5-1998

ORBIT: The Oregon Road Base Information Team, A Draft Summary Report

Mark Bosworth
Portland State University

Kenneth Dueker
Portland State University

Philip J. Wuest
Portland State University

ORBIT

The Oregon Road Base Information Team

A Draft Summary Report

Center for Urban Studies
Research Project Report
PR106

Mark Bosworth
Kenneth J. Dueker
Phil Wuest

5/07/98

Introduction and Outline

This progress report will touch on a wide variety of topics and activities; each of which relates to the overriding task of developing a common road database system for Oregon. The structure of the report will proceed as follows:

Figures:

Tables:

General Issues

It is clear that transportation organizations across the nation are integrating GIS into operations at many different levels—from day to day use for data display, to full-scale enterprise level integration for operations, inventory management, research and a variety of other purposes. The cost of building and maintaining a current and accurate GIS database can be substantial within any given organization. For some smaller level organizations—small counties, cities or special districts, the cost of gathering data, organizing it and implementing systems within expensive software on an expensive operating platform can be downright discouraging. Also, as more complex data structures are accumulated a window for more comprehensive modeling and analysis of regional issues is opened. Each of these trends alone provide ample incentive to develop data standards that can be applied to all systems to facilitate data sharing between organizations for system development, system update, or project specific purposes. Taken together these trends provide an imperative to develop data-sharing standards.

Data sharing among organizations has the potential to 1) decrease long-term costs of obtaining and maintaining data and 2) to facilitate data consistency and accuracy. Consistency includes both completeness and currency, while accuracy includes positional and relative accuracy of transportation features and their attributes, i.e. any data element related to roads or other transportation infrastructure.

At the national level the NSDI has sponsored work groups and research to develop common standards and definitions. Mark Bosworth of Metro recently attended one of these workshops in North Carolina and found that the problems being discussed at the national level are very similar to those that ORBIT has struggled with at the local, regional and state levels. Some of the questions being raised are

1) What constitute data standards?
    2) common item definitions?
    3) common data structure?
    4) common cartographic elements?
    5) shared fundamental datum?
6) What is the fundamental unit to which all other data is linked?
7) How will this unit be defined?, consistency issues?
8) Who will define it?
9) Is the discussion centered on developing a "data warehouse" approach, thereby requiring centralization and funding to keep up a project, or is it focused on developing common standards so that network elements and data can be shared more easily on an ad-hoc basis.
10) What is the political will to accomplish these goals?
    11) who are the stakeholders?

12) what benefits do they have to offer potential participants?
13) what coercive avenues exist to mandate the development of a standardized system?
14) what financial incentive avenues exist to encourage the adoption of a standardized system?

In addition to some of these fundamental questions of creating and maintaining consistent and accurate data among transportation organizations, it has become apparent that there are intra-organization data-sharing problems as well. Within a county for example, there may be several existing systems for maintaining road data: Engineering, safety, funding and accident data may all be stored using different systems and may each have unique methods to relate these data to roads. The question of intra-organizational data sharing will not be explicitly addressed here, although many of the concepts presented here are valid for either intra or inter-organizational data sharing.

Statewide Effort: What is an ORBIT?

ORBIT, The Oregon Road Base Information Team, is an ongoing effort to create "An accessible and comprehensive GIS transportation base for use by public and private agencies with shared stewardship through stakeholder partnerships and standards." The effort began with a statewide meeting sponsored by ODOT in January of 1995. The group defined a series of goals with the defining mission of building a comprehensive statewide road coverage. The statewide emphasis requires that roads of abutting jurisdictions edge math in location and by type. In addition, roadway data from various organizations within jurisdictions need to be related and shared. The ORBIT effort on roads coincides with the efforts of other groups to build comprehensive statewide databases and geographic coverages of other resources/management units such as streams and tax lots. Dean Anderson of Polk County, one of the early participants in the ORBIT effort has described the importance of developing data standards and a statewide digital road base with the following points:

- All roads intersect
- Road information tracking is Federal law (FHA, ISTEA, now nextTEA)
- Emergency management crosses road management units
- many joint projects
- high costs of development, creation and updating networks for ad-hoc purposes
- duplication creates errors and wastes time/money
- planning must be connected with inventory which must be connected to wide variety of other data, from accident information, to stream run-off, to zoning

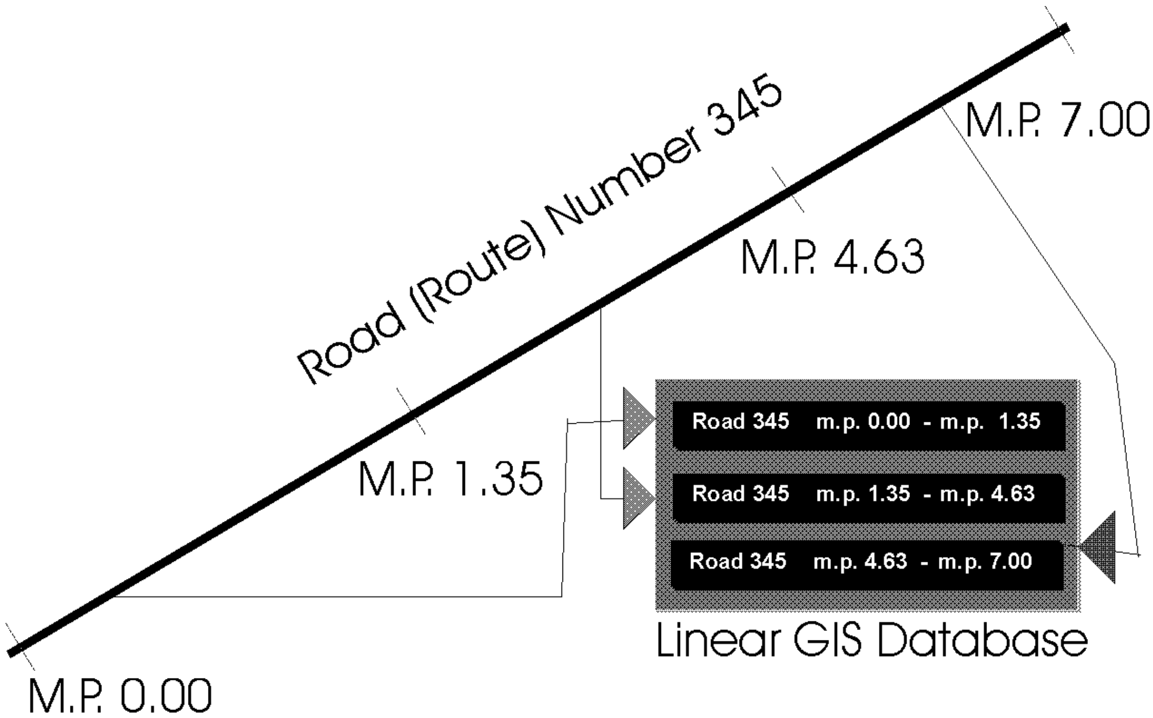
The larger ORBIT group originally split into four working sub-groups: stakeholders, data repository, implementation and data modeling. After two years, the group has reconvened as a single unit with one core group working to integrate these sub-topics, to define a process, and to develop a plan to implement an integrated solution. It comes as no surprise that policy issues, rather than the technicalities of building data-sharing standards and systems, are the most difficult to work around.

Review of Current Data Models and Practices

Some general distinctions:

The first and most fundamental distinction that exists among current systems is that between “feature-based” data systems and “link-based” systems. In the database world feature-based systems rely primarily on one-to-many relationships to maintain road attributes, while link-based systems are designed to carry all major attributes on a one-to-one relationship with specific road segments. Feature-based data storage systems rely on the power of the relational database model, while link-based systems have as a fundamental unit individual road segments more like the structure of a flat file— where each road segment carries a unique identifier and all of its characteristics. Feature based systems describe larger entities, entire roads for example, with a measurement system, and have separate tables that describe the attributes of that road at different locations along the measurement system-- These require a linear referencing system (LRS) and dynamic segmentation to function within a GIS. Figure One illustrates the concept of linear referencing.

