Intelligent Transportation Systems
U.S. Department of Transportation

Federal Transit Administration

Transit Operations Decision Support Systems (TODSS): A USDOT Pilot Expert System for Transit Bus Fleet Management

Background

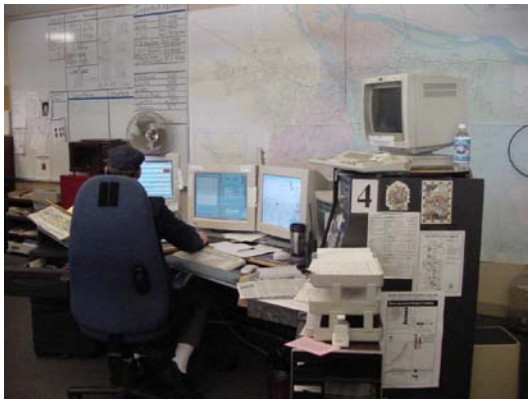
Steve Mortensen
Senior ITS Engineer
Office of Research, Demonstration & Innovation
Federal Transit Administration

October 21, 2009

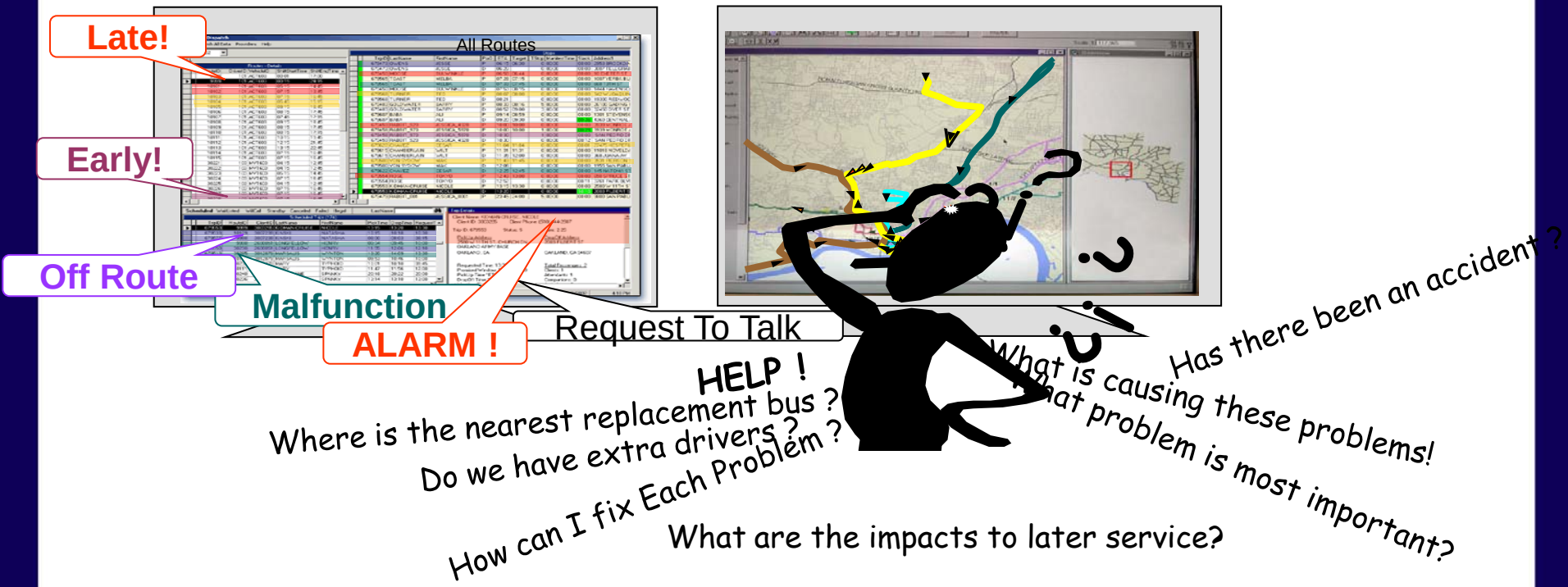
T3 Webinars are brought to you by the ITS Professional Capacity Building Program (ITS PCB) at the U.S. Department of Transportation's (USDOT) ITS Joint Program Office, Research and Innovative Technology Administration (RITA)

