
CHAPTER 16

ECONOMICS OF RAILWAY ENGINEERING AND OPERATIONS¹

TABLE OF CONTENTS

Part/Section	Description	Page
1	Railway Location.....	16-1-1
1.1	Importance of Railway Location.....	16-1-2
1.2	Location Selection.....	16-1-4
1.3	Economic Considerations.....	16-1-9
1.4	Design Considerations.....	16-1-12
2	Train Performance.....	16-2-1
2.1	Resistance to Movement.....	16-2-2
2.2	Train Performance Calculations.....	16-2-10
2.3	Energy Consumption.....	16-2-21
3	Power.....	16-3-1
3.1	Introduction.....	16-3-2
3.2	Locomotive Characteristics.....	16-3-4
3.3	Electric Locomotives.....	16-3-16
3.4	Diesel-Electric Locomotives.....	16-3-22
3.5	Other Types of Motive Power.....	16-3-28
3.6	Passenger Motive Power Considerations.....	16-3-28
4	Railway Operation.....	16-4-1
4.1	Introduction.....	16-4-2
4.2	Trains.....	16-4-3
4.3	Train Management.....	16-4-10
4.4	Engineering Effects on Operation.....	16-4-19
4.5	Capacity.....	16-4-22

¹ The material in this and other chapters in the AREMA *Manual for Railway Engineering* is published as recommended practice to railroads and others concerned with the engineering, design and construction of railroad fixed properties (except signals and communications), and allied services and facilities. For the purpose of this Manual, RECOMMENDED PRACTICE is defined as a material, device, design, plan, specification, principle or practice recommended to the railways for use as required, either exactly as presented or with such modifications as may be necessary or desirable to meet the needs of individual railways, but in either event, with a view to promoting efficiency and economy in the location, construction, operation or maintenance of railways. It is not intended to imply that other practices may not be equally acceptable.

TABLE OF CONTENTS (CONT)

Part/Section	Description	Page
4.6	Network Operating Issues	16-4-34
4.7	Yards and Terminals.	16-4-40
5	Economics and Location of Defect Detector Systems	16-5-1
5.1	Introduction.	16-5-2
5.2	Types of Defect Detector Systems	16-5-2
5.3	Location of Defect Detectors	16-5-5
5.4	Design Considerations for Defect Detectors	16-5-8
5.5	Alert Train Crews or Dispatchers	16-5-9
5.6	Integration of Defect Detector Systems.	16-5-11
5.7	Economics of Detectors.	16-5-11
5.8	Summary	16-5-14
5.9	References in 2002 AREMA Communications & Signals Manual of Recommended Practice, Volume 2, Part 5 Defect Detection Systems	16-5-14
6	Railway Applications of Industrial & Systems Engineering	16-6-1
6.1	Overview	16-6-2
6.2	Organization Issues	16-6-2
6.3	Project Design and Management	16-6-3
6.4	Strategies and Techniques	16-6-4
6.5	Summary of Railway Applications	16-6-17
7	Public Improvements and Public Private Partnerships – Their Costs and Benefits . .	16-7-1
7.1	Introduction.	16-7-2
7.2	Public Improvement Project Development	16-7-2
7.3	Public-Private Partnerships.	16-7-3
7.4	Preliminary Engineering for Public Improvements	16-7-7
7.5	Force Account Project Estimates	16-7-8
7.6	Plans, Specifications and Special Provisions.	16-7-8
7.7	Public Improvement Agreements	16-7-9
7.8	Costs and Benefits.	16-7-9
7.9	Cost and Benefit Analysis.	16-7-10
7.10	Project Completion and Billing	16-7-11
7.11	Government Relationship Considerations.	16-7-11
8	Organization.	16-8-1
8.1	Introduction.	16-8-2
8.2	Functions.	16-8-2
8.3	Methods	16-8-5
8.4	Organization	16-8-6
8.5	Training.	16-8-9
9	Program Work	16-9-1
9.1	Introduction.	16-9-4
9.2	Terms and Definitions	16-9-4
9.3	Program Work Organization	16-9-5
9.4	Program Work Activities and Methods	16-9-7
9.5	Work Identification	16-9-9
9.6	Activity Background	16-9-10

