

CHARTing a Data-Rich Future in Maryland

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1. Introduction

- Availability of operational data for archiving
- Process of building a data archiving and retrieval function for Maryland's CHART system
- Assessment of alternate architecture approaches for archiving and access
- Phased implementation of an ADUS
- Anticipated application to decision support
- Implications and recommendations

2. Availability of Data for Archiving

- In Maryland, SHA operates CHART, (Coordinated Highways Action Response Team)
- CHART has been focused on freeway operations and management functions of:
 - Traffic Monitoring
 - Traveler Information
 - Incident Management
 - Traffic Management
- Data archiving has not been a function of the initial CHART system

3. Establishing Data Archiving

- A process was established to help define a data archiving functionality
- Currently at the end of the second, beginning of the third of three phases:
 - **Initial Phase:** identified and interviewed a sample of likely ADUS users
 - **Assessment Phase:** defined user groups, data sources, access methods, output display techniques, and assessment of architectures
 - **Design Phase:** ADUS functions to be part of the releases and builds for CHART II

Initial Phase Interview Questions

- Types of primary data being collected
- Types of secondary data being gathered
- Types of data want to get from CHART II
- Time frames, geographic detail, kinds of summaries, formats, and access needed
- Hardware/software and communication systems available for accessing the data
- System upgrading plans and connectivity concerns and opportunities

Assessment Phase Activities

- Documentation and analysis of the Initial Phase interviews
- Explored and defined four key issues:
 - Who are the potential users?
 - What types of data do they want?
 - How do they want to access the data?
 - What formats do they want to get it in?
- Assessed alternative architectures for an Archived Data User Service for CHART

3a. Who are the Potential Users?

- Based on the National ITS Architecture stakeholder groups (propose adding one)
- Refined for Maryland conditions
- Four major functional categories with sixteen main ADUS User Groups defined
- Main ADUS User Groups consist of similar organizations, defined by a range of sub-functions

The ADUS User Groups

- **Planning Functions**

- Metropolitan Planning Organizations and State Transp. Planning
- Transportation System Monitoring
- Air Quality Analysis
- MPO/State Freight and Intermodal Planning
- Land Use Regulation and Growth Management
- Transportation Administration and Policy Analysis
- Transit Planning

- **Operations Functions**

- Traffic Management
- Transit Management
- Construction and Maintenance
- Private Sector
- ***Transportation Management Organizations***

The ADUS User Groups (cont'd)

- **Safety Functions**
 - Safety Planning and Administration
 - Commercial Vehicle Operations
 - Emergency Management
- **Research Functions**
 - Transportation Research

3b. What Types of Data do Users Want?

- Based upon **7 data types** and **30 data sources** identified in the specifications for the National ITS Architecture
- Each of the 30 data sources has several **primary data elements**; over 110 listed
- Relationship to data type of the Traffic Management Data Dictionary (TMDD), which is part of the Standards process
- The draft TMDD has 4 sections, 16 partitions and about 450 data elements
- There is a need to harmonize with the TMDD, other Data Dictionaries, the ITS Data Registry, etc.

Seven Data Types from the National ITS Architecture

- **Freeway and Toll Collection Data**
- Arterial and Parking Management Data
- Transit and Ridesharing Data
- **Incident Management and Safety Data**
- Commercial Vehicle Operations Data
- Environment and **Weather Data**
- Vehicle and Passenger Data

(**bold** = CHART II as the main source)

Assessment of Types of Data User Groups Want

- The Initial Phase interview responses were mapped against each primary data element by specific interviewed user, within the defined user groups
- BMC survey interim results were also used
- Mapping resulted in an initial assessment of the types of data user groups want

Preliminary Results of the Interviews on Data Needs and Requirements

- Of the 30 data sources three seem to be of universal interest to all User Groups
- Three seem to be of widespread interest to more than half of the User Groups
- Remaining 24 data sources are of interest to less than half of the User Groups
- Interestingly, every data source appears to have at least a few User Groups interested in it

Data Sources of Most Interest

- **All User Groups are interested in:**
 - Freeway traffic flow surveillance data
 - TMC generated traffic flow metrics
 - Arterial traffic flow surveillance data
- **More than half of the user groups are interested in:**
 - Visual and video surveillance data
 - Transit usage
 - Incident logs

3c. How do Users want to Access Data?

