Bellevue's Traffic Adaptive Signals

ITE Quad Mtg
April 18, 2011

BELLEVUE
INTELLIGENT TRANSPORTATION SYSTEMS

What we'll cover

- SCATS Phase 1 Implementation
- SCATS Operations
  - Responsiveness
  - New Features
  - Some Initial Results
- 2011 Program and Beyond
- Final Thoughts

Background

- New Signal System funded – 2008
- Comm. system upgraded – 2008 to 2011
- Signal System Study – 2009
- SCATS Traffic Adaptive – May 2010

Downtown Bellevue 2008

Bellevue ATMS

Bellevue Fiber Trunks

SCATS Implementation

- Initial SCATS deployment – **Phase 1**
  - Downtown
  - Factoria

SCATS Phase 1

- SCATS Traffic Adaptive – 31 Intersections
- Downtown and Factoria
- Target Completion – end of 2010

- NE 8th Street - 100th to 112th
- Bellevue Way - Main to 12th
- NE 4th Street - Bellevue Way to I-405 NB on/off ramp

- Factoria Blvd - Newport Way to SE 32nd St

SCATS Phase 1

- Council Award July 2010
- Software/Hardware Testing Summer/Fall 2010
- Installation October 2010
- Traffic Adaptive Active Early November
- System Adjustments and Training – November & December

TRANSCORE

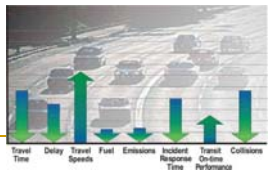
SCATS Phase 1

Summary – Phase 1

- 31 intersections completed on time and within budget
- Successful Effort
  - City staff (engineers/signal shop)
  - TransCore ITS
- Only City in Washington State

Operations

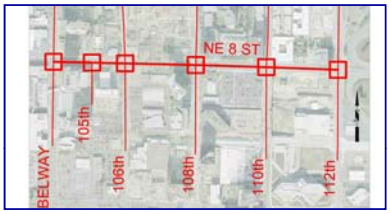
- Objectives:
  - Reduce delay
    - Vehicles
    - Pedestrians
  - Adapt quickly to changing traffic conditions
  - Gain New Features



Signal System

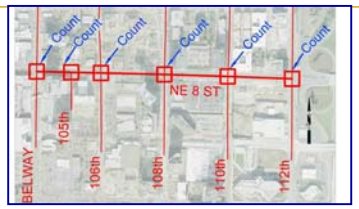
- **Why "Traffic Adaptive"?**
- **Signal Coordination Methods:**
  - Time of Day Coordination
  - Traffic Responsive Coordination
  - **Traffic Adaptive**

Why Traffic Adaptive?



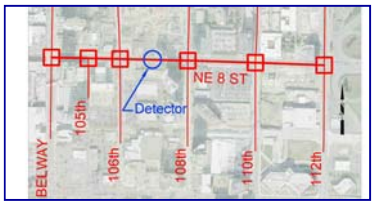
- Signal Coordination
  - Group of signals work together to achieve an objective
  - All signals in group typically have same cycle length

Why Traffic Adaptive?



- Time of Day Coordination
  - Staff counts intersections on a "typical" day
  - Engineer designs coordination plans (AM, Noon, PM, Off Peak, Etc)
  - Plans implemented by time of day
  - Plans don't respond to changes in traffic

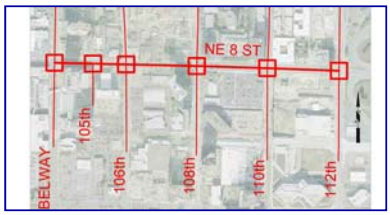
Why Traffic Adaptive?



