

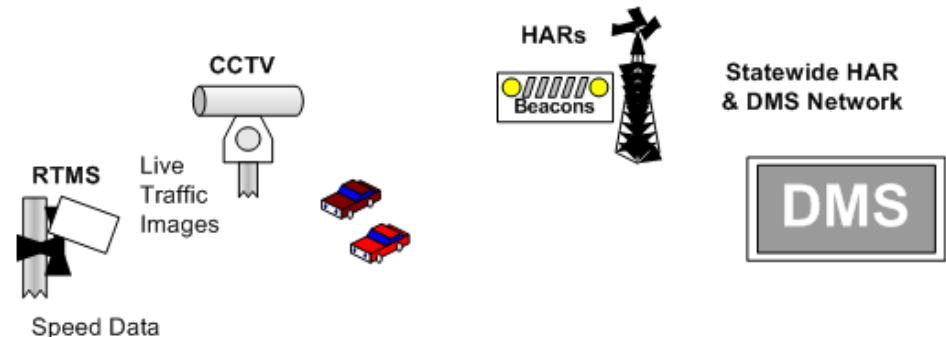
**Using the I-95 Corridor Coalition
Vehicle Probe data
to put
Automated Travel Times on
Dynamic Message Signs in Maryland**

**Richard R. Dye
Maryland State Highway
Administration**



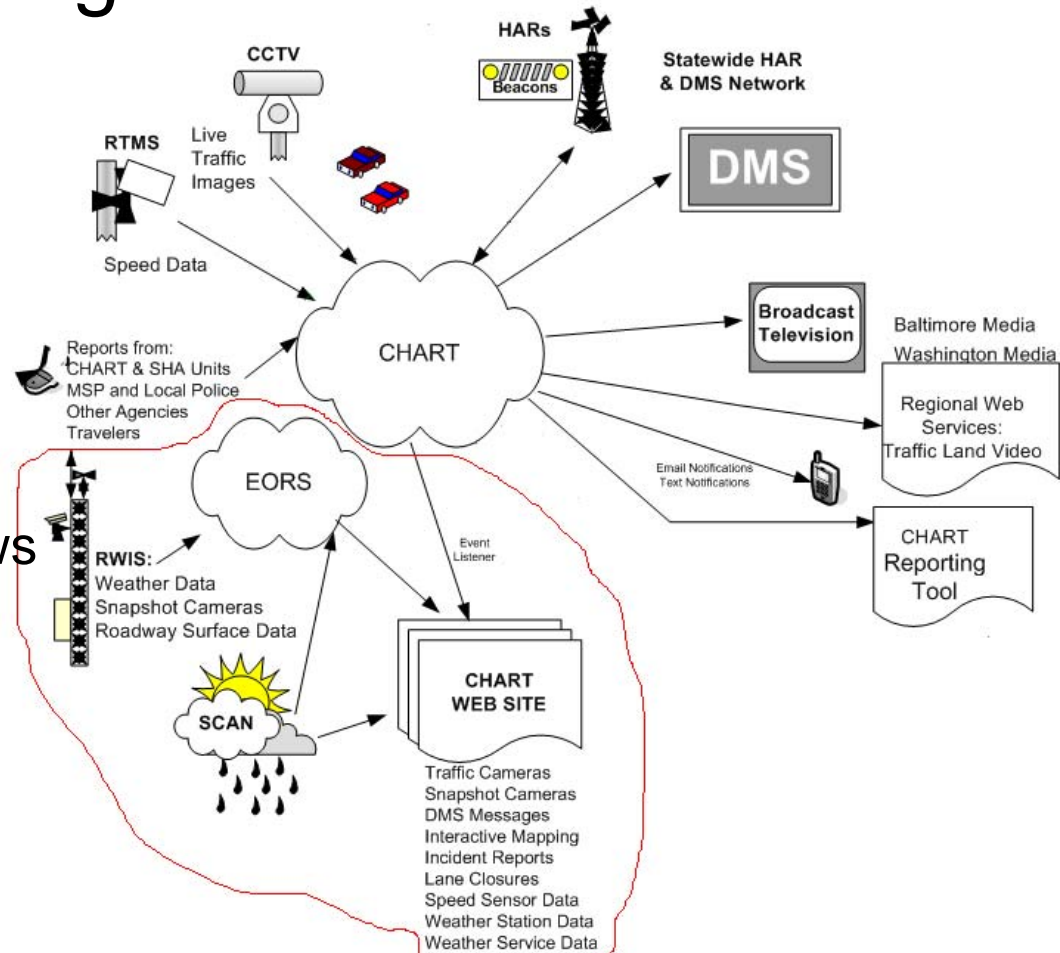
CHART Grew From Reach the Beach

- 1988
 - State Highway
 - State Police
- 1995
 - Statewide Operations Center
 - 2 Remote Traffic Operations Centers
 - MdTA AOC



