



PennState
Physical Plant



THE PENNSYLVANIA STATE UNIVERSITY

PROJECT DELIVERY SYSTEM GUIDEBOOK



Record of Revision

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Foreword

The Pennsylvania State University is one of the nation's largest and most comprehensive universities, with 46,000 employees on 24 campuses, an annual budget of \$4 billion, and a physical plant of 1,700 buildings. Stakeholders continue investing in new state-of-the-art facilities as well as expecting wise cost-effective stewardship of existing assets. As a result, selection, development, and execution of projects are critically important to Penn State.

I am pleased to introduce the Project Delivery System (PDS). It is primarily designed to deliver projects that fully satisfy all promised objectives safely, on time, on budget, in a sustainable and environmentally responsible fashion, with no surprises. PDS emphasizes satisfactory completion of phase gated requirements by carefully defining the “Deliverables” required to pass each gate. A Deliverable is a specific, measurable, tangible, and verifiable outcome or result. PDS does not describe how to generate deliverables, but does describe what they should look like to be fully achieved. PDS describes characteristics of high-quality deliverables and relies on proven best practices and the experience of Penn State Project Leaders to produce them.

Penn State Executive Leaders continue to strongly support our project delivery system and expect us to deliver best-in-class results:

"To help address the challenges of affordability and accessibility, we continue to pursue our most ambitious fundraising campaign in Penn State history -- For the Future: The campaign for Penn State Students. At the heart of this campaign is the priority to make Penn State the top student-centered research university in America. Despite the current economic climate, Penn State's alumni and friends are continuing to support the University enthusiastically. PDS can help Penn State fulfill our obligation to make the best possible use of this loyalty and generosity in the development and execution of projects."

- Graham B. Spanier, President
The Pennsylvania State University

"F&B (Finance and Business) doesn't do the teaching, research, and outreach...we help make the teaching, research, and outreach better. We have made noteworthy progress and have been recognized as one of the most successful support organizations—from service, delivery, and cost perspectives—in higher education. PDS provides the roadmap as we relentlessly strive for continuous, measurable project improvement."

- Albert G. Horvath, Senior Vice President Finance & Business/Treasurer
The Pennsylvania State University

This Guidebook is designed to be used by both the internal Penn State community such as the President, Provost, Deans, Faculty, Department Heads, Facility Coordinators, and staff, as well as external service providers.

Best regards,

H. Ford Stryker, P.E.
Associate Vice President Physical Plant
The Pennsylvania State University

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Above: Lewis Katz Building on Penn State's University Park campus

Front Cover: Hershey Medical Center Cancer Institute and Children’s Hospital, Information Sciences and Technology (IST) Building, Hetzel Union Building (HUB), Shortlidge Mall, Academic Commons (PSU Wilkes-Barre)

PART I – PENN STATE OPP PROJECT DELIVERY SYSTEM

1. INTRODUCTION

1.1. Purpose

The purpose of the Project Delivery System (PDS) is to provide project requirement details necessary for developing and executing Penn State University new construction or renovation projects greater than \$5,000,000 ¹. The Penn State Office of Physical Plant (OPP) is the owner of this process, and responsible for its upkeep. However, the PDS applies to the internal Penn State community such as the President, Provost, Deans, Faculty, Department Heads, Facility Coordinators, Project Leaders and other staff, as well as external service providers. The project process described within this Guidebook is designed to maximize overall capital efficiency by designing investing opportunities towards the best projects when appropriate, and structuring project delivery safely, efficiently and for maximum value.

The Project Delivery Guidebook Objective is to provide a standard set of project phases, stages and specific milestone deliverables required by the Penn State Office of Physical Plant (OPP) to enable the consistent structuring and cost-effective processing of projects, and to improve the University's overall capital effectiveness.

This Guidebook is also intended to improve communication and understanding between all stakeholders involved in the project delivery process. To achieve this, the Guidebook clearly identifies the roles and responsibilities of various project stakeholders along with the expected deliverables for each project stage. Clear expectations and communications facilitated by this Guidebook will enable improvement of project delivery effectiveness, project quality and overall project stakeholder satisfaction.

The PDS incorporates project management, institution and industry best practices in delivering successful projects. These practices will be described in this Guidebook. The PDS enhances the previous Project Life-Cycle methodology with a new stage-gated process to efficiently and effectively deliver project results. This process includes Front-End-Loading (FEL) process steps when applicable; an Industry best practice approach used to identify opportunities, develop alternatives, plan and then implement the selected best option as a project. The PDS structure formalizes Administration decision-making at Stage Gates, and functional or technical management reviews at sub-gates. It helps to ensure projects are developed and executed properly and consistently by defining project "Deliverables" that must be achieved at the right time.

This Guidebook introduces the concept of utilizing Core Project Teams, which have team accountability and responsibility for delivering projects, as opposed to the Project Leader alone. Teams perform better than individuals, but are led by project leaders. Core project teams are typically made up of four-to-seven cross-functional team

members, more or less according to the nature of the project. Core Team members are subject matter experts in their fields, and they can make project related decisions, representing their respective functional areas. Core Project Teams are selected from a combination of internal and external resources.

This Guidebook promotes utilization of Project Steering Committees on complex projects and introduces the concept of further engaging Project Sponsors to assist project teams. Project teams often fail because they do not have adequate management involvement, guidance, and support. Project Steering Committees and Sponsors can fill this void, and are crucial in providing senior level support.

This Guidebook assumes an understanding of basic project management, and it is not intended to teach or be a project management primer. However, it does provide some essential process descriptions to frame the context of requirements and to clarify Penn State's expectations within that context. This Guidebook is not intended to be a "how to" procedural manual, instead it outlines what is needed to consistently deliver the best project and business outcomes utilizing an integrated project approach.

More specifically, this Guidebook:

- Provides the "Deliverable-oriented" project life-cycle stage-gated process to deliver projects;
- Explains the value of applying the process;
- Identifies accountabilities and responsibilities;
- Provides an allowance for good judgment, and the right amount of flexibility in its compliance;
- Provides definitions of Deliverable components and attributes;
- Provides Scaling of Deliverables for project size and complexity; and
- Serves as a reference for applying the Project Delivery System's stage-gated process.

The Guidebook's function is to provide a framework of the PDS requirements necessary to demonstrate successful completion of a project's key Deliverables, Stages, and total project.

1.2. Background

This Guidebook replaces the "Capital Project Delivery Handbook, version 1.0 (rev: 7/20/06)," which was developed with the goal "to improve communication and understanding between all stakeholders involved in the project delivery process." The Handbook was originally developed "as a communication and education tool for delivering new construction or renovation projects over \$1 million." In this new Guidebook, improving communications and understanding of the project delivery process remain as important objectives. The types of projects covered in the new Guidebook are new construction or renovation projects over \$5 million¹. The primary goal of this Guidebook is to improve overall project performance by providing a framework of the requirements necessary to demonstrate successful completion of a project's key Deliverables. The PDS was designed for new construction or renovation projects over \$5 million¹ with an expectation that this process will be followed to achieve

its maximum value. It is also expected that more complicated mid-sized projects (projects greater than \$1 million but less than \$5 million) and small projects (projects less than \$1 million) follow the Guidebook principles as well. Project Leaders should discuss the required application of the PDS with their Director for mid-sized and small projects¹. The process allows the flexibility of process exceptions as decisions are made and documented by taking appropriate account of the consequences.

1.3. Audience

This Guidebook is designed to facilitate communication with internal and external project stakeholders interested in understanding Penn State's Project Delivery Process. The Guidebook can assist in educating new staff, clients and service providers while serving as a valuable day-to-day reference for OPP personnel. Examples of the intended audience for this Guidebook include the internal Penn State community such as the President, Provost, Deans, Faculty, Department Heads, Facility Coordinators, Project Managers and other staff, as well as external service providers. The Guidebook is designed to serve as a communication tool to educate and guide project stakeholders through the project delivery process used by OPP.

This guidebook alone does not contain all of the detailed information OPP employees use to deliver construction projects. Other related processes, documents, and standards can be accessed from www.opp.psu.edu.

1.4. Guidebook Overview

This Guidebook is divided into two Main Parts: Part I describes and frames the PDS, and Part II describes the PDS Deliverables and their requirements.

A further break-down of these two Parts, follows:

PART I - PENN STATE OPP PROJECT DELIVERY SYSTEM:

Section 1 provides an introduction and overview of the Guidebook, including: purpose, background, the intended audience and the Guidebook's structure.

Section 2 provides a description of the "Deliverable-oriented" Stage-gated process methodology to guide Project Teams and describes the seven principles that serve as the foundation for applying the PDS.

Section 3 provides an overview of the "Office of Physical Plant" and describes the Organization's Mission, Vision, and its Guiding Principles.

Section 4 provides an overview of the broader "Project Delivery Team Stakeholders," and introduces Core Project Teams, Sponsors and Steering Teams as vital components of the PDS and broad project success.

Section 5 provides a detailed description of the Project Delivery System. This section describes the tasks, deliverables, and approvals that combine to create the organized set of process controls representing the actual Project Delivery System process used by OPP. It begins by first outlining the Project Life-cycle;

its Phases and Stages that are divisions of the time required to accomplish the project in sequential time periods. It then provides an overview of the “deliverable-oriented” stage gated process and its benefits.

Each Stage requires specific tasks to be performed to complete required deliverables prior to obtaining approvals to move the project forward, and this process is controlled by Project Gates, which are fully described in the section. Scaling Deliverables for project size and complexity is discussed. The distinction in the amount of rigor required to be applied to manage Major projects (those greater than \$5,000,000) and Mid-Sized projects (those Greater than \$1,000,000 and less than \$5,000,000) is defined. Small projects are defined as those under \$1,000,000, but small projects are not part of the Guidebook’s scope. A less rigorous version of the PDS could be adapted to small projects. The section concludes by describing the incorporation of Front-End-Loading (FEL) Industry practices.

PART II - PROJECT STAGE GATE DELIVERABLES:

Section 6 provides an introduction to “Deliverables.” This section defines and describes two types of Deliverables under PDS: The common and standard Deliverables required for each stage, and project defined Deliverables required for each unique project.

Section 7 provides Project Deliverables for each Stage of the Project, and each Deliverable is described in terms of Major and Mid-Sized Project requirements. Every Deliverable required is described by its definition and purpose, keys to success, content and tools and techniques.

This Guidebook provides transparency into how a selected project is delivered. Each stage contains tasks, deliverables and approvals representing the Process, and ensuring the project is on track with overall goals, budget and schedule. An understanding of these processes is essential to ensure project stakeholders are knowledgeable and able to make informed decisions.

The Guidebook also provides definition of acronyms and a glossary of terms in Appendices A and B. The PDS Overview Diagram (8½ x 17 in. format) is included in Appendix C, and Stage Deliverables are identified in a Stage Deliverables Chart in Appendix D.

This Guidebook is intended to evolve and therefore to change as new processes, tools and techniques are deployed and as continuous improvements are identified for inclusion in the manual. The “Revision” and “Revision date” are located in a footer at the bottom of each page. A record of revisions is maintained on page i of vii, which also describes a brief summary of the primary reason for the new “Revision.” However; the new “Revision” may incorporate any number of major or minor changes to the manual since the last “Revision.” Significant changes or modifications from the prior “Revision” are identified with the symbol ¹; enlarged and placed in the right-hand margin adjacent to the changed content. Corrections of typos and other minor fixes not affecting the original content’s meaning are not typically identified.

2. THE PDS FOUNDATION

The PDS provides a “Deliverable-oriented” Stage-gated process methodology to guide Project Teams on what is needed to deliver successful Penn State University projects. To meet the challenge, the PDS enables the Project Teams to:

- Consistently frame Capital Asset Needs to align with Penn State Objectives and Strategies.
- Continuously improve the selection and development of projects by defining Project Objectives required to meet Penn State Capital Asset Needs.
- Improve the delivery of new and enhanced assets and promote wise stewardship of the University’s existing assets in support of the University’s mission of teaching, research, and service

The following seven principles have driven the development of the PDS. These are the foundation and the fundamental assumptions that have been brought to bear on the process of developing the system:

2.1. University and OPP values

Project Leaders and Project Teams must know, understand and endorse Penn State University and OPP values. It is their role to motivate personnel under their leadership to commit to these values.

2.2. Project execution always complies with University Policies

Project execution must always comply with Penn State University and OPP Policies.

2.3. PSU Projects are managed using the PDS Stage Gated Process

All Projects are managed using the PDS Stage Gated Process. The PDS Stage Gated Process is a structured process for implementing projects in progressive stages, with corresponding Deliverables. The Process refines the design concepts, scope, cost and schedule. At the end of each Stage, a Gate is set where the associated Deliverables are reviewed. This process allows:

- In the Planning and Development Phases to plan and define project scope. Also, to minimize costs, delays and risks and to provide timely decision-making information to determine whether or not to pursue the Project;
- In the Construction and Closeout and Turnover Stages, to deploy cohesive and top performance in order to maximize project capital effectiveness.

2.4. Systematic Planning and Controls throughout Project Cycle

Meticulous application of a systematic planning and controls process throughout the Project Cycle is a fundamental prerequisite to create a “no-surprise” environment for Project Stakeholders and to deliver capital effective projects.

2.5. Make the Right Decisions at the Right Time

The PDS is designed to develop information in a structured and sequenced manner to facilitate decision-making in a stage-wise manner.

2.6. Early Involvement in Operations Planning

Planning and Operations personnel are to become involved at the Capital Planning Stage and throughout the subsequent Stages in order to:

- Ensure space requirements and experience from other facilities is brought to bear in concept development and engineering. Also, to ensure documents, project scope, and criteria decisions are made according to the capital needs;
- Provide need requirements and maintenance and engineering information for Operations Readiness Plans.
-

2.7. People and Diversity make the System Robust

PDS is a process requiring the strengths associated with cross-functional integrated project teams to achieve project objectives and success. The teams can also ensure its continuous improvement.

3. PROJECT DEVELOPMENT AND EXECUTION

The Office of Physical Plant (OPP) and HMC Facilities Planning and Construction are responsible for using the PDS to develop and execute projects.

4. PROJECT DELIVERY TEAM STAKEHOLDERS

A stakeholder, as defined by the Project Management Institute is a “Person or *organization* (e.g., *customer*, *sponsor*, *performing organization* or the *public*) that is actively involved in the *project*, or whose interests may be positively or negatively affected by execution or completion of the project. A stakeholder may also exert influence over the project and its *deliverables*.”

To use this Guidebook, it is important to understand the roles and responsibilities of the different groups and individuals involved in OPP’s project delivery process as key stakeholders shaping the outcome of projects. Serious problems can occur when project participants do not understand other roles. For example, when University Administration is unfamiliar with the technical implications of decisions, other members of the Core Project team often have to provide explanations. There is a sharp contrast between managing a project through a number of relatively independent decisions by separate decision-makers, and an integrated approach that includes thorough follow-up.

In the broadest sense, the Expanded Project Delivery Team consists of a diverse and wide range of project stakeholders including: the Board of Trustees, HMC, Penn State

representatives, the OPP, Service Providers, Permitting Agencies, Customers, Facility Coordinators and Service Desk Coordinators. These stakeholder groups come from both internal and external sources, and all exert influence over the project and its deliverables. It is also important to understand day-to-day management of a project is conducted by a Core Project Team, and guidance to them is provided by a Project Sponsor and sometimes a Steering Committee for complex projects. Key decision-making and approval authority for specific Deliverables are the responsibility of the Project Team. Finally, a Project Decision Review Board (PDRB) convenes to make project decisions on whether to continue or not. Each of these stakeholder groups is briefly discussed below.

4.1. Board of Trustees

Penn State's Board of Trustees (BOT) is an integral part of the project team. While they are not directly involved in a project's delivery on a day-to-day basis, an information package is required to inform the BOT about projects between \$5,000,000 and \$10,000,000. BOT approval is required for full funding for all projects larger than \$10,000,000.

Presentations for and coordination of these approvals are essential to a successfully delivered project. From a scheduling perspective, it is important to note that the BOT meetings are typically bi-monthly and a BOT Presentation Package must be prepared a minimum of 4 weeks in advance of the meeting to facilitate PSU executive review and BOT pre-reading requirements.

Projects at HMC have additional approval requirements including the HMC Board of Directors.

4.2. Penn State Representatives

The Penn State representatives come from both the user group and senior leadership at Penn State. The user group refers to the eventual occupants of the building who are an important contributor to the project team, providing input to ensure the completed project meets their needs. The user group includes faculty, staff, and students, and is organized to collectively speak to the Project Team through the Facility Coordinator/Director of Business Services (DBS) and/or through a Department Head (Dean or Administrative Unit Leader)/Chancellor. Senior leadership contributes to the project team through communication of project financing as well as project approvals.

4.3. PSH/COM

Penn State Health and the College of Medicine have responsibility to develop and execute Hershey campus projects³.

4.4. OPP Representatives

OPP assigns a project leader and some Core Team members; they have responsibility to develop and execute projects at University Park and Commonwealth campuses. In addition, OPP Internal customers are those customers within the Office of Physical Plant whose needs and requirements must also be considered during project development and execution. Some examples of our internal customers include Operations, Planning Design and Properties, and Energy and Engineering. The needs

of these units will become more evident in the later sections of the Guidebook.

4.5. Service Providers

The service provider includes design and construction professionals and consultants that have been contracted by OPP. Examples of service providers are architects, engineers, contractors, construction managers and commissioning agents. The service provider implements the design and construction through input and guidance from OPP and Penn State.

4.6. Permitting Agencies

Similar to the BOT, permitting agencies are a very important part of the project team, while not being involved in day-to-day project delivery activities. Inspections, reviews, and approvals from permitting agencies including the Pennsylvania Department of Labor and Industry (L&I), are required throughout the project. A project delivery team must consider the time associated with these approvals in their project planning and scheduling.

4.7. Customers

The Office of Physical Plant is a customer-focused organization whose purpose is to serve the University community in accomplishing the design, construction, maintenance and overall facility management for our customers. What is a "Customer?" - The dictionary definition of Customer is anyone who purchases a product or a service or anyone with whom a person has to deal. A much broader definition of Customer is an individual, organizations or governing body, which has needs or requirements you can meet by performing your assigned duties. Customers can be internal to the organization or external to the organization.

The external customers are the many colleges, units, and students at the University. Each college/unit has specific facility needs ranging from a simple maintenance request to the construction of a large complex laboratory building. OPP is the vehicle used by customers to meet those needs. If the broader definition of Customer is used, external customers include the governing bodies, which identify the requirements you will need to satisfy in the management and administration of the work.

4.8. Facility Coordinators

At UP, the University has developed a network of individuals among the colleges and units, which act as the primary point of contact for facilities work. The Facility Coordinators are the liaison on all project related work. Facility Coordinators work closely with the Project Managers and Project Coordinators. This individual is charged with monitoring all project activity within the unit. All project requests are routed via the Facility Coordinator to the Office of Physical Plant. Additionally, all formal correspondence pertaining to a project is routed to the Facility Coordinator from OPP. (In many instances, the Facility Coordinator will identify appropriate individuals within a specific department to work with OPP on program details.) Facilities Coordinator, Budget Executive/Budget Administrator, and Financial Officer signatures are required to move projects to the next project stage within OPP and for funding authorization.

4.9. Service Desk Coordinators

Service Desk Coordinators are the individuals within the colleges and units who are the individuals within each building responsible for identifying maintenance related work within the facility. Service Desk Coordinators work closely with the Area Services Supervisors.

4.10. Core Project Delivery Team

On a project level, Projects are led by a Project Leader, either a Project Manager or a Project Coordinator, with the rest of the Core Project Delivery Team assisting to manage the project.

A Core Project Delivery Team should be formed for most projects, but this decision is made jointly by the Project Sponsor and Vice President of OPP. For most projects, Core Project Delivery Teams are accountable and responsible to deliver projects - not the Project Leaders alone. The reasons for this lie in the fact that while a Project Leader provides team leadership, teams are better able to solve problems, more productive in delivering existing services through cross-functional representation without delays, and better at projects.¹

The Project Leader is selected from the appropriate department. The additional Core Project Delivery Team members are selected by various OPP and Penn State Directors and include both internal and external resources. The Core Project Delivery Team, including the Project Leader, usually consists of between 4 and 7 cross-functional designated key personnel, with the Team configuration being flexible to the needs of the project. Due to unique nature of projects Core Project Delivery Team roles vary according to the project. However, similar project types typically have very similar roles, so these Teams will be markedly similar in their membership make-up. Initial membership is selected in the early Programming Stage, but additional team members will join the Core Project Delivery Team when appropriate (e.g., Construction Manager may join the core team in the Schematic Design Stage or later).

4.10.1. Purpose of Project Team Approach

The purpose of utilizing a Team approach in projects is to have:

- Necessary resources available when needed
- Input from all affected parts of organization considered at all stages of project
- No “hand-off” gaps from one functional group to another

¹ 1996 Survey by Mercer Management Consulting, Inc

4.10.2. Teams Outperform Individuals When

Teams Outperform Individuals when the project is:

- Complex, both for planning and implementation;
- Involves many ideas and a lot of data; and
- Creative solutions are required

4.10.3. Responsibilities of the Core Project Delivery Team

The responsibilities of the Core Project Delivery Team include:

- Representing their functional areas in Project matters
- Designing the project plan, and being responsible for its implementation
- Being accountable for Stage Deliverables and Project Specific Deliverables
- Procurement of all necessary items for project
- Completing required project documentation
- Planning tasks and deliverables within their functional area
- Development and ensuring quality of assigned deliverables
- Managing other project resources in their functional area

4.10.4. Staffing the Core Project Delivery Team

In staffing the Core Project Delivery Team, the Essential Roles to consider include:

- Project Leader - Project Manager or Project Coordinator
- Lead Engineer or Technical Representative
- Construction Services Representative
- Facility Coordinator
- Area Services Supervisor
- EHS Representative
- Construction Manager or General Contractor
- Architect/Engineer

4.10.5. Characteristics of Successful Core Project Delivery Team

The qualities of a successful Core Project Delivery Team are:

- Leader able to listen, synthesize, and motivate
- Trust and “cohesiveness” felt by members;
- differences discussed honestly; creativity encouraged
- Job titles do not interfere with team functioning
- All are committed to the project’s success
- Expectations, roles, and responsibilities are clear
- Patience, tolerance, and respect for all viewpoints, ideas, and feelings
- Emphasis on communication, cooperation, collaboration

| Stakeholder | Critical Project Function |
|---|---|
| Board of Trustees / PSH/COM Board of Directors | Ultimate authority that authorizes Architect selection and full funding allowing construction to begin for projects >\$10 million ^{1,3} |
| PDRB (Project Decision Review Board) | Decision making board that authorizes project development to advance beyond a hard gate or to be submitted to the Board of Trustees (or the HMC Board of Directors when applicable) |
| Project Sponsor | Provides the Core Team additional insight into project expectations and requirements; acts as a liaison with senior executives; advocates for or provides critical resources. |
| Project Leader | Person assigned responsibility for project development and execution (typically a Project Manager or Project Coordinator). The Project Leader provides leadership for the core team. |
| Core Project Team | Core Team members are subject matter experts in their fields. They can make project related decisions representing their respective functional areas. Core Project Team members may be full or part time and may be internal or external resources. |
| OPP / PSH/COM Directors (e.g., Design & Construction) | Directors provide management oversight to project personnel and are responsible for appropriate use (and maintenance) of the PDS. |
| Facility Coordinators (FCs) | At University Park, FCs act as the primary point of contact for facilities work and are the customer liaison monitoring all project activity within the unit (e.g., Education, Engineering, Libraries) |
| Service Providers | Design and construction professionals and consultants that have been contracted to provide service for a project (e.g., architects, engineers, contractors, commissioning agents). |

Figure 1: Stakeholders and their Critical Project Functions

4.11. The Role of Project Sponsors and Steering Committees

As defined by PMI, the Project Sponsor is “The person or group that provides the financial resources, in cash or in kind, for the *project*.” Project Sponsors provide the Project Team with clarification or interpretation of decisions from senior management. The Project Sponsor provides the Steering Committee with additional insights into project functioning, and act as a liaison between Core Project Team & Steering Committee (senior management). Project Sponsors are usually higher ranking than team members, and for strategically important efforts, the sponsor should be a senior executive.

Note: The Project Sponsor is **Not** the Project Leader or a member of the Project Team – the Sponsor is a resource for the team. To assist them in achieving their objectives

The Project Steering Committee, as used in this Guidebook, is described as a group of persons selected by Project PDRB (Project Decision Review Board), described in Section 4.11, whose role is to support the Project Leadership Team in decision-making and in the relationship with higher decision Authorities. Not all projects will be assigned a Steering Committee by the PDRB (Project Decision review Board); usually they are assigned to the most complex projects.

4.12. The Project Decision Review Board (PDRB)

PDRB is an industry best practice to achieve optimal major projects oversight. The Penn State University PDRB is convened monthly to review and make decisions about the portfolio of Major (usually \$5,000,000 or greater) or selected critical projects.

5. INTRODUCTION OF THE PROJECT DELIVERY SYSTEM

The Project Life-cycle is the most meaningful framework for discussing, understanding and processing projects from initial recognition to successful conclusion. The Project Life-cycle is divided into Phases and Stages, which are divisions of sequential time periods. The Project Life-cycle covers the complete Project cycle from ideation and project planning and screening activities to Project completion. The Penn State PDS Stage Gate Process is based on a high-level segmentation and sequencing of Project activities – stages separated by decision points – in order to guide Project activities and gather information for sound management decisions.

Phases are high level groups of stages, and are the largest logical collections of related work activity divisions of the Project Life-cycle breakdown of the PDS Stage Gated Process. An overview of the Project Phases is provided in Section 5.6 of the Guidebook. There are four project phases in Penn State’s PDS Stage Gated Process, these are:

| | |
|----------|-------------|
| Planning | Development |
| Delivery | Operations |

A Stage is a subset of a Phase. It is the second level breakdown of the PDS Stage Gated Process. A Stage consists of the necessary activities to ensure preparation and the gathering of the Deliverables required at the Gate marking the end of the Stage. Each Stage requires specific tasks to be performed and deliverables to be produced prior to obtaining approvals to move forward. These tasks, deliverables, and approvals combine to create an organized set of process controls representing the actual process used by OPP, and based on best practices and industry standards for building delivery processes. Stages divide the effort into distinct related activities, separated by management decision gates. Project Teams must complete prescribed Deliverables in each stage prior to obtaining management approval to proceed into the next stage. This collection of project phases and stages, and their names and numbers, have been determined by Penn State OPP's project control needs.

Integral to the Penn State PDS Stage Gated process is the incorporation of industry best practice FEL (Front-End-Loading), sometimes called Front-End-Planning. This is a specific process that considers a company's financial resources, facilities, people and organizations in order to translate a company's marketing and technological opportunities into Projects. It is best applied when a need, and an analysis to determine the best solution, or alternative ideas to address the need is required. Projects that have been pre-determined, and require little analysis to select the best alternative to solve the need will utilize appropriate pieces of this best practice and skip those steps which are not applicable.

The primary objective of FEL is to achieve an understanding of the proposed Project that is sufficiently detailed so that changes in the program, design, construction and startup phases will be minimized. Key products of the front-end loading phase include: (4) design and engineering documents, (2) a strategy for executing the Project, (3) cost estimates, and (1) agreement by all University functions regarding the Project's objectives and scope.

The four FEL stages are:

- FEL 0 - Identify the needs, often called "Pre-Concept"
- FEL 1 - Identify and assess the opportunity, often called "Concept"
- FEL 2 - Generate and select alternatives, often called "Pre-Feasibility"
- FEL 3 - Develop the preferred alternative, often called "Feasibility" or Front End Engineering Design (FEED)

The figure below illustrates the Penn State Stage Gate Process Phases with respective Stages, FEL Stages, and their associated gates for project decisions used in managing projects.

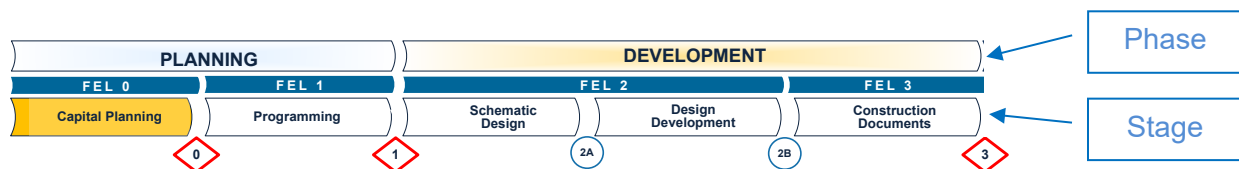


Figure 2: Project Delivery Phases / Stages

5.1. Stage Gated Process

Stage gate is a widely employed process management tool which relies on a “stages and gates” approach. A stage-gated process is a road map for moving a project from idea to production. Stages divide the effort into distinct related activities, separated by management decision gates. Project Teams must complete prescribed Deliverables in each stage prior to obtaining management approval to proceed into the next stage. The Stage-gated process breaks the Project cycle into distinct time-sequenced stages separated by management decision points called gates. Each stage:

Consists of sets of parallel activities undertaken by the different functional areas of the University;

Is designed to gather information needed and complete key Deliverables to advance the Project to the next decision point (gate);

Is cross-functional; more than one functional area is involved.

The stage-gated process is the framework for good Project Management practices promoting the efficient progression of a Project from idea to fruition by:

- Building into the Project processes high quality execution through timely generation of all necessary Deliverables for sound decision making and advancing the Project;
- Reducing uncertainties at each successive stage by minimizing risk;
- Stopping poor projects as early as possible to avoid project failure and waste;
- Gathering information needed and completing key Deliverables to advance the project to the next decision point, or Gate.

All University personnel, and especially those responsible for managing personnel involved in OPP Projects, have the responsibility to ensure application of the Penn State PDS Stage-Gated Process across all functions.

5.2. Benefits of Stage Gated Process

Adherence to the stage-gated process, in combination with good project management practices, will result in significant gains to Penn State University. The discipline of the Stage-gated process promotes better control. It encourages Deliverables to be produced at the right time and right level of detail, enabling optimum decisions by the right people, leading to improved project performance and ultimately to improved project delivery results and capital effectiveness.

Stage Gate = Reduced Project Costs & Project Cycle Duration → Improved Capital Effectiveness

The stage-gated process is one of the proven drivers of project effectiveness. It contributes to project success factors including better portfolio management, thorough and timely project definition, and increased University control by:

- Up-front, well-sequenced pre-work;

- Definition and specification of Deliverables to gates;
- Objective Go / No Go decisions using consistent metrics;
- Level of detail required to the Project Stage and each Stage Gate;
- Completeness and quality of execution throughout; and
- Effective resource allocation and use.

Adherence to stage gated process, in combination with good project management practices, results in better project results. The stage gated process discipline promotes:

- better project control
- ensures deliverables produced at the right time
- Enables optimum decisions by the right people
- leads to improved Project performance and ultimately improved capital effectiveness

In conclusion, the stage-gated process forces a disciplined decision-making process for early Go / No Go Project decisions. The goal is to quickly stop projects that won't meet the University's financial requirements or that are inconsistent with its values. It also provides project Teams with a road map for delivering successful projects; increasing the level of definition of solution and benefits as the project proceeds.

5.3. Project Gates

As shown in Figure 2 earlier, within phases and stages of the Project Cycle, are 8 gates: six Major Gates where important Go / No Go / Hold / Redirect decisions about the Project are made, and two Minor Gates or Sub-Gates that are Deliverables check points. Once the initial Project Planning Stage has been completed for a potential project, and between every stage of the project thereafter is a gate where all available project information is brought together for project and business decision making.

A gate is a quality-control checkpoint of Project Deliverables (Minor Gate), or a Go / No Go / Conditional / Redirect decision point (Major Gate), where the decision could be to:

- Allow the Project to proceed to the next Gate (with or without conditions);
- Redirect to complete some of the Deliverables;
- Hold (shelve) the Project;
- Terminate the Project.

The conclusion of a Project stage is marked by a Gate review of Deliverables, Project performance and viability in order to:

- Determine if the Project should continue into the next stage, and/or
- Detect and correct errors and/or omissions.

As illustrated in Figure 3, Gates have a common structure consisting of three main elements:

- A set of required Deliverables, e.g., what the Project Leader - and the Team must bring to the Gate Passage Process or decision point;

- A Gate Passage Process where the Project is assessed against Criteria, leading to a decision. These criteria can include Project specific must-meet and should-meet criteria and Deliverables, as well as Penn State PDS Deliverables and controls criteria;
- A set of technical and managerial University requirements that will serve as the basis to carry out the next Project stage.

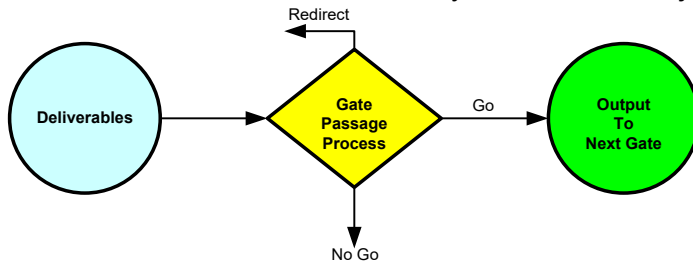


Figure 3: Generic gate

Three Major Gates (Stage Gate 0, 1 and 3) and Sub-Gate (Stage Gates 2A) are important Go / No Go management decision points where the PDRB Gatekeepers analyze the business environment, the Project drivers, and Stage Deliverables. A Gatekeeper is an individual or a group of persons whose role is to evaluate the compliance of required Deliverables at Major Gates and recommend actions and path forward. At these Gates, Gatekeeping is accomplished by checking the Project Deliverables to ensure they are completed according to Penn State PDS Stage-Gated Process requirements. The quality of Deliverables is also evaluated and resources are allocated. Poor Projects are terminated before additional resources are wasted. Based on gate-specific passage criteria, a decision is then made on whether or not the Project will proceed to the next stage. Major Gates 5 and 6 are Director level Gate Reviews, not requiring the PDRB as discussed in Section 4.11.

