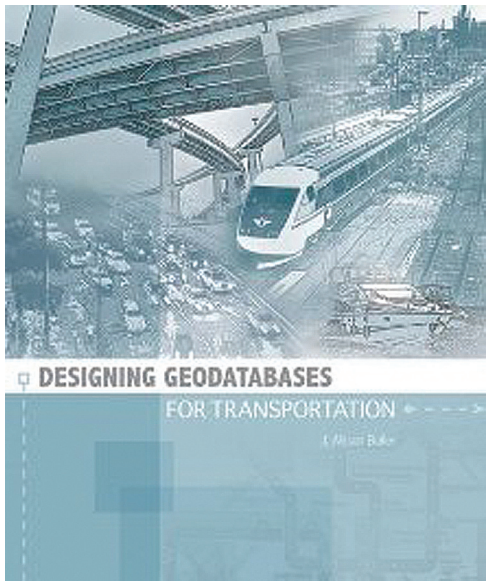
Book Review

Designing geodatabases for transportation, by J. Allison Butler. © 2008 ESRI Press, Redland, California. ISBN 978-1-58948-164-0. 461p. — **Reviewed by Landon Blake**

Designing Geodatabases for Transportation is a guide to creating geodatabases for transportation networks. It describes many aspects of real-world transportation networks and explains how these can be modeled in a database with spatial capabilities.

Designing Geodatabases is an excellent resource for GIS professionals who need to build and maintain their own spatial data sets representing transportation networks. It is also a valuable reference for land surveyors, cartographers, land-use planners, civil engineers, and other professionals who need to understand how transportation systems work or who deal with spatial data sets representing transportation features. In addition, programmers, database managers, or GIS professionals who need to build geodatabases of any kind can benefit from the book's coverage of such topics as database normalization, versioning, alternative methods of modeling real world features, and behavior.



The book has been written primarily with users of ESRI software in mind as the target audience. I am not an ESRI software user, yet, I found the book of great benefit to me as well. Much of the principles contained in the book could be applied to other vendors of GIS or database software, or to work done with open source programs.

Designing Geodatabases is well written. Technical terms are well defined and unfamiliar aspects of transportation networks are explained. The book is also well organized. Subject matter is logically separated into 19 chapters, and the chapters follow a logical order. A description of each chapter's contents is typically included in the first couple of pages of each chapter. The book has broad and deep coverage of topics. It is filled with attractive color diagrams and figures which clearly convey information in graphical form. The book is applicable to geodatabase designing in general, and to transportation systems in particular.

CONTENT

Chapter 1: Introduction. In this chapter, a basic definition of transportation is provided. Two common transportation problems which can be solved using data stored in a transportation geodatabase are identified. The author describes transportation systems and admits that their diversity requires something more than a one-size-fits-all geodatabase solution. A GIS data model is described, and a short explanation of how we represent the features of a transportation system in a geodatabase is provided. This introductory chapter also introduces agile development and concludes with a note on how the book is organized.

Chapter 2: Data Modeling. This begins with a discussion of how to design geodatabase objects which represent real world objects. It follows with basic instructions on geodatabase design. A six-step process is described for data modeling in a GIS, with the first three steps being examined in detail.

Chapter 3: Geodatabases. This chapter starts with a list of benefits that a geodatabase offers when compared to a purely relational database. It then defines a geodatabase and looks at the components and structure of a geodatabase, including attribute domains, valid value tables, subtypes, and relationship classes. It concludes with an excellent discussion of normalization in a database with examples from the modeling of transportation systems.

Chapter 4: Best Practices in Transportation Design. The focus of this chapter is representing transportation system features at various scales. This includes dealing with the difference between logical centerlines and carriageways, variable width roads, and multipoint intersections. Various methods for breaking road features into individual segments are discussed, as is the use of TIGER data for transportation layers, how to handle multiple street names in a geodatabase, emergency dispatch, and pavement management applications. The information in this chapter will benefit users who need to maintain geospatial datasets representing elements of a transportation system (such as a road network).

