Practical Manual of Land Development

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Barbara C. Colley, P.E.

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To the young engineers who have been educated in the principles of engineering but not the day-to-day work of producing land development projects.

To the working engineers who need a quick reference or checklist to expedite their work.

To architects and developers who would like to understand why development engineers do the things they do.

Contents

Preface

The objective of my book has always been to provide engineers and others working in land development with a quick, easy reference for day-to-day design problems and to introduce engineering students to the applications of their education. Some factors important to engineers and others in land development have changed significantly since the last publication. The importance of keeping the book relevant has prompted me to prepare this revision.

Expanded use of the Internet for general information and reference material facilitates the design process. Where Web sites can be helpful during the process, they are added to the text. An appendix "Useful Websites" has been added to the back of the book for quick reference to facilitate research.

Since the third edition of the *Practical Manual of Land Development*, protection of our water resources has become more important. The Clean Water Act of 1972 and its amendments have come to the forefront. Chapter 10 has been added to include various methods for protecting our water resources. That chapter includes requirements and design methods for implementing the National Pollution Discharge Elimination System (NPDES) and Storm Water Pollution Prevention Plans (SWPPP). Explanations to the requirements and examples and drawings related to the above issues are included in this edition.

Because of the pressure of population growth, the use of central wastewater treatment plants has come into question. In some cases, it is more cost effective to construct community wastewater treatment with leach fields and treatment on-site than to provide sewers to transport effluent to a central processing facility. Chapter 8 has been expanded to present some of the options.

Chapter 14 has been added describing step-by-step procedures for the land development process. Federal, state, and local governments are more involved every year. Engineering realities are seldom if ever taught in learning institutions. Much of the land development process involves laws, politics, and economics. They influence or even dictate the engineering approach. Also included in that chapter are procedures and methods for working with electronic files supplied by other consultants and ideas and hints for using CADD in a way that will facilitate the work.

The expanded capabilities and increased use of computer-aided design for earthwork, profiles and utilities design has made some of the sections of the earlier editions to be no longer pertinent to land development designers. For that reason, the sections of the book involving those calculations are no longer necessary for understanding the design process. In an effort to keep the book relevant and easy to use, those sections have been changed to appendices and moved to the back of the book. They are therefore still available for training purposes and for engineers who are not yet using CAD to its fullest extent.

Acknowledgments

I wish to express my appreciation to Dave Hanson and Jennifer Costello of Carlile-Macy for generously giving their time and for providing the plans showing a development plan with detention ponds and wetlands replacement and restoration. They also provided the Erosion Control Plan for that project for which I am grateful.

Pete Lescure of Lescure Engineers, Inc. has given his time and expertise about on-site sewage treatment facilities for this edition, which is greatly appreciated.

Larry Hager of McGraw-Hill has been the editor for the last three revisions and has been very helpful. His suggestions and patience have greatly contributed to the success of these revisions. Thank you Larry.

Barbara C. Colley

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Chapter

1

Land Development

Making the environment more useful, safe, and comfortable for humanity is the purpose of civil engineering. Civil engineering for land development includes the design and construction of transportation corridors; flood control facilities; potable water supply facilities; collection and treatment facilities for solid and waterborne waste products; electrical, gas, and communications facilities; and buildings.

Implementing the development and improvement of land involves political, economic, and esthetic considerations as well as engineering realities. A project may involve entrepreneurs, financiers, politicians, public agents, architects, landscape architects, geologists, hydrologists, environmentalists, biologists, and construction contractors as well as engineers.

The skills and talents of land surveyors, mechanical engineers, fire safety engineers, and electrical and lighting engineers may be needed in addition to those of several kinds of civil engineers. Civil engineers specializing in traffic, structures, soils, and hydraulics may be needed. Effective communication among them is essential. Lack of clear communication can be the greatest obstacle to timely, satisfactory completion of any project. The intent of this book is to present a clear description of the tasks of the land development engineer and to promote a better understanding among the various people involved in land development.

Using This Book

The engineering design of public works and private projects should be done under the supervision of a highly educated, experienced engineer. This book has been written as an overview and guide to the engineering design of a variety of land development projects. The design of each aspect of the project must be made with an understanding and respect for the other aspects.

The information found here is necessarily presented in a broad but shallow way. Readers desiring more depth of understanding should refer to the references at

the end of each chapter for further reading on the subject. Work through each of the examples presented in the chapters: The examples contain information about techniques and procedures that are not described in the text. By solving the problems in the examples, the text will become clearer and you will be more likely to retain the information. Reading and solving the problems at the end of each chapter will show you which information the author considers most important.

Nomenclature

Terms used to describe governing agencies, construction materials and techniques, and maps and plans vary in different parts of the country. The usage in this book should make the meaning clear. Great care has been taken to define terms and jargon when first used. However, if the meaning of a word used is not clear, refer to the glossary. The terms *jurisdiction* and *agency* are used frequently and interchangeably throughout this book. They refer to the political body that has power of approval over the aspect of the design being discussed. The jurisdiction may be anything from participants in a town meeting to representatives of the federal government. The terms *pipe, line, conduit*, *main, sewer*, and *drain* are also used interchangeably. The term *developer* can refer to a private party, a development company, or a public agency.

Local customs and resources

The words chosen to describe materials or procedures in this book may vary from the terms used for the same material or procedures in another part of the United States or another country. It is best to use what is customary locally unless there is clear evidence that some new terminology, material, or technique is superior. There are always those who resist change, and change initially requires additional time. Local agencies should be consulted for design criteria and specifications. When local agencies have not established criteria, nearby agencies with similar conditions and history or respected contractors working on the area can be helpful. This book is written as a guide only—as a set of rules.

Coordination

Each aspect of the improvement of any site must be coordinated with every other aspect. One may design the sanitary sewer with no problems, only to discover that its location creates a problem in the design of the storm drain. After both have been redesigned, it may be discovered that the new design creates a problem in a third area. The engineering may go smoothly, only to have the client or a public agent request redesign. The plans must be polished and polished again before they are finished.

No subject or chapter in this book should be used without the others. Each chapter necessarily focuses on one aspect of the improvements, but all aspects are inextricably bound together.