# **ENGINUITY TUTORIAL**



## **Handling Job Delays**

**Copyright Virtual Management Simulations** 



The **effectiveness of labour** allocated to a job by the Construction Manager can be adversely affected by a number of factors, such as :-

- The expertise of the project manager on the site
- Labour relations
- Overmanning of the site

There is also another key factor that the Construction Manager needs to take into account, and that is **delays to the job caused by risks striking**.

We will at how the Construction Manager can mitigate against the consequences of job delays.



#### 👹 Job 106 (In progress)

Navigate to "Main menu/Making decisions/Job progression decisions (Labour)/Display job details"

Management consultants report Risk analysis

	JOB S	UMMARY	'		JO	B PROGR	ESS							
				Profit analysis										
Planned schedule Actual progress										Ву ре	eriod	Cumul	ative	
Job period	Planned labour	Cumul % complete	Period	Status	Actual labour	Ineffect due to delays	Ineffect due to overman	Effective labour	Actual % complete	Completion status	Profit	Profit % of cost	Cumul profit	Cumul profit % of cost
1	68	25 %	- 7	Past	80	5.4	0.0	74.6	28.16 %	Ahead of schedule	165,909	3.0 %	165,909	3.0 %
2	81	55 %	8	Past	96	0.0	0.4	95.6	64.27 %	Ahead of schedule	498,526	7.4 %	664,435	5.5 %
3	81	85 %	9	Past	96	9.2	0.0	86.8	96.77 %	Ahead of schedule	110,051	1.7 %	774,486	4.2 %
4	41	100 %	1% 10 Current							FINAL planned period of the job				

Total planned labour needed to complete the job is 271.

For a Energy job, the effective labour on site (after delays) cannot be more than 18% above the planned labo

Consider the following example.

The intention was to complete job 106, an **Energy job**, in period 9, a period earlier than the planned duration of 4 periods, and receive a bonus from the client for early job completion. To achieve this 96 labourers were allocated to site.

However, the effective level of labour **was reduced by 9.2 due to delays caused by risks striking**. This resulted in the job being 96.77% complete at the end of period 9, and not quite completing.

We will now look in more detail at what caused the risk delays using the **Risk analysis** option at the top of the screen, and what action could have been taken to mitigate against their affect in order to complete the job a period early.



COST ANALY										
000174042	YSIS	;		DELAY ANALYSIS						
Job deta	ils			Risk details				tatus	Dela	ays
Job Status In BIM Sector				Risk description	escription Chance				Affect of Invest	Actual labour reduction
progress	IND	Yes	ENE	Inadequate site procedures	Medium	2.3 %	No			
				Local transport problems	Medium	2.4 %	Yes	9	-30.0 %	1.68 %
				Hazardous materials found at site	Low	6.9 %	Yes	7	-30.0 %	4.83 %
				Inadequate staff training	Medium	2.7 %	Yes	7	-30.0 %	1.89 %
				Site safety issues	Medium	11.3 %	Yes	9	-30.0 %	7.91 %
P	Job deta	Job details tus In rogress IND	Job details tus In BIM job rogress IND Yes IND Yes	Job details   tus In BIM job Sector   rogress IND Yes ENE   IND Yes IND Yes   IND Yes IND   IND Yes IND   IND Yes IND   IND Yes IND   IND Yes IND	Job details   Risk details     tus   In   BIM job   Sector   Risk description     rogress   IND   Yes   ENE   Inadequate site procedures     In   In   Yes   ENE   Inadequate site procedures     In   In   In   Hazardous materials found at site     Inadequate staff training   Site safety issues	Job details   Risk details     tus   In   BIM job   Sector   Risk description   Chance     rogress   IND   Yes   ENE   Inadequate site procedures   Medium     In   In   In   In   Local transport problems   Medium     Inadequate staff training   Inadequate staff training   Medium     Inadequate staff training   Medium     Inadequate staff training   Medium     Inadequate staff training   Medium     Inadequate staff training   Inadequate     Inadequate   Inadequate     Inadequate   Inadequate	Job details   Risk details     tus   In   BIM job   Sector   Risk description   Chance   Expected labour reduction     rogress   IND   Yes   ENE   Inadequate site procedures   Medium   2.3%     Indequate site procedures   Medium   2.4%   Hazardous materials found at site   Low   6.9%     Inadequate staff training   Medium   2.7%   Site safety issues   Medium   11.3%	Job details   Risk details   Risk s     tus   In   BIM job   Sector   Risk description   Chance   Expected labour reduction   Struck     rogress   IND   Yes   ENE   Inadequate site procedures   Medium   2.3%   No     In   Yes   ENE   Inadequate site procedures   Medium   2.4%   Yes     In   In   Inadequate staff training   Medium   2.4%   Yes     In   Inadequate staff training   Medium   2.7%   Yes     Inadequate staff training   Medium   11.3%   Yes	Job detailsRisk statustusInBIM jobSectorRisk descriptionChanceExpected labour reductionStruck periodIn periodrogressINDYesENEInadequate site proceduresMedium2.3%NoInImImImImIm periodImIm periodIm periodIm periodImYesENEInadequate site proceduresMedium2.3%NoIm PeriodImImIm 	Job detailsRisk statusDetailstusInBIM jobSectorRisk descriptionChanceExpected labour reductionIn periodAffect of InvestrogressINDYesENEInadequate site proceduresMedium2.3%No