Figure 1: Linear Reference System



Linear referencing and dynamic segmentation can be used in conjunction with link-based systems as well. Routes and associated LRS can be used to aggregate links to a larger transportation feature, defined by some common attribute along adjacent links; or it can be used to sub-divide links in order to prorate the location of events along links. This avoids the need to subdivide links into increasingly smaller links to maintain homogeneity with respect to attributes. So, the difference between feature or link-based systems is really more a conceptual device than it is a real limitation when it comes to data sharing. A feature-based system carries attributes that allow to be subdivided into links of appropriately homogeneous character for specific purposes, likewise the link-based system can be aggregated up to a given level of generality based on some common link attribute.

ODOT

ODOT's data storage system is ITIS, the Integrated Transportation Information System. It is feature-based. ODOT has unique identifiers for each of it's facilities; characteristics of these facilities are then stored in tables that refer to a given milepost location along any of the facilities. The system is maintained in a mainframe environment and is not readily accessible to end users. The results of an attribute query of the mainframe database must be passed to a GIS for display; a spatial query from the GIS must be passed back to the mainframe database. There is no direct link between the network attributes and a GIS-based network representation.

City of Portland

Individual street segments with a 50 foot threshold for maximum length make up the base of the city system. Each segment carries a wide variety of attributes, for example street name, segment length, street type, from_node, to_node, census tract, and address range. Many of the elements that make up the main segment table can be linked to other tables in the system, for example jurisdiction. The system is maintained in an Arc/Info environment, so that "routes" or transportation features can be constructed on-the-fly using common fields from various segments, for example street name. Portland is an example of enforcing a common data model and prescribing a specific set of links jurisdiction-wide. All departments within the city must adopt the data model and prescribed links, but other organizations such as Multnomah County or ODOT do not explicitly recognize the city's network structure of links and nodes.

IRIS and the AOC

The Association of Oregon Counties has developed road database management software and made it available for implementation to all Oregon Counties. IRIS (Integrated Road Information System) is a feature-based system, that relies on county road-id numbers to act as the base unit in the database. Each county may have a different logic for assigning road id's; the important point is that each "feature" or county road management unit carry with it some sort of id number and an associated milepost system. IRIS has been developed to serve many functions and is initially composed of four modules that relate to the fundamental road inventory file mentioned above; they are Cost Accounting, Maintenance Management, Pavement Management and GIS. The goals of IRIS are very similar to the goals of the ORBITS effort: standardize technical definitions and standards, provide for a consistent data format across jurisdictions, develop fast and efficient data acquisition methods, and to ease the process of mandated reporting.

Polk County and IRIS: A GIS Implementation of IRIS

Polk County has taken the IRIS structure and is in the process of fully implementing the IRIS data system with GIS. Link-based road geometry is maintained in Arc/Info, and identifiers for unique transportation features (road-id) are carried at the link level. Route systems can be built in the GIS using road-id number, from milepoint and to milepoint. Attributes from the IRIS database can then be easily integrated on the GIS network based on mile point locations provided in the IRIS database and the LRS associated with a route in the Arc/Info database. In addition, Polk County is using a GPS to improve the locational accuracy of the Arc/Info nodes and shape points. This implementation provides maximum flexibility for data sharing.

Lane County and the Single Center Line Road Base

Lane County, the Cities of Eugene and Springfield and LCOG have all agreed to work together to develop a common road-base file. This approach to data sharing extends the common data model, common link structure and common geometry to several separate governmental units within the same county. Agreement on a common data structure eliminates data sharing problems among systems. Developing the initial base required consensus on one base network representation and one cartographic representation of the transportation system of Lane County using one GIS software. While this is an ideal solution on a relatively small scale, it may be impractical on a larger, statewide, scale.