The primary purpose of each Gate is described in Figure 4, below:

| Phase | Gate | Gate Purpose |
|-------------|---|--|
| Planning | Major-Gate 0 Capital Planning | To determine whether proposed solution to need warrants a more detailed investigation and assessment, and to do a ranking of Project ideas in order to signal a tentative or sometimes firm commitment to pursue the appropriate opportunities. |
| | Major-Gate 1 Programming | To ensure there are no “showstoppers” related to EHS, political, economic, labor or other major risks. To confirm core project team, cost estimate and completion of Programming and agreement on Initial Project Charter; and confirm approval of Designer selection. |
| Development | Sub-Gate 2A Schematic Design | To confirm alternative solutions to needs thoroughly investigated, refined alternatives to a single concept that satisfies the program and schematic design approval. |
| | Sub-Gate 2B Design Development | To confirm preliminary design documents, final opportunity was provided for user input into design, and Final Project Charter with project scope and design freeze authorization. |
| | Major Gate 3 Construction Documents | To confirm critical Agreements and local authorizations are firm; Integrated Project Plans finalized; all required information to approve full funds provided; and to authorize full Project Funding, allowing proceeding with Detailed Engineering, Procurement and Construction activities of the Delivery Phase. |
| Delivery | Major Gate 4 Construction | To confirm Construction substantially completed; compliance and regulatory compliance completed; the Contractor has handed over part of the new facilities and Operations is ready to fully accept the facilities; Commissioning and Production Ramp-up activities have been completed. It gives the signal to fully Closeout and Turnover the facilities to Operations. |
| | Major-Gate 5 Closeout & Turnover | To validate the mechanical completion of the new facilities, as agreed between the Contractor and Penn State, and to validate the facilities are built and installed in compliance with design, specifications and all applicable standards. To confirm Penn State Operations is ready to assume full care, custody and control of the new Facilities. |
| Operation | Major Gate 6 Operations & Maintenance | To demonstrate that Project objectives have been reached, bond inspections have been completed, warranty issues have been resolved, B & G and Operations are now the primary contact for the User Group within OPP, that the Project files can be completely closed and new facilities are accepted. |

Figure 4: Gate Purpose Table

5.4. The Role of the Project Decision Review Board (PDRB)

The PDRB is designed to make Go / No Go / Hold / Redirect project decisions at Stage Gates 0 through 3. Stage Gate 4 is primarily intended to provide the PDRB with an update on the project delivery status. Project Presenters are invited to attend and present at PDRB reviews as required.

Stage Gates 5 & 6 requires Director level reviews to formally accept closing projects and transferring accountabilities. The PDRB does not typically review these Stage Gates. They are reviewed by the Design and Construction and Building and Grounds Directors to insure proper project completion and closure.

The Penn State PDRB is composed of a core senior leadership membership, with additional members joining as appropriate to the stage, type and location of project.

The core PDRB consists of the:

President – PDRB Chair

Senior Vice President for Finance and Business

Provost

Associate Vice President for Finance/Corporate Controller ²

Senior Vice President for Development and Alumni Relations ²

Vice President for Physical Plant OPP – PDRB Secretary

Budget Officer ²

Student Representative ²

Stage Gate 0 is primarily for approval of a selection of projects to be further developed, and therefore this is a strategic decision making Gate, where projects are selected to enter into the active project portfolio. For Hershey Medical Center projects, the HMC CEO attends the PDRB.

Stage Gate 0 PDRB:

President – PDRB Chair

Senior Vice President for Finance and Business

Provost

Associate Vice President for Finance/Corporate Controller ²

Senior Vice President for Development and Alumni Relations ²

Vice President for Physical Plant OPP – PDRB Secretary

Budget Officer

Student Representative ²

Invited Guests:

Vice President for Commonwealth Campuses ²

HMC CEO (HMC Projects)

Stage Gate 1 is primarily to accept individual programs and Project Charters, and to make decisions about continuing to develop them in the Development Phase. At Stage Gate 1, 2A, 2B, and 3, in addition to the core PDRB, the Senior Vice President Development may again be a part of the PDRB in projects involving significant donor funding. The principal “User” (e.g., Dean, Chancellor, Vice Presidents, AD) will also attend the PDRB for associated project decisions at these Stage Gates. At HMC, The Executive Steering Committee and Capital Planning are part of the PDRB.

Stage Gate 1 – 3 PDRB:

President – PDRB Chair

Senior Vice President for Finance and Business

Provost

Associate Vice President for Finance/Corporate Controller ²

Senior Vice President for Development and Alumni Relations ²

Vice President for Physical Plant OPP – PDRB Secretary

Budget Officer ²

Student Representative ²

Invited Guests:

“User” (e.g., Dean, Chancellor, Vice Presidents, AD)

Executive Steering Committee and Capital planning (HMC Projects)

Vice President for Commonwealth Campuses ²

The PDRB:

ensures the major assumptions are valid and consistent across the portfolio;

decides if the potential rewards are worth the potential risks;

prioritizes competing projects from available (often incomplete) information;

when necessary makes the difficult decision to stop a project that for whatever reason should no longer continue to be developed.

PDRB Project Cost Overrun Responsibilities are to:

Ensure the project teams understand in sufficient detail why the project was unable to keep its commitment to remain within the approved budget;

Understand what corrective actions are already in place and what is planned to ensure the project meets all authorization expectations (promises);

Decide if the Project should continue at the newly proposed funding level;

Ensure Projects do not go back to the board without PDRB approval.

Stage Gate 4 – 6 PDRB:

The PDRB is briefly informed about the Project Delivery status at Stage Gates 4. Gate 4 provides an opportunity for the PDRB to compare expected results to what was actually achieved.³

5.5. Project Size and Scalability

The PDS Stage-Gated Process is the same for both Mid-Sized and Major projects. Project scalability is achieved very simply by adjusting the Stage Deliverables requirements as necessary. Every Project Stage Deliverable is fully described in Part II of this Guidebook, including any requirement differences related to project size.

Small-Sized projects of less than \$1,000,000 are not specifically covered in this Guidebook. This should not be taken as indication smaller projects are less important; they make up almost 90% of the Universities projects, and it is essential they be successfully delivered. However, due to the sheer scale, larger projects require more project management and decision making rigor, and this Guidebook is aimed at describing what is needed to accomplish them. This Guidebook can be used to sequence Small-Sized project Stage Deliverables, scaling down their requirements as needed. Since smaller projects require less rigor and management decisions, fewer stages and decision points, or Stage Gates, are required. As a recommendation, the three Development Stages could be combined into one Stage, and the Construction and Closeout Stages could similarly be combined on smaller projects.

This Guidebook takes into consideration project size and scalability as important factors in successfully delivering projects. Project size, in terms of its cost, can adequately be used to determine the amount of rigor required to successfully accomplish it. The amount of rigor required can be scaled for the size of a project. Generally, the larger the project, the more rigor required to achieve the project. Penn State has grouped its projects into three broad categories for financial and project management scaling purposes, as defined below:

- Small-Sized Projects, those under \$1,000,000 -- modified PDS ¹
- Mid-Sized Projects, those greater than \$1,000,000 and under \$5,000,000 – modified PDS ¹
- Major Project, those over \$5,000,000 – PDS to be applied as designed ¹

The rigor of a project can be scaled according to its cost, but its complexity should also be taken into account. For instance, what if a project to convert a classroom into a state-of-the-art medical laboratory clean-room expected to cost \$4,900,000 was compared to a project to construct two adjoining soccer fields on existing farmland for \$5,000,000. Is project complexity the same?

This Guidebook is designed to simplify project scalability by first scaling projects according to the three Project Cost Size Categories, and then possibly adjusting for judged complexity. Directors have the prerogative to move projects to different sized categories according to their judgments to better scale project rigor to size and complexity.

In the project example given above, it's possible the medical laboratory clean-room conversion is judged to be much more complex than the soccer field construction. The Director could decide to treat the laboratory clean-room conversion as a Major project, even though it's sized as a Mid-Sized project. The Director could also decide the soccer field project, sized as a Major project, should be treated as a Mid-Sized project because it's only moderately complex.

5.6. Front End Loading (FEL) Approach

IPA (Independent Project Analysis, Inc.) is a preeminent consultancy in project evaluation and in project system benchmarking for capital projects, and has become an industry leader in quantitative analysis of project management systems. IPA describes FEL (Front-End Loading) as the “process by which a company translates its marketing and technological opportunities into capital projects.” These early project planning principles have been incorporated into the PDS, into a compatible process adopted by the University. Some organizations such as the CII (Construction Industry Institute) call this process “Front End Planning,” and others in the project management field simply call it good early project planning. The objective of each nevertheless is a detailed understanding of the project in order to meet business objectives while minimizing changes during later phases of project execution. However, FEL is a specific process that considers business entities financial resources, facilities, people and organizations in order to translate its marketing, technological opportunities and problem solving into projects. The primary objective of FEL is to achieve an understanding of the proposed project that is sufficiently detailed so that changes in the Project Execution and start-up will be minimized. It is important that a quality Work Plan be developed and approved at the beginning of each FEL Phase. Key components of the FEL are illustrated in Figure 5. The key components of FEL include:

- Understanding site factors;
- Engineering definition; and
- Project Execution Plan.

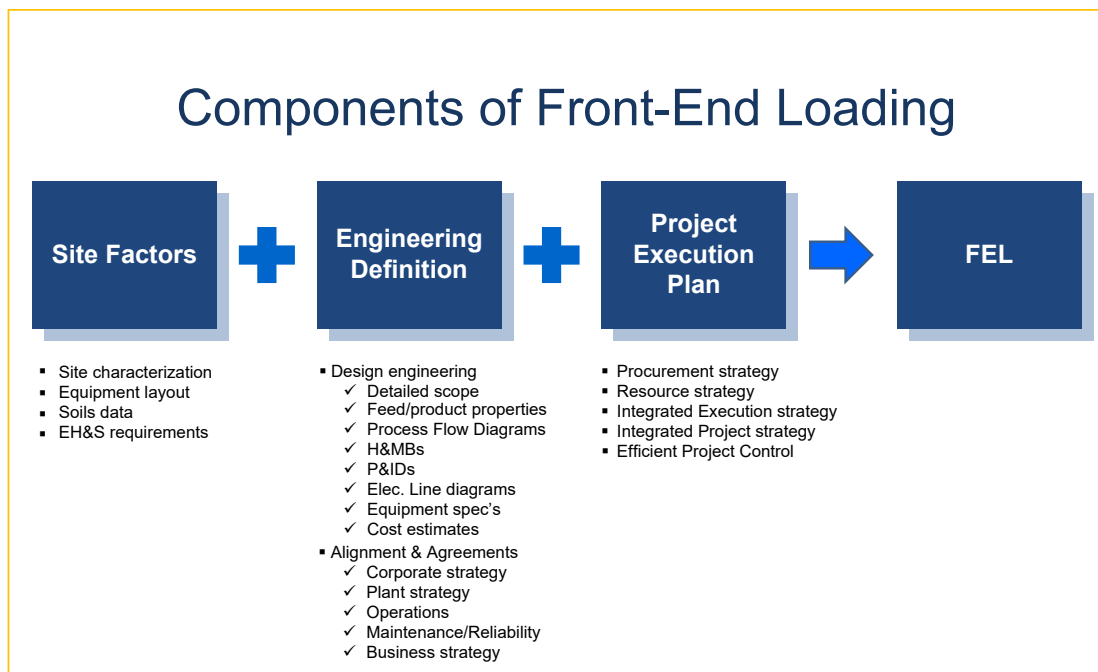


Figure 5: Components of Front-End Loading

Source: Independent Project Analysis, Inc.

The adoption of the FEL approach is based on the recognition that early decisions have the greatest effect on project outcomes. The decreasing ability to influence project costs and duration as the project progresses is illustrated in Figure 6. Key decisions made early in the FEL drive downstream design and engineering tasks, govern operability, performance and economics of facility operations.

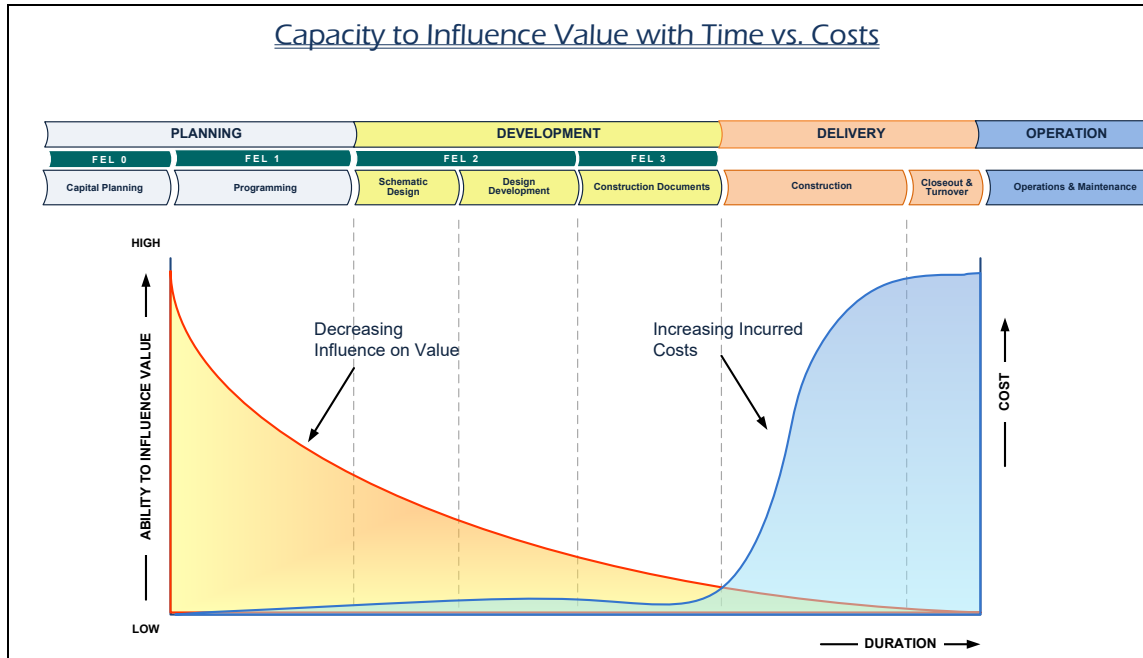


Figure 6: Capacity to Influence Value with Time vs. Costs

Sound FEL studies offer the best opportunity to minimize capital expenditure because:

- Redefinition and adjustments to project criteria and scope are preferably made at a time when they have the least financial impact on the project; that is, before Project Execution;
- Completion of quality FEL studies results in well-defined criteria, scope and plans for the rest of the project, which in turn results in more accurate estimates, lower contingencies, schedule reduction, earlier benefits, delivered with lower overall project costs;
- Upfront FEL efforts lead to substantial technical, operations and business savings in the Construction Stage, reduce uncertainty, as they result in efficiencies, eliminate redundant or premature tasks and ensure effective sequencing of activities.

The key elements of FEL are:

- The alignment of all University functions with regard to project objectives and scope;
- A set of design and engineering documents that incorporate site-specific conditions;
- A plan for executing the project;
- A cost estimate which is $\pm 10\%$ accurate;

- The completion of FEL should coincide with project authorization.

5.7. Project Phases

Penn State utilizes the Project Life Cycle as a framework for discussing, understanding and processing projects. Phases are the high-level chronological groups of stages, and are the largest divisions of a project time frame, generally useful for discussing project progress at a high level. Projects are further segmented into stages to provide better management control and appropriate integrative links to the ongoing operations. The four High level Project Phases are – Planning, Development, Delivery and Operation.

5.7.1. Planning Phase

The Planning Phase is the first phase of the Penn State PDS Stage-Gated Process and its main objectives are to align opportunities with business goals, and ensure that Projects passing Gate 1 – Programming, are based on sound strategic business decisions. Under the responsibility of the FRP or HMC OPP Division, depending upon the location, the Project Leader assumes leadership during the Planning Stage. The Project Leader will continue to lead the project throughout the entire Project Life-Cycle until its conclusion.

The Planning Phase is composed of two stages: Capital Planning and Programming.

The Goal of this Phase is to gain a prioritized listing of project opportunities aligned with business strategy, and then select the right projects to develop. The purpose is to assess different needs and opportunities, generate ideas for potential solutions, prioritize solution according to University strategy, and select the right solution ideas as projects.

The Capital Planning Stage is where University Strategies and plans are developed. It includes conducting needs and opportunities gap analysis to rule out (screen) projects that are not likely to be viable and don't fit Penn State University strategy or values. Ideas are developed and evaluated to provide enough information to enable Administration to make decisions on whether or not to pursue them. Recommendations are made for project selection decisions, which continue as projects in the Programming Stage, where a Core Project Team is assigned and the project officially initiated. Only projects with a reasonable chance of success and University fit can successfully pass into the Development Phase.

Much of the idea gathering in the Planning Phase isn't formalized. Ideas for projects can come from many sources including: University Administration, Faculty Staff, Students and donor sources. The Planning Phase is an important starting point in the Penn State PDS to identify ideas that could potentially achieve business goals or further University Objectives and Vision.

5.7.2. Development Phase

The Development Phase is the second phase of the Penn State PDS Stage-Gated Process. This Phase progresses from concept option selection, basic and detailed engineering and design, detailed project scope definition and fully integrated project planning and project funding authorization. This Phase prepares the project execution to be done right during the Delivery Phase.

The Development Phase is composed of three stages: Schematic Design, Design Development and Construction Documents.

The Goal of the Development Phase is to select and design the initial concept, develop the concept and complete project scope definition. The purpose of the Development Phase is to turn a solution idea into a preliminary or schematic design concept with alternative solutions to be analyzed so the best alternative solution can be selected to further develop, and to complete the detailed scope definition and design.

The Schematic Design Stage is where an initial design concept is developed and compared to alternative solutions, and the best one is selected as the Concept. In the Design Development Stage, this Concept is developed and project scope is progressed. In the Design Development Stage, the project scope and design are frozen, the final Project Charter and Execution plans are developed, and project full funds are requested.

5.7.3. Delivery Phase

The Delivery Phase is the third phase of the Penn State PDS Stage-Gated Process. Delivery is where the work of the project gets done, and includes the implementation of the project execution plan developed during the Development Phase. A detailed issues and opportunities log is maintained and tracked by the project team, and action items are implemented to quickly achieve and complete project goals. At the same time, functional operations personnel assume full responsibility for the asset. The phase ends when all project requirements and quality objectives have been achieved. The largest percent of total project cost is spent during the Delivery Phase.

The Delivery Phase is composed of two stages: Construction and Closeout & Turnover.

The goal of the Phase is to produce an operating asset, or delivered facility, consistent with the planned user satisfaction, project scope, cost and schedule. The purpose of the Delivery Phase is to construct, start-up, ramp-up, owner acceptance and turnover of the asset to the functional operations group and closing of the project.

The Construction Stage is where the detailed engineering and design are implemented and the construction is done to build/renovate the facility. In this stage, commissioning and start-up also occur, with occupants moving into the facility. Punch lists are created for any items requiring correction. In the Closeout and Turnover Stage the Facilities are inspected and accepted by the user, owner training on building and equipment is completed with punch lists completed.

5.7.4. Operation Phase

The Operation Phase includes Bond and Warranty inspections, user and maintenance turnovers, document archiving and project closing. Lessons learned are captured and retained for future project improvement and the final project report with an overall project performance assessment and cost reconciliation. The Certificate of Occupancy signals approval to occupy/use the facility.

5.8. Project Stages

Projects are further segmented from Project Phases into Stages to provide better management control and appropriate integrative links to the ongoing operations. The eight Project Stages are – Capital Planning, Programming, Schematic Design, Design Development, Construction Documents, Construction, Closeout and Turnover and Operations and Maintenance. The first Stage, Capital Planning, is a pre-project stage, often called Pre-Programming. The other seven Stages continue to plan, develop, execute and close the project. Each Stage is briefly described below. Accomplishment of each stage is according to the Deliverables described in Part II of this Guidebook.

5.8.1. Capital Planning Stage 0

The purpose of the Capital Planning Stage is to: Identify, prioritize and select project opportunities aligned with strategic plans. In this Stage, it is the responsibility of the Office of the Physical Plant to manage and provide an orderly and efficient approach to suggesting, reviewing, and judging the merit of new project ideas before significant resources are committed to projects, and to ensure resources get allocated to only worthwhile projects. The Capital Planning Stage is a pre-project stage, where ideas for potential projects are articulated into proposed solutions and business cases, which are then formulated into Initial Building Program Statements to be evaluated and selected to address University needs or requirements. Ideas are coming into the Senior Leadership from any of a number of sources, such as: the University strategic planning process, University Officers, Academic and Administrative University Departments, Schools, the Office of Physical Plant itself and University Donors. A University representative, sometimes representing a Donor, submits a proposal for a project that can solve a problem, address a need, or otherwise enhance the University's facilities, services or image. Business planning and portfolio management processes are being conducted; no project team activities yet take place, but a Project Leader leads this effort with assistance from either a "*Due-diligence Team*" used in review of non-University facilities, or a "*Building Assessment Team*".

The Office of the Physical Plant organizes these ideas into a portfolio of Initial Building Program Statements or project proposals for evaluation and selection. Potential sources of funding are identified for promising projects, along with rough order of magnitude screening estimates (-40%, +60%) and initial project budgets. Depending upon the current business conditions and specific situation, a time delay between projects' Initial Building Program Statements and selection and initiation may occur. The primary goals of this stage are to create a prioritized listing of potential project opportunities aligned with business strategy and to make

project selections for further development during the Programming Stage.

5.8.2. Programming Stage 1

The purpose of the Programming Stage is to: Initiate the project, establish a core project team, confirm project objectives, initiate planning processes for all aspects of the project and define the project scope in enough detail the design team can attempt to design within defined parameters of budget and time, create the Initial Project Charter and Integrated Project Plan, select a designer, compare and select the best concept to move forward, complete programming, define the key project success factors and prepare the project to be successful.

Programming is the written and graphical statement of the needs of the project upon which the design of the facility is based and its success judged. Starting with the space needs data developed through working closely with the client, Planning Design and Properties develops a detailed listing of all functional and physical needs of each space in the project along with other pertinent information necessary to comprehensively describe the project.

The programming phase usually begins with the Provost's development of the "Committee Charge Letter" with the aid of FR&P. The letter includes the estimated budget, square footage, general concept (scope), and general schedule for the entire project. At the beginning of the programming phase, FR&P remains accountable with the Project Leader taking the lead. Client involvement and input is very important from the outset as decisions made early in project delivery form the foundation for the remainder of the project. Early decisions have the greatest impact on project scope while costing the least to implement. It is much more feasible and cost-effective to identify scope needs during the planning phase than during the construction phase. At the beginning of Programming Stage the Core Team is assigned and the project is launched. The Project Leader works with the Project Sponsor to identify the necessary resources and team members needed to further develop and define the project objectives, goals and key project success parameters – Scope, Schedule, Cost and Quality. The Project Team reviews historical information, establishes a project repository and documents its charge in the form of an Initial Project Charter, based on the Building Program Statement and Business Case developed during the Capital Planning Stage.

The Programming Stage builds upon the work done in Project Capital Planning, through the development of an Integrated Project Plan and updated budget. During this Stage the Building Program Statement is completed, with all of the activities outlined under the Program Stage Workplan. Each section and subsection of the Building Program Statement is intended to provide adequate information for the selected professional team to understand the needs of the End User and the Office of Physical Plant. After a programming team is established, the site selection process (for new buildings only) can also begin. CP&D identifies "building

opportunities” at University Park and leads selection of a recommended site from these building opportunities based on factors such as pedestrian and vehicular access and parking, zoning, utility requirements and special site considerations.

The purpose of the Feasibility and Comparative Study is to study the various potential solution options that might satisfy the purpose of the original project objectives as outlined in the Initial Project Charter from the standpoint of costs, economic benefits, ease of construction, schedule impacts, as well as to re-confirm alignment with the business objectives. The end result of this Study will be to recommend the best Solution to further develop. Solution options are developed to the extent necessary to identify key site, utility, and building relationships; preliminary space requirements; and building systems. Alternative estimates and project schedules are prepared for each viable Solution option, and all viable Solution options become part of an Alternative Solution Analysis Study (Deliverable 1-14, Feasibility / Comparative Study). There is often a short hold-point while the Study, including a Solution recommendation, is presented to the requesting department and funding authority for selection of a preferred option to be developed in the Schematic Design Stage. At the end of the *Study*, the risk-adjusted Alternative estimate for the now selected Concept (Deliverable 1-15, Concept Cost Estimate) is compared with the Preliminary Budget estimate. If the Concept Choice estimate exceeds the Preliminary Budget estimate, either the scope must be revised to reduce the estimate, or a request must be made to proceed using a higher budget, or some combination thereof. Increases must be justified. This process will continue into the Development Stages until the project scope and design are frozen during the Design Development Stage and a Construction Documents Estimate provided with the Final Project Charter approved in the Construction Documents Stage. Once the final project budget is established at the end of the Design Development, further increases in scope are not allowed, and typically budget changes are not permitted unless justified based upon the further refined Construction Document Project Estimate.

The final phase of programming includes verification by the provost that the developed program fits with the University’s Strategy and budget. The Facilities Resources Committee provides the final approval to the program before the PDRB Stage Gate. The Program Statement is utilized to complete the Project Charter, which forms the basis of the user group’s expectations and goals for the completed project.

During the programming phase, a project delivery method is selected for the planned facility. The decision on which delivery method to use is made by Project Leader with input from the Director of D&C and other appropriate University parties. This decision is made based on a number of factors including the individual characteristics of the project, the project size, the required construction schedule, and the current state of the construction market. Common delivery methods utilized by PSU include: “Design, Bid, Build”, “Design, Bid, Build, Delivery” (Single Prime Contractor), “Construction Manager Agency”, and “Construction Manager at Risk”.

Approval of the Initial Project Charter by the Project Decision Review Board (PDRB) and other Stage Deliverables authorizes the designated team to continue with the Project in the Development Phase. The PDRB also considers the current business and project conditions before giving authorization to move into the Development Phase.

5.8.3. Schematic Design Stage 2A

The purpose of the Schematic Design Stage is to: gain approval of Schematic Design drawings validate the program, explore the most promising alternative design solutions, and provide a reasonable basis for analyzing the project cost and scope. During the Schematic Design Stage, the User Group has the opportunity to further detail specific requirements for the design option outlined in the program and evolving Project Charter.

The Schematic Design Stage is the first Stage of the Development Phase, and where the project accountability shifts from the Planning Design and Properties Division of OPP to Design and Construction Divisions. The primary objectives of the Development Phase are to progressively move through the Design Stages to complete the Project Definition through progressive engineering and design refinements, complete project planning and gain project execution funds. The Design Phase is broken down into three distinct Stages: *Schematic Design*, *Design Development* and *Construction Documents*. These Stages are a continuum of progressive design development, with a great deal of overlapping and considerable similarity, with assigned points of completion. If the cost estimates at each of the design stages result in a project cost greater than the project budget, then the project may need to be redesigned, by adjusting the scope, the budget, or combination thereof. Bids are solicited from contractors at the end of the Development Phase, and, again, redesign may be required if the bids result in a project cost that exceeds the budget.

Schematic design, also known as Sketch design, begins with Design Firm review of the program and OPP Design and Construction Standards or applicable design standards (fix this throughout), and Design Firm visits to the project site. After these reviews and visits, the Design Firm(s) provides a preliminary evaluation of the program, schedule, and construction budget requirements. Next, the Design Firm will present and review alternative approaches to project design and construction. These approaches will be reviewed during frequent meetings with the building committee and OPP until arriving at a clear, feasible concept that meets the project requirements and is approved by Penn State's project team. From the approved concept, schematic drawings are developed so that scope and budget can be understood and evaluated. These drawings, along with the Design Firm estimate of construction cost (adjusted for the projected bid date), and any other required documents are submitted by the Design Firm to Penn State for sketch design approval.

Schematic Design drawings are preliminary drawings. These drawings may be freehand sketches, but they should illustrate the project's character and emphasize such aspects as harmony with the surrounding area and any improvements, architectural style, exterior appearance, planning and zoning requirements and overall structural concepts. Civil engineers will commence site analysis and layout, based in part on legal and topographic surveys prepared as part of the Alternative Solution Analysis and Pre-Feasibility Studies, with some updating if necessary; features include existing structures, utilities, topography, soil conditions, parking, access, setback requirements, water features, drainage, and required easements. Surveyors will continue with on-site surveying and mapping. Special consultants may also be engaged with the schematic design; one example might be an acoustical expert to advise on layout and basic features of a large auditorium. Typically, 35% of the total planning and design effort has been expended upon completion of schematic design.

The design professional is responsible for producing a set of schematic drawings as well as a written report, for approval by the University. On a building project, the architect will take the lead in developing a design concept with plan, elevation and sectional views that meet the space and project requirements. Engineers will develop concepts of how the various systems will fit into the facility: foundation systems, cooling and heating systems and data communication systems.

Towards the end of the Schematic Design Stage, it is valuable to begin involving a commissioning agent in the project's design. By involving the commissioning agent in this early phase of design, OPP enables a substantial positive impact on project cost, quality, and performance that is not possible when a commissioning agent is employed starting with the construction phase.

To complete Schematic Design, the designer must obtain formal client approval that the sketch design satisfies needs and budget. The Project Leader shall obtain review comments from the entire review team, which generally includes all divisions of OPP; Office of Telecommunications; Safety and Disability Services; Classroom Committee; Customer units; and the University Insurance Carrier. The University President may also need to approve the Schematic Design. The size and type of project will determine review team makeup and number of reviews required. Review teams shall be informed of general project scope criteria. Reviews will encompass adherence to Penn State/OPP policies, OPP Design Handbook, and constructability. The Project Leader will coordinate all review comments through correspondence and/or scheduled meetings. Comments will be incorporated, resolved, or rejected by the review groups, and the Project Leader will inform reviewers of the results. The schedule for reviews typically is approximately two weeks.

5.8.4. Design Development Stage 2B

The purpose of the Design Development Stage is to further develop the selected Concept as a project, to freeze the project scope and the design in order to be able to complete planning and development in the next stage. It is re-confirmed the project meets the user's needs as well as the University's budgetary parameters. The project team further develops the planning, and project and design goals. The team progressively elaborates scope definition and develops the conceptual design and Concept estimate, along with a proposed schedule.

Design development activities flow naturally from, and are based on, documents produced during schematic design. The Stage begins after review and approval of the schematic design documents and approval from the PDRB. During preliminary design development, the design team works out a clear, coordinated description of all aspects of the design. These approaches will be reviewed during frequent meetings with the design team. The preliminary design documents fix building size, delineate and describe the various construction materials to be used, and indicate the structural, mechanical, and electrical systems upon which the design is based. All major issues with potential to cause significant re-study during the construction documents phase should be resolved before the end of the preliminary design phase.

The design firm prepares an estimate for the preliminary design phase, advising D&C of any adjustments to the sketch design estimate as previously determined. If the preliminary design estimate is not consistent with the previously approved budget, then a scope and budget realignment exercise is necessary. Work continues on the site plan, floor plans, exterior elevations and building sections, with detailed work on wall sections, structural floor plans, reflected ceilings and laboratory layouts. Mechanical, electrical and plumbing distribution design receives major emphasis. Code analysis work is updated and site utility, cost estimate and agency review efforts are expanded and refined. In addition, work on construction specifications is begun.

By comparison with schematic design, design development is specific and detailed. By the end of this step, most major decisions about the entire project are resolved. The design professional's submittal to the owner will generally consist of a written report and a set of detailed drawings. In addition, a more refined cost estimate will be required, based on preliminary quantities of the various elements of the finished project (cubic yards of concrete, square yards of paving, linear feet of cabling and pounds of steel), rather than overall area or volume measures as in earlier estimates. The report will include initial technical specifications, particularly proposed materials, to be refined later during development of contract documents. With the completion of design development, approximately 65% of the planning and design effort has been expended.

During preliminary design, an initial building code review is performed. This initial review is important in identifying major issues that could potentially delay the project if they are not recognized at this stage in design. A formal L&I review and approval of design documents is required prior to building construction, and this preliminary review is an essential step for a timely L&I design approval. The

preliminary Design phase is the last opportunity for major design input from the user group. Changes to the project scope or program after this milestone will incur added budget and schedule impacts. The development of construction contract documents can begin. Project Scope and design are frozen prior to ending this Stage.

5.8.5. Construction Documents Stage 3

The purposes of the Construction Documents Stage are to complete construction documents, achieve a Construction Cost Estimate, finalize the Project plan, gain BOT approval for funding the full project, and have a contractual agreement to execute the construction. At the end of this stage the contractor, or contractors, are selected, after which the work involved in procuring and assembling the physical parts can begin.

5.8.6. Construction Stage 4

The purpose of the Construction Stage is to: build the asset safely in alignment with its project scope and objectives. The Construction Stage implements the goals identified during the planning phase and defined during the development phase. The objective of the Construction phase is to safely build the project represented in the contract documents within the budget and schedule. The construction professionals are responsible for the buy-out of the construction contract components, and coordination of their delivery, construction and/or installation. This transformation of the project from drawings on paper into a physical building requires incorporation of materials, equipment, and skills into an orderly sequence of activities designed to achieve the finished project. Project Execution is where most of the resources are applied/expended on the project. A significant number of team members will join the project at the beginning of this phase. The primary task of the Project Leader during construction is to enable the Project Team to execute the tasks on the defined Project Schedule and develop the product or service the project is expected to deliver. The Project Leader uses the processes and plans prepared during Project Planning and Project Development to manage the project, while preparing the organization for the implementation of the product/service and for transitioning the product/service responsibility from the Project Team to the Performing Organization.

Inputs for the construction phase are 1) construction professionals to construct the facility and 2) bid documents, forming the basis of the construction professional's contract and representing the building to be constructed. The Project Leader ensures that the contractor has submitted all necessary materials, and issues a written request/approval for the contractor to begin work. The OPP Project Leader is the primary decision-maker for any issues related to the building program or major client requested scope changes. The Project Leader also is responsible for monitoring the over-all project budget¹.

Prior to commencement of the work, an Initial Job Conference is conducted to introduce all parties and to discuss and develop mutual understanding relative to administration of the project, general conduct of the work, progress schedules, and other contract procedures relating to the work.

Change and Budget Management: A change order is defined as the formal document that authorizes an adjustment (increase or decrease) to the contract amount, the project completion date or both.

