Simulation Performance Measures in System Design

Or: How We Have Used Simulation in Signal Timing and Other Design Projects

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Overview

- Example Projects Using Microsimulation
- What Approaches Lead to a Good Design?
- What Measures Suggest a Good Design?
- Use of Microsimulation in Design
Example Projects Utilizing Simulation

- **Signal Timing/Coordination**
  - Susie Wilson Road, Essex, VT
  - US 2/Main Street; Burlington, VT
  - Memorial Drive; Montpelier, VT
  - US 7; Colchester, VT
  - Route 120; Lebanon, NH
  - Route 12A; Lebanon, NH (current)

- **Network Design**
  - Downtown Circulator; Winooski, VT (2001-2004)
  - CBD Circulation; Middlebury, VT
Visionary client interested in establishing new urbanist development pattern

Intersection of 2 major commuting routes controlled by 3 traffic signals (AADT ~36,000)

Work with client to develop alternative circulation designs

- Traffic signals seen as problematic
- Desire motivated search for alternative intersection control methods
- Circulator concept emerged as favorite
- Developed microsimulation model to test circulator concept
Simulate Existing
Approaches to Meet the Objectives
Downtown Circulator – Winooski, Vermont
Approaches to Meet the Objectives
Downtown Circulator – Winooski, Vermont

Simulate Circulator
Approaches to Meet the Objectives
Downtown Circulator – Winooski, Vermont

Design Circulator
What Measures Suggest a Good Design?

- Does the design work?
- Two steps:
  - Visual inspection of the simulation--
    - Any adverse queuing?
    - Any extreme delays?
  - Use of standard capacity analysis tools
    - At any node in the design can the merging, weaving, or conflicting flow be handled by the geometry?
Finished Product
Interstate Access and Arterial Coordination: NH 12 A – Lebanon, NH

- NH 12A
  - Retail corridor served by I89
  - Limited routing alternatives
  - Overcapacity conditions

- NHDOT Project with 2 Objectives:
  - Improve I89 Ramp Functioning & Safety
  - Improve Overall Corridor Mobility with Coordinated Timing Plan
Analytical Approaches
NH 12 A – Lebanon, NH

◆ Obtain complete count set
  ◆ Recent counts conducted on same day
  ◆ Do counts = demand?

◆ Adjustments
  ◆ Look for peak of corridor, not just local intersection
  ◆ Average AND peak conditions are considered

◆ Develop Synchro model
What Measures Suggest a Good Design?

- For Coordinated Timing Plans:
  - Synchro
    - Develop preliminary timing plans optimized in Synchro
    - Test 2-4 reasonable cycle lengths
    - Focus on critical intersections or movements
  - SimTraffic—Select Best Timing Plan Based on:
    - Multiple runs (5-10)
    - Average and maximum queues
    - Calculated delay for critical movements and system-wide
    - Compare arterial delay and speed
  - Microsimulate resulting plan for visual check.
  - Install plans and optimize offsets in field.
Use of Microsimulation in Design

- 5-10 years ago:
  - relied on heavily for refinement
  - computer analysis time consumed as much as 70% of effort
- Now:
  - limit usage to special cases
  - useful to evaluate future conditions
  - Focus on specific output
  - Spend 50-60% of project time in field.
- Optimized results of models should be over-ridden by engineering judgment
- Models are used to inform judgment