



Progress Evaluation Applying Earned Value Management in the Construction of Commercial Buildings

**Presented by
Planning & Management Services, Inc
Federal Way, WA (near Seattle)**

Who We Are

Planning & Management Services, Inc “P&M”

At P&M, we specialize in project delivery and project controls including capital program and project solutions. We are involved in the project delivery from planning throughout design, permitting and construction.

We define, implement and staff Project Management Offices (PMOs), which include Tools and Procedures for Project Controls and Program Management. We provide Scheduling; Cost; Risk and Forensic Claims Management services.

Solutions From A-Z

Determining the client's precise needs is what our skilled consultants do in order to provide flexible, scalable and personalized project delivery solutions which is more than just standard solutions. This ensures a harmonic integration of new technology, people, and processes from A-Z.

Our project controls SQL/VB based proprietary software *Myriad* supports the owner, contractor and designer with project delivery and project controls.

Case Study

- This case study focuses on applying “Earned Value” management in the construction of commercial projects
- The project example is based on the Port of Seattle (POS) - Terminal 91 Cruise Ship Building Project (T91)
 - This \$70M project consists of construction of a 144,000 square foot, two-story cruise terminal building supported by augercast piles
 - Significant consideration and analysis of scope, schedule, and budget issues was required to determine whether to proceed, and if so, on what basis
 - This required comprehensive risk evaluation regarding scope, schedule, and cost issues and a documented recommendation
 - The T91 project had significant challenges that had to be managed and coordinated
 - The construction was occurring on sites with on-going operations and the budget and schedule was tight



Case Study - continue

- The construction project was complex with:
 - tight schedule constraints
 - significant structural changes and related delays
 - significant delay encountered during project initiation; however completion date did not change
 - increased visibility from stakeholders (POS commission, public, media, etc)
 - multiple construction contracts
 - complex coordination with tenant and move in activities
- This invited several unforeseen constraints and inefficiency impacts that could not be incorporated into contract documents.

Challenge

- When a project schedule is **tight** it is not unusual that project stakeholders begin asking questions like:
 - will the project complete on time
 - have you considered
 - what assumptions have been made in the construction schedule
 - are updates to the construction schedule accurate and realistic
- The discussions and explanations become **Complex** and the **Credibility** can become questionable - which is every Project Manager's worst nightmare!
- Provide an **accurate** picture of project status as well as identify potential problem areas

Solution

- With the complexity of the project and the tight schedule constraints, the level of detail a typical CPM schedule would provide was not sufficient to provide accurate project status.
- At the Port of Seattle we introduced “Earned Value Management” to the construction progress evaluation as the **Solution to the Problem**.
- The modified approach has shown **SIGNIFICANT** results in the increased **Visibility** and **Credibility** of the Project Controls.

Summary

- Comparison of Planned versus Earned
- Contractor required to provide a resource loaded construction schedule
- Leverage the schedule to determine resource hour distribution
 - For finish work activities, using the square footage of each room / area determined the weights to allocate resource hours
 - Quantity takeoffs were completed for Architectural, Mechanical, Electrical and Plumbing items. Each item / device / fixture comprised a system represented in the construction schedule as multiple activities
- Method used for tracking progress based on visual inspection of work activity or physical quantities installed
- From this information we were able to provide
 - accurate progress status on a weekly and monthly basis
 - deviation metrics comparing Earned Value and Schedule variances
 - extrapolation of project completion as well as completion of intermediate major construction milestones

Highlights

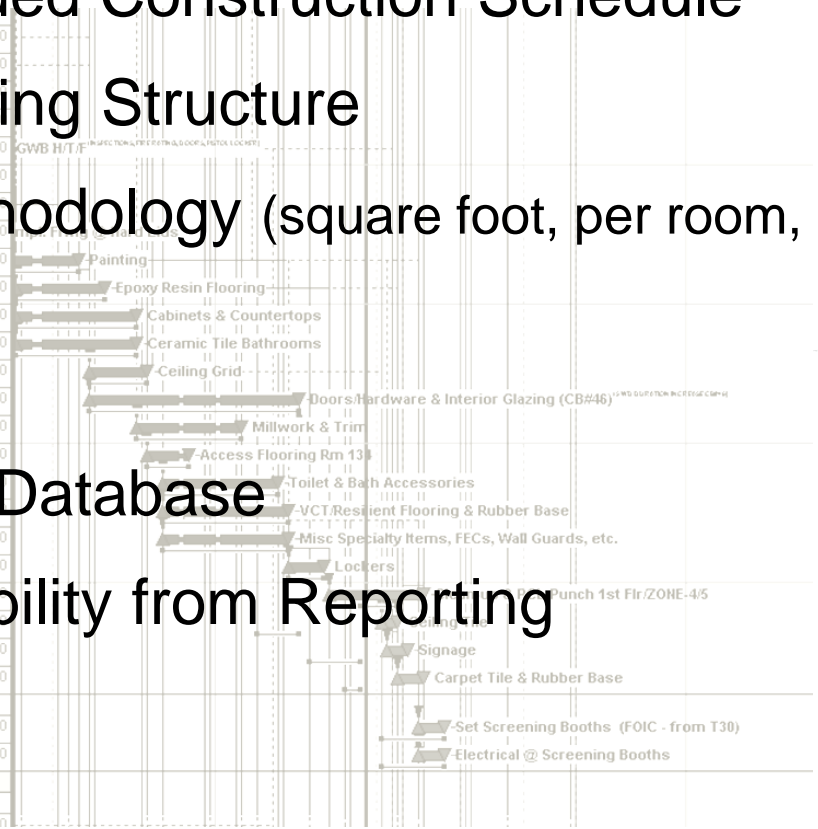
- 144,000 square foot, two-story cruise terminal building
- 119 Rooms / areas tracked
- Greater than 660 activities in the schedule
- Major disciplines involved during interior construction included in the table

| Discipline | |
|--------------------------------------|----------------------------------------|
| Plumbing - Plumbing RI/Fixtures/Trim | |
| HVAC - HVAC RI/Trim/DDC Control | |
| Electrical | |
| | Main Elec Rm Equip/Gear |
| | Substation Wiring/Equip/Gear/Panels |
| | Light Fixtures |
| | Electrical Trim |
| Elevator | |
| Escalator | |
| Low Voltage System | |
| | LV Systems Wiring |
| | Fire Alarm |
| | Security |
| | CCTV Camera |
| | Telephone / Data |
| Finish | |
| | GWB H/T/F |
| | Painting |
| | Finish Flooring – Stain, VCT, & Carpet |