Customer requests for changes shall be routed through the Project Leader. The Contractor then prepares a detailed proposal, including a breakdown of pricing that is then forwarded to the Professional for review. The Professional shall either forward the proposal with a recommendation for acceptance to the Project Leader or return it with comment to the contractor for revision.

Upon receipt of change order proposal from the Professional, the Project Leader shall review it for acceptability and completeness. If rejected, the Project Leader shall inform the Professional and the Contractor. If the proposal is accepted by the Project Leader, a change order request must be prepared and forwarded to the appropriate Contract Administration Office for initiation of a formal change order.

The Contract Administration Office shall perform a final review of the proposal and supporting documentation for conformance to contract requirements and if acceptable, initiate a formal change order document. The change order is transmitted to the contractor for signature and returned to the University. It is the Project Leader's responsibility to assure the presence of funding in the project budget.

L&I inspectors visit the site and examine construction progress to ensure the building is constructed in compliance with the construction documents which were reviewed and approved in the issuance of the building permit. Inspections are performed as outlined by the Building Permit.

Commissioning is a process for ensuring that the constructed facility and its systems are operated and maintained to perform in conformity with the design intent. While the commissioning process extends through all phases of a project, the primary physical work of commissioning occurs in the construction phase where the commissioning agent validates that building system performance meets the design intent.

Studies indicate that on average the operating costs of a commissioned building range from 8-20 percent below that of a non-commissioned building. The one-time investment in commissioning for a building (ranging from 0.5-1.5 percent of construction) is often quickly repaid through reduced operating costs over the life of the building.

The construction phase output is a completed facility and the corresponding punch-list delineating remaining minor construction work to be completed ¹.

5.8.7. Closeout and Turnover Stage 5

The purpose of the Closeout and Turnover Stage is to: facilitate the occupancy and turnover of the finished project to the user group and maintenance group and commence closing the project. During this phase, the PL coordinates occupant move-in, completion of the punch-list and commissioning, and O&M and occupant training. The PL also facilitates contractual closeout with the design and construction professionals. During the turnover period, the management responsibilities for the facility transfer from Design and Construction to Operations. The daily maintenance and building services activities become a part of the routine services provided by these divisions. In Project Closeout, the Project Team assesses the outcome of the project, as well as the performance of the Project Team and the Performing Agency. This is accomplished primarily through soliciting and evaluating feedback from Customers, Project Team members, Consumers and other stakeholders. The primary purpose of this assessment is to document best practices and lessons learned for use on future projects. Key project metrics are also captured to enable the Performing Organization to compare and evaluate performance measurements across projects.

The Project Leader coordinates move-in for the user group. Typically, professional movers are contracted to physically perform the work. Inevitably, there are items requiring modification and adjustment during the actual move-in and OPP personnel will assist building occupants during the move-in stage by arranging for minor modifications in telephone, computer and electrical outlet locations to accommodate departmental and individual needs. The turnover team will designate representatives to coordinate specific move times with the faculty, staff and students involved.

Contractor obligations regarding provision of training, including onsite Factory Representation, shall be as identified in the contract documents. Any training over and above that which is specified is at the option (and potential additional cost) of OPP. Any arrangement for such supplemental training shall be coordinated through the PL or Construction Services Representative (CSR). Project budgets shall, where appropriate, include a line item dollar amount for such supplemental training.

The operational and maintenance responsibility for the facility is turned over to Operations during this stage. All calls for service relating to the building should be directed to Operations. The Project Leader will be available to assist with resolution of warranty and post-occupancy construction issues.

The punch-list work items identified in the construction phase are completed by the contractor. Punch-lists are defined here as a written list documenting the results of an inspection and listing each item of the Work that is to be completed or corrected and affixing the time within which the deficiency is to be resolved. Punch-lists as defined here are intended to document ONLY those items that are the Contractor's responsibility, or for which responsibility has not yet been ascertained and could potentially be that of the Contractor. Punch-lists are NOT intended to address design-related issues assigned to OPP or the Professional, Customer requests, etc., which are not, or which have not yet, been incorporated into the scope of the Contractor's contractual responsibilities; such issues are generally addressed through other project mechanisms. Punch-lists should be issued and controlled through the PL or CSR, not through the Design Firm.

Commissioning in the turnover phase consists primarily of performance testing to verify that performance of the systems meets the objectives defined in the design intent. Building system O&M documentation is reviewed and approved by the designer and commissioning agent.

All formal training of OPP Tradespersons on equipment/systems on construction projects is to be coordinated and conducted through the CSR or PL. The CSR may, upon request, provide occasional assistance in arranging such training by providing names of contacts, suggestions for appropriate training, identification of new equipment that is unusual to the University.

When the punch list work is completed, the contractor will request a final inspection. This request is made in writing to the PL or CSR. A final inspection is then performed to ensure that all work is complete in accordance with the contract documents.

With the user group moved-in and all major contractual responsibilities completed, the PL finalizes the contractual closeout process for the project's service providers. Closeout ensures items such as warranties, guarantees, certifications, maintenance manuals, and as-built drawings are supplied to the appropriate parties (including archiving) by the service providers. The closeout of the service providers is only one step in the closeout of the project as projects at Penn State may remain active while equipment continues to be purchased or work is accomplished under other contracts or by in-house personnel to finalize the work

on the project.

The output from the turnover phase is an occupied, complete building. Importantly, the output also includes operations and maintenance staff and a user group that are trained in the building's operation¹.

5.8.8. Operations and Maintenance Stage 6

OPP's role in projects continues throughout the life of the building. The appropriate Operations division leads provision of building attendant and custodial services throughout the University. In addition, the Energy and Engineering division focuses their efforts on issues that deal with optimizing energy performance, reducing energy use, improving indoor air quality, and increasing occupant comfort and productivity. This is achieved primarily by ensuring that energy systems in a building are properly installed and operating optimally.

The operations phase begins when there is an occupied, contractually completed building input from the Turnover phase. For clarity, this manual assumes that all construction contract work is complete prior to the operations phase beginning. The only remaining interaction with the Contractor will be for work items are those that fall under the one-year warranty. The PL or CSR monitors the project during the one-year warranty period and will manage contractor call-backs following contract completion. As defects in the work are discovered, the PL or CSR is notified either directly by the client or by an individual or organization conducting field quality assurance checks. They investigate the issue, notify the contractor if corrective action is required, and work with the client and contractor to coordinate access and scheduling for the work.

Unless otherwise specified in the contract documents, the Contract warrants and guarantees all work against defects in materials, equipment and/or workmanship for a period of one year from the date of Substantial Completion of the entire Work (or, for partial occupancy, for the respective portion thereof). Just prior to the one-year anniversary date of Substantial Completion, a follow-up inspection is conducted to ascertain any deficiencies that might have come to light since the Substantial/Final Inspections. As with the Substantial Completion Inspection, the Bond Inspection produces a Punch-list documenting items which are now found to be in need of completion/correction. After the Punch-list items are completed, or if no punch-list items are identified, the bond inspection generally serves as release of the Contractor's surety's obligations under the terms of the Performance Bond furnished to the University.

After the new facility is occupied, a Post Occupancy Evaluation (POE) should occur. The Professional, Project Leader, Facility Coordinator, Physical Plant Personnel and the Occupants all provide input and participate in analyzing the project. The POE is an important tool for providing constructive feedback for use on future Penn State projects.

PART II – PROJECT STAGE GATE DELIVERABLES

Purpose and Definition of Stage Gated Deliverables

6. Structure used for the Description of the PSU Stage Gate Deliverables

6.1. Definition

A PSU Stage Gate Deliverable is any measurable, tangible and verifiable outcome or result required to pass a gate. There are two distinct types of Deliverables:

Stage Gate Deliverables are the common and standard Deliverables PSU requires for its projects. Fully describing these Deliverables is one of the primary purposes of this Guidebook.

Project Specific Deliverables, which are the additional unique Deliverables specific to each project, identified by the project team and based on the project scope definition to achieve project objectives, which are not already covered by the common standardized Stage Gate Deliverables.

Deliverables may be defined in three ways: what it is, what it does, or what it provides and is used for.

6.2. What it is

To define a Deliverable, specific terms such as the following are used:

- a letter, an instruction or directive, a request, an authorization;
- an assignment, or an organization chart (for a team, an individual or a group);
- a report, results from studies, analyses, audits or workshops;
- a drawing, spec sheet, data sheet;
- a permit: government authorization, certificate;
- an agreement;
- a description;
- a representation;
- a repository;
- a document (this general term is avoided as much as possible).

6.3. What it does

A Deliverable identifies, defines, sets, indicates, confirms or validates, requests, verifies, assembles information or data, etc.

6.4. What it provides or what it is used for

A Deliverable provides general information, decision-making information, instructions, objectives, guidance, resources, basis, parameters settings, solutions or potential solutions, expert-advice, corrective action or Backup information for users.

That aspect is in fact the purpose of the Deliverable as to how it is useful or what objective it serves. It corresponds to its added value. Normally, the purpose is to serve as a resource (input) to a process/activity in a subsequent stage, leading to the production of some other output or Deliverable.

NOTE: A Deliverable is not a process, but the result (Deliverable) of a process; it cannot be a methodology, an approach or a practice but the Deliverable that arises out of that process or methodology.

a) Purpose at Gate

The Purpose at gate indicates specifically what the Deliverable is intended to accomplish. It should give a sense of what PSU management expects from the Deliverable.

b) Parameters

These are examples of Deliverable parameters:

- Who is responsible for the production of the Deliverable;
- What would satisfy PSU;
- Use of a prescribed or formal methodology, process, practice or procedure;
- Use of an existing Form or Template;
- Deliverable as a refinement or upgrade of a previous version or of a previous Deliverable;
- To be included in another Deliverable;
- Prerequisite to another Deliverable, timing and synchronization;
- Quality Criteria to be considered or applied;
- Limits and boundaries;
- Level of detail;
- Revision or update frequency;
- Level of accuracy and reliability of data or information;
- Application of Value Improvement Practices;
- Any other specific requirements.

c) Content

It describes the components that constitute a Deliverable as a final result.

d) Tools & Techniques

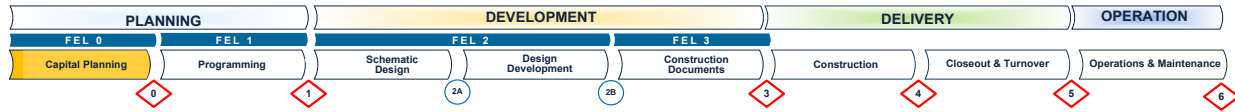
A tangible element such as a Form, Template, Electronic file or Software used to facilitate the production of a Deliverable.

e) Mandatory Templates

Specific Templates identified as **Mandatory** must be used by PSU personnel and Service Providers for the following Deliverables:

- TBD

7. Stage Gate Deliverables



7.1. Capital Planning Stage

The Capital Planning Stage (sometimes referred to as FEL 0) is the first part of the Planning Phase. The Goal of this stage is (1) to generate a prioritized listing of project opportunities aligned with business strategy, and (2) select the right projects to develop. The purpose is to assess different needs and opportunities, generate ideas for potential solutions, prioritize solution according to University strategy, and select the right solution ideas as projects. It includes conducting needs and opportunities gap analysis to rule out (screen) projects that are not likely to be viable and don't fit Penn State University strategy or values. Ideas are developed and evaluated to provide enough information to enable the Administration to make decisions on whether or not to pursue them. Recommendations are made for project selection decisions, which continue as projects in the Programming Stage, where a Core Project Team is assigned and the project officially initiated. Only projects with a reasonable chance of success and University fit can successfully pass into the Development Phase.



| | |
|------|---|
| 0-01 | Business Case |
| 0-02 | Project Risks Identification |
| 0-03 | Proposed Solution Analysis |
| 0-04 | Comprehensive Master Plan |
| 0-05 | Cost Estimate - Screening (-40%, +60 %) |
| 0-06 | Operating Cost Estimate |
| 0-07 | Energy Cost Estimate |
| 0-08 | Capital Budget Funding Source Identification |
| 0-09 | Building Program Statement – Initial |
| 0-55 | Deliverables Check-list Verification |

0-01 – Business Case

Definition

A Business Case is a justification of business feasibility that analyzes the market or service uses for the project, the approximate project cost, and the financing options. A classically defined Business Case is only relevant when the decision to authorize work on a project is based on financial parameters such as those made in a “for profit” environment such as HMC. In a “nonprofit” environment like University Park, a business case might involve building a state of the art research facility to attract and retain world class Researchers.

Purpose of Deliverable

A classical business case determines whether the time-based long-term expenditure and revenue plan will produce the required return on investment. The financial planning document is often called a “proforma”, especially for a building that is to be leased or sold. Because the calculated return on investment, or financial viability for a public service, can only be as reliable as the corresponding estimates and assumptions, the project justification and proforma should fully recognize the project uncertainties. Each should be updated as the project and its users and usage are defined in more detail.

Parameters

- The “not for profit” Business Case contains at a minimum the first 6 items described in the content section (below)
- The Classical Business case contains at a minimum the information described in the content section (below)
- Is coordinated by project requestor.

Content

- A general definition of the situation and conditions (opportunity/problem) in terms of events (what is foreseen or projected to happen);
- A description of the consequence of not resolving the situation or not taking the opportunity;
- A list of contemplated opportunities or Project options to be screened, with available pertinent details;
- Objectives and typical benefits;
- An evaluation of the opportunity (What makes it an opportunity now?);

- A general description of the asset to be implemented (main components and products);
- A benefit order of magnitude for the proposed asset, based on similar operations;
- An estimated cost magnitude for the Project based on most recent information from similar assets, accompanied by major assumptions retained;

Tools and Techniques

- Sample business case (TBD)

0-02 – Project Risks Identification

Definition

A documentation of risks and their characteristics identified which might affect achievement of project objectives. On Major project (> \$5 million, or deemed critical by PDRB) a second identification of strategic risks may be required to identify which risks may affect the achievement of University's strategic objectives.

Purpose of Deliverable

At the earliest stages of a project long before a risk register or mitigation plans are established, project and strategic risks are apparent to some of those involved in the project based on their specific domain expertise and prior experience. This deliverable exists to:

1. ensure the most significant apparent risks and their likely consequences are understood by the Sponsor and Executive Management
2. ensure this project (and not an alternative project) should continue to be developed in spite of these early identified risks
3. provide an opportunity to exploit potential opportunities ("risks" with potential positive consequences)

Parameters

- Context established including objectives, stakeholders, criteria, and key elements;
- Brief risk identification including what can happen and how it can happen;
- Brief risk analysis including potential controls, likelihoods or probabilities, consequences
- High level plans that focus on specific risks and/or opportunities

Tools and Techniques

- Risk Identification template (TBD)

0-03 – Proposed Solution Analysis

Definition

A Proposed Solution Analysis is the summary report to document the analysis and the rationale for justification of a recommended preferred solution (potential project) to a problem, need or opportunity.

Purpose of Deliverable

This deliverable identifies and quantifies a preferred solution. It documents what alternatives were considered and why they were not selected. If there was no solution that satisfied all of the original boundaries, constraints, and desired scope, it provides an opportunity for someone (potentially years from now) to understand what changes were required to reach an acceptable solution.

Parameters

- Generated by the PL in close collaboration with the core team

Content

- Alternatives considered
- Rationale for solution selection
- Changes (if required) in the original scope, boundaries, and constraints

Tools and Techniques

- Example (TBD)

0-04 – Campus Master Plan

Definition

A Campus Master Plan is a comprehensive University facilities planning and analysis plan (evaluation ratings) maintained by Planning Design and Properties. All projects should be informed by this overall plan to be initiated, or to continue into the Programming Stage.

Purpose of Deliverable

The purpose of the Campus Master Plan to guide the future assignment of land for various University functions, to establish appropriate adjacencies among uses, and to develop an overall structure of campus open space that ties the campus together, defines its visual character and protects its environmental quality. The Master Plan is focused on the long-range development of the campus, and on the broad structural framework for physical growth.

Parameters

- Refer to appropriate PSU master plan

Content

- TBD

Tools and Techniques

- TBD

0-05 – Cost Estimate - Screening (-40%,+60%)

Definition

A Cost Estimate - Screening (-40%, +60%) is a ROM (Rough-Order-of-Magnitude) range estimate(s), based on historical data for potential project options under screening consideration, where the level of Project Definition complete is estimated between 0% and 2 %. This estimate will continue to be iterated and refined in the Programming Stage and Development Phase Stages.

Purpose of Deliverable

The Screening Cost Estimate is useful for assessing initial viability, location studies, and long range capital planning.

Parameters

Estimates are prepared by factoring costs from past or current projects, to suit the scope and anticipated conditions of this project;

The Cost Estimates are typically broken down as follows:

- Direct Costs
- Indirect Costs Owner's Costs Escalation;
- Contingency for specific risk items ;
- Cost estimate information must be sufficient to satisfy AACE Class 5 (-40%, +60%) accuracy criterion.

Content

Basis of Estimate

- Purpose;
- Scope of work;
- Methodology and assumptions used for estimating;
- Basis for pricing;
- Equipment costs;
- Materials costs;
- Labor costs;
- Indirect costs;
- Owner's costs;
- Escalation provisions;
- Contingency (explains risks covered);
- Reference to Project Schedule (key dates);
- Specific site conditions;
- Special Project constraints to be considered;
- Exclusions

Estimate

- Each option shall be presented according to the Parameters above;
- Appendices shall include backup documents, as appropriate.

Tools and Techniques

- Previous Cost estimates (TBD)

0-06 – Operating Cost Estimate

Definition

Operating costs (maintenance, landscaping, cleaning, etc.) are calculated by appropriate facilities group (i.e., Buildings and Grounds at UP). These inputs are utilized in the project selection process, budgets, Comparative and Feasibility Studies and Operational Readiness planning.

The information (square footage and schedule) from the capital plan are the initial basis for the estimates for new buildings/projects, and are then updated as information is received.

Purpose of Deliverable

To ensure that:

- significant differences in operating costs between different project alternatives are identified and understood early enough in the project development process to allow good long term decisions based on total lifecycle costs to be made
- the operating costs for new facilities are included in the correct operating budget by the budgeting deadline.

Parameters

- The Core team is responsible for this deliverable

Content

- Refer to previous Operating Cost Estimates

Tools and Techniques

- Refer to previous Operating Cost Estimates

0-07 – Energy Cost Estimate

Definition

Energy costs are calculated by Energy & Engineering. These inputs are utilized in the project selection process, budgets Comparative and Feasibility Studies and Operational Readiness planning.

The information (square footage and schedule) from the capital plan is the initial basis for the estimates for new buildings/projects, and is then updated as information is received.

Purpose of Deliverable

To ensure that:

- significant differences in energy costs between different project alternatives are identified and understood early enough in the project development process to allow good long term decisions based on total lifecycle costs to be made
- the energy costs for new facilities are included in the correct budget by the budgeting deadline
- data is available for long term energy capacity planning (e.g., new substation)

Parameters

- The Core team is responsible for this deliverable

Content

- Refer to previous Energy Cost Estimates

Tools and Techniques

- Refer to previous Energy Cost Estimates

0-08 – Capital Budget Funding Source Identification

Definition

Capital Budget Funding Source included in Capital Budget is a verification statement that the funding source has been identified for the project and the Capital Budget has captured this provision.

Purpose of Deliverable

To ensure sufficient funding is clearly identified and available for this specific project and to ensure the project is properly represented in the PSU Capital Budget.

Parameters

The Customer (project champion) is responsible for identifying funding sources and PL is responsible for documenting this deliverable. Funding sources for projects may include the following:

- Annual State Funds
- Tuition-Supported Borrowing
- Self-Supported Borrowing
- Gifts
- Auxiliary Reserves
- Special State Capital Funds
- Other

Content

- Previous Funding Source Identification

Tools and Techniques

- Previous Funding Source Identification

0-09 – Building Program Statement - Initial

Definition

A Building Program Statement is a document containing pre-Programming data collection and assessments necessary for project planning. This process should commence prior to *Initial Occupant Discussions*, but will continue through most of the Capital Planning Stage. It is the primary Stage Deliverable. The content will be further developed, and much of the material will be included in the *Project Charter* in the Programming Stage.

Purpose of Deliverable

The purpose of the *Building Program Statement* is to provide adequate information to understand the needs of the End User and the Office of Physical Plant, about projects being considered in new construction and renovation project planning. The program statement is also used for design professional selection and for the design development phase of the project. Much of the data collection is required and done during the Capital Planning Stage, as described below.

Parameters

The Project Leader is responsible for obtaining the Building Program Statement. Prior to engaging the future occupants in the development of the *Building Program Statement - Initial*, the following sections of the Statement shall be completed:

- Estimated Construction Schedule in calendar days
- Estimated Project Budget to address the known building/site deficiencies
- Pertinent Appendices/Reports
- Building History
- Existing Facilities/Conditions
- Site Information
- Pedestrian and vehicular Access and Parking
- Zoning and Permitting
- Utility Requirements
- Special Site Considerations

Content

- Completed Template - defined by Office of Space Planning and Management

Tools and Techniques

- Template from Office of Planning Design and Properties

Note: In the Programming Stage, the *Building Program Statement* will be reviewed and refined by the Building Program Committee, and signed-off.

0-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

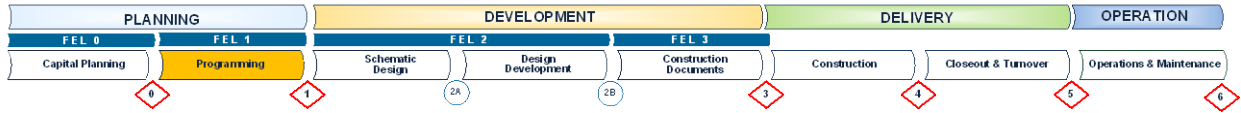
- Gate 0 is a go/no go decision point;
- Check-list confirms to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;
- Summary of checklist is presented at the PDRB (Project Decision Review Board).

Content

- Gate 0 list of all deliverables

Tools and Techniques

- Deliverables Checklist Verification template



7.2. Programming Stage

The Programming Stage (sometimes referred to as FEL 1 or Pre-concept) is the last part of the Planning Phase. Programming is development of the written and graphical statement of the needs of the project upon which the design of the facility is based and its success judged. Based on the building program as developed and verified, CP&D leads the selection of a design team for the project. In the design selection phase, it is important to select a design team with the ability and resources to design a building or facility that can be constructed to satisfy the building program, schedule, and budget. Selected design firms use the building program, Penn State standards, the schedule, and the budget as the basis for their design.



1-01 – Facilities Resources Committee Charge Letter

Definition

A Facilities Resources Committee Charge Letter is a letter from the Office of the Provost, which is used to formally charge a Building Program Committee to refine and make further assessments to the Building Program Statement that will provide the foundation for addressing strategies for the project.

Purpose of Deliverable

The Charge Letter is used for establishing the general scope of the project, future occupants to be accommodated, schedule to complete the Program, and budget for the project. However, the Building Program Committee may not always be officially or formally charged.

Parameters

- This letter is written by the Office of the Provost

Content

- Refer to “Specific Information on each section/subsection: Committee Charge Letter, Pre-Programming Data Collection and Assessment,” version 1

Tools and Techniques

- Refer to “Specific Information on each section/subsection: Committee Charge Letter, Pre-Programming Data Collection and Assessment,” version 1

1-02 – Core Project Team Established

Definition

A Core Project Team is a formal assignment of a Core Team to a project. This Team will be led by a Project Leader, either a Project Manager or Project Coordinator, who has typically already been assigned to the project. In addition to the Project Leader, other cross-functional representatives are selected from the broader Project Delivery Team (both internally and externally represented).

Purpose of Deliverable

Teams consistently perform better than individuals. Each assigned member must have sufficient time available to devote to the project based on project complexity and the specific demands expected based on their skills, experience, and domain expertise.

Parameters

- The Project Leader is responsible for this deliverable.

Content

Core Project Teams usually consists of between 4 and 7 team members, which are recommended by the Project Leader and the OPP Director of Design and Construction. These teams are flexible to the requirements of the Project, but always contain a Project Leader and the Facility Coordinator to represent the end user assigned. Typical Core Team Members are:

- Project Leader (Project Manager or Project Coordinator)
- Engineer or Technical Representative
- Construction Services Representative
- Facility Coordinator
- Area Services Supervisor
- EHS Representative
- Construction Manager or General Contractor
- Design Professional
- Others as may be required by each unique project

Tools and Techniques

- None

1-03 – Project Kick-off

Definition

A Project Kick-off is a meeting or workshop to introduce the Project Core Team and other key project stakeholders to the project.

Purpose of Deliverable

The purpose of a Project Kick-off meeting is to officially start up project team activities, to orient a new project team to the reasons for the project, to discuss boundaries and constraints, and to start the project with a common understanding of goals and near term work. It's critical that this group begins to create a project charter (shared vision) document together. The group should discuss other key project areas such as scope—including requirements and implementation alternatives—risks, costs, resources needed, and desired schedule. The team captures that information and translates it into draft team roles and responsibilities lists, budgets, risk lists, and project timeline.

Parameters

- The meeting typically lasts from 2 hours to a full day depending on the size of the project and how much group time needs to be invested in project kickoff discussions and related deliverables.
- A review of the Building Program Statement is completed along with some initial high level project planning.
- The Sponsor and Core Team leave the meeting “on the same page” with a good understanding of what success looks like for this project.

Content

- Meeting minutes
- Initial Draft (or plan to quickly generate a draft) Charter

Tools and Techniques

- Single Point Accountability (SPA) Action items (What, Who, By When)
- RACI Chart (Responsible, Accountable, Consulted, Informed)

1-04 – Programming Work Plan

Definition

A Programming Work Plan is a plan for the execution and management of the Programming Stage. It defines the Programming scope of work and provides a framework for its orderly execution and management.

Purpose of Deliverable

To ensure commitments are not made without adequate planning and resources.

Parameters

- This deliverable is produced by the Project Leader

Content

- High level schedule
- Internal resource requirements
- External resource requirements
- Progress and Status reporting process

Tools and Techniques

- Previous Work Plan

1-05 – Project Delivery, Procurement and Contracting Strategy

Definition

A Contracting strategy describes the roles and responsibilities of the contracting parties; it determines the risk allocation strategies, methods of payment, basis for reimbursement, and incentive strategies for encouraging enhanced contribution. A Project Contracting Strategy is a description of the means for PSU to get supporting resources to implement the Project, including a list of contracts and their scope of work.

Purpose of Deliverable

It defines the best Project contracting strategy for the Development Phase (Schematic Design, Design Development and Construction Documents Stages), as well as Detailed Engineering, Procurement and the Construction Stage. The Project Delivery Method refers to the specific delivery system selected, such as: Design-Bid-Build, Design-Build, Construction manager agency, Construction manager at-risk.

Parameters

- The Project Leader is responsible for this deliverable with significant input required from the Core Team.

Content

- General strategy and high level expected needs (skills, quantity, timing) for Service providers to develop the project
- General strategy and high level expected needs (skills, quantity, timing) for Contractors to execute the project
- Rational for selection of Project Delivery Method

Tools and Techniques

- Refer to previous Procurement and Contracting Strategies

1-06 – Risk Management Plan - Initial

Definition

A Risk Management Plan – Initial, is the document describing how project risk management will be structured and performed on the project. It is a subsidiary plan of the Integrated Project Plan. The risk management plan is different from the risk register that contains the list of project risks, the results of risk analysis, and the risk responses used as a tool to manage risks. The plan documents a Project-level risk management process compliant with the internationally recognized risk management framework AS/NZS 4360:2004. It will document how Project risks are identified, analyzed, and recorded in a risk register. Explain how options are developed to treat the risks which have been prioritized based on probability and consequences (severity). In particular, the risk management process will ensure that all extreme risks and those with catastrophic outcomes receive an additional Management review. The risk management process should be continuous throughout the project lifecycle, and the plan should be updated if necessary. The risk register is used to actively manage Risks, and should always be current.

Purpose of Deliverable

This deliverable exists to:

1. ensure the most significant apparent risks and their likely consequences are understood by the Sponsor and Executive Management
2. ensure this project (and not an alternative project) should continue to be developed in spite of these early identified risks
3. provide an opportunity to exploit potential opportunities (“risks” with potential positive consequences)

Parameters

- Context established including objectives, stakeholders, criteria, and key elements;
- Risk identification including what can happen and how it can happen;
- Risk analysis including potential controls, likelihoods or probabilities, consequences
- Mitigations and actions that focus on specific risks and/or opportunities

Content

- PSU risk management process

Tools and Techniques

- Risk template

1-07 – Operational Readiness Plan - Initial

Definition

A plan identifying all Deliverables and activities under PSU Operating responsibility, outside of the Construction contractors and service providers, that are carried out concurrently with project execution and beyond, up to Final Acceptance. It covers the development of all processes required to interface with the Project Team and to take-over and operate the delivered facilities.

Purpose of Deliverable

An Operations Readiness Plan – Initial, is intended to provide a framework plan for the Operations organization, for scope of work by business process, schedule and budget. The ultimate goal is to achieve a smooth transition between Construction and Operations by identifying all activities outside the direct control of the project team early enough to ensure they are properly planned, resources, tracked, and executed.

Parameters

- The owner representative on the Core Team (e.g., FC) is responsible for this deliverable.

Content

Content is significantly different for a new complex (e.g., Medical Center) versus a sports facility or an addition to an existing building. Project type, size, and complexity will dictate required elements. Here are a few items common to most projects:

- Building Operations
- Ongoing Maintenance
- Emergency response (notification, map updates, etc.)
- Environmental Health and Safety
- Custodial services
- IT system

Tools and Techniques

- none

1-08 – Integrated Project Plan - Initial

Definition

An Integrated Project Plan – Initial, completed in the Programming Stage is the early development to a complete set of documents that defines how the project is to be executed, monitored and controlled. Depending upon project size and complexity, it may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents. At this stage, the Initial plan includes a: Project Charter – Initial (also a separate Deliverable), WBS, high level schedule or Milestone Chart and a Cost Estimate (also a separate Deliverable), which all continue to be elaborated in later stages. Subsidiary plans to be used will have been selected and draft forms written.

An Integrated Project Plan – Updated, completed in the Design Development Stage is an update of this plan, which now includes more detailed scope and project information, and a further developed plan.

The Integrated Project Plan – Final, is the final and formally-approved document used to guide both Project execution and management. It defines the execution and management strategies to bring the Project to successful completion. It provides information for Project controls and decision-making.

Purpose of Deliverable

The Initial Project Plan creates the initial framework that will be refined and enhanced until full funding has been approved and execution begins.

Parameters

- The Project Leader is responsible for creation of the plan with significant input from the Core Team.

Content

There are many ways to organize and present the project plan, but it commonly includes all of the following, which can also be separate documents and Deliverables:

- Project Charter with Scope Statement, which includes the project objectives and the project deliverables
- Description of the project management approach or strategy
- Work Breakdown Structure (WBS) to level at which control will be exercised, as baseline scope document
- Project Schedule, including major milestones, cost estimates, Core Project Team

- Risk management plan
- Stakeholder management plan
- Project Execution Plan
- Project Control Plan
- Open issues and pending decisions.

Project plan, may also include Subsidiary management plans:

- Safety management plan
- Scope management plan
- Schedule management plan
- Cost management plan
- Quality management plan
- Staffing management plan
- Communications management plan
- Risk response plan
- Procurement management plan

Tools and Techniques

- Previous Integrated Project Plans

1-09 – Completed Project Program

Definition

A Completed Project Program is the PDRB approved Building Program Statement, which includes verification by the Provost that the developed program fits with the scope and budget established. The Program becomes the basis for project planning and the user group's expectations and goals for the completed project.

Purpose of Deliverable

The purpose of the *Building Program Statement* is to provide adequate information to understand the needs of the End User and the Office of Physical Plant, about projects being considered in new construction and renovation project planning. The program statement is also used for design professional selection and for the design development phase of the project. The approved Building Program Statement represents a project that has been formally approved to advance to the next project development stage.

Parameters

- The Project Leader is responsible for obtaining the Building Program Statement.

Content

- Refer to the PDP Building Program Statement process

Tools and Techniques

- Refer to approved Building Program Statements

1-10 – Sustainability Strategy - Initial

Definition

An Initial Sustainability Strategy is the identification of the initial distinct design opportunities that can have a measurable impact on a project—enhancing the performance of the development, reducing its environmental footprint and increasing market value.

Purpose of Deliverable

A thoughtful Sustainability Strategy which is identified early for each project can reduce PSU's environmental footprint and ultimately can have a demonstrable effect on the quality of the environment. PSU is committed to improving overall environmental footprint and being a leader in the area of sustainability.

Parameters

- The Project Leader is responsible for this deliverable.

Content

- Consider ISO14000 series standards, LEED, greenhouse gas emissions, sustainable construction techniques
- Refer to prior project Sustainability Strategies
- Refer to Penn State LEED Guidelines

Tools and Techniques

- Refer to prior project Sustainability Strategies
- Refer to Penn State LEED Guidelines

1-11 – BIM Execution Plan - Initial

Definition

Building Information Modeling (BIM) is the process of generating and managing building data during its life cycle. Typically it uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. The process produces the Building Information Model (also abbreviated BIM), which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components.

Purpose of Deliverable

An Initial BIM (Building Information Model) Execution Plan will define the appropriate uses for BIM on a project (e.g., design authoring, cost estimating, and design coordination), along with a detailed design and documentation of the process for executing BIM throughout a project's lifecycle.

Parameters

- The Core Team is responsible for this deliverable.

Content

- OPP BIM Project Execution template

Tools and Techniques

- Current PSU Building Information Modeling Project Execution Plan

1-12 – Programming Consultant(s) Contract(s)

Definition

Programming Consultant Contracts are signed documents required to legally and successfully bid and execute the Programming stage.

Purpose of Deliverable

Contracts establish the agreement that PSU and the Service Providers have made and fix their rights and duties in accordance with that agreement.

Parameters

- The Project Leader shall establish the project specific parameters.

Content

- Standard Penn State Owner-Professional form of agreement.

Tools and Techniques

- Owner-Professional agreements.

1-13 – Environmental Impact Study/ Social Impact

Definition

An Environmental Impact Study/ Social Impact is a full report that contains the results of the Environment and Socio-economic Impact Assessment. It includes all the data collected regarding the Environment and Socio-economic situation and conditions where the Project will evolve, with risk analysis and recommended risk response.

