

Advanced Project Management

Fall 2005



**Washington State
Department of Transportation**

Project Control & Reporting
Project Management and Training

Advanced Project Management (formerly MSSB)

Course Title: Advanced Project Management (MSSB)

Course Code: CPH

Date: _____

Location: _____

Instructor(s): _____

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE CLASS PARTICIPANT WILL BE ABLE TO:

- ✓ Identify project team roles and method of project conflict resolution
- ✓ Plan and estimate percent complete for schedule and budget management
- ✓ Identify methods for schedule compression and/or recovery
- ✓ Develop Risk Management Plans
- ✓ Identify methods for budget and scheduling estimates
- ✓ Develop a resource histogram and balance resources
- ✓ Perform Earned Value analysis on an actively tracked project plan
- ✓ Successfully pass the Learning Assessment at the end of the course

Resources / Manuals used:

WSDOT Executive Order 1032.00E “Project Management”, dated July 1, 2005.

WSDOT. “*Project Management Process*” training manual, 2005.

WSDOT. “*Intro to Project Scheduling*” training manual 2005.

WSDOT. “A Policy for Cost Risk Assessment”, dated August 2005.

Project Management Institute. *A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guide)*. Project Management Institute, Inc. 2004.

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Velociteach. *The PMP Exam, 2005 Edition*. Andy Crowe, PMP. 2004.

International Institute for Learning (IIL). *Advance Project Risk Management” training manual, version 4.0*. International Institute of Learning, Inc. 2004

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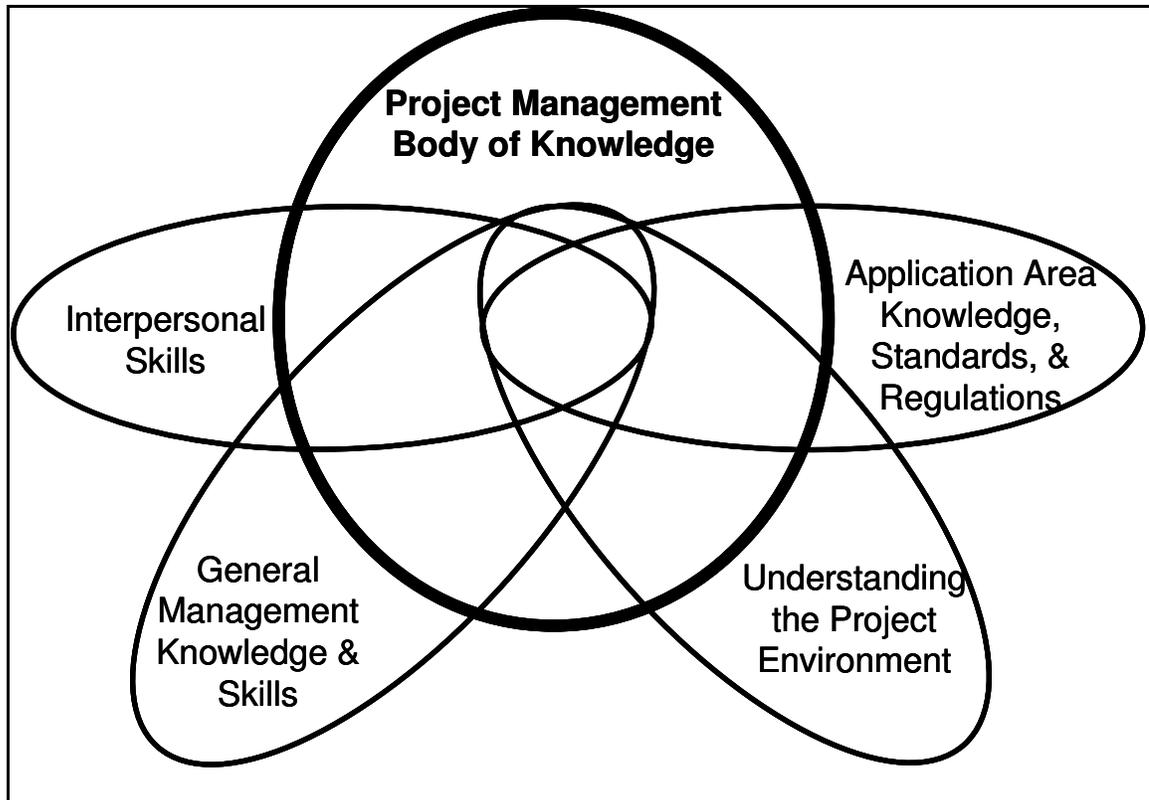
Bill Elliott – OR Project Management Office

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Module 1 – General Project Management Theory & Skill

Project Management Body of Knowledge

While terminology may vary, the principles of project management are consistent. A project manager needs more than tools to succeed in delivering quality projects on time and within budget. Project managers with the knowledge and skill to lead a team toward a common goal will optimize team member talents to the best benefit of the team.



PMBOK Guide, 3rd Edition

The Project Management Body of Knowledge (PMBOK) Guide describes the work planning process as defining and refining objectives and selecting the best alternative courses of action. There are many tools and techniques unique to project management; such as work breakdown structures, critical path, or earned value. These tools and techniques alone are not sufficient without effective project management knowledge and skills. The project team must recognize and use knowledge and skills from at least five areas of expertise:

The Project Management Body of Knowledge

Knowledge unique to the project management field and overlaps other management disciplines.

Application area knowledge, standards, and regulations

Project categories with common elements but not necessary in all projects

- Functional and supporting disciplines - legal, inventory management, personnel, traffic, right-of-way, environmental, etc.
- Technical elements – software development or ENGINEERING
- Management specializations – government contracting, new product development
- Industry groups – automotive, chemical, agriculture.

Each of these areas typically have their own set of accepted standards and practices.

Understanding the project environment

The team needs to understand the positive and/or negative cultural, political, social and environmental impacts the project may have and how people (customers, stakeholders, etc.) may affect the project.

General management knowledge and skills

Planning, organizing, staffing, controlling ongoing operations; including strategic planning, accounting, procurement, human resources, information technology, etc.

Interpersonal skills

Effective communication, getting things done, leadership, motivation, conflict management, and problem solving.

Each of these areas may appear to be discrete elements, but they generally overlap. It is not required that every team member be an expert in all five areas, the combined knowledge of the team leads to an effectively managed project.

The Project Team

Organization planning is a process that is primarily concerned with identifying and assigning roles and responsibilities for the project. Everyone on a project has a function or role and a responsibility assigned to that role or function. It is important for the Project Manager to identify these roles and help influence these team members in order to keep the project running smoothly and ensuring project success.

Identifying and defining these roles is a vital part of the “Initiate and Align” step of the project management process.

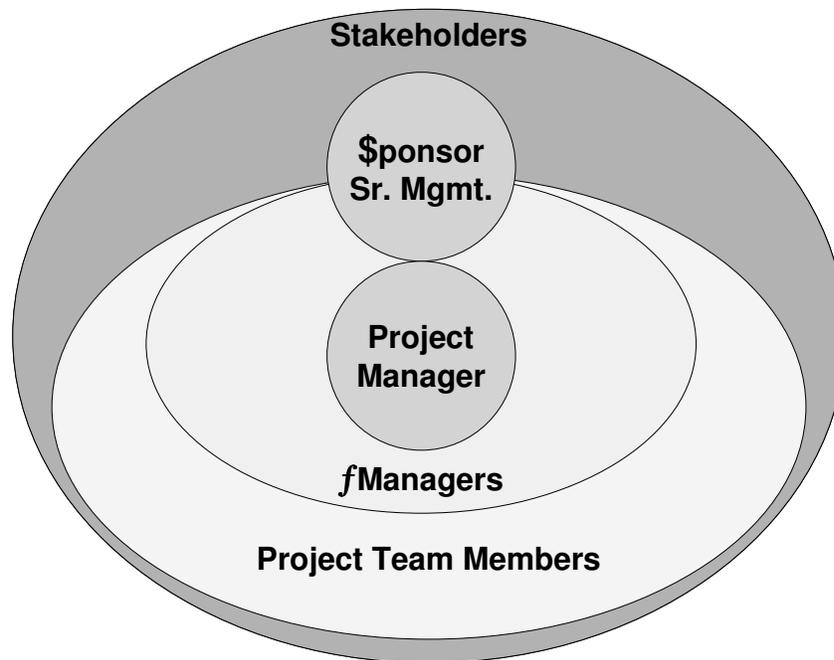


Figure 1-1

Project Manager

The project manager is ultimately responsible for the project. This person uses organizational resources to accomplish the project objectives. The project manager is “large and in charge” for the project. The project manager leads each step in the project management process.

Project Sponsor

The sponsor and the project manager are the “owners” of the project. Usually, the project sponsor will come from senior management, but can be the customer in some cases. The project sponsor is the person or group responsible for providing the financial resources (funding) for the project

Senior Management (Executive Management)

Senior managers are the people above the project manager within an organization. Senior management will prioritize projects in the organization. Senior management will *Initiate* the project, which is the formal recognition that a project exists. Senior managers delegate project responsibilities and authority to the project manager.

It is also senior management’s role to create a productive environment for the project, and to review and endorse the project management plan.

Functional Manager

The functional manager manages the specialty or specific resources required to create deliverables required for the project. Project managers will coordinate and negotiate with the functional managers for the resources needed for the project. Functional managers are often involved in project planning and setting priorities for the project.

Project Team Member

The group of individuals that is performing the work required for the project and project delivery.

Stakeholder

A project stakeholder is anyone with a particularly significant interest in the project’s outcome including those providing funding or right of way for the project and property owners who are affected by the project. Stakeholders are unique for each project and include anyone actively involved in the project and whose interests may be positively or negatively affected by the execution or completion of the project. A stakeholder may also exert influence over the project and its deliverables.

A project manager must manage stakeholder expectations, which can be difficult because stakeholders often have different or even conflicting objectives for the project. A Project Manager will need to work with the project team and perform a key stakeholder analysis. Key stakeholders are those stakeholders who have a direct impact on project success. Maintaining effective communication with key stakeholders is vital to project success.

Customer

The person or organization that will acquire or use the project’s product, service, or result.

Organizational Breakdown Structure (OBS)

An Organization Breakdown Structure (OBS) is a hierarchical organized depiction of the project organization arranged so as to relate the work packages to the performing organizational units (functional managers). This is an effective tool for defining roles and responsibilities and facilitates the development of the Project Communication Plan.

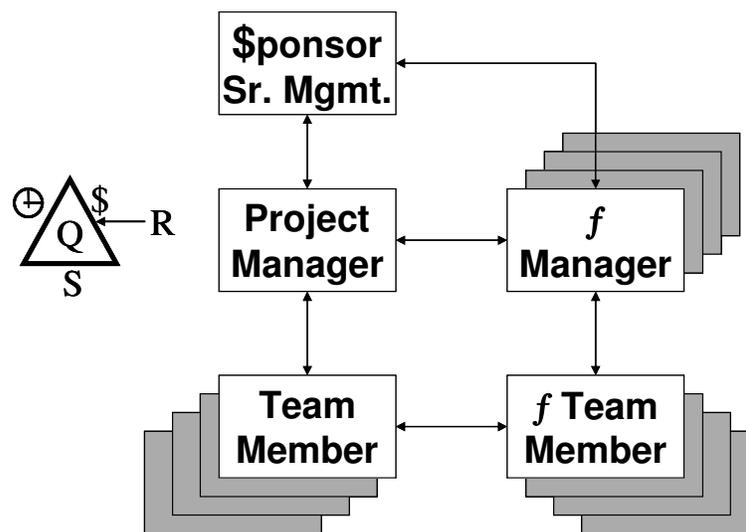


Figure 1-2

Responsibility Assignment Matrix (RAM)

A Responsibility Assignment Matrix (RAM) is a tool that relates the project OBS to the project Work Breakdown Structure (WBS). It is used to help ensure that each component of the project’s scope is assigned to a responsible team or person.

WBS Item \ Role	Project Manager	Functional Manager A	Functional Manager B	Functional Manager C	Functional Manager D	Functional Manager E	Functional Manager F	Functional Manager G	Functional Manager H	Functional Manager J	Functional Manager K	Functional Manager L	Functional Manager M	Functional Manager N	Functional Manager P
WBS Deliverable 1	R						S			A					
WBS Deliverable 2			P		S	R									A
WBS Deliverable 3	R				I			I				A	S		
WBS Deliverable 4										S					I
WBS Deliverable 5	R			A				I			S				
WBS Deliverable 6		R			I			A			S				
WBS Deliverable 7	R	S					S							A	

P - Participant; A – Accountable; R – Review; I – Input Required; S – Signature Required

Figure 1-3

Organizational Influences and Structure

Projects are typically part of an organization that is larger than the project. Examples of organizations include corporations, governmental agencies, healthcare institutions, international bodies, professional associations, and others.

Project based organizations are those whose operations consist primarily of projects. These organizations fall into two categories:

- Organizations that derive their revenue primarily from performing projects for others under contract (i.e. architectural firms, engineering firms, consultants, construction contractors, and government contractors).
- Organizations that have adopted management by projects. These organizations usually have a management system in place to facilitate project management.

The structure of an organization often constrains the availability of resources.

Org Structure> Characteristics	Functional	Matrix			Projectized
		Weak	Balanced	Strong	
Project Mgr's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who controls project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Mgr's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Mgr Admin Staff	Part-time	Part-time	Part-time	Full-time	Full-time

PMBOK Guide, 3rd Edition

Figure 1-4

Functional Organization

The typical functional organization is a hierarchy where each employee has one clear supervisor. Staff members are grouped by their specialty. The scope of work is typically bound by the group's specialty or specific function. Projects developed in a functional organization will have a project coordinator in lieu of a project manager.