Methodology

- Start from a Resource Loaded Construction Schedule
- Analyze Schedule and Coding Structure
- Determine Distribution Methodology (square foot, per room, zone, area, etc)
- Perform Site Walk
- Leverage the Power of the Database
- Provide Visibility and Credibility from Reporting

| | | | | | | | | |
|---------------------------------------------|-----------------------------------------------|----|---|-----|-----|----------|----------|--------|
| 05440-145 | MS Framing | 15 | 0 | | 100 | 16JUN08A | 05AUG08A | 70,000 |
| 08100-145 | HM Frames | 10 | 0 | | 100 | 14JUL08A | 12SEP08A | 20,000 |
| 06100 | | | | | | | | |
| 07215-145 | | | | | | | | |
| 09251-145 | GWB H.T.F | 15 | 0 | | 100 | 15SEP08A | 21NOV08A | 70,000 |
| 09252-145 | Greenboard (Tile Areas) | 4 | 0 | | 100 | 29SEP08A | 02OCT08A | 20,000 |
| 09252-145 | | | | | | | | |
| 05441-145 | | | | | | | | |
| 09910-145 | Painting | 11 | 0 | | 100 | 18NOV08A | 05DEC08A | 74,800 |
| 09960-145 | | | | | | | | |
| 06410-145 | Cabinets & Countertops | 15 | 0 | | 100 | 24NOV08A | 10DEC08A | 10,000 |
| 09300-145 | Ceramic Tile Bathrooms | 15 | 0 | | 100 | 24NOV08A | 16DEC08A | 90,000 |
| 09510-145 | | | | | | | | |
| 08120-145 | Doors | 0 | 0 | | 100 | 08DEC08A | 18DEC08A | 25,000 |
| 06230-145 | Millwork & Trim | 12 | 0 | | 100 | 17DEC08A | 05JAN09A | 25,000 |
| 09690-145 | Access Flooring Rm 134 | 5 | 0 | | 100 | 19DEC08A | 26DEC08A | 0 |
| 0172-145 | Toilet & Bath Accessories | 0 | 0 | | 100 | 08DEC08A | 08DEC08A | 20,000 |
| 09691-145 | | | | | | | | |
| 10250-145 | Misc Specialty Items, FECs, Wall Guards, etc. | 10 | 0 | | 100 | 22DEC08A | 14JAN09A | 15,000 |
| 10505-145 | Lockers | 5 | 0 | | 100 | 15JAN09A | 21JAN09A | 15,000 |
| 01999-145 | | | | | | | | |
| 09511-145 | Ceiling | 0 | 0 | | 100 | 08DEC08A | 08DEC08A | 0 |
| 10560-145 | Signage | 8 | 4 | -21 | 0 | 03FEB09 | 06FEB09 | 10,000 |
| 09681-145 | Carpet Tile & Rubber Base | 3 | 3 | -21 | 0 | 05FEB09 | 09FEB09 | 10,000 |
| T30 ITEMS | | | | | | | | |
| 13100 | Set Screening Booths (FOIC - from T30) | 10 | 5 | -21 | 0 | 09FEB09 | 13FEB09 | 10,000 |
| 16611-145 | Electrical @ Screening Booths | 10 | 5 | -21 | 0 | 09FEB09 | 13FEB09 | 80,000 |
| ZONE 1 (Grids 1-2) - Crew/Break/Toilets (1) | | | | | | | | |
| MEP | | | | | | | | |
| 115400-110 | Plumbing/Piping R4 Overhead | 16 | 0 | | 100 | 03JUN08A | 09JUN08A | 17,000 |



Analyze Schedule

- Analyze Schedule and Coding Structure
 - WBS and activity coding structure will help determine structure for updating information
- Resource Loaded Construction Schedule
 - Understand how resource hours are distributed per WBS element as well as throughout the project lifecycle

WBS L1 WBS L2

All Areas/Floors

All Areas/Zones

Milestones & Submittals

Milestones

Pre-Construction Submittals & P

Other Submittals

Key Long-Lead Submittal/Procure

Sitework / Utilities

Cbs / Changes / Etc.

Erosion Control

Sitework / Utilities

Site Improvements

Foundation

Foundations / Sogs

Cbs / Changes / Etc.

Structure & Exterior

Structural / Framing

Exterior

1st Floor Framing, Mep & Finish

Zones 4 & 5 (Grids 6-9) - Cbp/Cta, Mech/Elec (1)

Zone 1 (Grids 1-2) - Crew/Break/Toilets (1)

Zones 2 & 3 (Grids 2-6) - Baggage Lay-Down (1)

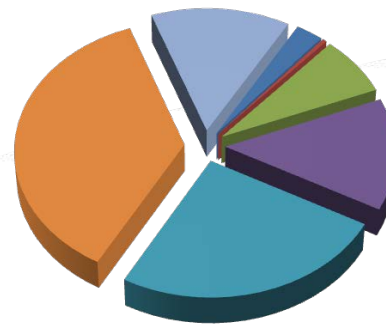
Zone 6 (Grids 9-12) - Entry Lobby

2nd Floor Framing, Mep & Finish

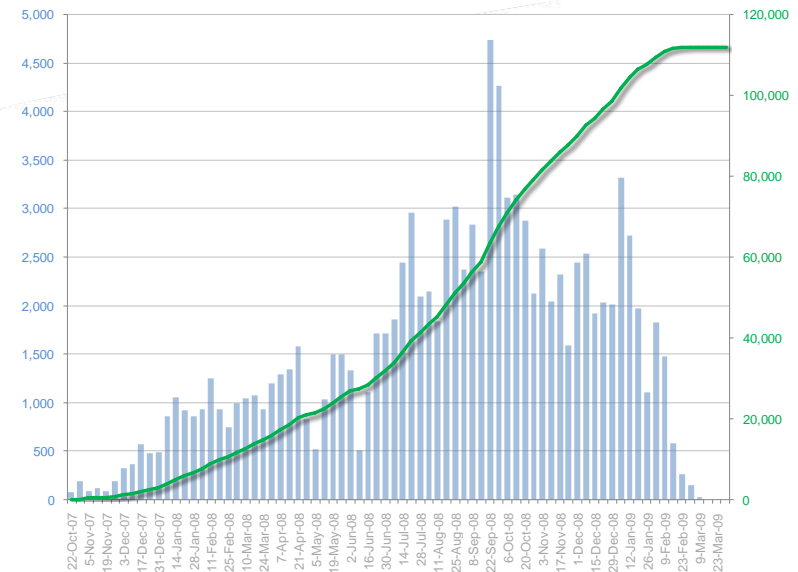
Zone 1 (Grids 1-2) - Vestibules (2)

Zones 2 & 3 (Grids 2-6) - Lobby & Bathrooms (2)

Zones 4 & 5 (Grids 6-9) - Ticketing/Services (2)

