

## Earned Value Management (EVM)

It's not as hard as you think

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<https://mosaicprojects.com.au/PMKI-SCH.php>



## Agenda

- Earned Value – The key requirements
- Introduction to AS 4817 / ISO 215080
- Using EVM Data
- Summary
  - Resources
  - Conclusion



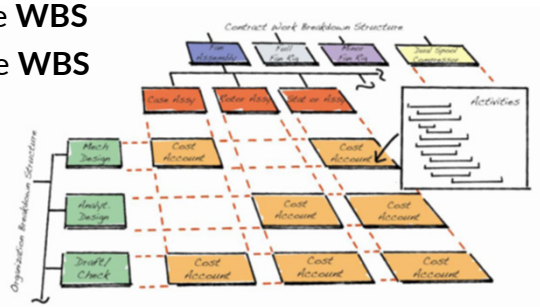
# EVM – it's not as hard as you think

Earned Value –  
The key requirements



## EVM - The Key Requirements

- The project decomposed into management cells using an effective **WBS**
- An effective **schedule** linked to the **WBS**
- An effective **cost plan** linked to the **WBS**
- Management authority and responsibility linked to the **WBS**
- The lowest level of the WBS are the **work packages**



WBS = Work Breakdown Structure:  
[https://mosaicprojects.com.au/WhitePapers/WP1011\\_WBS.pdf](https://mosaicprojects.com.au/WhitePapers/WP1011_WBS.pdf)



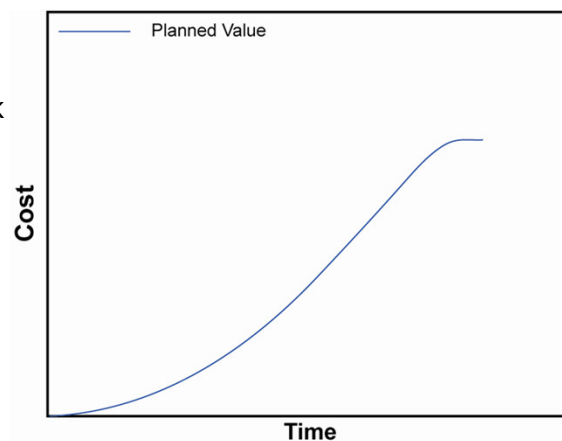
## EVM - The Key Requirements

- EVM operates at the Work Package (WP) level
  - A manager is responsible for delivering the product or service defined in the WP
  - The value and duration of the WP are defined and significant
  - The manager's span of responsibility covers many related:
    - Schedule activities
    - Cost plan 'line items'



## Overview of Earned Value

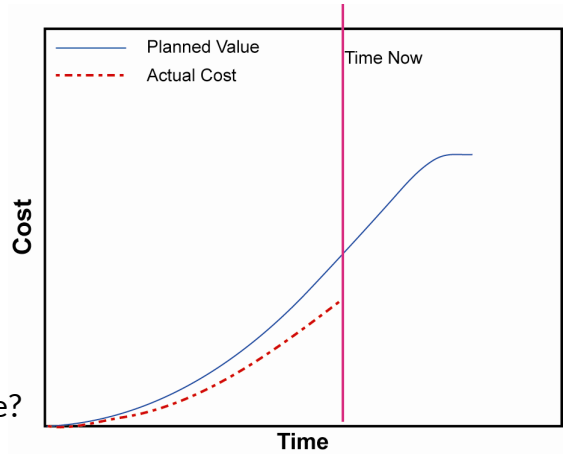
- The foundation is a time phased budget
- This shows when the work is planned to occur – the planned value (PV)
- PV is based on the timing and value of the work in the work packages



## Overview of Earned Value

- Measuring actual costs adds little extra value
- All you know is what was spent
- **You do not know what was achieved**

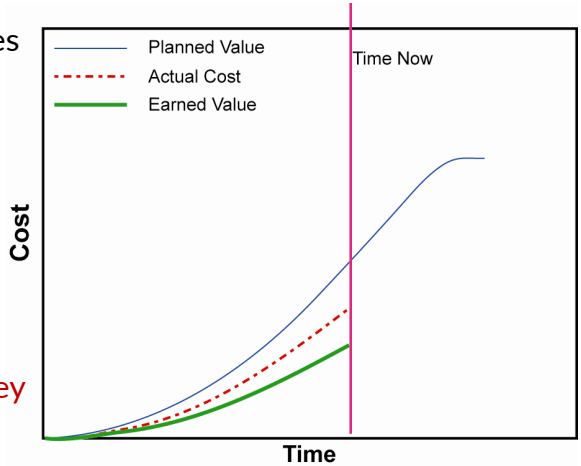
Is this project profitable or behind schedule?