- Integrated Workstations (not stand-alone)
- Maryland Enterprise Network
- Special Intranet and/or File Transfer Protocol procedures for registered users
- Service bureau processing of on-demand user requests for data and/or compiled information
- World Wide Web/Internet
- Distribution of CD-ROM or DVD summaries upon request
- Published report series

Desired Access by User Groups

- Operations and selected planning groups:
 - Integrated work stations (@25)
 - Maryland Enterprise Network (@ 10), and
 - Special Intranet and/or FTP (@ 50)
- @ 20% of data sources by all access methods
- @ 2/3 reached thru service bureau assistance
- @ half would be reachable using the Web
- Last four access methods require more expense, but serve more potential users

3d. Which Output/Display Formats Do Potential Users Want?

- Text
- Tables
- Graphs, charts, schematic diagrams
- Static maps:
 - Link and flow maps, route maps, contour maps
- Time-lapsed animations of graphs, charts, diagrams, or types of maps above
- Interactive graphics

Generalizations about Outputs

- Important to match needs of expected users
- **By Output/Display Techniques:**
 - #2 & #3 appear to be universally applicable
 - #4 could apply to 25 of the 30 data sources
 - #1 & #5 appear to apply to @ half of the sources
 - #6 appears least applicable; used 1 of 3 sources
- **By Data Sources:**
 - 5 of the 30 would likely use all six techniques
 - 7 would use 5 of 6 techniques
 - 9 would use 4; 8 use 3 ; 1 use 1
- Anticipate being flexible: different users may want different outputs at different times

4. Assessment of Alternative Architecture Approaches for Archiving and Access

- Factors distinguishing among alternatives
- Nine alternatives defined
- Assessment relative to the answers to the four previous questions:
 - Who are the potential users?
 - What types of data do they want?
 - How do they want to access the data?
 - What formats do they want to get it in?
- Strategy developed for structuring a system

Builds on Three New Market Packages

- **ITS Data Mart:** is a focused archive from one agency and/or data source,
- **ITS Data Warehouse:** provides for multiple data sources to be integrated at one location, and
- **ITS Virtual Data Warehouse:** allows combining of remotely located sources of multiple archives, such that a user can receive data and information from any combination of source components

Exhibit 2.1: Likely Applicability of Physical Market Packages for Integration of Archive Data and Information

Styles of Organizational Authority	Locus and Character of Institutional Resources		
	Local or Isolated/ Contribution	Regional or Cooperative/ Sharing	State or Centralized/ Support
Voluntary	1. Individual Data Marts	2. Cooperative Data Marts	3. MDOT, Regional, and Local Data Warehouses
Coordinated	4. Coordinated Data Marts	5. Regional Coordinated Data Warehouses	6. Centrally Coordinated Virtual Data Warehouse
Controlled	7. Locally Controlled Data Warehouses	8. Regionally Controlled Virtual Data Warehouses	9. State Controlled Virtual Data Warehouse

Factors Used in Assessing Alternative Architecture Approaches

- **Archived Data Potential Users Need and/or Want:**
 - (Q#1) Breadth of potential user group customer base – ranging from narrow to broad, and
 - (Q#2) Depth of data and information sources – ranging from limited to full.
- **Ease of Access & Support of Retrieval Services:**
 - (Q#4) Degree of access – ranging from hard to easy, and
 - (Q#5) Support for retrieval/formatting of output/display techniques – ranging from low to high.

