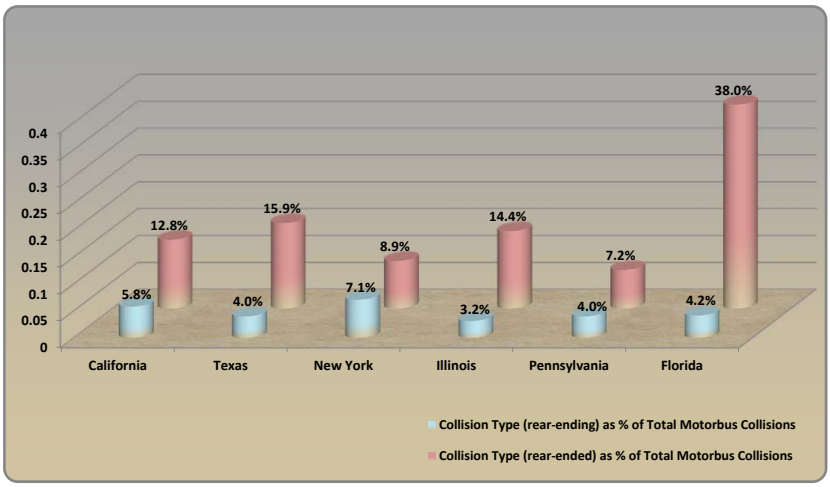
14

Total Motorbus Collisions - Six Most Populous States - 2012



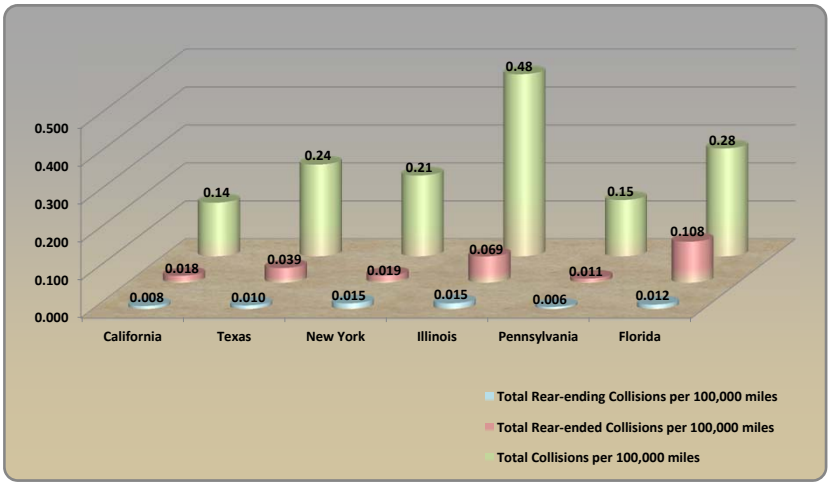
15

Rear-ended and Rear-ending as a Percentage of Total Collisions - Six Most Populous States - 2012



16

Collisions per 100,000 Miles - Six Most Populous States



17

Review of Collision Files

- Reviewed a total of 55 files of rear-ended collisions at LYNX (CFRTA) from January 2011 through December 2012.
- Reviewed a total of 51 rear-ended collision files at Broward County Transit (BCT) from October 2011 to September 2013.

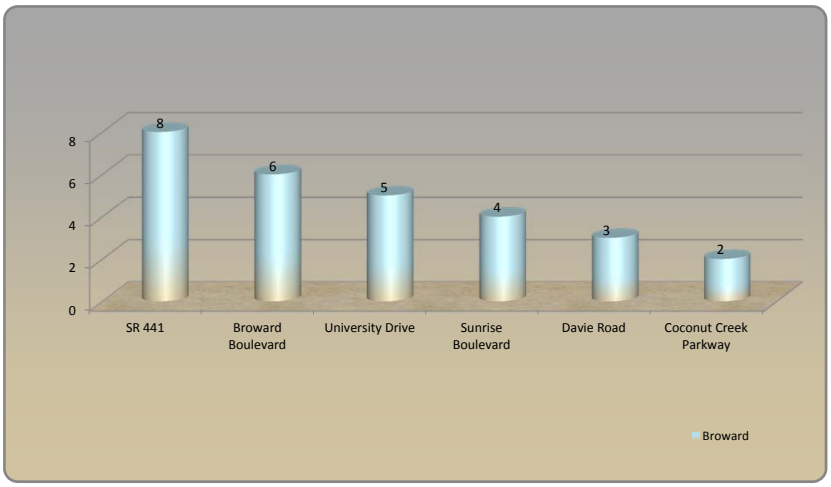
18

Factors Coded from Collision Files

- **Route Direction,** direction the bus was traveling when the collision occurred;
- **Roadway surface conditions,** expressed as dry or wet;
- **Lighting conditions,** expressed as light, dark (lighting and no-lighting), dawn and dusk;
- **Weather conditions,** expressed as clear, cloudy or raining;
- **Time factors,** including day of week and time of day;
- **Roadway factors**, which include prevalent rear-ended collision corridors, roadway classifications, ownership, lanes, divided/undivided, jurisdiction, and posted speed limits;
- **Transit factors,** including stop location (near side, far side and mid-block), bus movement at rear-ended collision location, passenger injuries, and estimated damage; and
- **Other vehicle factors,** reported for Broward only and including estimated speed of vehicle rear-ending the bus, distraction, obstructed vision, suspicion of drug and/or alcohol use, and whether the driver of the vehicle was transported for medical treatment.