Projectized Organization

At the other end of the spectrum from the functional organization is the projectized organization. Often, team members are collocated. Most of the organization's resources are involved with the project's work. Project managers have a great amount of independence and project authority.

Matrix Organization

Matrix organizations are a blend of functional and projectized characteristics.

Strong Matrix

In a strong matrix organization, the Project Manager has considerable authority and usually will have full-time staff assigned. The Project Manager will usually report to a manager of project managers, or a Project Management Office.

Weak Matrix

Weak matrices maintain many of the characteristics of a functional organization, with the project manager actually providing a coordination role, with limited or no project authority.

Balanced Matrix

A balanced matrix recognizes the need for a project manager; this structure does not provide the project manager with the full authority over the project and project funding.

Project Coordinator

In some organizations, project managers do not exist. Instead, these organizations use the role of a project coordinator. The project coordinator has less authority than a project manager. This person may not be allowed to make budget decisions or overall project decisions, but they have some authority to assign resources. Project coordinators are typically found in weak matrix and functional organizations.

Project Expeditor

This role has the least amount of authority. The project expeditor is a staff member who makes sure things arrive on time and that tasks/activities are completed on time. An expeditor is usually found in a functional organization.

Power

Power is the ability to influence behavior in others. Power that is based on the organization and the position/title of the Project Manager is “Organizational” or “Legitimate” power. Power that is based on the characteristics of the person is “Individual” or “Earned” power.

Legitimate/Formal Power

Legitimate power, also known as formal power, is the power that the Project Manager has due to the position or title. This power comes from being formally in charge of a project and the backing and support from the agency/organization.

Strong, broad based formal authority for a project manager is rare. This would be characteristic of a projectized organizational structure.

Reward Power

Reward power is the ability to give rewards and recognize achievements. Some examples of these rewards and recognition are pay raises, bonuses, time off, or any other type of reward that would motivate the person.

Punishment Power

Similar to Reward power, this type of influence is the ability to punish an employee if a goal is not met. “Nobody is taking vacation next month if we miss this milestone date,” or “If you overspend the project budget, you’ll be demoted” are examples of a manager using punishment power. This type of power is also known as coercive power.

Expert Power

Expert power exists when the individual, or Project Manager, is an expert on the subject. People will listen and respond to an individual that has Expert power because that person has credibility. A subject matter expert (SME) has significant power to influence and control behavior.

Referent Power

Referent power is a form of power based on the respect or charismatic traits of the individual. This power is based in the persuasive ability of the person.

Another form of referent power is when a less persuasive (powerful) person will use the influence of, or allies with, another person with more persuasive trait, and leverages the power of the ally.

Most project management references consider Reward and Expert power as the most effective and Punishment or Coercive power as the least effective.

Conflict Management

Project Managers need to realize that conflicts during the life of a project are inevitable. Recognizing this fact, developing good procedures or techniques, and planning for conflict resolution can help resolve conflicts as they arise. A project management plan can identify potential conflicts, develop resolution methods, and document the methods for the project team to use throughout the project.

Sources of Conflict

Research has shown that the greatest source of conflict is between project managers and functional managers. Most of these are the result of disagreements over schedules, priorities, and resources. This runs contrary to commonly held beliefs that most project conflicts are a result of personality differences.

Confronting / Problem-Solving

Sometimes referred to as “confronting” or “collaborating”, although the term *confronting* may have a negative connotation to it, this method is generally viewed as the best method for conflict resolution. It “confronts” the source of conflict and looks to solve the conflict so it will not be an issue for the project.

Compromising

To compromise is to negotiate or bargain for a solution that gives both parties some degree of satisfaction. Some would call this a “give and take” or “win-win situation. Others might call it a “lose-lose” position, since neither party will get everything they want or need.

Forcing

Forcing is exactly as the name implies. It is when one party tries to impose the solution on the other party. The result is usually viewed as a “win-lose” situation, where one party wins at the expense of the other. Typically, this method does not address the underlying source of conflict and can reduce team morale. It is not viewed as a good method for long term solutions and relationship building.

Smoothing / Accommodating

When using the smoothing, or accommodating, technique, the Project Manager will emphasize the areas of agreement or turn attention to what is going well and deemphasizing the areas of disagreement or conflict. Smoothing tends to downplay the conflict instead of resolving it.

Withdrawing / Avoiding

Withdrawal is often regarded as a temporary solution at best. Some argue that this is not a conflict resolution at all. A project manager that uses this method is merely hoping that the problem will go away by itself over time. Because of the avoidance or temporary nature of this method, the conflict can come up again and again throughout the project life.

Team Roles

A project manager’s ability to effectively address and manage conflicts on a project will be affected by his or her ability to recognize and deal with constructive and destructive roles on the project team. An effective project manager will be able to identify destructive roles within the team and look to diminish or eliminate them and enhance and maximize the positive effects from constructive team roles.

Constructive Team Roles

Initiators

An initiator is a project team member that brings ideas and activities to a project. This role is proactive and is considered highly productive and positive.

Information Seekers

An information seeker is a project team member that actively seeks to gain as much project information and project understanding as possible. This role is considered positive because this develops an environment of increased project knowledge and open communications for the project team.

Information Givers

An information giver is a project team member that openly shares project information. Similar to the information seeker, this role is considered positive because it develops an environment of increased project knowledge and open

communications for the project team. Be mindful that not all information can be readily shared (i.e. confidential, classified, secret information).

Encouragers

Encouragers are project team members that maintain a positive and realistic attitude within the project team. These individuals keep the team focused on what can be accomplished. This role is considered positive because it contributes, improves, and maintains team morale.

Clarifiers

A clarifier is a project team member that works to ensure that everyone has the same project understanding and project knowledge. This role is considered positive because it is proactive and keeps the team focused on the project objectives. This role also improves communication.

Harmonizers

A harmonizer is a project team member that actively looks to enhance project information in a way that increases project understanding. This is considered a positive role because it increases project understanding and can contribute to better communication.

Summarizers

A summarizer can take the minute details of the project and restate or relate them in a summarized form back to the project objectives. This is considered a positive role because the fine details of a project can become overwhelming to project team members. A summarizer will, similar to the harmonizer, help in increased project understanding and can contribute to better communication.

Gate Keepers

The role of gate keeper has a couple of possible meanings in project management, depending on the reference used. One definition is a project team member that works to draw other team members into the project discussions. This role is considered possible because it encourages participation on the project.

Another definition is the project team member that judges whether the project will continue when a “kill point” or “stage gate” has been reached. This project team member makes decisions whether the project still meets the business needs and is justified in transitioning to the next phase.

Destructive Team Roles

Aggressors

An aggressor is a project team member that is openly opposed and hostile to the project and project objectives. This is a negative role because it serves no productive purpose for the project.

Blockers

A blocker is a project team member that blocks access to information and looks to disrupt the flow of communication. Since good project communication is essential for project success, this role is very destructive.

Withdrawers

A withdrawer is a project team member who does not participate in discussions, brainstorming sessions, team meetings, etc. This person will likely remain quiet or refuse to participate at all. This is a negative role because it usually produces a project team member that will not commit to the project plan and can have a negative effect on team morale.

Recognition Seekers

A recognition seeker will look at a project to see how it can personally benefit him or her. Because this person is more interested in personal benefit rather than project success, he or she can ultimately jeopardize the project.

Topic Jumpers

A topic jumper is a project team member that constantly changes the subject and brings up irrelevant facts. This is a destructive role because it disrupts effective communication and could prevent important topics from being fully discussed and brought to closure.

Dominator

A dominator is a project team member that disrupts team participation and communication by presenting their own opinions forcefully and without any recognition or consideration of other's contributions or points of view. This person will dominate the communication and bully their way through the project. This is a negative role because it prevents effective communication, quashes other's valid opinions, and may be contrary to the project's objectives.

Devil's Advocate

“*advocatus diaboli*”. Although the origins of this role are rooted as a positive role for the critical examination of canonization or beatification in the Roman Catholic Church, for project management this is considered a negative role. The definition of this role is a project team member that takes up the contrary view just for the sake of argument and not on the arguments merits (if any). This role is negative because it often frustrates and disrupts effective communication and discourages people from participating.

Module 1 references

Harold Kerzner, Ph.D. *Project Management, A Systems Approach to Planning, Scheduling, and Controlling, 8th Edition*. John Wiley & Sons, Inc. 2000.

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Module 1 exercise

- 1) The project team member who is responsible for providing the financial resources (funding) for the project is the:
 - a) Project Manager
 - b) Functional Manager
 - c) Project Sponsor
 - d) Senior Manager

- 2) An effective tool for identifying roles and responsibilities and facilitating the development of the project communication plan is the:
 - a) Organizational Breakdown Structure (OBS)
 - b) Responsibility Assignment Matrix (RAM)
 - c) Work Breakdown Structure (WBS)
 - d) Key Stakeholder Analysis

- 3) Who manages the project budget in a functional matrix organization?
 - a) Project Manager
 - b) Functional Manager
 - c) Customer
 - d) Key Stakeholder

- 4) In what type of matrix organization does the Project Manager have high to total authority of the project?
 - a) Balanced Matrix
 - b) Functional Matrix
 - c) Projectized Matrix
 - d) Weak Matrix

- 5) Which one of the following is an example of “Earned” or “Individual” power?
 - a) Referent power
 - b) Reward power
 - c) Punishment power
 - d) Legitimate power

- 6) A project team member is an expert in hydraulic analysis. The other project team members, including the project manager look to this team member for guidance through the hydraulic design and permitting process. What type of power is this?
- a) Punishment power
 - b) Referent power
 - c) Reward power
 - d) Expert power
- 7) Which of the following is a productive team role?
- a) Recognition seeker
 - b) Withdrawer
 - c) Clarifier
 - d) Topic Jumper
- 8) If the Project Manager is heard saying, “We agree that this deliverable is important and we have agreed on all of the other deliverables, let’s not fight over a few thousand dollars.” What conflict resolution method is this Project Manager using?
- a) Smoothing
 - b) Confronting
 - c) Compromising
 - d) Forcing
- 9) Which conflict resolution method produces the most lasting results and is considered the most effective method?
- a) Smoothing
 - b) Confronting
 - c) Compromising
 - d) Forcing
- 10) According to research, what is the most common source of conflict on a project?
- a) Personality conflicts
 - b) Procedures
 - c) Resource priority (availability) / Schedules
 - d) Technical Opinions

Module 2 – WSDOT Project Management Overview

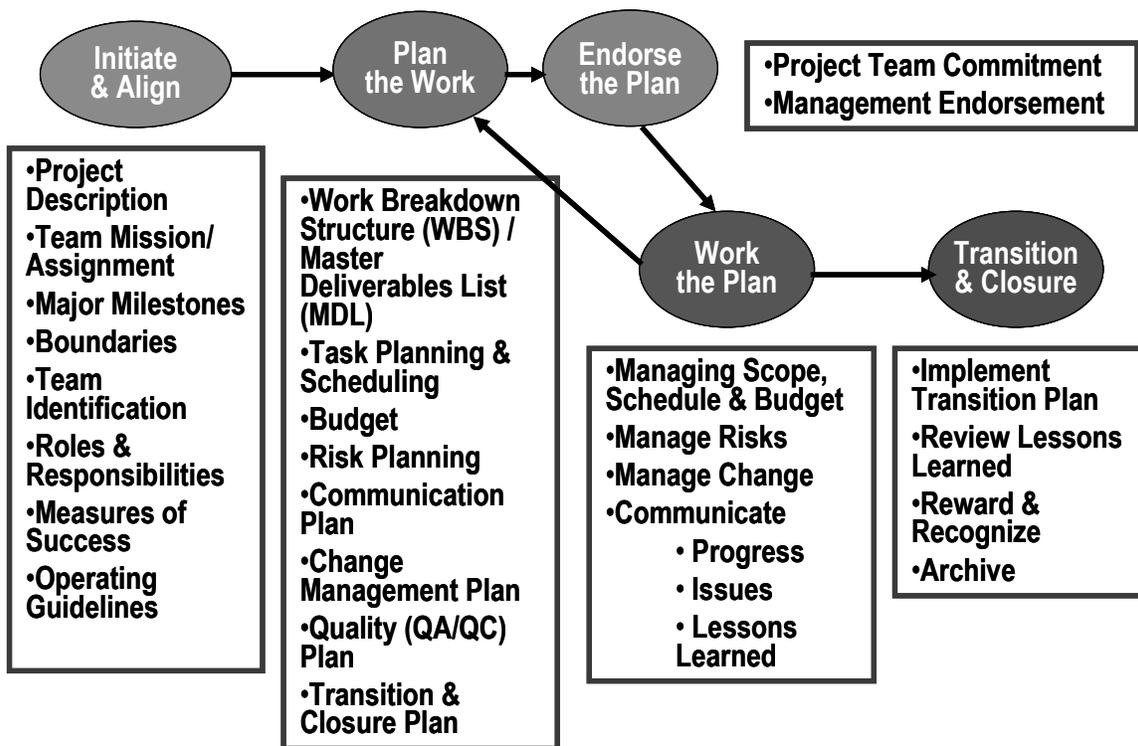


Figure 2-1

Project Management Policy

In late 1998, a focus team was formed to begin looking at how WSDOT could more effectively and efficiently deliver projects. The team developed guidance and tools for project management as it applies to WSDOT. An Instructional Letter (IL) recommending the use of these principles was signed in the summer of 2000, followed by Design Manual Chapter 140. Many other tools for delivery, accountability, and communicating have followed:

- Cost Estimating & Validation Process (CEVP)
- Project Delivery Information System
- Cost Risk Assessment
- Project Control & Reporting (change management)

In 2004, the Joint Legislative Audit and Review Committee (JLARC) review focused on the agencies critical path management, risk management, project reporting, and organizational structures used to execute capital projects. Since the study was intended to be a pre-audit review, only eight example projects were selected to represent the diversity of issues and characteristics in WSDOT's capital program. JLARC chose projects well into the construction phase; many of these projects were designed prior to some of the tools and processes we have in place today.