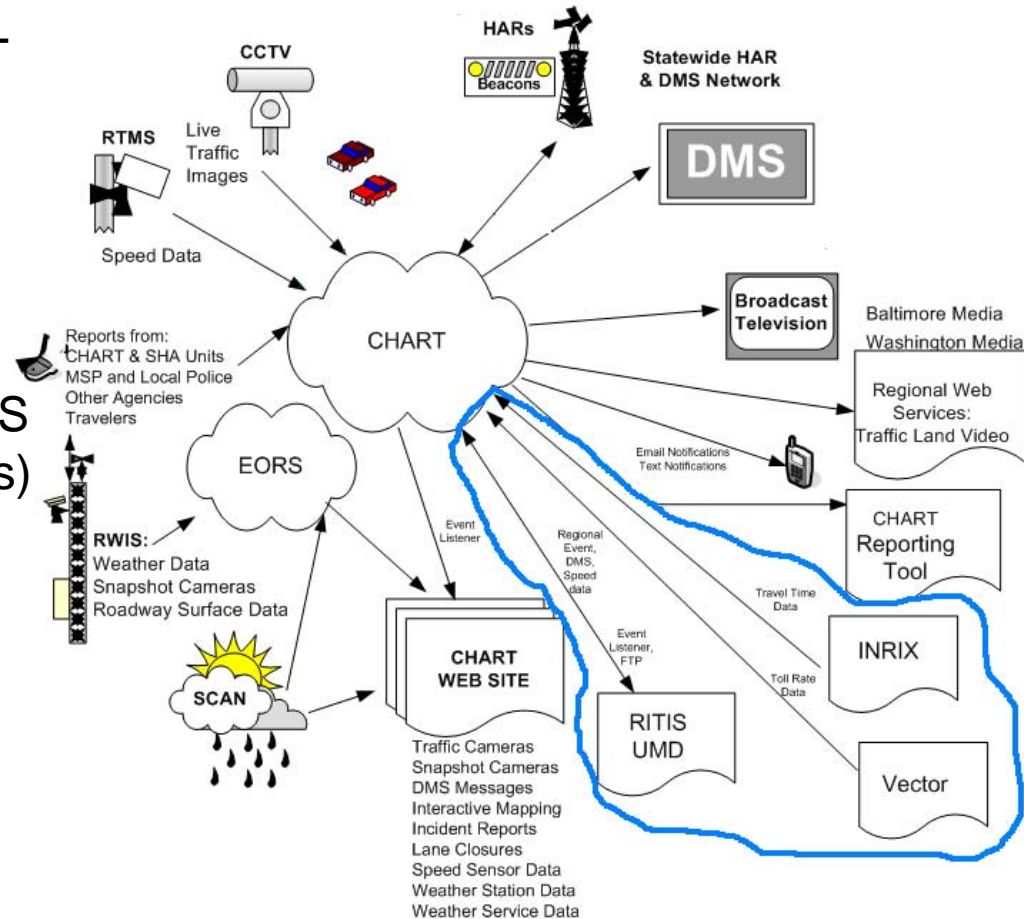
But Quickly Grew Beyond it's Limited Beginnings

- 1999
 - CHART on the Web
- 2001
 - Event-Based Control (allows multi-TOC Operations)
- 2002
 - Arbitration Queue (allows multi-agency Control)
- 2004
 - NTCIP for DMS
 - Web-based GUI