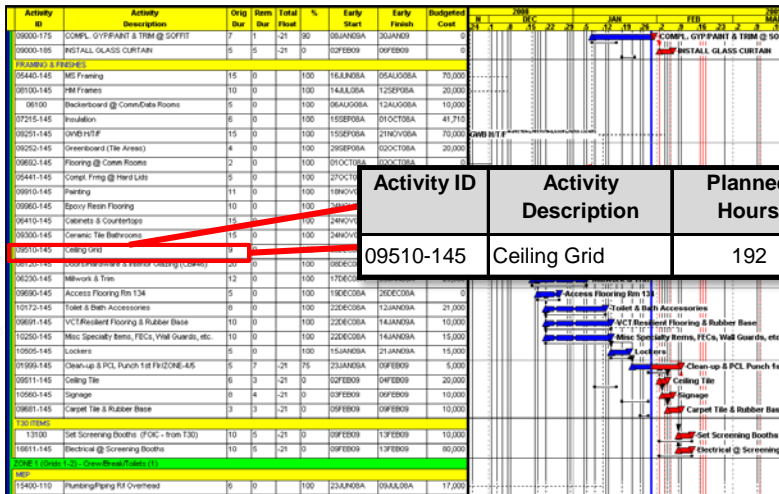


- All Areas/Floors
- Milestones & Submittals
- Sitework / Utilities
- Foundation
- Structure & Exterior
- 1st Floor Framing, Mep & Finish
- 2nd Floor Framing, Mep & Finish



Planned Resource Hours

- In this case study updates were made per room.
 - This will vary depending on the structure of the contractor's construction schedule and the logistics of the site walk
- Determine the construction schedule activities associated to each room.
- Calculate the square footage or quantity for each room to determine resource hour allocation.



| ROOM | CEILING GRID | SF | TOTAL SF | % of Total | PLANNED HOURS |
|----------------------------------------|--------------|--------|--------------|-------------|---------------|
| 145_111 - CTA Storage | N | 509 | | | |
| 145_112 - Data | N | 110 | | | |
| 145_113 - CTA Badging | Y | 195 | 195 | 5% | 10 |
| 145_114 - CTA Office | Y | 574 | 574 | 16% | 30 |
| 145_116 - Site Sub #2 | N | 726 | | | |
| 145_117 - Main Electrical Room | N | 638 | | | |
| 145_118 - Mechanical Room | N | 594 | | | |
| 145_119 - Telephone | N | 99 | | | |
| 145_122 - CBP Screening and Queuing | N | 11,632 | | | |
| 145_124 - Triage Lobby | N | 264 | | | |
| 145_125 - Unified Secondary Inspection | Y | 2,451 | 2,451 | 68% | 130 |
| 145_127 - Hall (NE) | Y | 148 | 148 | 4% | 8 |
| 145_128 - Security Break Room | Y | 252 | 252 | 7% | 13 |
| 145_129 - Search | N | 90 | | | |
| 145_130 - Search | N | 90 | | | |
| 145_131 - Lab | N | 120 | | | |
| 145_132 - Storage | N | 88 | | | |
| 145_133 - Passenger waiting | N | 328 | | | |
| 145_134 - CBP Coord. Center | N | 249 | | | |
| 145_135 - Interview | N | 92 | | | |
| Total | | | 3,620 | 100% | 192 |

Track Progress

- Walk the project site
- Update the percent complete for each activity or physical quantities installed per room via a site walk through
- Percentage based on visual inspection of work completed.
- Again, walk the project site...



| ACT ID | ACTIVITY DESCRIPTION | 145_111 - CTA Storage | 145_112 - Data | 145_113 - CTA Badging | 145_114 - CTA Office | 145_116 - Site Sub #2 | 145_117 - Main Electrical Room | 145_118 - Mechanical Room | 145_119 - Telephone | 145_122 - CBP Screening and Queuing |
|-----------|-------------------------------------------|-----------------------|----------------|-----------------------|----------------------|-----------------------|--------------------------------|---------------------------|---------------------|-------------------------------------|
| 15845-145 | HVAC Trim / IRHs, Paddle Fans, Etc. | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 33% |
| 15950-145 | DDC Control Wiring | | | 100% | 100% | 100% | 100% | 100% | | 100% |
| 16200-145 | Elec & LV Systems R/I - Walls (E) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 16600-145 | Light Fixtures | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 16610-145 | Electrical Trim | 100% | 100% | 100% | 100% | 100% | 100% | 50% | 100% | 5% |
| 01900-145 | Cover Insp. Compl. (per zone; partial) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 16620-145 | LV Systems Devices (excl. cameras) | 50% | 25% | 100% | 100% | 38% | 50% | 43% | 75% | 47% |
| 16750-145 | LV Systems Wiring (CRXs) | 100% | 85% | 100% | 100% | 96% | 100% | 95% | 100% | 92% |
| 16900-145 | Elec & Comm Rooms Equip/Panels/Racks | | 100% | | | | | | 100% | |
| 01999-145 | Clean-up & PCL Pre-Punch 1st Flr/ZONE-4/5 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 05440-145 | MS Framing | 100% | | 100% | 100% | 100% | 100% | 100% | | 100% |
| 610000% | Backerboard @ Comm/Data Rooms | | 100% | | | | | | 100% | |
| 07215-145 | Insulation | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 08100-145 | HM Frames | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| 08120-145 | Doors/Hardware & Interior Glazing (CB#46) | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | |

Data Crunching

- Leverage the use of the database to crunch the numbers
- Progress data input into a database
- Data can be structured in a variety of formats to meet the needs of the audience
- Audit data to ensure data quality and integrity increasing visibility and credibility
- Allows for flexibility in future reporting requirements

