Planning & Scheduling Professional Certification Study Guide

A Product of the Education Board of AACE International

AACE INTERNATIONAL

promoting the planning and management of cost and schedules

Planning and Scheduling Professional (PSP) Certification Study Guide

aace® International
The Authority for Total Cost Management®

2014

Planning and Scheduling Professional (PSP)
Certification Study Guide
First Edition, Revised

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Please see **Acknowledgments** on the next page

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PREFACE

AACE International's **Planning and Scheduling Professional (PSP) Certification Study Guide** was developed to accomplish two purposes similar to that of the **CCP Certification Study Guide**. First, it aids professionals wishing to achieve AACE International's specialty certification in Planning and Scheduling. Second, the **PSP Certification Study Guide** summarizes various topics considered central to the planning and scheduling profession, as outlined in **AACE International Recommended Practice 14R-90***, Responsibility and Required Skills for a Planning and Scheduling Professional*, along with the current edition of the **Skills and Knowledge of Cost Engineering**.

The **PSP Certification Study Guide** should be a beneficial and useful publication for all planning and scheduling professionals. It primarily serves the needs of planning and scheduling professionals who are preparing to take AACE International's PSP certification examination. This publication is intentionally concise and does not delve deeply into any subject, yet it broadly touches upon all topics within the required skills and knowledge of a planning and scheduling professional. This text is not intended to be a source of detailed planning and scheduling knowledge, nor does it substitute for the minimum experience necessary to qualify to sit for and pass the PSP certification exam. That is, the reader will not find deep development of planning and scheduling concepts in this manual, since listed references are already available to provide all necessary details. Rather, it introduces required knowledge and skills for potential PSP certificants.

Much of the information contained in this **PSP Certification Study Guide** parallels and amplifies information presented in **Skills and Knowledge of Cost Engineering** and the **CCP Certification Study Guide.** These publications can be used together for study of fundamental cost engineering, as well as essential planning and scheduling. They also include sample problems related to the subject matter.

The **PSP Certification Study Guide** incorporates terms and phrases that are generic to the profession, and some are specific to AACE International. Terms and phrases used in industry and technical software may not always agree precisely with one's previous understanding, or how the terms are used in a specific organization or industry. One should consult the list of terms found in Appendix C and the terminology definitions in the latest edition of **AACE International Recommended Practice 10S-90**, *Cost Engineering Terminology*, to learn the definitions as applied in the exam. AACE International's **Recommended Practices** can be obtained from AACE International's web site at www.aacei.org.

The AACE Education Board will continue to improve this publication, revising and improving it as needed to support the PSP exam, enhancing its value as described above. Recommended changes and updates are highly welcome and should please be forwarded to the AACE International Education Board at edchair@aacei.org.

Please see **Introduction to PSP Certification Study Guide** on the next page

Introduction to PSP Certification Study Guide

AACE International's **PSP Certification Study Guide** enables users to understand the scope of the PSP Certification Examination and prepare for it. It does not provide fundamental education in the basics of planning and scheduling. Whoever uses this guide should already possess the minimum PSP education and work experience as required to sit for the PSP certification exam. The guide informs PSP applicants of subjects that the exam tests, poses representative questions and problems, and lists useful references for detailed study.

This text uses a typical engineering-procurement-construction (EPC) project as the basis for presenting knowledge and concepts integral to planning and scheduling. Further, it uses the term "project" in its generic form while recognizing the knowledge and skills can apply to multiple projects or a "program." However, these concepts, tools, and techniques are applicable to the majority of industries that rely on planning and scheduling professionals to effectively manage work. This includes aerospace, agriculture, telecommunications, ship building, software development, resource planning and management, manufacturing, and others.

In addition to the EPC model for construction, process and industrial operations have been incorporated into the development of the **PSP Certification Study Guide**. Other major themes include:

- The planning process extends from conceptual through delivery phases.
- Planning includes design and engineering development.
- The change management process is considered throughout all phases.
- Stakeholders' interests are presented with emphasis on considerations and constraints.
- Human issues are presented with emphasis on health, welfare, safety, and environment.

The study guide is organized according to *Scope of Knowledge* (see figure 1), and the taxonomy lists the knowledge areas that may be tested.

The **PSP Certification Study Guide** begins by discussing the PSP Certification Examination Structure. The guide discusses topics outlined in Figure 1 by identifying the following:

- Introduction and Learning Objectives
- Related Sections
- Terms to Know
- Key Points for Review
- Summary
- Sample Questions

The **PSP Certification Study Guide** is divided into two main chapters (Planning and Scheduling) and two sections in both of those chapters:

- Planning.
  - ✓ Planning development.
  - ✓ Planning product.