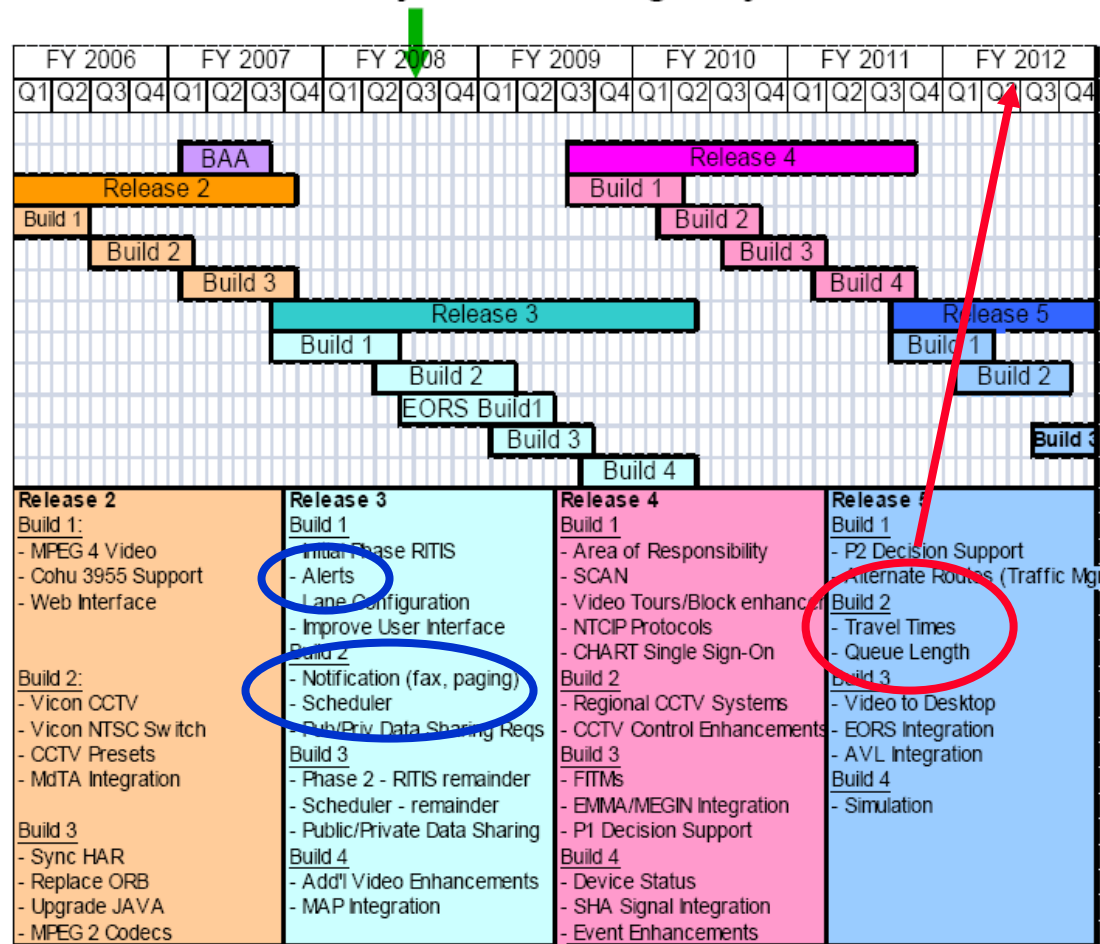


But Quickly Grew Beyond it's Limited Beginnings

- 2006 - 2007
 - Multicast Video (allows Multi-TOC and Multi Agency Control)
- 2008
 - Real-time External Traffic Management Center Data Feed to DC and VDOT (RITIS allows multi-State Operations)
- 2009
 - Real-Time 3rd Party input for Travel Times and Toll Rates on DMS