The Overview of Washington State Department of Transportation Capital Project Management Report, dated January 21, 2005, made four summary management recommendations:

- Recommendation 1 – WSDOT should extend the application of the Managing Project Delivery, Project Delivery Information System, and Primavera Project Planner for the Enterprise tools and put management steps in place to confirm their adoption.
- Recommendation 2 – WSDOT should develop a plan and timeline for implementing recommendations issued by Gannett Fleming, which center primarily on a) using existing exemplary practices in place at some projects to develop minimum standards and/or templates; b) improving the clarity of project communication by documenting terms and definitions; and c) confirming the consistency and currency of reporting information.
- Recommendation 3 – WSDOT should conduct an assessment of the effectiveness of current information systems and options for addressing any deficiencies.
- Recommendation 4 – WSDOT should develop criteria for extending Cost Risk Estimating and Management (CREM) analyses to a wider universe of projects.

WSDOT is proactively identifying ways to address these recommendations. One step was the formation of a Project Management Task Force. The Project Management Task Force was made up of representatives from across the state; representing multiple disciplines (design, construction, etc.). This team was tasked with identifying ways to implement the JLARC recommendations, but more importantly to improve our project management process. The result of this effort is the Project Management Online Guide and Executive Order 1032.00.

Copies of the Executive Order and a link to the Project Management On-Line Guide are available on the project management website.

www.wsdot.wa.gov/Projects/ProjectMgmt/

Project Management Processes

A few changes have occurred over the years but the philosophy remains the same. WSDOT's project management process features a 5-step process very similar to other project management approaches being used around the world by project managers in the private and public sectors.

Initiate & Align the Project Team

This is the first step in the project management process. Initiation is the formal recognition that a project exists. Organizational senior management will initiate the project and assign the project to a Project Manager. The Project Manager will identify the project team and align the team with a common goal and purpose. The elements of the Initiate & Align process are:

- Project Description: A description of the project's product, purpose, or intended outcome.

- Team Mission/Assignment: A high level description of what the project team's work will be to achieve the Project Description. The work order assigned to the project phase is a good indication of what the Team Mission/Assignment is.
- Major Milestones: A listing of programmed milestones for the project.
- Boundaries: Identification of physical boundaries, operational limitations, and project objective constraints for the project.
- Team Identification: The Project Manager will identify the functional teams required to deliver the project.
- Roles & Responsibilities: "Who will do what?" The project team roles (the "who") and the project responsibilities (the "what") will be identified by the project team. This is further developed with the Responsibility Assignment Matrix (RAM) during the "Plan the Work" process step.
- Measures of Success: Identifying critical success factors and methods to measure performance for these factors.
- Operating Guidelines: The project team will identify how decisions will be made and plan methods for managing project conflicts.

This information is documented on the Initiate and Align Worksheet and reviewed by the project team.

Plan the Work

This is the second step in the project management process. This step produces the Project Management Plan that will be used by the project team to deliver the project. The elements of the Plan the Work step are:

- Work Breakdown Structure (WBS): Using the Master Deliverable List (MDL) as a template, the project team will decompose the list and develop a project specific WBS. This will define the project's requirements objective (the project scope) and the expected quality standard for the project's deliverables.
- Task Planning & Scheduling: The project team will use the WBS and the RAM to develop tasks to deliver the project deliverables. These activities are entered into the organization's enterprise project scheduling program. This will define the project's time objective (the project schedule).
- Budget: The project team will resource load the project schedule to develop a "bottom-up" or engineering estimate for the project. This will define the project's cost requirements (the project budget). This is compared against programmed budgets. The project team will look at ways to optimize the scope, schedule, and budget to match the earlier identified project boundaries.
- Risk Planning: The project team will develop a Risk Management Plan and Risk Register to identify, analyze, plan response action strategy, and monitor the risk event.

- Communication Plan: The project team will develop a Communication Plan to identify and describe the methods, media, frequency, required details and information needed. Both external and internal communications are planned.
- Change Management Plan: The project team will develop a Change Management Plan that will provide a framework and process for the team to use when change occurs.
- Quality Plan: The project team will identify the quality methods to be planned and implemented to prevent errors from reaching the customer (Quality Control – QC) and to ensure that the team is “doing the right things” (Quality Assurance – QA).
- Transition & Closure Plan: “Beginning with the end in mind.” The project team will develop the Transition & Closure Plan for the transition of the project to the next phase, or the closure of the project.

The first four elements (WBS, schedule, budget, risk) define the Project Performance Baseline. The last four elements (Communication Plan, Change Management Plan, Quality Plan, and Transition & Closure Plan) are developed to help facilitate project management.

Endorse the Plan

Endorsement is the third step in the project management process. Endorsement also completes the “Plan the Work” phase of project management. Once the Project Management Plan is endorsed, the project team will move to the “Work the Plan” phase of project management. The elements of endorsement are:

- Project Team Commitment: Getting an agreement or pledge from the project team that they will perform and deliver the project deliverables as documented in the Project Management Plan.
- Management Endorsement: Getting approval and a commitment from senior management that the resources required and documented in the Project Management Plan will be available.

Once the Project Management Plan is endorsed, the Project Manager will baseline the plan and use the plan as a metric for project performance and for facilitating project management.

Endorsement is not a “one-time” event, but is done throughout the life of the project. As changes occur, the project team will need to review and re-commit and re-endorse the updated plan.

Work the Plan

“Work the Plan” is the fourth step of the project management process. Although the steps have been listed as a linear order, working the plan requires the project manager to continually update the plan, requiring some additional planning and possible re-endorsement in the case of change. This updating process is referred to as

“progressive elaboration”, or in other words, an iterative process. As the project team knows more about the project, further refinement of the plan is required.

The elements of “work the Plan” are as follows:

- Manage the Scope, Schedule, & Budget: These are the components of the Project Performance Baseline. The project manager will continually update the Project Performance Baseline by tracking what work was actually completed, when that work was actually completed, and how much was actually expended to complete the work planned. Comparing these actuals against the Project Performance Baseline will give the project team a sense of how the project is performing with respect to schedule and budget.
- Manage Risks: The project team created a risk management plan with risk register during the “plan the work” step. During the “work the plan” step, the project manager and the project team will monitor the identified risk, continue to update the plan with identifying new risks, evaluating the impact and probability of the identified risks, and monitoring the effectiveness of the risk response strategy.
- Manage Change: Change is inevitable on a project. A project manager will manage change by implementing the Change Management Plan for the project.
- Communication: The most important skill set for a project manager is the ability to communicate clearly and appropriately. The Communication Plan developed during the “plan the work” step is implemented and updated as needed. The items required for reporting are progress reporting (schedule and budget performance); issues (risks and changes); and lessons learned. These items should be a standing agenda item for all team meetings.

Throughout the project life, the project manager will need to manage a dynamic project team. These teams must be built and sustained to attain high performance, produce effective results, and successfully deliver the project.

Transition & Closure

The final step in the project management process is “Transition & Closure”. This is the step of transitioning the project to the next phase or completing the project as described in the project description and delivering the product to the customer. The elements for this project management step are as follows:

- Implement the Transition Plan: During the “Plan the Work” step, the project team developed a plan for transitioning and closing the project. Implementation of this plan gives a foundation to accomplish this.
- Review Lessons Learned: Lessons learned was planned early on and maintained throughout the project life. The team will review lessons learned from the project and share it with the team and agency.

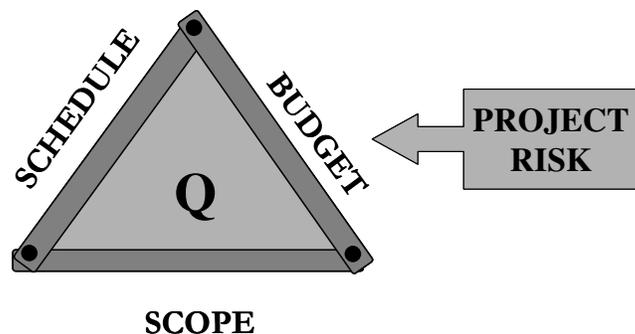
- Reward & Recognize: Look to recognize and award the outstanding achievements of the project team. Since teams are dynamic, this is an element that is managed throughout the project's life.
- Archive: Archiving the project information as directed by agency policies and from the Transition and Closure Plan. Being able to plan early to what information will be archived and in what format or media will allow the team to archive as it develops and completes the project.

Project Management Plan

During the “Plan the Work” phase of the project, which encompasses the first three project management steps, the project team will create and endorse a Project Management Plan. This plan will typically consist of the following:

- Completed Initiate and Align Worksheet
- Project Work Breakdown Structure (WBS)
- Project Schedule
- Project Budget with appropriate forecasted expenditures (aging)
- Risk Management Plan with Risk Register
- Communication Plan
- Change Management Plan
- Quality Plan
- Transition and Closure Plan
- Commitment and Endorsement

Project Performance Baseline Management



Project Managers often talk of a “triple constraint” or “trade off triangle” – project requirements (scope), project time (schedule), and project costs (budget). Replacing these project objectives with the tools to manage those objectives gives the “trade off” triangle of

scope, schedule, and budget. The relationship between these parameters is such that if any one of the three parameters is changed, at least one of the other project parameters is likely to be affected.

Project quality is affected by balancing these project objectives. High quality projects deliver the required product, service, or result within scope, on time, and within budget.

Project managers also manage projects in response to uncertainty. Project risk is an uncertain event or condition that, if the risk event occurs, has a positive or negative effect on at least one project parameter.

Project Requirements (Scope) and Quality

The Project WBS is developed to define the project requirements and project scope. The project manager will manage the project scope and the associated quality defined for the project deliverables. If an additional project deliverable is required, the project manager will implement the appropriate change management actions to update the project scope. Work completed that is not part of the endorsed project WBS is called “scope creep”. Technically oriented team members are motivated not only by meeting specifications, but also by exceeding them. Unfortunately, exceeding specifications can become quite costly. A project manager needs to be able to discern between legitimate scope change and scope creep.

Project Time (Schedule)

The Project Schedule is developed to define when the work will be completed on a project. During the “work the plan” process step, a project manager will track the actual dates for the work completed and evaluate/analyze the effects of these dates on the remainder of the project network. Schedule performance will be evaluated by comparing the actual dates to the planned dates (project performance baseline). A project manager will use schedule compression techniques (discussed later) to recover a project schedule.

Project Costs (Budget) & Aging

The Project Budget is developed to define when financial resources will be required. Based on the Project WBS (work to be done) and the Project Schedule (when work will need to be completed), the budget is developed and an appropriate forecasting report, “aging report” is developed. During the “work the plan” process step, a project manager will track the actual expenditures for the work completed and evaluate/analyze the effects of these actual costs on the remainder of the project aging. Budget performance will be evaluated by comparing the actual expenditures to the planned expenditures (project performance baseline).

Module 2 references

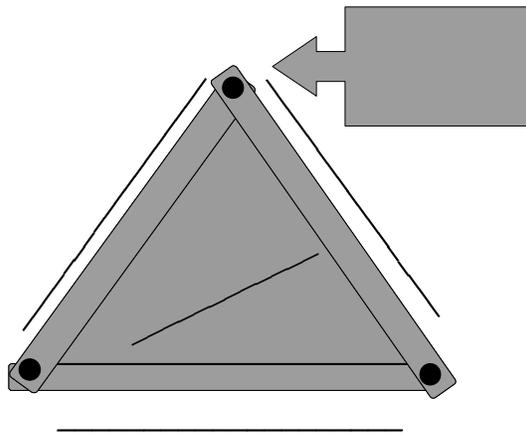
WSDOT Executive Order 1032.00E “Project Management”, dated July 1, 2005

WSDOT. “*Project Management Process*” training manual, 2005.