TIGER-based

Metro's enhanced TIGER and ETAK files have a TIGER-like character in that they are topologically structured network link-based systems. Similarly, vendor products that come with GIS software are TIGER derivatives. These files are difficult to update on a transactional basis, instead new additions supercede old ones.

CADD Files

CADD files, such as ODOTs urbanized areas maps are one cartographic file, while street name or other displayable attributes are maintained in separate layers. The cartographic strings for streets cannot know their own name.

The Dueker-Butler Model

Dueker and Butler introduce an enterprise-level data model for transportation systems. This model attempts to relax the single base network constraint with uniquely identified transportation features (Dueker/Butler 1997). They distill the problem of data sharing down to a fundamental level, pointing out that in any relational data model the problem of unique identification of roadways must be faced. They describe a Transportation Feature (TF) as a global entity or a large "chunk of road." This system minimizes the number of features requiring unique identification. Attributes are related to TFs by linear referencing. TFs may have multiple cartographic representations and TFs can be select for inclusion in different networks for the purpose of building routes. However, Transportation Features require that a system of unique identification of roadways across all organizations be implemented. They concede that this is no easy task; it is recognized that road databases are maintained at many different jurisdictional levels and for many different purposes within any given jurisdiction. But, they do propose a solution to the feature-naming problem. A paper describing how feature-naming conventions can be implemented is provided with the logical framework upon which a comprehensive database can be built (Butler/Dueker 1997,1998).

Table 1 attempts to summarize some of the relevant characteristics of existing road base systems in Oregon.

Table 1: Characteristics of Legacy Street/Road Centerline Files

File/ Characteristic	TIGER	Metro's Enhanced TIGER	ODOT Urbanized Area Maps	IRIS Road Inventory	ODOT Straight Line Charts	ETAK
Record Structure (unit of observation)	network link (link)	network chain (link)	coordinate strings (???)	Route # (feature)	State Road # (feature)	Network link (link)
Intersections of streets of boundaries	nodes nodes	nodes nodes	where strings intersect	Route #, MP	Road #, MP	Nodes Nodes
Street Name	repeated for each link	repeated for each link	separate annotation layer	alias of route	alias of route	Repeated for each link
Address Range	yes, for residential links only	yes, for all chains	no	no	No (state roads only, no local streets)	yes
Cartography	separate shape records, 1:100K DLG and DIME in urban areas	Improved spatial accuracy using GPS and local data	1:24K USGS quads	none, distance measure	none, distance measure	1:24K USGS
Unique External ID	TIGER link #	TIGER link #, plus A/I internal ID	none	Route #	State Road #	ETAK Link#
Date	1970 DIME, various USGS dated DLG	1990+	USGS quad dated with local correction	varied	varied	varied

Discussion of the various models

Each of the above systems provide an important input to the development of a unified statewide approach to transportation data. Perhaps the most important lesson to take away from the above examples is that any statewide standard will, by definition, have to relate to each of the systems described above. A second point is that this is a relatively select group. These examples are drawn from jurisdictions or systems that have endeavored to build a comprehensive GIS transportation database, so each is relatively sophisticated. Because this is the case it points to another important element of the ORBIT mission: to present a data standard, ex ante, that most jurisdictions in the state can build to, rather than presenting a standard after each jurisdictions has engineered its own solution.

Three elements stand out from the above examples as being particularly important to any statewide solution. 1) Dueker and Butler state that each feature must be uniquely identified. Their solution is the common adoption of detailed naming conventions for all features; this is an attractive, though difficult to implement solution. 2) The AOC has skirted the issue by designing a system that allows whoever adopts it to use their own naming system, so long as a reference measurement system co-exists with it. 3) The Lane county example is also very valuable, pointing out the advantages of a shared or common centerline file—they have been able to enforce data compatibility with a collaborative approach.