The Problem

- AVL/CAD systems generate large quantities of data
  - Dispatchers do not have sufficient time to digest the data for decision making in a normal operating environment
  - Dispatchers are unable to recognize patterns of operational problems
  - Available data and AVL/CAD capabilities are not fully utilized

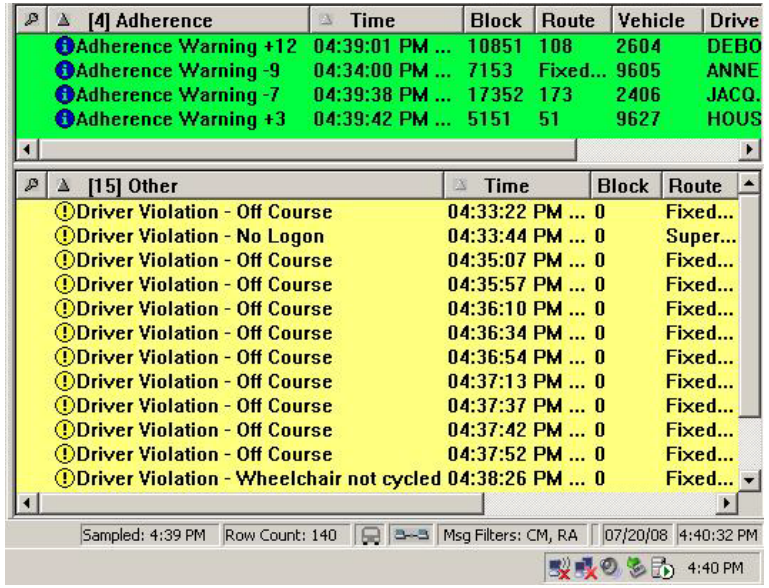


The Problem (continued)



The Solution -- TODSS

- Develop enhanced capabilities and tools to help dispatchers and field supervisors:
  - Identify and prioritize problems as they occur
  - Make decisions to resolve operational issues before they become problems
  - Manage problems or incidents as they arise
  - Restore service with minimal disruption to the transit system



[4] Adherence	Time	Block	Route	Vehicle	Drive
Adherence Warning +12	04:39:01 PM ...	10851	108	2604	DEBO
Adherence Warning -9	04:34:00 PM ...	7153	Fixed...	9605	ANNE
Adherence Warning -7	04:39:38 PM ...	17352	173	2406	JACQ.
Adherence Warning +3	04:39:42 PM ...	5151	51	9627	HOUS

[15] Other	Time	Block	Route
Driver Violation - Off Course	04:33:22 PM ...	0	Fixed...
Driver Violation - No Logon	04:33:44 PM ...	0	Super...
Driver Violation - Off Course	04:35:07 PM ...	0	Fixed...
Driver Violation - Off Course	04:35:57 PM ...	0	Fixed...
Driver Violation - Off Course	04:36:10 PM ...	0	Fixed...
Driver Violation - Off Course	04:36:34 PM ...	0	Fixed...
Driver Violation - Off Course	04:36:54 PM ...	0	Fixed...
Driver Violation - Off Course	04:37:13 PM ...	0	Fixed...
Driver Violation - Off Course	04:37:37 PM ...	0	Fixed...
Driver Violation - Off Course	04:37:42 PM ...	0	Fixed...
Driver Violation - Off Course	04:37:52 PM ...	0	Fixed...
Driver Violation - Wheelchair not cycled	04:38:26 PM ...	0	Fixed...