Module 2 exercise

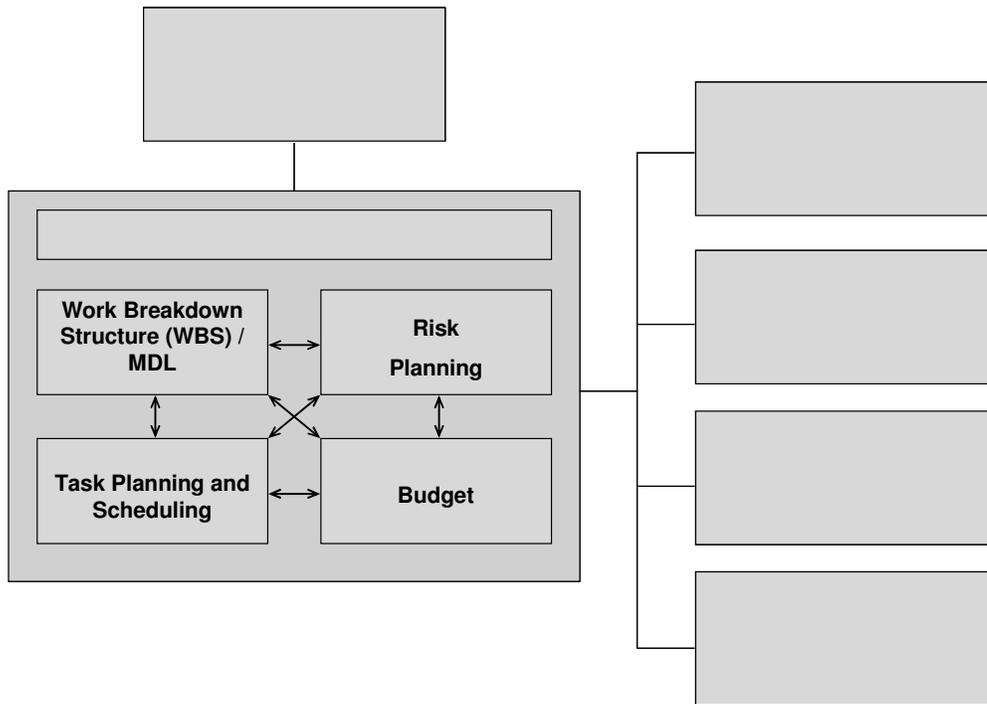
1. The five steps of the project management process, as defined in the Executive Order 1032E, dated July 1, 2005, and the Project Management On-Line Guide are:

2. Complete the below “trade off triangle” with the appropriate project objectives and tools to manage the objectives:



3. The Endorsed Project Performance Baseline consists of:

4. The Project Management Plan consists of:



5. The most important skill set for a project manager is:

- a. Scheduling expertise
- b. Communication
- c. Technical Knowledge
- d. Budgeting

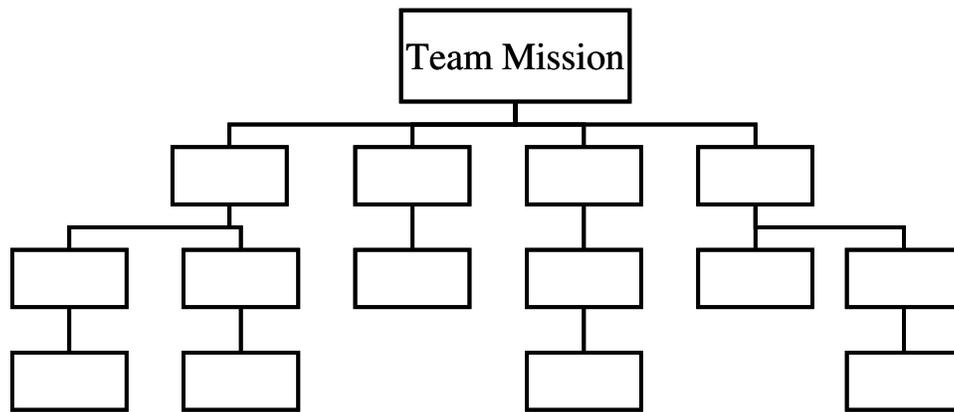
Module 3 – Schedule Management

Schedule Terminology & Definitions

Work Breakdown Structure (WBS)

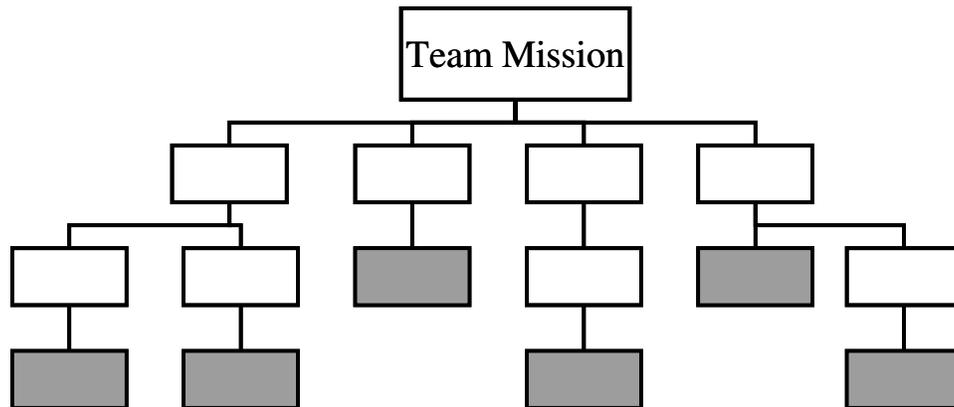
A deliverable oriented hierarchical decomposition of the work to be executed by the project team to accomplish the team mission and create the required deliverables.

The WBS defines the project scope.



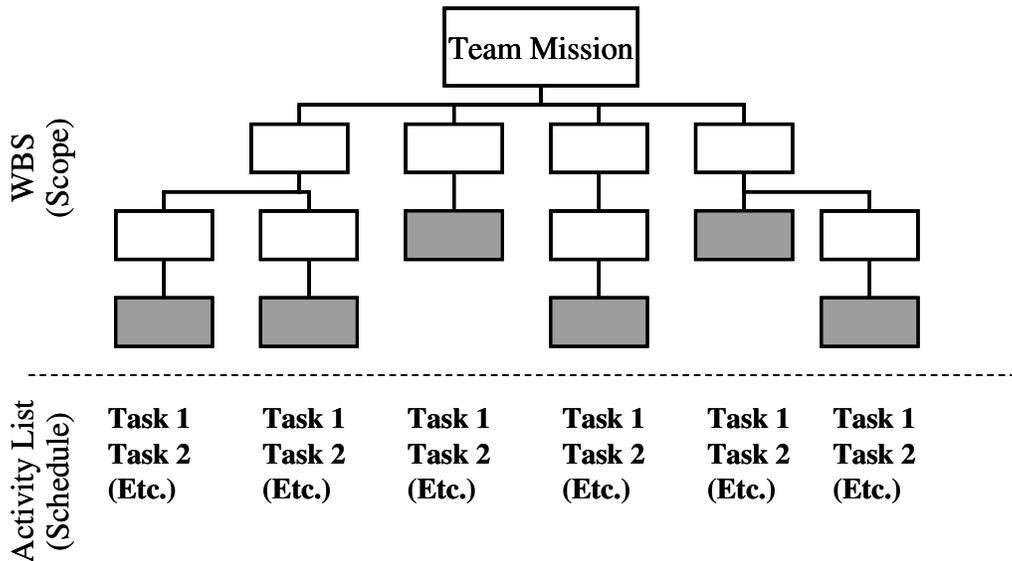
Deliverable

Any unique and verifiable product or result that must be produced to complete a project. Usually the lowest level of the WBS.



Scheduled Activity (Task)

A component of work performed to create a deliverable.



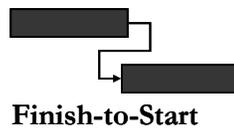
Schedule Milestone

A significant event in the project schedule, such as an event restraining future work or marking the completion of a major deliverable. A “measuring point”. Milestones have “0” (zero) duration and no resource assignments.

Logical Relationship

Logical relationship is a dependency between two project schedule activities, or between a project schedule activity and a schedule milestone. Logical relationship are generally defined as *mandatory dependencies* (or “hard logic”) and *discretionary dependencies* (or “soft logic”). The four possible types of logical relationships are:

- Finish-to-Start (most common): The end of one schedule activity will constrain the start of another activity.



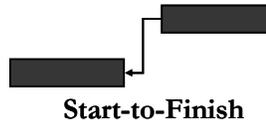
- Finish-to-Finish: The end of one schedule activity will constrain the finish of another activity.



- Start-to-Start: The start of one schedule activity will constrain the start of another activity.



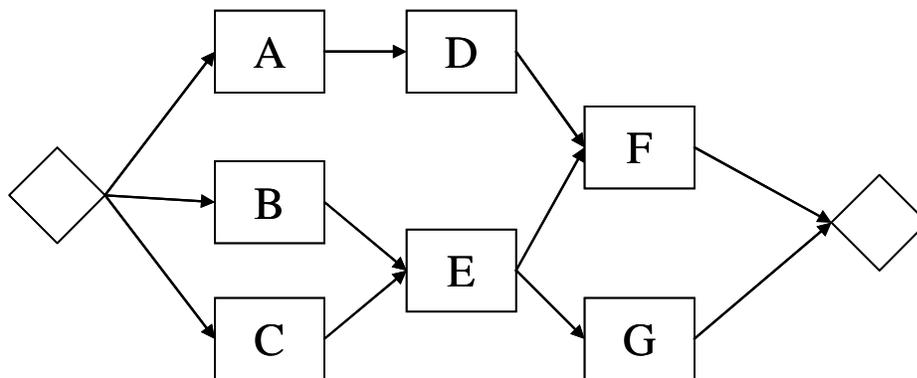
- Start-to-Finish (very rare, not available in some software applications): The start of one schedule activity will constrain the finish of another schedule activity.



All four of these logical relationships can be modified by applying a “lead”, acceleration in the start of the successor activity, or a “lag”, a delay in the start of the successor activity.

Precedence Diagram (Network Diagram)

A schedule network diagramming technique in which schedule activities are represented by nodes. Schedule activities are graphically linked by one or more logical relationships to show the sequence in which the activities are to be performed. Also referred to as “Activity-on-Arrow (AOA)”



Precedence Diagram

Critical Path

The critical path is the sequence of schedule activities that determines the duration of the project. Some characteristics of the critical path are:

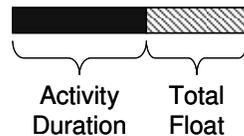
- Longest duration path through the project network
- Activities on the Critical Path are called “Critical Activities”
- Critical activities have no float or slack
- A project can have more than one critical path
- Activities not on the Critical Path are called “Non Critical Activities”

- To shorten the project duration, a scheduler must modify the critical path activities or dependencies

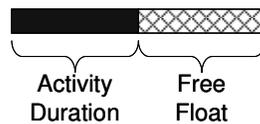
Float (Slack)

Float, or slack, is the amount of time a scheduled activity has that it can be delayed or extended without affecting the project end date or the next scheduled activity. Float can be further defined as:

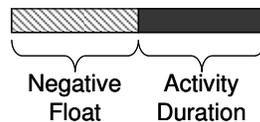
- Total Float – The total amount of time that a scheduled activity (or milestone) may be delayed or extended without delaying the project end date or violating a schedule constraint.



- Free Float – The amount of time that a scheduled activity (or milestone) can be delayed without delaying the start of the next activity in the network.



- Negative Float – The amount of time that by which a critical activity (or milestone) misses a required date.



Critical Path Method (CPM) Scheduling

A schedule network analysis technique used to determine the amount of schedule flexibility (float) on various network paths in the project schedule network, and to determine the minimum project duration (critical path). This is done by performing a *forward pass* through the project schedule network to determine the *early start* and *early finish* dates. Then performing a *backward pass* through the project schedule network to determine the *late start* and *late finish* dates.

Gantt Chart

Also called a “bar chart”. A graphic display of schedule related information. Schedule activities or WBS components are listed at the left of the chart and dates are shown across the top of the chart. Schedule activities are shown as a date paced horizontal bar. This is the most common form of communication for a schedule. This is a report from the project management or project scheduling programs.

Schedule tracking

Once the project team has committed to and endorsed a project schedule, a project manager needs to baseline the project schedule. This project performance baseline represents a “snapshot” of the approved project scope (WBS), project schedule, and corresponding project cost. Evaluating actual schedule dates and actual cost to the project performance baseline will help the project team evaluate schedule and cost performance.

A project manager needs to track the schedule activities and record when these schedule activities actually started and completed. This will help identify where the project is currently at and what potential changes or delays are approaching.

Tracking Schedule “Actuals”

Actual Start

This is the date that the work on the deliverable or schedule activity actually started. In the project schedule software applications, this field is called “Actual Start”.

Actual Finish

This is the date that the work on the deliverable or schedule activity actually finished. In the project schedule software applications, this field is called “Actual Finish”.

Percent Complete

Percent Complete is a function of time. The formula for this value is defined as “*Elapsed Duration/Activity Duration*”. With the current project management software system the WSDOT has, this field must be greater than “0” before the Base Cost % Complete can be entered.

Base Cost Percent completes

The key to accurately calculating project progress is having an accurate estimate of how much of the deliverable (or work) is complete, expressed in a percentage (%). There are several methods to choose from, depending upon the type of work performed.

Units Produced Method

This is the ratio of the units produced to the total specified at completion. Units must be nearly identical. Some examples would be:

- Drilling 10 holes, completed 4 holes, % complete would be 40%
- Paving 5 lane miles, completed 4 lane miles, % complete would be 80%

Interim Milestone Method (Agreement Method)

Establish the percent of the total that is represented by each milestone, based on experience or, an agreement with the project team members on percent complete of various stages of the process/deliverable. Some examples would be:

- Geometric design complete = 30%

- Detailed Plans = 60%
- Contract Documents = 90%

or

- Data Collection = 10%
- Draft Report = 70%
- Revised Draft = 90%
- Published final = 100%

50/50 Method

The 50/50 method is best used when an accurate estimate is nearly impossible and when durations are relatively short (less than the reporting frequency). This method is a good method for higher-level EVM and when there are several processes (or deliverables) to be evaluated. The more tasks/deliverables evaluated, the more accurate the EVM. 50% complete is assumed when the task/deliverable has started. 100% complete is assumed when the task/deliverable is finished.

0/100 Method

The 0/100 method is best used when a task/deliverable has no value unless it is completed and when durations are relatively short (less than the reporting frequency). This method is also a good method for higher-level EVM and when there are several processes (or deliverables) to be evaluated. 0% complete is assumed until a task/deliverable is complete. 100% complete is assumed when the task/deliverable is finished.

Proportional Relationship Method

This method is used when the completion of a measurable amount of one work package indicates the completion of another task that cannot be easily measured. This method works well for the “on-going” or hammock tasks within the project schedule. An example of this method would be:

- 40% of the project is complete, so 40% of the project management task is complete.