Purpose of Deliverable

These studies ensure that an appropriate investigation has been conducted considering the environmental and social impact of the proposed project. It provides information to support the Project Program planning and the decision-making to proceed with the Development Phase.

Parameters

- The Core Team is responsible for this deliverable

Content

- Project Description
- Environmental baseline and identification of issues
- Socio-economic baseline and identification of issues
- Residual impacts
- Community impacts
- Management and monitoring of environment and socio-economic impacts
- Overall project assessment

Tools and Techniques

- Refer to previously performed studies (TBD)

1-14 – Feasibility/Comparative Study

Definition

A Feasibility/Comparative Study - is a Study Package that develops the alternative solutions (technologies, process configurations, etc.) sufficiently such that the project team can evaluate the alternative solutions against the Project Objectives.

Purpose of Deliverable

The Comparative Study creates a common, objective basis with consistent assumptions for evaluating alternatives.

Parameters

- The Core Team is responsible for this deliverable

Content

- List of technologies considered (if applicable) and rationale for selection
- List of sites/locations considered (if applicable) and rationale for selection
- List of architectures considered (if applicable) and rationale for selection
- List of configurations considered (if applicable) and rationale for selection
- Other appropriate project specific considerations.

Tools and Techniques

- Refer to previously performed studies.

1-15 – Cost Estimate - Concept (-20%, +30 %)

Definition

A Cost Estimate - Concept (-20%, +30 %) is an Order of Magnitude Estimate based on concept engineering and prepared by factoring costs and other pertinent data from similar past or current Projects, to suit the scope and anticipated conditions of the Project. It estimates costs for activity-groups and for major components. This estimate continues to be iterated and refined in the Development Phase Stages. The level of Project Definition complete is estimated between 1% and 15 %.

Purpose of Deliverable

The Concept Cost Estimate has a significantly tighter range than the initial Screening Estimate. It is useful for confirmation of technical or economic feasibility, preliminary budget approval, and approval to proceed to the Development phase (the Schematic Design stage).

Parameters

Estimates are prepared by factoring costs from past or current projects, to suit the scope and anticipated conditions of this project;

The Cost Estimates are broken down as follows:

- Direct Costs Indirect Costs
- Owner's Costs Escalation;
- Contingency for specific risk items ;
- Cost estimate information must be sufficient to satisfy AACE Class 5 (-20%, +30%) accuracy criterion.

Content

Basis of Estimate

- Purpose;
- Scope of work;
- Methodology and assumptions used for estimating;
- Basis for pricing;
- Equipment costs;
- Materials costs;
- Labor costs;
- Indirect costs;
- Owner's costs;
- Escalation provisions;
- Contingency (explains risks covered);
- Reference to Project Schedule (key dates);

- Specific site conditions;
- Special Project constraints to be considered;
Exclusions

Estimate

- Each option shall be presented according to the Parameters above;
- Appendices shall include backup documents, as appropriate.

Tools and Techniques

- Cost estimate – Screening (0-05)
- Previous Project Planning cost estimates.

1-16 – Planning Phase Lessons Learned Review

Definition

A Planning Phase Lessons Learned Review is a documentation of the learning gained from the process of performing the project during the Programming Stage. This listing of experiences and issues (both positive and negative) also identifies success factors and/or solutions to problems encountered and/or risks to be aware of for further Project work and for other Projects. It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. Lessons learned may be identified at any point. Also considered a project record, to be included in the lessons learned knowledge base.

Purpose of Deliverable

It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. Multiple lessons learned deliverables exist to prevent too much time from passing between “learning the lesson” and documenting it. In addition, some different personnel are involved in the Planning phase that will not be involved during execution or at the Lessons Learned process at the end of the project.

Parameters

- The Core Team and Key Service Provider personnel need to participate
- The best situation is to use a facilitator that was not part of the project team (e.g., an experienced OPP project leader that had nothing to do with the project). This allows all participants to contribute rather than focus on the lessons learned process. This also brings additional objectivity to the process.

Content

- Factual, non-judgmental descriptions of outcomes and contributing decisions and issues (the purpose is not to assign blame or perform a performance review but to capture things that went well and things that did not go well for the benefit of all future projects)
- Backup/supporting documents

Tools and Techniques

- none

1-17 – Project Charter

Definition

A Project Charter is a Project description establishing overall project vision, key objectives and goals of the project. The Charter also addresses key assumptions, constraints, and target performance. Assumption or constraint affecting the project's schedule, budget, or quality will be listed. An important part of a classic project charter formally authorizes the work of the project to begin and gives the project leader authority to do his/her job. In the PSU process, this is done with a separate document (1-01 Facilities Resources Committee Charge Letter).

Purpose of Deliverable

The Project Charter collects and defines business needs, Project parameters and planning information. It is progressively elaborated from this Initial version in the Programming Stage, updated in the Schematic Design Stage and finalized in the Design Development Stage after the project scope is frozen (at which point it becomes a comprehensive and complete Project description).

The Charter identifies scope of work and project objectives. It provides the information to ensure a common understanding between all key stakeholders and decision-making personnel as to what the Project aims are and the work to be accomplished to pursue the opportunity. It quantifies expectations and identifies critical success factors. It identifies critical elements of the project and provides high-level or summary schedule targets, as well as the progressive cost estimates and budgets.

Parameters

- The project Charter is prepared by the Core Project Team with close collaboration of the project Sponsor and key Stakeholders

Content

- Project Executive Summary and Overview
- Project Justification - Business Need or Opportunity
- Project Objectives, Scope, Assumptions, and Constraints
- Project Estimated Cost/Duration
- Project Risks
- Funding/Budget
- Project Organization and Approvals
- Environmental Health and Safety

Tools and Techniques

- Project Charter Template (TBD)

1-18 – PDRB Approves Program Statement

Definition

PDRB Approves Program Statement is the final approval of the Program Statement and program. This Approved Program Statement is often used for project evaluation and selection.

Purpose of Deliverable

Final approval for a project to progress to the next stage

Parameters

- This Project Leader is responsible for this deliverable

Content

- none

Tools and Techniques

- none

1-19 – Designer Selection and Approval

Definition

A Designer Selection and Approval is an approval of the Professional to be used for the Project. Based on the building program as developed and verified, a design team is selected

Purpose of Deliverable

This deliverable exists to ensure appropriate input and approvals are received before beginning the Development Phase.

Parameters

- The Project Leader is responsible for this deliverable
- Refer to Campus, Planning, and Design Architect Selection process
- Refer to PSU Policy AD-38

Content

- none

Tools and Techniques

- none

1-20 – Designer Funding Approval

Definition

A Design Funding Approval is a funding request approval for the Development Phase of the Project.

Purpose of Deliverable

To ensure that sufficient funds are available and are properly authorized before design service provider spending begins

Parameters

- The Project leader is responsible for this deliverable.

Content

- SBFR to be submitted

Tools and Techniques

- none

1-21 – Architectural/Engineering Agreements

Definition

Architectural/Engineering Agreements are signed documents required to legally perform the project Design.

Purpose of Deliverable

Contracts establish the agreement that PSU and the Service Providers have made and fix their rights and duties in accordance with that agreement.

Parameters

- The Project Leader shall establish the project specific parameters.

Content

- Standard Penn State form of agreement

Tools and Techniques

- Refer to completed Architectural/Engineering Agreements

1-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

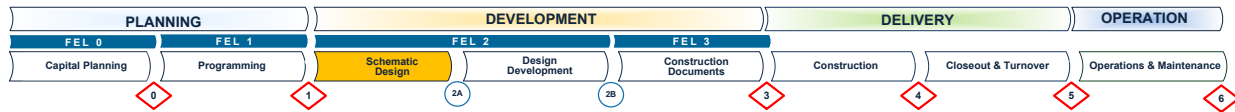
- Gate 1 is a go/no go decision point;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;
- Summary of Checklist is presented at the PDRB (Project Decision Review Board)

Content

- Gate 1 list of all deliverables

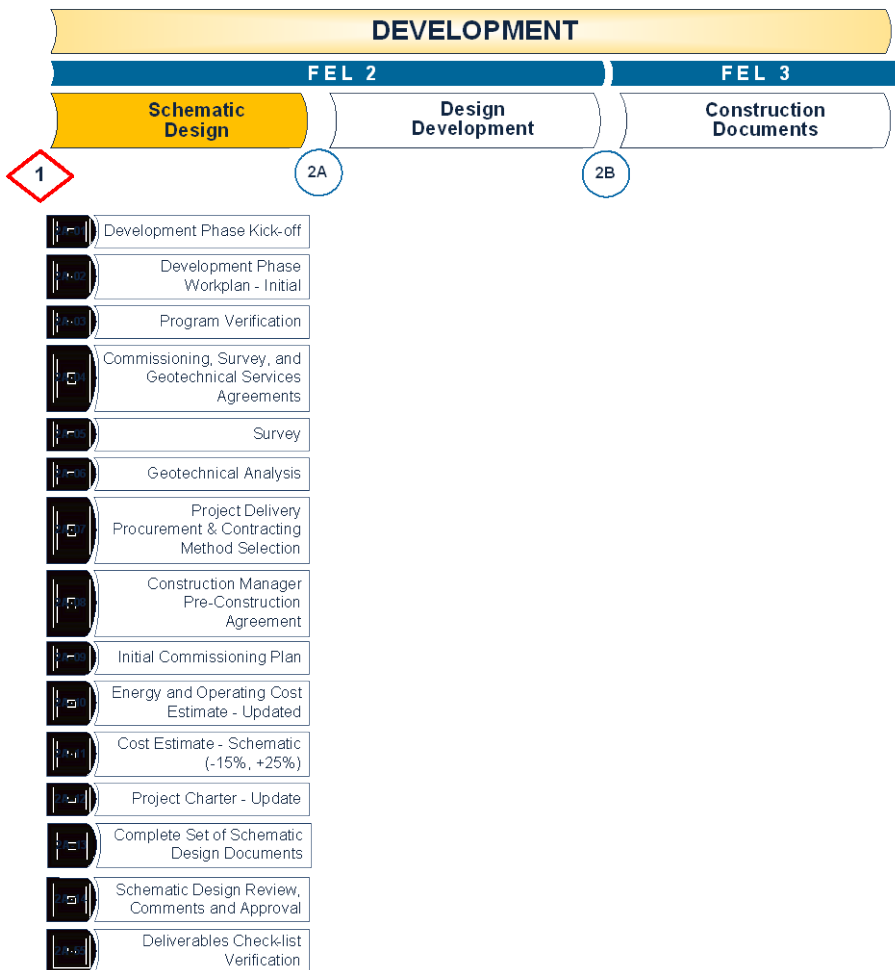
Tools and Techniques

- Deliverables Checklist Verification template (TBD)



7.3. Schematic Design Stage

The Schematic Design stage (sometimes referred to as Sketch Design or the first portion of Pre-feasibility or FEL 2) is the first part of the Development Phase. It begins with Designer's review of the program and Penn State Project Delivery System Handbook, and the Designer's visit to the project site. After these reviews and visits, the Designer provides a preliminary evaluation of the program, schedule, and construction budget requirements. When an external Design Firm is involved, they typically present and review alternative approaches to project design and construction. These approaches are iteratively reviewed during frequent meetings with the building committee and OPP until arriving at a clear, feasible concept that meets the project requirements and is approved by Penn State's project team. From the approved concept, schematic drawings are developed so that scope and budget can be understood and evaluated. These drawings, along with the Design Firm's estimate of construction cost (adjusted for the projected bid date), and any other required documents are submitted by the Design Firm to Penn State for schematic design approval.



2A-01 – Development Phase Kick-off

Definition

A Development Phase Kickoff is a meeting of the Core Team and Sponsor to review the rationale and boundaries for the project and begin to create a project charter (shared vision) document together. The group discusses other key project areas such as scope—including requirements and implementation alternatives—risks, costs, resources needed, and desired schedule. The team captures that information and translates it into draft team roles and responsibilities lists, budgets, risk lists, and project timeline.

Purpose of Deliverable

The purpose of a Development Phase Kickoff meeting is to officially start up project team activities, to orient a new project team to the reasons for the project, to discuss boundaries and constraints, and to start the design with a common understanding of goals and near term work.

Parameters

- The meeting typically lasts from 2 hours to a full day(s) depending on the size of the project and how much group time needs to be invested in project kickoff discussions and related deliverables.
- The Sponsor and Core Team leave the meeting “on the same page” with a good understanding of what success looks like for this project.

Content

- Meeting minutes
- Initial Draft (or plan to quickly generate a draft) Charter

Tools and Techniques

- Single Point Accountability (SPA) Action items (What, Who, By When)
- RACI Chart (Responsible, Accountable, Consulted, Informed)

2A-02 – Development Phase Workplan - Initial

Definition

A Development Workplan is a plan for the execution and management of the entire Development Phase which consists of the Schematic Design, Design Development, and Construction Documents Stages. It defines the scope of work and required resources with a framework for management of the project design up to final BOT approval.

Purpose of Deliverable

It provides all necessary high level information to ensure that the Development Phase is properly planned for efficient execution, management and control. It also helps to ensure commitments are not made without adequate planning and resources.

Parameters

- This deliverable is produced by the Project Leader

Content

- Detailed schedule
- Internal resource requirements
- External resource requirements
- Progress and Status reporting process

Tools and Techniques

- Previous Work Plan template

2A-03 – Program Verification

Definition

A key deliverable of the previous (Programming) Stage is a written and graphical statement of the needs of the project upon which the design of the project is based and its success judged. Program Verification engages resources with additional expertise at a lower level of detail to validate (verify) Programming Stage conclusions.

Purpose of Deliverable

To ensure the program fully satisfies the Charter requirements without violating boundaries or constraints when considered at a detailed design level.

Parameters

- The Core Team is responsible for this deliverable

Content

- Previous Program Verification template

Tools and Techniques

- Previous Program Verification template

2A-04 – Commissioning, Survey, and Geotechnical Services Agreements

Definition

Commissioning, Survey, and Geotechnical Contracts define mutual, legally-binding conditions and obligations between PSU and all Service Providers for outsourcing and contracting portions of Schematic Design Stage work. Contracts are designed to secure the necessary know-how, resources and continuity to complete Schematic Design and may include a provision to cover the needs for the Design Development Phase as well.

Purpose of Deliverable

Contracts establish the agreement that PSU and the Service Providers have made and fix their rights and duties in accordance with that agreement.

Parameters

- The Design Professional shall establish the project specific parameters. in consultation with Project Leader.

Content

- Standard Penn State form of Agreement

Tools and Techniques

- Refer to previously prepared documents

2A-05 – Survey

Definition

A Survey establishes site benchmarks, grades, topographical information, and locations required for key project elements.

Purpose of Deliverable

Construction survey measurements made prior to or while construction is in progress are used for many reasons including to control elevation, horizontal position, dimensions, and configuration, establishment of line and grade for buildings, fences, roads, etc.

Parameters

- The Core Team is responsible for determining the specific survey requirements based on the specific project elements and complexity.

Content

- Project specific

Tools and Techniques

- none

2A-06 – Geotechnical Analysis

Definition

Geotechnical (Engineering) Analysis uses principles of soil mechanics and rock mechanics to investigate subsurface conditions and materials that may impact the project.

Purpose of Deliverable

This analysis typically involves determination of the relevant mechanical and chemical properties of subsurface materials, evaluation of stability of natural slopes and man-made soil deposits, and the assessment of risks and opportunities as a result of general site conditions. For some projects, earthworks and structural foundation design will be impacted by this analysis.

Parameters

- The Core Team is responsible for this deliverable

Content

A typical Geotechnical Analysis begins with a review of project needs to define the required material properties. A site investigation is then conducted focused on soil, rock, fault distribution and bedrock properties on and below an area of interest to determine their engineering properties including how they will interact with, on or in a proposed construction. Investigations can also include the assessment of the risk to humans, property and the environment from natural hazards such as earthquakes, landslides, sinkholes, soil liquefaction, debris flows and rock falls.

Tools and Techniques

- none

2A-07 – Project Delivery Procurement & Contracting Method Selection

Definition

A Project Delivery Procurement & Contracting Method Selection documents execution of the Project Delivery Procurement & Contracting strategy established during the Programming Stage. All major contracts anticipated to be awarded are included with their general scope of work. Engineered equipment (if any) to be procured is also identified. Based on the project's design, Design and Construction leads the selection of a construction services provider for the project. The construction procurement method depends on whether the project will be delivered in a design-bid-build, construction leader at-risk, or design-build arrangement. In this stage, it is important to select construction professionals with the ability and resources to construct the facility on schedule and within budget.

Purpose of Deliverable

The procurement process (e.g., design-build, construction manager agency, etc.) to be implemented has been selected and the control and administration processes to be used are identified. This deliverable also requires identification of early appropriation of funds (if required) for critical long lead time items or equipment.

Parameters

- The project leader is responsible for this deliverable with significant input required from the Core Team, Contract Administration, Design and Construction leadership.

Content

- Detailed strategy and specific needs (skills, quantity, timing) for resources needed during project execution
- Rational for selection of Execution Methodology
- Long lead time item identification and associated funding requirements

Tools and Techniques

- Refer to previous Procurement and Contracting Strategies template

2A-08 – Construction Manager Pre-Construction Agreement

Definition

A Construction Manager Pre-Construction Agreement is an agreement with a construction management firm to provide pre-construction services such as scheduling, site logistics, estimating, constructability reviews, value engineering, and other expertise as required.

Purpose of Deliverable

Contracts establish the agreement that PSU and the Service Providers have made and fix their rights and duties in accordance with that agreement.

Parameters

- The Project Leader shall establish the project specific parameters in consultation with Contract Administration.

Content

- Standard Penn State form of Agreement

Tools and Techniques

- Refer to previously prepared documents

2A-09 – Initial Commissioning Plan

Definition

An Initial Commissioning Plan is part of the project execution plan and describes all activities required and establishes a plan for testing and activation of all building operational systems before the asset owner/occupant assumes full use of the facility.

A final update will be prepared during the Construction stage.

Purpose of Deliverable

The prime objective is to ensure a timely preparation of commissioning activities and achieve a smooth transition between Construction and Operations/Maintenance for expedient attainment of all project expectations.

Parameters

- The Core Team is responsible for this deliverable.

Content

- Special attention must be focused on the division of responsibilities between those executing the construction project and others involved in commissioning. The plan clearly describes the magnitude and timing of commissioning and start up activities that are carried out concurrently and in synchronization with project execution and beyond, up to occupancy/operation on specification. It also covers take-over and acceptance process.

Tools and Techniques

- Refer to previously prepared plans

2A-10 – Energy and Operating Cost Estimates Update

Definition

Energy and Operating Cost Estimates Update is actually the final estimate submitted by Energy and Engineering Division and the appropriate facilities group (i.e., Buildings and Grounds at UP) for the project.

Purpose of Deliverable

It is used to understand operating costs and future expected costs generated from the specific project. This Energy and Operating Cost Estimate is required in this early stage so it can also be used to understand any potential significant differences between project alternatives in Total Lifetime Costs or Total Costs of Ownership can be completely understood and incorporated in alternative selection analysis and decisions.

Parameters

- The Core team is responsible for this deliverable

Content

- Refer to previous Energy and Operating Cost Estimates

Tools and Techniques

- Energy Cost Estimate (0-07)
- Refer to previous Energy and Operating Cost Estimates

2A-11 – Cost Estimate – Schematic Design (-15%, +25 %)

Definition

A Cost Estimate - Feasibility (-15%, +25 %), based on some Preliminary Engineering and Design during the Schematic Design Stage (mid-way through FEL 2) and prepared primarily by developing preliminary material quantities and rough estimates for major equipment. This estimate continues to be refined in the Design Development (completion of FEL 2) and Construction Documents (FEL 3) Stages. It estimates costs for activity-groups and for major components with their Work Packages corresponding to the Project WBS. The level of Project Definition complete is estimated between 10% and 40%.

Purpose of Deliverable

The Schematic Design Cost Estimate incorporates some predictable elements (for major items with unit cost line items at assembly level). Previous estimates have all been tested against future projections of anticipated market variations. (cost/capacity curves and factors, scale of operation factors, other parametric modeling techniques).

Parameters

Estimates are prepared by Design Professional and/or independent cost estimator.

The Cost Estimates are broken down as follows:

- Direct Costs (Mechanical Equipment, Bulk Materials, Labor)
- Indirect Costs (CM Services; Field Indirect Costs)
- Owner's Costs (Project support costs and Operations Costs)
- Escalation
- Contingency for specific risk items
- Cost estimate information must be sufficient to satisfy AACE Class 5 (-15%, +25%) accuracy criterion

Content

Basis of Estimate

- Purpose
- Scope of work
- Methodology and assumptions used for estimating
- Basis for pricing
- Equipment costs
- Materials costs
- Labor costs
- Indirect costs
- Owner's costs
- Escalation provisions

- Contingency (explains risks covered)
- Reference to Project Schedule (key dates)
- Specific site conditions
- Special Project constraints to be considered
- Exclusions

Estimate

- Each option shall be presented according to the Parameters above;
- Appendices shall include backup documents, as appropriate.

Tools and Techniques

- Cost Estimate – Concept (1-15)
- Previous Project Planning cost estimates template

2A-12 – Project Charter - Update

Definition

A Project Charter – Update, is an elaborated version of the Initial Project Charter. It is a Project description and establishes the overall project vision.

Purpose of Deliverable

The Project Charter collects and defines business needs, Project parameters and Project planning information. It is progressively elaborated from the Initial version in the Programming Stage, updated in the Schematic Design Stage and finalized in the Design Development Stage after the project scope is frozen (at which point it becomes a comprehensive and complete Project description).

The Project Charter identifies scope of work and project objectives. It provides the information to ensure a common understanding between all key stakeholders and decision-making personnel as to what the Project aims are and the work to be accomplished to pursue the opportunity. Further, the Project Charter quantifies expectations and identifies critical success factors. It identifies critical elements of the project and provides high-level or summary schedule targets, as well as the progressive cost estimates and budgets.

Parameters

The Project Charter – Update is:

- prepared by the Core Project Team with close collaboration of the project Sponsor and key Stakeholders
- an update of 1-17; it will be updated again to create 2B-07 Final Charter

Content

- Project Executive Summary and Overview
- Project Justification - Business Need or Opportunity
- Project Scope and Objectives
- Project Estimated Cost/Duration
- Project Assumptions and Constraints
- Project Risks
- Funding/Budget
- Project Organization and Approvals
- Environmental Health and Safety

Tools and Techniques

- Project Charter – Initial (1-17)

2A-13 – Complete Set of Design Development Documents

Definition

Design Development Documents are all documents necessary to define the design development phase of the project. They also establish building/facility size, and describe materials.

Purpose of Deliverable

Design Development Documents consist of drawings, specifications, front end documents, cost estimate, schedule and all other deliverables previously defined. in the latest Project Charter.

Parameters

- The Project Leader oversees and the Design Professional is responsible for preparation of the documents.
- Refer Design and Construction Design Phase Deliverables for standard listing of requirements.
-

Content

The Design Development Documents should address:

- Project needs (as defined in the building program) are satisfied.
- University aesthetic goals are being met.
- Project budget goals are satisfied
- University long-term operation and maintenance are satisfied.
- Project schedule goals are realistic.
- Project constructability is realistic.

Tools and Techniques

- Previous Design Development Documents

2A-14 – Schematic Design Review, Comments, and Approval

Definition

Schematic Design Approval is complete when the project team (including the Designer) obtains formal (written) client approval that the schematic design satisfies all formal needs without violating any boundaries or constraints (e.g., schedule, budget, etc.). The Schematic Design Approval Process typically requires the Project Leader to obtain review comments from the entire review team, which generally includes all divisions of OPP; Office of Telecommunications; Safety and Disability Services; Classroom Committee; Customer units; and the University Insurance Carrier. The size and type of project will determine review team makeup and number of reviews required. Review teams shall be informed of general project scope criteria. Reviews will encompass adherence to Penn State/OPP policies, OPP Design and Construction Standards, HMC Standards and constructability. The Project Leader will coordinate all review comments through correspondence and/or scheduled meetings. Comments will be incorporated, resolved, or rejected by the review groups, and the Project Leader will inform reviewers of the results. The schedule for reviews typically is approximately two weeks.

Purpose of Deliverable

A Schematic Design Review evaluates all aspects of the Schematic Design stage (e.g., drawings, cost estimates, budget, schedule, risks, etc.) against desired requirements established in the latest Project Charter. The review raises deficiencies, gaps, and issues that need to be resolved for the project to be successful.

Parameters

- Project Leader is responsible for facilitating and assuring review completion.

Content

The Schematic Design review process examines the present design to determine whether:

- Project needs (as defined in the building program) are satisfied.
- University aesthetic goals are being met.
- Project budget goals are satisfied (via independent estimate or estimate review performed by qualified personnel operating only on PSU's behalf and independent of the Design firm)
- University long-term operation and maintenance goals are satisfied.
- Project schedule goals are realistic.
- Project constructability is realistic

Tools and Techniques

- Previous Schematic Design reviews

2A-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

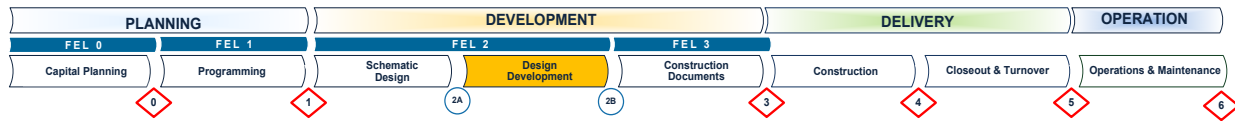
- Gate 2A is a checkpoint;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;

Content

- Gate 2A list of all deliverables

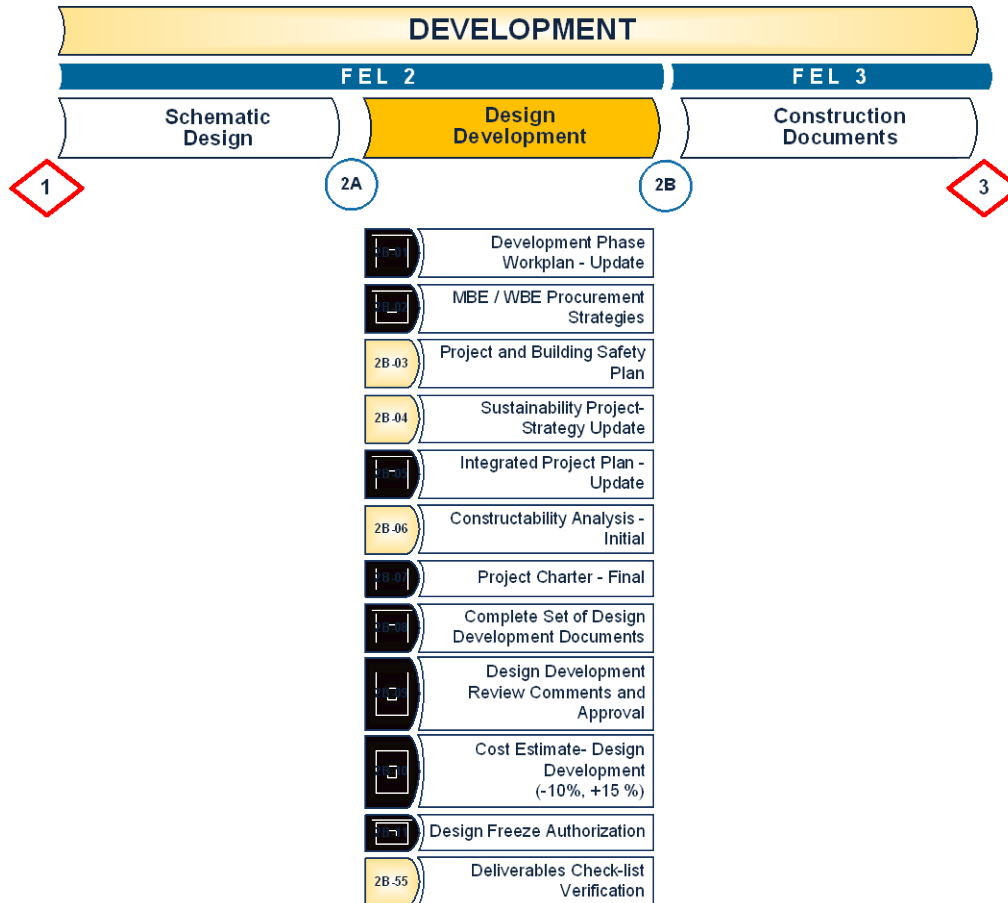
Tools and Techniques

- Deliverables Checklist Verification template
- Design and Construction Design Phase Deliverables



7.4. Design Development Stage

The Design Development Stage (sometimes referred to as the last half of FEL 2 or Pre-feasibility) is the middle part of the Development Phase. The schematic design is further developed based upon the programmatic requirements of the project.



2B-01 – Development Phase Workplan - Update

Definition

A Development Phase Workplan update is an update with any changes to the Development Phase Workplan developed in the Schematic Design Stage for the execution and management of the entire Development Phase which consists of the Schematic Design, Design Development, and Construction Documents Stages. It defines the scope of work and required resources with a framework for management of the project design up to final BOT approval. It provides all necessary high level information to ensure that the Development Phase is properly planned for efficient execution, management and control.

Purpose of Deliverable

To ensure commitments are not made without adequate planning and resources.

Parameters

- This deliverable is produced by the Project Leader

Content

- High level schedule
- Internal resource requirements
- External resource requirements
- Progress and Status reporting process

Tools and Techniques

- Development Phase Workplan – Initial (2A-02)
- Previous Work Plan

2B-02 – MBE / WBE Procurement Strategies

Definition

PSU Procurement has a mandatory process in place for MBE and WBE Subcontractor and Supplier Certification, Solicitation, and Commitment. When developing a project procurement strategy, MBE and WBE Subcontractors and Suppliers must be considered by following the PSU and/or DGS procedure.

Purpose of Deliverable

- To ensure mandatory compliance with a PSU and/or DGS process

Parameters

- The Core Team is responsible for this deliverable

Content

- Refer to PSU MBE/WBE Program Requirements.
- DGS BMWBO Program Requirements

Tools and Techniques

- Previous MBE / WBE Procurement Strategies

2B-03 – Project and Building Safety Plan

Definition

A Project Safety Plan is part of the project execution plan and describes all activities required to achieve the project safety performance objectives.

Purpose of Deliverable

The ultimate goal is achieving an injury and incident free project

Parameters

- The Core Team is responsible for this deliverable

Content

- This preliminary plan must be detailed enough to support Execution Contractor/Subcontractor selection. A final update will be prepared during the Construction Documents phase.

Tools and Techniques

- Previous Project and Building Safety Plans

2B-04 – Sustainability Project Strategy - Update

Definition

A Sustainability Project Strategy Update is an updating with any changes to the identified initial distinct design opportunities that can have a measurable impact on a project—enhancing the performance of the development, reducing its environmental footprint and increasing market value.

Purpose of Deliverable

A thoughtful Sustainability Strategy which is identified and implemented for each project can reduce PSU's environmental footprint and ultimately can have a demonstrable effect on the quality of the environment. PSU is committed to improving overall environmental footprint and being a leader in the area of sustainability.

Parameters

- The Project Leader is responsible for this deliverable.

Content

- Consider ISO14000 series standards, LEED, greenhouse gas emissions, sustainable construction techniques
- Refer to prior project Sustainability Strategies

Tools and Techniques

- Sustainability Strategy – Initial (1-10)
- Refer to prior project Sustainability Strategies
- CII (Construction Industry Institute) research team 250 Sustainability Implementation Resources

2B-05 – Integrated Project Plan - Updated

Definition

An Integrated Project Plan – Update, completed in the Design Development Stage is the progressed development to a complete set of documents that defines how the project is to be executed, monitored and controlled. Depending upon project size and complexity, it may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents. At this stage, the Updated plan includes a: Project Charter – Final (also a separate Deliverable), detailed WBS, high level schedule or Milestone Chart and an Cost Estimate – Funding Request (also a separate Deliverable). Subsidiary plans to be used will have been updated or completed.

An Integrated Project Plan – Update, completed in the Design Development Stage has the Scope of the project frozen, and is mid-way to finalizing in the Construction Documents Stage.

Purpose of Deliverable

The Initial Project Plan creates the initial framework that will be refined and enhanced until full funding has been approved and execution begins.

Parameters

- The Project Leader is responsible for creation of the plan with significant input from the Core Team.

Content

There are many ways to organize and present the project plan, but it commonly includes all of the following, which can also be separate documents and Deliverables:

- Project Charter with Scope Statement, which includes the project objectives and the project deliverables
- Description of the project management approach or strategy
- Work Breakdown Structure (WBS) to level at which control will be exercised, as baseline scope document
- Project Schedule including major milestones
- Cost estimates
- Core Project Team
- Risk management plan
- Stakeholder management plan

- Project Execution Plan
- Project Control Plan
- Open issues and pending decisions.

Project plan, may also include Subsidiary management plans:

- Safety management plan
- Scope management plan
- Schedule management plan
- Cost management plan
- Quality management plan
- Staffing management plan
- Communications management plan
- Risk response plan
- Procurement management plan

Tools and Techniques

- Integrated Project plan – Initial (1-08)
- Previous Integrated Project Plans

2B-06 – Constructability Analysis - Initial

Definition

A Constructability Analysis – Initial is a structured process with the goal of optimizing the balance between construction cost, construction quality, and construction schedule.

Purpose of Deliverable

Project achieves an optimum balance between construction cost, construction quality, and construction schedule

Parameters

- It must be performed by an individual or organization with a detailed experience and knowledge of construction methods and techniques, current material and labor costs, material availability, industry workload, etc. during the preparation of contract documents and the formulation of bid packages for competitive bids.

Content

- Content varies significantly based on the size, complexity, and type of project. Refer to a previously performed Constructability Analysis for a similar project or an organization with experience in this area.

Tools and Techniques

- Previous Constructability Analyses.

2B-07 – Project Charter - Final

Definition

A Project Charter – Final, is an elaborated version of the Project Charter - Update. It is a Project description and establishes the overall project vision.

Purpose of Deliverable

The Project Charter collects and defines business needs, Project parameters and Project planning information. It is progressively elaborated from the Initial version in the Programming Stage, updated in the Schematic Design Stage and finalized in the Design Development Stage after the project scope is frozen (at which point it becomes a comprehensive and complete Project description).