- Scheduling.
  - ✓ Schedule development.
  - ✓ Schedule maintenance and reporting.
- Complex problem.
- Appendix.
  - ✓ Recommended references and resources.
  - ✓ PSP certification glossary.
  - ✓ Sample application.
- Answers to questions and complex problem.

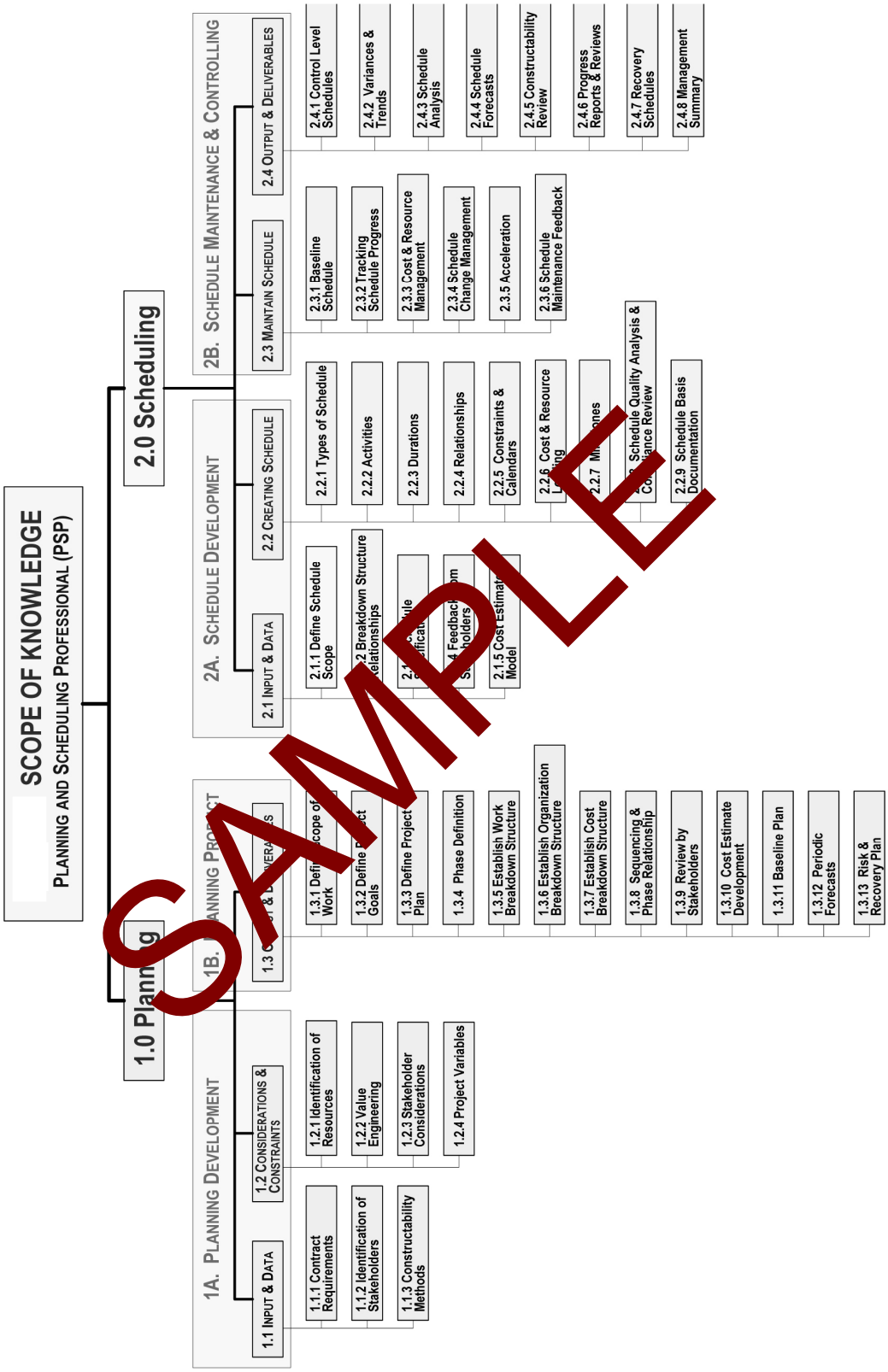

Figure 1—Scope of Knowledge, Planning and Scheduling Professional (PSP)

Certification Policies, Procedures and Examination Structure

The most current information regarding AACE certification is posted on our website at www.aacei.org, under the Certification tab.