Schedule Recovery / Schedule Compression

Schedule compression is a technique used to shorten the project duration without reducing the project scope. There are two methods used to compress, or recover a schedule.

Schedule crashing

Schedule crashing is a compression technique in which schedule activity durations are modified, working day definitions are modified, or resource requirements are modified. These modifications are analyzed to determine how to obtain the greatest amount of compression for the least incremental cost (Triple Constraints Theory).

Typically, crashing a project schedule will increase project costs, and sometimes crashing a project schedule does not produce a viable alternative. Some examples of crashing are:

- Shorten schedule activity durations
- Assigning additional resources
- Working overtime / working during non-working days
- Changing project or resource calendars

Schedule fast tracking

Fast tracking is a compression technique in which activities that would normally be completed in sequence are performed in parallel. Fast tracking does not change the resource requirements, but modifies the logical relationships between schedule activities. This approach can require work to be performed without complete detailed information. Typically, fast tracking a project schedule will increase project risk, which may have an impact on project costs (Triple Constraints Theory).

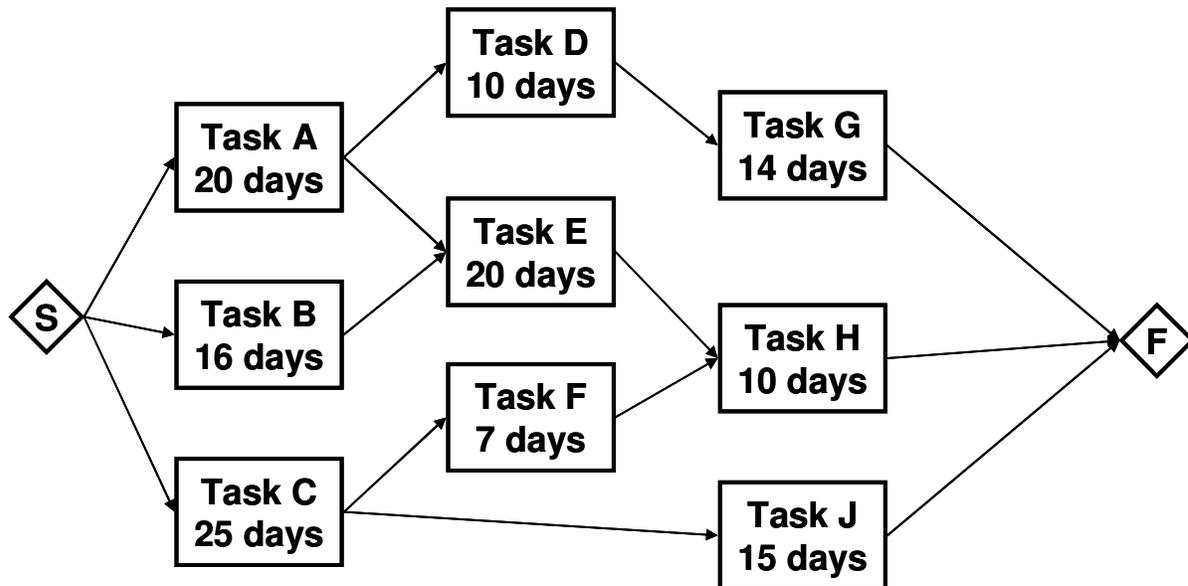
“What-If” Scenario Analysis

This is the analysis of the question “What if the situation represented by scenario ‘X’ happens?” Using the schedule model, the effects of different compression techniques can be analyzed with regards to project costs and the amount of schedule time recovered. The outcome from “what-if” analysis can be used to assess the feasibility of the project schedule under certain adverse conditions. This can be further used for risk planning, contingency planning, and response planning. Monte Carlo Analysis is a common “what-if” technique used. (To be discussed later.)

Module 3 references

WSDOT. *“Intro to Project Scheduling” training manual* 2005.

Project Management Institute. *A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guide)*. Project Management Institute, Inc. 2004.

Module 3 exercise

1. Identify the paths through schedule network and determine the critical path and project duration.
2. The project customer is requesting this project completed in 45 days. Is schedule compression even required? If so, what methods would be used to compress the project schedule?
3. Using the revised project schedule from #2 as the baseline plan, the duration of Task E is delayed to 24 days due to a key resource being unavailable for the first 4 days. Does this impact the project schedule and project end date? If so, what methods would be used to recover the remaining project schedule (assume everything else to date is completed or in progress).

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Module 4 – Risk Planning & Risk Management

Risk Definitions

Risk Management

Risk management is the act or practice of dealing with project risk. It includes planning for risk, assessing risk (identification and analyzing), developing risk response strategies, and monitoring risks to determine how risk changes during the project life.

Risk

Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on at least one of the project objectives (scope, schedule, budget, quality)

Threat

A project risk that has a negative effect is referred to as a threat. A project manager will proactively manage threats to the project and look for ways to reduce the probability or impact of the threat or eliminate the threat all together.

Opportunity

A project risk that has a positive effect is referred to as an opportunity. A project manager will proactively manage opportunities to the project and look for ways to exploit, enhance, or share the opportunity.

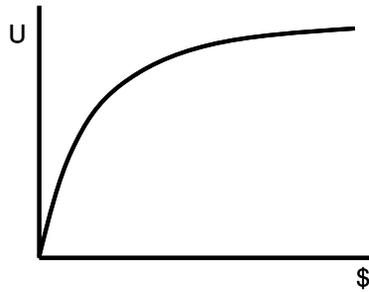
Risk Trigger

A risk may have one or more causes, and if the event occurs, one or more impacts. Identifying the causes of risk events help define the risk trigger. A risk trigger indicates that a risk event is imminent.

Risk Tolerance

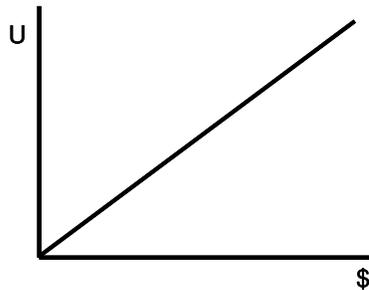
There are many resources available to give guidance for risk management. Unfortunately, there is no single textbook answer for how to manage project risk. Project managers need to rely on the organization's policies, project team involvement in risk planning, and the input from subject matter experts. Ultimately, the decisions made on how to deal with project risk will be based on the risk profile, or risk tolerance, of the project manager, project team and organization.

Three common classifications used for describing risk tolerance are the risk averter (or avoider), risk neutral, or risk seeker (or taker). The method to classify these is based on the "utility", or the satisfaction received from the risk payoff.

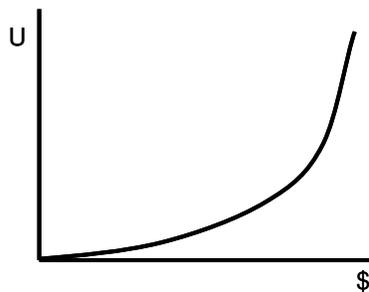
Risk Adverse / Averter

With a risk adverse or averter, the utility rises at a decreasing rate. This means when more money is at stake, the tolerance diminishes. Another way to describe this is that the limit of risk tolerance is achieved at a lower dollar amount.

A risk adverse person will prefer a more certain outcome and demand a premium to accept risk.

Risk Neutral

With a risk neutral profile, the utility, or satisfaction from a risk payoff rises at a constant rate.

Risk Taker / Seeker

With a risk taker or risk seeker, the utility rises at an increasing rate. This means when more money is at stake, the tolerance increases. Another way to describe this is that the limit of risk tolerance is not achieved unless the dollar amount is greater.

A risk adverse person will prefer a more uncertain outcome and is willing to pay a penalty to take a risk.

WSDOT Risk Policy

Executive Order 1032E directs project managers to the Project Management On-Line Guide for the agency policy on development of the Project Management Plan. From the project management step “plan the work”, the element of Risk Planning is identified and the development of the Risk Management Plan and Risk Register is described. The Project Management On-Line Guide also has tools available for risk planning, such as the Risk Management Plan Template, sample risk plans, and the Cost Risk Estimating and Management (CREM) website link.

<http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/>

The CREM office provides risk planning tools for projects that meet certain funding thresholds. Coordination with the CREM office is required for these projects. WSDOT “A Policy for Cost Risk Assessment” is available from the CREM office website and defines the process and products of risk planning for these projects.

A Cost Risk Assessment (CRA) is required for all projects with an estimated cost of \$25 million or more. A Cost Estimate Validation Process (CEVP[®]) is required for any project with an estimated cost of \$100 million or more. Other projects can greatly benefit from formal risk assessments; typically those projects having a preliminary estimate exceeding \$5 million or more and include one or more of the following:

- Projects that are unique or unusual;
- Project with a high degree of political interest
- Project that have been through an abbreviated scoping process
- Projects with alternative solutions that vary scope and cost
- New alignments of bypass sections
- Capacity improvements that widen an existing highway
- Major structures
- Interchanges on multilane facilities
- Projects with extensive or expensive environmental or geotechnical requirements
- Materials that are difficult to acquire or require special efforts
- Major reconstruction or difficult construction
- Projects with multiple stages
- Major right-of-way and/or utility issues

These factors are important because the levels of risk, variability, and opportunity associated with each are generally higher than with routine or typical projects.

Risk Planning Process

Step 1 – Review Organization Risk Policy

The first step in risk planning is to review the organizations risk policy. Depending on the cost or complexity of the project, special risk planning skills will be required from the CREM office. Reviewing the Project Management On-Line Guide and the Policy for Risk Assessment will help the project team determine the appropriate level of risk planning.

Step 2 – Risk Identification

Risk identification determines which risks might affect the project and documents the characteristics of the risk event. Risk identification is an iterative process because additional risks may become apparent as the project progresses through its life cycle.

Some tools a project team can use to identify and gather information about project risks are:

Brainstorming: The goal of brainstorming is to obtain a comprehensible list of project risks. The project team will identify the risk events and the trigger for the risk event. Risks can also be categorized by which project parameter(s) are affected by the risk event. This is a common technique for risk information gathering.

Delphi Technique: The Delphi technique is a way to reach a consensus of experts. Risk experts participate anonymously as a facilitator uses a questionnaire to solicit project risks. The responses are summarized and then re-circulated to the experts for further comment. Consensus is reached after a few rounds of this process. This technique helps reduce bias in the data and keeps any one person from having undue influence on the outcome.

Interviewing: Interviewing experienced project team members, stakeholders, and subject matter experts (SMEs) can identify risks. Interviews are another common source of risk identification data gathering.

Root Cause Identification: This is a method used to further define the risk event. Think of the little 2-year old, asking “why” after each response. Eventually, the root cause, the trigger, for the risk event is identified. Developing the plan to address the risk trigger is the most effective way to respond to risk events.

SWOT Analysis: Strengths, weaknesses, opportunities, and threats (SWOT) technique ensures examination of the project from each of the SWOT perspectives. This increases the breadth of considered risks.

Assumption Analysis: Every project is developed based on a set of hypotheses, scenarios, or assumptions. Analyzing and exploring the validity of the assumptions can help identify risks due to inaccuracy, inconsistency, or incompleteness.

Diagramming Techniques: Risk diagramming methods such as the cause-and-effect diagram (also known as “Ishikawa” or “fishbone” diagrams) and flow charts can be used to help in risk identification and risk trigger identification.

Risk Register

The outputs from risk identification are typically contained as initial entries into a document called a risk register. A template of the risk register can be downloaded from the Project Management On-Line Guide. The risk identification part of the template identifies:

- **Status:** Whether a risk is an active risk, a dormant risk, or a retired risk.
- **ID#:** the identification for the risk
- **Date Identified & Project Phase:** When a risk was identified and what project phase (preconstruction or construction) the risk was identified in.
- **Functional Assignment:** The capital delivery functions (planning, design, ROW, environmental, construction, etc.) which are impacted by the risk.
- **Risk Event:** What the risk event is to the project with detailed description using the SMART technique (**S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**ime sensitive)
- **Risk Trigger:** warning signs that indicate the risk is likely to occur or imminent. Used to determine when response strategies will be implemented.

Once the risk has been identified, the project team can conduct further analysis (qualitative and quantitative) on the risk event.

Exercise – Risk Identification

As a team, choose one of the following projects:

1. Building a house
2. Planning a Caribbean trip

For the project, use risk gathering techniques such as interviewing and brainstorming to identify risk events. Also identify the risk triggers for each event. Enter the information onto the risk register. Prepare a listing to present to the group.

(Time: 15 minutes)

Step 3 – Qualitative Risk Analysis

Qualitative Risk Analysis includes methods for prioritizing the identified risks for further action, such as Quantitative Risk Analysis and Risk Response Planning. Project teams can improve performance by focusing on high level or high priority risks.

Qualitative Risk Analysis assesses the risk events with respect to the impact to the project objectives and the probability of occurrence. Definitions of the levels of impact and probability, as well as interviewing techniques, can help correct biases that are present in the data, as well as address the different risk profiles (tolerances) within the project team.

Impact/Probability Matrix

A very useful tool for Qualitative Risk Analysis is the Impact/Probability matrix. This matrix combines impact and probability values for the risk event that lead to categorizing the risk as low, medium, or high priority risks. These matrices can vary in size depending on the organization's risk policies and the nature of the project. For projects meeting the thresholds for a CRA or CEVP[®], the CREM office will provide the risk register and facilitate the risk analysis for the project. The Impact/Probability matrix for these projects will typically be a 5x5 size with values ranging from very low through very high.

For the projects that do not meet the thresholds for CRA or CEVP[®], a simplified risk register is available from the Project Management On-Line Guide that uses a 2x2 Impact/Probability matrix. The values in this matrix are "low" and "high".

