Evaluation TSP Benefits Using VISSIM Modeling and Lessons Learned

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Outline

1) Project Background
2) Why VISSIM?
3) Evaluation Methodology
4) VISSIM Modeling Process
5) Lessons Learned
6) VISSIM 3-D Visualization
1) Background

- CTA Bus Services
  - Large areas
  - Increased traffic
  - Increased ridership

- Challenges
  - To adhere bus schedule
  - To meet transit users’ needs
1) Background

§ TSP Benefits
  § Improve Transit Mobility
  § Improve Transit Reliability
  § Improve General Traffic Mobility
  § Reduce Energy Consumption and Pollutant Emissions
2) Why VISSIM?

§ A Powerful Tool
§ Capable of Simulating Transit Operations
§ Cost-Effective to Evaluate Different Scenarios
  § Impact of shifting near-side bus stops to far-side
  § TSP benefits with 1min/2min/5min bus lateness thresholds
§ Provides Flexible TSP Modules
§ 3D Visualization for Presenting the Concepts to Stakeholders
3) Evaluation Methodology

§ Identification of measures of effectiveness (MOE’s)
§ Data collection
§ Signal Optimization
§ VISSIM Modeling
§ Before and After Comparisons
4) VISSIM Modeling Process

- VISSIM Modeling Data Collection
- Base Model Development and Calibration
- Optimized Model Development
- TSP Model Development
VISSIM Modeling Data

1) Traffic Data
   - Roadway and intersection lane geometrics and control
   - Intersection turning movement volumes
   - Existing signal timing plans
   - Other traffic parameters and traffic operations

2) Bus
   - Bus route and schedule
   - Bus schedule lateness
   - Bus stop location
   - Bus stop dwell time
   - Ridership

3) Travel Time
   - Bus travel time
   - General traffic travel time
Base Model Calibration

MOE Output (10 Runs)
- Intersection Level Volumes
- Approach Level Volumes
- Segment Level Travel Time

Calibration
- Simulation Results vs. Field Data
- Absolute Percentage Difference
- Acceptable threshold: 10%
TSP Model Development

VISSIM TSP Capability

§ RBC: TSP Module
§ VAP Programming

Challenges

§ LMD 40 Peek Controllers
§ Not in VISSIM RBC Module
§ Using VAP to develop TSP Emulator
TSP Logic Implementation

- TSP Logic Coded in VAP
- 50% Cycle Length for Max Green Extension
- 20% Green Time per Cycle for Cycle Length Recovery
- No Phase Skip or Min Green Skip
- Check-in and Check-out Detectors Placement
  - Check-in Detector:
    Distance to Stop Bar = Approaching Speed \times (Max Green Extension - Dwell Time)
  - Check-out Detector: Center of the intersection
TSP Model Development

1) Signal controller emulator (PTV America)
   § Peek LMD40 (Green Extension and Early Green)
2) TSP timing development
3) Incorporate emulators and TSP timings into optimized models
4) Build 2-min bus lateness models
5) Output MOEs
   § Average Bus Travel Time
   § Average Bus Delay
VISSIM Analysis Results
– Optimized 2-min vs. TSP 2-min

Bus Travel Time

Bus Travel Time Reduction - North Segment
Optimized 2-min vs. TSP 2-min

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-19% -8% -28% 469 418

Optimized 2-min TSP 2-min
VISSIM Analysis Results
– Optimized 2-min vs. TSP 2-min

Bus Delay

Total Average Bus Delay Reduction - North Segment
Optimized 2-min vs. TSP 2-min

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5) Lessons Learned

§ Strong capabilities for transit-related operations simulation
§ Flexible for implementing TSP Logic
§ Detailed MOE Outputs for Analysis
§ Detailed TSP MOEs for analysis
§ 3D Visualization for public meetings
§ Modeling is Time Consuming
§ Requires VAP programming experience
6) VISSIM 3-D Simulation

CTA Western Ave. TSP Demo
Bus Route X-49 Express
Western Ave. NB

00:00:00
Non-TSP Scenario

00:00:00
TSP Scenario