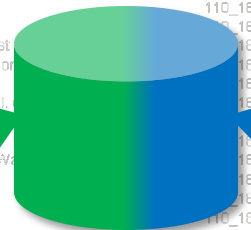
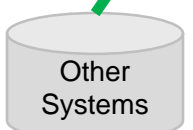
| SCW | Date | TYPE/AREA | GROUP | SUBGROUP/ZONE | ACTIVITY_ID | Activity description | AREA_RM_ID | ROOM_ID | ROOM NAME | AREA | Need by Date | STATUS | PHYSICAL_PRC |
|-----|-----------|-----------|-------|---------------|-------------|-----------------------------------------------|------------|---------|----------------------|--------|--------------|--------|--------------|
| Yes | 2/23/2009 | 110 | L1 | MEP | 16100-110 | Electrical & LV Systems R/I Overhead | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 08120-110 | Doors/Hardware & Interior Glazing | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 07215-110 | Insulation | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 06410-110 | Cabinets & Countertops | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 06295-110 | Mills & Tops | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 01999-110 | Clean-Up & PCL Punch 1st Flr/ZONE-1 | 110_165 | 185 | Longshore Break Area | 110_N5 | 0.75 | | 0.75 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 01900-110 | Cover Insp. Compl. (per zone; partial) | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16750-110 | LV Systems Wiring | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16620-110 | LV Systems Dev. (per zone) | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 0.56 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16510-110 | Electrical Trim | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15300-110 | Sprinkler R/I | 110_166 | 186 | Comm room | 110_N1 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16200-110 | Elec & LV Systems R/I - Walls | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 09511-110 | Ceiling Tile | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15945-110 | HVAC Trim | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15900-110 | HVAC Units & Rough-In | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16410-110 | Sprinkler Drops to Grid | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15300-110 | Sprinkler R/I | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 10250-110 | Misc Specialty Items, FECs, Wall Guards, etc. | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 09910-110 | Painting | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 09591-110 | VCT Flooring & Rubber Base | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 09251-110 | GW/B H/T/F | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 10120-110 | Doors/Hardware & Interior Glazing | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16300-110 | Light Fixtures | 110_164 | 184 | Lobby | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16100-110 | Electrical & LV Systems R/I Overhead | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15945-110 | HVAC Trim | 110_161 | 181 | Hall | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 09251-110 | GW/B H/T/F | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 08120-110 | Doors/Hardware & Interior Glazing | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 08100-110 | HM Frames | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 07215-110 | Insulation | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 05440-110 | MS Framing | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 01999-110 | Clean-Up & PCL Punch 1st Flr/ZONE-1 | 110_166 | 186 | Comm room | 110_N5 | 0.75 | | 0.75 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 01900-110 | Cover Insp. Compl. (per zone) | 110_166 | 186 | Comm room | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16750-110 | LV Systems Wiring | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16620-110 | LV Systems Dev. (per zone) | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16510-110 | Electrical Trim | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 09251-110 | GW/B H/T/F | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 16200-110 | Elec & LV Systems R/I - Walls | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | FIN | 09511-110 | Ceiling Tile | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15950-110 | DDC Control Wiring | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15945-110 | HVAC Trim | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15900-110 | HVAC Units & Rough-In | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15450-110 | Plg R/I - Walls | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15420-110 | Plumbing Fixtures/Trim; DFS | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15400-110 | Plumbing Piping R/I Overhead | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15310-110 | Sprinkler Drops to Grid | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |
| Yes | 2/23/2009 | 110 | L1 | MEP | 15300-110 | Sprinkler R/I | 110_165 | 185 | Longshore Break Area | 110_N5 | | 1 | 1 |



Construction Schedule



Site Walk Update



Reporting

- When the updates have been loaded into the database, queries are used to generate reports providing visibility to percent complete per project and area/zones and schedule variances.

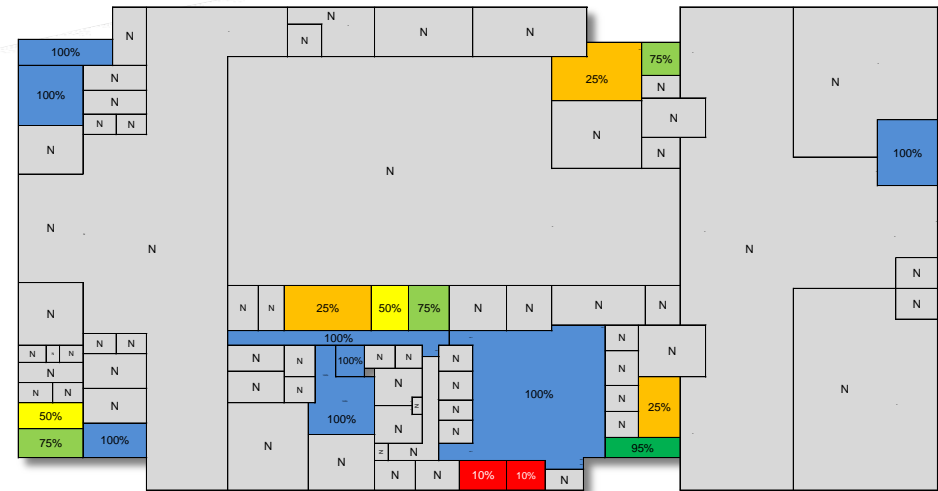
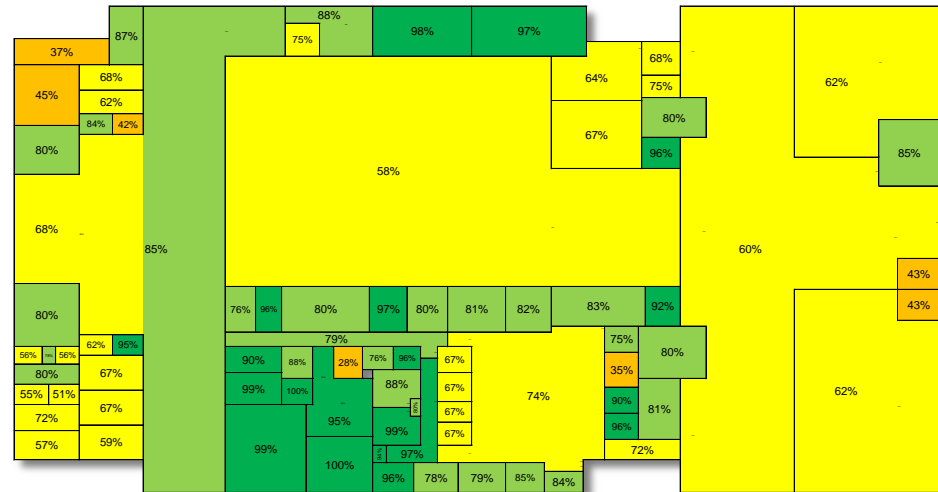
P3 Schedule: v9138