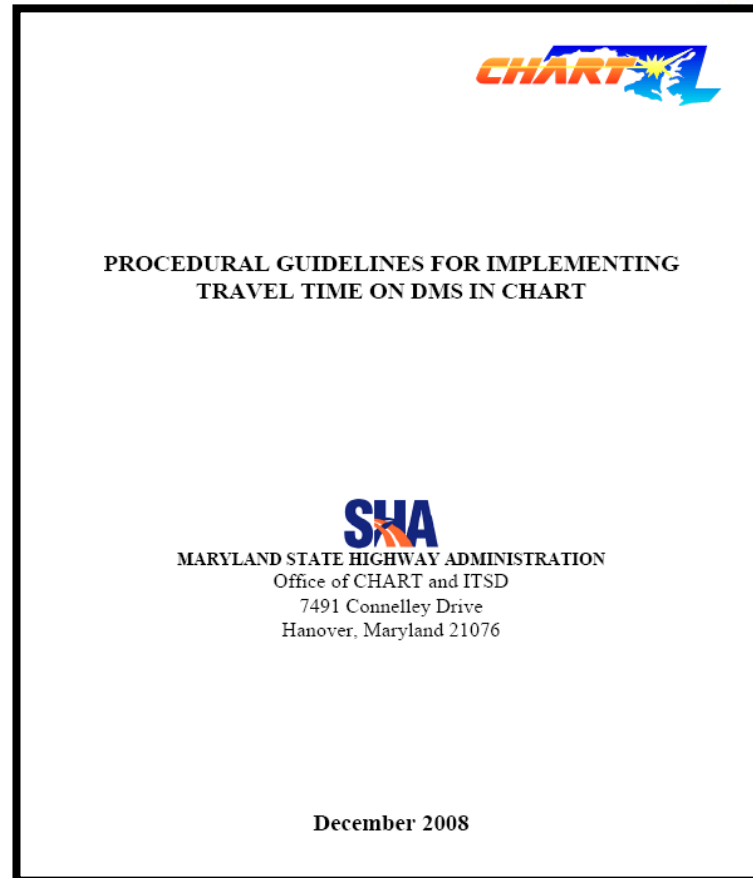


Multi-year Deployment Schedule Maryland State Highway Administration



Maryland State Highway Administration

- That same month, Inrix was awarded the Corridor Travel Time contract and software development for automated messages on CHART signs was pushed forward to meet the challenge
- Work was also begun on Engineering Guidelines for Implementing Travel Times On DMS in Maryland

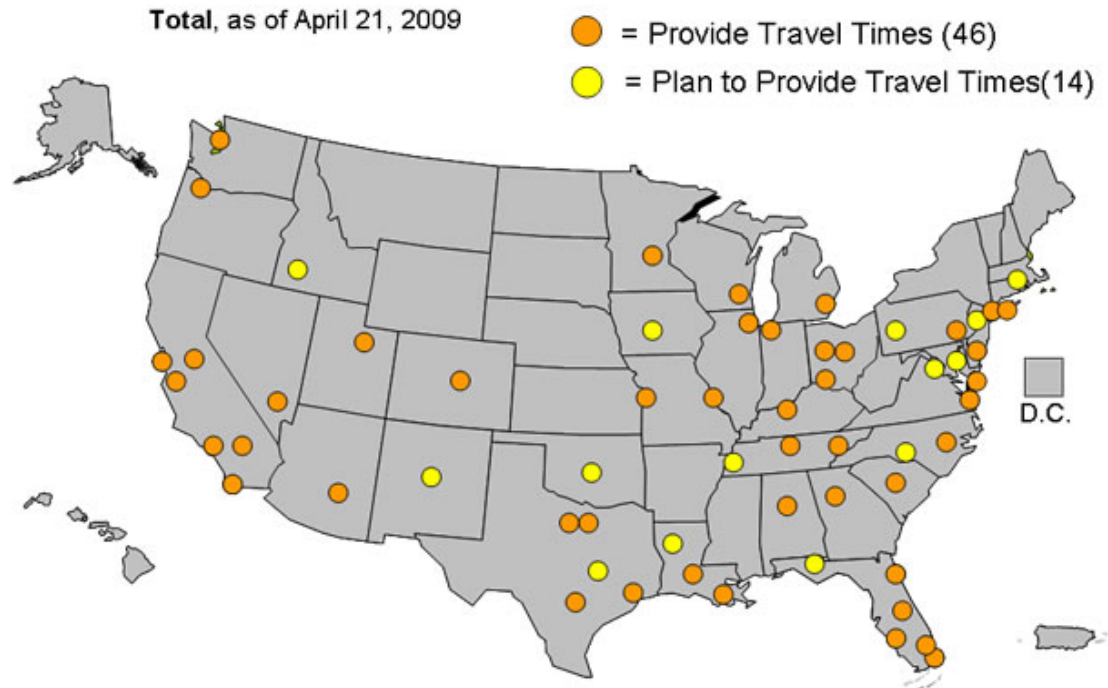


More Info, download Procedural Guidelines For Implementing Travel Time on DMS In CHART (PDF) at http://traffic.md.gov/readingroom/RR_ChartSWProgDocumenation.asp



- ...but... developing software to implement a 3rd party interface that had been neither developed nor tested was risky (to say the least)
- This is the 1st time EVER that messages will be put on a CHART field device without the direct approval or even overt knowledge of an operator. How do we manage our risk?
- ... and the FHwA “map” was not going away

Travel Times on DMS Status



Assumptions!