A summary of the steps to become AACE certified is that the candidate must do the following, in order:

1. Meet the minimum eligibility requirements (it is the responsibility of the candidate to ensure they can meet the eligibility requirements prior to registering for the examination).
2. Register and pay for the (certification) exam.
3. Submit all verification documentation and other required documents to certificationsubmittals@aacei.org within 30-days of registering.
4. Schedule an exam at a Kryterion testing center after receiving clearance from Headquarters within 6 months of clearance.
5. Successfully pass a written examination as determined by the AACE International Certification Board.

All AACE certification examinations are conducted through computer based testing at Kryterion testing centers worldwide.

Our website contains all the necessary information for becoming certified, including exam and scheduling tutorials, exam specific toolbox – containing helpful documents and guides, and the recommended resources to assist in preparing for the certification examination. Please visit our website at www.aacei.org for all of your certification questions and needs.

All certification related questions should be directed to certification@aacei.org or 1-800-858-2678.

PSP Certification Requirements and Process

Eligibility

For the most current information regarding PSP eligibility requirements, visit the AACE website at www.aacei.org under the Certification tab. It is also important to be aware of the certification policies and procedures regarding certification registration, payment, and examination scheduling, which can also be found on the AACE website.

Examination Format

The exam is delivered through computer based testing (CBT) and consists of multiple choice questions and an essay-style question. The examination is closed book. Programmable or per-programmed calculators (including those with financial functions) are also permitted.

For the latest information regarding the PSP exam or recommended resources, visit the AACE website at www.aacei.org, under the Certification tab.

Preparing for the PSP Certification Examination

Generally speaking a candidate's education and professional experience are the primary sources that prepare the individual for the examination. However, there are other ways to prepare for the examination:

- Study the ***PSP Study Guide***.
- Study the reference materials referenced in Appendix B of this manual.
- Learn the planning and scheduling terms found in Appendix C of this manual, in conjunction with **AACE International Recommended Practice 10S-90**, *Cost Engineering Terminology*.
- Access relevant distance learning opportunities through AACE International's website.
- Attend the PSP review seminar conducted at the AACE International Annual Meeting
- Attend review sessions or seminars at AACE International Sections and Regions.
- Attend AACE International Section monthly meetings at least whenever the discussion includes planning and scheduling topics.

PSP Certification Examination Structure

Introduction

To be certified as a Planning & Scheduling Professional (PSP), a candidate must meet the minimum eligibility requirements and successfully pass a written examination as determined by the AACE International Certification Board. This study guide provides the information needed to prepare for the PSP examination. All current information regarding PSP certification can be found on the AACE website at www.aacei.org, under the certification tab.

Basis of the Examination

The purpose of any professional certification or licensing program is to provide a mechanism to formally evaluate the individual's knowledge and skill in a subject against widely accepted standards. Public recognition of the professional's capabilities in the defined skill area may result. Certification as a Planning and Scheduling Professional (PSP) recognizes certificate holders who have demonstrated their experience and expertise in planning and scheduling. Planning and scheduling are respectively defined as:

- **Planning** – The identification of the project objectives and the orderly activities necessary to complete the project (the thinking part) and not to be confused with scheduling; the process by which the duration of the project tasks is applied to the plan. It involves answering the questions:
    1. What must be done in the future to reach the project objective?
    2. How it will be done?
    3. Who will do it?
    4. When it will be done?

- **Scheduling** – (1) A description of when each activity in a project can be accomplished and must be finished so as to be completed timely. The simplest of schedules depict in bar chart format the start and finish of activities of a given duration. More complex schedules, generally in CPM format, include schedule logic and show the critical path and floats associated with each activity. (2) A time sequence of activities and events that represent an operating timetable. The schedule specifies the relative beginning and ending times of activities and the occurrence times of events. A schedule may be presented on a calendar framework or on an elapsed time scale.

These definitions of planning and scheduling provide the underlying basis for the AACE International certification examination. The examination tests professional proficiency across these areas. The candidate is directed to study from the Primary References in Appendix B.

Planning and scheduling is a dynamic profession affected by advances in philosophies, methodologies, and technology. Professional planners and schedulers are expected to keep abreast of advances in these three realms.

In summary, the definition of a planner and scheduler and the **Skills and Knowledge of Cost Engineering** (Planning and Scheduling chapters) determine the scope of the PSP certification examination. In recognition of this, the examination addresses:

- Minimum knowledge covered by the basic skills documents; and
- Advanced knowledge based upon planning and scheduling experience.