Polk County provides an example of a lead agent approach. The county GIS unit has taken the initiative to integrate transportation data for all jurisdictions operating in Polk County. The have adopted a linear referencing system for data storage and manipulation and also the construction of a detailed link-based network. Their approach in incorporating IRIS can be widely applied by other ArcInfo and IRIS using counties. This is not as comprehensive as the Dueker/Butler model, bus is a workable system to relate IRIS feature-based attribute data for an ArcInfo link-based GIS. Also, Polk County has been working to build an accurate and comprehensive, base centerline geometry of shape points that may serve many purposes. As they use GPS to improve the positional accuracy of the network their ability to share data by encouraging other participants to use Polk County geometry, and thereby Polk County's link structure, improves.

At one level the problem is to combine roadway data from counties, a horizontal integration. There are problems of: edge matching after placing in a common projection, establishing a common functional classification of roads so that what is called an arterial road is common across all counties, and establishing a common data to enforce a temporal consistency. The second problem identified in Table 2 is to combine roadway data within counties, collected by cities, county, state and federal agencies. This is more difficult. Missing and repeated records must be resolved. Often a lead agency attempts to enforce a common set of links and geometry as in LCOG or Polk County. But a more equal partner-based system will require a federated approach based on Transportation Feature Ids.

Table 2 below presents a hierarchy of data-sharing issues along with approaches and issues that may be raised at each level. Section 1 deals with horizontal data sharing: sharing of data to provide a state-wide coverage, when the concern is a common projection and common definitions of what roads are to be included and how they should be classified. Section 2 deals with the sharing of data vertically, wherein duplications, gaps and spatial accuracy are issues to be resolved. Section 3 deals with maintenance and update, the need for unique identifiers if transactional updating is employed, or the release of new editions without having to re-identify constituent roads.

Table 2: Hierarchy of Data-sharing: Approaches and Issues

Purpose	Approach	Issues
1) Statewide coverage of roads		
Sharing data among non-overlapping areas	Compile from local jurisdictions and state & federal agencies with common projection and common field definitions Build a large regional coverage from adjacent jurisdictions. Built on common datum.	Edge match Problem at jurisdictional boundaries Consistent road classification across jurisdictions Multiple agencies within a jurisdiction with duplicate/missing data Varying update cycles/currency Partial statewide coverage by state & federal agencies
2) Systematic Data sharing within same geographic area		
Importing cartography (from a system with incompatible records/road segmentation)	Assemble sending segments (arcs) into strings using road name/number Cut strings at nodes of "near" receiving segments (arcs) and add shape points from sending strings to receiving segments	Matching strings with correct segments
Import attributes (from a file having incompatible records/segmentation)	Establish APs in both files Match road name and MPs in one file to AS of other	Extensive manual work
Integrated Cartography	Agreement on base network (same arcs), or common cartography for common routes	Requires lead agency and willing participants
Federated System	A TF ID and AP & ASs data model	Requires agreeing on a common ID method
3) Update/Maintenance		
Add/delete roads	Add/delete TFs and associated strings	Common IDs
Add/delete attributes	Reference by Route and MP, or x,y	Common Linear LRS by participants
Issue new edition		Individual changes are not identifiable

The ORBITs Solution Framework

It is possible to view the ORBIT effort more as a process model than a single solution. In some counties a lead agency approach may be the most workable approach, while in others a federated system may be more effective. The Portland metropolitan area may be of the latter type.

An incremental approach to data sharing might consist of the following steps or stages:

Horizontal Data Integration

- Edge matching of links and/or features
- Define roads by a common functional and jurisdictional classification system.

Vertical Data Integration

- Work to reduce differences where overlapping jurisdictions, each with data on only their roads, can relate to roads from another system:
    - Different beginning and ending points
    - Different measurement systems
    - Intersection matching problems

Resolve differences among overlapping jurisdictions that maintain separate data on same roads. This is normally addressed by network conflation which resolves geometric differences and link differences. The alternative is to allow the continuation of disparate roadway geometry, and to adopt a relational database-centric approach. This requires the adoption of unique transportation feature IDs to integrate separate geometric representations and separate sets of links.