Exhibit 2.3: Assessment of Alternative Architecture Approaches for Archiving Data and Information for CHART II

Alternative Architecture Approaches for Archiving Data for CHART II		Institutional and Organizational Arrangements		Archived Data and Information that Users Need and/or Want		Ease of Access and Support of Retrieval Services	
		Styles of Organizational Authority	Locus and Character of Institutional Resources	Breadth of User Group Customer Base	Depth of Data and Information Sources	Degree of Access	Support for Retrieval and Formatting
No.	Name			Narrow ↔ Broad	Limited ↔ Full	Hard ↔ Easy	Low ↔ High
1	Individual Data Marts	Voluntary	Local or Isolated/Contribution	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
2	Cooperative Data Marts		Regional or Cooperative/ Sharing	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
3	MDOT, Regional and Local Data Warehouses		State or Centralized/ Support	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
4	Coordinated Data Marts	Coordinated	Local or Isolated/Contribution	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
5	Regional Coordinated Data Warehouses		Regional or Cooperative/ Sharing	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
6	Centrally Coordinated Virtual Data Warehouse		State or Centralized/ Support	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
7	Locally Controlled Data Warehouses	Controlled	Local or Isolated/Contribution	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
8	Regionally Controlled Virtual Data Warehouses		Regional or Cooperative/ Sharing	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔
9	State Controlled Virtual Data Warehouse		State or Centralized/ Support	↔ X ↔	↔ X ↔	↔ X ↔	↔ X ↔

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Characteristics of the Two Alternatives

- **Common Aspects:**
 - Strong MDOT role
 - High degree of coordination needed
- **Distinguishing Aspects:**
 - #6 focused more on coordination between MPOs and the jurisdictions
 - #9 depends more on MPOs controlling the archive relative to the member jurisdictions

Recommended Strategy

- a) Get archived data (five main sources in MDOT)
- b) Management of the collection of roadside data
- c) Manage the CHART II archive
- d) Interface with the Archived Data Administrator
- e) Coordinate with other archives
- f) Process user requests for data
- g) Support analysis of the archived data, including training and user support in using the archive
- h) Prepare data for government reporting systems
- i) Process on-demand archive requests

5. Phased Implementation of ADUS

- To be implemented as part of the design builds and releases for CHART II
- Two archiving activities of CHART:
 - Rolling 14 day operational archive within the TMC
 - Historic Archive to be set-up on a separate server
- Essentially a data mart of data collected directly by CHART
- Functional Visioning Process: multi-modal and multi-organizational still underway
- Approach to manage ADUS is yet to be agreed on

6. Anticipated Applications

- Anticipated feedback on system use and performance – for operators and planners
 - **Planners:** less focused on long term trends/ more focused on system variability
 - **Operators:** think beyond non-recurring conditions
- Enable a combining of perspectives:
 - Many periodic and predictable patterns of variation in system demand and use; not just commuting
 - Extremes caused by sporadic and random reductions in short-term system supply

Categories of Congestion and System Disruption

Temporal and Spatial Patterns	Conditions that Primarily Affect	
	Demand	Supply
Periodic	<ul style="list-style-type: none"> • Weekday commutes • Weekend shopping • Holiday and recreational • Seasonal • School & college schedule 	<ul style="list-style-type: none"> • Reconstruction lane closures; station repairs • Reversible HOV/HOT lanes • Reversible arterial lane controls
Sporadic	<ul style="list-style-type: none"> • Planned special events • Reaction to unusual weather, good or bad • Evacuation conditions • Reactions to labor strikes or slowdowns 	<ul style="list-style-type: none"> • Local lane blockages • Systematic disruptions due to adverse weather (ice, fog, wind); utilities • Natural disasters: i.e., earthquakes, fires, floods, mud slides

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Planning

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7. Implications and Recommendations

- Using stakeholder participation process to establish Archived Data User Services
 - Start with needs and requirements of users
 - Participation – involvement of stakeholders
 - Need a large and diverse enough sample
- Work on refining the classification of congestion and system disruptions
 - **Planning:** periodic demand variations
 - **Operations:** sporadic supply disruptions
 - **ADUS** will help us see that it is not an either-or situation