## Overview of Earned Value

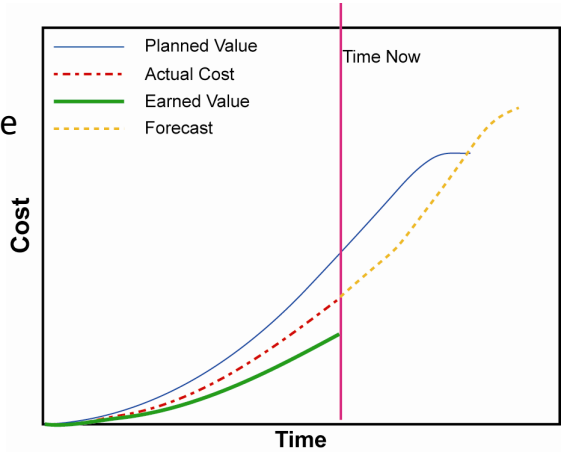
- Earned value (EV) measures what has been accomplished to highlight the real situation
- EV is the value of the work accomplished calculated from the same base as the PV

**This project is losing money and behind schedule!**



## Overview of Earned Value

- EVM also calculates the forecast to completion based on the performance to date
- Traditional EVM – Cost
- Earned Schedule – Time



AS 4817:2019 & ISO 21508:2018



## AS 4817/ISO 21508

Earned Value Performance Management requires:

- Knowing what work is to be done: who, when and how much
- Applying objective measures of progress
- Reporting significant deviations
- Planning and implementing corrective actions
- Forecasting completion costs and dates
- Managing changes



## AS 4817/ISO 21508

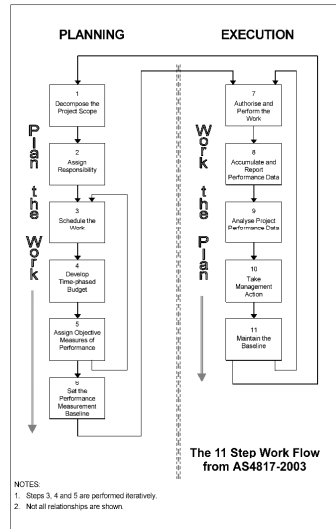
- The Standards describe how to accomplish this in 11 steps

1. Decompose the Project Scope
2. Assign Responsibility
3. Schedule the Work
4. Develop Time-Phased Budget
5. Assign Objective Measures of Performance
6. Set the Performance Measurement Baseline (PMB)
7. Authorize and Perform the Work
8. Accumulate & Report Performance Data
9. Analyze Project Performance Data
10. Take Management Action
11. Maintain the Baseline



# EVM – it’s not as hard as you think

## AS 4817/ISO 21508



These 11 steps are consistent across:  
 AS 4817: 2003 The original Australian Standard  
 AS 4817: 2006 The updated Australian Standard  
 ISO 21508: 2018 International standard.  
 AS 4817: 2019 Australian adoption of ISO 21508 with modifications\*.

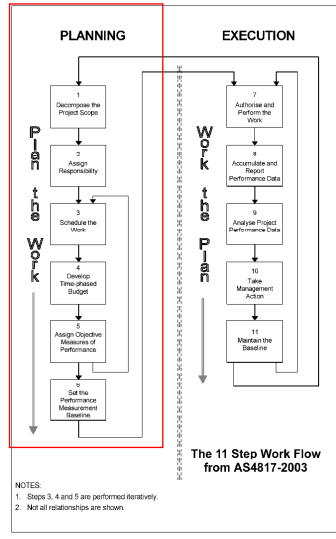
\* Modification incorporated a normative annex for use in commercial contracts.