The framework for achieving sharable data on a statewide basis is being built using the following process:

Step One: Complete pilot studies that focus on defining essential base road-data; strictly define these elements both in terms of a common reference language (so that all jurisdictions can apply the same functional class and jurisdictional definitions for example) and in terms of database field definitions, i.e. text or numeric and number of characters. These elements alone will allow data from different jurisdictions to at least appear similar. Finally, adopt a statewide exchange standard. Agree on metadata, i.e. common data items and field definitions. This will largely solve the horizontal data integration problem.

Step Two: With the initial pilot studies in hand, develop guidelines to address vertical data integration. Develop memorandums of understanding (MOU) for participating jurisdictions. These will include: 1) which approach, lead agency or federated system, will be implemented, 2) a description of the commitment of the participants to adopt geometry and links, or Transportation Feature IDs., 3) the interval to update their contribution, and 4) for the lead agency approach, a jurisdiction's description of the commitment to resolve inter-jurisdictional cartographic inconsistencies—that is where two jurisdictions submit line work on the same road segment, there will be a process for resolving those differences so that both use the same cartographic representation (within some defined parameters) of the network; for the federated approach, a description of the commitment to assign permanent Transportation Feature IDs.

Step Three: Define implementation. This step will have to include the assignment of the project to a statewide agency (ODOT or the State Service Center for GIS) or a series of regional agencies (MPOs?). In either case, the responsibility to collect data and networks from all participating jurisdictions on a regular basis and to facilitate the process of network resolution between jurisdictions has to be well defined. This stage will also have to include the adoption of an operating platform and the design and implementation of a data sharing system, preferably something web-based.

Step Four: Ongoing implementation. Once data sharing standards have been widely adopted, expand on the process for those jurisdictions that are prepared to follow guidelines developed in Step Two to enhance seamless data sharing across jurisdictions.

Step One: Exchange Standards

The following is the current structure of the data exchange standard. It is a minimum standard in the sense that these are the fewest number and type of fields that make the structure flexible enough to meet all purposes-- in terms of having enough common elements to link with a variety of data models. It is a maximum standard in the sense that no additional information is required at the section level, any additional attribute information must come in data tables that relate in some logical way to the fields in the exchange standard.

File Header Information (Metadata):

Origination date-- Date the file is turned over
Validation date-- Date the data is current
SOURCE - jurisdictional level at which the data originates (F, S, C, M, O, U)
SOURCEAG - agency that provides the data set (—see accompanying acronyms)
Global-- "Global" characteristics—anything contained in the header is assumed to describe every record contained in the file

Data:

COUNTY- County FIPS code for feature location (3 characters)*
PREFIX - directional prefix (i.e NE)
NAME - road name used
TYPE - road type (i.e. RD, ST, CT, LN)
SUFFIX - directional suffix (i.e. NE)
ROADNUM - road number (feature reference number—up to 12 characters)
FROM_MP - from milepost # (six characters including 3 decimal places)
TO_MP - to milepost # (six characters including 3 decimal places)
RT_FROM_ADD - right from address
LF_FROM_ADD - left from address
RT_TO_ADD - right to address
LF_TO_ADD - left to address
OWNED - jurisdictional level of owner of facility (F, S, C, M, O, U)
OWNER - jurisdictional classification of owner (see accompanying acronyms)
MANAGED - jurisdictional level of manager of facility (F, S, C, M, O, U)
MANAGER - jurisdictional classification of manager (see accompanying acronyms)
FUNCCLS - functional classification (description follows)
FUNCTYP - functional class type (description follows)
LOCALID - optional link identifier for contributing jurisdiction

*May be global if all data in file are within the same county
Note: See Appendix A for a more detailed description of functional class and jurisdictional definitions.