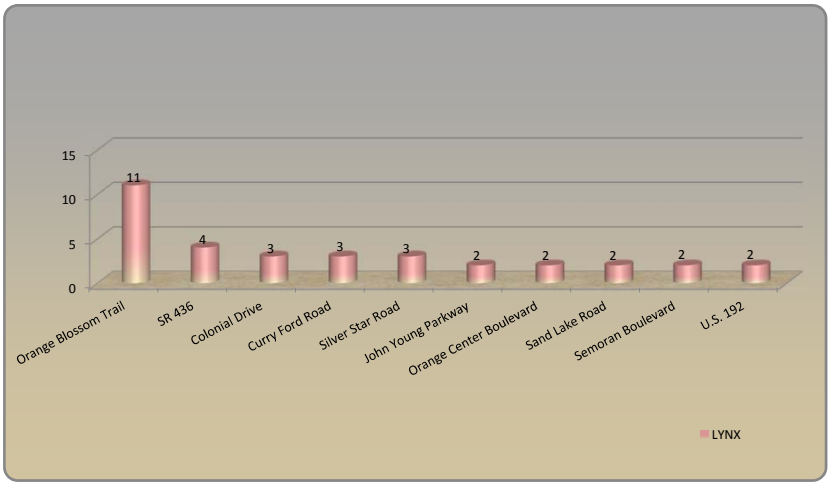
19

Principal Collision Facilities with >1 Rear-ended Collision



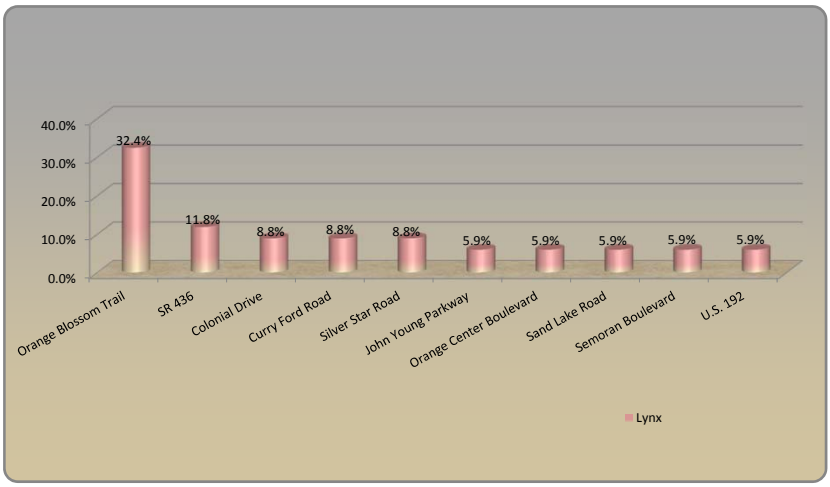
20

Principal Collision Facilities with >1 Rear-ended Collisions



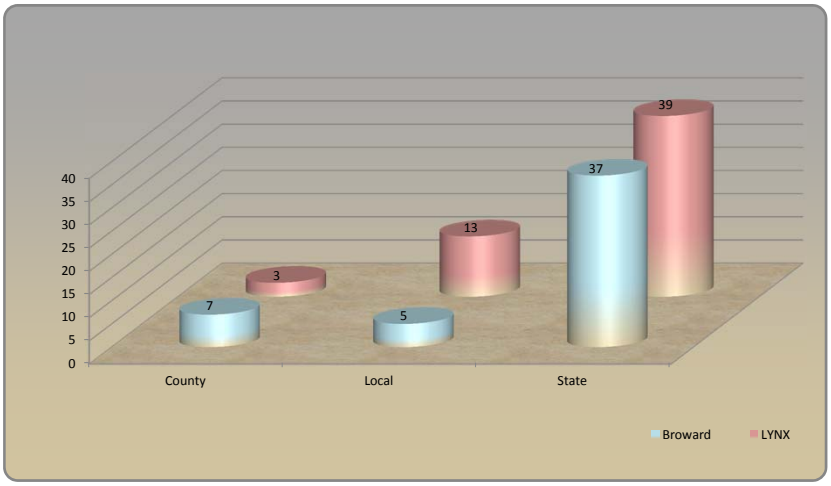
21

Principal Collision Facilities with >1 Rear-ended Collisions: Percentages



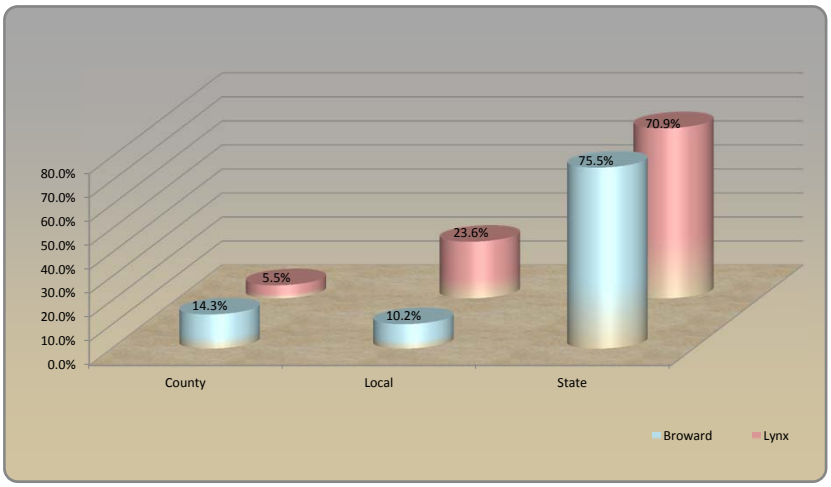
22

