

8th Annual PMICOS Scheduling Conference

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Why are Schedule Components Vital in One Industry and Useless in Another?

(Improving Industry Cross-Pollination by Classification of Schedule Types)

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Schedule Types

- Resources and leveling?
 - Crucial to IT
 - Leveling rarely used in construction
- Other examples
 - Earned Value
 - Risk Management
- How can schedulers communicate across industries?
- How do sectors and industries use scheduling?
- Can we categorize by common needs and component solutions?
- Can we provide an understanding of the differences between industry schedule use?
 - Allow better communications
 - Increase opportunity to spread innovation across all industries

Schedule Types

- Industry or segments of industries stagnate
 - Common buzz words
 - Fairly standardized scheduling methodologies
 - Common although unique needs
- Innovation
 - Common practices in one industry are innovative in others
 - Example: EVMS – originally defense, spread to commercial construction
- No wide categorization of scheduling types
 - Minimal cross-pollination
 - This type of conference is one of few ways

Schedule Types

- Our experiences reinforce this
 - Resources use
 - Dua
 - Extensive use of individual manpower resources
 - Resource leveling used widely
 - Resource driven schedules common
 - Carson
 - Wide use of crew manpower resources
 - Resource leveling only done manually
 - Resource driven schedules only used for what-if scenarios
 - Highly technical schedules – careful network development
 - Both require accurate total float values
 - Both require careful identification of critical and near-critical work
 - Both are subject to high penalty and legal risks for failure
 - Both deal in claims (which may explain this category)

- Scheduling Component Determinants
 - Scheduling techniques
 - Use of features of schedule software
 - Define schedule use
 - Appear to unify sectors and industries

 - Investigation into the use of various components
 - What drives the use in various industries?
 - How do they use them?

- Scheduling Component Determinants

- Level of detail of the schedule
- Frequency of schedule updates
- Resource data and techniques used
- Activity level data collected in updates
- Project participants (categories monitored in schedules)
- Scheduling components
- Drivers for update monitoring and analysis
- Primary project management constraint
- Schedule accuracy

- Scheduling Component Determinants
 - Level of detail of the schedule
 - Function of how schedule is developed
 - Bottom up produces higher level of detail
 - Top down produces lower level of detail
 - Based on needs as well
 - Reporting to senior management
 - Managing field resources
 - Managing engineering resources
 - General project management
 - Direct management of contractors and resources

- Scheduling Component Determinants
 - Frequency of schedule updates
 - Hourly level monitoring
 - Plant maintenance and shutdown
 - Engineering
 - Software design
 - Weekly monitoring
 - Management of field resources
 - Short interim planning
 - Monthly monitoring
 - Management and client reporting
 - Overview of separate system of short interim planning

- Scheduling Component Determinants
 - Resource data and techniques used
 - Area of wide variance
 - Individual resource management
 - Generally large counts of resources
 - Requires equivalence in resource, such as engineering designers or piping installers
 - Individual resource consumption is large driver of progress
 - Enables ability to level automatically
 - Crew resource management
 - Lowered use of similar individual resources
 - Wider variation of resources comprising a crew
 - Easy to identify
 - Leveling is more likely to be done manually
 - Legal risks increase need to avoid resource leveling changes to CPM network

- Scheduling Component Determinants
 - Activity level data collected in updates
 - Actual resource data collected in detail
 - Yes, individual resource data
 - » Generally supports individual resource assignments
 - No, crew/equipment resource data
 - » Use resources to validate duration estimates, progress
 - Comparison to planned resources
 - Captured for job cost monitoring
 - Captured for claims avoidance or analysis
 - Updating methodology
 - Percent complete (cost)
 - Remaining duration (time)
 - Control of resources depends on need
 - Subcontractors – less control of individual resources
 - Direct hire employees – more control of individuals

- Scheduling Component Determinants
 - Project participants (categories monitored in schedules)
 - Labor only
 - Engineering, IT
 - Labor, equipment, materials
 - Transportation, bridge building
 - Labor, equipment, materials, subcontractors
 - Military construction
 - High subcontractor involvement
 - Reduces ability to manage individual resources

- Scheduling Component Determinants
 - Scheduling components focus
 - Labor resources
 - Engineers, materials quantities
 - Costs resources
 - Used for billing
 - Earned value – Earned schedule
 - Needs both cost and time information for accuracy
 - Correlation with project budget
 - Generally used in areas of higher maturity in cost/time correlation
 - WBS usually tied to cost control accounts
 - Often deliverables based

- Scheduling Component Determinants
 - Drivers for update monitoring and analysis
 - Critical path slippage
 - Based on penalties for late completion
 - High risk increases need to monitor
 - Claims culture due to case law from litigation
 - Near-critical path slippage close in importance
 - Milestone monitoring
 - Near-critical path monitoring equally important
 - Milestones tied to performance or other projects
 - Often called gates and completion launches other phases
 - Activity monitoring
 - Risk of inefficiency drives monitoring to activity level
 - Associated with large resource type projects
 - Disruption risks

- Scheduling Component Determinants
 - Primary project management constraint
 - Triple constraints – time, cost, scope/quality
 - Sometimes add scope and risk
 - Primary driver helps categorize schedule types
 - Alignment of primary drivers among the project participants increases probability of success
 - » A quality oriented contractor working for a cost oriented owner will likely fail financially
 - » A cost driven contractor working for a quality oriented owner will likely end in disputes related to quality
 - » A time driven contractor works well with a cost oriented owner, but less well with a quality oriented owner
 - Projects may have multiple drivers but usually one is primary