Physical Walk through: 02/23/09 ~10:00AM

| AREA | A | B | C | D | E | F | G | H | I | J | K | L | M |
|--------------------------------------------------|-----------------------------|----------------|-------------------|-----------------|-----------------|------------|-----------------|-----------------------|---------------------------|--------------------------------------|-------------------------------|--------------------|--------------------|
| | Primavera data per 01/30/09 | | | | | | PMSI Evaluation | P3 % Variance | Schedule Variance in Days | | | | |
| | PLAN Man Hrs | EARNED-Man Hrs | % Complete (=B/A) | Min Start | Max Finish | DUR (=E-D) | % Complete | EARNED Man Hrs (=G*A) | P3 % vs Physical % (=C-G) | Elapsed Time to Date (=Walk date -D) | Elapsed Time to Date % (=J/F) | EARNED Days (=F*G) | Days Behind (=J-L) |
| MILESTONES & SUBMITTALS | 504 | 120 | 24% | 08/28/07 | 03/11/09 | 561 | 70% | 350 | -46% | 545 | 97% | | |
| SITWORK / UTILITIES | 8,269 | 8,087 | 98% | 10/10/07 | 03/06/09 | 513 | 99% | 8,212 | -2% | | | 509 | 0 |
| FOUNDATION | 15,626 | 15,626 | 100% | 09/25/07 | 04/28/08 | 216 | 100% | 15,626 | 0% | | | 216 | 0 |
| STRUCTURE & EXTERIOR | 28,201 | 28,099 | 100% | 04/07/08 | 02/06/09 | 305 | 100% | 28,201 | 0% | | | 305 | 0 |
| ALL AREAS/FLOORS | 3,070 | 2,126 | 69% | 07/23/08 | 03/09/09 | 229 | 89% | 2,722 | -19% | 215 | 94% | 203 | 12 |
| ZONE 1 (Grids 1-2) - Crew/Break/Toilets (1) | 9,802 | 9,498 | 97% | 06/23/08 | 02/11/09 | 233 | 98% | 9,602 | -1% | 245 | 105% | 228 | 17 |
| ZONES 2 & 3 (Grids 2-6) - Baggage Lay-Down (1) | 3,988 | 3,728 | 93% | 06/23/08 | 02/17/09 | 239 | 99% | 3,968 | -6% | 245 | 103% | 238 | 7 |
| ZONES 4 & 5 (Grids 6-9) - CBP/CTA, Mech/Elec (1) | 22,103 | 21,019 | 95% | 06/16/08 | 02/13/09 | 242 | 100% | 22,023 | -5% | | | 241 | 0 |
| ZONE 6 (Grids 9-12) - Entry Lobby | 4,827 | 4,499 | 93% | 07/07/08 | 02/13/09 | 221 | 100% | 4,807 | -6% | | | 220 | 0 |
| ZONE 1 (Grids 1-2) - Vestibules (2) | 2,627 | 2,563 | 98% | 07/07/08 | 02/05/09 | 213 | 100% | 2,619 | -2% | | | 212 | 0 |
| ZONES 2 & 3 (Grids 2-6) - Lobby & Bathrooms (2) | 6,039 | 5,911 | 98% | 07/14/08 | 02/11/09 | 212 | 100% | 6,023 | -2% | | | 211 | 0 |
| ZONES 4 & 5 (Grids 6-9) - Ticketing/Services (2) | 6,840 | 6,080 | 89% | 08/25/08 | 02/23/09 | 182 | 93% | 6,348 | -4% | 182 | 100% | 169 | 13 |
| TOTAL | 111,896 | 107,356 | 95.9% | 08/28/07 | 03/11/09 | 561 | 98.8% | 110,500 | -2.8% | 545 | 97.1% | | |
| INTERIOR (ZONES 1-6) | 56,226 | 53,298 | 94.8% | 06/16/08 | 02/23/09 | 252 | 98.5% | 55,389 | -3.7% | 252 | 100% | 248 | 4 |
| MILESTONES | | | | | | | | | | | | | |
| December 1, 2008 | 1,157 | 1,156 | 100% | 06/16/08 | 12/01/08 | 168 | 100% | 1,157 | 0% | 252 | 150% | 168 | 84 |
| December 15, 2008 | 244 | 243 | 100% | 08/25/08 | 12/15/08 | 112 | 100% | 244 | 0% | 182 | 163% | 112 | 70 |
| January 12, 2009 | 951 | 951 | 100% | 06/16/08 | 01/12/09 | 210 | 100% | 951 | 0% | 252 | 120% | 210 | 42 |
| January 19, 2009 | 9,241 | 8,766 | 95% | 06/16/08 | 02/25/09 | 254 | 100% | 9,228 | -5% | 252 | 99% | 254 | -2 |
| Remainder | 44,632 | 42,182 | 95% | 06/16/08 | 02/25/09 | 254 | 98% | 43,809 | -4% | 252 | 99% | 249 | 3 |
| TOTAL Interior | 56,226 | 53,298 | 95% | | | | 99% | 55,389 | -4% | | | | |

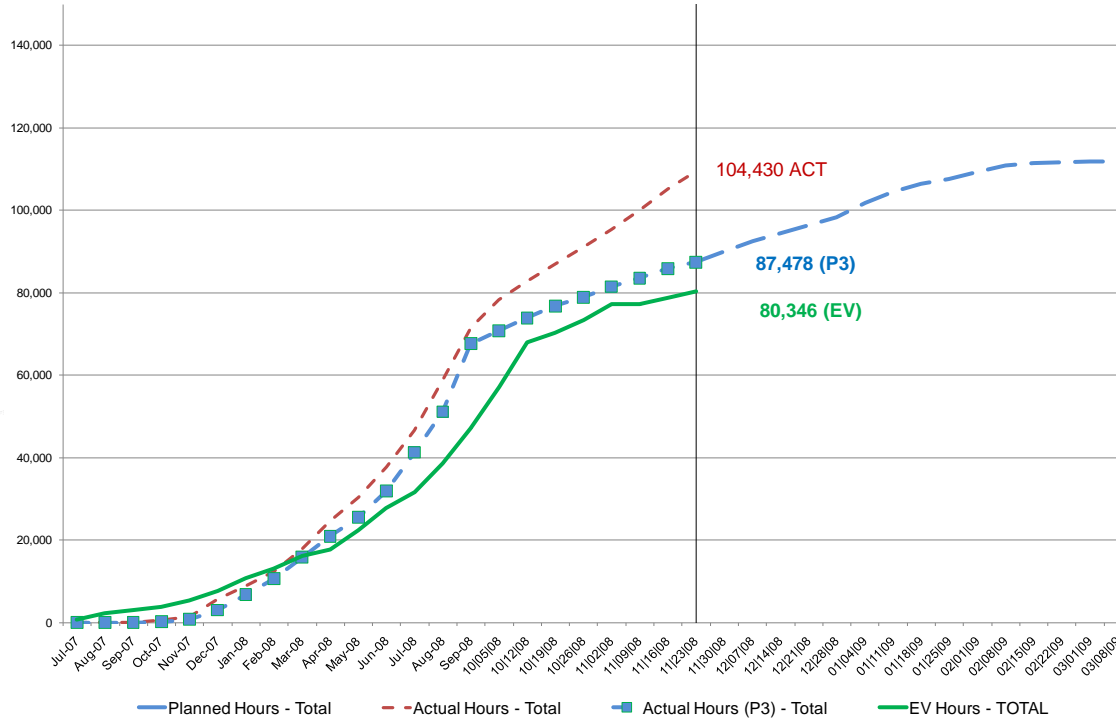
Reporting

- Another example of the flexibility of the evaluation process used in the case study are the following examples:
 - Percent complete per room via a floor plan view
 - Percent complete for each discipline such as: “Ceiling Grid” per room (notice rooms without ceiling grids are filled in with grey)



