

Tight Diamond Interchange versus Single Point Urban Interchange: Pedestrians Perspective

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Outline

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- Problem Definition
- Study Design
 - Traffic Volumes
 - Signals Phasing
- Analysis Results
 - Light Traffic Scenarios
 - Medium Traffic Scenarios
 - Heavy Traffic Scenarios
- Summary and Conclusions

Introduction

TDI

Tight Diamond
Interchange

vs.

SPUI

Single Point Urban
Interchange

Control Operation

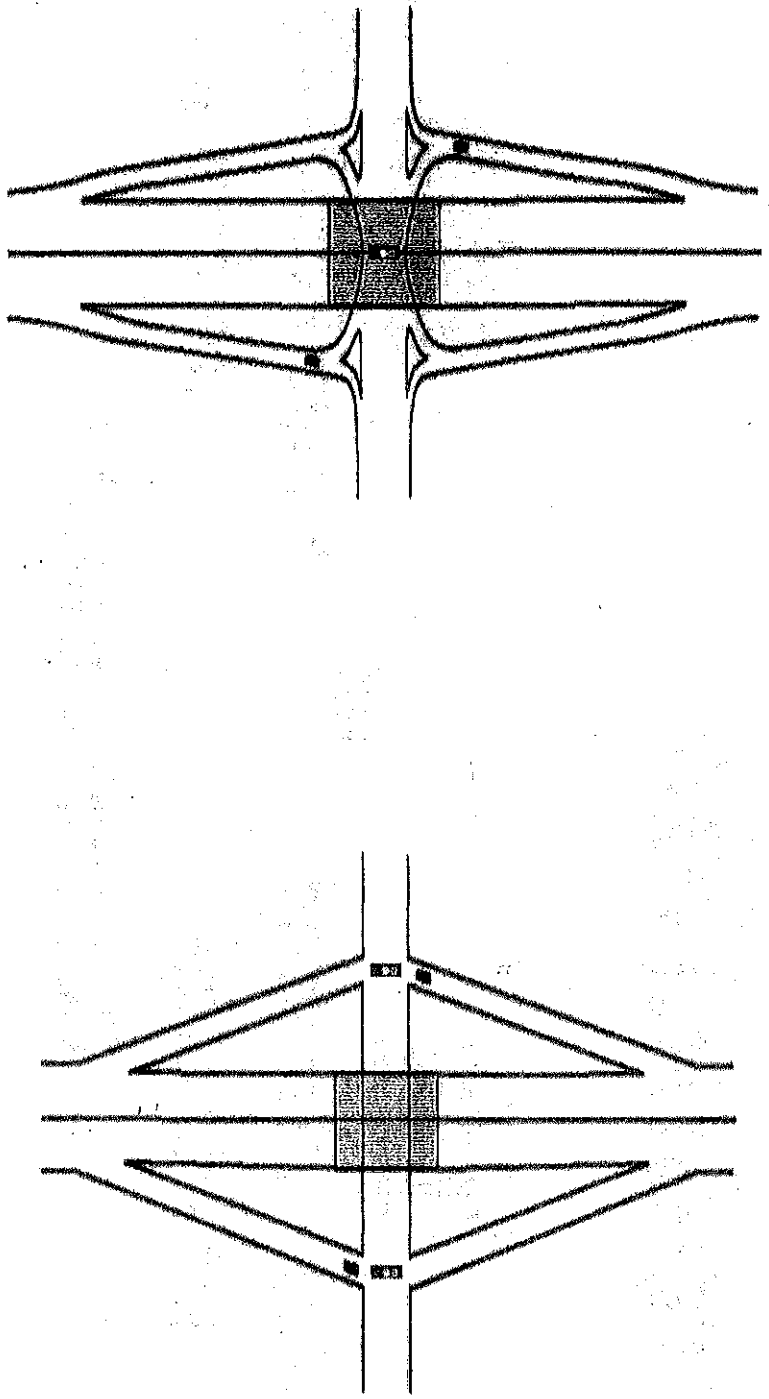
- Operates as two closely spaced signalized intersections, managed together as one signal
- Compresses the two intersections into one signalized intersection