TABLE OF CONTENTS (CONT)

Part/Section	Description	Page
9.7	Work Priority	16-9-12
9.8	Estimating	16-9-12
9.9	Economic Analysis	16-9-15
9.10	Budgeting	16-9-16
9.11	Scheduling	16-9-17
9.12	Spending Plan	16-9-19
9.13	Material Supply	16-9-19
9.14	Program Related Activities	16-9-19
9.15	Program Work Progress Reporting	16-9-21
9.16	Quality Measurement	16-9-22
9.17	Management	16-9-23
9.18	Completion Reporting	16-9-24
9.19	Summary	16-9-24
10	Construction and Maintenance Operations	16-10-1
10.1	Rail	16-10-3
10.2	Rail Support	16-10-8
10.3	Ballast	16-10-11
10.4	Other Track Material	16-10-14
10.5	Track	16-10-18
10.6	Roadway	16-10-19
10.7	Bridges	16-10-20
10.8	Buildings	16-10-21
10.9	Tunnels	16-10-21
10.10	Handling of Traffic	16-10-25
10.11	Appendix	16-10-26
11	Equated Mileage Parameters	16-11-1
11.1	Introduction	16-11-2
11.2	Tables	16-11-4
11.3	Examples	16-11-6
12	Accounting	16-12-1
12.1	Introduction	16-12-3
12.2	Explanation of Contents of Primary Account Listings	16-12-4
12.3	Definition of Unit of Property	16-12-5
12.4	Primary Accounts	16-12-5
12.5	Capital Expenditure or Operating Expense	16-12-23
12.6	Authority for Expenditures	16-12-23
12.7	Depreciation Accounting	16-12-24
12.8	Joint Facilities	16-12-25
12.9	Roadway Completion Reports	16-12-25
12.10	Property Asset Ledgers	16-12-25
12.11	National Transportation Agency of Canada System of Accounts	16-12-26
14	Taxes	16-14-1
14.1	Introduction	16-14-2
14.2	Federal Income Tax	16-14-2

TABLE OF CONTENTS (CONT)

Part/Section	Description	Page
14.3	State Income Tax	16-14-7
14.4	State Franchise Taxes	16-14-7
14.5	Investment Tax Credit (ITC)	16-14-7
14.6	Property Tax (Ad Valorem)	16-14-8
14.7	Sales and Use Tax	16-14-9
15	Planning, Budgeting and Control	16-15-1
15.1	Introduction	16-15-2
15.2	Strategic Planning	16-15-3
15.3	Long-Term Planning	16-15-6
15.4	Annual Budget	16-15-8
15.5	Authorization Process	16-15-16
15.6	Control Functions	16-15-18
15.7	Permanent Data Base	16-15-20
References.	16-R-1

INTRODUCTION

The Chapters of the AREMA Manual are divided into numbered Parts, each comprised of related documents (specifications, recommended practices, plans, etc.). Individual Parts are divided into Sections by centered headings set in capital letters and identified by a Section number. These Sections are subdivided into Articles designated by numbered side headings.

Parts 12 through 15 of this Chapter formerly constituted Parts 1 through 4 of Chapter 11, which has been eliminated from the AREMA Manual.

Page Numbers – In the page numbering of the Manual (16-2-1, for example) the first numeral designates the Chapter number, the second denotes the Part number in the Chapter, and the third numeral designates the page number in the Part. Thus, 16-2-1 means Chapter 16, Part 2, page 1.

In the Glossary and References, the Part number is replaced by either a “G” for Glossary or “R” for References.

Document Dates – The bold type date (Document Date) at the beginning of each document (Part) applies to the document as a whole and designates the year in which revisions were last made somewhere in the document, unless an attached footnote indicates that the document was adopted, reapproved, or rewritten in that year.

Article Dates – Each Article shows the date (in parenthesis) of the last time that Article was modified.

Revision Marks – All current year revisions (changes and additions) which have been incorporated into the document are identified by a vertical line along the outside margin of the page, directly beside the modified information.

Proceedings Footnote – The Proceedings footnote on the first page of each document gives references to all Association action with respect to the document.

■ **Annual Updates** – New manuals, as well as revision sets, will be printed and issued yearly.