Practical Manual of Land Development

Second Edition

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In memory of my father, Irvin S. Duncan, who often told me, "Complications are just misarrangements of simplifications."

Preface

Much has changed in civil engineering design practices since I first wrote the *Practical Manual of Site Development.* Use of computers has become commonplace and necessary for engineering companies to be competitive. The political environment in which civil engineers work has also changed significantly. There is greater emphasis on protecting people from hazardous materials and the environment from degradation. A new chapter has been added which focuses on resources. With the placement of navigation satellites and the use of geographic information systems, the applications for civil engineers and surveyors will continue to become more widespread. Linear projects require a somewhat different approach to land development than nonlinear projects do. This new edition includes the requirements of linear projects.

Young people today are introduced to computers in elementary school. Engineering students are required to take computer classes and to have an understanding of programming. Now the college graduate can begin doing engineering design much sooner. Software is becoming easier to use. As a result, the risk increases that young engineers will be performing work for which they have not been adequately trained. The connection between education and training must be made; this book provides that connection.

The greatest value of this book is as a learning tool for civil engineering seniors or newly graduated engineers. Some of my colleagues have presented the original book to college graduates when they first come to work, to provide an understanding of the application of their education in the real world. This book would be of great value as a text for college seniors in an engineering applications class. After taking such a class, students would be prepared to put their education to work immediately upon graduation. Such a class is seldom offered, however, so such training continues to fall on the employer.

Linear projects such as highways use the same principles as other aspects of land development. There are, however, some additional considerations for linear projects. Further, public works projects require additional interaction with the public, which we cover in this new edition. Another important aspect of dealing with large-scale public works projects is that the focus in training and

practice is often limited to the specific type of project being designed, and coordination with other facilities may not receive sufficient attention.

An important aspect of the original book was coordination among the different aspects of the design. The information in the original book is as valid today as it was in 1986. This book adds coordination among the elements of the land development design and the use of the computer as a tool.

B. C. Colley

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A great many people have contributed to the knowledge that has made this book possible. It would be impossible to thank them all. I am particularly grateful to those who have made a direct contribution. I wish to thank Larry Hager for his original suggestion for this edition and Olive Collen for her direction in polishing the language for this finished product. I am grateful to Bob Raznatovich of Aero-Geodetic Corporation for providing the cover photograph of San Jose, California, Tony Voo for information on available computer software, Bill Wagner of HMH, Inc., and Bob Smith of Ruth and Going, Inc., for providing some of the computer-generated plans for illustrations, and Paul Hauser for providing resources for the chapter on construction. I wish to thank Earl and Gara Cross of Right of Way Professionals, Inc., for knowledge gained while working with them on state-of-the-art surveying. Special thanks must go to my daughter, Cinamon Alexander, for teaching me Autocad and DOS and for supporting my work on the computer.

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Contents

Chapter

1

Land Development

Making the environment more useful 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, and construction contractors as well as engineers.

The skills and talents of land surveyors, mechanical engineers, and electrical and lighting engineers will 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 engineering tasks 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 more clear and you will be more likely to retain the information. Reading and solving the problems at the ends of each chapter will show you which information the author considers to be 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 which 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, 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—not 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 repolished 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.