+ You + Me

- If the 3rd party data is good, we can move automated travel times on DMS up to a non-dedicated build if:
 - Routes in CHART will be built using links that we choose
 - This will allow us to avoid obvious trouble spots for probe-based systems (e.g. welcome station on I-95 where long runs parallel to the highway may confuse the data)
 - Travel Time will run during hours of day that we choose
 - This will allow us to avoid obvious trouble spots for probe-based systems (e.g. low volume of probes between 2am and 4am)

Select Link

Search for Links

County: Any | Road Type: Any | Road: Any | Direction: Any | Ext ID:

Select	Source	Ext ID	Name	Road	Direction	Length	County	Dist From	Prior
<input type="checkbox"/>	INRIX	125P06000	Link Name 1	I-95	Northbound	0.500 mi	Baltimore	0.0 mi	
<input type="checkbox"/>	INRIX	125P06001	Link Name 2	I-95	Northbound	0.267 mi	Baltimore	0.0 mi	
<input type="checkbox"/>	INRIX	125P06002	Link Name 3	I-95	Northbound	0.345 mi	Baltimore	0.0 mi	

CHART - Windows Internet Explorer

Comm Log | Source: Other (no info) | Text: | Add | I/S | C

[Toggle Menu](#) | [Recent Events](#) | [Back](#) | [Forward](#) | [Refresh](#) | [Center Rpt](#) | [Communications Log](#) | [Instant Messaging](#) | [Home Page](#) | [Paging](#) | [Map](#) | [Traffic Events](#) | [Help](#)

Edit Travel Time Message Display Schedule

(Does not apply to travel time messages that also contain toll rate)

Enabled 24/7 Enabled during specific times

Travel Time Message Allowed From: 05 : 30 Until: 09 : 30

Travel Time Message Allowed From: 15 : 00 Until: 18 : 30

[Add Time Range](#)

[Top](#) | [Back](#) | [Forward](#) | [Refresh](#) | [Center Rpt](#) | [Communications Log](#) | [Instant Messaging](#) | [Home Page](#) | [Paging](#) | [Map](#) | [Traffic Events](#) | [Help](#) | [Save Window Position](#)

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Assumptions!



+ You + Me

- Travel times will be displayed in ranges, not exact times
- The currently approved quality scores will be used to determine if a message is displayed
- A smoothing algorithm will be added to the travel time data received from Inrix
 - This should mitigate the severity of seriously outlying data points

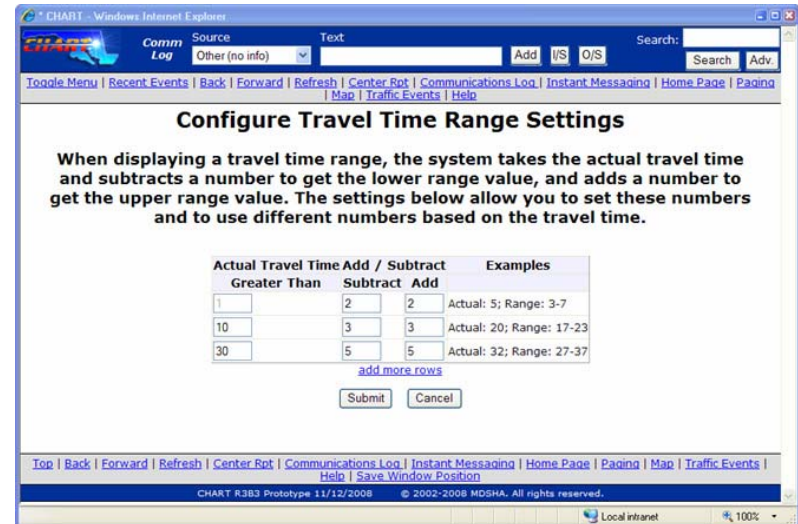


CHART - Windows Internet Explorer

Comm Source Text
Log Other (no info) Add US Q/S Search: Adv.

Toggle Menu | Recent Events | Back | Forward | Refresh | Center Rpt | Communications Log | Instant Messaging | Home Page | Paging | Map | Traffic Events | Help

Configure Travel Time Range Settings

When displaying a travel time range, the system takes the actual travel time and subtracts a number to get the lower range value, and adds a number to get the upper range value. The settings below allow you to set these numbers and to use different numbers based on the travel time.

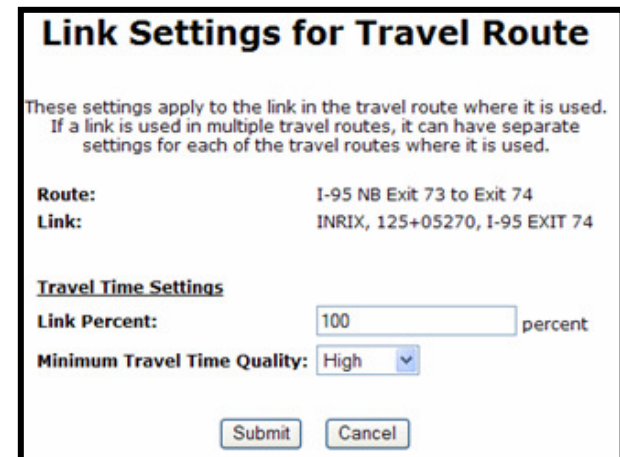
Actual Travel Time	Greater Than	Subtract	Add	Examples
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	Actual: 5; Range: 3-7
10	<input type="text"/>	<input type="text"/>	<input type="text"/>	Actual: 20; Range: 17-23
30	<input type="text"/>	<input type="text"/>	<input type="text"/>	Actual: 32; Range: 27-37