- Scheduling Component Determinants
 - Schedule accuracy
 - Smallest time period used for planning
 - Hour
 - » Plant maintenance and shutdown, software design
 - Day
 - » Military or commercial construction; monitored to the day but updated to month
 - Week
 - » Project documents generated daily or weekly for record purposes
 - Month
 - » Common, but overview use
 - Longer
 - » Long term projects, program monitoring schedules

- Concept of the Schedule Matrix

- Maps categories of schedules with industries/sectors
- Designed to facilitate ordering of scheduling into appropriate types based on use of schedule and component determinants
- Based on a number of industries

Commercial construction

Military construction

Hospital construction

Power plant construction

Maintenance and shutdown of
factories and plants

Defense projects

Oil and gas projects

Manufacturing

Energy projects

Shipbuilding and aerospace
construction

Pharmaceutical projects

Software development projects

Information technology projects

Engineering projects

Transportation construction

High-rise construction

Wide-rise housing construction

Financial projects

- Comments about Schedule Matrix
 - Worthy of a scheduling industry-wide study
 - Some sectors or industries operate with different schedule types at different times in the life-cycle
 - Pharmaceutical
 - Research – Critical Chain
 - Regulatory phase – Milestones only
 - Engineering – EVMS
 - Construction – EVMS
 - Matrix study requires development of a taxonomy

- **Compile Matrix Markers into Summaries**
 - Study of schedule types requires combination of schedule techniques and component determinants
 - Results in a Schedule Type Matrix

- Schedule types fall into 11 broad categories
 - Technically-oriented scheduling
 - Complex phasing-oriented scheduling
 - Recovery-oriented scheduling
 - Large resource-oriented scheduling
 - EV-oriented scheduling
 - Rolling wave oriented scheduling
 - Timesheet-oriented or small resource-oriented scheduling
 - Location-oriented scheduling
 - Program-oriented overview scheduling
 - Financial management oriented scheduling
 - Forensic scheduling

- Schedule types fall into 11 broad categories
 - Technically-oriented scheduling
 - Used where litigation requires highly technical network calculations
 - Analysis of delay and disruption becomes an area of expertise, including expert witness testimony
 - Risk of time related disputes results in claims
 - Claims drive the preparation, review and approval of schedules
 - Resources limited to macro level
 - Used to verify duration calculations
 - Helps identify benchmark against which to analysis progress and measure delay
 - Specifications often require resource loading
 - Examples: military and commercial scheduling

- Schedule types fall into 11 broad categories
 - Complex phasing-oriented scheduling
 - location coordination
 - Logistics of resource movement
 - Component assembly of systems
 - Also carries needs of technical scheduling
 - May be combined with technically-oriented and large resource – oriented scheduling
 - Examples: hospital construction, process plants

- Schedule types fall into 11 broad categories
 - Recovery-oriented scheduling
 - Costs of each day of delay mount into millions of dollars
 - Main goal is to mitigate all delay to meet milestones
 - Highly important to capture full scope of work
 - Often spawns rapid response teams
 - Project participants may include multiple parties with highly evolved coordination requirements to avoid disruption
 - Airport renovation, shut down and maintenance of power plants

- Schedule types fall into 11 broad categories
 - Large resource-oriented scheduling
 - crosses several industries or sectors
 - Huge resources, mostly labor, must be planned and managed
 - Requires high level of detail in monitoring of those resources
 - Resources drive production
 - Examples: defense, some phases of oil and gas, manufacturing

- Schedule types fall into 11 broad categories
 - EV-oriented scheduling
 - Separated due to method of monitoring, EVMS
 - Focused on budgets and metrics
 - Need for identification of the critical path not as important
 - Milestone slippage must be monitored
 - Examples: large energy projects, ship and plane building, some defense, some phases of pharmaceutical

- Schedule types fall into 11 broad categories
 - Rolling wave oriented scheduling
 - Project cycles are very long
 - Different phases of the project have vastly different available information
 - Ability to plan in detail for work to be done in future is limited
 - Individual project phases may fall into other types of scheduling
 - Examples: pharmaceuticals, research and development

- Schedule types fall into 11 broad categories
 - Timesheet-oriented or small resource-oriented scheduling
 - Small resource oriented
 - Schedules are used to manage personnel and actual costs
 - All about managing individuals
 - Examples: IT projects, software development, engineering