Examination Structure

The PSP exam is delivered through computer based testing (CBT) and consists of multiple choice questions and a written exercise.

1. **MULTIPLE CHOICE QUESTIONS**: The exam is delivered through computer based testing (CBT)* and is comprised of multiple-choice and compound, scenario questions. The topics covered in the exam are: *basic planning& scheduling skills and knowledge, communication competency, practical exercises, and planning & scheduling applications.*
2. **MEMO ASSIGNMENT**: The memo assignment provides a scenario and will require the candidate to demonstrate both communication skills and insight regarding a challenging PSP workplace scenario. The memo will be written in the text box provided onscreen and should demonstrate a candidate's ability to organize thought and communicate effectively. The memo will need to be addressed properly, include a purpose statement, describe the potential impact of any described problem or issue, propose a clear actionable solution with supporting rationale and include a closing statement.

The exam is closed book. Candidates are permitted to bring any style of calculator, including programmable calculators, to use during the exam. Candidates will have a maximum of 5 hours to complete the exam.

The examination is not based upon use or knowledge of specific software, but rather embodies the knowledge and experience of a PSP practitioner using such tools. All materials provided during the examination, including work paper, must be turned in upon completion of the examination.

Recognizing that there are many industries and fields within the profession—engineering, construction, manufacturing, process facilities, mining, utilities, transportation, aerospace, environment and government—candidates can expect questions from any of these practices. The exam takes into account the fact that no one can be expected to be conversant in all practice areas through its multiple-option format and extensive use of questions of general applicability.

Understanding and Using the Sample Questions Provided in the PSP Study Guide

The **PSP Study Guide** includes many sample questions with answers. These questions should be answered to you know which areas might need additional preparation on your part. The questions are found at the end of each subchapter.

PSP Study Guide questions have been developed specifically for those preparing for the examination and are similar in content and context to the actual exam questions. All of the questions on the PSP Certification Examination, except the writing requirement, are multiple-choice questions. Each has four possible answers with one correct solution, whereas the questions in this ***Study Guide*** include other forms of questions.

Questions in the ***PSP Study Guide*** are in the following formats:

- Multiple choice questions, similar to what you might find on the certification examination.
- Fill-in-the-blank questions. These questions are intended to provide relevant thinking exercises to support preparation for the examination.
- A complex problem. The intent of this question-set is to enable the student to prepare for complex question section of the examination. The complex question sample is found in Appendix A.

Test Your PSP Knowledge

As a good gauge of PSP knowledge gained by using this study guide, the candidate is encouraged to start by answering the following pre-test questions. Answers should be recorded, and when studies are complete, the candidate will answer the same questions again. A close comparison of the results, before and after study, will show the knowledge gained and what gaps may remain prior to sitting for the exam.

1. What is planning?
2. Why is planning important?
3. What is scheduling?
4. Why is scheduling important?
5. What is a work breakdown structure (WBS) and how is it used?
6. What is a CPM schedule?
7. What are a planning and scheduling professional's general duties and responsibilities?
8. What are the different types of schedule activities and how are they used?
9. Who are the stakeholders who use and work with plans and schedules?
10. What does a forward and backward pass schedule calculation provide?
11. What types of schedule logic and constraints are normally used and why are they important?
12. What is the difference between ADM and PDM schedules and how do they differ?
13. What are schedule levels and why used?
14. What makes for a successful plan?
15. What makes for a successful schedule?
16. Why do plans and schedules fail?
17. Define basic steps in CPM schedule model development.
18. What does scheduling of resource utilization in the schedule provide?
19. Define schedule calendars and their use.
20. How are schedules updated for progress?
21. How should changes and delays be incorporated into a schedule model?
22. What is involved in shortening the overall duration of or compressing a schedule?
23. What is analyzed when defining a schedule recovery plan?
24. What is important to document as the plan and schedule basis?
25. What are planning and scheduling deliverables during the life cycle of a project?

Please see **Chapter 1.0—Planning** on page 11

Chapter 1.0 - Planning

Introduction

The Planning chapter provides an organized outline to assist in understanding the means, methods and tools necessary in the planning process. This chapter includes:

- Planning Development.
  - Planning Input and Data.
  - Planning Considerations and Constraints.
- Planning Product.
  - Planning Output and Deliverables.

Each section identifies the concepts associated with particular planning phases.

