

How does current Critical Path definitions consider resources?

Is it time for a change?



Mostafa AbdelRazik BIO

- Project Controls Specialist
- 10+ years of experience in Project Controls
- Director of PMIS INC
- Bachelors in Civil Engineering (Carleton U, Ottawa)
- Masters in Construction Management (Concordia U, Montreal)
- PSP, EVP, PMP, Meng
- Active public speaker
- Things you don't know about me..

Introduction



Introduction

- Critical path definitions are listed in different literature
- All current critical path definitions are in terms of time only
- Do labor hours (work effort) have any effect on the critical path?

Background



Background

- A few critical path definitions (AACE RP 49-R06)
 - Longest path through a CPM network where a delay to the path affects the duration of the project
 - Path with lowest float especially when constraints are used in the schedule

Background

- These definitions are in terms of time
- What about criticality in terms of cost or manhours?

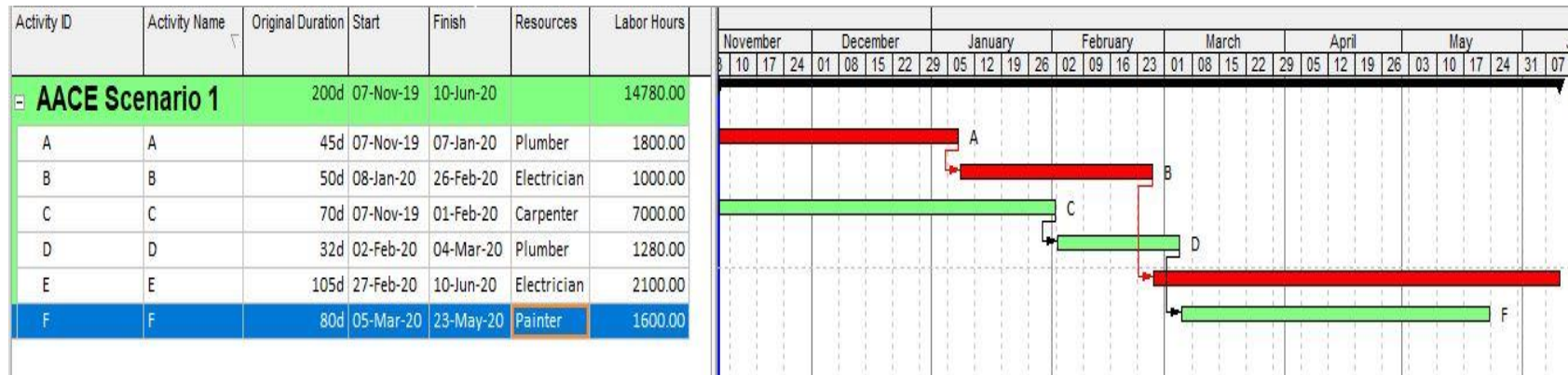
Background (A simple brain teaser)

Discipline	Electrical	Piping
Total man hours	50,000	12,000
Resources available	50 workers	10 workers
Start to Finish duration	1,000 hours	1,200 hours
Cost assuming \$120/hr	\$6,000,000	\$1,440,000

- Is piping the critical path or is electrical?
- Do you notice the big difference in the number of resources needed?
- Electrical work is taking less time because it has a lot more resources

Background

Activity	Predecessor	Original Duration (Days)	Resource Type	Headcount	Total Manhours
A	Start Milestone	45	Plumber	4	1,800
B	A	50	Electrician	2	1,000
C	Start Milestone	70	Carpenter	10	7,000
D	A and C	32	Plumber	4	1,280
E	B	105	Electrician	2	2,100
F	D	80	Painter	2	1,600



Case Study



Case Study

- Turnaround of an oil and gas refinery in Canada
- 346 activities
- 557 relationships
- Total manhours = 125,989

Case Study

Activity ID	Original Duration	Budgeted Labor Units	Start	Finish
A0202	7	748	15-Apr-19*	24-Apr-19
A0246	7	0	15-Apr-19	24-Apr-19
A0268	19	1894	22-Apr-19	16-May-19
A0290	4	0	13-May-19	17-May-19
A0334	2	0	21-May-19	23-May-19
A0444	28	8405	30-Apr-19	1-Jun-19
A0466	2	0	1-Jun-19	3-Jun-19
A0510	2	0	4-Jun-19	6-Jun-19
A0532	2	0	6-Jun-19	8-Jun-19
A0554	1	0	8-Jun-19	10-Jun-19
A0576	1	0	10-Jun-19	11-Jun-19
A0598	1	0	10-Jun-19	11-Jun-19
A0620	11	919	11-Jun-19	24-Jun-19
A0636	2	127	24-Jun-19	25-Jun-19
A2700	1	86	25-Jun-19	26-Jun-19
A0637	2	138	26-Jun-19	28-Jun-19
A0623	4	302	28-Jun-19	3-Jul-19
A0621	8	627	3-Jul-19	11-Jul-19
A0626	1	72	11-Jul-19	12-Jul-19
A0617	8	635	12-Jul-19	22-Jul-19
A0627	1	43	22-Jul-19	22-Jul-19
A0618	4	295	22-Jul-19	26-Jul-19
A0624	4	312	26-Jul-19	31-Jul-19
A0631	1	90	31-Jul-19	1-Aug-19
A0622	4	297	1-Aug-19	5-Aug-19
A0619	10	829	5-Aug-19	16-Aug-19
A0630	1	112	16-Aug-19	19-Aug-19
A0629	3	255	19-Aug-19	22-Aug-19
A0628	8	627	22-Aug-19	30-Aug-19
A0650	1	0	30-Aug-19	31-Aug-19