Introduction

TDI

SPUI

General Layout



Introduction

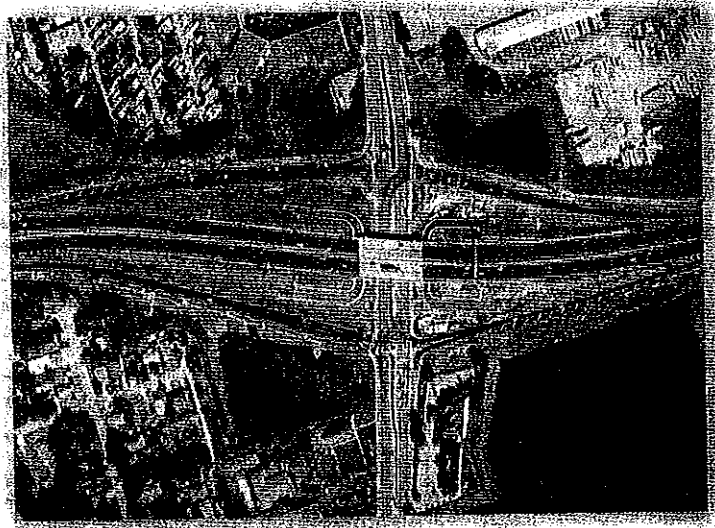
SPUI

Example Application

Driving Transportation with Technology



TDI



SR-408 at Kirkman Road, FL



SR-408 at Valencia Collage Lane, FL

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Introduction

TDI

SPUI

Operation Features

- Easier for the user to understand and get familiar with
- Shorter clearance times
- Left turns proceed simultaneously
- Less delay with heavier traffic volumes

Problem Definition

- Many arguments over the use of the TDI or the SPUI:
- Apparently, SPUI is more preferred over TDI
- Considering pedestrians, SPUI may have longer delays than TDI
- Pedestrian control requires sufficient clearance time based on the walking speed:
- MUTCD = 4.0 ft/sec (Traditionally)
- ADAAG = 3.5 ft/sec (Considering disables)

Problem Definition

Study Objectives:

- to compare the performance of the TDI vs. the SPUI from a pedestrians-operation perspective
- to investigate the impact of reducing walking speed from 4.0 ft/s (MUTCD) to 3.5 ft/s (ADAAG)

Problem Definition

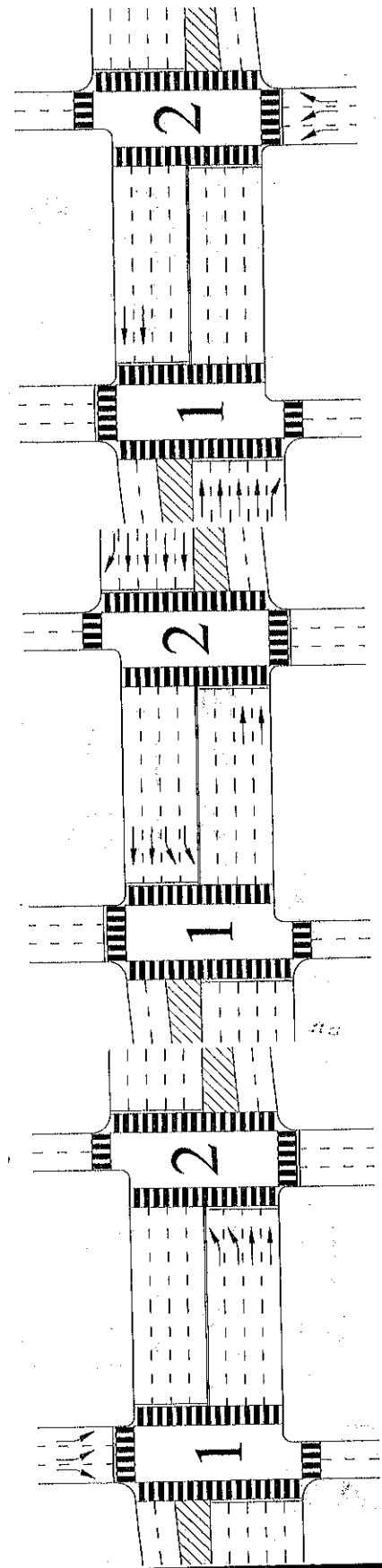
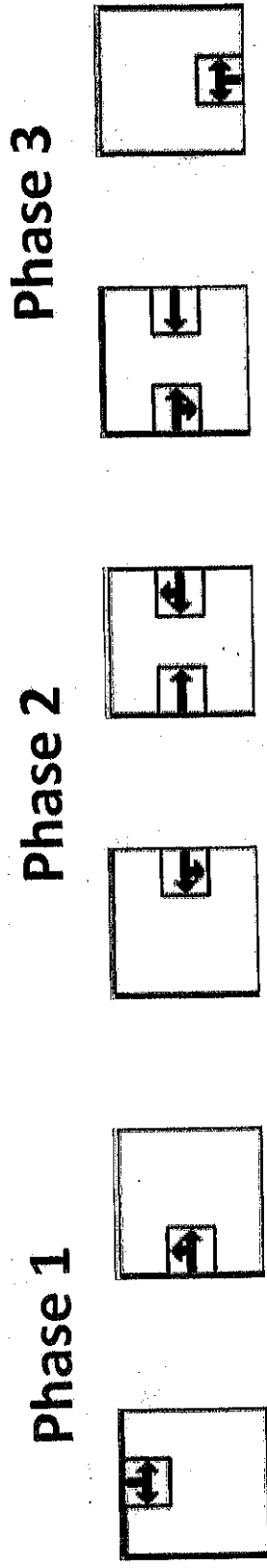
- Control delay is the main measure of performance for the signalized intersection
- Control delay: delay experienced by a driver due to congestion at an intersection due to:
 - deceleration while approaching the intersection,
 - stopping in a queue at the intersection, and
 - acceleration after the queue is released
- Hence, control delay is used to compare the operation of the TDI vs. the SPUI