Loop Detector

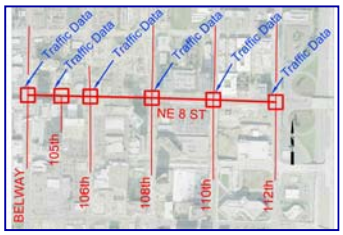
- Traffic Responsive Coordination
  - Detector continuously sends traffic data to the traffic computer
  - Traffic computer selects plan based V+kO, not time of day
  - Better method than time of day
  - Traffic only monitored at 1 location; only 2-5 plans to select from

Why Traffic Adaptive?



- Traffic Adaptive

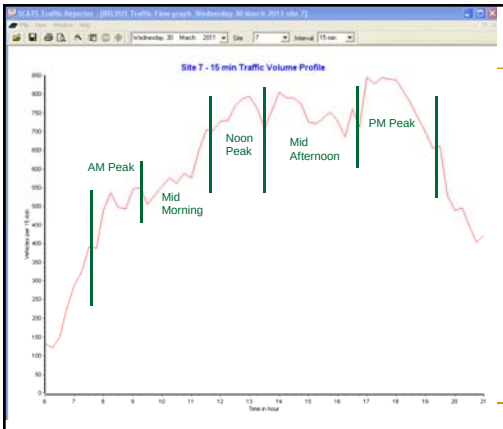
Why Traffic Adaptive?



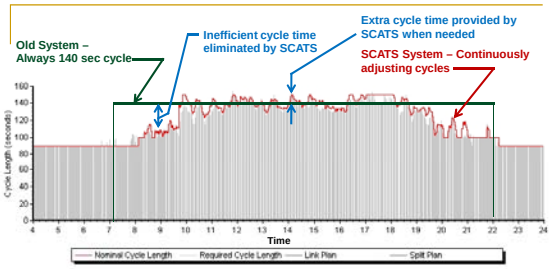
- Traffic Adaptive
  - Continuously obtain traffic data from all lanes at all intersections

Why Traffic Adaptive?

- Traffic Adaptive
  - Data fed to central computer via communication system
  - Computer sends new coordination plan every cycle



Operations



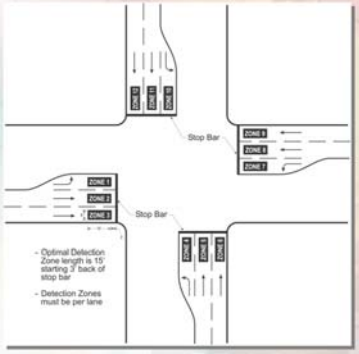
Bellevue Way and NE 8th Street –
Cycle Length before & after SCATS

SCATS Objectives

Select cycle length, splits and offsets to achieve

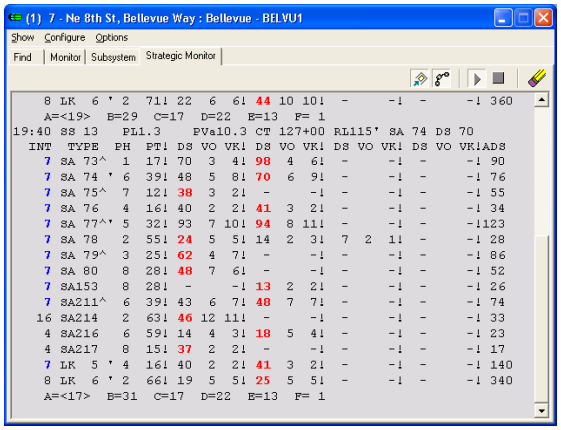
- Minimum stops with light demand
- Minimum delay with normal demand
- Maximum throughput with heavy demand

Typical Detector Layout



SCATS Detectors

- SCATS operates by looking at "space" between vehicles
- Eliminates vehicle length from equation
- Graph is linear with no double curves

