



**“Scheduling
With
the Masters”**

Schedule Design – Planning for Schedule Development

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Schedule Design



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- **Why design a schedule?**
 - **A schedule meets the criteria for a “project” in itself**
 - **A schedule is a guideline or plan for a project**
 - **A schedule provides a a methodical approach for a project**
 - **Keeps the schedule development on track**
 - **Prevents rework due to late understanding of needs**
 - **Allows buy-in from end users prior to Development**
 - **Makes the schedule development session much more meaningful**
 - **Documents the assumptions and intention of the schedule**
 - **For reviewer and approver**
 - **For future reference**
 - **To facilitate changes in schedulers**
 - **Place to capture Lessons Learned**

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- **Scope of Design vs. Development**
 - **Design – Conceptualizing the schedule**
 - **Planning**
 - **Starting with the end in mind**
 - **Providing concept of final product**
 - **Creating organizational structure to fulfill the concept**
 - **Development - Building the schedule**
 - **Input activities**
 - **Input logic**
 - **Input durations**
 - **Review for design compliance**
 - **Review for CPM methodology best practices**
 - **Quality control**

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- **Design vs. Development – How PMI & PMBOK handles it?**
 - **PMBOK identifies six Project Time Management processes, usually defined as part of the project lifecycle, Section 2.1 of PMBOK.**
 - *Activity Definition.*
 - *Activity Sequencing.*
 - *Activity Resource Estimating.*
 - *Activity Duration Estimating.*
 - *Schedule Development.*
 - *Schedule Control.*
 - **These processes are preceded by a planning effort by the project management team, which is part of PMBOK's “Develop Project Management Plan”, PMBOK Section 4.3 (which sets the format and establishes criteria for developing the project schedule).**
 - **These processes are documented in what PMBOK calls a Schedule Management Plan, which is contained in the project management plan, in the introduction to Section 4.3, Project Integration Management.**

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- **PMBOK Process Inputs.**
 - The inputs for the different Time Management Processes are listed as:
 - *Activity list.*
 - *Product description.*
 - *Mandatory dependencies.*
 - *Discretionary dependencies.*
 - *External dependencies.*
 - *Resource requirements.*
 - *Resource capabilities.*
 - *Historical information.*
 - *Identified risks.*
 - *Constraints.*
 - *Assumptions.*
 - All of these items, along with the Schedule Management Plan, are part of Schedule Design, but PMBOK does not offer clear definition and delineation of Schedule Design.
 - The Time Management Processes do not include Schedule Design.

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- **Design vs. Development – why emphasize the distinction?**
 - **Design tends to be ignored in favor of jumping right into development.**
 - Many schedulers elect to begin creating activities instead of Designing.
 - Work is subsequently repetitive, with lots of potential for rework.
 - Results tend to be disorganized.
- **Avoid planning mistakes and problems.**

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- **Avoid planning mistakes and problems**

Activity ID	Activity Description	Floor	Vert Align	Orig Dur	Rem Dur	Early Start	Early Finish
OWN Owner Responsibilities & Decisions							
FIN Building Rough-ins & Finishes							
FULL Full Building Work							
FULL Full Building Work							
16401	Coordinate & install building sprinkler	FIN		5	0	11JUN07A	20JUL07A
16402	Coordinate & install building fire alarms	FIN		5	0	11JUN07A	20JUL07A
DELY Delays & Time Related Impacts							
ADM Administration							
420	Delay to issuing 100% construction	ADM		485*	0*	24AUG05A	
MS Phases and Milestones							
ADM Administration							