Sampled: 4:39 PM | Row Count: 140 | Msg Filters: CM, RA | 07/20/08 | 4:40:32 PM | 4:40 PM

Resulting Activities

- FTA and ITS JPO launched an effort to help develop TODSS:
  - Met with transit agencies to discuss problems
  - Conducted workshops with transit agencies and AVL/CAD vendors to discuss issues, needs, and recommended actions
  - Worked with the industry to developed TODSS concept and core requirements, which:
    - Identify and prioritize service disruptions
    - Recommend options for restoring service
    - Available at: http://ntl.bts.gov/lib/jpodocs/repts_te/13964.html
  - Conducted a competitive procurement to develop a prototype TODSS employing the core functional requirements
    - Awarded project to Pace Suburban Bus System in 2006

Core Functional Requirements

- Provide for a common understanding between vendors and agencies concerning TODSS
- Help vendors reduce the cost of customization
- Help agencies with procurement specifications
- Solve problem of AVL/CAD data overload for bus dispatchers

Service Disruptions	Service Restoration Strategies																																		
	Adjust Travel Time	Selective Hold	Speed Control (along route)	Signal Prioritization	Schedule shift	Adjust Travel Time & Passenger Access/Egress	Egress Only	Express along route	Deadhead	Passing	Short Turn	Adjust Travel Time, Passenger Access/Egress, Rou	Re-Route	Express re-route	Additional Driver	Provide driver relief	Additional Vehicle	Insert/Replace vehicle	From barn	From standby location	From other in service route	From other out of service route	Relay Vehicle	From barn	From standby location	From other route	From other out of service route	Field Support	Transit Police	Public Safety	Maintenance Crew	Supervisor	No Action	Monitor
Schedule: Vehicles are either too early or late based upon thresholds																																			
Vehicle Early		1	1																																3
Vehicle Late				1	1			2	3	3	2		3	3					1	1	3	2		1	1	3	2								
Route Early		1	1																																
Route Late			1	1	2			2	3		2		3	3					1	1	3	2		1	1	3	2								
System/Corridor Late					1			3	3		3								2	2	2	2		2	2	2	2								
Vehicles through time point early		2	1																																3
Vehicles through time point late			1	1	2			2	3		3		3	3					2	2	3	2		3	3	3	3								
Missing / late logon																1			2	2		3											1		2
Headway: Vehicles are gapping and bunching along route, at a specific point, or along segment																																			
At point location (time point)		1	1		2		2	2	2	2	2																						2		
Along Route (Distance based)		1	1	2			2	2	2	2	2																								
Coordinated (shared segment)		1	1		2		2	2	2	2	2																								
Passenger Load: Passenger loads exceed thresholds (from APC or MDT)																																			
Automatic Vehicle Overload							1	1	1	1									1	1	3	2													
Manual Vehicle Overload							1	1	1	1									1	1	3	2													
Route overload							2	3		3									1	1	3	2											2		
Off Route: Vehicle leaves route																																			
Notified (approved)					1				1				1	1					2	2	3	2							3	2		1		2
Detected by System					1				1				1	1					1	1	3	2		1	1	1	1		1	2		1		1
Vehicle Performance: Vehicle is incapacitated or crippled																																			
Mechanical Breakdown					2				2				1	1					1	1	3	2									1	1			
Mechanical Malfunction					2		2	3	2				1	1					1	1	3	2									1	1			3
Accident					2			3	2				1	1					1	1	3	2							1	1	2	1			
Driver Incident: Driver sick, incapacitated/emergency, inappropropriate performance																																			
Driver Incident							2		2							1			2	2	3	2							2	2		1			
Passenger Incident: Passenger sick, incapacitation/emergency, inappriopriate behavior, crime																																			
Passenger Incident									2		3		2	2					1	1	3	2		2	2	3	2		1	1		1			
Emergency Alarm: Emergency alarm on vehicle is activated																																			
Emergency Alarm									1				1	1					1	1	3	2							1	1		1			
Connection Protection: Request for unscheduled transfer, or scheduled daily connection																																			
Passenger Requested		1	2	2				1						3																					
System Managed		1	2	2				1						3																			2		
Communication Status (on/off): Loss of communications with vehicle for unknown reason																																			
No Data Transmissions																															2	1		2
No Contact at All																			3	3	3	3							1			1		2
External Event: Notification of event from outside source. Event may have direct impact on service or request transit assist																																			
Event Notification					2				2		2		1	1					1	1	3	2							1	1		1		2

1 = Common practice, likely response
2 = Used by some agencies, in some situations
3 = May be applicable in certain situations