- **Planning is conceptual.**
- **Planning is dynamic.**
- **Planning is both cyclical and iterative.**

The planning process is repeated with each phase of work effort and development throughout the project's life cycle. As scope is developed, information becomes more detailed, and the plan and schedule are more detailed, as well. This iterative review, development, and modification cycle is constant throughout the life of the project.

The scope of the planning process must be appropriate to the phase of work. The elements of a plan developed in the planning process must be equally weighted to achieve a balanced and usable product.

When conditions change for the plan or any of its elements, the planner should re-examine and update it as necessary. The plan for the next phase is the key to developing a plan for the next phase, as well as for the project as a whole.

Project planning begins early and continues as the project moves through phases of the project's life cycle, from conception through to completion, and closeout. Rather than a serial process, it is best thought of as a planning cycle. Effective implementation of a plan results in the ability to produce a credible schedule.

Most project management professionals agree that there is a basic five-step process involved in developing a project plan. Essential questions answered during project planning:

- **What?** The physical feature and technical objectives (scope).
- **How?** Work breakdown structure (WBS).
- **Who?** Resource commitments and organization breakdown structure (or OBS).
- **When?** Timeline initially and then the schedule later in the planning process.
- **How much?** Budget estimate.

Based on these questions, the recommended sequence of actions to develop a project plan is:

1. Define project scope.
2. Establish a work breakdown structure (WBS).
3. Identify resources and availability (people and capital assets).
4. Establish timeline and sequence of deliverables.
5. Determine a budget for each component activity, work package, or group of tasks.

A planning and scheduling professional (PSP) assists the project manager to accomplish the following:

- Facilitate preparation of the project plan and work breakdown structure (WBS).
- Facilitate estimation of timelines and project phases.
- Identify key project results and milestones.
- Involve team members in planning process; and involve the client in defining project goals and key results.

Learning Objectives

- Understand fundamental concepts of the planning process and its terminology.
- Recognize that the planning process is a dynamic process repeated throughout each phase of a program or project life cycle.
- Scaling of the planning process must be appropriate and equally weighted to each phase of work to achieve a balanced and usable product.
- When conditions change, the planning process and deliverables should be examined and updated as necessary. The plan for one phase of a project offers a pattern for developing the plan or next phase of the project as well as the project as a whole.
- Effective implementation of a plan results in a schedule.