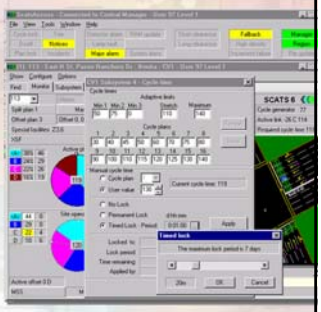


SCATS Modes

- Adaptive Mode
  - *Traffic adaptive coordination mode*
- Time-of-Day Mode
  - *Fixed-time coordination fallback mode*
- Free Mode
  - *Vehicle actuated operation*
- Master Free Mode
  - *Vehicle actuated with SCATS calculated splits*
- Flash

SCATS GUI

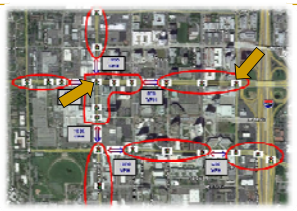
- Familiar Windows interface
  - Pull down menus
- Real-time information

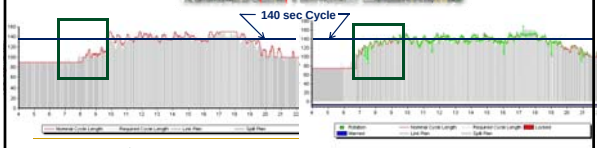


Operations

SCATS Downtown Coordination Design

Operations – SCATS Downtown





NE 8th St/Bellevue Way

NE 8th St/112th Ave NE

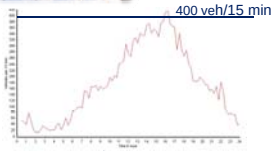
Operations – Responsiveness

November 23rd, 2010 Snow Day (Tuesday)

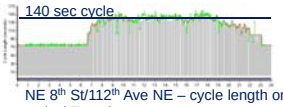
Typical Tuesday

Snow Day Tuesday

NE 8th St volume – higher on typical Tuesday



NE 8th St volume – much lower on snow day



NE 8th St/112th Ave NE – cycle length on typical Tuesday

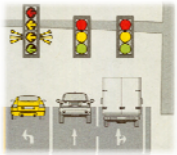
NE 8th St/112th Ave NE – cycles much lower on snow day

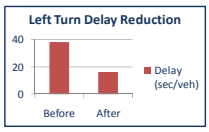
Operations – Responsiveness

Truck Accident Closes NE 8th St

Operations – New Features

- Flashing Yellow Arrow (FYA)
  - By Time of Day or Adaptive Trigger





Factoria Blvd & Newport Way FYA

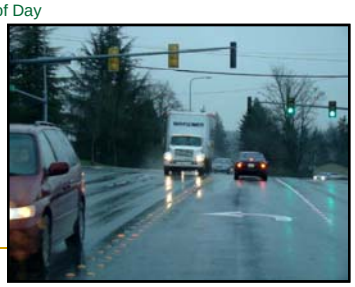
Operations – New Features

EXAMPLE

- Factoria Blvd & Newport Way – South to East Left Turn

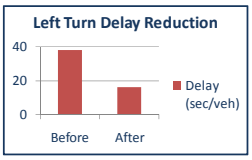
Old System – Protected Left Only

SCATS – FYA by Time of Day



Operations – New Features

- Factoria Blvd & Newport Way – RESULTS
  - Delay Reduction Sample – Weekday PM peak
    - Old Delay = 38 sec/veh
    - SCATS Delay = 16 sec/veh
    - 58% Reduction



Operations – New Features

- Phase Reservice
  - NE 4th St at NB I-405 on-ramp
  - Factoria Blvd at WB I-90 on-ramp

Eastbound NE 4th Queue to NB I-405
(March 1 & 2, 2011)

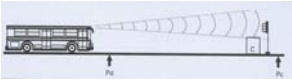
EB 4th Queued Past 110th:

	Start	*End*
Old System	4:10pm	7:00pm
SCATS	4:40pm	6:30pm

Result = 1 hr less congestion

Operations – New Features

- Phase Reservice
- Ped Reservice
- Ped Advance
- Transit Signal Priority



Operations – Results

- Flashing Yellow Arrow - Results

Intersection	Annual Delay Reduction (hours)	Annual Public Benefit ($)
Factoria Blvd & Newport	7000 hrs	$70,000
NE 8th St & 100th	8100 hrs	$81,000
Richards Rd & SE 32nd	2700 hrs	$27,000
Bellevue Way & NE 12th	6400 hrs	$64,000
5 Others	2000 hrs	$20,000
TOTAL	**26,000 hrs**	**$260,000**

Operations – Results

Intersection Delay Change Sample
(Delay Reduction due to SCATS)
January 25, 2011

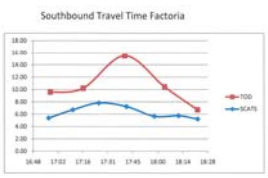
Intersection	8am-9	10am-11	Noon-1pm	3pm-4	5:30-6:30
BelWay/8th					
Factoria /SE 38th					
NE 4th/112th					
BelWay/12th					

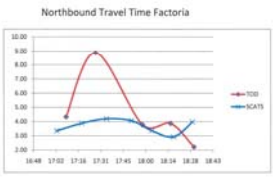
KEY:
- Little or no change
- Delay reduction > 10%
- Delay reduction > 20%

Overall Delay Reduction approx. 10%

Operations – Results

Factoria Blvd
Travel Time – SCATS vs Old System
(PM Peak)
Feb 15 & 16, 2011





Operations – Results

NE 8th Street & NE 4th Street
Travel Time – SCATS vs Old System
(2 pm to 6 pm)
February 15 & 16, 2011

- NE 8th Street – *Bellevue Way to 112th Ave NE*
  - Eastbound – 9 sec reduction
  - Westbound – 100 sec reduction

- NE 4th Street – *Bellevue Way to I-405 NB ramp*
  - Eastbound – 70 sec reduction
  - Westbound – 27 sec increase

Operations – Results

NE 8th Street & Bellevue Way
Pedestrian Crossing Opportunities
(7am to 8pm)

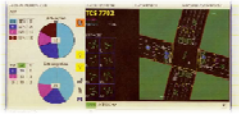
8% Increase

2011 and Beyond

2011 and Beyond

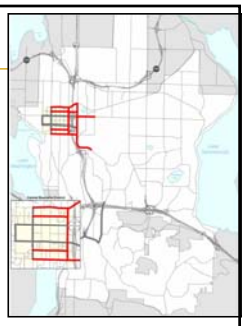
Current Status

- Old System (Computran)
  - 52 intersections, 28%
- Bridge System (i2TMS)
  - 93 intersections, 51%
- Traffic Adaptive (SCATS)
  - 38 intersections, 21%



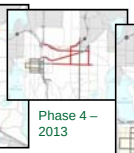
Project Phasing

- Phase 1 – complete
- Additional 5 phases needed
- 1 Phase per year
- 30 signals per phase
- Completion 2015



SCATS Phase 2 - 2011

Phase 3 - 2012



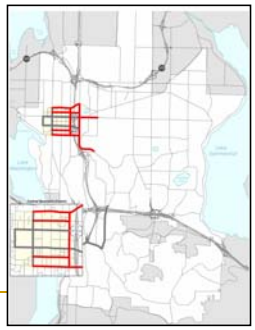
Phase 4 – 2013

Phase 5 - 2014

2011-2012 and Beyond

SCATS Phase 2

- 2011
- Finish Downtown Corridors
- 37% Completion



2011-2012 and Beyond

SCATS Phase 3

- 2012
- 148th Avenue NE/SE
- 53% Completion

2011-2012 and Beyond

- **SCATS Phase 4**
  - 2013
  - 69% Completion

- **SCATS Phase 5**
  - 2014
  - 88% Completion

- **SCATS Phase 6**
  - 2015
  - Completes Project

Project Cost

Description	Cost
Comm System, Studies, Equipment, Labor - 2008 to 2011	$2,000,000
Phase 1 - 2010	$630,000
Phase 2 - 2011	$480,000
Phase 3 - 2012	$475,000
Phase 4 - 2013	$475,000
Phase 5 - 2014	$475,000
Phase 6 - 2015	$450,000
TOTAL	**$4,985,000**