- Current longest path
- Need to examine EVERY path
- Is there a software that does that?
- Access database tool was created
- 162,217 different paths were found

Case Study

Activity on “most Manhours” path	Start	Finish	On CPM Longest Path?	Total Float
A0381	22-Apr-19*	26-Apr-19	No	2
A0376	26-Apr-19	01-May-19	No	2
A0395	01-May-19	06-May-19	No	2
A0396	06-May-19	10-May-19	No	2
A0462	09-May-19	23-May-19	No	2
A0452	25-Jun-19	26-Jul-19	No	15
A0474	26-Jul-19	29-Jul-19	No	15
A0518	29-Jul-19	31-Jul-19	No	14
A0540	31-Jul-19	02-Aug-19	No	14
A0562	02-Aug-19	04-Aug-19	No	14
A0606	04-Aug-19	05-Aug-19	No	14
A0628	22-Aug-19	30-Aug-19	Yes	0
A0650	30-Aug-19	31-Aug-19	Yes	0

Case Study

- Three updates were analyzed
- Change in critical path were examined
- “Most man hours path” were checked if it became critical by checking their floats

Case Study (Update 1)

Activities on "most Manhours" path	Start	Finish	On CPM Longest Path?	Baseline Total Float	May 8 Total Float
A0381	15-Apr-19 A	11-May-19	No	2	3
A0376	22-Apr-19 A	12-May-19	No	2	3
A0395	16-Apr-19 A	13-May-19	No	2	3
A0396	15-Apr-19 A	13-May-19	No	2	6
A0462	27-Apr-19 A	21-May-19	No	2	6
A0452	07-May-19 A	28-Jul-19	No	15	16
A0474	28-Jul-19	30-Jul-19	No	15	16
A0518	17-Aug-19	20-Aug-19	No	14	1
A0540	20-Aug-19	22-Aug-19	No	14	1
A0562	22-Aug-19	23-Aug-19	No	14	1
A0606	23-Aug-19	24-Aug-19	No	14	1
A0628	26-Aug-19	30-Aug-19	Yes	0	0
A0650	30-Aug-19	31-Aug-19	Yes	0	0

Case Study

- Four activities on the “most manhours path” have witnessed a big drop in float and hence are becoming near critical
- Not on longest path

Case Study (Update 2)

Activities on "most Manhours" path	Start	Finish	On Longest Path?	Baseline Total Float	Aug 8 Total Float
A0381	15-Apr-19 A	17-Jun-19 A	No	2	0
A0376	22-Apr-19 A	09-Jul-19 A	No	2	0
A0395	16-Apr-19 A	29-May-19 A	No	2	0
A0396	15-Apr-19 A	29-May-19 A	No	2	0
A0462	27-Apr-19 A	06-Aug-19 A	No	2	0
A0452	07-May-19 A	13-Aug-19*	No	15	-10
A0474	01-Aug-19 A	03-Aug-19 A	No	15	0
A0518	02-Aug-19 A	06-Aug-19 A	No	14	0
A0540	13-Aug-19	15-Aug-19	No	14	2
A0562	15-Aug-19	16-Aug-19	No	14	2
A0606	16-Aug-19	17-Aug-19	No	14	2
A0628	17-Aug-19	23-Aug-19	No	0	2
A0650	29-Aug-19	29-Aug-19	No	0	2

Case Study

- Most of the activities on the “most manhours path” experienced delays
- Multiple activities on the “most manhours path” came very close to being critical with total float values of 1 and 2.
- Activities on the project’s longest path are driven by activities on “most manhours path”

Case Study (Update 3)

Activity on “most Manhours” path	Start	Finish	On Longest Path?	Baseline Total Float	Aug 15 Total Float
A0381	15-Apr-19 A	17-Jun-19 A	No	2	0
A0376	22-Apr-19 A	09-Jul-19 A	No	2	0
A0395	16-Apr-19 A	29-May-19 A	No	2	0
A0396	15-Apr-19 A	29-May-19 A	No	2	0
A0462	27-Apr-19 A	06-Aug-19 A	No	2	0
A3020	13-May-19 A	13-Aug-19 A	No	15	0
A0452	07-May-19 A	13-Aug-19 A	No	15	0
A0474	01-Aug-19 A	03-Aug-19 A	No	15	0
A0518	02-Aug-19 A	06-Aug-19 A	No	14	0
A0540	15-Aug-19	17-Aug-19	Yes	14	0
A0562	17-Aug-19	18-Aug-19	Yes	14	0
A0606	19-Aug-19	20-Aug-19	Yes	14	0
A0628	20-Aug-19	26-Aug-19	Yes	0	0
A0650	30-Aug-19	31-Aug-19	Yes	0	0

Case Study

- Activities on “most manhours path” have become drivers of longest path.
- “Most manhours path” have shown tendency to becoming critical

Conclusion



Conclusion

- Activities with large number of manhours usually require close attention
- Resource absence can have huge effect on activities with large manhours
- Case study showed tendency of “most manhours path” to becoming critical during project execution



THANK YOU