[add more rows](#)

Top | Back | Forward | Refresh | Center Rpt | Communications Log | Instant Messaging | Home Page | Paging | Map | Traffic Events | Help | Save Window Position

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Local intranet 100%



Link Settings for Travel Route

These settings apply to the link in the travel route where it is used. If a link is used in multiple travel routes, it can have separate settings for each of the travel routes where it is used.

Route: I-95 NB Exit 73 to Exit 74
Link: INRIX, 125+05270, I-95 EXIT 74

Travel Time Settings

Link Percent: percent

Minimum Travel Time Quality: High



Assumptions!



+ You + Me

- If a maximum travel time threshold is received, the message will not be displayed and an alert will be set to the controlling Ops Center as well as notification to selected pager/email groups in the system
- Travel times below a minimum will display travel time as if the speed limit were traveled

Travel Time Settings [\(Edit\)](#)

Travel Time Enabled:	Yes
Max Displayable Travel Time (mins):	25
Min Travel Time (mins):	5
Max # of Links Below Quality Threshold:	0
Alert/Notification Travel Time (mins):	25
Travel Time Alerts Enabled:	Yes
Op Ctr To Alert:	SOC
Travel Time Notifications Enabled:	Yes
Group To Notify:	Travel Time Group

How Does The Design Look Right Now?

- Privileged operators can create travel routes

Add Travel Route

Name:

Destination (preferred): (for DMS Msgs)

Destination (option 1): (for DMS Msgs, used if preferred too long)

Destination (option 2): (for DMS Msgs, used if preferred and option 1 too long)

Links (Optional, required for Travel Time)

System Ext ID	Name	Route	Direction	Length	County	Dist	From	Prior
Add Link								

Toll Rate Source (Optional, required for Toll Rate)

System Start ID	End ID	Description
Add		

Location Settings From Links User Specified

Counties: [\(more\)](#)

Route Type:

Route:

Direction: [\(multiple routes\)](#)

Length: miles

Travel Time Settings

Travel Time Enabled:

Max # of Links Below Quality Threshold: (If more than this number of links have low quality data, ignore the travel time)

Max Travel Time (mins): (If the route travel time exceeds this limit, it will not be shown)

Min Travel Time (mins): (If the route travel time is less than this, this value will be used)

Alert and/or Notification Travel Time (mins): If the route travel time is \geq this value, send an alert and/or notification as follows:

Send Alert to Op Center:

Send Notification To Group:

Toll Rate Settings

Toll Rate Enabled:

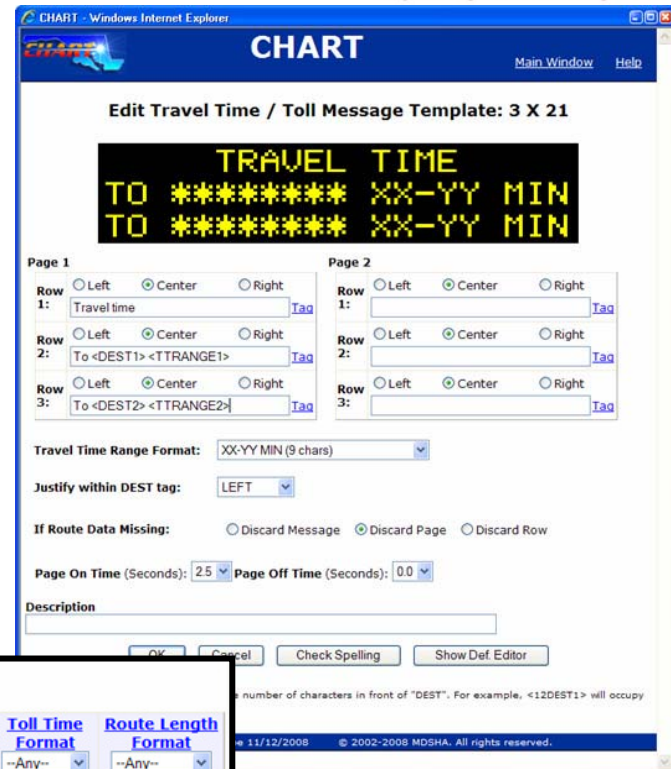
Toll Rate Alerts Enabled: Send Alert to Op Center:

Toll Rate Notifications Enabled: Send Notification To Group:



How Does The Design Look Right Now?