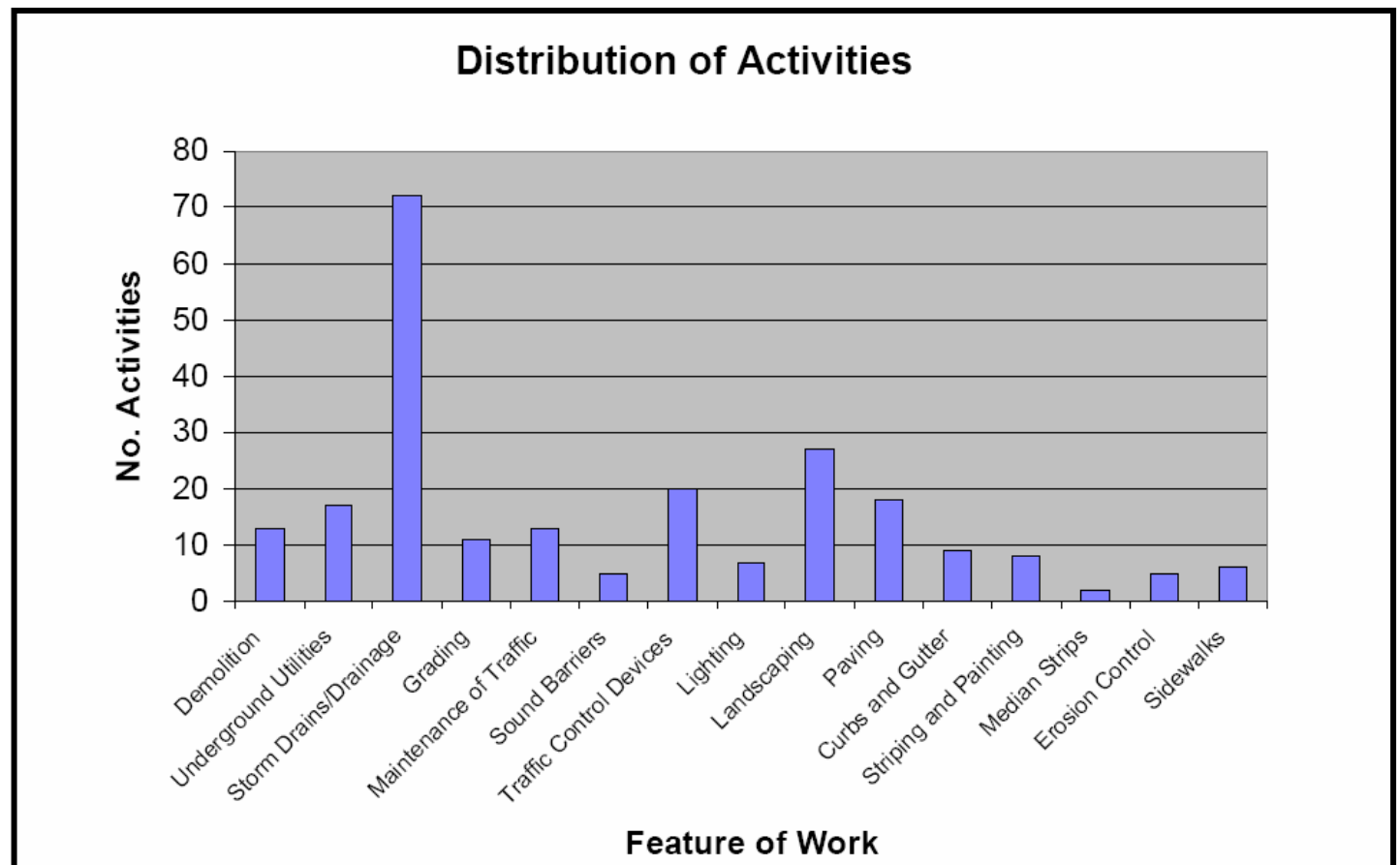
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Some trades are heavily developed while others are left with summary-level activities only.

- **Inconsistency in level of detail throughout trades:**



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- **Documentation and use of Schedule Design**
 - Create a book or binder
 - Use the highest level of checklist outline items as tabs
 - Use the book as basis for schedule submittal documentation
 - Keep the book current during project
 - Use the book for handoff between schedulers
 - Share a copy of the book with superintendent/PM
- **Timing**
 - Must be done prior to Schedule Development

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- Project Description**
 - Reference Documents**
 - Contract**
 - Project Drawings**
 - Specifications**
 - Scheduling Specification**
 - Notice to Proceed or Release Letter**
 - Any Owner produced master schedule**
 - Liquidated Damages schedule**
 - Area Designation Plan**
 - Sequencing plan**
 - Estimate & quantity surveys/bills of materials**

Schedule Design Checklist -

Schedule Specification – General Contents.