Study Design

- Three traffic loading volumes: (various LOS)
 - Light (4000 vph)
 - Medium (5500 vph)
 - Heavy (7000 vph)
- Two traffic balance distributions:
 - Balanced (70% arterial / 30% ramps)
 - Heavy ramps (60% arterial / 40% ramps)
- Two pedestrian speeds:
 - MUTCD (4.0 ft/sec)
 - ADAAG (3.5 ft/sec)
- Total: 12 TDI + 12 SPUI = 24 loading scenarios

Study Design

TDI Signal Phasing:

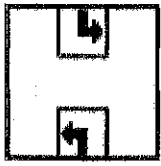


$$Y+AR = 3 + 1 = 4 \text{ sec}$$

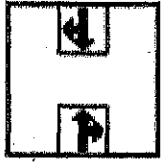
Study Design

SPUI Signal Phasing:

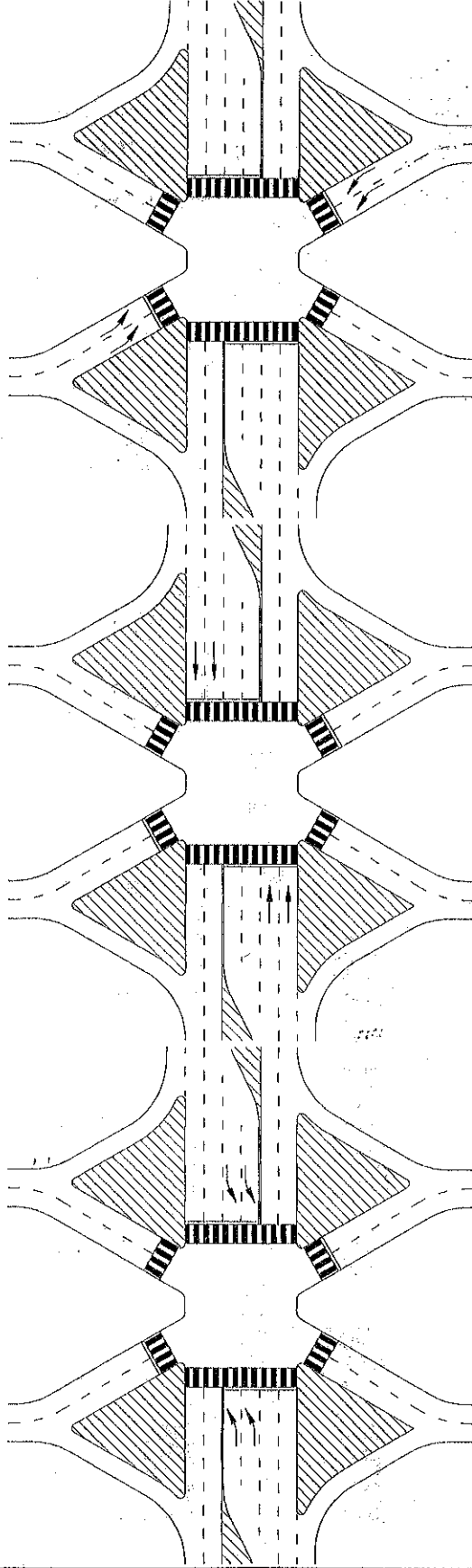
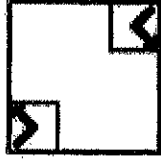
Phase 1