- For maximum flexibility, DMS Message Templates are used to define the format and layout of messages used to show travel times and/or toll rates on DMSs. Message templates target DMSs of a specific size (rows /columns) to allow layout features such as column data and to ensure messages created with the template match the layout specified by the template designer.
- Templates may contain both text and data fields. Data fields will be replaced with actual data from one or more Travel Routes when a template is used for a DMS message.



Travel Time / Toll Message Templates										
Template	Sign Size	Page 1	Page 2	Example Message	Actions	Travel Time Format	Travel Time Range Format	Toll Rate Format	Toll Time Format	Route Length Format
TT to DEST multiple routes 3x21	3 x 21	<TT1> TO <DEST1> <TT2> TO <DEST2> <TT3> TO <DEST3> <TT4> TO <DEST4> <TT5> TO <DEST5> <TT6> TO <DEST6>		999 MIN TO ***** 999 MIN TO ***** 999 MIN TO *****	Edit Remove	999 MIN				
TR to DEST and TT 1 route 3x18	3 x 18	<TR1> TO <DEST1> <TT1>		\$9.99 TO ***** 999 MIN	Edit Remove	999 MIN		\$9.99		
ICC Toll Msg 3x8	3 x 8	<TR1> <TR2> <TRTIME>		\$9.99 \$9.99 12:59 PM	Edit Remove			\$9.99	12:59 PM	



How Does The Design Look Right Now?

- Any Operator can see
 - The name and length of the route
 - The current travel time for the route
 - The current travel time trend
 - The current average speed on the route
 - The current toll rate for the route
 - The devices using the travel route
 - The roadway route(s) that are included in the travel route.
 - The roadway direction(s) that are included in the travel route.
 - The Counties that are included in the travel route

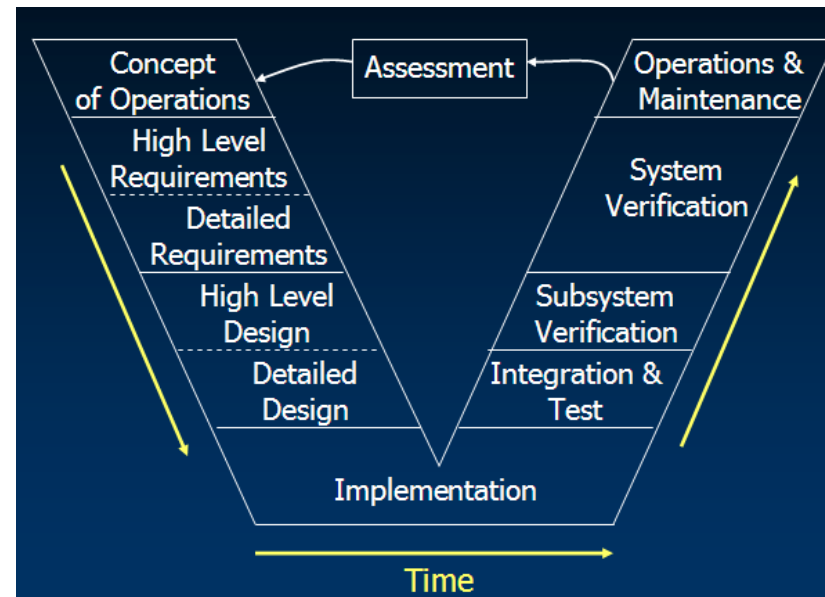
Name	Length	Trav Time	Trend	Speed	Toll Rate	Used By	Route	Dir	County	
152 to White Marsh	5 mi	7 mins	Up	55	N/A	DM1 XYZ	I-95	SB	Harford County	details edit remove
270 Split to Amer. Legion Br.	10 mi	15 mins	Down	55	N/A	DM1 XYZ abc	I-95 I-495	SB OL	Montgomery County	details edit remove
ICC Exit 1 to Exit 3	7 mi			55	\$0.75 at 14:00	DM1 XYZ	MD 200	EB	Montgomery County	details edit remove
ICC Exit 6 to Exit 8	4 mi	6 mins	Flat	55	\$0.50 at 14:05	DM1 XYZ	MD 200	EB	Montgomery County Prince George's County	details edit remove
Route - no current TT data	4 mi				N/A	DM1 XYZ	I-95	NB	Baltimore County	details edit remove
Route - no current Toll data	4 mi	N/A	N/A	N/A		DM1 XYZ	MD 200	WB	Montgomery County	details edit remove
Route - tt and toll disabled	3 mi	N/A	N/A	N/A	N/A		MD 200	WB	Montgomery County	details edit remove