Chapter 5: Geometric Networks. **This chapter describes a** spatial network as a series of edges and junctions and explains the difference between simple and complex edges. It offers options to handling bridges and tunnels in a network. It follows with 8 pages of discussion of traffic demand modeling and a 6 page discussion of path finding.

Chapter 6: Data Editing. This includes geodatabase versioning, check-in/check-out procedures, and continuous editing. (Permanently saving database edit history.) Other aspects discussed in this chapter are supporting temporal characteristics of transportation features and preserving data dictionary history. Finally, reasons for separating the editing and publishing databases are given.

Chapter 7: Linear Referencing Methods. There are two problems associated with creating and maintaining large transportation geodatabases. The first is defining the extent of linear transportation features. The second problem is that transportation facilities and their attributes change over time. Linear referencing systems and linear events are discussed, as well as dynamic segmentation. The chapter also examines creating routes from individual road segments, creating traversal (routes composed of other routes), and determining the difference between static and dynamic traversals.

Chapter 8: Advanced Dynamic Segmentation Functions. These include using offset events to represent features that are not directly on a road alignment. Using dynamic segmentation operations, the pattern, width, and color of displayed transportation features can be changed. The chapter includes tips on how to join linear event tables, import external event tables into the geodatabase, and use "elements" to represent the different physical parts of a transportation facility [ditch, guard rail, median, etc…]. Other topics focus on method to avoid storing duplicate information for route intersections and the use of traversals for path finding.

Chapter 9: Traffic Monitoring Systems. The chapter defines the term "traffic pattern" and explains some common traffic statistics. It discusses three common types of traffic counters or monitors and describes a traffic monitoring system. A discussion of how to represent traffic monitoring system events in a geodatabase follows. In addition, three other major geodatabase-related issues are discussed: handling seasonal variations in traffic monitoring data, representing traffic monitoring site maintenance, and storing traffic count data.

Chapter 10 through Chapter 17. These chapters provide an in-depth review of six different transportation data modeling, including the classic transportation data model, the original UNETRANS data model, a revised UNETRANS data model, a State DOT Highway Inventory data model (for editing), a State Highway DOT Inventory data model (for publishing), and a multi-purpose transit geodatabase.

Chapter 18: Navigable Waterways. In this chapter, a geodatabase design is introduced which is suitable for use by local and state governments when conducting waterway inventories focused on recreational uses. Particular attention is given to abstracting waterways into separate elements, such as flow line (or thalweg) banks and floodplain boundaries. The author draws attention to river reach data included in the national hydrography data set and explains how these can be used in the geodatabase design. Finally, linear referencing on waterways, waterway events, and river mile and channel markers are discussed, as is using channel cross-sections and thalweg profiles in describing channel geometry.

Chapter 19: Railroads. Chapter 19 begins with a description of the physical qualities of railroad tracks and the three (3) main types of track segments. It follows with a discussion of track intersection and track switches. It provides a simple scheme for creating geometry to represent track segments. It documents how railroad companies and ownership of railroad infrastructure can be stored in the geodatabase. The operation of railroad classification yards is then presented. The chapter concludes with an overview of typical track side structures that may be represented in a geodatabase and the attributes and markings of railroad and road intersections (grade crossings).

CONCLUSION

Designing Geodatabases for Transportation is an excellent guide to the challenges and nuances of representing transportation systems in a GIS. The text offers excellent advice on general geodatabase design topics. *Designing Geodatabases* should be on the bookshelf of anybody involved in representing and model transportation systems in a GIS. I hope the author will take the opportunity to expand the book's coverage of transportation on river and lakes systems and large freight railroad systems. I would also like to see added coverage of light rail, busses, and other forms of public transportation. A move to make the book more "software vendor neutral" would be an improvement. *Designing Geodatabases for Transportation* is a comprehensive guide to the application of GIS to the transportation domain. Many professionals would benefit if there were similar guides for the other common GIS application domains.