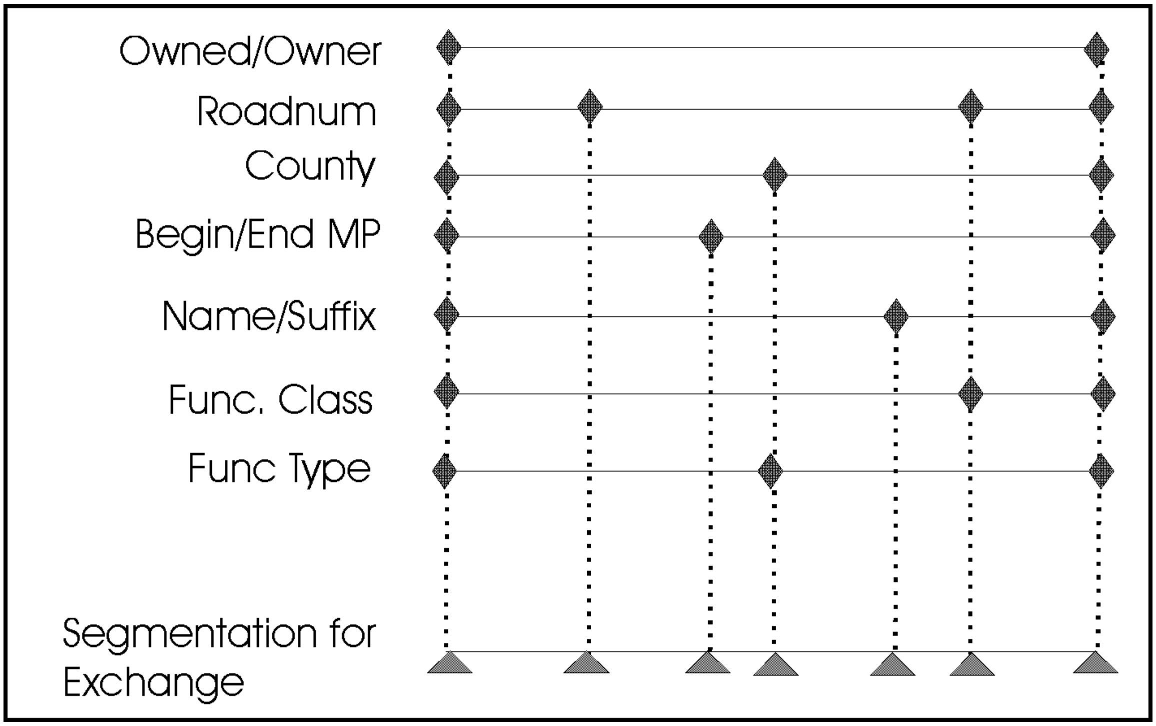
Exchange standards and data models

It important to be explicit on this point: the exchange standard is not a data model, rather the exchange standard is to be a key that facilitates the combining of data from a variety of distinct data models.

How is the exchange implemented?

At this point, we envision building the exchange based on the preceding feature definitions. That is, for each attribute listed in the exchange standard any contributing jurisdiction would segment their data according to the populated fields. Figure Two gives a graphical example of this implementation.

Figure 2: Segmentation of Exchange Network



Where any of the characteristics of road features change in value the road feature should be segmented, so that every segment is homogeneous for all of the populated fields of the exchange standard.

Steps 2 through 4: The Vision and the Implementation

Not all of the attributes listed in the standard are necessary for every contributing jurisdiction. Applying common field definitions is helpful to the degree that having similar looking data is helpful. As we work to “horizontally” integrate data, that is stitch together existing networks at the edges, data will appear the same on either side of the join (it may not mean the same thing, but that is another hurdle.) This is the starting point to tackle the more complicated process of vertical integration and seamless data sharing.

Vertical data sharing, which includes the vertical integration of data between two distinct networks, or databases, that identify the same feature, can only be accomplished in three ways: 1) Everyone uses the same network, or database, 2) all networks are defined to a degree of spatial accuracy that allows for direct conversion of data from one to the other or 3) unique feature identifiers are defined for every "transportation feature" in the state, and a set of anchor points that define the beginning and ending points of all major facilities…county roads, state roads etc. are defined.