2 X 2 Impact/Probability Matrix

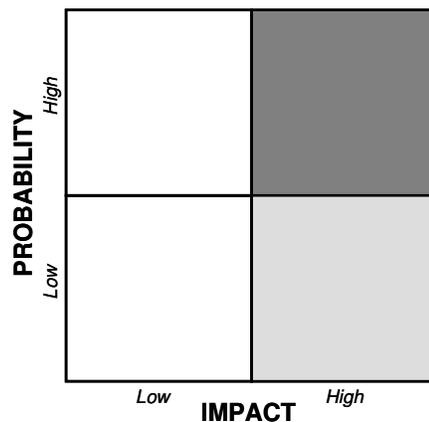


Figure 3-1

Each risk event is evaluated with respect to the impact to the project objectives. Once the impact for the risks has been assessed, the project team will evaluate the probability of the high impact risks. Risks are categorized as low risk (green condition), medium risk (yellow condition) or high risk (red condition). *(In a black and white matrix, these conditions are noted as shades of gray with the darker gray representing high risk and white representing low risk.)*

Typically, in a 2x2 matrix, the high (red) risks will be further analyzed and a specific response strategy will be developed. The medium (yellow) risks will be actively accepted or further analyzed, depending on the risk tolerance of the project team. The low (green) risks will be passively accepted. Acceptance is further discussed in *Risk Response Strategy*.

Comparative Risk Rating (CRR)

Once risk events have been qualitatively assessed, the project team can prioritize the risks within each category. An easy and common method of prioritizing these risks is using a comparative risk rating method, (sometimes referred as “poor man’s” rating).

Each risk event within the category is compared one-on-one with the other risk events. The project team will identify the higher priority risk event and record that comparison result. A simple matrix such as the following can be set up to compare these risk events.

Comparative Risk Rating for 4 risk events

A	X			
B	A	X		
C	C	C	X	
D	A	B	C	X
	A	B	C	D

Figure 3-2

Simply counting the number of occurrences for each risk comparison will prioritize the risks in the category. For the example in Figure 3-2, risk event C has 3 scored comparisons, risk event A has scored 2 comparisons, risk event B has 1 scored comparison and risk event D has none. The order of priority for these four risk events would be C-A-B-D.

Comparative risk ratings are done to the risk events that fall into the high (red) risk zone and medium (yellow) risk zone.

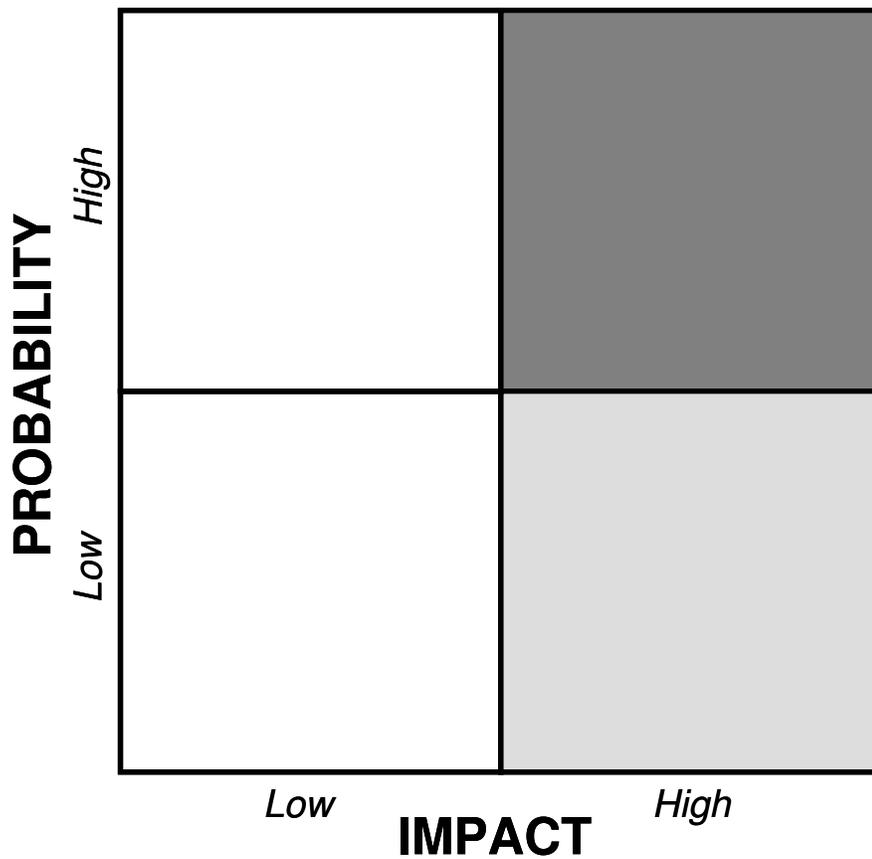
Exercise – Risk Analysis using 2x2 matrix (continuation of earlier exercise results)

Using a 2x2 impact and probability matrix, assess the risks identified in the last exercise.

- First, evaluate the impact of the risk event on the project objectives.
- Then, with the risks identified as “high” impact, assess the probability of the risk event
- Perform a comparative risk rating on the “high-high” risk events to prioritize these risk events.

(Time: 15 minutes)

2 X 2 Impact/Probability Matrix



Step 4 – Quantitative Risk Analysis

Quantitative Risk Analysis is a way of numerically estimating the probability that a project will meet its time and cost objectives. Quantitative analysis is based on simultaneous evaluation of the impacts of all identified and quantified risks.

Quantitative Risk Analysis is only performed on projects meeting the thresholds for a CRA or CEVP®. The CREM office will facilitate the risk analysis for the project and perform the quantitative risk analysis using modeling techniques. Project managers should contact the CREM office during the “Initiate and align” step of the project management process to plan for these risk analysis products.

Quantitative Risk Analysis is performed on risks that have been prioritized by the Qualitative Risk Analysis process as potentially and substantially impacting the project objectives. The Quantitative Risk Analysis process analyzes those risk events and assigns a numerical value to these risk events. This process uses modeling techniques such as Monte Carlo simulations and decision tree analysis to:

- Quantify the possible outcomes for the project and their probabilities
- Assess the probability of achieving specific project objectives
- Identify risks requiring the most attention by quantifying their relative contribution to overall project risk
- Identify realistic and achievable cost, schedule, or scope targets, given the project risks
- Determine the best management decision when some conditions or outcomes are uncertain.

Interviewing techniques are used to quantify the probability and impact of risks on project objectives. These values (typically optimistic, most likely, & pessimistic) are used to develop a probability distribution for the project components. Decision tree analysis or modeling and simulation techniques are then used to develop the probabilities for scenarios and the rewards for logical paths.

Products of the Quantitative Risk Analysis process are:

- An updated risk register, the information for the individual risk events is updated based on this analysis
- Probabilistic analysis of success for project objectives (time and cost)
- Updated prioritization of quantified risks, the risks that pose the greatest threat or present the greatest opportunity to the project
- Trends in quantitative risk analysis. If this process and analysis is repeated during the projects life cycle, trends can become apparent leading to conclusions regarding the risk response.

Monte Carlo Simulation

A project simulation uses a model that translates the uncertainties specified at the detailed level of the project into their potential impact on project objectives (time and cost). In a Monte Carlo simulation, the project model is computed many times (iterated), with the input values randomly selected based on the probability distribution for the project element or schedule activity. A probability distribution is calculated.

For a cost risk analysis, a simulation can use the project WBS or a cost breakdown as its model. For schedule risk analysis, the precedence diagramming method (PDM) is used. (*PDM is further discuss in Module 4 – Schedule Management*)

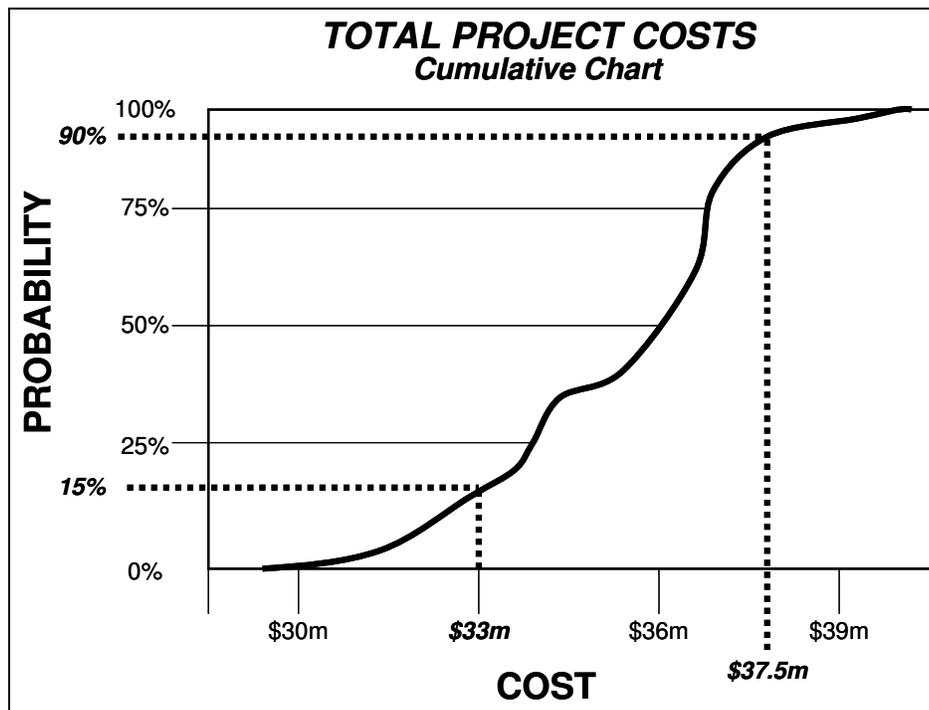


Figure 3-3

In the Figure 3-3 above, assume that the project has a programmed budget of \$33 million dollars. Risk events are identified, qualitatively analyzed, and quantitatively analyzed and tied to the project WBS. Using the Monte Carlo simulation technique, a Total Project Cost graph is generated reflecting the probability of achieving certain cost values. In the graph above, the project has a 15% probability of achieving a \$33 million cost or less. Depending on the risk tolerance of the organization, this chart can be used to look for contingency values needed to meet the probability for success. In this example, assume the organization is very conservative (risk averse) and wants a 90% confidence, or probability, for project success. Based on the evaluated risk events for the project, this project needs a contingency of \$4.5 million (a contingency of nearly 14%) to achieve this level of risk tolerance.

For further information regarding Quantitative Risk Analysis and the modeling techniques used by WSDOT, contact the CREM office.

Step 5 – Risk Response Strategy

Risk response strategy is the process of planning and developing options and actions to enhance opportunities and reduce or eliminate threats to the project objectives. This process follows the qualitative and quantitative analyses.

Planned risk responses must be:

- Proactive, not reactive
- Appropriate to the significance of the risk
- Cost effective
- Timely
- Realistic within the project context
- Agreed upon by the project team and parties involved
- Assigned to / owned by a responsible person

Selection of the best response from several options is often required. Several risk response strategies are available. The strategy (or mix of strategies) most likely to be effective should be selected for each risk event.

Risk Response Definitions:

Avoidance

Risk avoidance involves changing a project objective to eliminate the threat posed by the risk event.

Transference

Risk transference requires shifting the negative impact of a threat, along with the ownership of the response, to a third party. Transferring the risk does not eliminate the risk. Transferring liability for a risk is most effective in dealing with financial risk exposure. Risk transference nearly always involves payment of a risk premium to the party taking on the risk. Some examples of risk transference are insurance, performance bonds, warranties, guarantees, etc.

Mitigation

Risk mitigation implies a reduction in the probability and/or impact of a threat posed by the risk event to an acceptable threshold. Taking early action to reduce the probability and/or impact of a risk event occurring on a project is often more effective than trying to repair the damage after the risk has occurred.

Acceptance

This strategy is adopted because it is seldom possible to eliminate all risk from a project. This strategy is used when the project team has decided not to

change the project management plan to address or deal with the identified risk event, or the project team is unable to identify any other suitable response strategy. Acceptance is a risk response strategy used for both threats and opportunities. This strategy can be either passive or active. Passive acceptance requires no action, leaving the project team to deal with the risk event as they occur (workaround). Active acceptance strategies will establish a contingency reserve, including time, money, or resources to handle known (and sometimes unknown) risks.

Exploit

This strategy may be selected for risks with positive impacts where the organization wishes to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with an opportunity by making sure it happens.

Share

Sharing a positive risk involves allocating ownership to a third party who is best able to capture the opportunity for the project. One example of a share risk strategy is forming of partnerships or joint ventures.

Enhance

This strategy, similar to mitigation, increased the probability and/or positive impacts of an opportunity. This is done by identifying and maximizing key drivers of these positive risk events.

Contingency Reserve

Contingency reserve is not a risk response strategy; it is an output of risk planning. When a project team chooses to actively accept a project risk event, a contingency reserve is established. This is the amount of funds, budget, or time needed above the estimate to reduce the risk of overruns of project objectives to a level acceptable to the organization.

Exercise – Risk Response development

Using the result from the qualitative risk analysis from the last exercise:

- Identify risk response strategies for the “high-high” (red zone) risk events.
- Decide who will be the responsible person to monitor the risk event the effectiveness of the risk response.
- Decide if active acceptance of further risk response planning will be required for the “high-low” (yellow zone) risk events.

(Time: 15 minutes)

Risk Monitoring & Control

Throughout the project's life cycle, new risks will develop; some risks will not occur at all, the impacts of risk can change. If the Risk Management Plan and the Risk Register are not maintained, monitored, and controlled, the effort and work done during planning will go to waste.