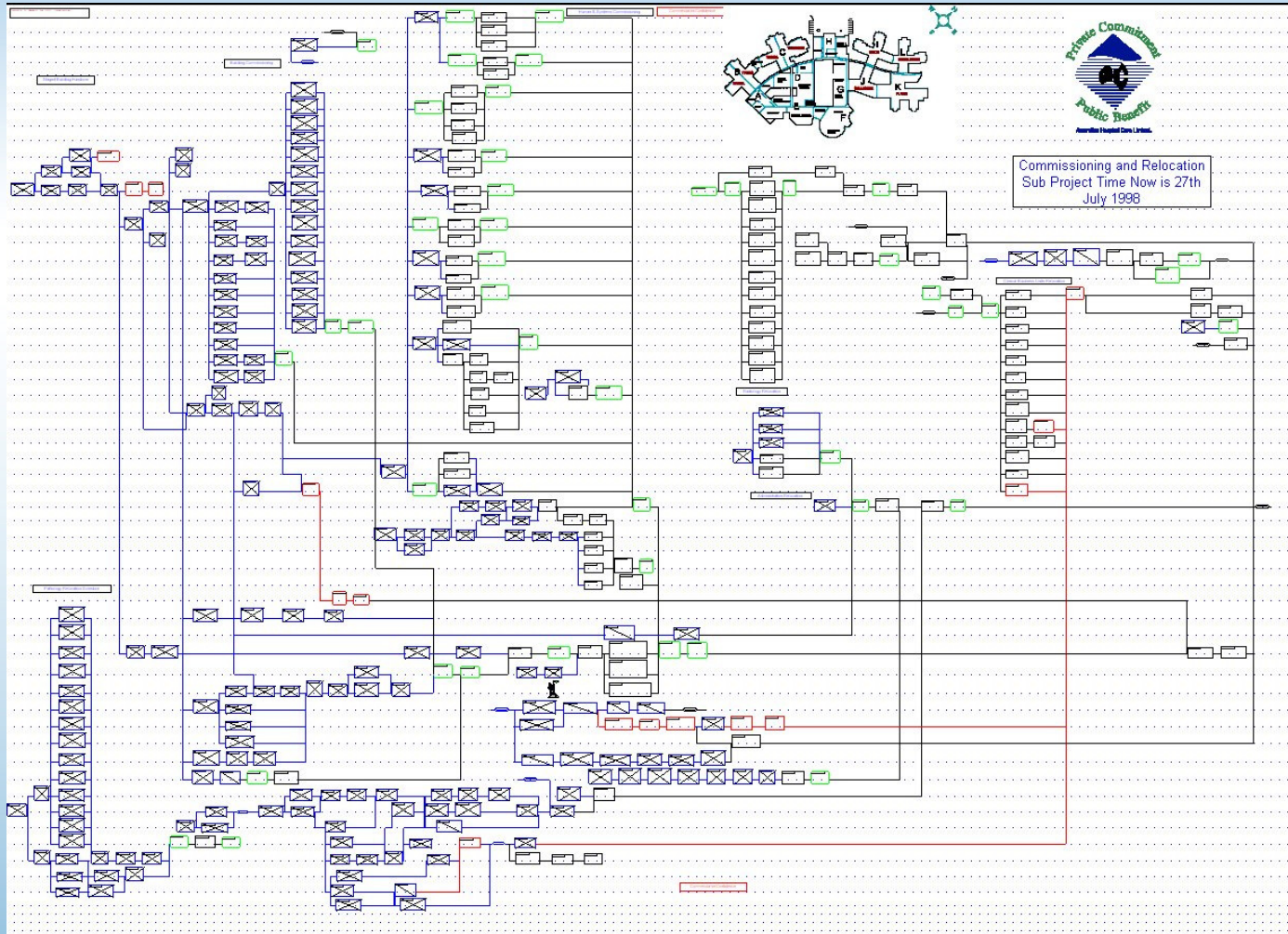
- Schedule types fall into 11 broad categories
 - Location-oriented scheduling
 - Defined by many repetitive fragments
 - Logic is used to sequence work within specific locations of the project
 - Sometimes combines velocity diagrams and CPM
 - Linear scheduling is popular for this type of scheduling
 - Examples: transportation-type projects such as utilities, roadways, bridges, tunnels, and facilities-type projects such as high-rise office buildings, condominiums, apartments

- Schedule types fall into 11 broad categories
 - Program-oriented overview scheduling
 - Schedules have both resource and delivery constraints
 - Budgets span across years
 - Sections of development opened, completed, closed