The Project Charter identifies scope of work and project objectives. It provides the information to ensure a common understanding between all key stakeholders and decision-making personnel as to what the Project aims are and the work to be accomplished to pursue the opportunity. Further, the Project Charter quantifies expectations and identifies critical success factors. It identifies critical elements of the project and provides high-level or summary schedule targets, as well as the progressive cost estimates and budgets.

Parameters

- The Project Charter – Final is prepared by the Core Project Team with close collaboration of the project Sponsor and key Stakeholders

Content

- Project Executive Summary
- Project Overview
- Project Justification - Business Need or Opportunity
- Project Scope and Objectives
- Project Estimated Cost/Duration
- Project Assumptions & Constraints
- Project Risks
- Funding/Budget
- Project Organization and Approvals
- Environmental Health and Safety

Tools and Techniques

- Project Charter – Update (2A-12)

2B-08 – Complete Set of Design Development Documents

Definition

Design Development Documents are all documents necessary to define the design development phase of the project. They also establish building/facility size, and describe materials.

Purpose of Deliverable

Design Development Documents consist of drawings, specifications, front end documents, cost estimate, schedule and all other deliverables previously defined. in the latest Project Charter.

Parameters

- The Project Leader oversees and the Design Professional is responsible for preparation of the documents.
- Refer Design and Construction Design Phase Deliverables for standard listing of requirements.

Content

The Design Development Documents should address:

- Project needs (as defined in the building program) are satisfied.
- University aesthetic goals are being met.
- Project budget goals are satisfied University long-term operation and maintenance are satisfied.
- Project schedule goals are realistic.
- Project constructability is realistic.

Tools and Techniques

- Previous Design Development Documents

2B-09 – Design Development Review, Comments, and Approval

Definition

Design Development Approval is complete when the PSU project team (including the Designer) obtains formal (written) client approval that the Design satisfies all formal needs without violating any boundaries or constraints (e.g., schedule, budget, etc.).

Purpose of Deliverable

A Design Development Review evaluates all aspects of the Design Development stage (e.g., drawings, cost estimates, budget, schedule, risks, etc.) against desired requirements established in the latest Project Charter.

Parameters

- The Project Leader is responsible for facilitating and assuring completion of the review.
- The review is much more in depth than the Schematic Design review raising deficiencies, gaps, and issues that need to be resolved for the project to be successful.
- Administrative approval of these documents must be obtained. Approval by the PSU President as well as the SVP of Finance and Business satisfies the requirements of this step.
- The Project Leader shall obtain review comments from the entire review team, which generally includes all divisions of OPP; Office of Telecommunications; Safety and Disability Services; Classroom Committee; Customer units; and the University Insurance Carrier.
- The size and type of project will determine review team makeup and number of reviews required.
- Review teams shall be informed of general project scope criteria.
- Reviews will encompass adherence to Penn State/OPP policies, OPP Design and Construction Standards, HMC Standards, and constructability.
- The Project Leader will coordinate all review comments through correspondence and/or scheduled meetings. Comments will be incorporated, resolved, or rejected by the review groups, and the Project Leader will inform reviewers of the results.
- The schedule for reviews will usually include approximately two weeks.

Content

The Design Development review process examines the present design to determine whether:

- Project needs (as defined in the building program) are satisfied.

- University aesthetic goals are being met.
- Project budget goals are satisfied (via independent estimate or estimate review performed by qualified personnel operating only on PSU's behalf and independent of the Design firm)
- University long-term operation and maintenance goals are satisfied.
- Project schedule goals are realistic.
- Project constructability is realistic.

Tools and Techniques

- Previous Design Development reviews

2B-10 – Cost Estimate – Design Development (-10%, +15 %)

Definition

A Cost Estimate - Feasibility (-10%, +15 %), based on completed Preliminary Engineering and Design at the end of the Design Development (FEL 2) Stage and prepared primarily by developing preliminary material quantities and obtaining budget quotations for major equipment. It estimates costs for activity-groups and for major components with their Work Packages corresponding to the Project WBS. This estimate continues to be refined in the Construction Documents (FEL 3) Stage. The level of Project Definition complete is estimated between 30% and 70%.

Purpose of Deliverable

The Design Development Cost Estimate provides an accurate projection of total project cost. It is almost entirely based on predictable elements (e.g., PFD's, P&ID's, equipment lists, Layouts & sections, Soil data, Mechanical concept, Piping sketches, Electrical single lines, Architectural features, Preliminary 3D model, Execution Plan, budget pricing)

Parameters

Estimates are prepared by Design Professional and/or independent cost estimator.

The Cost Estimates are broken down as follows:

- Direct Costs
- Indirect Costs
- Owner's Costs (Project support costs and Operations Costs);
- Escalation;
- Contingency for specific risk items;
- Cost estimate information must be sufficient to satisfy AACE Class 3 (-10%, +15%) accuracy criterion.

Content

Basis of Estimate

- Purpose;
- Scope of work;
- Methodology and assumptions used for estimating;
- Basis for pricing;
- Equipment costs;
- Materials costs;
- Labor costs;
- Indirect costs;

- Owner's costs;
- Escalation provisions;
- Contingency (explains risks covered);
- Reference to Project Schedule (key dates);
- Specific site conditions;
- Special Project constraints to be considered;
- Exclusions

Estimate

- Each option shall be presented according to the Parameters above;
- Appendices shall include backup documents, as appropriate.

Tools and Techniques

- Cost Estimate – Schematic Design (2A-11)
- Previous Design Development cost estimates.

2B-11 – Design Freeze Authorization

Definition

Design Freeze Authorization is a process to notify the owner/occupant of their last opportunity for major design input. Changes to the project scope or program after this milestone will be done in accordance with project change control procedures and have the potential to incur significant adverse budget and schedule impacts.

Purpose of Deliverable

The deliverable exists at this point in the process to prevent late scope changes which can have a very significant negative impact on project cost, schedule, and quality.

Parameters

- The Project Leader is responsible for this deliverable

Content

- Previous Design Freeze notices template

Tools and Techniques

- Previous Design Freeze notices

2B-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Check-List Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

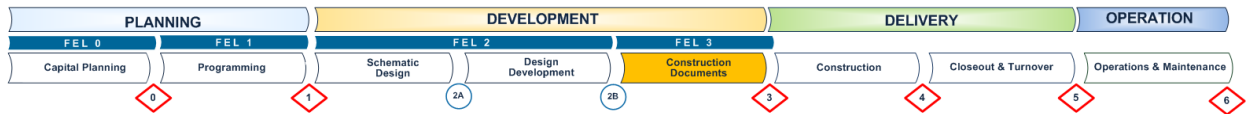
- Gate 2B is a checkpoint;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;
- Summary of Checklist is presented at the PDRB (Project Decision Review Board)

Content

- Gate 2B list of all deliverables

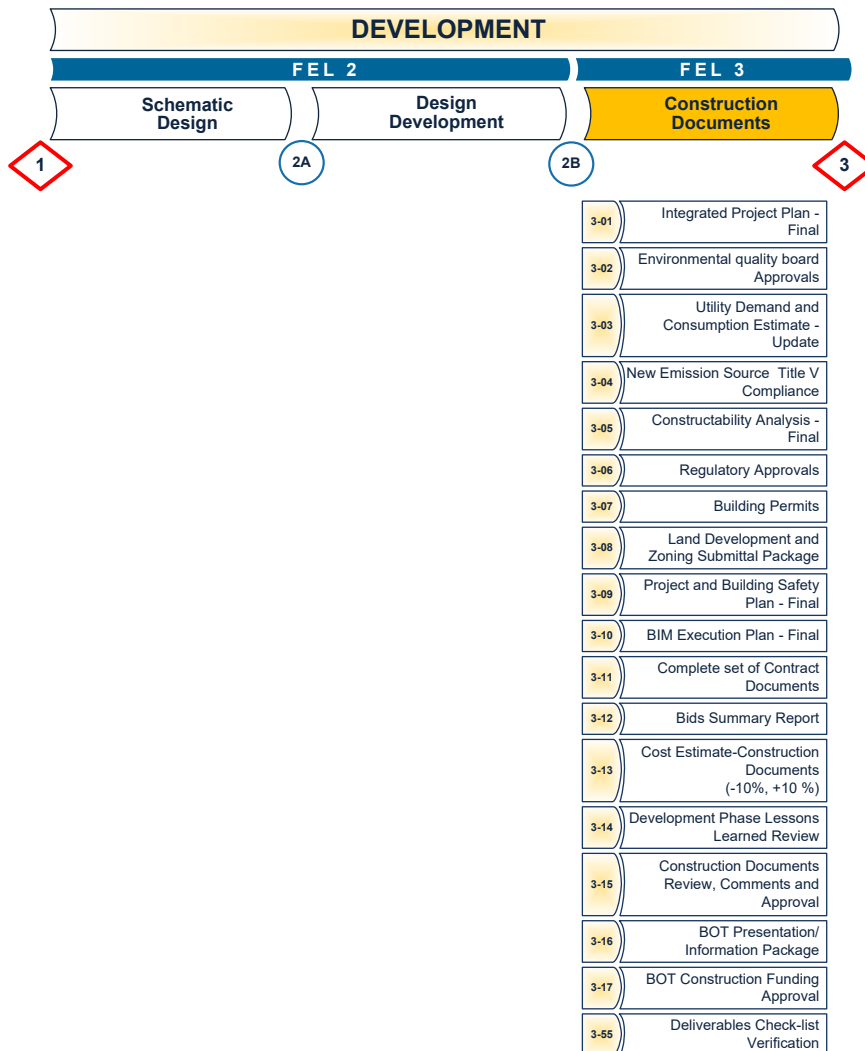
Tools and Techniques

- Deliverables Checklist Verification template
- Design and Construction Design Phase Deliverables



7.5. Construction Documents Stage

The Construction Documents stage (sometimes referred to as Feasibility or FEL 3) is the last part of the Development Phase. The primary purpose is to complete the project definition and detailed design, sanction the project, and finalize detailed execution plans.



3-01 – Integrated Project Plan - Final

Definition

An Integrated Project Plan – Final, completed in the Construction Documents Stage is a complete set of documents that defines how the project is to be executed, monitored and controlled. Depending upon project size and complexity, it may be summary or detailed and may be composed of one or more subsidiary management plans and other planning documents. At this stage, the Final plan includes a: Project Charter – Final (also a separate Deliverable), detailed WBS, high level schedule or Milestone Chart and a Cost Estimate - Control (also a separate Deliverable). Subsidiary plans to be used have also been completed.

The Integrated Project Plan – Final, is the final and formally-approved document used to guide both Project execution and management. It defines the execution and management strategies to bring the Project to successful completion. It provides information for Project controls and decision-making.

Purpose of Deliverable

The Initial Project Plan creates the initial framework that will be fleshed out and enhanced until full funding has been approved and execution begins.

Parameters

- The Project Leader is responsible for creation of the plan with significant input from the Core Team.

Content

There are many ways to organize and present the project plan, but it commonly includes all of the following, which can also be separate documents and Deliverables:

- Project Charter with Scope Statement, which includes the project objectives and the project deliverables
- Description of the project management approach or strategy
- Work Breakdown Structure (WBS) to level at which control will be exercised, as baseline scope document
- Project Schedule including major milestones
- Cost estimates
- Core Project Team
- Risk management plan
- Stakeholder management plan

- Project Execution Plan
- Project Control Plan
- Open issues and pending decisions.

Project plan, may also include Subsidiary management plans:

- Safety management plan
- Scope management plan
- Schedule management plan
- Cost management plan
- Quality management plan
- Staffing management plan
- Communications management plan
- Risk response plan
- Procurement management plan

Tools and Techniques

- Integrated Project Plan – Update (2B-05)
- Previous Integrated Project Plans template

3-02 – Environmental quality board approvals

Definition

Environmental Quality Board (EQB) approval is required for all applicable projects.

Purpose of Deliverable

To ensure compliance with a mandatory PSU process

Parameters

- The Core Team is responsible for this deliverable.

Examples of work requiring EQB approval include:

- changes to a building's exterior appearance such as installation of window air conditioners
- installation of objects on the land such as antennas, street furniture, landscaping, and electrical transformers
- anything that would change the general appearance of campus.
- these examples are not intended to be a finite listing but are to only illustrate the type of work that requires EQB approval.

Content

- Previous approvals

Tools and Techniques

- Previous approvals
- Please refer to PSU EQB process.

3-03 – Utility Demand and Consumption Estimate - Update

Definition

A Utility Demand and Consumption Estimate must be provided using the following OPP process:

Purpose of Deliverable

To ensure that:

- the energy costs for new facilities are included in the correct budget by the budgeting deadline
- data is available for long term energy capacity planning (e.g., new substation)

Parameters

- The Core team is responsible for this deliverable

Content

- Refer to the OPP Utility Demand and Consumption Form (link in Definition)

Tools and Techniques

- Energy and Operating Cost Estimate – Updated (2A-10)
- Refer to previous Utility Demand and Consumption Estimates

3-04 – New Emission Source Title V Compliance

Definition

Operating permits are legally enforceable documents that permitting authorities issue to air pollution sources after the source has begun to operate. A Title V Operating Permit is required for most large sources (and some smaller sources) of air pollution. The name comes from Title V of the Clean Air Act.

Purpose of Deliverable

Projects that contain any New Emission Source must comply with Title V requirements by following mandatory OPP procedure at www.opp.psu.edu

Parameters

- The Core Team is responsible for this deliverable
Most Title V permits are issued by State and local permitting authorities.

Content

- Refer to the Title V New Emission Source Information

Tools and Techniques

- Previous projects with new emissions sources

3-05 – Constructability Analysis - Final

Definition

A Constructability Analysis – Final is a structured process with the goal of optimizing the balance between construction cost, construction quality, and construction schedule.

Purpose of Deliverable

Project achieves an optimum balance between construction cost, construction quality, and construction schedule

Parameters

- It must be performed by an individual or organization with a detailed experience and knowledge of construction methods and techniques, current material and labor costs, material availability, industry workload, etc. during the preparation of contract documents and the formulation of bid packages for competitive bids.

Content

- Content varies significantly based on the size, complexity, and type of project. Refer to a previously performed Constructability Analysis for a similar project or an organization with experience in this area

Tools and Techniques

- Constructability Analysis – Initial (2B-06)
- Previous Constructability Analyses

3-06 – Regulatory Approvals

Definition

There are many potential regulatory approvals required for construction projects including: PA Labor, Industry, Land Development and Zoning by municipality, Zoning, Permits, Erosion and Sedimentation, NPDES, and Planning Module.

Purpose of Deliverable

To ensure all applicable Federal, State, and Local regulatory approvals are obtained in a timely manner

Parameters

- The Core Team is responsible for this deliverable

Content

- Establish approvals based upon requirements of authority having jurisdiction
- For projects funded by the state, documents must be submitted for conformance to the request for project action for establishment of MBE/WBE participation rates. Refer to Guidelines for Capital Construction Projects with the Department of General Services for requirements.

Tools and Techniques

- Previous project's regulatory approvals/requirements.

3-07 – Building Permits

Definition

In 2004, the State of Pennsylvania adopted a set of standards that regulates new construction and renovations to residential and commercial buildings in the State of Pennsylvania. These standards are collectively known as The Uniform Construction Code (UCC). Enforcement of the UCC began in April 2004.

Purpose of Deliverable

To ensure compliance with the current building codes for all construction activities

Parameters

- The Design Professional is responsible to ensure that project complies with this deliverable.
- The Department of L&I is responsible for all code enforcement at the University.

Content

- Mandatory OPP procedures must be followed as related to Annual Permits for minor alterations or replacements in a facility and Building Permits for construction projects

Tools and Techniques

- Building Permit Application

3-08 – Land Development and Zoning Submittal Package

Definition

The potential impact of State and local Land Development and Zoning regulations must be considered for any construction project. Please refer to requirements of the authority having jurisdiction.

Purpose of Deliverable

To ensure compliance with all state and local requirements

Parameters

- The Core team is responsible for this deliverable

Content

- Land Development and Zoning Applications.

Tools and Techniques

- Previous Land Development and Zoning submissions.

3-09 – Project and Building Safety Plan – Final

Definition

A Project and Building Safety Plan is part of the project execution plan and describes all activities required to achieve the project safety performance objectives with the ultimate goal of achieving an injury and incident free project. This final plan must be detailed enough to support Execution Contractor/Subcontractor selection as well as to establish clear expectations for pre-mobilization and on-site safety processes. The Building Safety aspect exists to ensure existing building safety plans are carefully reviewed to identify changes required as a result of this project.

Purpose of Deliverable

The ultimate goal is achieving an injury and incident free project

Parameters

- The Core Team is responsible for this deliverable

Content

- This final plan must be detailed enough to support Execution.

Tools and Techniques

- Project and Building Safety Plan (2B-03)
- Previous Project and Building Safety Plans

3-10 – BIM Execution Plan - Final

Definition

Building Information Modeling (BIM) is the process of generating and managing building data during its life cycle. Typically it uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. The process produces the Building Information Model (also abbreviated BIM), which encompasses building geometry, spatial relationships, geographic information, and quantities and properties of building components.

Purpose of Deliverable

An Initial BIM (Building Information Model) Execution Plan during the Programming stage (1-11) defined the appropriate uses for BIM on this project. This final plan ensures that the specific BIM implementation has been followed during project development and is ready for transition to project execution.

Parameters

- The Core Team is responsible for this deliverable

Content

- OPP BIM Project Execution Plan

Tools and Techniques

- BIM Execution Plan – Initial (1-11)
- Refer to previously prepared BIM execution plans

3-11 – Complete set of Contract Documents

Definition

A Complete set of Contract Documents include all documents required to legally and successfully bid and execute the project. As the construction documents are completed, a bid date is established and the preparation of the bidding documents is coordinated with the architect. Bidding documents include construction documents and standard “front-end” contractual documents that are used for all Penn State projects. The front-end documents may be slightly modified to address unique characteristics of each project.

Purpose of Deliverable

The purpose of contracts is to establish the agreement that PSU and the parties (Contractors, Service Providers) have made and to fix their rights and duties in accordance with that agreement. The review process is designed to ensure that the contracts are valid and enforceable and that all applicable PSU policies and procedures have to be complied with.

Parameters

- The Project Leader shall establish the bid date, pre-bid date, and liquidated damages in consultation with Contract Administration. This information is inserted into the “Instructions to Bidders” section. Once the front-end specifications are drafted and edited to suit the specific project, Penn State's Contract Administration Office shall review these documents for accuracy and completeness.
- Refer Design and Construction Design Phase Deliverables for standard listing of requirements.

Content

- Complete set of contract documents including the standard Penn State front-end documents tailored to the specific project.

Tools and Techniques

- Refer to previously prepared contract documents
- Refer to Division 00 Design and Construction Standards

3-12 – Bids Summary Report

Definition

On the day bids are due, Contract Administration opens the bids, prepares a Bid Tab recording the bids along with the Architect's estimate of construction cost, and posts the results on the OPP website. If there are any irregularities in the bidding, they are reported on the Bid Summary.

The Project Leader then prepares and distributes a Bid Summary for distribution to senior leadership. The Bid Summary includes the anticipated total project cost and the approved project budget.

Purpose of Deliverable

To objectively compare bidders and ultimately select the best bid for the project

Parameters

- The Project Leader is responsible for this deliverable.

Content

- Recommendation Summary
- Bid Tab

Tools and Techniques

- TBD

3-13 – Cost Estimate – Construction Documents (-10%, +10 %)

Definition

Cost Estimate - Control (-10%, +10 %) is based on completed Basic Engineering and Design at the end of the Construction Documents (FEL 3) Stage and prepared with substantial quoted pricing for equipment and bulk materials and detailed quantities extended with semi-detailed unit prices. It identifies cost for activity-groups and for facilities components with their Work Packages, corresponding to the Project WBS. This estimate is the Control estimate used for continuous cost control and budget management on the project. The level of Project Definition complete is estimated between 70% and 100 %.

Purpose of Deliverable

To ensure that the project can be completed for the estimated cost with a high level of confidence

Parameters

Estimates are prepared by the Core Team.

The Cost Estimates are broken down as follows:

- Direct Costs Indirect Costs
- Owner's Costs (Project support costs and Operations Costs);
- Escalation;
- Contingency for specific risk items;
- Cost estimate information must be sufficient to satisfy AACE Class 5 (-10%, +10%) accuracy criterion.

Content

Basis of Estimate

- Purpose;
- Scope of work;
- Methodology and assumptions used for estimating;
- Basis for pricing;
- Equipment costs;
- Materials costs;
- Labor costs;
- Indirect costs;
- Owner's costs;
- Escalation provisions;
- Contingency (explains risks covered);

- Reference to Project Schedule (key dates);
- Specific site conditions;
- Special Project constraints to be considered;
- Exclusions

Estimate

- Each option shall be presented according to the Parameters above;
- Appendices shall include backup documents, as appropriate.

Tools and Techniques

- Cost Estimate – Design Document (2B-10)
- Previous Project Planning cost estimates

3-14 – Development Phase Lessons Learned Review

Definition

A Development Phase Lessons Learned Review is a documentation of the learning gained from the process of performing the project during all of the Development Phase Stages (Schematic Design, Design Development and Construction Documents). This listing of experiences and issues (both positive and negative) also identifies success factors and/or solutions to problems encountered and/or risks to be aware of for further Project work and for other Projects. It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. Lessons learned may be identified at any point. Also considered a project record, to be included in the *lessons learned knowledge base*.

Purpose of Deliverable

It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. Multiple lessons learned deliverables exist to prevent too much time from passing between “learning the lesson” and documenting it. In addition, some different personnel are involved in the Planning phase that will not be involved during execution or at the Lessons Learned process at the end of the project.

Parameters

- The Core Team and Key Service Provider personnel need to participate
- The best situation is to use a facilitator that was not part of the project team (e.g., an experienced OPP project leader that had nothing to do with the project). This allows all participants to contribute rather than focus on the lessons learned process. This also brings additional objectivity to the process.
- For large or highly visible projects particularly those with some less than desirable outcomes, extreme care must be taken to ensure high candor and full participation. A skilled and “independent from the project” facilitator is an absolute requirement. When high level executives are involved, splitting the review into more than one session so lower level participants feel free to contribute generated the best lessons learned.

Content

- Factual, non-judgmental descriptions of outcomes and contributing decisions and issues (the purpose is not to assign blame or perform a performance review but to capture things that went well and things that did not go well for the benefit of all future projects)
- Back-up/supporting documents

Tools and Techniques

- none

3-15 – Construction Documents Review, Comments, and Approval

Definition

To complete the Construction Documents Approval deliverable, the designer must obtain formal client approval that the construction documents satisfy needs and budget. The Project Leader shall obtain review comments from the entire review team, which generally includes all divisions of OPP; Office of Telecommunications; HMC; Safety and Disability Services; Classroom Committee; Customer units; and the University Insurance Carrier. The size and type of project will determine review team makeup and number of reviews required. Review teams shall be informed of general project scope criteria. Reviews will encompass adherence to Penn State/OPP policies, OPP Design and Construction Standards, and constructability. The Project Leader will coordinate all review comments through correspondence and/or scheduled meetings. Comments will be incorporated, resolved, or rejected by the review groups, and the Project Leader will inform reviewers of the results. The schedule for reviews will usually include approximately two weeks.

Construction Documents review examines the present design to determine whether:

- Project needs (as defined in the building program) are satisfied.
- University aesthetic goals are being met.
- Project budget goals are satisfied (via independent estimate or estimate review performed by qualified personnel operating only on PSU's behalf and independent of the Design firm)
- University long-term operation and maintenance are satisfied.
- Project schedule goals are realistic.
- Project constructability is realistic.

Purpose of Deliverable

To ensure that the documents are complete and meet all standards and requirements

Parameters

- The Review is facilitated by the Project Leader

Content

- Refer to previously completed reviews

Tools and Techniques

- Refer to previously completed reviews

3-16 – BOT Presentation / Information Package

Definition

An information package is required to inform the PSU Board of Trustees (BOT) for projects between \$5,000,000 and \$9,999,999.

BOT approval to award contracts for construction is required for full funding for all projects larger than \$10,000,000³.

BOT meetings are typically bi-monthly and a BOT Presentation Package must be prepared a minimum of 4 weeks in advance of the meeting to facilitate PSU executive review and BOT pre-reading requirements.

Projects under \$10,000,000³ that are bond financed require approval to award contracts for construction.

Purpose of Deliverable

Compliance with matters requiring approval of the BOT per the Bylaws

Parameters

- The BOT presentation package is prepared by the Core Team.

Content

- Refer to BOT submission guidelines.

Tools and Techniques

- Refer to previously completed BOT presentations.

3-17 – BOT Construction Funding Approval

Definition

Refer to 3-16.

Purpose of Deliverable

To ensure all projects are properly authorized before construction contracts are awarded.

Parameters

- Approval to proceed is communicated in writing to the project core team.

Content

Approval is either:

- granted “as summarized and submitted” in 3-16 “BOT Presentation / Information or
- granted with specific additions or restrictions

Tools and Techniques

- None

3-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

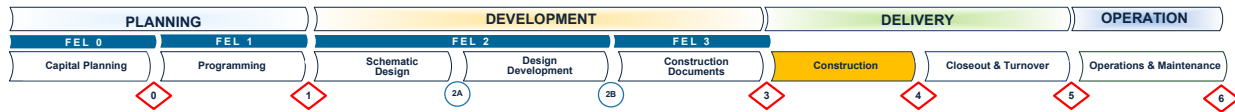
- Gate 3 is a go/no go decision point;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;
- Summary of Checklist is presented at the PDRB (Project Decision Review Board)

Content

- Gate 3 list of all deliverables

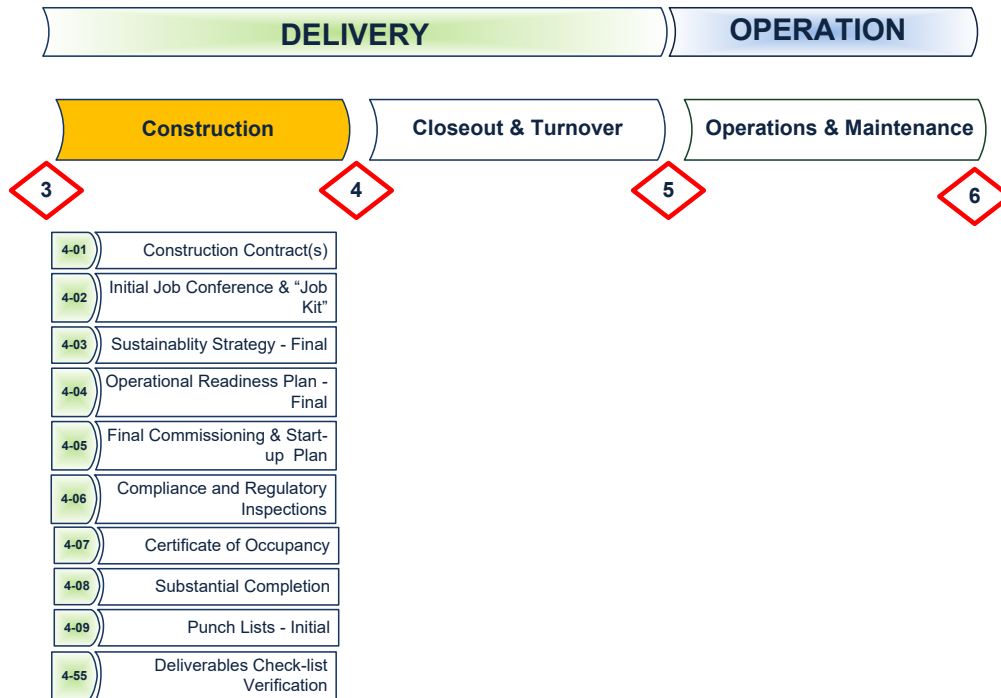
Tools and Techniques

- Mandatory Deliverables Checklist Verification template



7.6. Construction Stage

The Construction stage (sometimes referred to as execution) is the first part of the Delivery Phase. The construction stage implements the goals identified during the planning and defined during the Development phase. This transformation of the project from drawings on paper into a physical building/facility requires incorporation of materials, equipment, and skills into an orderly sequence of activities designed to achieve the finished project.



4-01 – Construction Contract(s)

Definition

A Construction contract is a legally enforceable agreement between PSU and one or more additional parties with mutual obligations.

Purpose of Deliverable

The Contract established clear obligations for all parties and establishes remedies (or a process for reaching a remedy) for breach of contract is (e.g., damages or monetary compensation).

Parameters

- The contract is prepared by Contract Administration with input from the core team.
- Deviations from standard PSU terms and conditions must be approved by Contract Administration.

Content

Refer to Contract Templates

Tools and Techniques

- Refer to previously completed contracts

4-02 – Initial Job Conference & “Job Kit”

Definition

Prior to commencement of the work, an Initial Job Conference is conducted. It is a meeting between the PSU project team and all prime contractors. Subcontractors are also strongly encouraged to attend.

Purpose of Deliverable

To introduce all parties and to discuss and develop mutual understanding relative to administration of the project, general conduct of the work, progress schedules, and other contract procedures relating to the work

Parameters

- The Project Leader is ultimately responsible for this deliverable
- The Project Leader is responsible for coordinating and chairing the Initial Job Conference.
- At the Initial Job Conference, OPP will provide all prime contractors with a copy of the PSU "Job Kit" which contains additional information and details concerning PSU regulations and requirements.

Content

- Refer to the “Job Kit” template

Tools and Techniques

- Refer to previously completed job conferences

4-03 – Sustainability Strategy - Final

Definition

A Final Sustainability Strategy is a final update to the Initial Sustainability Strategy in the Programming Stage with any changes, and it identifies the distinct design opportunities that will have a measurable impact on a project—enhancing the performance of the development, reducing its environmental footprint and increasing market value.

Purpose of Deliverable

A thoughtful Sustainability Strategy which is identified early for each project and consistently implemented can reduce PSU's environmental footprint and ultimately can have a demonstrable effect on the quality of the environment. PSU is committed to improving overall environmental footprint and being a leader in the area of sustainability.

Parameters

- The Core Team is responsible for this deliverable.

Content

- Consider ISO14000 series standards, LEED, greenhouse gas emissions, sustainable construction techniques

Tools and Techniques

- Sustainability Project Strategy Update (2B-04)
- Refer to prior project Sustainability Strategies
- Refer to PSU LEED Policy.

4-04 – Operational Readiness Plan – Final

Definition

A plan identifying all Deliverables and activities under PSU Operating responsibility, outside of the Construction contractors and service providers, that are carried out concurrently with project execution and beyond, up to Final Acceptance. It covers the development of all processes required to interface with the Project Team and to take-over and operate the delivered facilities.

Purpose of Deliverable

An Operations Readiness Plan – Final, is intended to provide a detailed plan identifying all Deliverables and activities under PSU Operating responsibility, outside of the Construction contractors and service providers, that are carried out concurrently with project execution and beyond, up to Final Acceptance. It covers the development of all processes required to interface with the Project Team and to take-over and operate the delivered facilities. The ultimate objective is to achieve a smooth, seamless transition between Construction and Operations. properly planned, resources, tracked, and executed.

Parameters

- The owner/occupant representative on the Core Team (e.g., FC) is responsible for this deliverable.
- The Core team must ensure these activities are properly planned, resourced, tracked, and executed.

Content

Content is significantly different for a new complex (e.g., Medical Center) versus a sports facility or an addition to an existing building. Project type, size, and complexity will dictate required elements. Here are a few items common to most projects:

- Owner/occupant provided furnishings, technology, signage, etc.
- Maintenance
- Emergency response (notification, map updates, etc.)
- Move in

Tools and Techniques

- Operations Readiness Plan – Initial (1-07)

Purpose of Deliverable

An Operations Readiness Plan – Initial, is intended to provide a framework plan for the Operations organization, for scope of work by business process, schedule and budget. The ultimate goal is to achieve a smooth transition between Construction and Operations by identifying all activities outside the direct control of the project team early enough to ensure they are properly planned, resources, tracked, and executed.

Parameters

- The owner representative on the Core Team (e.g., FC) is responsible for this deliverable.

Content

Content is significantly different for a new complex (e.g., Medical Center) versus a sports facility or an addition to an existing building. Project type, size, and complexity will dictate required elements. Here are a few items common to most projects:

- Building Operations
- Ongoing Maintenance
- Emergency response (notification, map updates, etc.)
- Environmental Health and Safety
- Custodial services
- IT system

Tools and Techniques

- none

4-05 – Final Commissioning & Start-up Plan

Definition

A Final Commissioning & Start-up Plan is part of the project execution plan and describes all activities required after construction completes up through and including the asset owner/occupant to take-over and fully utilize/operate the delivered facilities.

Purpose of Deliverable

The prime objective is to have a carefully thought through transition plan between construction, start-up, and operation stages.

Parameters

- Special attention must be focused on the division of responsibilities between those executing the construction project and others involved in commissioning, start-up and operations.
- The Core Team is responsible for this deliverable.

Content

- The plan clearly describes the magnitude and timing of commissioning and start up activities that are carried out concurrently and in synchronization with project execution and beyond, up to occupancy/operation on specification. It also covers take-over and acceptance process.

Tools and Techniques

- Refer to previously completed plans

4-06 – Compliance and Regulatory Inspections

Definition

Compliance and Regulatory inspectors, such as, Labor and Industry (L&I) inspectors, will visit the construction site and examine construction progress to ensure the project is constructed in compliance with the construction documents which were reviewed and approved in the issuance of the permit(s). The process is designed to also ensure compliance with regulatory agency requirements

Purpose of Deliverable

To ensure construction is in compliance with construction documents and all applicable regulatory requirements.

Parameters

Currently, the University is mainly regulated by three authorities, two state and one federal:

- US Environmental Protection Agency (EPA)
- PA Department of Environmental Protection (PA DEP)
- PA Department of Labor and Industry (PA Labor and Industry)
- Other project specific regulatory authorities

Content

- Project specific;

Tools and Techniques

- Inspection documentation provided by agency performing inspection.