Roadway Jurisdiction at Rear-ended Collision Location



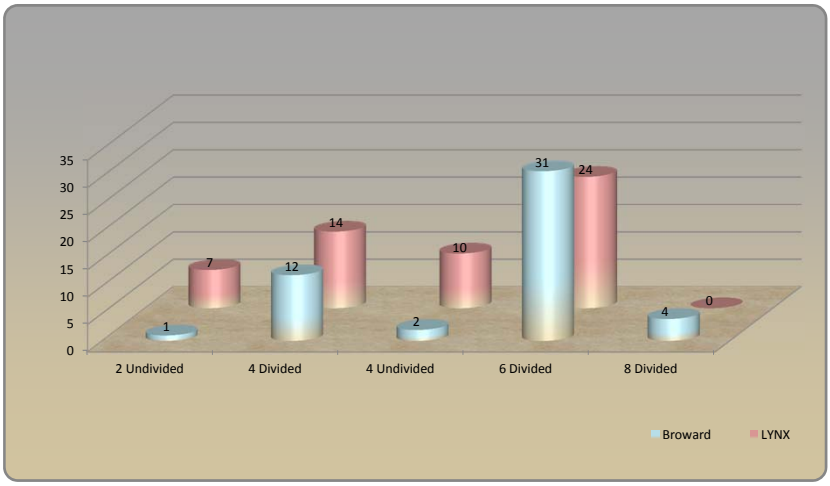
23

Roadway Jurisdiction at Rear-ended Collision Location: Percentages



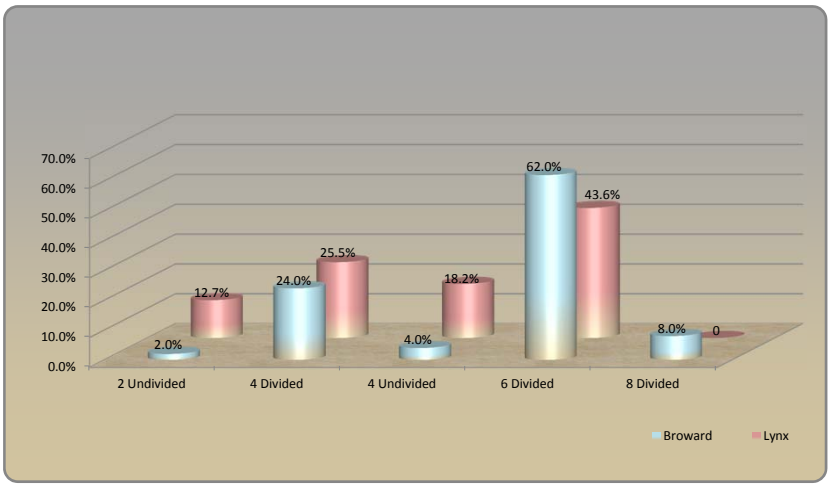
24

Number of Lanes and Divided/Undivided Roadways at Rear-ended Collision Location



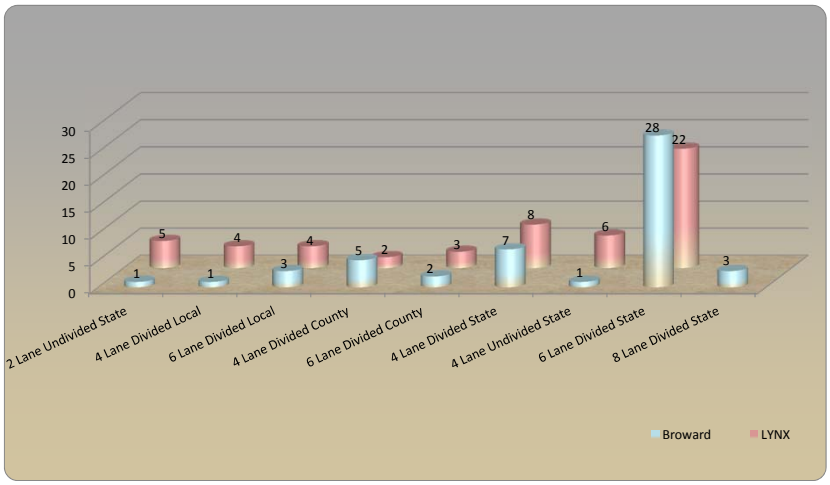
25

Number of Lanes and Divided/Undivided Roadways at Rear-ended Collision Location: Percentages