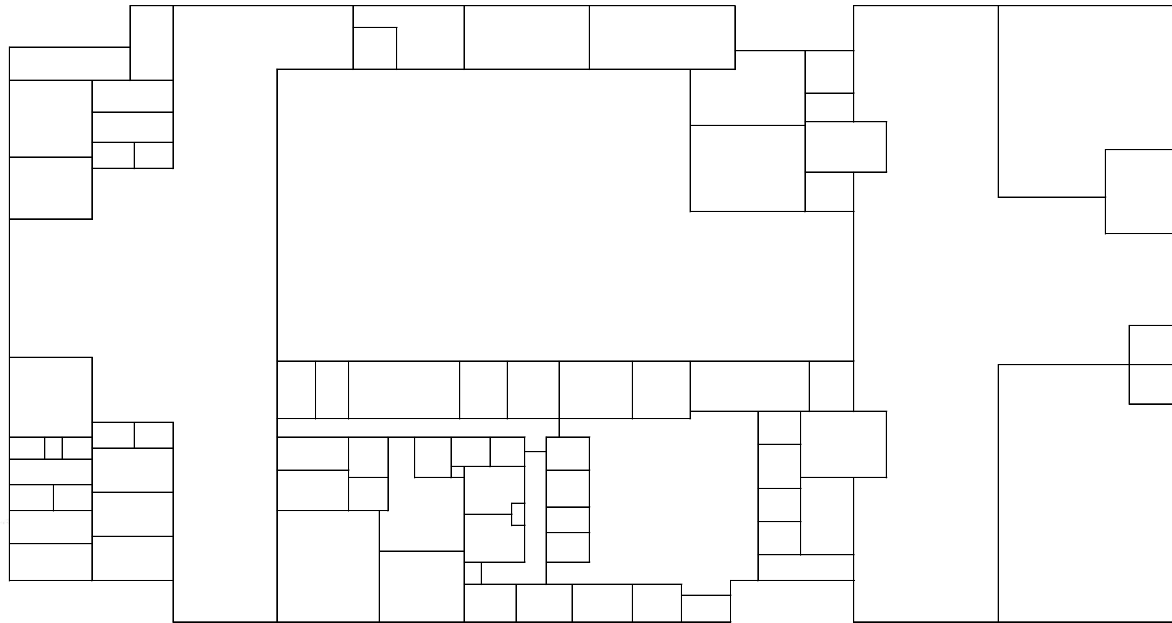
Reporting

- Data is also used to generate S-curve charts comparing construction schedule to Earned Value (EV)
 - Percent Complete – Construction schedule
 - Percent Complete – Earned Value
 - Variance



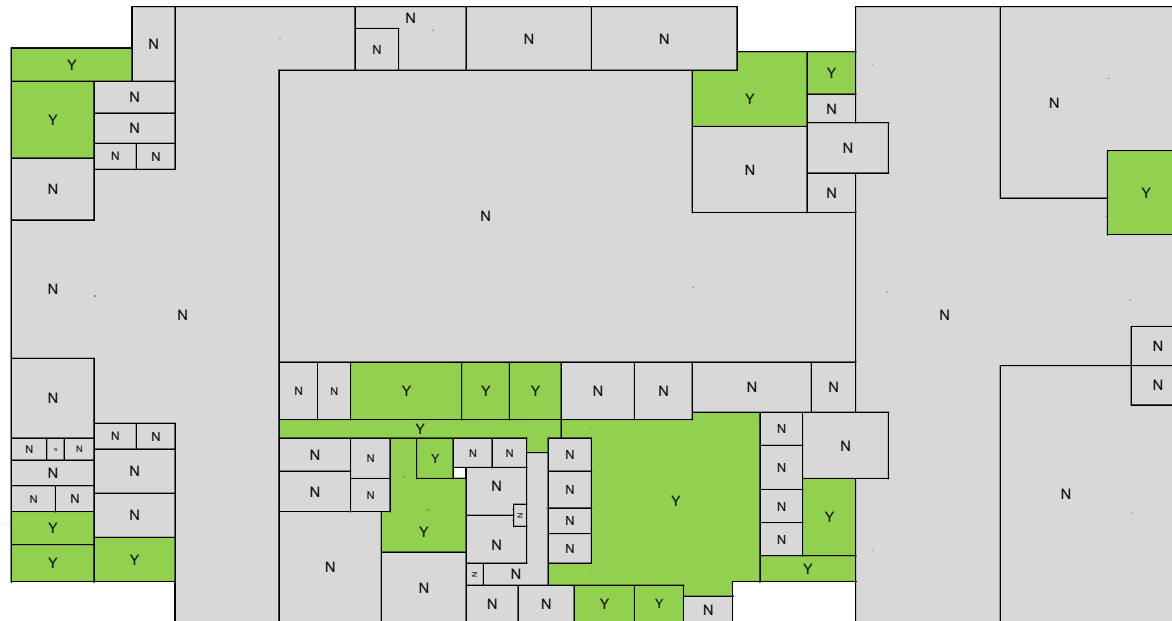
Methodology

- Project Floor plan



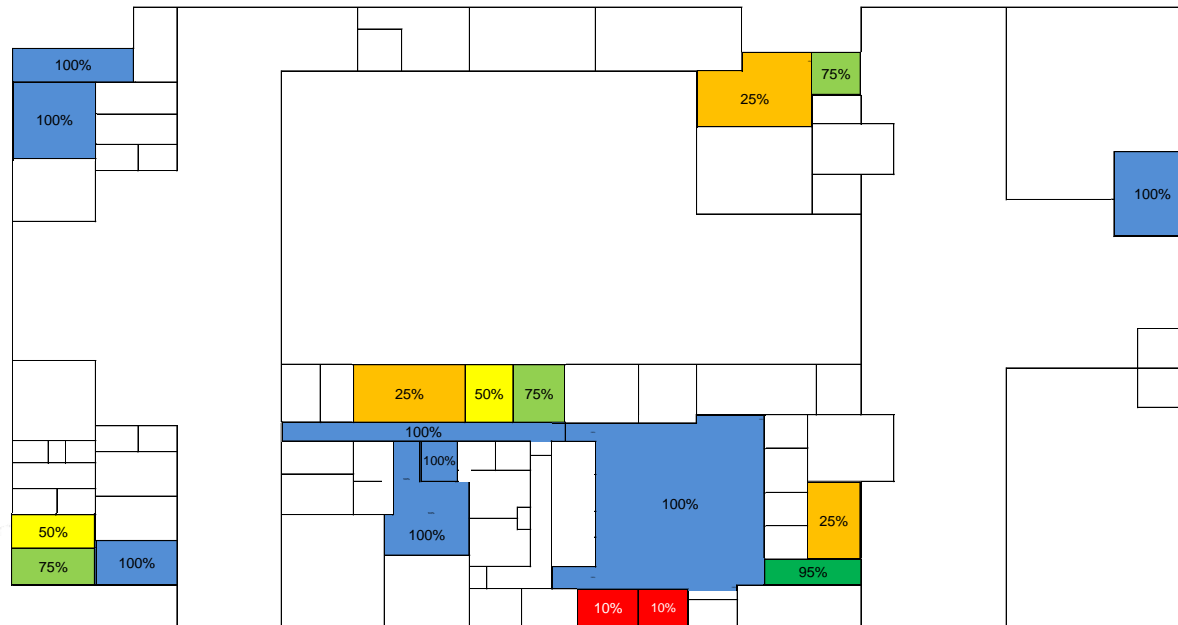
Methodology

- Determine scope
- In this example rooms requiring a ceiling grid were identified