Phase 2



Phase 3



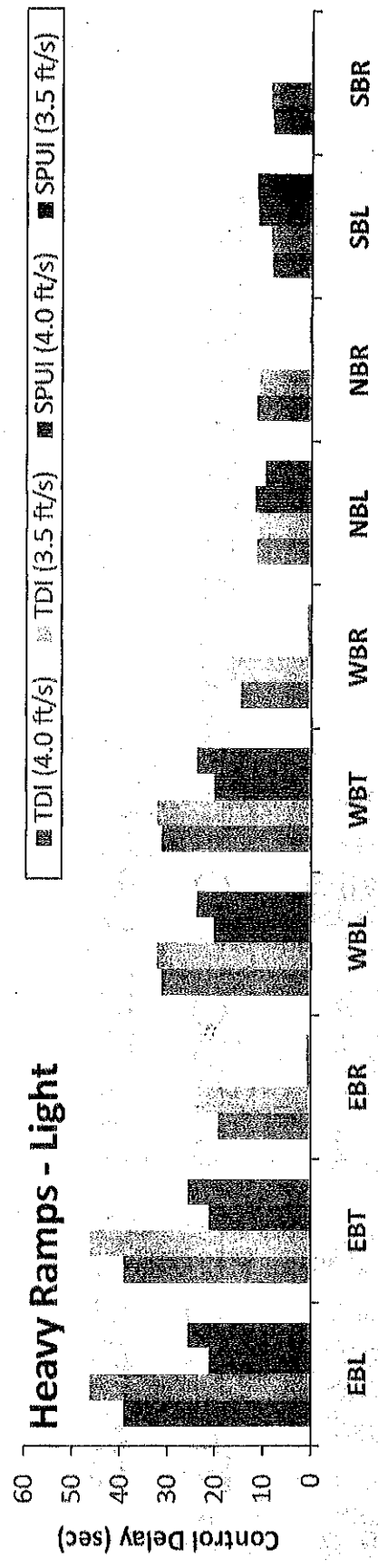
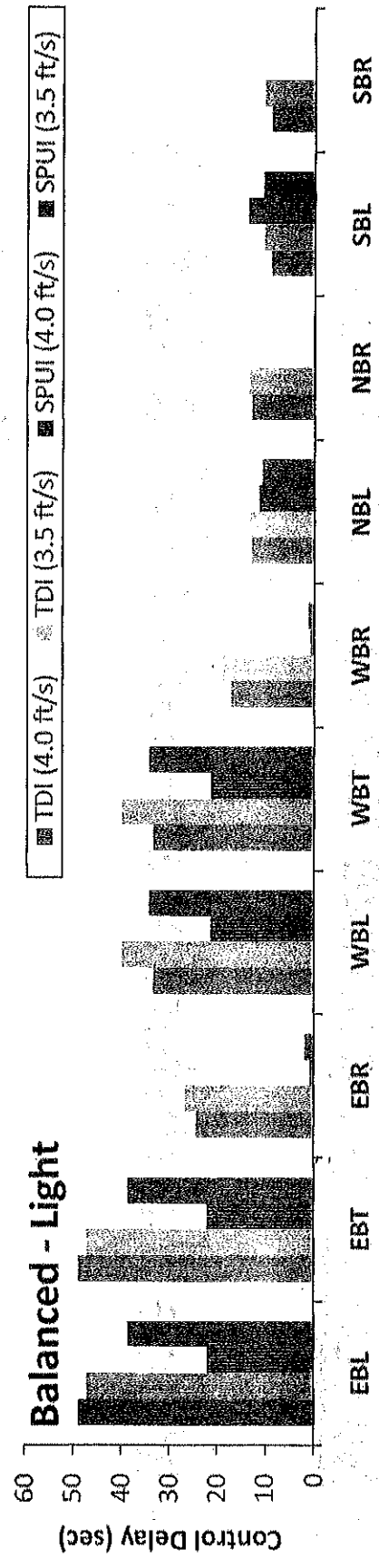
$$Y+AR = 4 + 2 = 6 \text{ sec}$$