Final Thoughts

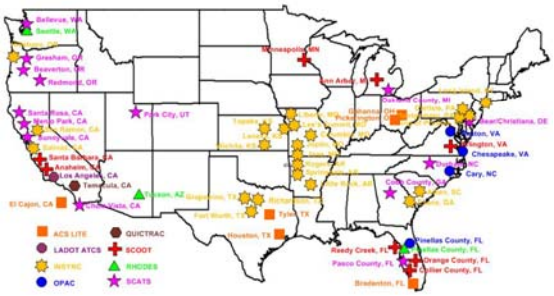
- Spot vs Systematic Investments

NE 8th St Widening
600' long lane addition
$4,000,000 cost
$170,000/yr benefit

SCATS Phase 1
4 key corridors, 31 intersections
$630,000 cost
$1,500,000/yr benefit

Final Thoughts

- Traffic Adaptive will grow quickly



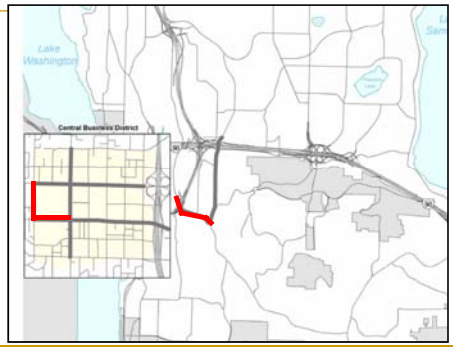
SCATS Demo/TMC Tour

Bellevue's Traffic Adaptive Signals

mpoch@bellevuewa.gov

QUESTIONS?

BELLEVUE
INTELLIGENT TRANSPORTATION SYSTEMS

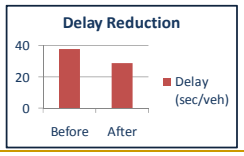


Review

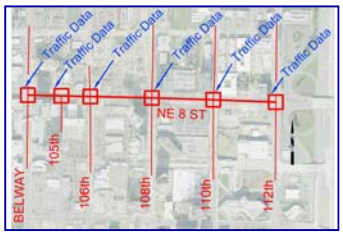
- Current Signal System Obsolete
- PW-R-155 begins 2009
- Communication system upgraded
- Signal System Study
- SCATS Traffic Adaptive – May 2010
- SCATS Phase 1 Contract – July 2010

Operations

- Bellevue Way and NE 8th St
  - Mid-Morning, Mid-Week Delay Sample (10:00 hour)
    - Old Delay = 38 sec/veh
    - SCATS Delay = 29 sec/veh
    - 24% Reduction
    - Approximately $XX,XXX/yr in travel time savings



Operations



- Traffic Adaptive
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Operations

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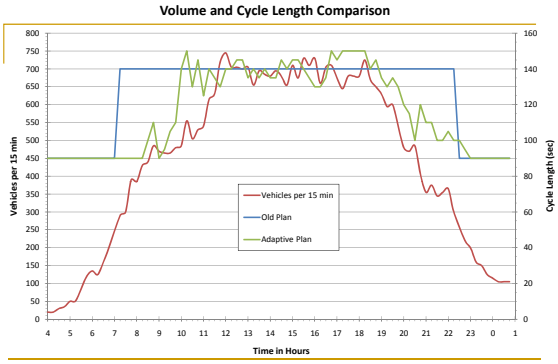


Operations

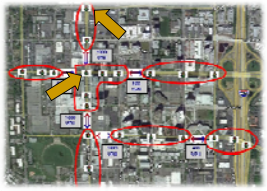
Computran Coordination (old signal system)