## AS 4817/ISO 21508

• Steps 1 through 6 create the plan and set the 'performance management baseline' (PMB) for the project

1. Decompose the Project Scope
2. Assign Responsibility
3. Schedule the Work
4. Develop Time-Phased Budget
5. Assign Objective Measures of Performance
6. Set the Performance Measurement Baseline (PMB)

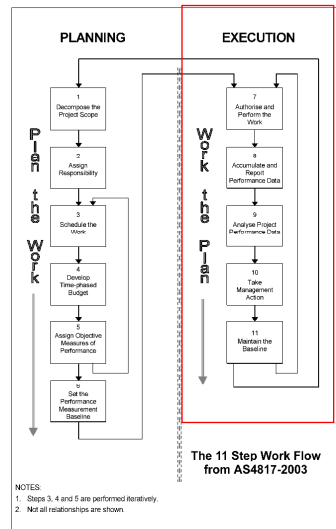


# EVM – it's not as hard as you think

## AS 4817/ISO 21508

- Steps 7 through 11 manage the work of the project to achieve the PMB
- These steps are repeated each month (project update) or as needed

- 7. Authorize and Perform the Work
- 8. Accumulate & Report Performance Data
- 9. Analyze Project Performance Data
- 10. Take Management Action
- 11. Maintain the Baseline



Using EVM data





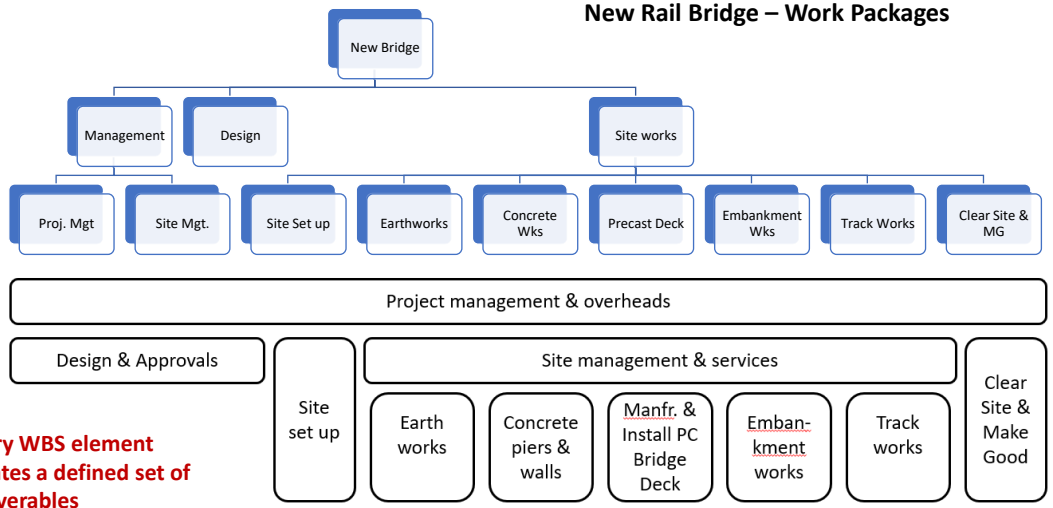
## Setting the baseline

- Managing a small bridge project
- The key is simple and robust work packages
- Derived from the WBS



## Setting the baseline

### New Rail Bridge – Work Packages



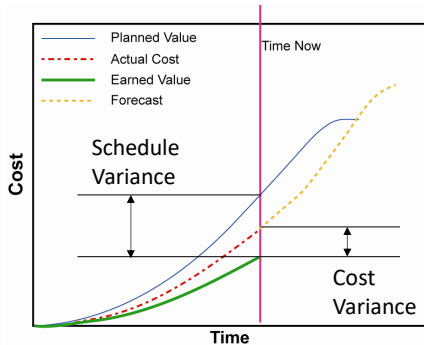
Every WBS element creates a defined set of deliverables



# EVM – it's not as hard as you think

## Using the EVM data

- PV, EV and AC are accumulated for each WP
- The two variances offer 9 possible combinations
- The responsible manager needs to explain
  - What caused the variance
  - What is being done about the variance



Performance Measures		Schedule		
		SV > 0 & SPI > 1.0	SV = 0 & SPI = 1.0	SV < 0 & SPI < 1.0
Cost	CV > 0 & CPI > 1.0	Ahead of Schedule Under Budget	On Schedule Under Budget	Behind Schedule Under Budget
	CV = 0 & CPI = 1.0	Ahead of Schedule On Budget	On Schedule On Budget	Behind Schedule On Budget
	CV < 0 & CPI < 1.0	Ahead of Schedule Over Budget	On Schedule Over Budget	Behind Schedule Over Budget

But you need good data!