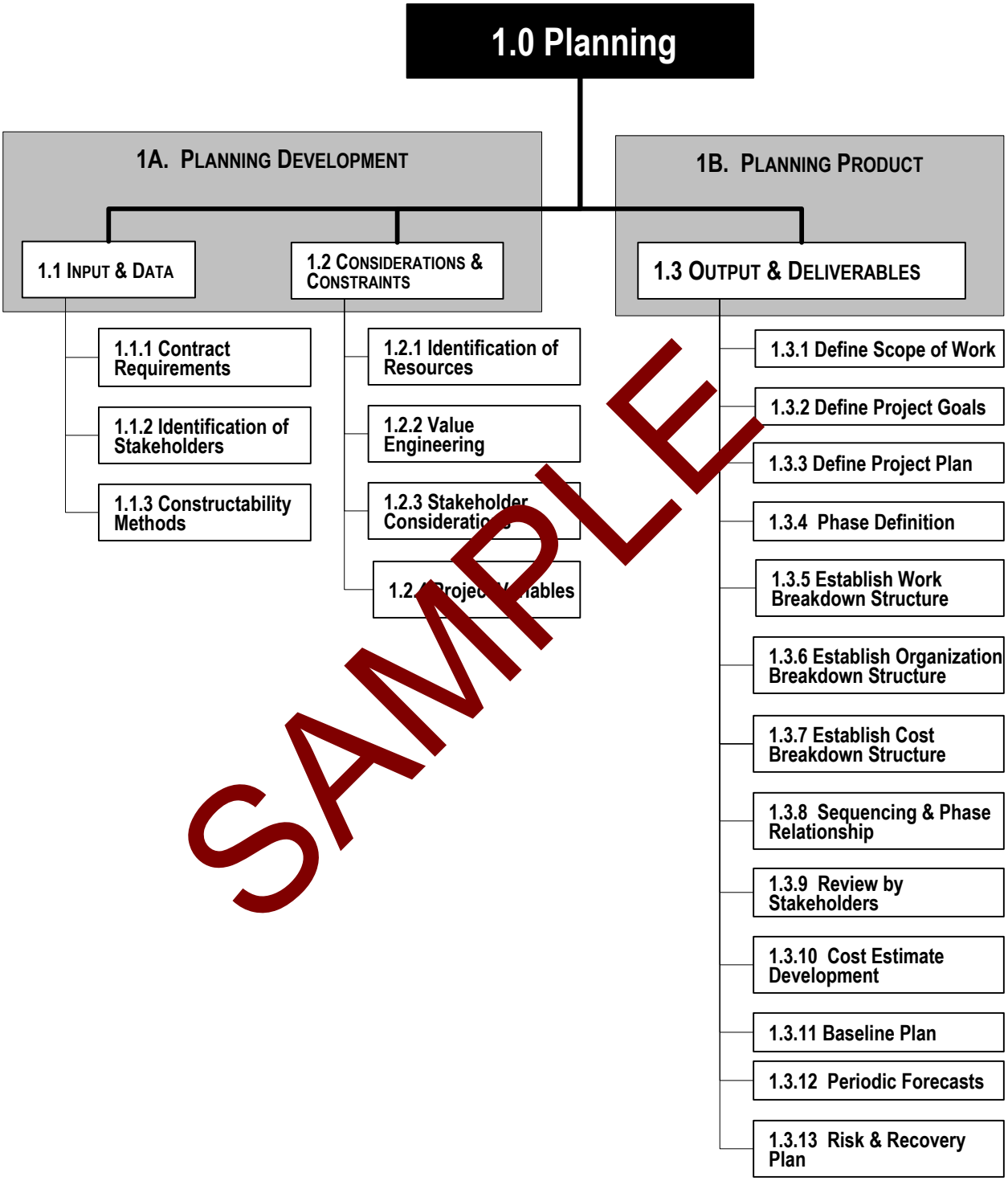

Figure 2—Planning Elements of PSP

Please see **Section 1A—Planning Development** on page 15

Section 1A – Planning Development

An owner or developer, whether a public entity or a private individual or organization, first perceives a need for an industrial process, building, or facility. From this initial effort, project planning begins. In some organizations, this process may be undertaken by outside experts performing contract work for the owner or developer.

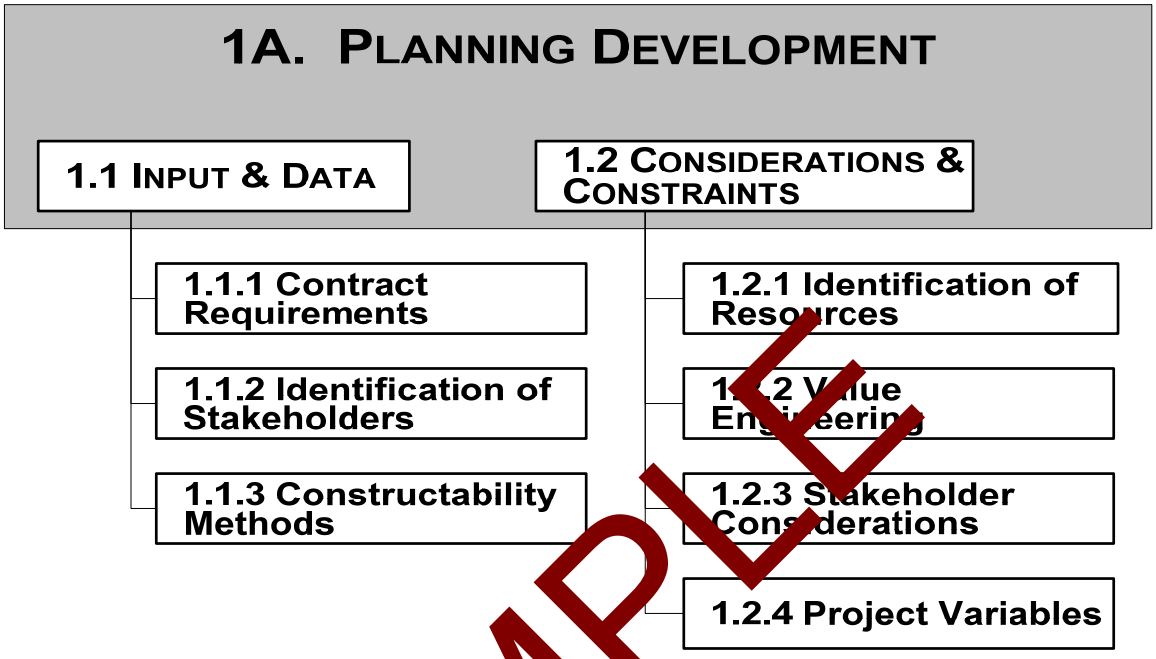

Figure 3—Planning Development

Important participants in any planning development team are those who have developed expertise in the planning process and abilities to conceptually schedule work. These conceptual planning and scheduling capabilities are needed in both the planning and construction cycles. The most important elements that these professionals bring to the planning development phase include:

- Input and Data.
- Considerations and Constraints.