Timeline

- 12/2007 – CHART Release 3, Build 3 changed to add Traveler Information Messages, including Travel Times and Toll Rates obtained via an external connection
- 4/2008 - I-95 Vehicle Probe Project Interface Guide (Draft) published (API)
- 4/2008 – CHART Board (Senior Traffic Operations Managers of the CHART program) briefed on assumptions of how CHART will handle the Inrix data feed

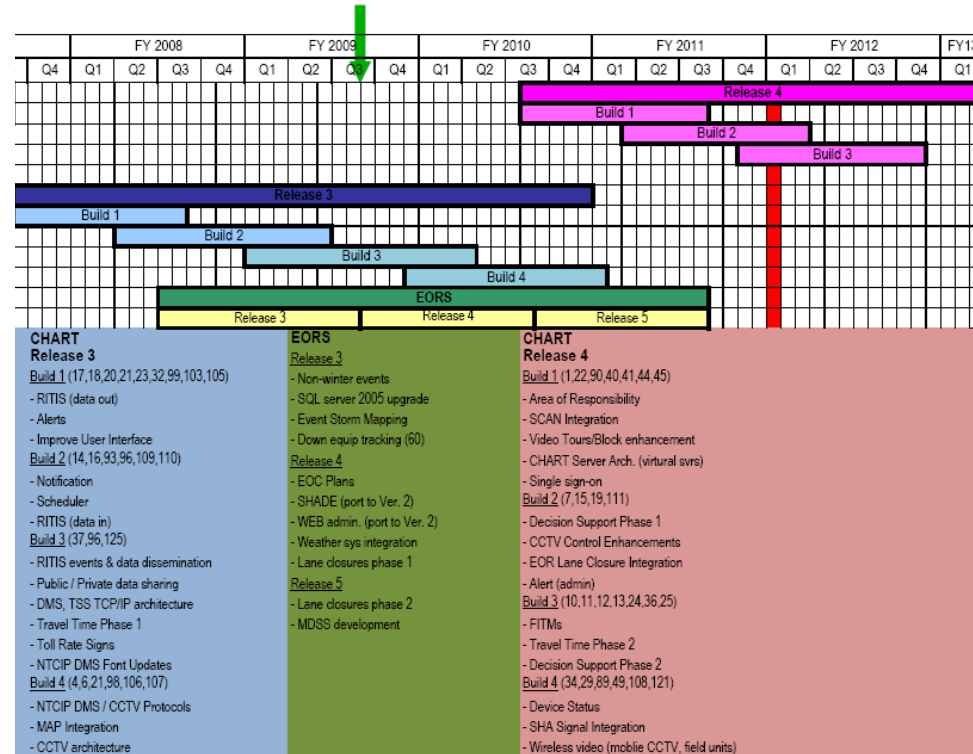
- 7/2008 – R3B3 Notice to Proceed
- 7/2008 Scope Doc/Project Plan
- 10/2008 - Updated Software Requirements
- 10/2008 – Notification by Inrix that there will be a mandatory change to one of the existing APIs for Connected Services (GetSecurityToken)
- 12/2008 - Detailed Design
- 12/2008 - “rumor” that Inrix will change the “quality” ratings in data feed
- 5/2009 – Inrix acknowledges by e-mail that new data quality score will be forthcoming, but not until June or July 2009



And if all goes well?

- CHART Release 3, Build 3 will be deployed in October 2009 and will be composed of:
 - Traveler Information Messages, including Travel Times and Toll Rates obtained via an external connection to the INRIX system and Vector system.
 - Device Location fields to CHART devices, including DMS, TSS (Detectors), HAR, SHAZAM, and Cameras allowing the system to show devices close to traffic events to aid in event response.
 - External Event Import including External Event Alert
 - External DMS and TSS import from RITIS.
 - Capability to manage geographical area definitions
 - Direct TCP/IP communication for DMS and TSS

Multi-year Deployment Schedule



More Info, download CHART R3B3 Detailed Design.pdf at
http://traffic.md.gov/readingroom/RR_ChartSWProgDocumenation.asp