Methodology

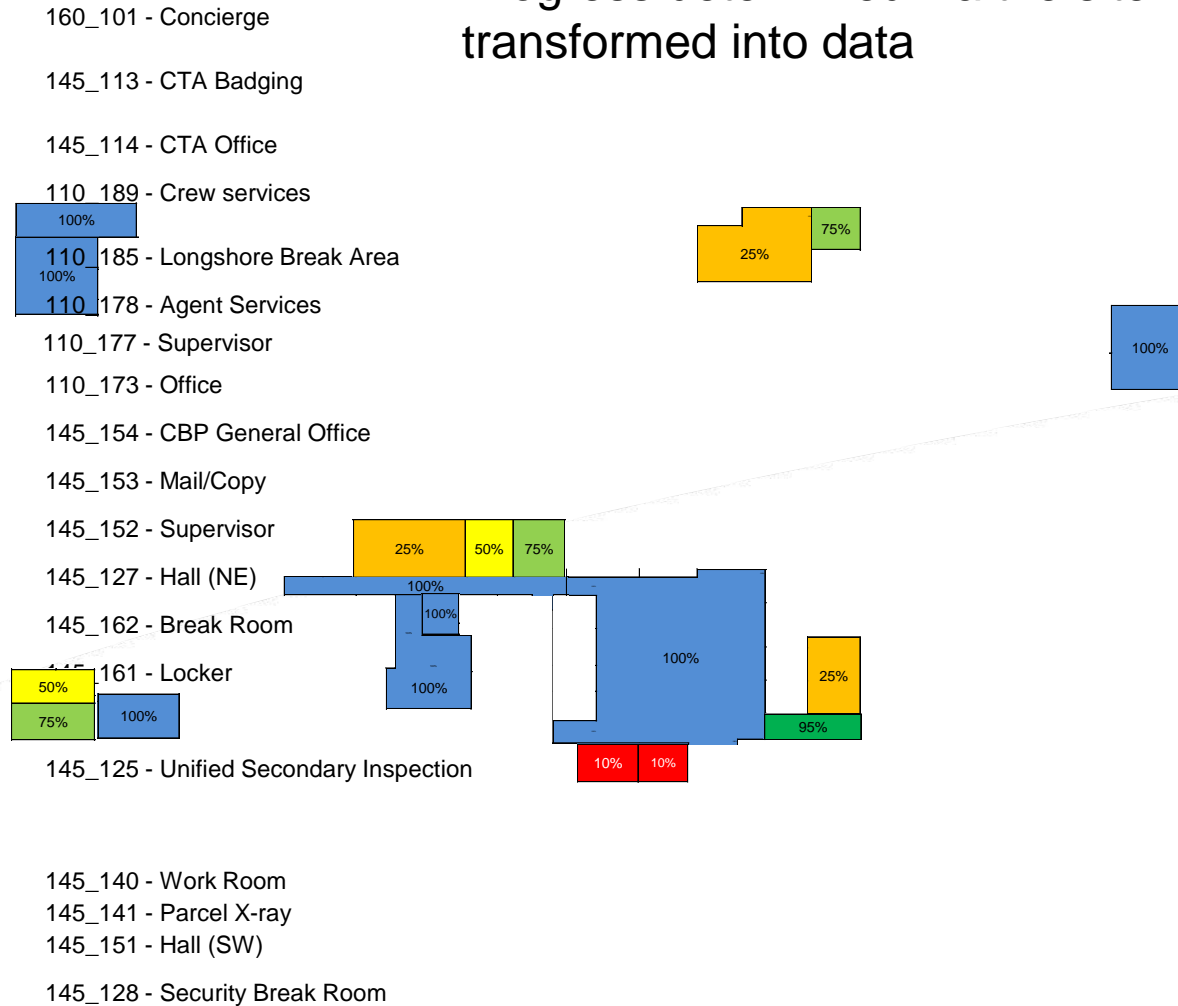
- Conduct a site walk
- Based on tracking of physical components / quantities installed



| | Not Applicable | Red | Orange | Yellow | Light Green | Green | Blue |
|------|----------------|--------|--------|--------|-------------|--------|------|
| High | N | 24.99% | 49.99% | 74.99% | 89.99% | 99.99% | 100 |
| Low | | 0.00% | 25.00% | 50.00% | 75.00% | 90.00% | |

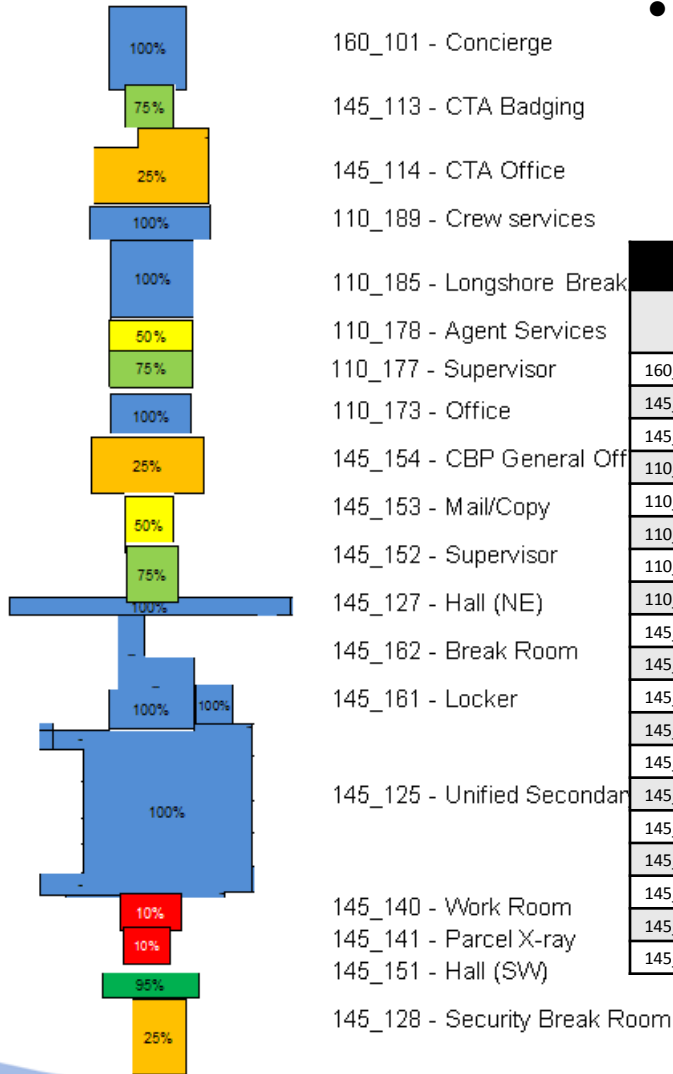
Methodology

- Progress determined via the site walk is transformed into data



Methodology

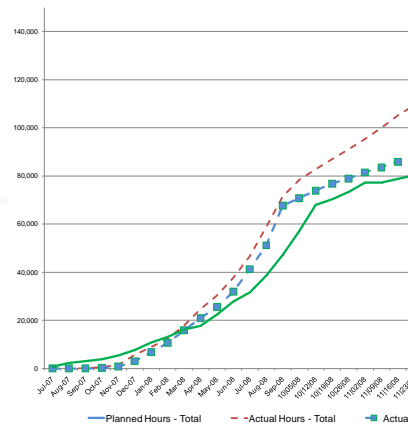
- Progress information is loaded into the database