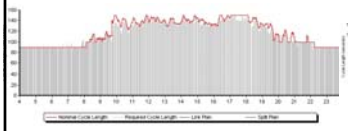
Operations – SCATS Downtown

NE 8th St/Bellevue Way

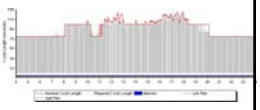
NE 8th St/106th Ave NE

Operations – SCATS Downtown



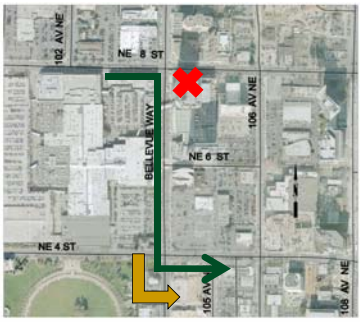


NE 8th St/Bellevue Way

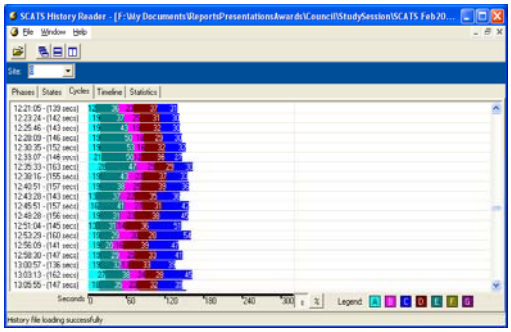


Bellevue Way/NE 12th St

Operations - Responsiveness



Operations - Responsiveness



Operations - FYA

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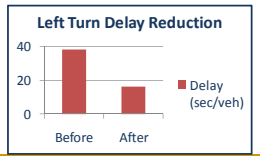


Operations – Results

Intersection Delay Modeling Results
(Delay Change due to SCATS)

Intersection	8am-9	10am-11	Noon-1pm	3pm-4	5:30-6:30
BelWay/8th	-20%	-12%	+3%	0%	+4%
Factoria /SE 38th	+2%	-3%			-51%
NE 4th/112th	-6%	-9%	-13%	-13%	-10%
BelWay/12th	-23%	-23%	-19%	-24%	-13%

Operations – Results

Intersection Delay Modeling Results
(Delay Change due to SCATS)

Intersection	8am-9	10am-11	Noon-1pm	3pm-4	5:30-6:30
BelWay/8th	>20%	>10%			
Factoria /SE 38th					>30%
NE 4th/112th			>10%	>10%	>10%
BelWay/12th	>20%	>20%	>10%		>10%

2011-2012 and Beyond

Funding Picture

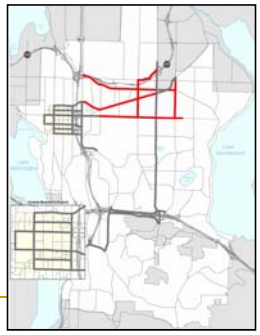
- PW-R-155 (Traffic Computer System Upgrade)
  - 2011 = $435,000
  - 2012 = $390,000
- Federal TSCP Grant
  - $360,000
  - Council Acceptance Sept. 2010

BELLEVUE
INTELLIGENT TRANSPORTATION SYSTEMS

2011-2012 and Beyond

SCATS Phase 4

- 156th Crossroads
- Bel-Red Rd
- NE 20th/Northup
- NE 8th St East Bellevue
- 29 Intersections
- Cost Estimate = $348,000
- Funded PW-R-155
- Implementation 2013
- 69% Completion



2011-2012 and Beyond

SCATS Phase 5

- Bellevue Way south/north
- SE 8th St @ I-405
- 140th Ave SE
- Lakemont
- 29 Intersections
- Cost Estimate = $348,000
- Request Funding '13-'14 Budget
- Implementation 2014
- 88% Completion

2011-2012 and Beyond

SCATS Phase 6

- Completes SCATS Project
- Isolated Intersections
- 23 Intersections
- Cost Estimate = $276,000
- Request Funding '13-'14 Budget
- Implementation 2015