The models for input and data include consideration of contract requirements, the end product, and constructability. Initially important is identification of the stakeholders who will be involved throughout the life of the project.

The planning process includes identification of considerations and constraints of resources and project variables. With the owner's scope identified, consideration of engineering or technical variables is reviewed in a cyclical process. The process identifies the alternatives that the various stakeholders must review, so that appropriate decisions optimally satisfy the interests of the parties and the goals of the project.

One of the most important responsibilities for planners is recognition and communication of the cyclical and iterative nature of the planning process. Additionally, open-mindedness throughout the planning and development process leads to identification of the most appropriate concepts for project completion and success.

Please see **Subchapter 1.1 Input and Data** on page 17

Subchapter 1.1 Input and Data

The Input and Data Subchapter represents the initial process of identifying the requirements, both individual and specific elements necessary to understand and implement the planning phase of the project.

The Input and Data subchapter consists of the following sections:

- Contract Requirements.
- Identification of Stakeholders.
- Constructability Methods.

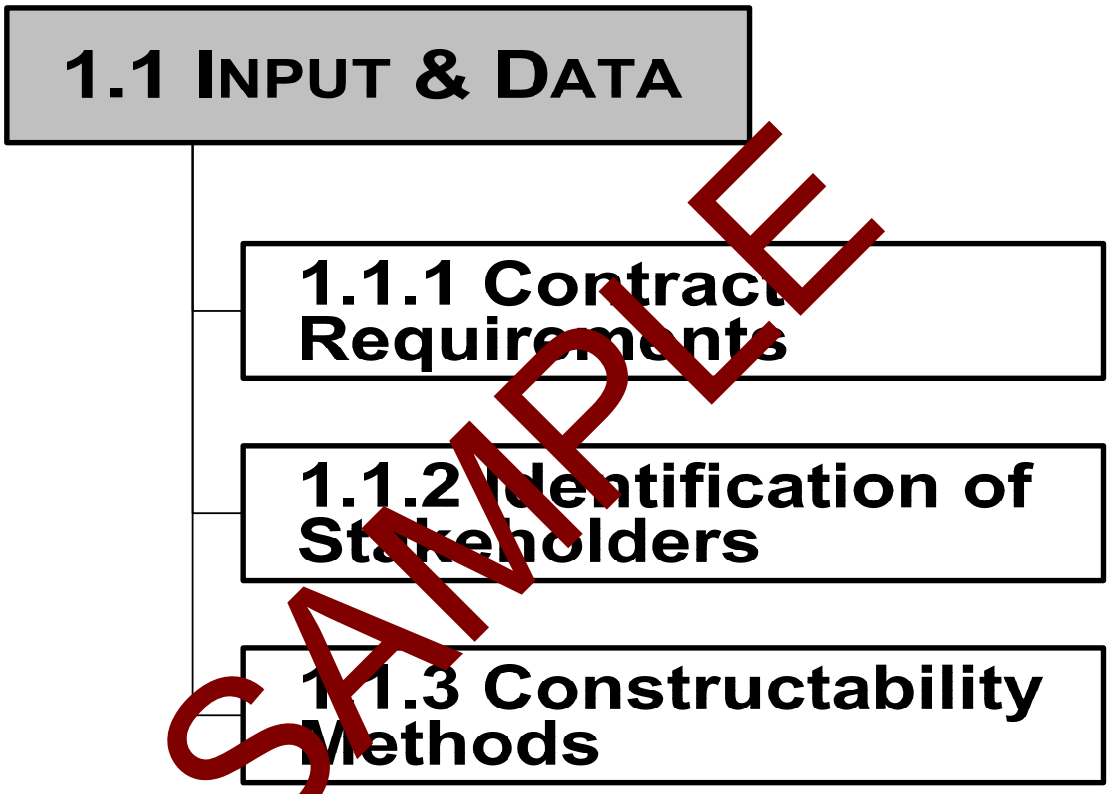

Figure 4—Planning Input and Data

Please see **1.1.1 Contract Requirements** on page 19

1.1.1 Contract Requirements

Introduction and Learning Objectives

Understand contracts and their relationship to the planning process used by the project team.
The primary focus of the project team during the planning phase is to understand the total scope of the contract documents. It is important that all project team members know and understand contract terms, conditions, requirements, and their relationship to the work.