## Using the EVM data

- The big picture is not enough:

mosaic Easy EVM Workbook		Update Date: 21-Feb-22		ETC: \$10,867,761.44		EAC: \$15,059,281.44		VAC: -\$59,281.44								
WP #	WP Description	Baseline Values		Actual This Update		Planned Value	Earned Value	SV	SPI	CV	CPI	Errors				
		Start	End	Start	End											
<b>Project totals =</b>		15-Nov-21	15-Sep-22	15-Nov-21	-	\$3,669,000.00	\$522,500.00	\$4,191,500.00	-	\$4,010,642.33	\$4,175,000.00	\$164,357.67	1.041	-\$16,500.00	0.996	
1.1	Project management and overheads	15-Nov-21	15-Sep-22	15-Nov-21		\$266,000.00	\$8,000.00	\$274,000.00	32.00%	\$274,013.16	\$272,000.00	-\$2,013.16	0.993	-\$2,000.00	0.993	
1.2	Site management and services	02-Jan-22	15-Sep-22	10-Jan-22		\$82,000.00	\$9,500.00	\$91,500.00	13.00%	\$117,187.50	\$90,000.00	-\$27,187.50	0.768	-\$1,500.00	0.868	
2	Design & Approvals	15-Nov-21	31-Jan-22	15-Nov-21	20-Jan-22	\$1,258,000.00	\$1,258,000.00	\$1,258,000.00	100.00%	\$1,550,000.00	\$1,550,000.00	\$0.00	1.000	-\$8,000.00	0.995	
3.1	Site set up	02-Jan-22	31-Jan-22	15-Jan-22	10-Feb-22	\$235,000.00	\$60,000.00	\$315,000.00	100.00%	\$300,000.00	\$300,000.00	\$0.00	1.000	-\$15,000.00	0.952	
3.2	Earth works	20-Jan-22	20-Mar-22	15-Jan-22		\$900,000.00	\$210,000.00	\$1,110,000.00	75.00%	\$813,559.32	\$1,225,000.00	\$311,440.68	1.383	\$15,000.00	1.014	
3.3	Manfr. & Install PC Bridge Deck	02-Jan-22	25-Jul-22	20-Dec-21		\$600,000.00	\$190,000.00	\$790,000.00	20.00%	\$655,882.35	\$780,000.00	-\$124,117.65	0.816	-\$10,000.00	0.987	
3.4	Concrete piers & walls	01-Nov-22	30-May-22	02-May-22	15-Feb-22	\$8,000.00	\$45,000.00	\$53,000.00	2.00%	\$58,000.00	\$58,000.00	\$0.00	N/A	\$5,000.00	1.094	
3.5	Embankment works	30-May-22	10-Jul-22													
3.6	Track works	26-Jul-22	30-Aug-22													
3.7	Clear Site & Make Good	30-Aug-22	15-Sep-22													

We are looking good

For more detail on this project see:

[https://mosaicprojects.com.au/Mag\\_Articles/AA015\\_Practical\\_EVM.pdf](https://mosaicprojects.com.au/Mag_Articles/AA015_Practical_EVM.pdf)



# EVM – it's not as hard as you think

## Using the EVM data

- The big picture is not enough:

mosaic Easy EVM Workbook												Update Date: 21-Feb-22		ETC: \$10,867,781.44	EAC: \$15,059,281.44	VAC: -\$59,281.44
WP #	WP Description	Baseline Values		Actual This Update		AC	%	Planned Value	Earned Value	SV	SPI	CV	CPI	Errors		
		Start	End	\$ Budget	Start										End	Account Costs
<b>Project totals =</b>		15-Nov-21	15-Sep-22	\$15,000,000.00	15-Nov-21	-	\$3,669,000.00	\$522,500.00	\$4,191,500.00	-						
1.1	Project management and overheads	15-Nov-21	15-Sep-22	\$850,000.00	15-Nov-21		\$266,000.00	\$8,000.00	\$274,000.00	32.00%	\$274,011.16	\$272,000.00	-\$2,011.16	0.993	-\$2,000.00	0.993
1.2	Site management and services	02-Jan-22	15-Sep-22	\$600,000.00	10-Jan-22		\$82,000.00	\$9,500.00	\$91,500.00	15.00%	\$117,187.50	\$90,000.00	-\$27,187.50	0.768	-\$1,500.00	0.984
2	Design & Approvals	15-Nov-21	31-Jan-22	\$1,550,000.00	15-Nov-21		\$1,558,000.00		\$1,558,000.00	100.00%	\$1,550,000.00	\$1,550,000.00	\$0.00	1.000	-\$8,000.00	0.955
3.1	Site set up	02-Jan-22	31-Jan-22	\$300,000.00	15-Jan-22		\$255,000.00	\$60,000.00	\$315,000.00	100.00%	\$300,000.00	\$300,000.00	\$0.00	1.000	-\$15,000.00	0.952
3.2	Earth works	20-Jan-22	20-Mar-22	\$1,500,000.00	25-Jan-22		\$900,000.00	\$210,000.00	\$1,110,000.00	75.00%	\$811,559.32	\$1,255,000.00	-\$443,440.68	1.385	\$15,000.00	-4.014
3.3	Manfr. & Install PC Bridge Deck	02-Jan-22	25-Jul-22	\$3,900,000.00	20-Dec-21		\$600,000.00	\$190,000.00	\$790,000.00	20.00%	\$955,882.35	\$780,000.00	-\$175,882.35	0.816	-\$10,000.00	0.987
3.4	Concrete piers & walls	01-Mar-22	30-May-22	\$2,900,000.00	15-Feb-22		\$8,000.00	\$45,000.00	\$53,000.00	2.00%	\$58,000.00	\$58,000.00	\$0.00	N/A	-\$5,000.00	1.094
3.5	Embankment works	30-May-22	10-Jul-22	\$1,200,000.00												
3.6	Track works	28-Jul-22	30-Aug-22	\$1,700,000.00												
3.7	Clear Site & Make Good	30-Aug-22	15-Sep-22	\$500,000.00												