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Schedule Specifications

● Content of Schedule Specifications

- Related specifications
- Software requirements
- Data exchange requirements
- Master dictionaries/reports
- Preconstruction meeting
- Qualifications of scheduler
- Required submittal contents
- Owner mandated milestone treatment
- Float ownership
- Prohibitions on manipulation
- Planning units/calendar requirements
- CPM Network requirements
- Duration definitions & restrictions
- Initial schedule submission
- Full detailed project schedule (baseline) submission
- Schedule updates
- Delays & time extensions
- Early completion schedules
- Final as-built submittal
- Short interim schedules
- Cost & Resource loading
- Narrative Requirements

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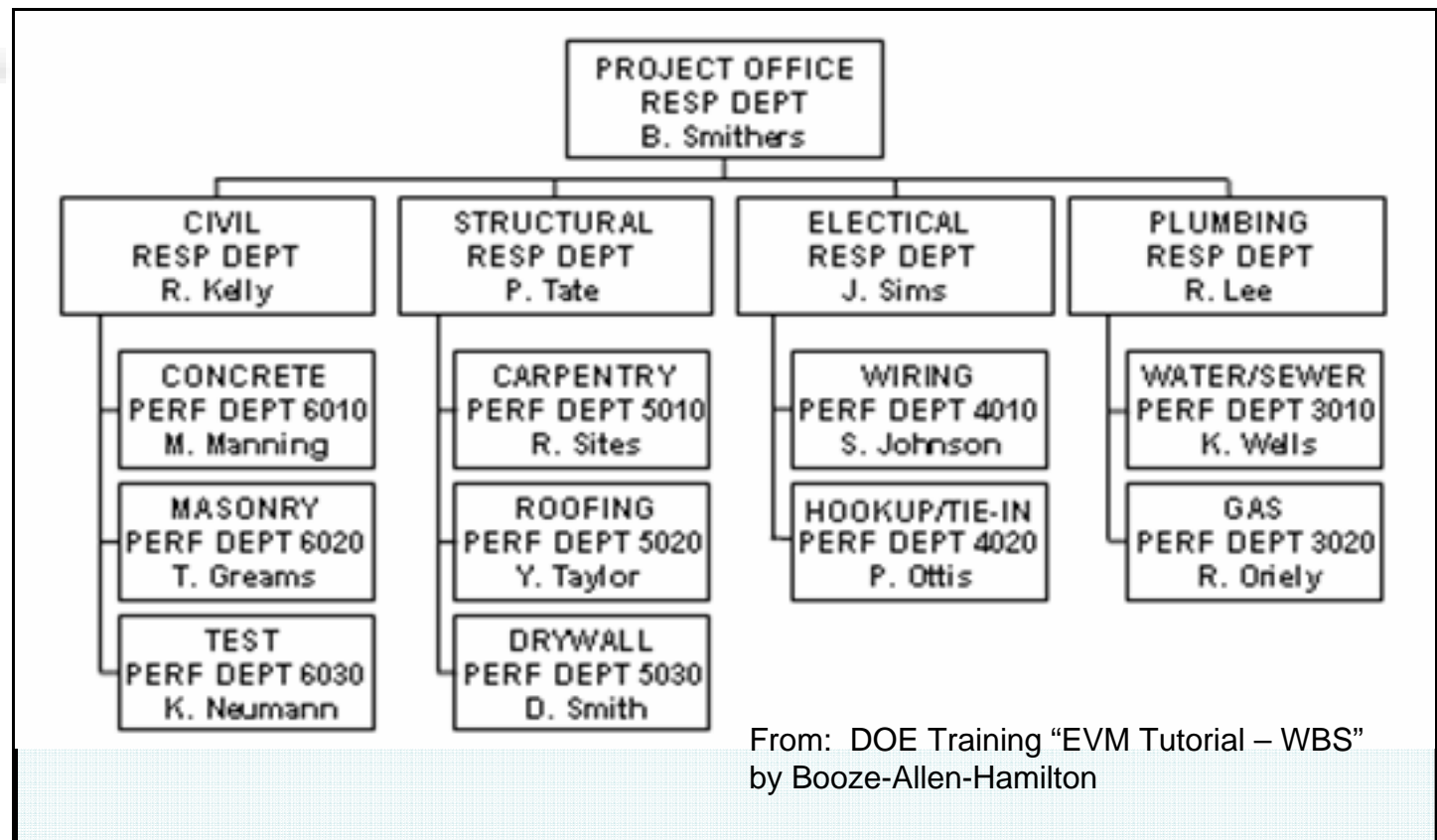
- Team Players**
 - Organizational Chart (OBS)**
 - Who are Schedule Users?**
 - Who has Input**
 - Who Updates**
 - Who Checks for Accuracy**
 - Who Reviews**
 - Who approves**
 - Identify Responsibility Assignment Matrix (RAM)**

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☐ Organizational Breakdown Structure.