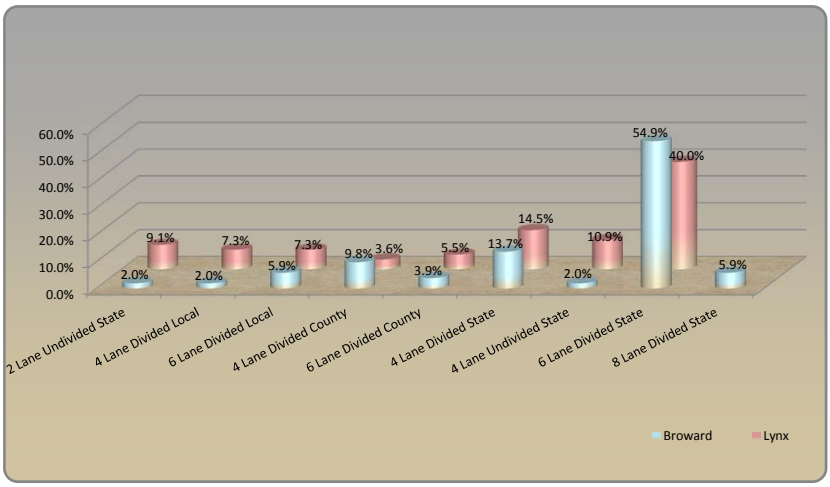
26

Vehicle Lanes and Jurisdiction



27

Vehicle Lanes and Jurisdiction: Percentages

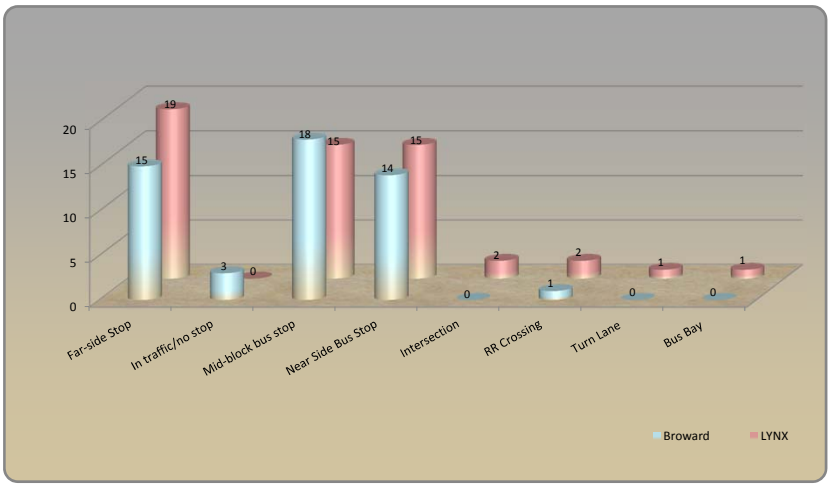


28

Rear-end Collision Location: US 441 and Copans Road

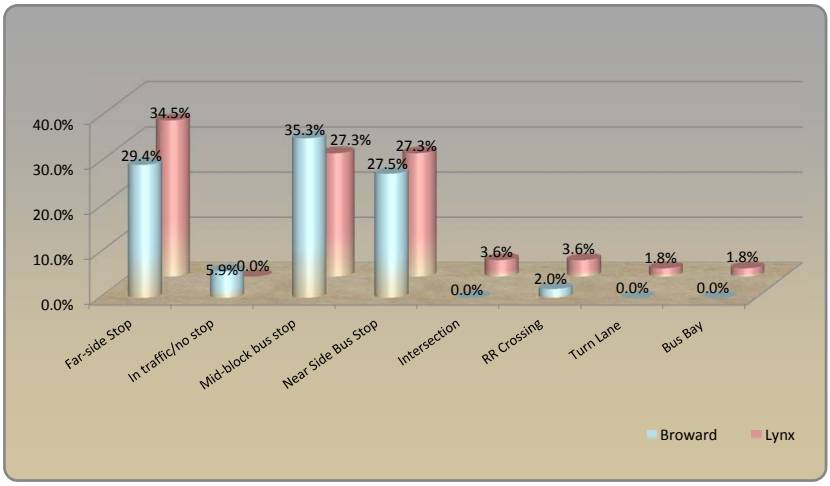
29

Stop Type



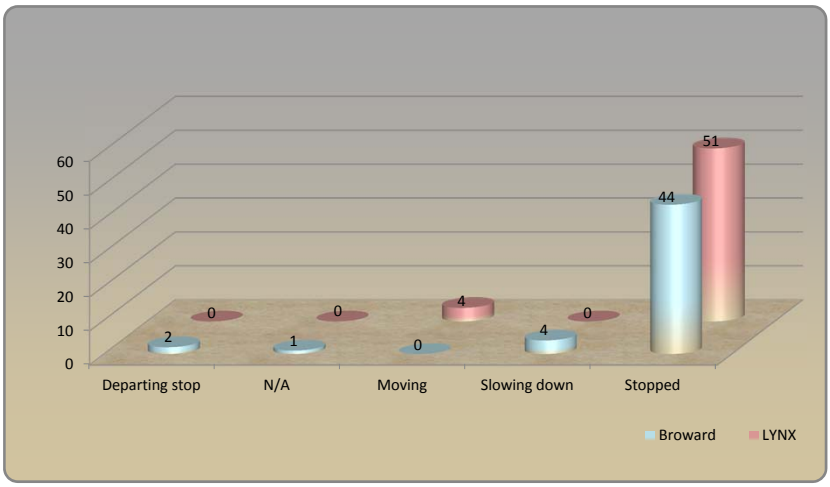
30

Stop Type: Percentages



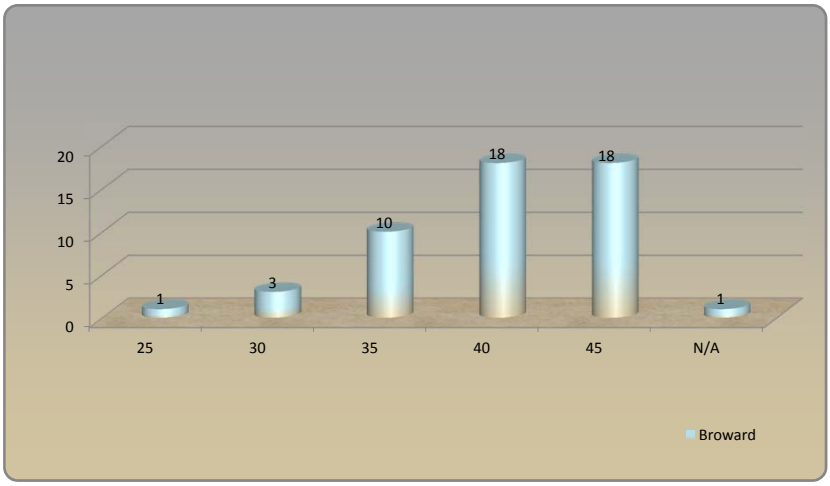
31

Bus Movement Status at Rear-ended Collision Location