Risk monitoring and control is the process of:

- Monitoring risk and opportunity elements
- Identifying new risk and opportunity elements
- Evaluating/upgrading probability of occurrence and potential impacts
- Devising and implementing response strategies
- Evaluating and documenting the effectiveness of response actions
- Reporting to Region/Organization Management and Stakeholders

Exercise – Monte Carlo simulation

Module 4 references

WSDOT Executive Order 1032.00E “Project Management”, dated July 1, 2005

WSDOT. “A Policy for Cost Risk Assessment”, dated August 2005.

Project Management Institute. *A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guide)*. Project Management Institute, Inc. 2004.

Harold Kerzner, Ph.D. *Project Management, A Systems Approach to Planning, Scheduling, and Controlling, 8th Edition*. John Wiley & Sons, Inc. 2000.

Velociteach. *The PMP Exam, 2005 Edition*. Andy Crowe, PMP. 2004.

International Institute for Learning (IIL). *Advance Project Risk Management” training manual, version 4.0*. International Institute of Learning, Inc. 2004

Module 5 – Resource Planning

Estimating schedule activity resources involves determining what resources (persons, equipment, materials) and what quantity of each resource will be used, and when each resource will be available to perform project activities.

Resource Estimating

Estimating the level of effort, or quantity of resource can be challenging, especially when a project manager is estimating the level of effort for a labor resource (person).

There are several tools and techniques available to the project manager and to the project team for estimating resources for project activities.

Expert Judgment

Any group or person with specialized knowledge can provide estimates for specific activities.

Bottom-up Estimating

Decomposing the activity into smaller, more detailed sub tasks and evaluating the resource requirements for these activities. The resource needs of each lower, more detailed piece of work are estimated, and these estimates are then aggregated into a total quantity for the schedule activity.

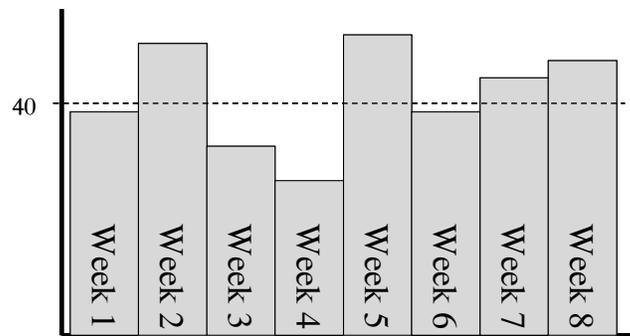
Three point Estimating

Similar to estimating schedule activity duration, an optimistic, pessimistic, and most likely estimate values are identified. This method will allow for risk contingency to be planned for the resource assignment and the schedule activity.

With the project management software currently used at WSDOT, the project manager will need to estimate the labor resource in terms of effort (total hours planned for the activity); or as a uniform rate (rate of effort for the activity duration).

Resource Histogram

A resource histogram is a bar chart showing the amount of time that a resource is scheduled to work over a series of time periods. Resource availability may be depicted as a line for comparison purposes.



Resource Histogram

Resource conflict and balancing

As discussed earlier, one of the primary sources of conflict on a project is the availability of resources, especially critical, or specialized, resources that must be shared with different projects. A project manager must be able to identify when a resource is needed. Using the resource histogram, and comparing the assigned work to the resource's availability (calendar), a project manager can validate the schedule activity.

Resource and Project Calendars

Resource calendars and project calendars identify the periods of work or when work is allowed. Project calendars affect all activities. Resource calendars only affect a specific resource or a category of resources.

Resource Leveling

Resource leveling is a schedule network analysis technique that is applied to a schedule model that has been already analyzed by the critical path method. Resource leveling is used to verify the project schedule is realistic. Scheduled start dates and scheduled finish dates can be modified to reflect resource availability. Resource leveling is also performed to ensure that capable resources are available for critical activities and to address situations when critical resources must be shared. Resource leveling can also help identify resources that may be underutilized, allowing a project manager to use this available pool of resources to deliver scheduled activities on the scheduled dates if other critical resources are not available.

There are different methods for resource leveling. A project manager must be able to identify how resolving a resource conflict can have any impact to the project objectives. The following methods can be used and the effects to time and cost analyzed.

Do nothing. This method is recognizing that the resource requirements are an estimate and that a tolerable limit can be set for accepting an over allocation of the resource.

- Time (schedule) impact – None.
- Cost (budget) impact – None.

Delay non-critical path tasks within available float.

- Time (schedule) impact – None.
- Cost (budget) impact – None (except for inflation effects).

Extend non-critical path task durations within available float (keeping total effort constant and decreasing the rate at which the resource is used).

- Time (schedule) impact – None.
- Cost (budget) impact – None (except for inflation effects).

Add or substitute resources of equal or greater capability for the over-allocated resource.

- Time (schedule) impact – May need to consider learning curve for new resources.
- Cost (budget) impact – Substitute resource may have higher cost.

Delay critical path tasks.

- Time (schedule) impact – Project schedule delay impact equal to delay value.
- Cost (budget) impact – Costs associated with project extension and possible inflation costs.

Extend the durations of critical path tasks (while keeping the total effort constant and decreasing the rate at which the resource is used).

- Time (schedule) impact – Project schedule delay impact equal to extension value.
- Cost (budget) impact – Costs associated with project extension and possible inflation costs.

Authorize the use of overtime for tasks that are on the critical path.

- Time (schedule) impact – Could shorten the schedule (schedule crashing).
- Cost (budget) impact – Cost impact due to higher resource cost if resources incur overtime cost.

Split the task into two or more non-sequential pieces.

- Time (schedule) impact – Schedule impact if part of task extends outside of float.
- Cost (budget) impact – Cost impact due to possible project extension, inflation costs, and inefficiencies in splitting the task.

Modify the Scope.

- Time (schedule) impact – Could possibly shorten the schedule due to less work or quality of work being accomplished.
- Cost (budget) impact – Could go either way. In the short run, the costs should be less due to less work being accomplished; however the long run costs may be increased

Module 5 references

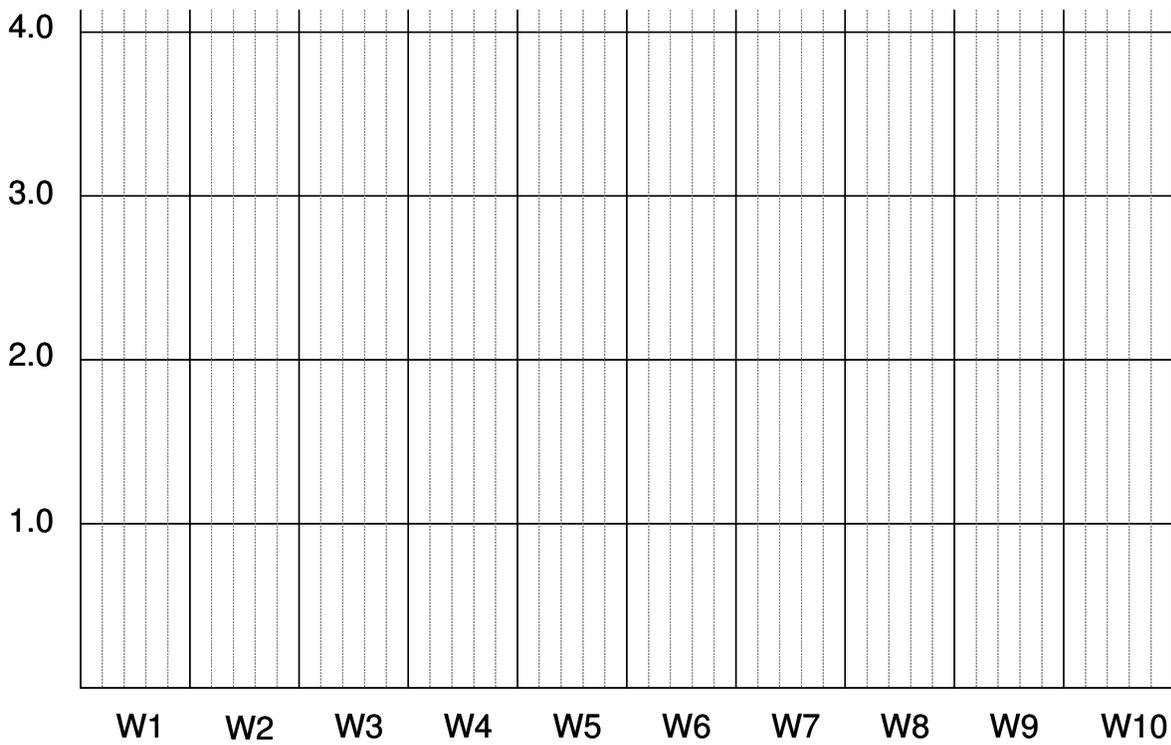
Project Management Institute. *A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guide)*. Project Management Institute, Inc. 2004.

Questions:

1. What are the most Design Engineers needed at any one time?
2. Only three Design Engineers are available. How would you resolve this resource conflict?
3. Was there an impact to the project end date?

Complete the revised resource histogram.

Resource Histogram



Module 6 – Budget Management

Budget Development

One of the most important duties of the Project Manager is to develop and manage the project budget. Developing the project budget involves good scheduling abilities, understanding of the project scope, and a well-developed WBS and schedule.

Some key reasons for overspending budgets are:

- **Bad luck:** Even the best of planning cannot prevent changes that are external to the project team and project manager's control. Good contingency plans can help mitigate these "unknown unknowns".
- **Overly optimistic initial cost estimates:** Often, project managers always assume the project will go without any changes. This leads to aggressive schedules and budgets with no flexibility. Understanding that change will occur at some point in the project and development of a good contingency plan will help offset the optimistic estimates.
- **Poor communication and understanding of the project objective:** Communication, communication, communication. Sometimes project team members are unaware of the project objective. It is key that the project manager ensures that all project team members, including specialty group members, are in agreement with the project objectives and is working towards the same goals.
- **Poor cost/time estimating practices:** Are project managers using sound estimating techniques and consulting with the team members and experts that are actually assigned to the work packages.

Project estimating is defined as three basic types:

Analogous Estimating

This is an estimating technique that uses the values (such as scope, cost, duration, etc.) from previous, similar activities or projects as the basis for estimating the same value for future activities or projects. This method is used when there is a limited amount of detailed information about the activity or project. This method is sometimes referred to as the "Top Down" method.

Parametric Estimating

This is an estimating technique that uses a statistical relationship between historical data and other variables to calculate an estimate for activity or project values. An example for a cost parameter is multiplying the planned quantity of work to be performed by the historical cost per unit to obtain the estimated cost.

Bottom-up Estimating

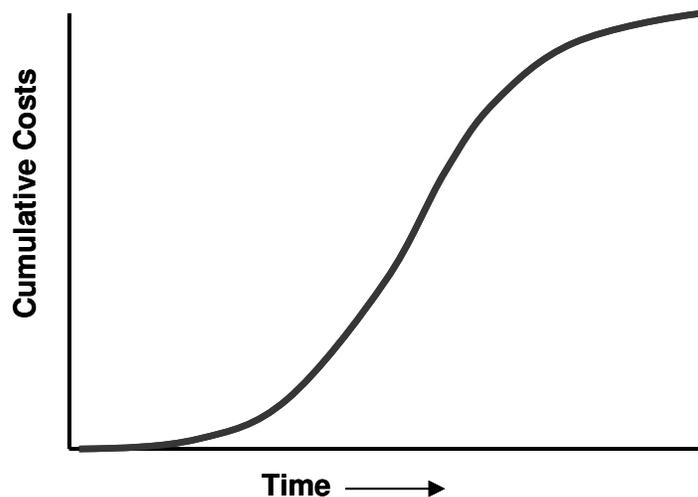
This is an estimating technique that decomposes the work into more detail. An estimate is prepared for what is needed to meet the requirements of each of the lower, more detailed pieces of work, and these estimates are then aggregated into a total quantity for the component of work. The accuracy of bottom-up estimating is driven by the size and complexity of the work identified at the lower levels.

Cost Budgeting

Cost budgeting is a planning process that involves aggregating the estimated costs of individual schedule activities to establish a total cost baseline for measuring project performance. The output from cost budgeting is called the Cost Baseline.

Cost Baseline

The cost baseline is the time-phased budgets that are used as a basis against which to measure, monitor, and control overall cost performance on the project. It is developed by summing the estimated costs for a period of time (based on the scheduled dates for the activities) and is typically displayed in a spreadsheet or an S-curve graphic.



This cost baseline also represents Planned Value, which is used for Earned Value Management (discussed later).

Cost Control

Cost control is the process of influencing factors that create variances, and controlling changes to the project budget.

Project cost control includes:

- Ensuring requested changes are agreed upon

- Managing the actual changes when and as they occur
- Assuring that potential cost overruns do not exceed the authorized funding periodically and in total for the project.
- Monitoring cost performance to detect and understand variances from the cost baseline
- Recording all appropriate changes against the cost baseline
- Preventing incorrect, inappropriate, and unapproved changes from being included in the reported, or actual, costs
- Informing stakeholders of approved changes
- Acting to bring expected cost overruns within acceptable limits

Project cost control searches out the causes for positive and negative variances to the cost baseline. Inappropriate responses, or lack of any response, can cause schedule problems or produce an unacceptable level of risk later in the project.

Tools for project cost control are a documented change control system and performance measurement analysis.