4-07 – Certificate of Occupancy

Definition

A Certificate of Occupancy is a document issued by a local government agency or building department certifying a building's compliance with applicable building codes and other laws, and indicating it to be in a condition suitable for occupancy. It complements a building permit which is a document that must be filed with the local authority before construction to indicate that the proposed construction will adhere to ordinances and codes and laws.

Purpose of Deliverable

It is a regulatory requirement before using the new facility.

Parameters

- The Core Team is responsible for this deliverable acquiring this deliverable from the authority having jurisdiction.

Content

- None

Tools and Techniques

- No Certificate of Occupancy provided by authority having jurisdiction

4-08 – Substantial Completion

Definition

Substantial Completion is the point at which the progression of work is sufficiently complete such that the owner/occupant can enjoy beneficial use of the project for its intended purpose.

Purpose of Deliverable

This deliverable is a project and contractual milestone.

Parameters

- This deliverable is performed by the Core Team and additional project team members as required by the project.
- When the work is sufficiently complete to meet this requirement (which is carefully defined in the contract with the contractor), the contractor requests a substantial inspection. The Design Professional, QA/QC Representative, and the Project Leader then inspect the work and prepare a substantial inspection report that documents the date of the inspection, any outstanding items and a time within which the outstanding items must be fixed.
- Substantial Completion is the date at which the One-Year Warranty Bond period generally begins.
- Upon Substantial Completion, the University generally assumes responsibility for utilities, maintenance, operation of equipment, warranty, insurance, etc., of the completed Work (or portions thereof), as further delineated in the contract documents (see deliverable 5-03)

Content

- Refer to substantial completion inspection report template

Tools and Techniques

- Refer to previously prepared substantial completion inspection reports

4-09 – Punch Lists - Initial

Definition

The Initial Punch List(s) are work items, issues, or defects identified during construction that are to be completed by the contractor. Punch-lists are defined here as a written list documenting the results of an inspection and listing each item of the Work that is to be completed or corrected and affixing the time within which the deficiency is to be resolved. Punch-lists as defined here are intended to document only those items that are the Contractor's responsibility, or for which responsibility has not yet been ascertained and could potentially be that of the Contractor.

Purpose of Deliverable

Punch Lists help ensure that PSU personnel and Service Providers understand items a specific Contractor must perform to complete the work in accordance with the contract. It can also prioritize the work if needed.

Parameters

- The Punch List is produced by the core project team and issued by Construction Services.

Content

- Refer to Punch List template

Tools and Techniques

- Refer to Punch Lists template

4-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Checklist by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

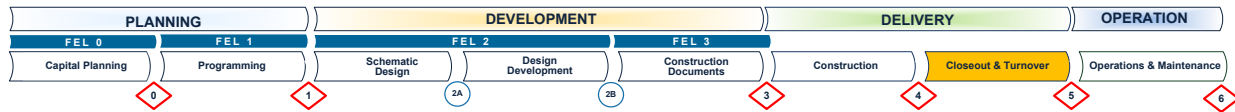
- Gate 4 is a checkpoint;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;

Content

- Gate 4 list of all deliverables

Tools and Techniques

- Deliverables Check List Verification template
- Design and Construction Design Phase Deliverables



7.7. Closeout and Turnover Stage

The Closeout and Turnover stage are the last part of the Delivery Phase. The goal of this stage is to facilitate the occupancy and turnover of the finished project to the user group and maintenance group. During this stage, the Design and Construction PL coordinates occupant move-in, completion of the punch-list and commissioning, and O&M and occupant training. The Design and Construction PL also facilitates contractual closeout with the design and construction professionals. During the turnover period, the management responsibilities for the facility transfer from Design and Construction to Buildings and Grounds and Energy and Engineering. The daily maintenance and building services activities become a part of the routine services provided by these divisions.



5-01 – Service Provider Evaluations

Definition

A Service Provider Evaluation (SPE) is an objective assessment of the quality and the cost effectiveness of work performed by the Service Provider.

Purpose of Deliverable

The SPE is an important tool for providing constructive feedback for use during service provider selection on future Penn State projects. The intent of the SPE process is to:

- improve the delivery, quality, and cost effectiveness of the service provider.
- promote better working relationships between OPP and contractors
- to remove poor performing firms from Penn State's Pre-qualified Bidders List.

Parameters

- The Core Project Team, Facility coordinator, Operations staff, and the Asset Owner/Occupants all provide input and participate in analyzing project service providers.

Content

- Refer to the Design and Construction Service Provider Evaluation Process

Tools and Techniques

- Refer to previously completed evaluations

5-02 – Attic Stock Turnover

Definition

An Attic Stock Turnover is a transfer of all unused items purchased for the project that were not used or are required by the contract from the Project contractors to Maintenance.

Purpose of Deliverable

To identify and document receipt of attic stock material

Parameters

- The Project Manager is responsible for this deliverable

Content

- Refer to previously completed turnover documentation
- List of materials turned over

Tools and Techniques

- Refer to previously completed turnover documentation

5-03 – Facilities Care, Custody and Control Acceptance Notice

Definition

It is a Notice of Acceptance of Care, Custody and Control of the facilities issued by PSU. It documents that care, custody and control of the facility is assumed by PSU operations entities on an agreed date. It provides a formal indication to all Project and operations personnel that the site and facilities are under PSU responsibility, including the Emergency Response Plan.

Purpose of Deliverable

The notice ensures that the Care, Custody, and Control notice is completed and accurate and that PSU accepts responsibility for the facility.

Parameters

The Care, Custody, and Control notice:

- Must clearly describe the transfer of responsibilities for the site and facilities from the Contractors to PSU
- is distributed to all Contractor personnel, all associated PSU personnel (e.g., occupant, maintenance, operating, etc.), all service providers and all emergency response personnel;
- does not liberate the Contractors from their obligations to deliver the facilities as planned and make corrections to deficiencies;
- is signed off by the Project manager, building FC and appropriate operations personnel.

Content

- Description of the site and facilities transferred to PSU responsibility
- Emergency Response Plan
- Date of Care, Custody and Control take over by PSU
- Facilities Care, Custody and Control Acceptance Notice sign-off

Tools and Techniques

- Refer to previous notices

5-04 – User & Maintenance Turnover Letter(s)

Definition

A User & Maintenance Turnover Letter is a formal communication from the Project Manager to the Users and Maintainers of a facility establishing a specific turnover date.

Purpose of Deliverable

Turnover letters define and document when complete responsibility transfers from the Project Team to Maintenance and Users (Occupants).

Parameters

- The Project Manager is responsible for turnover letter creation and distribution

Content

- Refer to previous turnover letters

Tools and Techniques

- Refer to previous turnover letters

5-05 – Operations & Maintenance Manuals

Definition

Operations & Maintenance Manuals are manufacturers or suppliers' documents provided by the contractors giving details about product specifications and design that will aid the owner in continued operations.

Purpose of Deliverable

To ensure:

- the service providers have delivered all required manuals for successful operation and maintenance of the facility
- the manuals are properly archived and centrally available when needed
- the quality of the manual is consistent with contractual requirements

Parameters

- The Project Manager is responsible for this deliverable

Content

- As specified in contract documents

Tools and Techniques

- none

5-06 – Record Set Drawings

Definition

Record drawings are a set of design documents marked up to show how the completed building was actual constructed. The drawings will be provided in the format stipulated by the construction contracts.

Purpose of Deliverable

To ensure accurate drawings are available for future troubleshooting and maintenance.

Parameters

- Refer to previous record set drawing transmittals

Content

- Refer to previous record set drawing transmittals

Tools and Techniques

- Drawing transmittal process/form

5-07 – Building Systems Training

Definition

As part of the facility commissioning process, orientation and training will be provided to appropriate personnel responsible for operating and maintaining the various facility systems. General walkthroughs should be scheduled for these individuals during construction as well. Orientation and training sessions should be videotaped for future reference.

Purpose of Deliverable

To provide building systems training to those responsible for operating the new facility.

Parameters

- Contractor and/or Manufacturer's Representation will provide this training as required by the contract documents.
- The QA/QC Representative shall document that such an orientation period was held, and when.

Content

- Contract documents and Commissioning plan will be used to identify the equipment and systems to be included in the training.

Tools and Techniques

- none

5-08 – Risk Management Report - Final

Definition

A Risk Management Plan – Final Report is the document describing how project risks management was structured and performed on the project. It is an executive summary of the major risks identified and actions taken to address these risks along with the outcomes. The report summarizes how extreme risks and those with catastrophic outcomes were addressed and their outcomes. Finally, it is important to also identify improvements that could be made on the project or in the process.

Purpose of Deliverable

This deliverable exists to improve OPP risk identification, categorization, and management.

Parameters

- Context established including objectives, stakeholders, criteria, and key elements;
- Comparison of risks as presented at full funding versus actual risks. Were risks not identified that materialized? Were consequences underestimated or overstated?
- Results of mitigations and actions that focus on specific risks and/or opportunities

Content

- PSU risk management process

Tools and Techniques

- Risk Management Plan – Initial (1-06)
- Integrated Project Plan (3-01)
- Previous Risk Management Reports

5-09 – Delivery Phase Lessons Learned Review

Definition

A Project Lessons Learned Review is a documentation of the learning gained from the process of performing the project. This listing of experiences and issues (both positive and negative) is a summary that identifies success factors and/or solutions to problems encountered and/or risks to be aware of for further Project work and for other Projects.

Purpose of Deliverable

It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. It is also considered a project record, to be included in the lessons learned knowledge base.

Parameters

- The Core Team and Key Contractor/Service Provider participation is essential.
- For maximum benefit, a facilitator that was not part of the project team should be used (e.g., an experienced OPP project manager that had nothing to do with the project). This allows all participants to contribute rather than focus on the lessons learned process. This also provides for brings additional objectivity.
- For large or highly visible projects, an independent professional facilitator is strongly recommended.

Content

- Factual, non-judgmental descriptions of outcomes and contributing decisions and issues (the purpose is not to assign blame or perform a performance review but to capture what went well and what did not for the benefit of all future projects)
- Backup/supporting documents

Tools and Techniques

- Refer to previously completed reviews

5-10 – Punch Lists - Completed

Definition

Punch List(s) are work items/issues/defects identified during construction that are to be completed by the contractor. Punch-lists are defined here as a written list documenting the results of an inspection and listing each item of the Work that is to be completed or corrected and affixing the time within which the deficiency is to be resolved. Punch-lists as defined here are intended to document only those items that are the Contractor's responsibility, or for which responsibility has not yet been ascertained and could potentially be that of the Contractor. Punch-lists are NOT intended to address design-related issues assigned to OPP or the Professional, Customer requests, etc., which are not, or which have not yet, been incorporated into the scope of the Contractor's contractual responsibilities; such issues are generally addressed through other project mechanisms.

Purpose of Deliverable

Punch Lists ensure that the Project Team understands items a specific Contractor must do to complete the work in accordance with the contract. It can also prioritize the work if needed.

Parameters

- All outstanding Punch-list items must be completed prior to completion of the Closeout and Turnover stage.

Content

- Refer to a previously completed Punch List

Tools and Techniques

- none

5-11 – Documentation Archived

Definition

The Documentation Archived deliverable is a written record regarding the disposition of the project documents.

Purpose of Deliverable

Some project documentation is only useful during a specific stage or until the project turnover and acceptance is complete and contractors and service providers demobilize. Other documents need to be retained to document project history or to be used for future similar projects. This deliverable forces a decision to be made about retaining or discarding all project documents.

Parameters

- Length of retention (e.g., 1 year, 5 years, forever)
- Format (electronic or hard copy)
- Location of master document

Content

- Meeting minutes
- Consider all prior deliverables
- Information transmitted by Contractors and Service providers

Tools and Techniques

- none

5-55 – Deliverables Checklist Verification

Definition

A Deliverables Checklist Verification is a signed Check-List by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Checklist Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Checklist verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

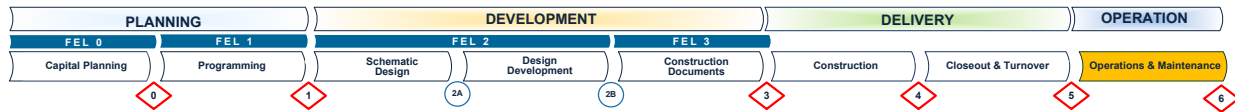
- Gate 5 is a checkpoint;
- Checklist confirm to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;

Content

- Gate 5 list of all deliverables

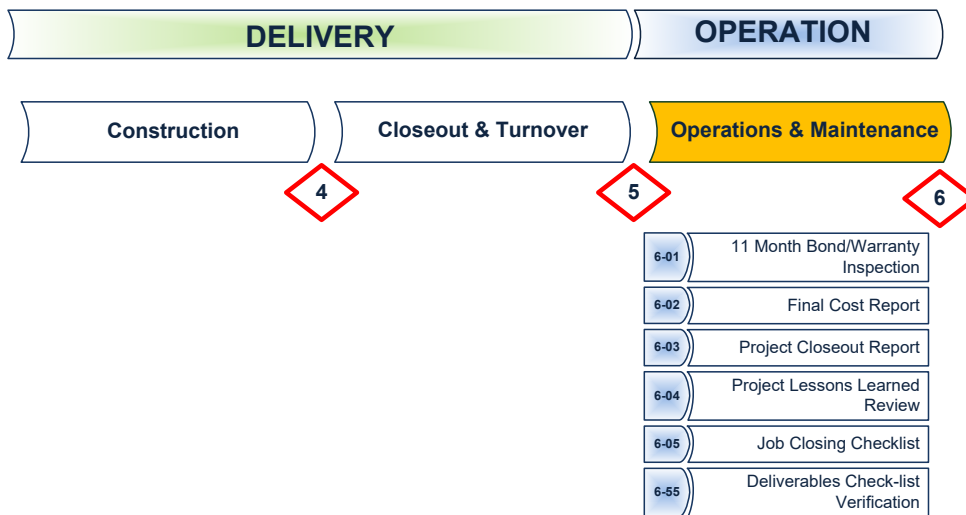
Tools and Techniques

- Deliverables Check List Verification template



7.8. Operations and Maintenance Stage

The Operations and Maintenance stage is the only stage in the Operations Phase. It begins when the Closeout and Turnover stage is finished by turning over an occupied, complete building to an operations and maintenance staff and occupants that are trained in the building's operation.



6-01 – 11 Month Bond/Warranty Inspection

Definition

Unless otherwise specified in the contract documents, standard PSU construction contracts require guarantees for all work against defects in materials, equipment and/or workmanship for a period of one year from the date of Substantial Completion of the entire Work (or, for partial occupancy, for the respective portion thereof). Just prior to the one-year anniversary date of Substantial Completion, a follow-up inspection is conducted to ascertain any deficiencies that might have come to light since the Substantial/Final Inspections. As with the Substantial Completion Inspection, the 11 Month Bond/Warranty Inspection produces a Punch-list documenting items which are now found to be in need of completion/correction. A bond/warranty inspection letter with the punch-list is issued to the contractor/CM informing them of the items requiring attention.

Purpose of Deliverable

After the Punch-list items are completed, or if no punch-list items are identified, the bond inspection generally serves as release of the Contractor's surety's obligations under the terms of the Performance Bond furnished to the University.

Parameters

- The Project Leader is responsible for the inspection.

Content

- Refer to previously completed inspections/letters.

Tools and Techniques

- Refer to previously completed inspections/letters

6-02 – Final Cost Report

Definition

A Final Cost Report is a report documenting actual project final costs compared to the Control Cost Estimate used for project authorization during the Construction Documents stage. Root causes for all significant differences (over and under) are to be documented.

Purpose of Deliverable

The Final Cost Report provides data to improve the project cost estimation and control process. Historical project cost data should be documented with this deliverable for future use by Project Leaders.

Parameters

- It is prepared by the Project Leader.

Content

- Summary of budgets and actual costs
- Change order summary
- Cumulative costs and commitments
- Service provider cost summary
- Trade specific cost summary
- Overall square foot costs and square foot costs by trade/discipline

Tools and Techniques

- Cost Estimate – Construction Documents (3-13)
- Refer to previously prepared final cost reports

6-03 – Project Closeout Report

Definition

After the user group is moved-in (for building projects) and all major contractual responsibilities completed, the Project Leader begins the contractual closeout process for the project's service providers. This report summarizes all close-out tasks completed for the project.

Purpose of Deliverable

Closeout ensures items such as warranties, guarantees, certifications, maintenance manuals, and as-built drawings are supplied to the appropriate parties (including archiving) by the service provider. The closeout of the service providers is only one step in the closeout of the project as projects at Penn State may remain active during the warranty period while equipment continues to be purchased or work is accomplished under other contracts or by in-house personnel to finalize the work on the project. A Project Closeout Report is then issued documenting the status of all applicable items (typically after the warranty period and after all service agreements, contracts, and purchase orders have been final paid).

Parameters

- The Project Leader is responsible for the Project Closeout Report

Content

- Refer to previously completed reports

Tools and Techniques

- Refer to previously completed reports

6-04 – Project Lessons Learned Review

Definition

A Project Lessons Learned Review is a documentation of the learning gained from the process of performing the project. This listing of experiences and issues (both positive and negative) is a summary that identifies success factors and/or solutions to problems encountered and/or risks to be aware of for further Project work and for other Projects.

Purpose of Deliverable

It provides information to ongoing Project personnel to improve the Project processes in future Project work. It also provides information to OPP to improve the overall PDS. It is also considered a project record, to be included in the lessons learned knowledge base. Without a formal lessons learned deliverable, key project and contractor personnel move on to the next job without investing time while key learnings are fresh in memory.

Parameters

- The Core Team and Key Contractor/Service Provider personnel need to participate
- The best situation is to use a facilitator that was not part of the project team (e.g., an experienced OPP project leader that had nothing to do with the project). This allows all participants to contribute rather than focus on the lessons learned process. This also brings additional objectivity to the process.
- For large or highly visible projects, particularly those with some less than desirable outcomes, extreme care must be taken to ensure high candor and full participation. A skilled and “independent from the project” facilitator is an absolute requirement. When high level executives are involved, splitting the review into more than one session so lower level participants feel free to contribute generated the best lessons learned.

Content

- Factual, non-judgmental descriptions of outcomes and contributing decisions and issues (the purpose is not to assign blame or perform a performance review but to capture things that went well and things that did not go well for the benefit of all future projects)
- Backup/supporting documents

Tools and Techniques

- Refer to previously completed reviews

6-05 – Job Closing Checklist

Definition

A Job Closing Checklist is a list of project and administrative items that must be completed and verified before a project is complete. This may be incorporated into the Project Closeout Report.

Purpose of Deliverable

A Job Closing Checklist is a resource that helps ensure that no important job closing items are overlooked.

Parameters

- The Project Leader is responsible for completion of the checklist (verification of the Contractor's portion).

Content

- Refer to OPP Job Closing Checklist

Tools and Techniques

- Refer to previously completed checklists

6-55 – Deliverables Check-list Verification

Definition

A Deliverables Check-List Verification is a signed Check-List by the Project Leader confirming each Deliverable has been completed, or is identified by an “N/A” and an exception explanation. The same Deliverables Check-List Sheet is used throughout the Project cycle, with each section being progressively completed.

Purpose of Deliverable

The Check-list verifies all applicable Deliverables have been completed before the stage gate is passed.

Parameters

- Gate 6 is a checkpoint;
- Checklist confirms to Executive Management that all required gate Deliverables are complete and in compliance with procedures and recognized practices;

Content

- Gate 6 list of all deliverables

Tools and Techniques

- Mandatory Deliverables Checklist Verification template

Appendixes

A- Acronyms

B- Glossary

C- Project Deliverables by Phases

D- Penn State PDS Chart

8. Appendix A - Acronyms

| ACRONYM | MEANING |
|---------------------|---|
| 3D CAD | Three-dimensional Computer-Aided Design and Drafting Software |
| AACE | Association for the Advancement of Cost Engineering |
| AC | Actual Cost |
| AF | Administration and Financial Services – A University Division |
| BCWP | Budgeted Cost of Work Performed |
| BG | Building and Grounds – A University Division |
| BMP | Best Management Practices, for Delivery of Green Buildings applicable to the project phase being described. |
| BOT | Board of Trustees |
| CBS | Cost Breakdown Structure |
| PDS | Project Delivery System |
| CFO | Chief Financial Officer |
| CII | Construction Industry Institute |
| CM | Construction Management |
| CPI | Cost Performance Index |
| CPM | Critical Path Method |
| CV | Cost Variance |
| DC (D&C) | Design and Construction – A University Division |
| ECM | Energy conservation Measures. Examples of ECM include: 1) steam traps, 2) low-flow water fixtures, 3) high-efficiency lighting and ballasts, 4) chiller/chilled water upgrades, 5) programmable thermostats, 6) reprogramming or upgrading control systems, 7) system/equipment tune ups, 8) fuel selection/switching, 9) water treatment, 10) cleaning/flushing HVAC piping, 11) exit sign retrofit, 12) replacement of incandescent exit sign lamps with energy efficient LEDs, 13) solar PV systems, 14) winter shut-down, and 15) temperature reductions during Winter break. |
| EHS | Environmental, Health and Safety – A University Division |
| EPC | Engineering, Procurement and Construction |
| EPC/M | Engineering, Procurement, and Construction or Construction Management. |

| ACRONYM | MEANING |
|-----------------|--|
| EV | Earned Value |
| EVM | Earned Value Management |
| EVT | Earned Value Technique |
| FEL | Front End Loading |
| FF&E | Furniture, Fixtures, and Equipment installation. |
| FRC | Facilities Resources Committee. It is made up of Penn State's Associate Vice President of Finance, Provost, related Deans, and others as needed to provide final approval for a project to move from the Capital Planning Stage into the Programming Stage. |
| GESP | Guaranteed Energy Savings Program. OPP Energy Program Engineers identify facilities where the environmental initiatives of the University can be applied to develop projects with creative and appropriate solutions to energy/utility related issues. |
| HR | Human Resources |
| IC | Industrial Controls |
| IPA | Independent Project Analysis Inc. |
| IPP | Integrated Project Plan |
| IPR | Independent Peer Review |
| IRR | Internal Rate of Return |
| IT | Information Technologies |
| IT/IC | Information Technology and Industrial Controls |
| KPI | Key Performance Indicator |
| L&I | Pennsylvania Department of Labor & Industry. During preliminary design, documents are submitted to the Pennsylvania Department of Labor & Industry (L&I) where an initial state building code review is performed. This initial review is important in identifying major issues that could potentially delay the project if they are not recognized at this stage in design. A formal L&I review and approval of design documents is required prior to building construction, and this preliminary review is an essential step for a timely L&I design approval. |
| LL | Lessons Learned |
| MCVT | Mechanical Completion Verification & Testing |
| MOU | Memorandum of Understanding |

| ACRONYM | MEANING |
|------------------|--|
| NRG | Energy and Engineering – A University Division |
| NPV | Net Present Value |
| OBS | Organization Breakdown Structure |
| O&M | Operations and Maintenance |
| OPP | Office of the Physical Plant |
| OR | Operations Readiness |
| OR&SU | Operations Readiness and Start Up (the process) |
| ORP | Operations Readiness Plan |
| PC | Project Controls |
| PDP | Planning Design and Properties - A University Division |
| PERT | Program Evaluation and Review Technique |
| PL | Project Leader, may be either a Project Manager or Project Coordinator |
| PM | Project Manager |
| PMBOK | The Project Management Body of Knowledge (PMBOK®) of the Project Management Institute. (Reference PMBOK, PMI). |
| PMI | Project Management Institute |
| POPS | Provide Outside Products and Services |
| POT | Pre-Operational Testing |
| PV | Planned Value |
| QA | Quality Assurance |
| QA/QC | Quality Assurance/Quality Control |
| QC | Quality Control |
| QBS | Qualification Based Selection |
| QCB | Quantitative Competitive Benchmarking |
| RACI | Responsible, Accountable, Consulted, Informed |
| RCM | Rapid Costing Model |

| ACRONYM | MEANING |
|-------------|--|
| RFP | Requests for proposals are sent to ~10 firms selected for further consideration to bid on a project. The RFP requires design firms to submit their qualifications specific to the project. |
| RFQ | Request for Quotation |
| SPA | Single Point of Accountability |
| TF | Total Float |
| TIC | Total Installed Cost |
| TUL | Tests Under Load |
| VBRM | Value-Based Risk Management |
| VIP | Value Improvement Practice |
| WC | Work Control Center – A University Division |
| WBS | Work Breakdown Structure |

9. Appendix B – Glossary

| TERMS | DEFINITION / MEANING |
|---------------------------------|---|
| 3D CAD | Three-dimensional Computer-Aided Design and Drafting Software. It is used during engineering to accelerate the design process, to reduce the frequency of dimensional errors and to identify and eliminate physical conflicts that may create the need for design changes during construction. |
| Acceptance (Gate) | See the following Gates terms definition: Final Acceptance, or Industrial Acceptance, or Facilities Mechanical Acceptance completed. |
| Activity | A term used in Project Management and defined by PMI as “an element of work performed during the course of a project. An activity normally has an expected duration, an expected cost and an expected resource requirement. Activities can be subdivided into tasks”. (Reference PMBOK, PMI). See also “Summary Activity” |
| Actual Cost (AC) | Total costs actually incurred and recorded in accomplishing work performed during a given time period for a scheduled activity or Work Breakdown Structure Component. Actual cost can sometimes be direct labor hours alone, direct costs alone, or all costs including indirect costs. See also Earned Value Management and Earned Value Technique. (Reference PMBOK, PMI). |
| Agreement | A legally-binding and/or professionally-binding document, between parties, defining relationship elements and formalizing mutual conditions and obligations to ensure mutual understanding of actions to be performed. The alternate term “contract” is also used. It provides the framework for the administration of an agreement. |
| Agreement Administration | The action of managing the relationship between the parties of an agreement. |
| Agreement Closeout | Completion and settlement of the Agreement, including resolution of all outstanding obligations. |
| Allowances | See Estimating Allowance. |
| Assignment | A definition of individual or team responsibility for the production of specific Deliverables. It indicates scope of work, Deliverables and client’s delegated authority to accomplish the assignment, as well as performance metrics. |
| Bar Chart | See Gantt Chart. |
| Baseline, Project | “The original approved plan (for a project, a work package, or an activity), plus or minus approved scope changes. Usually used with a qualifier (e.g., cost baseline, schedule baseline, performance |

| TERMS | DEFINITION / MEANING |
|--|--|
| | measurement baseline, technical baseline)". (Reference PMBOK, PMI). |
| Basic Engineering | Encompasses all Engineering activities and Deliverables produced in the course of FEL 3 (Feasibility) or ending with the Construction Documents Project Stage to finalize the Project scope and technical criteria of all engineering disciplines in preparation for Detailed Engineering Activities. |
| Basic Engineering Package | Report, produced by the Service Provider(s), containing the records of the FEL 3 (Feasibility) Stage technical work and results. It describes the Engineering Deliverables and the related information gathered during the FEL 3 (Feasibility) Stage. |
| Basic Engineering Service Agreement Notice to Proceed | A notice allowing Basic Engineering to commence. It refers to the Service Agreement for Basic Engineering Services Agreement conditions of execution and provides the information to let everyone involved with the Project know when the Basic Engineering work is to start. |
| Benchmarking | A process of comparing one's performance against known best practices and performances. A number of activities fall into the general category of benchmarking. See Quantitative Competitive Benchmarking. |
| Best Management Practices | Best Management Practices (BMPs), for Delivery of Green Buildings applicable to the project phase being described. |
| Bid Documents | <p>As the construction documents are completed, a bid date is established and the preparation of the bidding documents is coordinated with the architect. Bidding documents include construction documents and standard "front-end" contractual documents that are used for all Penn State projects. The front-end documents may be slightly modified to address unique characteristics of each project. Standard Penn State front-end documents include the following:</p> <ul style="list-style-type: none"> • Advertisement for Bids • Instructions to Bidders • Form of Bid • Bid Bond • Equal Employment Opportunity Data Reporting Form and Certificate of Reporting • <u>Targeted Small Business</u> Contact Form and Participation Form • Certified Targeted Small Business Directory • Form of Agreement Between Owner and Contractor |

| TERMS | DEFINITION / MEANING |
|---|---|
| | <ul style="list-style-type: none"> • Contract Performance and Payment Bond Form • General Conditions of the Contract • Supplementary Conditions • Special Conditions |
| Budget | Planned expenditures for the execution and management of Project activities, usually for one or many Project Stages or Phases. |
| Budgeted Cost of Work Performed (BCWP) | See Earned Value (EV). |
| Building Assessment Team | A team assembled during Project Planning to assess building systems conditions and make recommendations for replacements, the associated costs to implement and funding identified to achieve the goals. The Associate Vice-President of Physical Plan is responsible to establish this team from OPP Division personnel, Telecommunications and Networks and Planning, and Transportation Services as appointed by their respective directors. |
| Building life-cycle | The period from occupancy to de-commissioning. Life-cycle costs also cover the duration of the project. |
| Building process | All of the activities needed to progress from initial project goal to a building in-service, including development, permits, planning, design, construction and commissioning. |
| Building Program Committee | The office of the Provost may formally charge a Building Program Committee prior to Programming to further develop the Program Statement. The Committee is made up of representatives from: College/Admin Facilities Coordinators, Dean or his/her representative, Appropriate Department Heads, Planning Design and Properties, Planning Design and Properties, and the Project Leader. |
| Business Case | See Project Business Case. |
| Capital Expenditures (CAPEX) | Usually used as a descriptive for capital cost estimates. A term used to refer to the Project authorized funds to be capitalized. |
| Capital Funds Approved | It is the responsibility of BOT to approve funds allocated to the Project. |
| Central File | A location, whether physical or electronic, where all documentation relevant to a Project is filed for consulting. |
| Change Administrator | The individual responsible for the maintenance of the Change Register, for filing the documentation related to the Project Change Management Process (PCMP), for issuing the Change Notices and for informing the Project Team of submitted Change Requests. |

| TERMS | DEFINITION / MEANING |
|---|--|
| Change Management | A process involving the control of changes to key project parameters and engineering documents. Also known as Change Control. |
| Change Order | A legally-binding document issued by Procurement that confirms a change to a Service Agreement. |
| Change Request | A form used to process a proposed change to a previously agreed project parameter – baseline. |
| Changes Susceptible to Construction Pricing | After bid documents are developed and issued to contractors, any project scope changes will be susceptible to increased pricing. These changes will incur additional design and administrative fees. Additionally, the changes may require construction re-work. At a minimum, the changes will be subject to construction pricing without the advantage of competitive bidding. |
| Charter | See Project Charter. |
| Class 1 Execution Stage (Finite) Project Estimate (Better than -5%, +5%) | Gate Deliverable 3. A Finite estimate is made as Construction is near completion and mechanical completion is about to start. It is prepared in detail with the remaining work (yet to be done) being quantified and priced using actual purchase orders, contracts, and performance data and added to actual costs to date to calculate the projected final cost. |
| Class 2 Execution Stage (Definitive) Project Estimate (Better than -10%, +10%) | Gate Deliverable 2. A Definitive Estimate is made at approximately 50% detailed engineering, and after construction has reached approximately 20% progress, and prepared in detail with firm prices for equipment, bulk materials, labor and services. The detailed material quantities are extended with quoted detailed unit prices reflecting actual productivity performance experienced on the Project. For details, refer to APCS Volume A2. |
| Class 3 FEL 3 (Feasibility) Project Estimate (-10%, +15%) | Gate Deliverable 1b. A Feasibility-level Estimate is based on completed Basic Engineering Deliverables at the end of the FEL 3 (Feasibility) Stage and prepared with substantial quoted pricing for equipment and bulk materials and detailed quantities extended with semi-detailed unit prices. It identifies cost for activity-groups and for facilities components with their Work Packages, corresponding to the Project WBS. Accuracy of estimate is -10%, +15% for Brownfield and Mining Projects. |
| Class 4 Final FEL 2 (Pre-Feasibility) Project Estimate (-15%, +25%) | Gate Deliverable 1a. A Preliminary Cost Estimate based on completed Preliminary Engineering at the end of the FEL 2 (Pre-Feasibility) Stage and prepared primarily by developing preliminary material quantities and obtaining budget quotations for major equipment. It estimates costs for |

| TERMS | DEFINITION / MEANING |
|--|--|
| | activity-groups and for major components with their Work Packages corresponding to the Project WBS. |
| Class 4 Initial FEL 1 (Concept) Project Estimate (-20%, +30%) | Gate Deliverable 1. An Order of Magnitude Estimate (OME) is based on concept engineering and prepared by factoring costs and other pertinent data from similar past or current Projects, to suit the scope and anticipated conditions of the Project. It estimates costs for activity-groups and for major components. |
| Class 5 FEL 0 (Pre-Concept) Project Estimate (-40%, +60%) | Gate Deliverable 0. Rough estimate(s), based on historical data for options under consideration, are developed to provide cost comparisons and ranges for early conceptual studies. |
| Class of Cost Estimate | Classes 1 to 5 Estimates correspond to standard Project Cost Estimate accuracy prepared at different Stages of the Project. The accuracy of a Project estimate corresponds to the Project scope definition. See Project Estimate and Class 1 to 5 Project Estimates. |
| Close out | See Agreement Close out and Project Close out. |
| Commence Construction Notice | Gate Deliverable. A notice authorizing the start of construction. It provides information to the fact that all legal requirements necessary to start of construction have been met. |
| Commissioning | Commissioning encompasses activities associated with making systems and facilities ready for Operations. Commissioning of a system commences after Mechanical Completion verification and test witnessing. |
| Commissioning and Ramp-up Completion Notice | Gate Deliverable. A notice indicating that Commissioning and Ramp-up of the facilities have been completed. |
| Communication Matrix | A matrix that represents to whom the Project Deliverables will be transmitted between key Project stakeholders. |
| Committee Charge Letter | The Committee Charge Letter is from the Provost, development aided by the FRP, authorizing a project to begin the Programming Stage. It includes the initial cost estimate and budget, building square footage (if applicable), general concept scope and schedule for the entire project. |