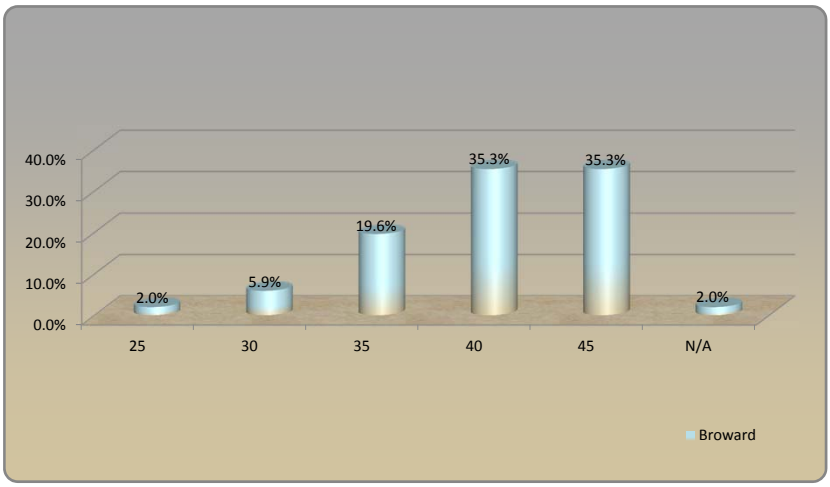
32

Posted Speed Limit at Rear-ended Collision Location



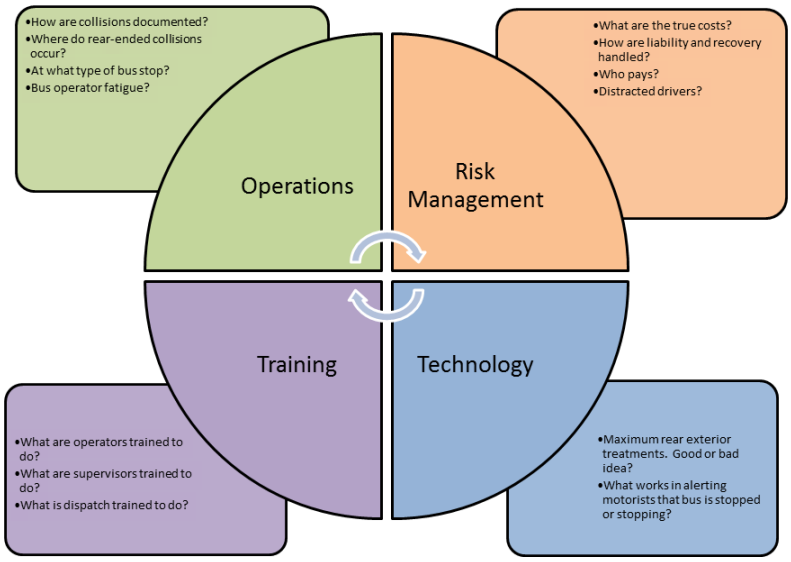
33

Posted Speed Limit at Rear-ended Collision Location: Percentages



34

Consultation with Transit Agencies



35

Technology Improvements

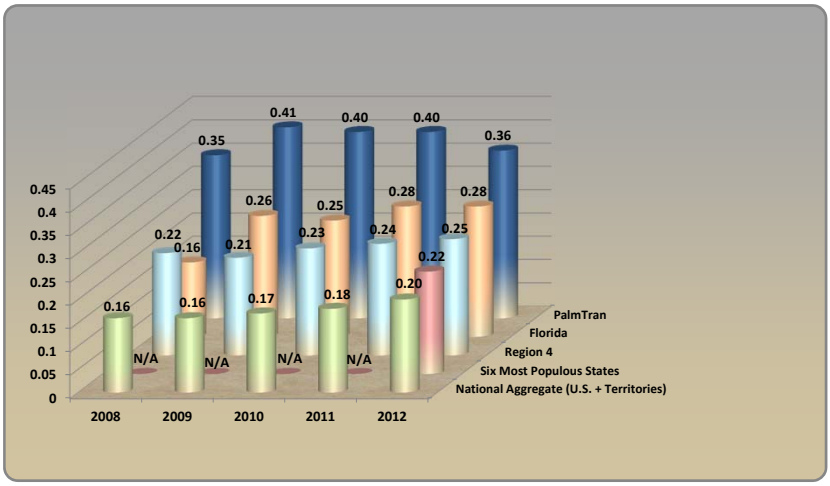
- Reflective Striping - PSTA, LeeTran, HART, RTS
- LED lights – HART, SCAT in Brevard, LeeTran
- Flashing "Stop" signs (Red) – HART, PSTA, LeeTran
- Yield to Bus – Illuminated - LeeTran
- Yield to Bus – Non-illuminated – Pasco County Public Transit
- Cameras/Video – SCAT in Brevard, RTS, HART, PSTA, VOTRAN, LeeTran, Pasco County Public Transit
- Audio (Bus interior) - VOTRAN
- 4 red bars to indicate bus is stopping – SCAT in Brevard
- 2nd Yield to Bus Sign - LeeTran
- Fluorescent lights – Pasco County Public Transit
- Red strobe and amber strobe lights – SCAT in Brevard