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❑ RAM Example (based on PMBOK RACI Chart)

RACI Chart (from PMBOK)	Roles				
	Project Controls Manager	Scheduler	Project Manager	Superintendent	Assistant Super
Schedule Design	R	I	C	C	I
Schedule Development	A	R	C	C	I
Schedule Statusing	I	A	I	A	R
Schedule Updating/Analysis	C	R	A	I	I
Schedule Reporting	C	R	I	I	A
Change Management	C	R	I	A	A
Recovery	C	R	I	A	I
Closeout	I	A	I	C	R

R = Responsible, A = Accountable, C = Consult, I = Inform

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- Software Identification**
 - Specific software**
 - Required minimum and versions allowed**
 - Enterprise specific issues**
 - Users identified**
 - Schedules used for import or data source**
 - Levels of access**
 - Validation process**
 - For master schedules, establish data dates**

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- Work Product**
 - What the Schedule can be used for (purpose)**
 - Reports Generated from the Schedule**
 - Who receives reports**
 - List of reports**
 - Samples of reports**
 - Glossary/Lexicon of ambiguous terms**
- Schedule Outline**
 - Key Activities being tracked**
 - Client Milestones**
 - Long Lead Items**
 - WBS Structure**
 - Other Contracts on Project**

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Reporting

Project Workspace - Jefferson Labs - Hall D Complex

Expand All | Collapse All | Customize

Project Statistics | Project Documents | Communication Center | Project Risks

Project Calendar: NOVEMBER 2007

Name	Priority	Owner	Risk Type	Status	Description
Beam operation	Normal		Schedule	Open	
Check funding phasing	Normal		Support & Funding	Open	
Cryogenic lines termination	Normal		Project Facilities	Open	
Determine end user needs	Normal		Schedule	Open	
Environmental impact study	Normal		Government/Regulatory Compliance	Open	
Equipment coordination	Normal		Schedule	Open	
Existing drainage swale across site	Normal		Weather/Env Hazards	Open	

Project Issues

Add | Expand All | Collapse All | Customize

Display: List Chart Filter All Issues

Issue Name*	Priority	Owner	Re
Geotechnical report	High		15
Interior stairs - Counting & Service buildings	Normal		30
Radiation Safety Process	High		15
Storm system pump stations locations	High		09
Water main loop	Low		21
Water shut down time	Normal		01

Run Date: 09-05-07 21:01 | Update: 09-01-07
Data Date: 08-03-07 | S. B. Ballard Construction Company
Harbor Heights - Tazewell Place | Sheet 1 of 8

Activity ID	Activity Description	FLR	VERT	Total Float	Orig Dur	Rem Dur	Early Start	Early Finish	% Comp	Actual Start	Actual Finish
OWN Owner Responsibilities & Decisions											
FIN Building Rough-ins & Finishes											
FULL Full Building Work											
FULL Full Building Work											
10401	Coordinate & install building sprinkler	FIN		5	0	0	06-11-07A	07-20-07A	100	06-11-07	07-20-07
10402	Coordinate & install building fire alarms	FIN		5	0	0	06-11-07A	07-20-07A	100	06-11-07	07-20-07
DELY Delays & Time Related Impacts											
ADM Administration											
ADM Administration											
420	Delay to issuing 100% construction documents	ADM		485*	0*	0	06-24-05A		100	06-24-05	
MS Phases and Milestones											
ADM Administration											
ADM Administration											

104210 Complete Project Duration (rcd) | ACIM | 1 | 0 | 1.546" | 40" | 106-29-05A | 110-10-07 | 91106-20-05 | 8.5 x 11in

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- Work Package Development.**
 - By Contract.**
 - As assigned by Client.**

VI. Work Packages

Division 2 and 5 Specifications require the following Work Packages:

- Superstructure Waterproofing
- Corrosion Protection of Structural Steelwork
- Movements and Tolerances Specification for Structural Steel
- Structural Steel Superstructure
- Cast in Place Concrete

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- Level of Detail**
 - Determine approach:**
 - Bottom-up (starting with detailed activities)**
 - Top-down (starting with summary schedule)**
 - Both (prepare Top-down, then Bottom-up)**
 - Identify frequency of updates**
 - Establish smallest activity duration range**

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- Codes Dictionary**
 - For tracking and monitoring work:**
 - Work Phase
 - Structure
 - Area
 - Floor or Station
 - Location.
 - For Project Management:**
 - Responsibility
 - Work Shifts
 - Costs
 - Resource
 - Specification
 - Change management

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- Calendars**
 - Establish number needed
 - Define calendars and application
- Costs & Resources**
 - Estimate & correlation to cost loading
 - Bill of Quantities & use in resources
 - Resource Crew descriptions
 - Equipment descriptions
 - How actual production will be monitored
 - Earned Value Management System
- Narrative Basis & Assumptions**
 - Procedure Used to create the Schedule
 - Definitions/lexicon
 - Description of sequence of work per structure

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Example of Calendar Section:

- **Calendars are defined as follows:**
 - Calendar 1 – 24 hours a day, 7 days a week.
 - Calendar 2 – 24 hours a day, only Fridays off. (This is the Default Calendar.)
 - Calendar 3 – Night Shift, only Fridays off.
 - Calendar 4 – Night Shift, 24 hours a day, 7 days a week.
 - Please note that 01140/1.9.a. requires that the Contractor notify the Client regarding multiple shifts, etc. This has been accomplished by using Day and Night shift calendars as well as by incorporating multiple crew codes into the Program. (For more on Crews, please refer to the Resources section of this report.)

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Example of Lexicon



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General Notes Regarding this Report:

- “Program,” “Programme,” and “Baseline CPM,” and “Schedule” all have the same definition and are used interchangeably.
- “Snagging” and “Punch-out” have the same definition and are used interchangeably.
- “Fixed” and “Rough-in” have roughly the same definition. For clarification purposes, “Fixed” has been used in this Program.
- “Conventional concrete” is defined as post-tension poured-in-place concrete.
- “Wild Air” is defined as a stage in construction, for which the building is closed in by perimeter walls and ventilation has started. (Ventilation only, not complete environmental controls or functioning air conditioning.) This term is used in lieu of “environmental controls,” or “drying –in” as wet weather is not a real factor in Dubai.
- “Raft” construction consists of the foundation including but not limited to piles, grade beams, footers, and slab-on-grade.



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□ Narrative Basis

Contractor Narrative

SPECIFIC AREAS OF WORK

Phasing of the project is as follows:

1. **Phase 1:** Includes storm drain, along with earthwork, paving, signalization and miscellaneous concrete work, on the South from station 15+55 to 32+45. On the North bound side storm earthwork, paving, striping, signalization and miscellaneous be completed from station 32+00 to 42+20.
2. **Phase 2:** Traffic will be split around the existing medians or outside work area that was completed during phase 1, and E. saw cut the existing pavement, remove the asphalt, install ten permanent storm drain, and then pave the medians to the top mix asphalt.
3. **Phase 3:** Traffic will then be moved to the Phase 1 work, to allow E.V. Williams, to complete tie ins of existing roads, complete the storm drainage, finish installing light poles, and signals, also completing the widening of Rt. 60 on both the North bound side and the south bound sides.
4. **Phase 4:** The final stage of work where traffic is split between the median into single lanes, one northbound and one southbound. E.V. Williams, Inc. will complete any remaining median work required at the time, the final paving and striping, brick paver crosswalks, lighting signalization and landscaping.