| TERMS | DEFINITION / MEANING |
|--|--|
| Communications Management | One of the PMI project management knowledge areas, including the processes required to ensure timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of Project information. It consists of communication planning, information distribution and performance reporting and administers closure (Reference PMBOK, PMI). |
| Concept Engineering | Encompasses all Engineering activities and Deliverables produced in the course of FEL 1 (Concept) required for the selection of a Project Concept and Process/Technology refinement. It allows to refine Project scope and to produce cost estimates as per stage requirements. |
| Concept Engineering Package | Gate Deliverable. A report produced by the Service Provider(s), containing the records of the FEL 1 (Concept) Stage technical work and results. It describes the Engineering Deliverables and the related information gathered during the FEL 1 (Concept) Stage. |
| Concept Engineering Service Agreement Notice to Proceed | Gate Deliverable. A notice allowing Concept Engineering to commence. It refers to the Concept Engineering Service Agreement conditions of execution and provides the information to let everyone involved with the Project know when the Concept Engineering work is to start. |
| Conditional Approval | A decision by RACI at Major Gates to authorize the passage to the next Stage under specified conditions. RACI sets the conditions and is responsible for the follow up to reach formal approval. RACI manages the risk to project success associated with the conditions and the conditional Approvals. |
| Constructability | The features of the building design that affect the ease of construction and therefore affect the time and cost needed to fabricate and construct the work. |
| Constructability Analysis | Gate Deliverable. An analysis of the design to reduce costs, improve safety and save time in the construction Stage. It identifies design configurations to facilitate construction and minimize cost. It identifies potential risks with the most critical countermeasures collected in a constructability contingency plan. It provides decision-making information to ensure the most efficient, safe and economical construction methodology and strategy. |
| Constructability Review | A constructability review provides for an analysis of the design, usually performed by experienced construction managers, to reduce costs, improve safety or save time in the Delivery phase. |

| TERMS | DEFINITION / MEANING |
|--|--|
| Construction Duration | Time, from first civil foundation work through end of Mechanical Completion. Site preparation activities are normally excluded from the determination of construction duration. (Reference IPA). |
| Construction Industry Institute (CII) | A consortium of more than 100 leading owner, engineering-contractor, and supplier firms from both the public and private arenas. These organizations have joined to enhance the business effectiveness and sustainability of the capital facility life cycle through CII research, related initiatives, and industry alliances. A learning organization with a wealth of knowledge and information, CII is unique in the engineering and construction industry. The CII is based at The University of Texas at Austin. |
| Cost planning | The process of estimating total project or contract costs, subdividing these into the components of the building, determining the timing of expenditures, allowing for uncertainty, and recommending budgets. This helps resolve inconsistencies between cost limits (initial budgets) and preliminary cost plans. The approved cost plan provides the basis for cost control and is often prepared by a Professional Quantity Surveyor or other cost specialist. |
| Construction Manager Agency | Construction Manager-Agency delivery occurs when a construction management firm is contracted to help manage the project in an advisor-only role. In this capacity, construction managers are contracted for preconstruction services, which may include: hiring a designer, overseeing design, providing constructability reviews, and developing cost estimates. The construction manager's services during construction procurement can include assisting the bidding process and writing construction contracts. |
| Construction Manager at-risk | In Construction Manager-at-Risk delivery, Penn State contracts directly with the Construction Manager firm for pre-construction services and facility construction. It is then the Construction Manager's responsibility to contract with subcontractors to complete facility construction. |
| Consultant | In a contract context, the person or entity, or an authorized representative, identified as such in the contract. The Consultant is most commonly an Architect or Professional Engineer licensed to practice in the state of the place of the work, but also includes other professional individuals or firms contracted to work in the Universities best interest. |
| Contingency | An allowance for undefined items of work which will have to be performed, or elements of cost which will be incurred, within the defined "Scope of Work" covered by the estimate, that cannot be explicitly foreseen or described at the time the estimate was made because of the lack of complete, accurate and detailed information. (Reference AACE). |

| TERMS | DEFINITION / MEANING |
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| Contingency Level 1 | An amount providing a Project Budget with a 50% probability of not being exceeded. Contingency Level 1 is appropriated to the Project Team for control purpose. It is used for such things as known unknowns; minor price fluctuations, design development adjustments and precisions within the scope, planning adjustments and estimate errors. |
| Contingency Level 2 | An amount above contingency Level 1 providing a Project Budget with a 60% probability of not being exceeded. Contingency Level 2 is appropriated to PDRB. It is used for such things as minor scope changes and estimate omissions. |
| Contingency Level 3 | An amount above contingency Level 2 providing a Project Budget with a 85% probability of not being exceeded. Contingency Level 3 is appropriated to GPP GEBA Vice-President Project Controls. It is used as the general management reserve to be accessed when contingencies Level 1 and 2 funds are depleted. |
| Contingency Plan | A plan that identifies alternative strategies to be used to ensure Project success if specified risk events occur. |
| Contract | See Agreement. |
| Contracting Strategy Work Plan | <p>Gate Deliverable.</p> <p>A plan describing the nature and scope of work considered to be contracted out for the complete Project cycle. It lists the Contracts to be awarded with their scope of work. It describes the procurement process to be implemented and the control and administration processes to be used. It provides a plan to control work contracting.</p> <p>For further details, refer to APCS Volume A2.</p> |
| Control Schedule | A time schedule developed through a logic network diagram that represents the Project activities with a level of detail for control purposes, showing their relationships, their criticality, the planned and actual dates, and the organization responsible to perform these activities. |
| Cost Baseline | The Cost Baseline for a Stage or a Phase is the one included in the funding request. This Cost Baseline may be modified through the Change Management process. |
| Cost Breakdown Structure (CBS) | The framework for budgeting cost accounting and cost control. The CBS is a grouping of financial resources that organizes and defines, through a hierarchical structure, the budget allocated for the Project needed to deliver the product. This allows the grouping of expenditures into Work Packages to cost account in a way that is meaningful. |
| Cost Control | The processes of influencing the factors that create variances and controlling changes to the Project budget. (Reference PMBOK, PMI). |

| TERMS | DEFINITION / MEANING |
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| Cost Deviation or Variance | Difference, in value and/or in percent, between a Project's most up-to-date constant dollar cost forecast and the constant dollar cost estimated at the time of authorization (adjusted for any post-authorization scope changes and external events). |
| Cost Management | One of the PMI Project Management knowledge areas. It includes the processes involved in planning, estimating, budgeting, and controlling costs so that the Project can be completed within the budget. (Reference PMBOK, PMI). |
| Cost Performance Index (CPI) | A measure of cost efficiency on a Project. $CPI = \frac{EV}{AC}$ (Earned Value) divided by AC (Actual Cost). A value equal to or greater than one indicates a favorable condition and a value less than one indicate an unfavorable condition. (Reference PMI). |
| Cost Variance (CV) | 1: Any difference between the budget cost of an activity and the actual cost of that activity. (Reference PMI). 2: In earned Value, $EV - AC = CV$. |
| Critical Path | The series of activities that determine the duration of the Project. It is the longest path through the Project. (Reference: PMBOK, PMI). |
| Critical Path Method (CPM) | A network analysis technique used to predict Project duration by analyzing the sequence of activity (which path) has the least amount of scheduling flexibility (the least amount of float). (Reference PMBOK PMI). |
| Cycle Time (IPA Index) | Project cycle time is the total time required to complete a Project, starting with the beginning of Project definition (FEL) and ending with the completion of startup (the steady-state operation of the facility). It measures the overall time a company takes to bring an idea "to market". (Reference IPA). See Project Cycle. |
| Cycle, Project | See Project Cycle. |
| Daily Management System(s) (DMS) | A facility daily monitoring and control system based on a real-time application platform. |
| Data Date (DD) | The date at which or up to which the Project reporting system has provided actual status and accomplishments. (Reference PMBOK, PMI). |
| Defined Systems Bench Testing Protocol | Gate Deliverable. A protocol and an identification of all systems to be bench tested before being installed. It defines systems and bench testing processes applicable to each system and/or part of a system. It provides information for planning and estimating. |
| Definitive Estimate (DE) | See Project Estimate Class 2, Execution Stage Definitive Project Estimate. |

| TERMS | DEFINITION / MEANING |
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| Deliverable | Any unique and verifiable product, result or capability to perform a service that must be produced to complete a process, stage, phase or project. Often used more narrowly in reference to an external Deliverable, which is a Deliverable that is subject to approval by the customer. (Reference PMBOK, PMI). |
| Deliverable, (Stage Gate Process) | A Deliverable required at a given Gate in the course or at the end of a Stage. |
| Deliverables Checklist | A list of all Stage Gate Deliverables used by the SPA for the verification of Deliverables. See Deliverables Check-List Verification. |
| Deliverables Check-List Verification | Gate Deliverables 1, 1a, 1b, 2, 3, 4 and 5.: A signed Check-List by the Project Leader confirming the Gate Deliverables have been completed. The same Deliverables Check-List is used throughout the Project cycle with each section being progressively completed. |
| Delivery method | One of a number of options for organizing and procuring the design documentation and construction of the project. The details of each method are defined by the contracts and work assignments used to assign all of the responsibilities and risks for design documentation and construction. |
| Delivery Phase | The second Phase of the Stage Gate Process that follows the Planning Phase. It is an important Phase in terms of effort. It includes basic engineering in FEL 3 (Feasibility) Stage, the Go/No Go decision and the detailed engineering. It is concluded with approval of the project execution funding. |
| Design brief | Documentation of requirements that will govern the spatial, component and aesthetic design of the building and its functions; it is part of the project implementation plan and is updated for the Master Project Plan. |
| Design Development Sub-Stage | A Sub-stage of the project Design Stage that elaborates on the schematic design by means of the optimized development drawings for the Master Project Plan. It is used to apply for municipal development approvals. |
| Design-Bid-Build | Project Delivery System process where Penn State contracts directly with either a single or prime contractor or with multiple prime contractors to build a facility. |
| Design-Build | Project Delivery System process where Penn State contracts directly with a single firm to provide design and construction services for the facility or asset. |
| Design-to-Capacity | An evaluation of the maximum capacity of each major piece of equipment and facility in total, in order to provide for capacity expansion in case asset needs to be increased. |

| TERMS | DEFINITION / MEANING |
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| Design Screening Committee | A typical design procurement team is made up of; 1) The Director of Planning Design and Properties, 2) The University Architect, 3) A member the Facilities Planning Advisory Board (FPAB) – typically an Architecture faculty, 4) An external architectural expert (ad hoc-for projects of highest architectural significance only), 5) The D&C Project Leader and, 6) 2-3 representatives of the user group. The goal of this group is to provide an appropriate balance between emphasis on overall design excellence and an emphasis on expedient design process, constructability, engineering, and satisfaction of user needs. |
| Detailed Engineering | Encompasses all Engineering activities and Deliverables to bring the Project to 100% engineering design level, ready for Procurement and Construction activities. It is part of the Construction Stage. |
| Detailed Engineering Package | Gate Deliverable. A report containing the records of the Execution Stage technical work and results. It describes the Engineering Deliverables and the related information gathered during the Detailed Engineering Phase. |
| Detailed Environment & Social Screens | Gate Deliverable. Detailed Environment & Social Screens are descriptions of the Environment and Socio-economic factors that may have significant impact on the Project concept, execution and outcomes. It identifies all Project parameters that may have an effect or may be affected by local conditions. It provides decision-making information to validate the earlier Screening and Ranking conclusions, the adequacy of the Project concept and the local conditions. |
| Early Service Requisitions & Long Lead Material Requisitions | Gate Deliverable. Early Service Requisitions & Long Lead Materials Requisitions are a list of services and materials requiring early authorization to meet Project delivery targets. It identifies all requirements and provides the purchasing requisitions with necessary backup documentation. It provides information to support the request for early expense authorization to get started as soon as the Project funds are approved and funds are available. |
| Earned Value (EV) | The value of work performed, expressed in terms of the approved budget assigned to that work for a scheduled activity or work breakdown structure component. (Reference: PMBOK, PMI). Also referred to as the Budgeted Cost of Work Performed (BCWP) |
| Earned Value Management (EVM) | A management methodology for integrating scope, schedule and resources, and for objectively measuring Project performance and progress. Performance is measured by determining the budgeted cost of work performed (i.e., earned value) and comparing it to the actual cost of work performed (i.e., actual cost). Progress is measured by comparing the Earned Value to the Planned Value. (Reference: PMBOK, PMI). |

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| Earned Value Technique (EVT) | A specific technique for measuring the performance of work and used to establish the Performance Measurement Baseline (PMB). Also referred to as earning rules and crediting method (Reference PMBOK, PMI). |
| Energy Optimization | A simulation methodology to optimize the facility life-cycle costs by examining and selecting the most economical methods for power supply and heat inputs and for power, heat and other energy recovery. |
| Engineering | See Concept Engineering, Preliminary Engineering, Basic Engineering and Detailed Engineering. |
| Engineering Deliverables Handover Certificate | Gate Deliverable. A signed certificate, containing reference to the Documentation prepared during the Delivery Phase. It certifies all Documentation has been handed over to the Asset Owner as per the EPC/M contract requirements. |
| Engineering, Procurement and Construction (EPC) | Refers to a project execution model in which a Service Provider is retained by Penn State to render Engineering, Procurement and Construction Services (EPC). In this case, other construction companies may be contracted and managed directly by the EPC Service Provider to provide construction services. |
| Engineering, Procurement and Construction / Management (EPCM) | Refers to a project execution model in which a Service Provider is retained by Penn State to render Engineering, Procurement and Construction Management Services (EPCM). In this case, several construction companies are contracted directly by Penn State to provide construction services, which are managed by the EPCM service provider on behalf of Penn State. |
| EPC/M Bids Summary | Gate Deliverable. A summary spreadsheet containing key information extracted from the bids received from potential EPC/M Service Providers. It lists the bids per cost breakdown required in the RFQ to show comparative indication of the offer from each bidder. It provides an indication of exceptions to the RFQ and an update of the EPC/M cost for decision-making. |
| EPC/M Contract Notice to Proceed | Gate Deliverable. A notice allowing the EPC/M Service Provider(s) to commence Detailed Engineering work. It refers to the EPC/M Contract conditions of execution and provides the information to let everyone involved with the Project know when the Detailed Engineering work is to start. |
| EPC/M RFQ Document | Gate Deliverable. A Request for Quotation (RFQ) for Detailed Engineering, Procurement, Construction and Management (EPC/M). It defines the services and products to be delivered by the EPC/M Service Provider(s) and formalizes the mutual obligations of the EPC/M Contractor and Penn |

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| | <p>State. It provides the information to obtain quotations from interested EPC/M Service Provider(s), facilitates the comparison between quotes for Service Provider selection, reduces negotiation and the contract award period in addition to reducing post contract award changes and surprises.</p> |
| EPC/M Selection Summary | <p>Gate Deliverable. A summary spreadsheet of the selection criteria scores of each bidder for EPC/M Services. It lists the Selection Criteria and gives the rating for the services breakdown items required from the RFQ. It provides an indication of the EPC/M services offered to select the recommended EPC/M Contractor.</p> |
| EPC/M Service Provider | <p>Refers to a service company retained by Penn State to render EPC (Engineering, Procurement and Construction) EPCM (Construction Management Services).</p> |
| Estimate at Completion | <p>The expected total cost of a scheduled activity, a work breakdown structure component, or the Project when the defined scope of work is completed. The Estimate at Completion may be calculated based on performance to date or estimated by the Project team based on the other factors, in which case it is often referred to as the latest revised Estimate. (Reference PMBOK, PMI).</p> |
| Estimate to Complete | <p>The cost needed to complete all the remaining work for a schedule activity, work breakdown structure component or the Project. (Reference PMBOK, PMI).</p> |
| Estimating Allowance | <p>A provisional cost or reserve quantity to be included in an estimate, when an item's cost, quantity or scope cannot be accurately determined, and the likelihood of using such an item is high.</p> |
| Example of Deliverable | <p>A document that has been singled out as having such quality that it is worthy of being imitated.</p> |
| Execution Schedule Performance (IPA Index) | <p>Ratio (times 100) of the actual time required for EPC to the time estimated by the IPA Engineering and Construction Schedule Model (the industry norm). (Reference IPA).</p> |
| Facilities Care, Custody and Control Acceptance Notice | <p>Gate Deliverable. A notice issued by DC. It indicates that care, custody and control of the facilities passes to PSU operations at an agreed date where all PSU Business Processes take responsibility for Facilities and their operation. It provides a formal indication to all Project and operations personnel that the site and facilities are under PSU responsibility, including the Emergency Response Plan.</p> |

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| Facilities Final Acceptance Notice | <p>Gate Deliverable.</p> <p>A notice acknowledging the successful completion of the Production on Specifications' pre-determined period and the Final Acceptance of the facilities by PSU. It indicates that the facilities have been operated for a sustained period to capacity with good quality as per specifications design and target operations parameters.</p> |
| Facilities Industrial Acceptance Notice | <p>Gate Deliverable.</p> <p>A notice acknowledging the completion of the Test Under Load and Ramp-up, concluding with the facilities Industrial Acceptance by PSU. It indicates that all components of the facilities meet specifications and target operations parameters. It identifies accepted gaps and issues that are not judged detrimental to capacity and quality. It provides formal information to all Project personnel regarding the facilities status.</p> |
| Facilities Mechanical Acceptance Completed | <p>Gate Deliverable.</p> <p>The end of the Construction Stage of the Stage Gated Process. It marks and makes official the successful completion of pre-operational testing. It is formally communicated through the issuance of a Facilities Mechanical Acceptance Notice from the EPC/M Service Provider(s) to Operations.</p> |
| Facilities Mechanical Acceptance Notice | <p>Gate Deliverable.</p> <p>A notice confirming the Mechanical Completion and the Acceptance of the installed facilities by PSU. It indicates that all components of the facilities have been tested for Mechanical Completion and that all facilities are installed as per design requirements and construction procedures. It identifies deficiencies (Punch List) that the EPC/M Contractor agrees to resolve as part of the Agreement. It also provides formal information to Project personnel regarding the facilities status.</p> |
| Facilities Resources Committee | <p>The Facilities Resources Committee (FRC) is made up of Penn State's Associate Vice President of Finance, Provost, related Deans, and others as needed to provide final approval for a project to move from the Capital Planning Stage into the Programming Stage.</p> |
| Feasibility Stage | <p>See FEL 3 (Feasibility) Stage.</p> |
| FEL 0 (Pre-Concept) Final Study Report | <p>Gate Deliverable.</p> <p>A report containing the records of the FEL 0 (Pre-Concept) Stage work and results. It describes the Deliverables and the related information gathered during the FEL 0 (Pre-Concept) Stage and information not collected as Stage Gate Deliverables. It concludes on the value of FEL 0 (Pre-Concept) Stage work and Deliverables. It builds on the FEL 0 (Pre-Concept) Initial Study Report, Deliverable, summarizing the results of all FEL 0 (Pre-Concept) Stage work, to understand the</p> |

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| | business opportunity and technical feasibility required for subsequent stages. |
| FEL 0 (Pre-Concept) | The FEL 0 (Pre-Concept) Stage purpose is to: Identify Pre-Concepts that could achieve business goals Expediently and at minimum cost, rule out a Project that is not likely to be viable and that is not likely to fit PSU Values; Develop an understanding of the opportunity; Enable management to make a decision as to whether or not to pursue the opportunity. |
| FEL 1 (Concept) | The FEL 1 (Concept) Stage purpose is to: Confirm FEL 0 (Pre-Concept) results through concept studies; Develop the business needs/opportunities into a business case; Prepare a Business Case that meets PSU Values and profit goals; Obtain agreements to further investigate the Project potential. |
| FEL 1 (Concept) Study Report | Gate Deliverable. A report containing the records of the FEL 1 (Concept) Stage work and results. It describes the Deliverables and the related information gathered during the FEL 1 (Concept) Stage and information not collected as Stage Gate Deliverables. It concludes on the value of FEL 1 (Concept) Stage work and Deliverables. It provides information to keep a proper record of the FEL 1 (Concept) Stage work, to understand the business opportunity and technical feasibility. It provides information on the work requirements for subsequent stages. |
| FEL 2 (Pre-Feasibility) | The FEL 2 (Pre-Feasibility) Stage purpose is to: Translate business objectives into Project objectives Gather enough information and data to assess the Project in order to make a sound decision as to whether or not the Project should proceed with the Feasibility Study; Have all Leases, Service Agreements for FEL 3 (Feasibility), Technical Agreements and Government Authorizations signed before starting the Feasibility Study; Have an Initial Project Plan completed and accepted by the Project Decision Reviews before starting the Feasibility Study. |
| FEL 2 (Pre-Feasibility) Study Report | Gate Deliverable 2D25. A report containing the records of the FEL 2 (Pre-Feasibility) Stage work and results. It describes the Deliverables and the related information gathered during the FEL 2 (Pre-Feasibility) Stage and information not collected as Stage Gate Deliverables. It concludes on the value of FEL 2 (Pre-Feasibility) Stage work and Deliverables. It provides information to keep a proper record of the FEL 2 (Pre-Feasibility) Stage work, to understand the business opportunity and technical feasibility. It provides information on the work requirements for subsequent stages. |

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| FEL 3 (Feasibility) | <p>The FEL 3 (Feasibility) purpose is to :</p> <p>Signal the end of Project options and define in detail the Scope of Work of the Project;</p> <p>Have a complete Feasibility report with required technical information and data to produce a Project Cost Estimate with an accuracy of -10%,+10% (Class 3);</p> <p>Have an Integrated Project Plan. This plan integrates:</p> <ul style="list-style-type: none"> ○ Project Execution Plan; ○ Project Management Plan; ○ Operations Readiness Plan; <p>Prepare activities schedule for the Construction Stage;</p> <p>Prepare requests for Full Funds;</p> <p>Prepare EPC/M RFQ documents and bidding process, ready for award at Funds available;</p> <p>When schedule dictates, prepare long-lead material/equipment and site development tender documents.</p> |
| FEL 3 (Feasibility) Study Report | <p>Gate Deliverable.</p> <p>A report containing the records of FEL 3 (Feasibility) Stage work and results. It collects the Deliverables and the related information gathered during the FEL 3 (Feasibility) Stage and information not collected as Stage Gate Deliverables. It concludes on the value of FEL 3 (Feasibility) Stage work and Deliverables. It provides information to keep a proper record of the FEL 3 (Feasibility) Stage work, to understand the business opportunity and technical feasibility. It provides information on the work requirements for subsequent stages.</p> |
| FEL Duration (IPA Index) | <p>Time from initiation of the FEL 0 (Pre-Concept) Integrated Plan through submission of Project RFA (Request for Authorization). (Reference IPA).</p> |
| Field Reviews | <p>Reviews by Registered Professionals to assure that work is constructed as designed, including reviews required by regulations.</p> |
| Final Design | <p>The remainder of the design after Preliminary Design (Design Development) is complete, until the design has been documented for construction procurement, and final details have been provided on shop and record drawings.</p> |
| Final Acceptance | <p>A Deliverable that marks the end of the. It is communicated by the issuance of a Final Acceptance Notice.</p> |
| Float | <p>See Total Float.</p> |
| Forecast Final Cost | <p>Applicable to a Contract, Work Package, Phase or Project. It is the current final cost estimate.</p> |

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| Form | A document in predefined format and content that provides a structure for collecting, organizing and presenting information. A tool to facilitate the production of a specific Deliverable. It consists of a document (physical or electronic) with blank spaces to be filled in. |
| Front End Loading (FEL) | FEL (Front End Loading) is the process that considers a company's financial resources, facilities, people and organizations in order to translate a company's marketing and technological opportunities into Projects. The primary objective of FEL is to achieve an understanding of the proposed Project that is sufficiently detailed so that changes in the production engineering, construction and startup phases will be minimized. |
| Funds Release Notice | Gate Deliverable. A Funds Release Notice is a notice confirming that funds are available for the remainder of the Project. |
| Gantt Chart | A graphic display of schedule-related information. In the typical Gantt chart, activities or other project elements are listed down the left side of the chart, dates are shown across the top and activity durations are shown as date-placed horizontal bars. Also called a bar chart. (Reference PMBOK, PMI). |
| Gate | In the Stage Gated Process, a decision point between two stages where Deliverables are evaluated and recommendations and decisions are made to proceed or not with the project work and to approve funds. See also Major Gate and Sub-Gate. |
| Gatekeeper | A Gatekeeper is an individual or a group of persons whose role is to evaluate the compliance of required Deliverables at Major Gates and recommend actions and path forward. |
| Government Environmental Approval | Gate Deliverable. A formal document stating that the Project can be developed within the Concept and Preliminary Engineering environmental impact. It indicates the potential environmental impact deduced from the Preliminary Concept and Preliminary engineering, and local Governing-Authorities regulations, expectations and general conditions under which the Project will be implemented and the facilities will be operated. It sets a framework between PSU and Environmental Governing-Authorities to proceed with further study to fully integrate environmental requirements. It provides the information and necessary agreements to proceed with FEL 3 (Feasibility) Stage. |
| Stage Gated Process | A Stage Gated Process adapted to PSU Project execution and management needs. See Phase, Stage, Gate, Deliverables, Gatekeeper. |
| Guideline | A description defining what needs to be done and under what conditions. Guidelines orient the development of procedures, with tools. It is a standard that frames a global system and thus serves as a framework for the development of the system and its processes. |

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| Human Resources (HR) | The department responsible for the human resources planning process and personnel management. |
| Human Resources Management | One of the PMI project management knowledge areas. It includes the processes that organize and manage the Project team. The Project team is comprised of the people who have assigned roles and responsibilities for completing the Project. Team members should be involved in much of the Project's planning and decision-making. (Reference PMBOK, PMI). |
| Independent Peer Review (IPR) | A process where independent peers review Project Deliverables including Project performance. The review records opinions and advice from peers on Deliverables and their production process. It raises deficiencies, gaps and issues to be resolved. It indicates proposed corrective actions by peers. Mandatory Stage Gated IPRs are conducted at the end of the FEL Stages 1, 2 and 3 to provide an evaluation for the BOT decision-making process to proceed further with a Project. An IPR Report is also submitted at the end of the Execution Stage to the Project Leader. |
| Independent Project Analysis (IPA) | IPA (Independent Project Analysis Inc.) is specialized in project evaluation and benchmarking. |
| Industrial Controls (IC) | See Information Technology and Industrial Controls. |
| Information Technologies (IT) | See Information Technology and Industrial Controls. |
| Information Technology and Industrial Controls (IT/IC) | Terminology used by the CoE identifying a CoE End-to-End enabling process and the corresponding organizational management areas of both the CoE and new smelter organizations. This End-to-End enabling process covers all Information Technology and Industrial Controls preparation and management related activities of Operations Readiness. |
| Initial Project Plan | Gate Deliverable. A formally-approved document used to guide both Project execution and management. It defines the execution and management strategies to bring the Project to successful completion. It provides information for Project controls and decision-making. |
| Integrated Project Plan – Final Edition | Gate Deliverable. A formally-approved document used to guide both Project execution and management. It defines the execution and management strategies to bring the Project to successful completion. It provides information for Project controls and decision-making. |

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| Integration Management | <p>One of the PMI project management knowledge areas. It includes the processes and activities needed to identify, define, combine, unify and coordinate the various processes and project management activities within the Project Management Process Groups. In this context, integration includes characteristics of unification, consolidation, articulation and integrative actions that are crucial to Project completion, successfully meeting customer and stakeholders' requirements, and managing expectations. (Reference PMBOK, PMI).</p> |
| Interface | <p>Common work boundary between two organizations or individuals. In a schedule, an interface corresponds to the relationship between two activities performed by two different organizations.</p> |
| Internal Rate of Return (IRR) | <p>Discount rate that equates the present value of all expected cash outlays with the present value of all expected cash revenues. (Reference IPA).</p> |
| Investment Review Report | <p>Gate Deliverable. A status report of the investment made and expected benefits compared to the investment approved and projected benefits expected at Project request for funds approval. It indicates how the funds were used compared to what was planned and the value of what is left as a result of the investment made. It indicates the details of the investment as it was approved at Project request for funds compared to actual cost and expected benefits derived from actual performance. It indicates risk to future benefit. It provides decision-making information to help Project personnel in achieving the most efficient Project Closeout. It provides information for Project portfolio and funds management.</p> |
| IPR Leader | <p>An individual assigned to plan, organize, direct and control an Independent Peer Review process.</p> |
| IPR Leader Assignment | <p>Gate Deliverable. An appointment by the OPP Vice President of an Independent Peer Review (IPR) Leader for the Project cycle. The IPR Leader's main responsibility is to plan and conduct IPR work sessions with designated IPR Team members.</p> |
| IPR Report | <p>See Independent Peer Review (IPR). The following Independent Peer Reviews are defined as Deliverables in the Stage Gated Process. IPR FEL 1 (Concept) Report.</p> |
| IPR Team Assignment | <p>Gate Deliverable. An assignment to an IPR (Independent Peer Review) Team. It defines the candidates, scope of work and team-member responsibilities to prepare for and execute IPRs. It includes a preliminary staffing plan. The IPR Team may change as required as the Project progresses.</p> |

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| Key Performance Indicators (KPI) | <p>A set of quantifiable measurements or metrics, agreed to beforehand, that reflect the critical success factors of a Project. It provides indications of the Project performance as a guide to management and for decision-making in meeting Project scope and other performance targets.</p> |
| Land Agreements | <p>Gate Deliverable.</p> <p>Legally-binding documents that define the conditions allowing PSU to use or own the land required for the facilities to be developed. It defines the necessary commercial and relationship elements to ensure mutual understanding of the use or ownership and management of the land used by PSU. It defines and formalizes mutual obligations of the landowner (Authority) and PSU. It provides the framework for Land Agreement administration with landowner (Authority).</p> |
| Lessons Learned (LL) | <p>Gate Deliverables 0, 1, 2, 3, 4 and 5.</p> <p>A list of situations identified from the Stage processes and recorded during Stage Lessons Learned work sessions. Lessons Learned identifies success factors and/or solutions to problems encountered and/or risks to be aware of for further Project work and for other Projects. They provide information to ongoing Project personnel to improve the Project processes for further Project work.</p> |
| Level of Technological Innovation | <p>IPA considers three levels of technological innovation:</p> <p><i>Off-the-Shelf:</i> Project nearly duplicates existing proven process with modifications limited to minor tailoring for the site; the process may employ new integration of known technology.</p> <p><i>Evolutionary:</i> Minor process modification (one or more steps in the process are new but the order and function of steps remain unchanged from current practice).</p> <p><i>Revolutionary:</i> (a) All new process, or (b) substantially new process, or (c) major process modification. (Reference IPA).</p> |
| Logic Network Schedule | <p>A planning and scheduling technique by which the activities constituting a Project, or part thereof, are presented in an interconnected logic sequence diagram or network, with all activity inter-dependencies presented by logic links.</p> <p>The two most popular logic Network Scheduling techniques used in the construction industry are: PERT for Program Evaluation and Review Technique, and CPM for Critical Path Method.</p> |
| Long List | <p>Initial List of design firms to be sent RFPs, and based upon their responses, 3 design firms will be “short-listed” for further considered for the project design contract.</p> |

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| Major Gate | A Gate of the Stage Gated Process where formal documented decisions are made as to the continuation and funding of a Project. |
| Master Project Plan | See Integrated Project Plan - the Owner's plan for delivering the project. |
| Master Schedule | A high-level summary schedule of a Stage or of a portion of a Project or of the entire Project cycle. It indicates major activity-groups in a graphic presentation, with milestones and decision points that are key to the Project duration, timing and success as they are foreseen at a given point in time. It provides a snapshot of the overall timeline of the Project or portion of the Project and the progress status to ensure a common understanding and to support decision-making. It forms part of the Integrated Project Plan and its revisions. |
| Mechanical Acceptance | See Facilities Mechanical Acceptance Completed. |
| Milestone | A significant event in a Project, usually completion of a major Deliverable. (Reference PMBOK PMI) |
| Mock-up Document | A sketch, the basis or the framework of a document in its early stage of Development. |
| Net Present Value (NPV) | The value of a benefit or cost found by discounting future cash flows to the base time. Also, the system of comparing proposed investments, which involves discounting at a known interest rate in order to choose the alternative having the highest present value per unit of investment. |
| Network Diagram | A schematic display of the logical relationships of Project activities. Always drawn from left to right to reflect Project chronology. (Reference PMBOK PMI – Project Schedule) |
| Notice | A document that typically notifies, acknowledges, instructs, authorizes or indicates situation status, a decision taken, a path forward or an action to be undertaken. |
| Operating Expenditures (OPEX) | Operating Expenditures are those expenditures covered by the Operations Budget. |
| Operational Index (IPA Index) | Difference, in percentage, between the actual plant operational performance and the operational performance estimated by the IPA Operational Performance Model (i.e., industry norm). (Reference IPA). |
| Operational Performance (IPA Index) | The average monthly plant production in a pre-defined period of sustained operation expressed as a percentage of the monthly nameplate capacity, excluding the effects of market restrictions and feedstock limitations. (Reference IPA). |

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| Operations Readiness (OR) | <p>Operations Readiness is the process of preparing all business processes and sub-processes to be ready to provide timely and quality Deliverables (Goods and Services) as required for the Turnover of the facilities. See ORP.</p> |
| Operations Readiness and Start Up (the process) (OR&SU) | <p>The process by which the operational organization of a new facility is designed and implemented, including start up activities.</p> |
| Operations Readiness Plan (ORP) | <p>Gate Deliverables. A plan identifying all Deliverables and activities under PSU responsibility, outside of the EPC/M Agreement, that are carried out concurrently with the Project execution and beyond, up to Final Acceptance. It covers the development of all processes required to interface with the Project Team and to take-over and operate the delivered facilities.</p> |
| Organization Breakdown Structure (OBS) | <p>A representation of the authority relationships between organizations that take part in the Project. The OBS is a grouping of organizations that organizes and defines through a hierarchical structure the authority levels. For Projects, the OBS represents relationships between all organizational entities and personnel involved. The OBS supports human resources management and communication management. Mandates are provided to entities of the OBS by assigning one or many WBS components (usually forming Work Packages) to these entities.</p> |
| Organizational Chart | <p>A graphic representation of a Team in a hierarchical way. Links in the chart represent lines of management authority, decision and communication.</p> |
| Peer Review | <p>See Independent Peer Review (IPR).</p> |
| Percent Engineering Complete at Project RFA (IPA Index) | <p>Percent of the total Project engineering effort to complete at the time of Project RFA authorization. (Reference IPA).</p> |
| Percent New Technology Cost | <p>The percentage of the total capital cost of a Project associated with the new technology portions of the facilities. (Reference IPA).</p> |
| Phase | <p>A Phase is the first level of the Stage Gated Process segmentation. These are: Planning, Design, Delivery, Operation.</p> |
| Plan | <p>A document describing a set of intended actions and providing decision-making information for execution and management, through which one expects to achieve a goal.</p> |