36

Rear Exterior Treatments – LeeTran Bus

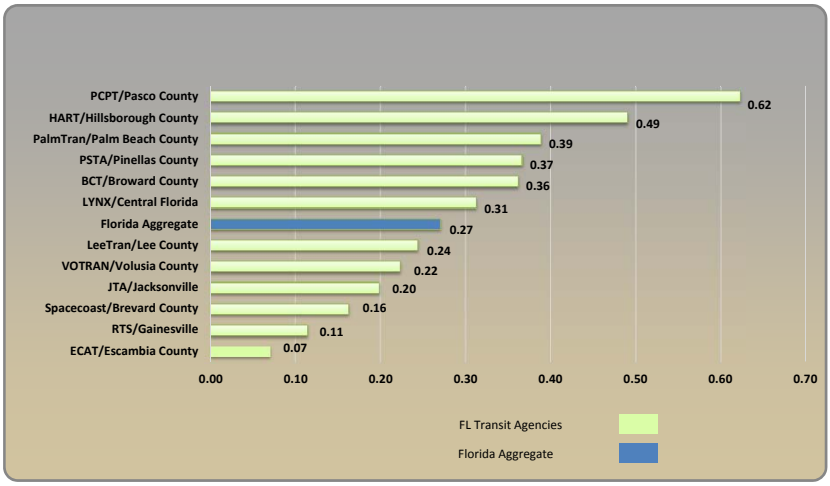
37

PalmTran - Agency with Comparatively High Total Collisions per 100,000 Miles



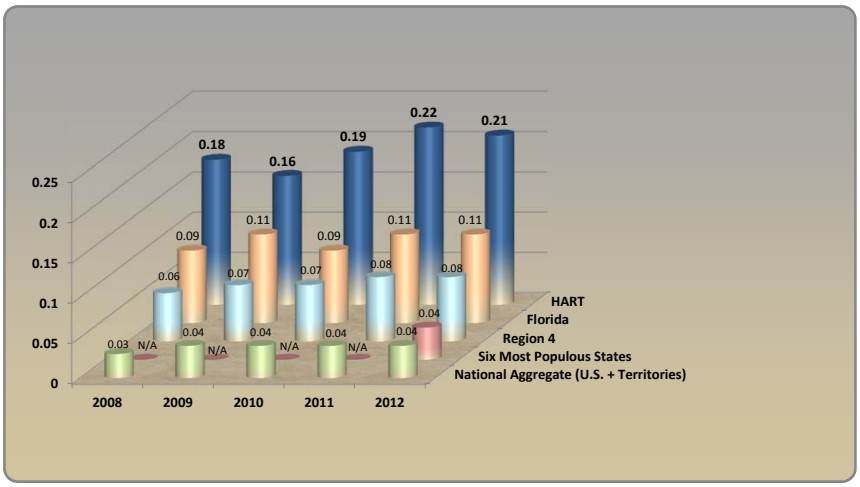
38

Total Collisions per 100,000 Miles – Comparison of Aggregate Five-year Agency Data to Florida Aggregate Data, 2008-2012



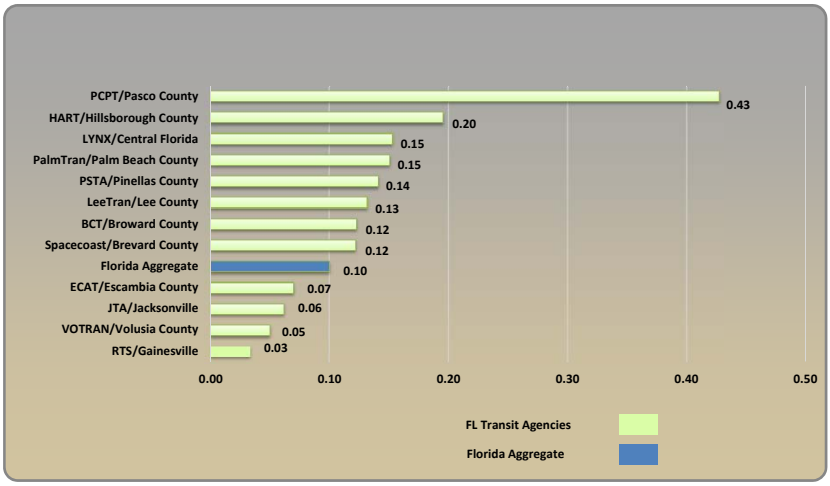
39

HART - Agency with Comparatively High Rear-ended Collisions per 100,000 Miles



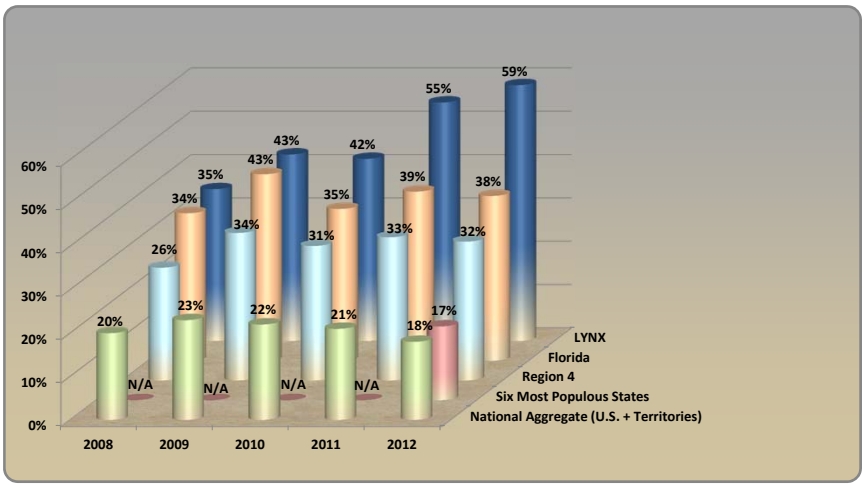
40

Rear-ended Collision per 100,000 Miles – Comparison of Aggregate Five-year Agency Data to Florida Aggregate Data, 2008-2012