The approach the ORBITs workgroup is pursuing leaves the door open to each of these approaches. Given the institutional constraints involved in cross-organizational agreement, the incremental approach seems to be the only realistic way of proceeding

Short Term Goals

The short-term vision is to implement the data exchange standard by having all participating jurisdictions contribute data in the common format and line work in a common projection. As each jurisdiction turns in their line work and data, a database of networks will be constructed with some of the problems described above; problems with field definitions and cartographic issues that impede horizontal and vertical network/data integration will be documented and resolved.

Definitional issues can be clarified through the process of updates and issuance of standards over a period of years.

Horizontal integration will be the first short-term goal; this will be an edge-matching exercise. It would be ideal to keep the edge-matching and vertical integration issues separate, but practical problems will prevent this. Edge-matching issues will arise: who's line work will be used for the edge-matching? For areas, like metropolitan Portland, many agencies may be turning line work and data sets for the same facilities—how can this be resolved? This is where the memorandums of understanding come in. The group would like to see a process defined for resolving network differences, and having all participating jurisdiction eventually using the same line-work. This is not to say that the "working" layer a jurisdiction maintains is on a live link to the ORBITS statewide road coverage, but only that the regular updates roughly correspond to existing line work for the statewide system. The process for network resolution would have to be well defined and gets into some very sticky and difficult problems.

For example, in Portland, Metro, the City of Portland, and ODOT may each contribute some line work and corresponding data in the exchange standard. In some cases the line work will match up, while in others it will not. These difficult issues than can only be handled incrementally.

Long Term Goals

The vision, or long tem goal, includes the creation and maintenance of a comprehensive statewide road cartographic coverage with links to associated data tables. Ideally this would be a web-based application, so that a user could go "virtually" to any location in the state, click on a road segment to get the base information that comes in the exchange standard. In addition, the user could clip a section of the area of interest and link additional information to the roads using the provided measurement system and associated data tables.

Appendix A

FUNCTIONAL CLASSIFICATION CODES

Functional Class:	1	Interstate
	2	Other Freeway/Expressway
	4	Principle Arterial
	6	Minor Arterial
	7	Major Collector
	8	Minor Collector(“seasonal” with “2” from functional class type)
	9	Local
Functional Class Type:	0	Rural
	1	Urban
	2	Resource

JURISDICTIONAL CODES

OWNED/OWNER:
X.YYY: where X is F (federal), S (state), C (county), M (municipal), O (other), or U (unknown) and YYY is a three character acronym representing a specific agency or jurisdiction.

MANAGED/MANAGER:
X.YYY: where X is F (federal), S (state), C (county), M (municipal), O (other), or U (unknown) and YYY is a three character acronym representing a specific agency or jurisdiction.

SOURCE/SOURCEAG:
X.YYY: where X is F (federal), S (state), C (county), M (municipal), O (other), or U (unknown) and YYY is a three character acronym representing a specific agency or jurisdiction.

Approved Jurisdictional Acronyms (proposed):

Acronym /Description:		Remarks:
FS	Forest Service	USDA Forest Service
BIA	Bureau of Indian Affairs	USDI Bureau of Indian Affairs
BLM	Bureau of Land Management	USDI Bureau of Land Management
BR	Bureau of Reclamation	USDI Bureau of Reclamation
DD	Defense Department	US Defense Department
DE	Department of Energy	US Department of Energy
FAA	Federal Aviation Administration	USDOT Federal Aviation Administration
FWS	Fish and Wildlife Service	USDI Fish and Wildlife Service
NPS	National Park Service	USDI National Park Service
OF	Other Federal Agency	Other Federal Agencies
RW	Public right-of-way	Public right-of-way, not “owned” by a particular agency
DOT	State Transportation Dept.	State DOT
SF	State Forest Road	State Forest Agency Road
SP	State Park Road	State Park Agency Road
LSD	Local Special District	Ports, Water Districts, etc…
PW	Public Works	for local publics works departments, at county or municipal level
PLN	Planning	for local planning departments, at county of municipal level
911	Emergency	defines emergency-owned facilities

CO	Cooperator	Cooperator (industrial cost share)
PP	Private, Public Access	Private roads that are open for public use
PC	Private, Closed	Private roads that are closed to public use