| CEILING GRID | |
|----------------------------------------|------------|
| Room | % Complete |
| 160_101 - Concierge | 100% |
| 145_113 - CTA Badging | 75% |
| 145_114 - CTA Office | 25% |
| 110_189 - Crew services | 100% |
| 110_185 - Longshore Break Area | 100% |
| 110_178 - Agent Services | 50% |
| 110_177 - Supervisor | 75% |
| 110_173 - Office | 100% |
| 145_154 - CBP General Office | 25% |
| 145_153 - Mail/Copy | 50% |
| 145_152 - Supervisor | 75% |
| 145_127 - Hall (NE) | 95% |
| 145_162 - Break Room | 100% |
| 145_161 - Locker | 100% |
| 145_125 - Unified Secondary Inspection | 100% |
| 145_140 - Work Room | 10% |
| 145_141 - Parcel X-ray | 10% |
| 145_151 - Hall (SW) | 100% |
| 145_128 - Security Break Room | 25% |

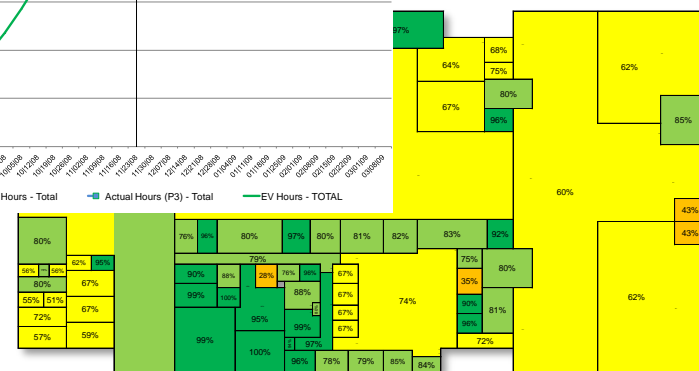
Methodology

- ...to apply “Earned Value” management to evaluate construction progress.
- This has shown **SIGNIFICANT** results in the increased **Visibility** and **Credibility** of the Project Controls.



P3 Schedule: v9138
Physical Walk through: 02/23/09 ~10:00AM

| AREA | Progress Data per 01/02/09 | | | | | | | | | | P3 % Variance | | Schedule Variance in Days | |
|-------------------------------------------------|----------------------------|-----------------|-------------------|--------------|----------------|--------------|----------------|-----------------------|---------------------------|-------------------------------------|--------------------|-------------------|---------------------------|--|
| | PLAN Man Hrs | EARNED Man Hrs | % Complete (+B/A) | Min Start | Max Finish | DUR (+E/D) | P3S Evaluation | EARNED Man Hrs (+G/A) | P3 % vs Physical % (+C-G) | Elapsed Time to Date (+W/Wk Date-D) | EARNED Days (+F/G) | Days Subst (+J-L) | | |
| MILESTONES & SUBMITTALS | 504 | 120 | 24% | 08/28/07 | 03/11/09 | 561 | 70% | 350 | -46% | 545 | 97% | | | |
| STEELWORK / UTILITIES | 8,269 | 8,067 | 98% | 10/10/07 | 03/06/09 | 513 | 99% | 8,212 | -2% | | 509 | 0 | | |
| FOUNDATION | 15,626 | 15,626 | 100% | 09/25/07 | 04/28/08 | 216 | 100% | 15,626 | 0% | | 216 | 0 | | |
| STRUCTURE & EXTERIOR | 28,201 | 28,099 | 100% | 04/07/08 | 02/05/09 | 303 | 100% | 28,201 | 0% | | 303 | 0 | | |
| ALL AREAS/FLOORS | 3,070 | 2,126 | 69% | 07/23/08 | 03/09/09 | 229 | 89% | 2,722 | -19% | 216 | 94% | 203 | | |
| ZONE 1 (Grds 1-2) - Crew/Break/Office (1) | 9,802 | 9,488 | 97% | 06/23/08 | 02/11/09 | 253 | 98% | 9,602 | -1% | 246 | 100% | 228 | | |
| ZONES 2 & 3 (Grds 2-6) - Baggage Lay-Down (1) | 3,988 | 3,728 | 93% | 06/23/08 | 02/17/09 | 239 | 99% | 3,968 | -6% | 246 | 100% | 238 | | |
| ZONES 4 & 5 (Grds 6-9) - CBP/CTA, Mech/Elec (1) | 22,103 | 21,019 | 95% | 06/16/08 | 02/13/09 | 242 | 100% | 22,023 | -5% | | 241 | 0 | | |
| ZONE 6 (Grds 9-12) - Entry Lobby | 4,827 | 4,489 | 93% | 07/07/08 | 02/13/09 | 221 | 100% | 4,807 | -6% | | 220 | 0 | | |
| ZONE 1 (Grds 1-2) - Vestibules (2) | 2,627 | 2,563 | 98% | 07/07/08 | 02/05/09 | 213 | 100% | 2,619 | -2% | | 212 | 0 | | |
| ZONES 2 & 3 (Grds 2-6) - Lobby & Bathrooms (2) | 6,038 | 5,871 | 98% | 07/14/08 | 02/11/09 | 212 | 100% | 6,023 | -2% | | 211 | 0 | | |
| ZONES 4 & 5 (Grds 6-9) - Ticketing/Services (2) | 6,840 | 6,880 | 99% | 08/25/08 | 02/23/09 | 182 | 90% | 6,348 | -4% | 182 | 100% | 169 | | |
| 95.9% | 08/28/07 | 03/11/09 | 561 | 98.8% | 110,500 | -2.8% | 545 | 97.1% | | | | | | |
| 94.8% | 06/16/08 | 02/23/09 | 252 | 98.5% | 55,389 | -3.7% | 252 | 100% | 248 | 4 | | | | |
| 100% | 06/16/08 | 12/01/08 | 168 | 100% | 1,157 | 0% | 252 | 150% | 168 | 84 | | | | |
| 100% | 08/25/08 | 12/15/08 | 112 | 100% | 244 | 0% | 182 | 163% | 112 | 70 | | | | |
| 100% | 06/16/08 | 01/12/09 | 210 | 100% | 951 | 0% | 252 | 120% | 210 | 42 | | | | |
| 95% | 06/16/08 | 02/25/09 | 254 | 100% | 9,228 | -6% | 252 | 99% | 254 | -2 | | | | |
| 95% | 06/16/08 | 02/25/09 | 254 | 98% | 83,809 | -4% | 252 | 99% | 249 | 3 | | | | |
| 95% | | | | 99% | 55,389 | -4% | | | | | | | | |



End

If you have further questions – feel free to contact our office

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Or visit our website

www.pmsvs.com