 - Work is also repetitive so low level of detail works
 - Often phases operate under more detailed schedules
 - Completion dates are not rigid, so critical path slippage is not as important
 - Examples: “wide-rise” housing industry, general program master schedule monitoring

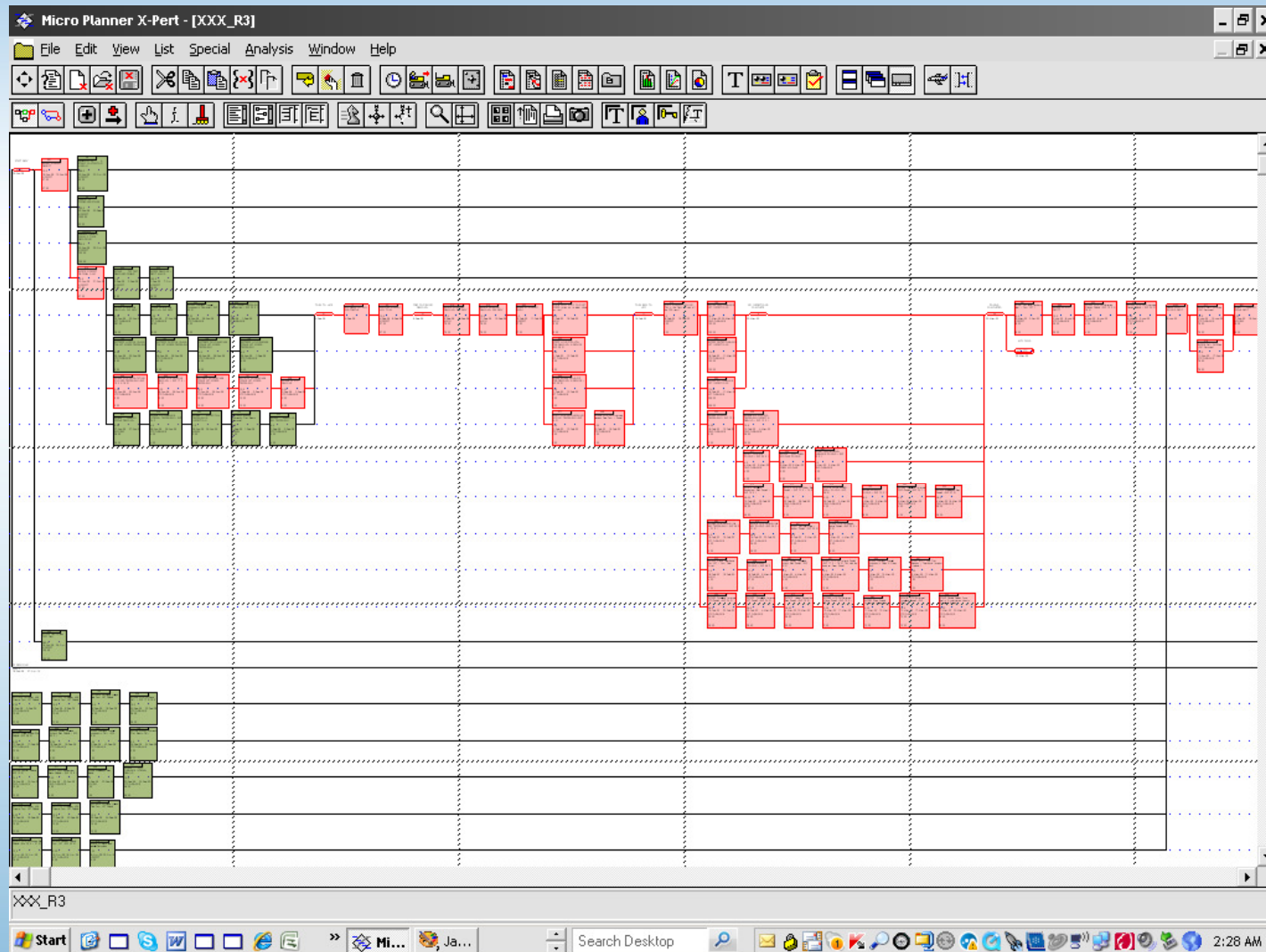
- Schedule types fall into 11 broad categories
 - Financial management oriented scheduling
 - Used to plan and monitor business acquisitions, restructuring and spin offs of divisions
 - CMP methodology not important
 - Schedule used to direct wide range of participants
 - Requires no real monitoring of critical path or float
 - Examples: restructuring of energy companies, banks, insurance companies