Study Design

- Traffic simulation to measure the average control delay per vehicle
- Synchro to optimize the signal timings
- Modeling different scenarios using CORSIM
- Control delay comparisons for different scenarios

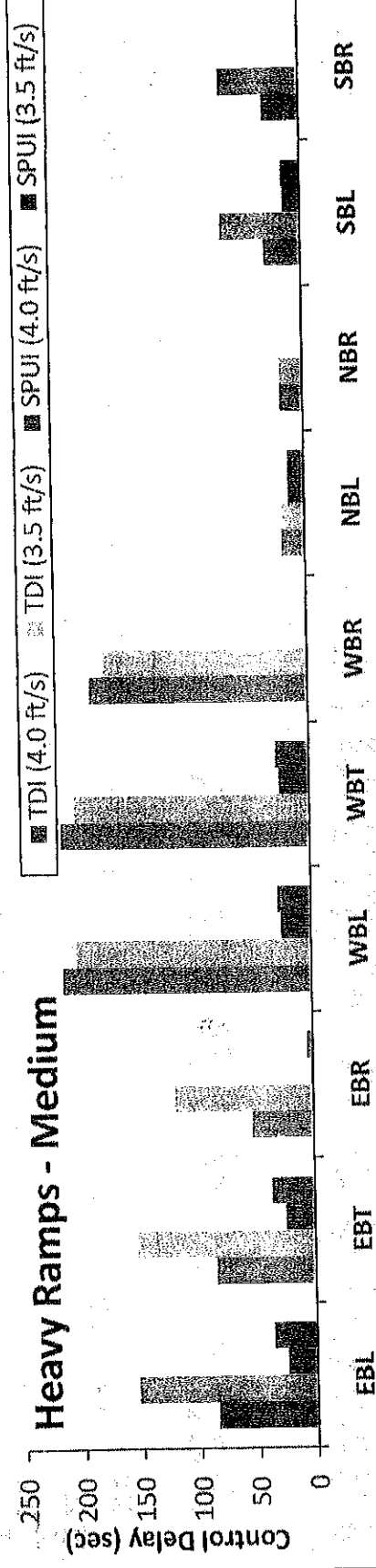
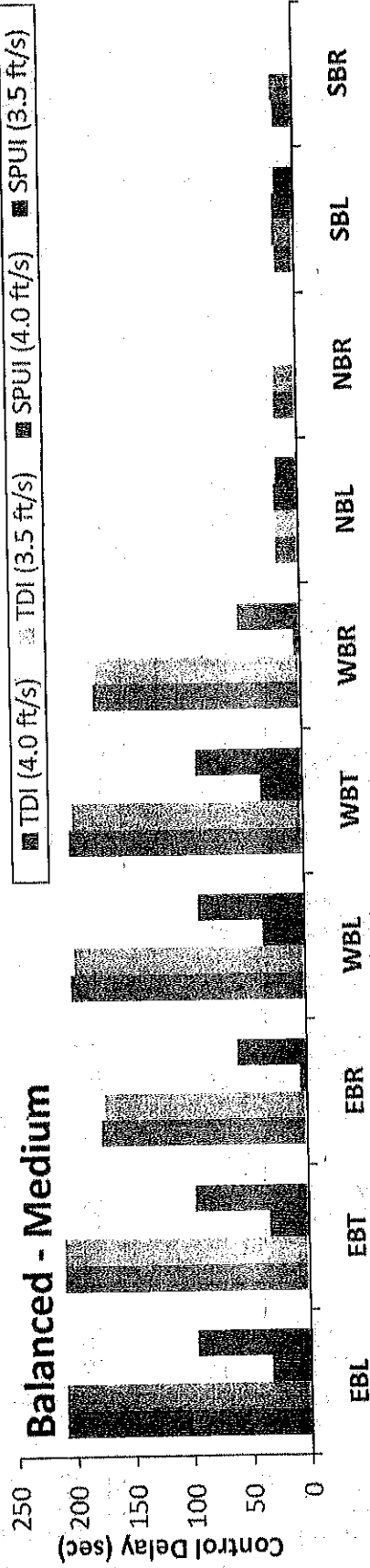
Analysis Results