The requirements for a program normally come from the governing contract documents. They define the scope and type of processes and procedures to be used. They explicitly or implicitly define the minimum planning and scheduling requirements.

Note that the term "contract documents" applies equally as well to projects that have evolved to the draft contract stage or to an endeavor that has yet to evolve to a contract, if a contract should result. In the latter case, a planning and scheduling specification, an organization's practices, or experience alone will govern how to proceed.

Related Sections

- Stakeholders: 1.1.2 – Identification of Stakeholders, 1.2.3 – Stakeholder Considerations, 1.3.9 – Review by Stakeholders, 2.1.4 – Feedback from Stakeholders, 2.3.6 – Schedule Maintenance Feedback
- Specifications: 2.1.3 - Schedule Specification
- Scope of Work: 1.3.1 - Define Scope of Work, 2.1.1 - Define Schedule Scope
- Goals and Phases: 1.3.2 - Define Project Goals, 1.3.3 – Define Project Plan, 1.3.4 -Phase Definition
- Schedule Types: 2.2.1 – Schedule Types, 2.3.1 – Baseline Schedule, 2.4.1 – Control Level Schedules, 2.4.7 – Recovery Schedules
- Durations, Constraints and Calendars: Section 2.2.3 – Durations, Section 2.2.5 – Constraints and Calendars
- Milestones: 2.2.7 - Milestones
- Change Management: 2.3.4 - Schedule Change Management, 2.3.5 - Acceleration
- Reporting: 2.4.6 - Progress Reports and Reviews

Terms to Know

Basic types of contracts:

- Fixed price.
- Unit price.
- Cost plus (with fixed, incentive, or award fees).
- Time and materials (T and M).
- Guaranteed maximum price (GMP).

Common delivery methods:

- Design-build.
- Design-bid-build.
- EPC (Engineering-procurement-construction).
- Design-build-operate.
- Variations of any above.

Changes and change management.
Planning, scheduling and reporting requirements:

- Notice to proceed (NTP).
- Milestones.
- Phases.
- Resources.
- Costing.
- Substantial completion.
- Project completion.

Value engineering (VE).
Constructability.

Key Points for Review

1. Contract types.
2. Delivery methods.
   a. Development and coordination of contract component elements:
   b. Specifications.
   c. Plans.
   d. Special requirements, e.g. permits.
   e. Contract formulation.
3. Change management.
4. General and special conditions:
   a. Labor.
   b. Weather.
   c. Equipment.
   d. Material.
   e. Environment.
   f. Regional constraints.
   g. Any other project-specific variables and requirements.

Summary

The key components include understanding the importance of development and implementing effective planning related to the contract documents. This includes terms and conditions that influence the outcome of a planning process.

Sample Questions for Section 1.1:

1. The traditional governmental contracting process in the US is:

   A. Design, build, and operate.
   B. Design, bid, build.
   C. EPC.
   D. Design, build.

2. Critical delivery dates are referred to as:

   A. Milestones.
   B. Phases.
   C. Substantial.
   D. Flags.

3. Which of the following documents is most likely to be of the LEAST value to a planner-scheduler when planning a contractor's baseline critical path schedule for the construction of a high rise building on a remote South Pacific resort island for a private developer? The contractor has been awarded the contract.

   A. Specifications as found in the contract document.
   B. The local government's report of future resort projects on the island.
   C. International Building Codes as referenced in the contract document.
   D. A project-specific geotechnical report.

4. When a planner-scheduler is collecting information about the project during the initial planning cycle, which information is of GREATEST value?

   A. Contract specifications.
   B. The contractor's pre-bid site visit meeting minutes and notes.
   C. The contractor's changes clause.
   D. A detailed scope of work statement.

5. Describe the difference between contract types and delivery methods.

6. Describe what milestones are.

Solutions to Sample Questions for Section 1.1.1

1. B. Design, bid, build

2. A. Milestones

3. B. The local government's report on future resort projects on the island.

4. D A detailed scope of work statement.

5. Contracts define the financial terms of a relationship between an owner and a contractor, while the delivery method describes the method of management the contractor will use to perform the work.

6. Milestones are interim completion dates that are either contract driven or contractor self-imposed to measure progress or trigger subsequent work activities. Their achievement may earn progress payments for the contractor.