We are looking good

Or are we?



## Using the EVM data

- For each Work Package and Control account:
  - What's occurred is easy
  - Why is harder
  - What can be done about it requires skill
- Focus on what matters!
- Corrective and preventative actions developed and implemented
- No retroactive changes to performance data
- Corrective and preventative actions monitored for effectiveness

Variance Analysis Report							
Project	Eclipse		Report Period		Period 6		
Role	February 8, 2015		MBS Element		L4.1 Braking System		Subtasks/Issues
	PV	EV	AC	CV	CV%	SV	SV%
Current Period	\$3,800	\$1,176	\$2,000	(\$2,241)	-70%	(\$2,744)	-70%
Committed	\$3,800	\$1,176	\$2,000	(\$2,241)	-70%	(\$2,744)	-70%
At Completion	\$11,440	\$12,000	(\$560)				

**SCHEDULE VARIANCE**  
**Problem Analysis - Cause**  
 Several delivered components from one vendor have failed receipt inspection, resulting in approximately \$3,000 of parts associated with the handlebars that were required in the vendor for modifications. These parts were planned to be delivered by February 26, however they are anticipated to be returned on March 11. It is anticipated that the schedule variance will go to zero at that time.  
**Progress/Task Impact**  
 The braking system is on the critical path of the program. Delay in these deliveries may impact all downstream activity including the shifting system, integration, assembly, and test. The anticipated impact to the braking system is a 2-week delay in completion.  
**Corrective Action Plan (Include Expected Recovery Date)**  
 The braking system team is working with the project manager and other component teams on a mitigation plan to recover some of the 2-week delay. Specifically, some component tests and product tests may begin without the braking system. In addition, we are working with the shifting system team to assess if activities can be performed simultaneously rather than serially as planned. Anticipated completion of the braking system by March 11, and program impact is still being managed and assessed.

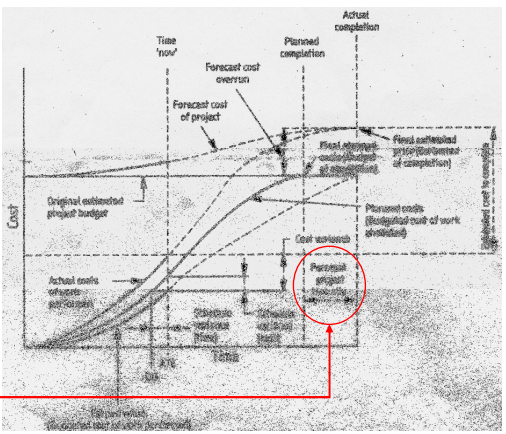
**COST VARIANCE**  
**Problem Analysis - Cause**  
 \$560 of the cost variance is due to a higher than anticipated cost associated with the brake calipers and pads. The remaining \$234 is labor associated with managing early receipt of wing components.  
**Progress/Task Impact**  
 The \$560 pad and caliper overrun cannot be mitigated and is included in the braking system EAC. No impact projected for the labor variance.  
**Corrective Action Plan (Include Expected Recovery Date)**  
 The \$254 of labor variance is level of effort activity performed earlier than anticipated. Since the associated wing components have arrived early, these LSC activities will not have to be performed when anticipated in late February, and the \$254 variance will go to zero at that time.  
**Impact to Estimate At Completion (EAC)**  
 Purchase orders released to vendors for braking system parts, primarily the pads and calipers, were requested \$560 higher than budgeted. Cost impacts associated with part inspection failures are still being evaluated, but a potential \$1,500 - \$2,000 EAC impact is possible.