Cost Change Control System

A cost change control system defines the procedures by which the cost baseline can be changed. At WSDOT, these procedures are defined in the Project Control and Reporting Guide. These measures should also be documented in the Project Management Plan for the project. It includes the forms, documentation, tracing systems, and required approval authority levels necessary for authorizing change.

Earned Value Management

Earned Value Management (EVM) is a method of integrating scope, schedule, and resources, and for measuring project performance. EVM compares the amount of work that was planned with what was actually earned with what was actually spent to determine if cost and schedule performance are as planned.

A project manager needs to have the following to perform EVM:

- A baseline plan.
- A project budget.
- A project end date.
- Tasks that are identified and assigned.
- Each task has a budget or effort (resource loaded or weighted).
- Actuals tracked.

EVM Definitions

To perform EVM, three values need to be determined:

Planned Value (PV)

What are the budgeted costs of the work scheduled?

- Time phased based on baseline budget.
- Only changes when baseline is changed.
- Also referred to as “BCWS”.
- Budget at Completion “BAC” is used for the planned value of the overall project.

Actual Costs (AC)

What are the actual costs of the work performed?

- Based on the actual completion of the work packages.
- Actual costs for reported work.
- Also referred to as “ACWP”.

Earned Value (EV)

What are the budgeted costs of the work performed?

- Based on the actual completion of the work packages.
- Baseline value of the reported work.
- Also referred to as “BCWP”

EVM Formulas

Once the project manager has the PV, EV, & AC values for the project, some EVM calculations can be done to measure the progress of the project and help identify trends, forecast costs, and identify ways to correct/mitigate project pitfalls.

Cost Variance (CV)

$$CV = EV - AC$$

CV is the difference between the Earned Value and the Actual Costs. If this value is positive, then the project is currently under budget (spending less than what was planned). If this value is negative, then the project is currently over budget (spending more than what was planned).

Cost Performance Index (CPI)

$$CPI = EV/AC$$

The CPI is a factor that indicates the budget efficiency. If this value is greater or equal to 1.0, the project cost trend is under or at planned budget. If this value is less than 1.0, the project cost trend is over planned budget.

Cost Variance Percentage (CV%)

$$CV\% = CV/EV$$

The cost variance percentage indicates the percentage difference that a project is over or under spending the planned budget. A positive percentage indicates that the project is currently under budget by the percent calculated. A negative percentage indicates that the project is currently overspending by the percent calculated.

Schedule Variance (SV)

$$SV = EV - PV$$

SV is the difference between the Earned Value and the Planned Value. If this value is positive, then the project is currently ahead of schedule. If this value is negative, then the project is currently behind schedule.

Schedule Performance Index (SPI)

$$SPI = EV/PV$$

The SPI is a factor that indicates schedule efficiency. If this value is greater or equal to 1.0, the project schedule trend is ahead of or on schedule. If this value is less than 1.0, the project schedule trend is behind schedule.

Schedule Variance Percentage (SV%)

$$SV\% = SV/PV$$

The cost variance percentage indicates the percentage difference that a project is over or under spending the planned budget. A positive percentage indicates that the project is currently under budget by the percent calculated. A negative percentage indicates that the project is currently overspending by the percent calculated.

Estimate at Completion (EAC)

There are different methods of calculating the EAC depending upon the project circumstances. Each method will produce a different result based upon those circumstances.

EAC = AC + ETC (Method #1)

This method is to be used when the baseline project schedule is no longer valid. This is when numerous changes have occurred and it is not feasible to attempt to recover the baseline schedule.

Adding the actual costs to date (AC) to the new estimate to complete (ETC) generated from the updated and approved schedule will give up a new EAC value. This most likely will require some change management, depending on which parameter of the project has been prioritized, optimized, and accepted.

EAC = AC + BAC - EV (Method #2)

This method is to be used when a project has incurred unusual costs or procurement costs. An example would be if there was a price increase in start up materials and more money was spent to purchase the materials. The remaining part of the project schedule is still valid. (Current variances are viewed as atypical.)

Adding the actual costs to date (AC) to the original project budget (BAC) and then subtracting the Earned Value will give the updated EAC value. Again, this most likely will require some change management, depending on which parameter of the project has been prioritized, optimized, and accepted.

$$\text{EAC} = \text{AC} + (\text{BAC} - \text{EV})/\text{CPI} \text{ (Method \#3)}$$

or

$$\text{EAC} = \text{BAC}/\text{CPI} \text{ (Method \#4)}$$

This method is used if the current variances are viewed as typical and the project manager is anticipating that the remaining of the project schedule will perform at the same index rate.

Earned Value Scenario

A new project manager, John Doe, has been asked by his senior manager to submit a project status report for the SR999, Main Street Intersection Signal & Channelization project. Being a diligent manager and proud that he is using PDIS, has a baseline project schedule & plan, and is actively tracking his project, the project manager submits the following report, stating that the project is 42% complete and the project team has spent \$48,000.

 Washington State Department of Transportation
<u>Monthly Project Status Report</u>
SR999, Main Street Intersection Signal & Channelization
Dear Boss,
As of 5/30/04, we are 42% complete and have spent \$48,000.
Respectfully submitted,
John Doe, Project Manager

Project Status Report #1

Of course the senior manager looks at the report and still feels that there may be more to the project than the report shows. The senior manager asks the project manager to look at whether the project will be completed as planned. The project manager generates a Gantt chart report from PDIS, identifies the critical path, and notices that

the Ad date is as planned – 8/1/04. The project manager submits a revised project status report stating that as of 5/30/04 (since the schedule is being tracked diligently), the Ad date is still on schedule and the budget is \$100,000.



Project Status Report #2

The senior manager, still feeling a little uneasy about the project (call it a hunch), goes to Program Management (project sponsor) and asks for the status of the SR999, Main Street Intersection Signal & Channelization project. The project sponsor cheerfully states, "The project has submitted aging reports and the planned expenditures were to be \$56K, but the project team has only spent \$48K, so we are ahead of budget."



Washington State
Department of Transportation

Program Management Status Report

SR999, Main Street Intersection Signal & Channelization

Status as of 5/30/04

Planned expenditures to date are \$56,000
 This is 56% of the project budget

Actual expenditures to date are \$48,000
 This is 48% of the project budget

We estimate cost at completion of \$100,000

Respectfully Submitted,
Jane Smith, Program Management

Program Management Report

The senior manager is still feeling uneasy about this report. The senior manager murmurs, “What good does it tell us to report actual costs against planned costs if we don’t know what has been done on the project? This report is of **NO** value!”

Next day, the senior manager calls the project manager and asks for better project status report. The project manager remembers from a class recently taken that organization executives like to know “bottom lines”, and everything bottom line ties to dollars, the project manager submits a project status report stating that the project is 42% complete, the Ad date is 8/1/04, and the money spent to date is \$48K and the budget is \$100K.



Washington State
Department of Transportation

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Schedule:
Current completion is 42%
We estimate project completion on 8/1/04

Budget:
Expenditures to date are \$48,000
We estimate cost at completion of \$100,000

Respectfully submitted,
John Doe, Project Manager

Project Status Report #3

The senior manager still has an uneasy feeling, but from the fragmented reports, which all state the project is on time, and ahead of budget, the boss is able to do some quick, easy Earned Value Analysis...

First, the values for the BAC, EV, PV, and AC need to be identified and calculated. From the various reports we can calculate the following:

Budget at Completion (BAC)

The budget at completion for this project is \$100,000. This is stated in several of the reports.

Earned Value (EV)

The reports stated that the project is 42% completed according to the schedule. This means that 42% of \$100,000 worth of work has been completed. The EV is \$42,000.

Planned Value (PV)

From the aging reports, the project should have accomplished 56% of the \$100,000 planned work. The PV is \$56,000

Actual Cost (AC)

From the actual expenditures report, \$48,000 has been spent as of the reporting date. Actual costs do not come from the schedule, but from an external source, such as work order ledgers or accounting programs. The AC is \$48,000.

Is this project doing as well as the project manager and Program Management manager think? Or are there some serious problems that need to be addressed?

Cost Variance (CV)

$$CV = EV - AC$$

$$CV = \$42,000 - \$48,000$$

$$CV = -\$6000$$

Calculating the CV, the project has a negative variance. This tells the senior manager that the project is currently over budget. How can that be? When the earlier reports even stated that the project was UNDER budget...

Cost Performance Index (CPI)

$$CPI = EV/AC$$

$$CPI = \$42,000/\$48,000$$

$$CPI = 0.875$$

Cost Variance Percentage (CV%)

$$CV\% = CV/EV$$

$$CV\% = -\$6000/\$42,000$$

$$CV\% = -14\%$$

The CPI calculates to 0.875, and the CV% calculates to -14%. This project is currently 14% over budget and is trending to overspend even more. The project team, during the "Plan the Work" phase, identified that Change Management action would be needed if the budget variation exceeded 10%.

Why hasn't the senior managers and project sponsors seen any funds request or change management plans?

Schedule Variance (SV)

$$SV = EV - PV$$

$$SV = \$42,000 - \$56,000$$

$$SV = -\$14,000$$

Calculating the SV, the project has a negative variance. This tells the senior manager that the project is currently behind schedule. How can that be? Earlier reports even stated that the project was on time, even the Critical Path shows the Ad date as 8/1/04 (but the boss also notices that some non critical tasks have been delayed and the project now has minimal float)...

Schedule Performance Index (SPI)

$$SPI = EV/PV$$

$$SPI = \$42,000/\$56,000$$

$$SPI = 0.750$$

Schedule Variance Percentage (SV%)

$$SV\% = SV/PV$$

$$SV\% = -\$14,000/\$56,000$$

$$SV\% = -25\%$$

The SPI calculates to 0.75, telling us that the SV% is -25%. This project is currently 25% behind schedule and is trending to miss the Ad Date milestone. The project team, during the development of the Change Management Plan, identified that a formal change request would be needed if the Ad date was more than 1 month delayed.

Why hasn't the senior managers and project sponsors seen any Ad date revision request or change management plans?

The senior manager calls the project manager into his office and shares the information he calculated from EVM. "This project is behind schedule and is overspending" explains the senior manager, "the legislature and the secretary are counting on this project being on time and on budget."

The project manager and senior manager discuss ways to get back on track. Using the Trade off triangle (Triple Constraints Theorem) and the project boundaries identified in the project management plan, the project team agrees that the priority is to deliver on time and get the project out to construction this season and request additional funding. The project manager evaluates the schedule and realizes that to make the 8/1/04 Ad date, additional resources, overtime and "soft logic" scheduling will be required. Method 1 was used to develop EAC.

Estimate at Completion (EAC)

Method #1

$$EAC = AC + ETC$$

ETC is calculated from the revised resource loaded schedule. ETC is \$68,000.

$$EAC = \$48,000 + \$68,000$$

$$EAC = \$116,000$$

The project manager now prepares and submits a new report, showing EVM values, to the senior manager, along with recovery plans and corresponding change requests.



**Washington State
Department of Transportation**

Monthly Project Status Report

SR999, Main Street Intersection Signal & Channelization

Status as of 5/30/04:

Planned Expenditures:	\$56,000	56%
Progress (EV):	\$42,000	42%
Actual Expenditures:	\$48,000	48%

SPI = 0.75 CPI = 0.875

Budgeted Cost at Completion:	\$100,000
Estimated Cost at Completion:	\$116,000*
Estimated Project Completion Date:	8/1/04

* (Change Management for the additional funds needed)

Respectfully submitted, John Doe, Project Manager

EVM Project Status Report

Although the news isn't great, the senior manager is glad to know the real story regarding the project status.

Now the project manager can use the Change Management Plan and the steps outlined in the plan to start the change process to request the additional funds needed to complete the project. The revised project performance baseline is shared with the project team and the project manager will analyze future performance against the revised project performance baseline. With a well planned, resource loaded, tracked schedule, the reasons for justification are easier to identify.

Module 6 references

Project Management Institute. *A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guide)*. Project Management Institute, Inc. 2004.

Module 6 Exercise – Earned Value and Recovery Methods

Project #1:

BAC = \$350,000 (original project budget)

- The project schedule is actively tracked and is 33% complete. Baseline #3 (design baseline) shows that at this time, 30% of the project was planned to be complete.
- From the work order ledgers, \$132,500 has been spent to date. But \$20,000 is for new equipment that was charged to the work order.
- A completion date was committed to the customer. Time is of the essence and the schedule is the priority.

Calculate the EV, PV, & AC. From these values, perform EVM to determine if the project is ahead or behind schedule and budget and what the EAC is. What Change management action would be appropriate, if needed?

Project #2

BAC = \$500,000 (original project budget)

- The project schedule is actively tracked and is 25% complete. Baseline #3 (design baseline) shows that at this time, 33% of the project was planned to be complete.
- From the work order ledgers, \$124,000 has been spent to date. The project team is relatively stable and the indexes calculated are a fairly accurate reflection of the team's production.
- The budget has no flexibility (no additional funding is available).

Calculate the EV, PV, & AC. From these values, perform EVM to determine if the project is ahead or behind schedule and budget and what the EAC is. What Change management action would be appropriate, if needed?

Project #3

BAC = \$750,000 (original project budget)

- The project schedule is actively tracked and is 33% complete. Baseline #3 (design baseline) shows that at this time, 50% of the project was planned to be complete.
- From the work order ledgers, \$275,000 has been spent to date. The project team is relatively stable, but some changes in permitting requirements have required some design changes and have caused the schedule to be re planned from this point on. The revised remaining schedule shows a new ETC of \$550,000.
- The project scope is the priority, with the project schedule as the optimized parameter.

Calculate the EV, PV, & AC. From these values, perform EVM to determine if the project is ahead or behind schedule and budget and what the EAC is. What Change management action would be appropriate, if needed?