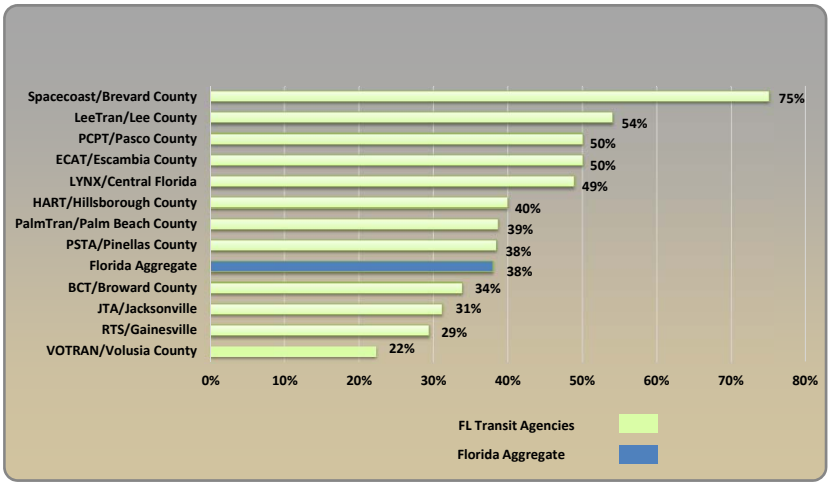
41

LYNX - Agency Comparatively High Percentage of Rear-ended Collisions to Total Collisions



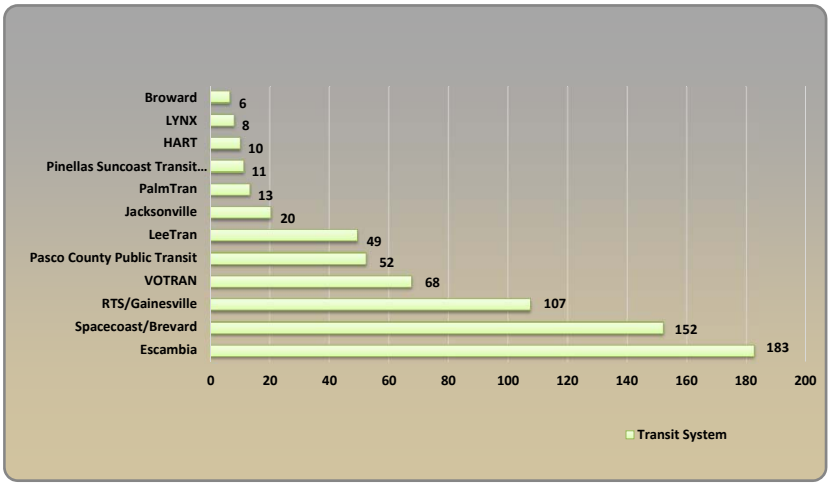
42

Rear-ended Collisions as a Percentage of Total Collisions – Comparison of Aggregate Five-year Agency Data to Florida Aggregate Data, 2008-2012



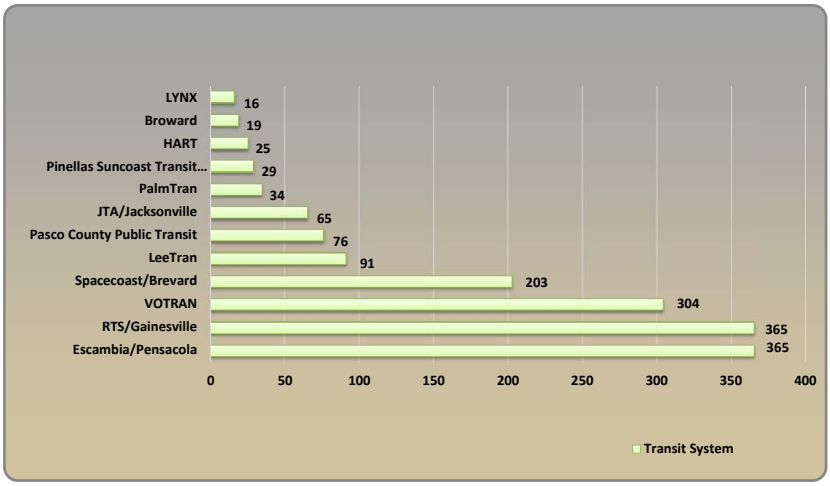
43

Average One (1) Total Collision Every "X" Days over Five-year Timeframe



44

Average One (1) Rear-ended Collision "x" Days over Five-year Timeframe



45

Mitigation Strategies

- Post-collision investigation
- Move/Improve/Remove bus stops
- Post-collision training for individual operators
- Annual in-service training
- Training for operators to maximize technology enhancements
- Every transit system has policies, procedures and training but not all agree on effectiveness

46

The "It" Questions

What is the factor or what are the factors that contribute to rear-ended bus collisions?

- Is it the amount of service on a facility?
- Is it conditions at the bus stop?
- Is it the design of the road network?
- Is it traffic operations?

47

Future Research

- Factors that are within the control of the transit agency.
- All collisions and reportable incidents
  - Rear-ended collisions may be most prevalent, but may not be the most expensive
- Best practices in post-collision investigation
- Best practices in risk management

48

Contact Information

William Morris
wpmorris@cutr.usf.edu

Christopher DeAnnuntis
deannuntis@cutr.usf.edu

Download final report:
http://www.nctr.usf.edu/2014/04/evaluation-of-rear-end-bus-collisions-and-identification-of-possible-solutions-2/

49