Sectioning of the project is as follows:

1. **Utilities and Storm Drain**
 - Section 1 – Station 15+55 to Station 20+40
 - Section 2 – Station 20+40 to Station 25+40
 - Section 3 – Station 25+40 to Station 32+45
 - Section 4 – Station 32+00 to Station 37+00



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Checklist for a Baseline Schedule Written Narrative

The purpose of the Narrative is to provide a summary of the work, explain the plan for construction, show how the schedule meets the specification and plan contractual requirements, identify potential problems, and summarize the Critical Path. The major components of the Written Narrative are:

- General description of the scope of work.
- Identification of any area designations.
- General description of the sequencing, including any necessary legend.
- Identification of any deviations from the contractually mandated sequencing.
- Identify any phasing.
- Identification of all Milestones that are contractually mandated.
- Identification of any other Milestones.
- Identify Traffic Control Plan, if applicable.
- Identification of problem areas of the project, and steps taken to limit risk.
- Identify any road closings, or utility coordination shutdowns, or other conflicts.
- List and explain Calendars.
- Explain Adverse Weather planning methodology incorporated in the schedule.
- Identify any unusual logic relationships, such as Start-to-Start or Finish-to-Finish Activity Types and rationale.
- Identify purpose and use of all relationship lags.
- Explain any Activity ID coding.

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- Risks & Constructability**
 - Brainstorming of issues**
 - Known problems (threats)**
 - Provisional Items**
 - Predicted Problems**
 - Lessons Learned**
 - Outside influences**
 - Site condition concerns**
 - Opportunities**
 - Develop Risk Management Plan**
 - Initial process during baseline schedule development**
 - Process for use during updates**

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☐ Risk Management Plan – Based on PMBOK

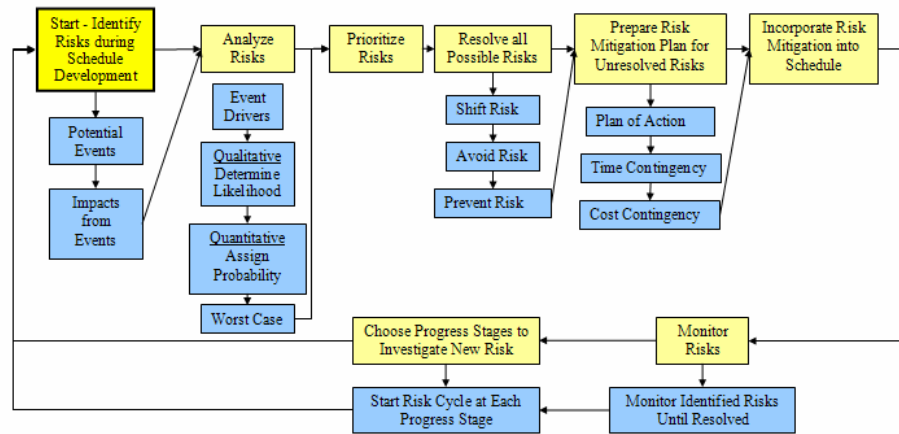


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Master Risk Management Checklist

Project:

Risk Factors	Description Explanation	Exist?	Likelihood	Consequence	Disposition
Constructability review performed					
Contract administration by designer					
Private or ROW work					
QC program of designer					
Quality of plans					
Quality of specifications					
Reputation of designer					
Stage of completion of documents					
Stage of permit authority reviews					
Subconsultants (structural, civil, MEP)					
Distance to asphalt plant					
Distance to batch plant					
New process usage (RCC?)					
New product usage					
Proposed QA/QC program					
Technical level of project					
Type of specification					
Land site acquisition					



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- Weather planning**
 - Expected adverse weather**
 - Identify source or specification requirement**
 - Identify methodology**
 - Identify accounting method for actual weather**

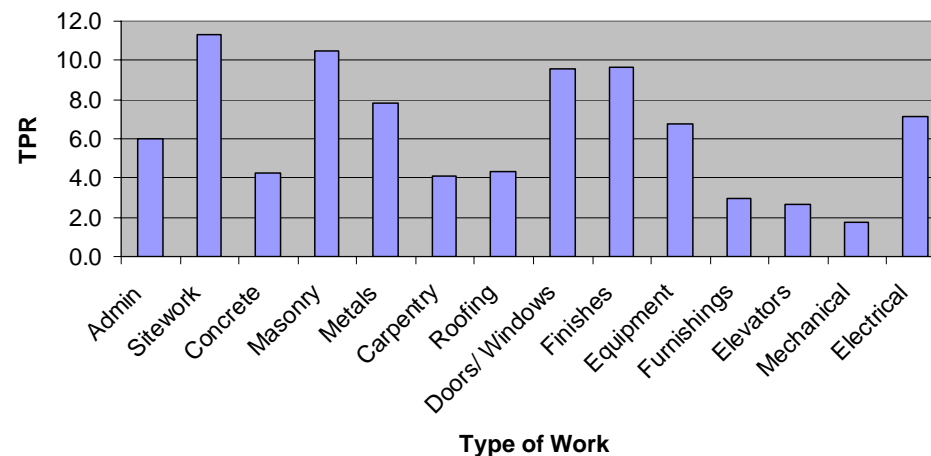
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- Time Contingencies**
 - Amounts**
 - Specific trade (from risk management plan)**
 - Specific contractor contingency**
 - How carried**
 - Use historical data for reference**