- Schedule types fall into 11 broad categories
 - Forensic scheduling
 - Schedules used to determine causality and identify responsibility
 - Assess liability and resolve time-related delay and disruption
 - Used in conjunction with technical-, complex phasing-, large resource- and location-oriented types
 - Examples: dispute resolution, claims analysis

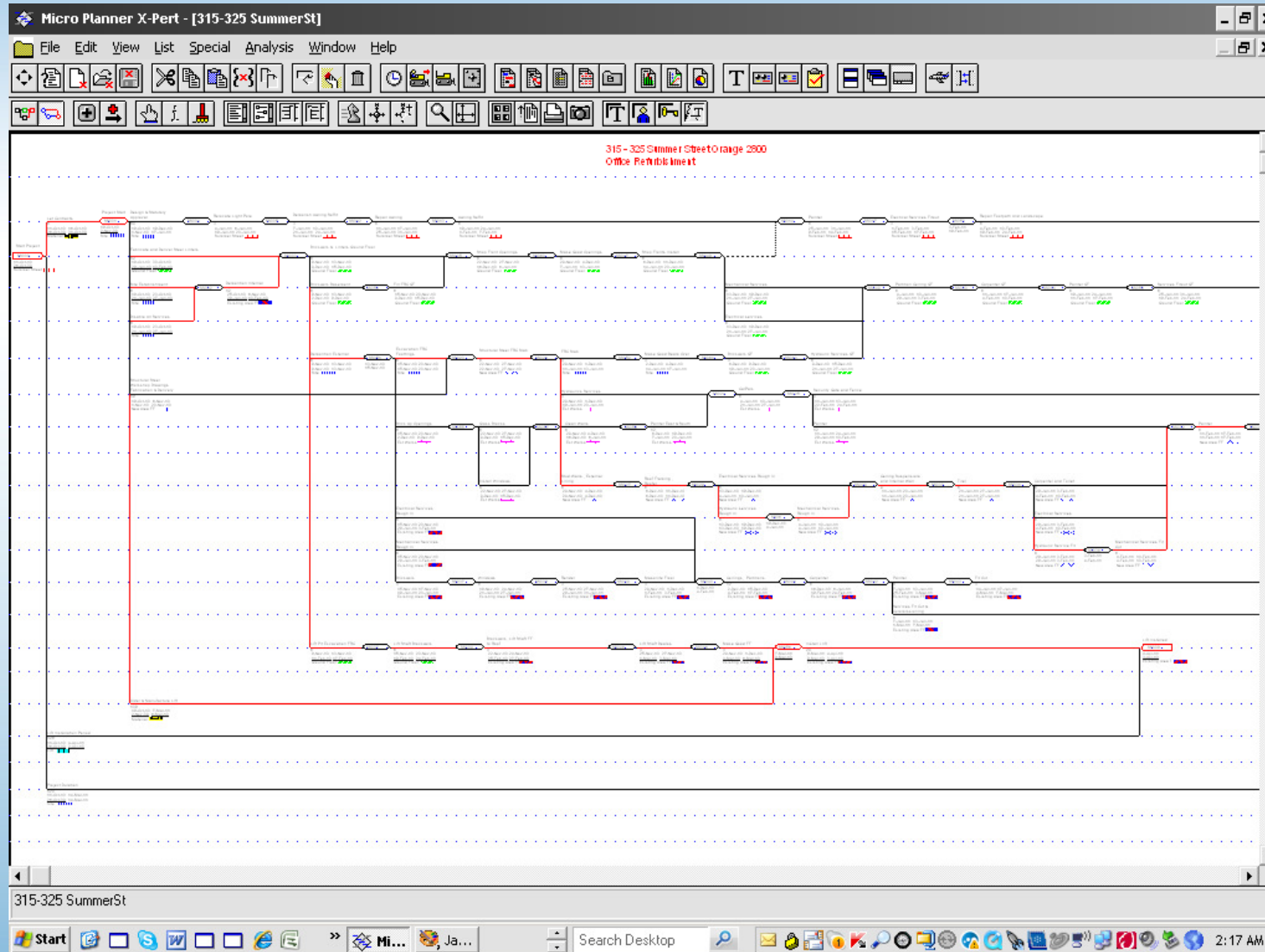
THE PROJECT PLAN

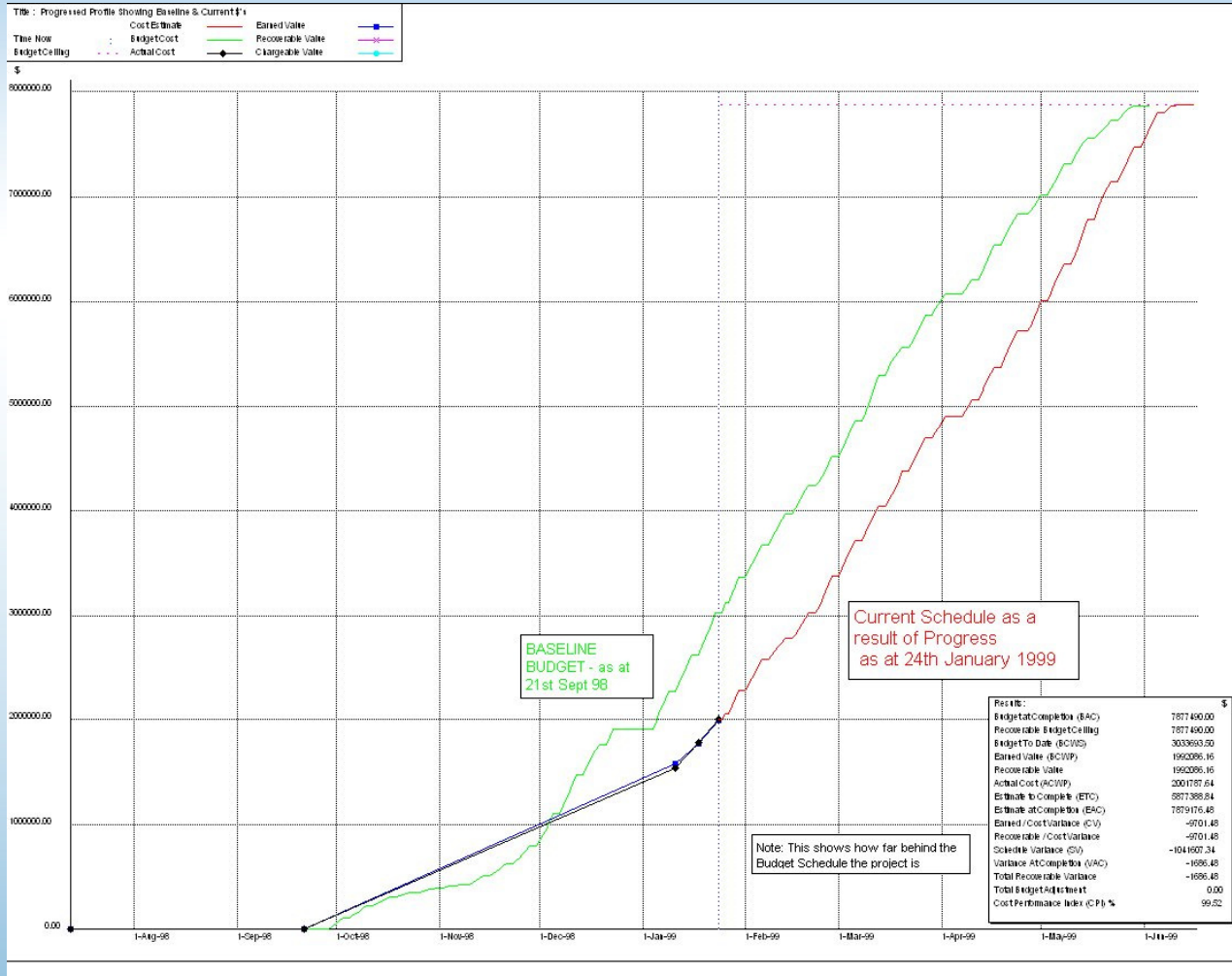


PDM SHOWING CRITICALITY

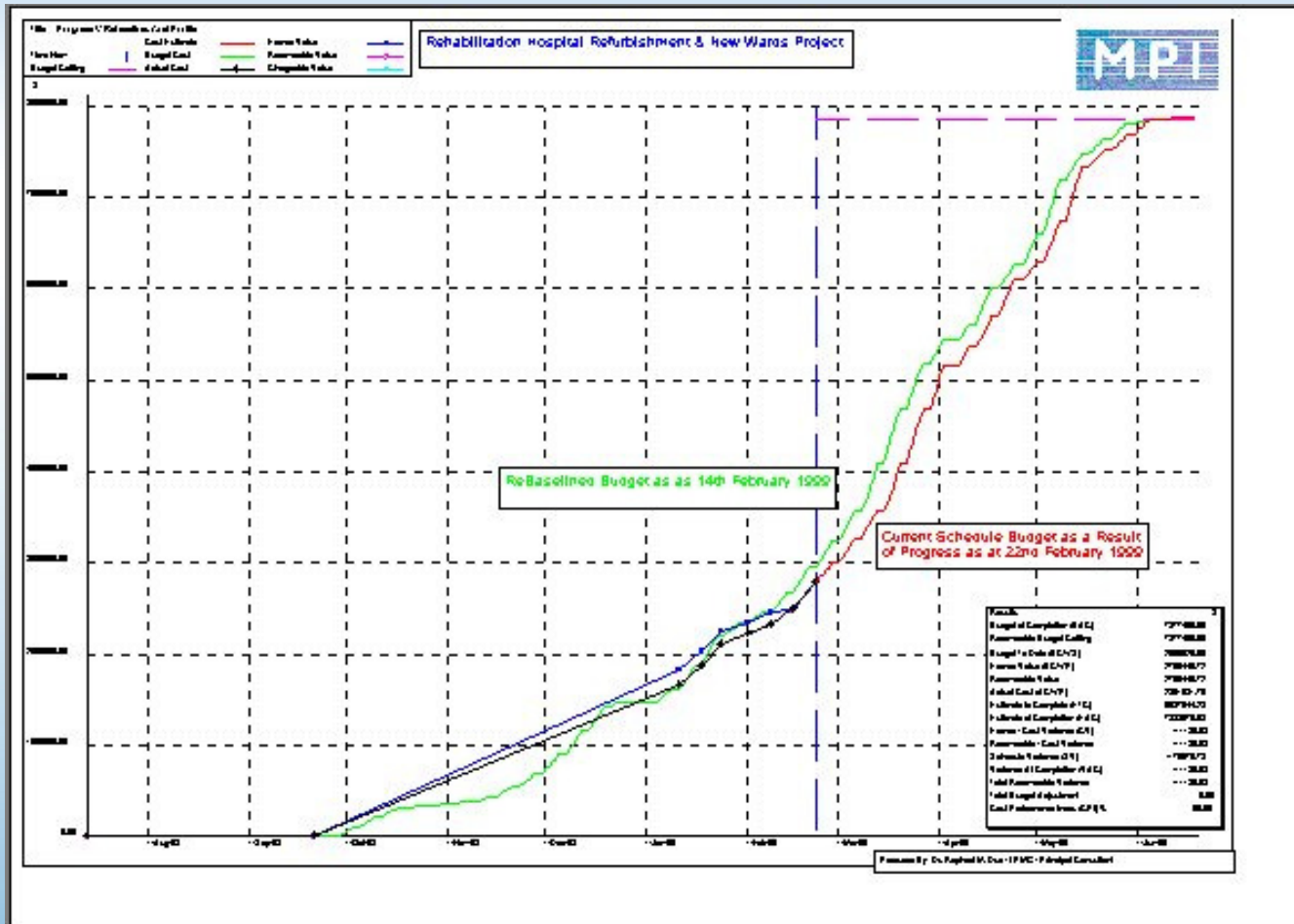


ARROW DIAGRAM

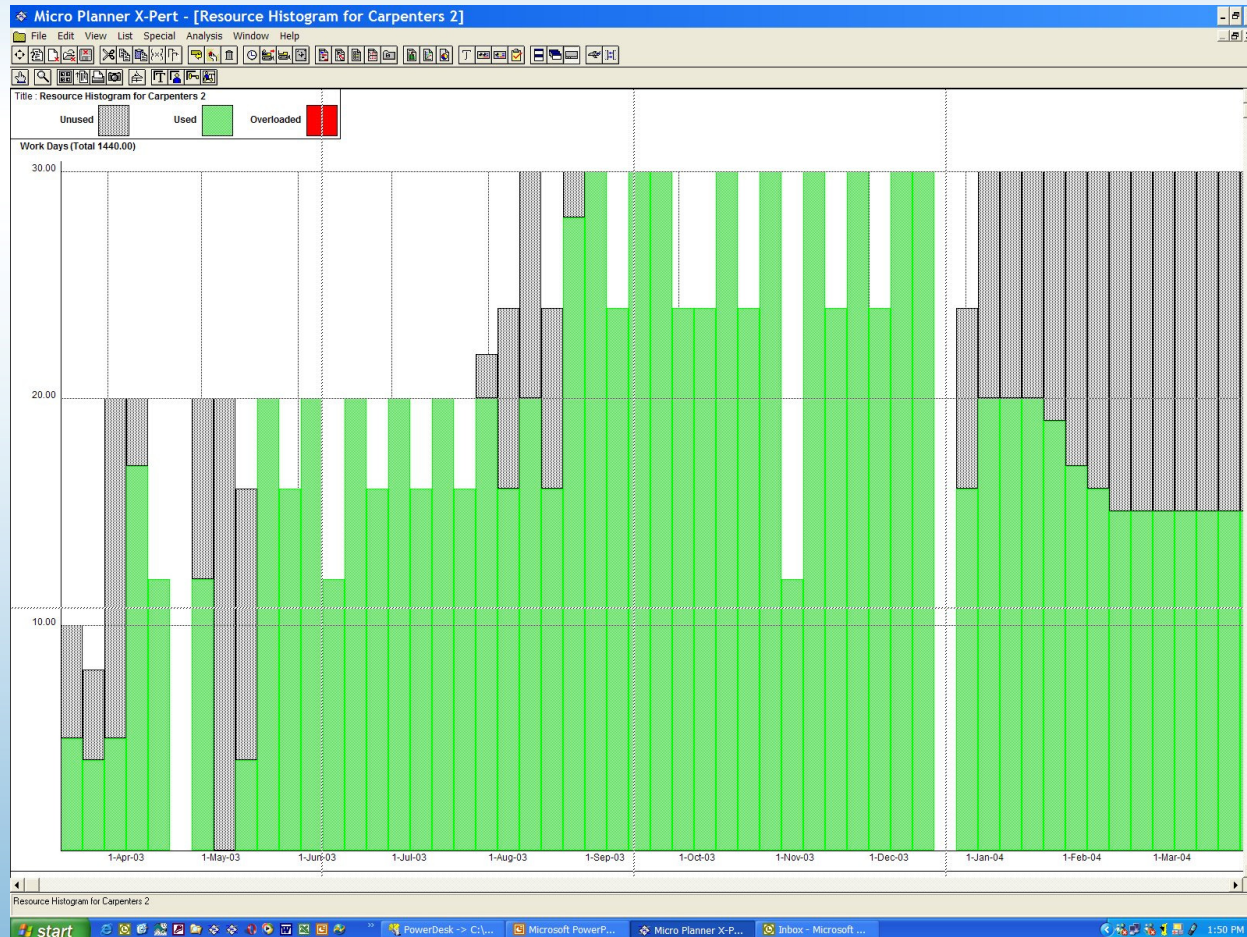




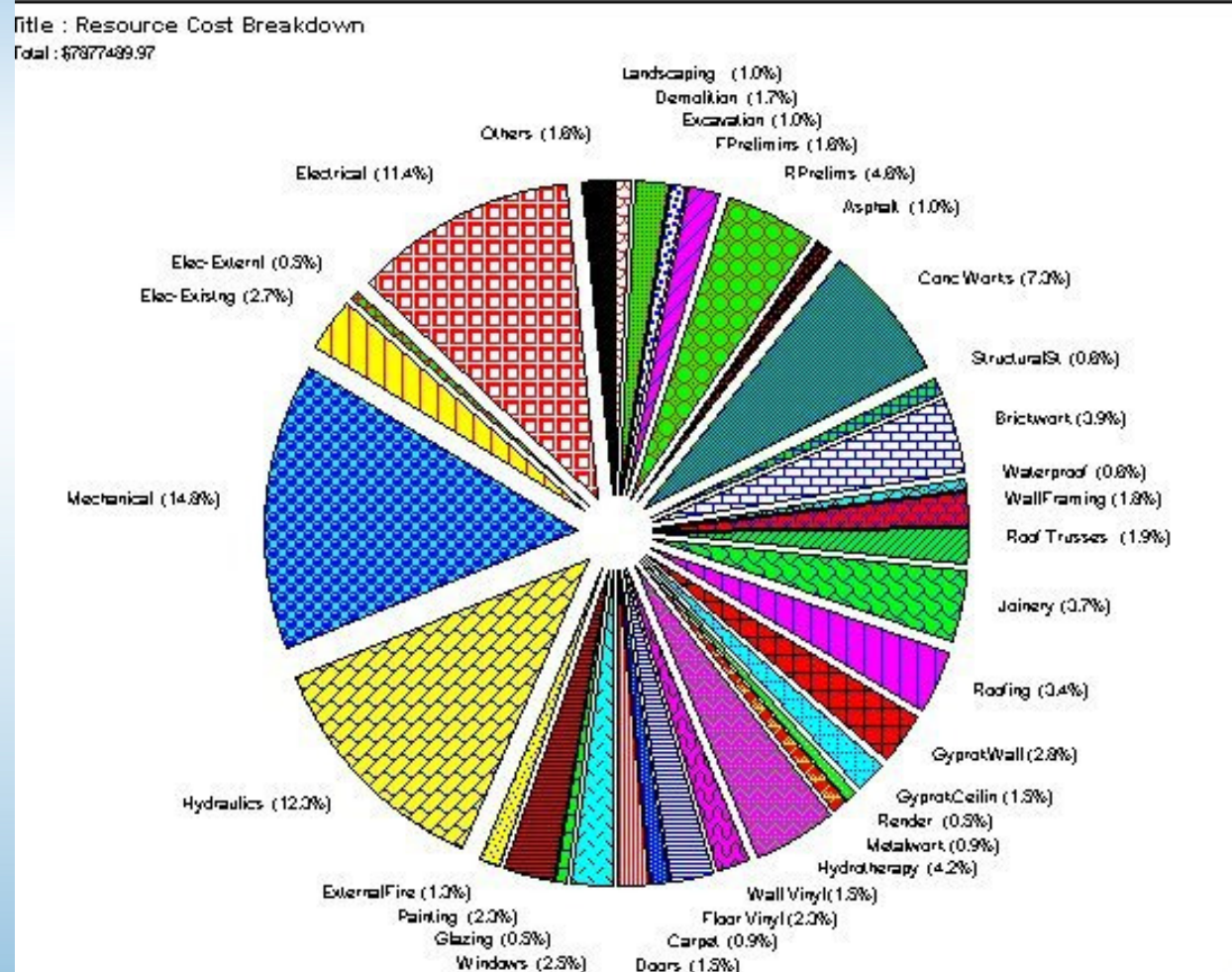
PROGRESSED REBASELINED COST CURVE



RESOURCE LIMITED SCHEDULE HISTOGRAM



RESOURCE DISTRIBUTION PIE CHART



BUDGET VARIANCE BY WBS

Date : 5-Jul-01 Project Re-Baselined on 14th February 1999
 Time Now : 15-Mar-99
 Project : **Lady Davidson Refurbishment & New Wards**
 Output : **Budget variance Report**
 Sheet : 1 of 1