# EVM – it's not as hard as you think

## Using the EVM data

- **It's all in the numbers**
- The complete picture is needed for effective governance and control

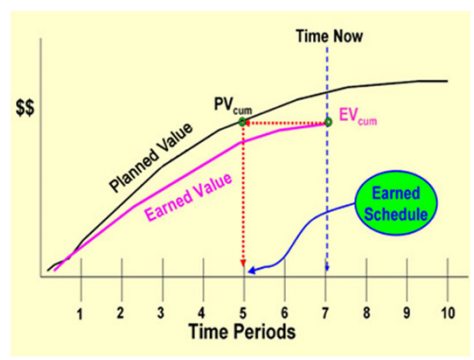


Traditional EVM cannot predict time slippage  
**Neither can a CPM schedule**



## Using the EVM data

- **Earned Schedule** predicts time outcomes based on performance
- As accurate as EV
- Uses the same data as EV
- Is freely available from: <http://www.earnedschedule.com>



See: *Why Critical Path Scheduling (CPM) is Wildly Optimistic*  
[https://mosaicprojects.com.au/PDF\\_Papers/P117\\_Why\\_Critical\\_Path\\_Scheduling\\_is\\_Wildly\\_Optimistic.pdf](https://mosaicprojects.com.au/PDF_Papers/P117_Why_Critical_Path_Scheduling_is_Wildly_Optimistic.pdf)




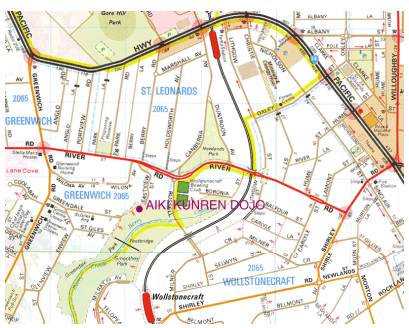


## Summary



## Summary

- System design matters
  - Useful, accurate, and 'fully detailed' are not synonymous and may be contradictory!



## Summary

- Everyone can tell a project is late after it finishes late
- Ditto cost overruns
- Generally time issues manifest before cost issues (SV or schedule)
- Project control systems focus on finding problems early
- Management is responsible for making sure they are fixed
- This requires a rigorous controls system

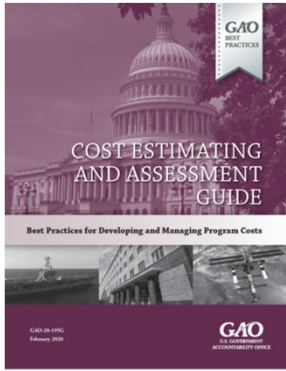


4 years late, £4+ Billion over budget.  
Reporting on-time and on budget 4 months before original opening date ☹️



## Resources

- **GAO COST ESTIMATING AND ASSESSMENT GUIDE**  
GAO-20-195G  
Published: March, 2020
- **GAO SCHEDULE ASSESSMENT GUIDE: Best Practices for Project Schedules**  
GAO-16-89G  
Published: Dec 22, 2015

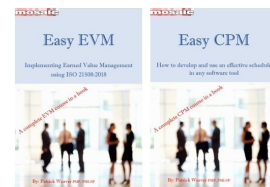


Both free to download & use



## Resources

- ISO 21508: Earned value management in project and programme management
  - Australian adoption as AS 4817: 2019
  - Modified to include normative appendix
- ISO 21511: Work breakdown structures for project and programme management
- Mosaic EVM links:  
<https://mosaicprojects.com.au/PMKI-SCH-040.php>
- Mosaic Scheduling links:  
<https://mosaicprojects.com.au/PMKI-SCH-010.php>



## Conclusions

- EVM provides the framework for an effective project management and governance system
- It is flexible in the **how** of its structure and implementation (work packages)
- It is rigorous in the **what** of measurement, visibility and accountability
- **Predicts cost outcomes accurately**



## Conclusions

- For a full understanding of the current situation
  - Risk Management to understand uncertainty
  - CPM to direct and plan use of resources
  - EVM (cost) to predict and manage cost outcomes
  - ES to predict time outcomes



# THANK YOU

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<https://mosaicprojects.com.au/PMKI-SCH.php>