Time Performance Ratio



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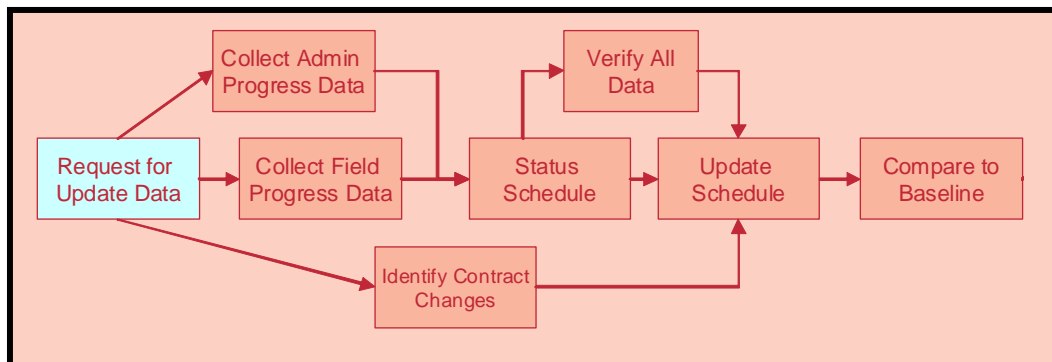


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- Establish Update process
 - Frequency
 - Data request and transmission
 - Validation
 - Process flowchart

Schedule Updating

- Frequency of Updates
- Data Collection
- Status Schedule
- Calculate
- Check for Out-of-Sequence Work
- Verify Schedule
- Analysis – On Time Completion
- Historical Trending & Statistics
- Analysis – Late Completion
- Reporting - Internal
- Narrative – External Reporting