WBS ID	Description	Budget Cost	Budget Adjust	Total Budget	Estimate to Complete	Gross Actual	Estimate at Completion	Variance
LDH	Project i98023 - Lady Davidson Rehab	7877490.00	0.00	7877490.00	4640507.96	3245470.51	7885978.47	-8488.47
LDH2	PRE-ADMINISTRATION	487000.00	0.00	487000.00	167394.00	322032.00	489426.00	-2426.00
LDH3	WORK BY OTHERS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LDH4	REHABILITATION BUILDING	1734236.00	0.00	1734236.00	0.00	1740298.49	1740298.49	-6062.49
LDH7	BUILDING WORKS	5346529.00	0.00	5346529.00	4231788.96	1114740.02	5346528.98	0.02
LDH71	STEPDOWN WARD & ACCESS CORRIDOR	1276446.00	0.00	1276446.00	612485.75	663960.24	1276445.99	0.01
LDH72	EAST WARD	1433466.00	0.00	1433466.00	1201186.21	232279.79	1433466.00	0.00
LDH73	WEST WARD	1541146.00	0.00	1541146.00	1322646.00	218499.99	1541145.99	0.01
LDH74	ADMIN. BUILDING & ACCESS CORRIDOR	1058271.00	0.00	1058271.00	1058271.00	0.00	1058271.00	0.00
LDH75	Waste Management Building	15000.00	0.00	15000.00	15000.00	0.00	15000.00	-0.00
LDH76	Whitegoods	17200.00	0.00	17200.00	17200.00	0.00	17200.00	0.00
LDH77	Museum	5000.00	0.00	5000.00	5000.00	0.00	5000.00	0.00
LDH8	ROADWORKS & PAVINGS	112000.00	0.00	112000.00	112000.00	0.00	112000.00	0.00

Produced By: Dr. Raphael M. Dua - LPMG - Principal Consultant

Schedule Type Matrix

Schedule Type Matrix	Schedule Types - Crosses Industry or Segments of Industry										
Schedule Technique & Component Determinants	Technical	Phasing	Recovery	Large Resource	Earned Value	Rolling Wave	Small Resource	Location - Linear	Program	Financial Mgmt.	Forensic
Examples:	Commercial Construction	Hospitals, Process Plants	Plant Shutdown & Maintenance	Defense, Oil/Gas, Manufacturing	Energy, Defense, shipbuilding, Pharma	Pharmaceuticals	IT, Software Development, Engineering	Transportation, High-Rise Construction	Wide-Rise Housing Industry	Also called Mgmt Accounting	Dispute Resolution & Claims Analysis
Level of detail											
Overview Management for Reporting	x	x									
Resource Management		x	x	x	x	x	x	x	x		x
Detailed Labor Management		x	x	x	x		x				x
Detailed Subcontractor Management	x	x						x	x		x
Frequency of Updates											
Hourly											
Daily		x	x				x				x
Weekly	x	x	x	x	x		x	x			x
Monthly	x	x		x	x	x		x	x	x	x
Larger Period											
Resource Data Managed											
No resources	x										
Individual resources (by name)							x				
Role resources (by position)		x		x	x				x		x
Crew resources (by trade crew)	x	x	x					x			x
Cost resources	x	x	x	x	x	x		x	x	x	x
Quantity resources	x	x	x	x	x	x		x	x		x
Leveling of resources commonly performed			x	x	x	x			x		
Activity Level Data Collected in Updates											
Resource Time Consumed	x	x	x	x	x	x	x	x	x		x
Resource Quantity Consumed	x	x	x	x	x			x			x
Time Remaining	x	x	x					x			x
Percent Complete	x			x	x	x	x		x	x	
Project Participants											
Labor only							x				
Labor and Materials						x					
Labor, Materials, Equipment				x	x						
Labor, Materials, Equipment, Subcontractors	x	x	x					x	x		x
Subcontractors only						x					

Schedule Type Matrix

Schedule Type Matrix	Schedule Types - Crosses Industry or Segments of Industry										
Schedule Technique & Component Determinants	Technical	Phasing	Recovery	Large Resource	Earned Value	Rolling Wave	Small Resource	Location - Linear	Program	Financial Mgmt.	Forensic
Examples:	Commercial Construction	Hospitals, Process Plants	Plant Shutdown & Maintenance	Defense, Oil/Gas, Manufacturing	Energy, Defense, shipbuilding, Pharma	Pharmaceuticals	IT, Software Development, Engineering	Transportation, High-Rise Construction	Wide-Rise Housing Industry	Also called Mgmt Accounting	Dispute Resolution & Claims Analysis
Scheduling Components											
Resources - Labor											
Resource loading	x	x	x	x	x		x	x	x		x
Resource leveling		x	x	x	x		x		x		x
Resource driving			x	x			x		x		x
Consumed labor	x	x	x	x	x		x	x	x	x	x
Resources - Costs											
Sell costs	x	x						x	x	x	
Planned costs	x	x	x	x	x	x	x	x	x		x
Actual costs			x	x	x	x	x			x	x
Resources - Quantity											
Planned quantities		x	x	x	x						x
Consumed quantities		x	x	x	x						x
Earned Value Orientation											
Costs	x	x				x		x	x	x	x
Quantities			x	x	x						x
Labor			x	x	x		x				x
Uses Earned Schedule	x							x			
Correlation with Budget											
WBS	x	x	x	x	x	x	x	x	x	x	x
Cost Accounts		x	x	x	x	x	x			x	x
Primary Driver for Update Monitoring/Analysis											
Critical Path Slippage	x							x			x
Near Critical Path Slippage											
Non-Critical Path Slippage											
General Activity Slippage			x								

Conclusions

- Topic needs a taxonomy developed
 - Should be formal study by industry association
 - Talking to Planning Planet about engaging with their 30,000 member base
- Common scheduling techniques from one industry or sector can be innovative in another
- Discussions will improve communications among different industries and sectors
- Ultimate goal is cross-pollination of different industries to improve the quality and value of scheduling

Thank You
For Attending!