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| Planned Value (PV) | The authorized budget assigned to the scheduled work to be accomplished for a scheduled activity or Work Breakdown Structure Component. (Reference PMBOK, PMI). |
| Planning Phase | The first Phase of the Process, consisting Pre-Concept, Concept, Pre-Feasibility and Feasibility segments corresponding to the FEL 1, 2 and 3 Stages. The Planning Phase consists of activities that produce the necessary information to build the scope, plans and baselines for the Deployment and Start Up Phases. It provides the Project with the information required to complete its Deliverables during the Front End Loading work. |
| Planning Process | Those processes performed to define and mature the Project scope, develop the Project management plan, and identify and schedule the Project activities that occur within the Project. (Reference PMBOK, PMI). |
| Pre-Commissioning | Starts with witnessing of pre-operational testing performed under EPC/M and includes Owner's specific activities required to prepare and be ready for Commissioning. |
| Predictive Maintenance | A maintenance approach using advanced monitoring techniques for equipment and processes to anticipate impending failure. |
| Pre-qualification (of bidders/proponents) | A process by which the list of companies to invite is limited to those that meet pre-determined criteria, often verified through statements of qualifications and interviews. |
| Preliminary Engineering | Encompasses all Engineering activities and Deliverables produced in the course of FEL 2 (Pre-Feasibility) to validate the feasibility of the selected concept and site selection. The above will further allow refinement of Project scope and cost estimate. |
| Preliminary Engineering Package | Gate Deliverable. A report, produced by Service Provider(s), containing the records of the FEL 2 (Pre-Feasibility) Stage technical work and results. It describes the Engineering Deliverables and the related information gathered during the FEL 2 (Pre-Feasibility) Stage. |
| Preliminary Engineering Service Agreement Notice to Proceed | Gate Deliverable. A notice allowing Preliminary Engineering to commence. It refers to the preliminary engineering Service Agreement conditions of execution and provides the information to let everyone involved with the Project know when the preliminary engineering work is to start. |
| Pre-Operational Testing (POT) | Pre-Operational Testing executed under EPC/M responsibility at the end of the Execution Stage before starting Tests Under Load for Commissioning. |
| Procedure | A description of a process to be used as the recipe for its execution and management. |

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| Process | A set of interrelated activities performed to achieve specified Deliverable, product, result, service or outcome, or reach pre-determined operational levels within a system. |
| Process Simplification | Process Simplification consists of a disciplined analytical method for reducing investment costs, and often operating costs as well, by either combining or eliminating one or more process steps. |
| Procurement Management | One of the PMI project management knowledge areas. It includes all processes to purchase or acquire the products or results needed (goods and services) from outside the Project to perform the work. (Reference PMBOK, PMI). |
| Product Breakdown Structure (PBS) | The Product Breakdown Structure represents a view of the final product. The PBS is oriented towards physical components of the Project (i.e., permanent components, those that remain at the end of the Project). The PBS is a grouping of physical components of a Project that organizes and defines through a hierarchical structure the product to deliver in its totality. This structure supports the definition of Project assets. It is used as a framework for scope management, for estimating and for value engineering. |
| Professional Services | Refers to Professional Services to be rendered under a service agreement between PSU and a Service Provider, for a Project or a part thereof. |
| Program | A description of a specific series of related Projects and/or actions that will be implemented to comply with laws and regulations, company values and policies, and other requirements related to that matter. |
| Program Evaluation and Review Technique (PERT) | A logical Network Scheduling technique used in the construction industry. |
| Program, Projects | The term Program specifically used in Project Management refers to a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of the discrete projects in the program. |
| Project | A temporary endeavor undertaken to create a unique product, service, or result. (Reference PMBOK, PMI). |
| Project Baseline | See Baseline, Project. |
| Project Business Case | Gate Deliverable. A definition of business needs and requirements complete with a definition of a Project that, when implemented, will meet these needs and will satisfy these requirements. It provides the technical, organizational, operational and financial parameters for Project development and control by senior management and other decision- |

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| | <p>makers. It also provides information to compare and control the Project at subsequent Stages.</p> |
| <p>Project Charter</p> | <p>A global detailed Project description. It collects and defines business needs, Project parameters and Project planning information to provide a comprehensive description and understanding of the Project matters and outcomes. It provides the information to ensure a common and sufficient understanding by all stakeholders and decision-making personnel as to what the Project aims are, the work to be accomplished and the Deliverables to be produced. It provides the information to communicate clear assignments and obtain commitment from all personnel involved in the Project. It serves as a reference for Project and Deliverables performance measurement, based on key objectives, targets and outcomes.</p> |
| <p>Project Charter - Final</p> | <p>Gate Deliverable.</p> <p>A global detailed Project description. It collects and defines business needs, it provides Project parameters and Project planning information to provide a comprehensive description and understanding of the Project matters and outcomes that form the basis on which the Project RFA is prepared. It provides the information to ensure a common and sufficient understanding of all stakeholders and decision-making personnel as to what the Project aims are and the work to be accomplished to deliver and operate the new facilities. It provides the information to communicate clear Assignments and obtain commitment from all personnel involved in the Project. It serves as a reference for Project and facilities performance measurement, based on key objectives, targets and outcomes.</p> |
| <p>Project Charter - Initial</p> | <p>Gate Deliverable.</p> <p>A global Project description. It collects and defines business needs, Project parameters and Project planning information. It provides an initial scope, comprehensive description and understanding of Project outcomes in order to authorize further work. It provides the information to ensure a common understanding between stakeholders and decision-making personnel as to what the Project aims are and the work to be accomplished to pursue the opportunity.</p> |
| <p>Project Charter - Update</p> | <p>Gate Deliverable.</p> <p>The Initial Project Charter Deliverable that has been upgraded with all the pertinent information collected through FEL 1 (Concept) and FEL 2 (Pre-Feasibility) Stages. Business needs, Project parameters, Project planning, economics and risks information are better defined from Concept and Preliminary Engineering, Class 4 Estimate and initial Plans, Programs and Project Business Case. Scope, Description and Project outcomes are more precise. It provides updated information to ensure a common understanding between stakeholders and decision-</p> |

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| | making personnel at Gate 2, as to what the Project aims are and the work to be accomplished to pursue the opportunity. |
| Project Closeout | The process of finalizing all activities across all of the Project process groups to formally close the Project or Phase. (Reference PMBOK, PMI). See also Project Closeout Report |
| Project Closeout Report | Gate Deliverables. A report collecting the Project documentation at the date of issue. It records all the information relevant to the Project Delivery and Turnover Phases. |
| Project Communications Management | See Communications Management. |
| Project Contracting Strategy | Gate Deliverable. A description of the means for Penn State to get supporting resources to implement the Project, including a list of contracts and their scope of work. It defines the best Project contracting strategy for FEL 2 (Pre-Feasibility) Stage and FEL 3 (Feasibility) Stage, Detailed Engineering, Procurement, Construction Stage and Turnover Phase. |
| Project Definition | The requirements for the final product and Scope of the project typically starting with the Owner's Project Goal and continuing through: the identification of objectives; facility programming and Design Stages, detailing and specification; and any subsequent changes. |
| Project Delivery | This takes the project from the end of its Design Phase to substantial performance and acceptance, through the Delivery and Operation Phases. It includes the "preparation for construction", "construction" and "commissioning" and "project completion." |
| Project Control Schedule | See Control Schedule. |
| Project Controls Procedure (PCP) | A procedure is a combination of steps to complete, means to take and methods to follow in the accomplishment of a task. A Project Controls Procedure is a procedure defining accomplishment of a Project controls task. |
| Project Cost | The monetary value or price of a Project activity or component that includes the monetary worth of the resources required to perform and complete the activity or component, or to produce the component. The Project cost is the total cost of all activities or components of the Project. (Reference PMBOK, PMI). See APCS Volume B1 Project Estimate for details. |
| Project Cost Management | See Cost Management. |

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| Project Cycle | The time period starting from Project Ideation and ending with Final Acceptance at the end of the Turnover Phase. |
| Project Estimate | A Project cost assessment made at predetermined times of the Project cycle (see Class 1 to 5 Estimates). It identifies costs for activity-groups and for facilities components with their Work Packages corresponding to the Project WBS details available. It is the basis for the RFA preparation at the end of FEL Stages and it provides a cost forecast during the Execution Stage. It provides a basis to confirm the required investment and the cost information to support Project control and manage funds. Project Estimates are categorized by Class number according to their accuracy range based on the quality and quantity of information available. See also Class of Cost Estimate. |
| Project Execution Planning (IPA Index) | A component of the IPA FEL Index. It measures, at the time of Project authorization, the extent to which the following Project execution plan items have been established: Project objectives and priorities, contracting strategy and plans, team participants and roles, a detailed network schedule, and cost and schedule controls. (Reference IPA). |
| Project Team Kick off Meeting | Gate Deliverable. The minutes of the meeting indicating the items reviewed, ideas expressed, and actions taken or to be initiated to start the Project Stage. They provide information that guides the Project Team members as the Project is initiated. |
| Project Funding Strategy | Gate Deliverable. A description of the means for PSU to get funding to implement the Project. It evaluates funding options and defines the best Project funding strategy for the Delivery Phase. It provides information for funding planning and decision-making. |
| Project Goal | A summary statement of the Owner's intent for the project as a whole. Project Goals are expressed in the Project Charter and Business Case. For example, a goal is to increase productivity and the corresponding objective is to increase net output by 20%. |
| Project Human Resource Management | See Human Resources Management. |
| Project Integration Management | See Integration Management. |
| Project Key Performance Indicators (KPI) | Gate Deliverable. A performance measurement program of the Project success metrics. It defines the Project performance metrics with definitions of the targets, the data collection system and the calculation methods. It provides indications of the Project performance as a guide to management and for decision-making. |

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| Project Leader | Refers to the person heading a Project at various Stages. |
| project life-cycle | The phases and stages of the project from its initiation until completion. This is different from the building life-cycle, which lasts until building de-commissioning. |
| Project Management Body of Knowledge (PMBOK) | The PMBOK® (Project Management Body of Knowledge) is an inclusive term that describes the sum of knowledge within the profession of Project Management. The primary purpose of the PMBOK® is to identify and describe knowledge and practices applicable to most projects most of the time and that have a widespread consensus about their value and usefulness. The PMBOK® provides a framework for organizations to develop specific Project Management Systems and for training in Project Management. (Reference PMBOK, PMI). |
| Project Management Institute (PMI) | A global member association and advocacy organization for the project management profession. PMI is known to be the leading membership association for the project management profession. |
| Project Management Knowledge Area | An identified area of project management defined by its knowledge requirements and described in terms of its component processes, practices, inputs, outputs, tools, and techniques. (Reference PMBOK, PMI). |
| Project Master Schedule – 1st Edition | <p>Gate Deliverable.</p> <p>A high-level summary schedule of the entire Project cycle. It indicates major activity-groups in a graphic format, with milestones and decision points that are key to the duration, timing and success of the Project as foreseen at the end of FEL 0 (Pre-Concept). It provides a snapshot of the overall timeline for Project implementation and the progress status to ensure a common understanding and to support decision-making.</p> |
| Project Master Schedule – 2nd Edition | <p>Gate Deliverable.</p> <p>A progressive elaboration of the Project Master Schedule 1st Edition produced under Deliverable.</p> <p>A high-level Summary Schedule of the entire Project cycle. It indicates major activity-groups in a graphic presentation, with milestones and decision points that are key to the Project duration, timing and success, as it is perceived at the end of FEL 1 (Pre-Feasibility) Stage. It provides a snapshot of the overall timeline for Project implementation and the progress status to ensure a common understanding and to support decision-making.</p> |

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| Project Master Schedule – 3rd Edition | <p>Gate Deliverable.</p> <p>A progressive elaboration of the Project Master Schedule 2nd Edition produced under Deliverable.</p> <p>A high-level Summary Schedule of the entire Project cycle. It indicates major activity-groups in a graphic presentation, with milestones and decision points that are key to the Project duration, timing and success, as it is perceived at the end of FEL 2 (Pre-Feasibility) Stage. It provides a snapshot of the overall timeline for Project implementation and the progress status to ensure a common understanding and to support decision-making.</p> |
| Project Network Diagram | <p>See Network Diagram.</p> |
| Project Objective | <p>An objective specifies a Project Goal as a measurable indicator. For example, a goal is to increase productivity and the corresponding objective is an increase in net output by 20%.</p> |
| Project Procurement Management | <p>See Procurement Management.</p> |
| Project Quality Management | <p>See Quality Management.</p> |
| Project Quality Management Plan | <p>Gate Deliverable.</p> <p>A plan to integrate Quality Management into the Engineering/Procurement/Construction Stage and Turnover Phase of the Project cycle. It defines the framework of the QA program to be implemented and the responsibilities of the managers and users. It provides the information needed to implement a comprehensive Plan.</p> |
| Project Requirements | <p>All the products and processes stipulated for performance of the project in order to meet all the Project Objectives.</p> |
| Project Risk Management | <p>See Risk Management.</p> |
| Project Risk Management Plan | <p>Gate Deliverable.</p> <p>A plan documenting completion of a Project-level risk management process compliant with the internationally recognized risk management framework AS/NZS 4360:2004. Project risks are identified, analyzed, and recorded in a risk register. Options are developed to treat the risks which have been prioritized based on probability and consequences (severity). In particular, the risk management process will ensure that all extreme risks and those with catastrophic outcomes receive an additional PSU Management review.</p> |

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| Project Schedule | The planned dates for performing scheduled activities and the planned dates for meeting scheduled milestones. (Reference PMBOK, PMI). |
| Project Scope & KPI Performance Targets | Gate Deliverable. A performance measurement program of the Project success metrics. It defines the Project performance metrics that can serve as rating metrics to express the success of the Project in meeting Project scope and other performance targets. It defines, for each metric, the target value, the data collection system and the calculation method. It provides indications of the scope and Project performance as a guide to management and for decision-making. |
| Project Scope Management | See Scope Management. |
| Project Specific Procurement Manual | Gate Deliverable. Manual describing Project specific procurement activities. It indicates and justifies any procurement activities or methods or procedures that may be different from the Corporate Procurement Procedures or be a complement to such procedures. It provides information to facilitate Project procurement within university policies. |
| Project Specific Manuals | A collection of manuals describing Project specific control activities. It indicates and justifies any Project Management and Controls activity, method or procedure that may be different from University procedures or PDS Project Controls procedures or be a complement to such procedures. |
| Project Specific Project Controls Systems & Procedures | Gate Deliverable. A manual describing Project-specific control activity. It indicates and justifies all control activities, methods or procedures that may be different from PDS Project Controls procedures or be a complement to such procedures. It provides information to facilitate the control of a Project within the PDS. |
| Project Specific Project Manual | Gate Deliverable. A manual describing Project specific Project Management and Controls activities. It indicates and justifies any Project Management and Controls activity, method or procedure that may be different from the PDS Project Controls procedures or be a complement to such procedures. It provides information to facilitate Project Management and Controls within University standards and PDS approach. |
| Project Sponsor | The person assigned to represent the functional area manager that will own the Project assets. The Project Sponsor is responsible for ensuring that financial resources, in cash or in kind, are available for the Project and that the Project benefits are delivered as outlined in the Project Charter and in the Business Case. |

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| Project Stakeholders | Individuals or organizations that are actively involved in the Project, whose interests may be affected positively or negatively as a result of Project execution and Project results. |
| Project Statement | <p>Gate Deliverable.</p> <p>A report that contains the main reasons and assumptions to initiate a Capital Planning Stage, with the objective of clarifying or resolving a situation or a condition. It describes the situation and needs, and it provides Capital Planning justifications and requirements to be used as the basis for the initial Screening of contemplated opportunities and subsequent development. It provides the decision-making information to authorize Capital Planning.</p> |
| Project Steering Committee | See Project Steering Committee Assignment. |
| Project Steering Committee Assignment | <p>Gate Deliverable.</p> <p>An assignment to a group of designated persons to oversee the Project cycle starting at Schematic Design Stage. It defines the composition of the team, scope of work and team-member responsibilities to support the Project Leader for rapid decision-making.</p> |
| Project Team | Refers to the grouping of Project Team and key Service Providers for a specific Project. |
| Project Time Management | See Time Management. |
| Project Work Breakdown Structure | <p>Gate Deliverable.</p> <p>A hierarchical graphic representation of Project elements. It defines elements from each descending level with an increasingly detailed definition and individual element coding. The lowest level of the Work Breakdown Structure is composed of Work Elements assigned by group or individually to one organization for execution.</p> |
| Punch-List | The punch-list work items identified in the construction phase are completed by the contractor. Punch-lists are defined here as a written list documenting the results of an inspection and listing each item of the Work that is to be completed or corrected and affixing the time within which the deficiency is to be resolved. Punch-lists as defined here are intended to document ONLY those items that are the Contractor's responsibility, or for which responsibility has not yet been ascertained and could potentially be that of the Contractor. Punch-lists are NOT intended to address design-related issues assigned to OPP or the Professional, Customer requests, etc., which are not, or which have not yet, been incorporated into the scope of the Contractor's contractual responsibilities; such issues are generally addressed through other project mechanisms. Punch-lists should be issued and controlled through the Construction Inspection Office and the Construction Quality Representative, and not through the Design Firm. |

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| Public Relations Strategy | Gate Deliverable. A report defining which groups are concerned with the Project and the nature of their preoccupations. It also defines the approach to adopt in order to ensure that the interests of the various concerned groups have been addressed. It is a living document that must be updated regularly as the project develops, concerns of the various groups become well understood, and as the community's perspective evolve. |
| Qualification Based Selection (QBS) | A competitive contract procurement process whereby Service Providers submit qualifications to a procuring entity (PSU) that evaluates and selects the most qualified firm, based on a scoring system applied to a set of evaluation criteria such as: <ul style="list-style-type: none"> • Skills and qualifications of personnel; • Technical competence; • Reputation; • Experience in similar projects; • Capacity to undertake the Project; • Understanding of and commitment to the client's interests; • Financial considerations. (Fee, Rates, Incentives etc.) |
| Qualifications | Evidence of the capability required to carry out a responsibility. Qualifications include general and specific education, training and experience requirements. Some qualifications are laid down by regulations, such as for Registered Architects, Professional Engineers and gas fitters; others are determined by good practice or by employers or clients. |
| Quality | The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs (an ISO definition). The term "product quality" may be applied to results, and "process quality" may be applied to all of the methods and services that contribute directly or indirectly to the results. |
| Quality Assurance (QA) | The planning and implementation of processes by which the work of designers, construction and trade contractors and suppliers, is monitored by others who are qualified to verify that the defined quality requirements are being, and have been, met. |
| Quality Control (QC) | The process by which designers, builders and suppliers check their own work-in-progress either to confirm that it complies with quality requirements such as project drawings and specifications, and with industry standards including workmanship. It includes inspection and tests by those responsible for the work, or conducted on their behalf, to measure conformance to specifications. |

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| Quality Management | One of the PMI project management knowledge areas. It includes the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the Project will satisfy the needs for which it was undertaken. It includes Quality Planning, Quality Assurance and Quality Control. (Reference PMBOK, PMI). |
| Quality Requirements: | The characteristics of the components of the work as specified in the project plans, design documents and specifications. The quality requirements must meet applicable codes or may exceed them. |
| Quantitative Competitive Benchmarking (QCB) | IPA uses Quantitative Competitive Benchmarking. QCB is the benchmarking of one's performance against competitors. QCB uses quantitative databases drawn from a large number of firms in the same or allied industries. The goal is to obtain a rigorous numerical comparison of business results on an "apples-to-apples" basis. (Reference IPA). |
| RACI Responsibility Matrix (RACI) | The general definition and use of a RACI Matrix are to show individuals or functions responsible, accountable, consulted or informed of a decision, or a communication related to a subject or a matter. |
| Regulatory Process | All the steps and processes needed to obtain all required approvals and permits from all Authorities Having Jurisdiction over design and construction. |
| Reliability Simulation Modeling | Reliability Simulation Modeling is used to determine the effect of different design configurations on plant and equipment availability and the impact on down time. |
| Report | A document collecting results and conclusions. It provides decision-making information to conclude. |
| Request for Proposal | Requests for proposals (RFPs) are sent to the ~10 firms selected for further consideration. The RFP requires design firms to submit their qualifications specific to the project. |
| Request for Quotation (RFQ) | A process implemented to obtain bids, usually competitive, for the acquisition of goods and services. The process involves the development and issue to potential suppliers of a series of documents covering the bidding process proper (tender form) and all PSU's requirements (scope, technical, legal, financial, managerial, execution considerations) in order to conclude a contract under the best conditions for PSU. |
| Reserve | A provisional amount established to cover strategic risk assessment. |

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| Rezoning | A requirement for a new or re-developed building whose characteristics are outside current restrictions applicable to the location, as laid down by the Authority Having Jurisdiction. |
| Risk | A risk is defined as an uncertain event or condition that, if it occurs, has a negative or positive effect on a Project's objectives. (Reference PMBOK, PMI). A risk is defined by five elements: (a) Description of the event; (b) Source of the risk; (c) Probability of occurrence (see Risk Probability); (d) Impact on Project objectives (see Risk Impact); (e) Severity (see Risk Severity). |
| Risk Analysis | The process of assessing risk by determining the expected impact, probability, and timeframe of a risk. It should be performed at predefined Stages of a Project and it is used to minimize the probability and consequences of threats to Project objectives. |
| Risk Impact | The potential damage of the risk to the Project, assuming the risk does occur. The potential damage is assessed with the following qualifiers: <ul style="list-style-type: none"> • Critical • Major • Moderate • Minor • Insignificant |
| Risk Management | One of the PMI project management knowledge areas. Project Risk Management includes the processes concerned with conducting risk management planning, identification, analysis, responses and monitoring and control on a Project. The objectives are to increase the probability and impact of positive events and decrease the probability and impact of events adverse to Project objectives. |
| Risk Probability | The likelihood that a risk will really occur. The likelihood is assessed with the following qualifiers: <ul style="list-style-type: none"> • Almost certain • Likely • Fairly Likely • Possible • Unlikely • Rare. |
| Risk Severity | The probability of the risk multiplied against the impact. There are four levels of severity: <ul style="list-style-type: none"> • Very high • High • Medium High • Medium • Low |

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| Roadmap | A PDS schematic tool that generally illustrates the sequences in which the PDS Deliverables required at each Gate are being developed. It is intended to provide a conceptual view of the logical sequence for timely completion of Stage Gate Deliverables. |
| Schedule | The planned dates for performing activities and the planned dates for meeting milestones. (Reference PMBOK PMI) See Project Schedule or Control Schedule or Master Schedule. |
| Schedule Baseline | The original approved schedule, plus or minus approved scope changes (Reference PMBOK PMI) |
| Schedule Duration | Time from the start of detailed engineering through mechanical acceptance, corresponding to the Execution Stage of the PSU Stage Gate Delivery Phase. |
| Schedule Performance Index | A measure of schedule efficiency on a Project. It is the ratio of EV (Earned Value) to PV (Planned Value). The SPI equal EV divided by PV. An SPI equal to or greater than the one indicates a favorable condition and a value of less than one indicates an unfavorable condition. See also Earned Value Management. (Reference PMBOK, PMI). |
| Schedule Predictability, (IPA Index) | Difference, in percentage, between the actual time required for execution and the time estimated at authorization. (Reference IPA). |
| Schedule Risk | An uncertain event or condition that, if it occurs, has a negative impact on a schedule (Reference IPA). |
| Schedule-Driven | Schedule-Driven Projects are those in which a pressing need to meet a scheduled date exists and to which funds are committed. Funds cover items such as overtime for engineering and construction and for expediting equipment and parts delivery to assure that critical dates are met. A special contingency should also cover other risks associated to schedule-driven conditions. |
| Schematic Design Sub-Stage | A Sub-stage of the project Design Stage that provisionally sets the building layout and system performance requirements. It provides complete design coverage for initial optimizing of the project definition and cost, consistent with available funds. |
| Scope Change | A change in task objectives plans or schedules that result in a material difference from the terms of an approval previously granted by a higher authority (BOT Project Funds). Under certain conditions, change in resource allocation may constitute a change in scope. Changes in Project design to meet the original Project objectives are not considered changes of scope. Scope changes are discretionary changes made to a Project's original objectives; for example, changes in Project location. |

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| | (Reference IPA). |
| Scope Management | One of the PMI Project Management Knowledge areas. It includes all processes required to ensure that the Project includes all the work required, and only the work required, to complete the Project successfully. Scope Management is broken down into five processes: scope planning, scope definition, creation of a WBS (Work Breakdown Structure), scope verification, scope control. (Reference PMBOK, PMI) |
| Scope of Project | The intended assets and capabilities of the Project. Scope is distinct from design. The design is intended to implement the scope, but changes in the design may be necessary to complete the scope. For example, if an unanticipated purification column is required to manufacture product of the specified characteristics, this does not constitute a change in scope although it will require a change in design. On the other hand, if the purification column is required because of a change in market demand, then that requirement constitutes changes in both scope and design. (Reference IPA). |
| Scope of Work | The definition of all work that must be done to deliver a product with the specified features and functions. |
| Sensitivity Analysis | A quantitative risk analysis and modeling technique used to help determine which risks have the most potential impact on the Project. It examines the extent to which the uncertainty of each Project element affects the objectives being examined when all other uncertain elements are held at their baseline values. This technique is commonly used in financial analysis. |
| Service Agreement | See Agreement. |
| Service Agreement Draft for FEL 1 (concept) | Gate Deliverable. A document defining mutual, legally-binding conditions and obligations between Penn State and Service Providers for outsourcing and contracting FEL study work. It secures the necessary know-how, resources and continuity to complete FEL 1 (Concept) and may include a provision to cover the needs for FEL 2 (Pre-Feasibility) and FEL 3 (Feasibility) Stages. |
| Service Agreement Draft for FEL 2 (Pre-Feasibility) | Gate Deliverable. A document defining mutual, legally-binding conditions and obligations between Penn State and Service Providers for outsourcing and contracting FEL study work. It secures the necessary know-how, |

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| | resources and continuity to complete FEL 2 (Pre-Feasibility) and may include a provision to cover the needs for FEL 3 (Feasibility) Stages. |
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| Service Agreement Draft for FEL 3 (Basic Engineering) | Gate Deliverable. A legally-binding document in draft form defining the services to be delivered by a Service Provider. It defines the necessary commercial and relationship elements to ensure mutual understanding of the work and Deliverables to be provided. It defines and formalizes mutual obligations between the Service Provider and PSU. It provides the framework for tender call and negotiations with the Service Provider, or for extending the Services Agreement. |
| Service Provider(s) | An entity retained by Penn State to render professional services in a specific area of expertise for a given Project. |
| Short List | Based on the review and evaluation of the RFP responses, 3 design firms are “short-listed.” These firms will be considered further for the project design contract. |
| Simulation Modeling | See Reliability Simulation Modeling. |
| Single Point of Accountability (SPA) | A person assigned as responsible for an action and its Deliverables. In the PDS Stage Gate Process, SPA is a person or a group of persons designated as being responsible for Deliverable’s verification. At all Gates, SPA is assigned to collect and evaluate the compliance of required Deliverables using the corresponding Deliverables Check-List. |
| Site Definition (IPA Index) | A component of the IPA FEL Index. It measures, at the time of authorization, the level of completeness with respect to four site-related factors: (a) equipment arrangements, (b) soils and hydrology data, (c) environmental requirements, and (d) health and safety requirements. (Reference IPA). |
| Solicitation of Interest | A solicitation of interest e-mail is sent to design firms in Penn State’s designer database. The purpose of the solicitation is to inform design firms of Penn State’s request to receive letters of interest and qualification materials from firms interested in providing design services for the project. Unless special scope or knowledge requirements necessitate an out-of-state design firm, solicitations of interest are sent only to design firms located in Pennsylvania. |
| Stage | A Stage is a subset of a Phase. It is the second level breakdown of the PDS Stage Gate Process. A Stage consists of the necessary activities to ensure preparation and the gathering of the Deliverables required at the Gate marking the end of the Stage. |
| Stage Gate Process | A Stage Gate Process is a widely employed project management methodology that divides the effort into distinct time-sequenced stages separated by management decision gates. It is a framework which aids the execution and management processes and enables the efficient movement from idea to fruition. |

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| Stakeholder | See Project Stakeholder. |
| Standard contracts | Generally accepted forms for agreements between Owner and design professionals, and between Owner and Builder, and subcontracts. |
| Start-up | All activities from Mechanical Acceptance to Industrial Acceptance. |
| Start-up Duration | The period required for startup is the length of time from Mechanical–Acceptance to the time of Industrial Acceptance. (Adapted from IPA). |
| Start-up Predictability | Difference, in percentage, between the actual time required for start-up and the time estimated at authorization. (Reference IPA). |
| Start-up, IPA Index | Index Difference, in months, between the actual time required for start-up and the time projected by the IPA Start-up Time Model (the industry norm). (Reference IPA). |
| Steering Committee, Project | A group of persons selected to support the Project Team in decision-making and in the relationship with higher decision Authorities. |
| Strategic Risk Management Plan | <p>Gate Deliverable.</p> <p>A plan documenting completion of a strategic level risk management process compliant with the internationally recognized risk management framework AS/NZS 4360:2004. Strategic risks beyond the project level are identified, analyzed, and recorded in a risk register. Options are developed to minimize the risks which have been prioritized based on probability and consequences (severity). In particular, the risk management process will ensure that all University, and Board Level extreme risks and those with catastrophic outcomes receive appropriate PSU Management review.</p> |
| Sub-Gate | A Gate of the PDS Stage Gate Process which is a quality control checkpoint to verify Deliverables. |
| Sustainability and Community Approach | <p>Gate Deliverable.</p> <p>A document defining the means considered to ensure that no damage will occur to the resources and environment of the community. It is the translation of PSU’s Sustainability values into site specific actions. It identifies how the new facilities operations will be of significant contribution to the community’s well-being and prosperity.</p> |
| Sustaining Project | A Project associated to an existing Facility consisting of maintaining or improving the value of the asset, or to comply with regulatory requirements. |

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| System | An integrated set of regularly interacting or interdependent components created to accomplish a defined objective, with defined and maintained relationships among its components and the whole, producing or operating better than the simple sum of its components. A System may be either process based, or management based, or more commonly a combination of both. Systems for project management are composed of project management processes, techniques, methodologies and tools operated by the Project Management Team. (Reference PMBOK, PMI). |
| Technology Selection | A systematic process aimed at identifying and selecting the best technology to meet objectives and to improve Penn State competitive advantage. |
| Template | A form with self contained instructions and/or proposed reusable statements to be completed (fill-voids type). A Template may include written statements. |
| Testing Pre-notice | A period of time defined and agreed to by the Project director and the EPC/M Manager to signal in advance the start of pre-operational testing allowing time for Owner's personnel to ensure that the preparation for commissioning is on time. |
| Tests Under Load (TUL) | A Commissioning activity carried out to perform tests with raw materials on systems and equipment in order to confirm their operational characteristics. |
| Time Management | One of the PMI project management knowledge areas. It includes the processes required to accomplish timely completion of the Project. Project time management includes activity definition, activity sequencing, activity resource estimating, activity duration estimating, schedule development and schedule control. (Reference PMBOK, PMI). |
| Timeline | A high-level graphical representation of a Project Cycle, showing only the key milestones of the Project. |
| Total Float (TF) | The total amount of time that a schedule activity may be delayed from its early start date without delaying the Project finish date, or violating a schedule constraint. (Reference PMBOK, PMI). |
| Total Installed Cost (TIC) | The total cost of a Project, including Development, Delivery and Turnover Phases costs. |
| Turnover Package | A system or a group of physical components (equipment, piping, electrical and electronic devices, building components with specifications, drawings, operation and maintenance material, training material, etc.) that, after mechanical completion verification and testing by construction, is handed to Operations for Commissioning and Ramp-up. |

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| Value Engineering | It consists of a disciplined method, requiring the use of a trained Value Engineering Consultant, aimed at eliminating or modifying items that do not contribute to meeting business needs. |
| Value Improvement Practices (VIP) | Formal and documented practices involving a repeatable work process with measurable results, used to improve Project and future asset performance. These practices are optimization type activities primarily performed during the Front-End-Loading (FEL) of a Project. (Reference IPA). |
| Value Management (value analysis/ engineering): | For the Owner, this is a structured process for obtaining the best value for the building life-cycle from each dollar spent, consistent with the Project Objectives. For others, its purpose is to obtain the best value from a lesser scope, such as a design-build contract. Sometimes it is incompletely used, mainly as a cost-cutting process. |
| Variance | A quantifiable deviation, departure or divergence away from an approved baseline. |
| Warranties Review Report | Gate Deliverables. A Warranties Review Report is a report documenting the status review and further follow-up on warranties. It confirms the information of the warranties register and plans actions to resolve outstanding warranty-related matters and to follow up on warranties during Test Under Load, Production, Ramp-up and Operations. It provides the information to ensure proper management of warranties. |
| Waste Minimization | A disciplined approach, used during design, aimed at reducing or eliminating each non-useful stream. More emphasis is placed on the reduction of waste at the source and/or the cost effective reuse of waste rather than 'end of pipe' treatment. |
| Work Breakdown Structure (WBS) | A Deliverable-oriented hierarchical decomposition of the work to be executed by the Project Team to accomplish the Project objective and create the required Deliverables. It organizes and defines the total scope of the Project. Each descending level represents an increasingly detailed definition of the Project work. The WBS is broken-down into Work Packages. The Deliverable orientation of the hierarchy includes both internal and external Deliverables. |
| Work Package | A regrouping of Deliverables and activities, identified in the Project Work Breakdown Structure that are to be performed under a distinct responsibility identified in the Project Organization Structure. For example, the scope of work assigned to a Service Provider is considered a Work Package. |
| Work Plan | Plans prepared for each Project Stage. |

10. Appendix C – Project Delivery System Overview Diagram (separate document)

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11. Appendix D – PSU Stage Deliverables Chart (separate document)