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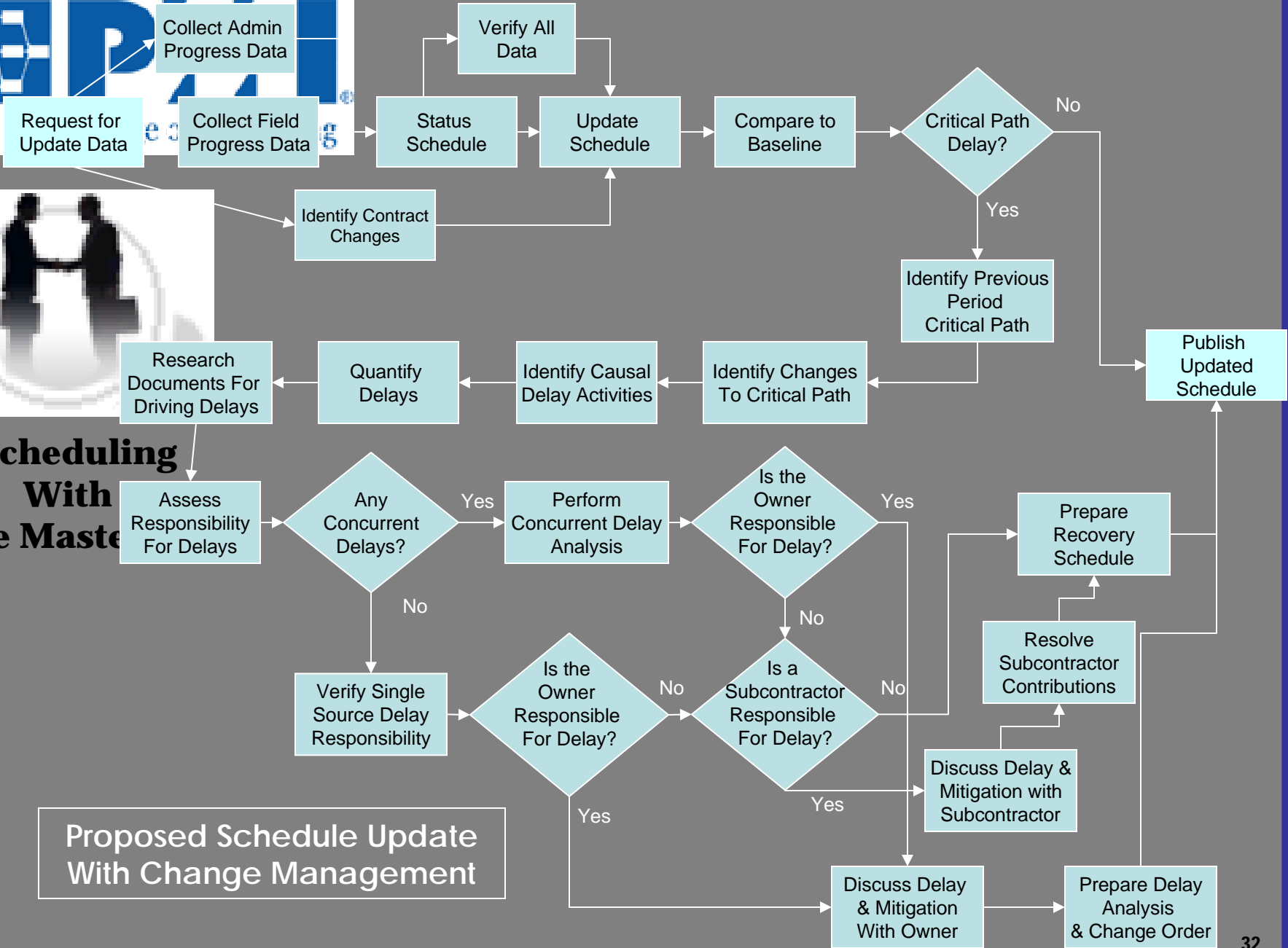


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- Change Management process**
 - Notification requirements
 - Methodology allowed
 - Process flowchart

Preparing a TIA

- Verify schedule (the current schedule)
 - Test for reasonableness
 - Ensure schedule logic models the actual project sequencing
 - Check for constraints
 - If constraints exist, establish methodology
 - Remove constraints, if possible
 - Insert logic to replace constraints
 - Verify accuracy of changes
 - Document use of methodology



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Proposed Schedule Update With Change Management

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- Recovery process**
 - Identify what logic changes are acceptable without formal approval**
 - Identify what constitutes a Revision requiring approval**
 - Provide process description or flow chart**

Step 3 Schedule Recovery

- Checklist ideas when recovery required
 - Resource Loading - Review Resources
 - Run resource comparison reports
 - Look for built-in contingency time
 - Filter by Areas
 - Look at Resource Table
 - Consider worker count in areas
 - Review CP in areas
 - Reallocate resources by CP by area
 - Load activities with Crews
 - Review Resource Table for 3 week look-ahead
 - Manually level crews to eliminate slippage
 - Discuss additional crews when stacked CP activities
 - Target areas and crews, don't just man-up

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18. Dispute resolution process

1. Review program for claims avoidance
 1. Reinforce planning for claims avoidance
 2. Identify specific program for claims avoidance during schedule updates and change management
2. Identify steps if change management process fails or stalls
3. Follow specifications
4. Provide time frames for stages in process
5. Provide process description or flow chart



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Conclusion

- **For success in Schedule Development, Schedule Design should be a completely different process**
- **Process done prior to Development**
- **Process and results documented**
- **Documentation done in formal Schedule Design Book**
- **Book used to provide continuity between schedulers or project managers**

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- **Resources**
 - See Lance Stephenson’s “Schedule Basis Memorandum” paper, also addresses schedule levels
 - See ACEi’s Total Cost Management
 - See PMBOK for Risk Management process
- **Recommendations**
 - Get involved with the CoS SEI Project developing Best Practices and Guidelines for Scheduling
 - Get involved with ACEi and the Recommended Practices development
 - Get involved with CMAA in the Time Management development



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Questions?

Recommendations?

War Stories?

Gripes?



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