Light Traffic Scenarios:



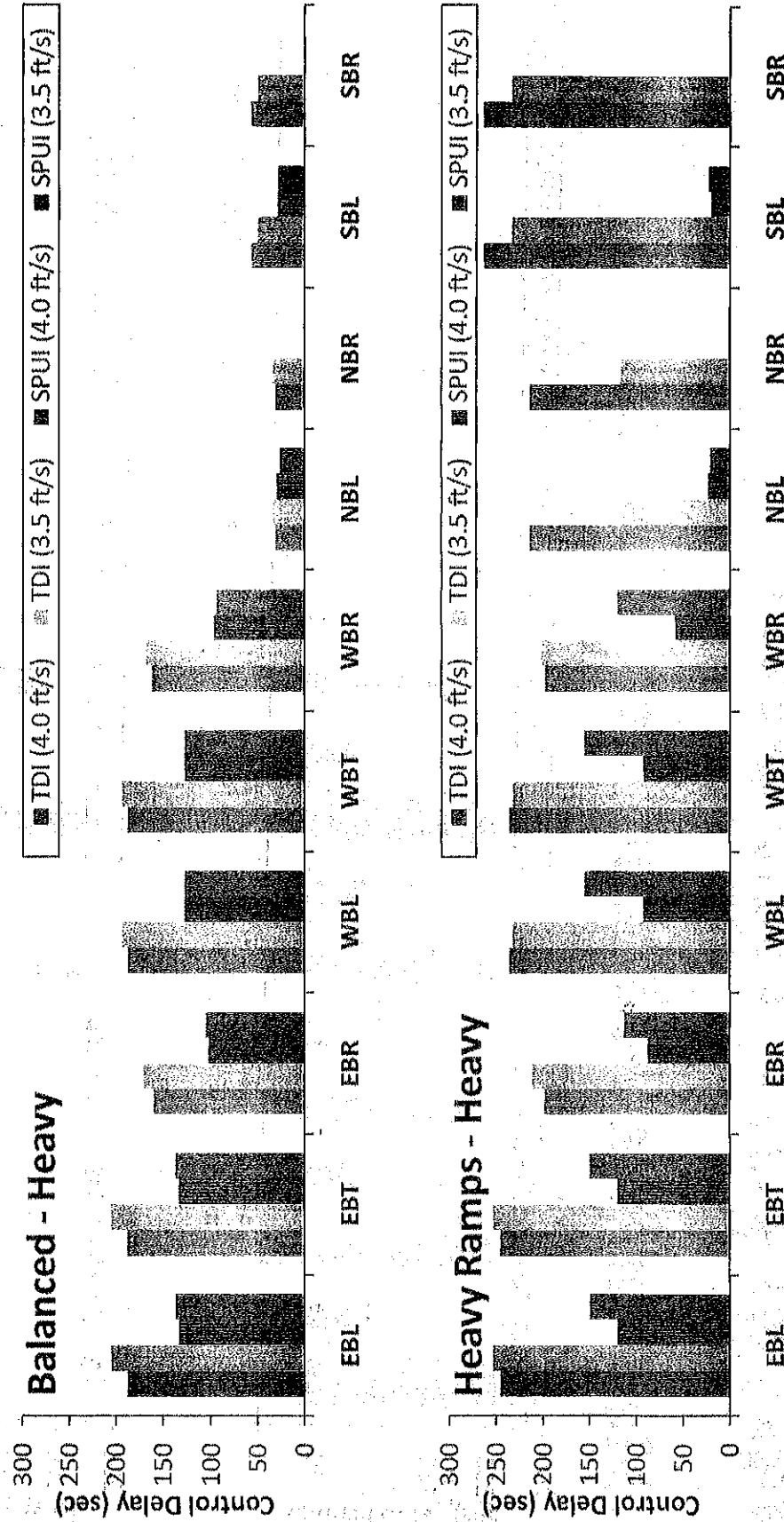
Analysis Results

Medium Traffic Scenarios:



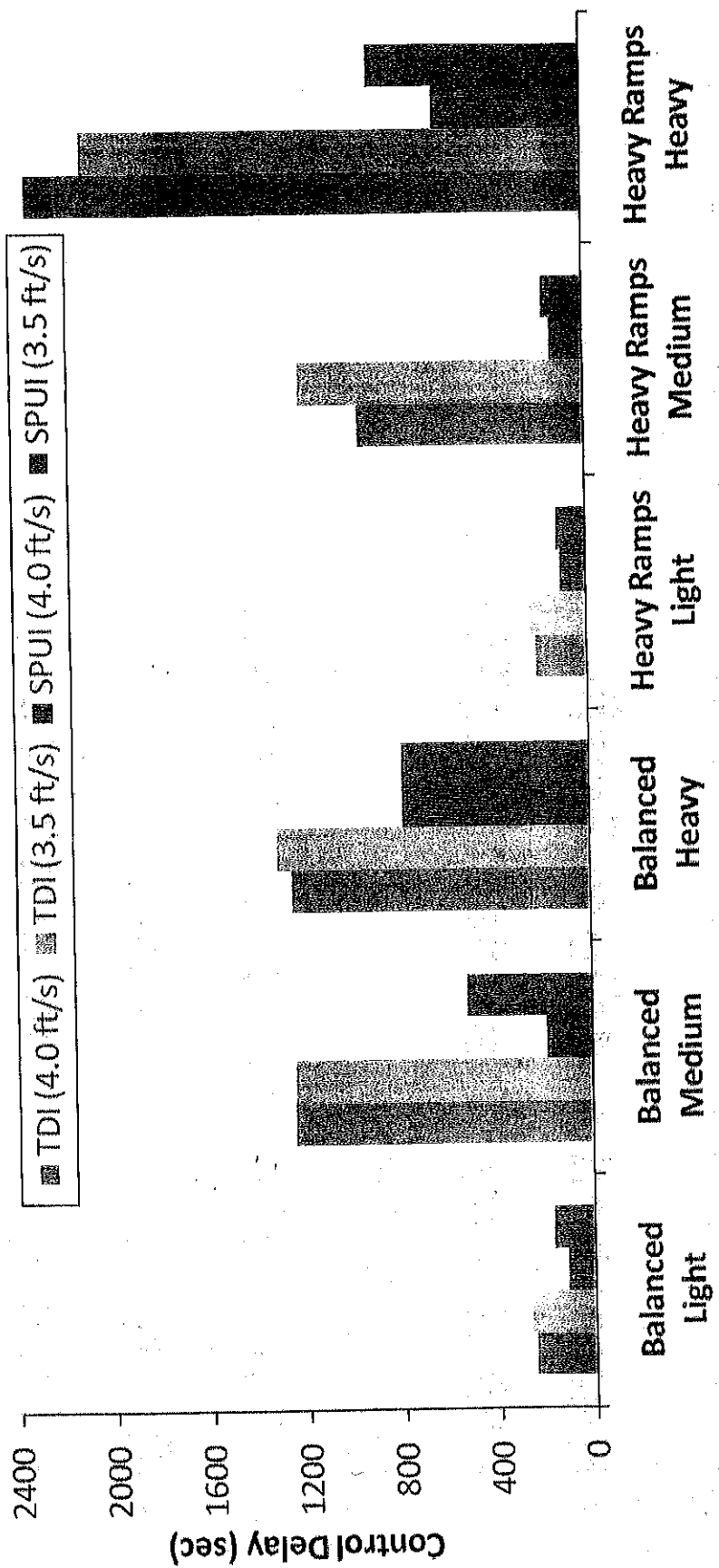
Analysis Results

Heavy Traffic Scenarios:



Summary & Conclusions

Total Control Delay – All Scenarios:



Summary & Conclusions

- Heavy and Medium Traffic:
- **SPUI** is more efficient over **TDI**
- Light Traffic:
- Either **SPUI** or **TDI** can be used
- Traffic Distribution:
- Small impact on control delay
- Walking Speed:
- Minor effect with light and medium traffic
- Not recommended with heavy traffic