The **Risk analysis** reveals that the delays to the job in period 9 were caused by 'Local transport problems' and 'Site safety issues'.

The combined delay should been a labour reduction of 13.7% (2.4% + 11.3%), but targeted investments on the Financial Decisions Screen reduced the labour reduction by 30% to 9.59%.

### **KEY POINTS**

- More than one risk can strike in any period of a job, but they only occur during the planned duration of a job, and not if it overruns.
- Completing a job at least one period early can prevent risks striking in future periods.



#### 👹 Investment Details

#### ASIA PACIFIC SOLUTIONS

#### Desc: Management consultants

Profile: For over 40 years, Australian based Asia Pacific Solutions have been saving their clients millions by providing risk mitigation solutions at all stages of the construction process, and they recently invested in a state of the art computer system to stay at the forefront of their field.

The company operate solely with contractors in the energy sector wordwide, although 75% of their turnover is within the Asia Pacific region, which they serve from their Gold Coast headquarters, along with around 20 regional offices.

		Company ir	ivestme
Period	% return to	Amount	Invest
renou	investors	invested	
1	2.4 %	0	
2	2.0 %	0	
3	2.5 %	100,000	
4	2.4 %	202,500	
5	2.0 %	307,360	7
6	2.6 %	413,507	
7	2.2 %	424,258	
8	2.5 %	433,5 <sup>9</sup>	
9	2.9 %	444,/	

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#### PERFORMANCE HISTORY

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	Build cost	Risk cost	% of total
Industrial	0	0	0%
Building & Commercial	0	0	0%
Transport	0	0	0%
Energy	0	431,437	100 %
Water & Sewage	0	0	0%
	0	431,437	

The targeted investment that reduced the job delay was in Asia Pacific Solutions, whose profile clearly shows that they have built up an enviable global reputation for risk management solutions to contractors in the Energy sector of the construction industry, which job 106 is.



🐉 Industry paramete	rs	
FINANCE	OVERHEADS PROCUREMENT JOB PROGRESSION	
CASH ACCOUNT	Credit rate:1.8 % per annumOverdraft rate:6.4 % per annumOverdraft limit:600,000	
CAPITAL BASE	Increase limited to:5 % this periodSold off limited to:25 % this periodDepreciation rate:2.5 % per annumCapital writing down:25 % per annum	
INVESTMENTS	Restrictions     There cannot be more than:   6     investments at any point in time     For each investment the maximum increase in the investment is limited to:   100000     each period	
	Benefits for jobs in progress A minimum amount of: 200000 needs to have been invested to obtain any benefits for jobs in progress	
	For investments that deliver build cost reductions, once the minimum amount has been invested to obtain benefits, and depending upon how much has been invested, the build cost reductions are between: 0.3 and 0.5 %	
	For investments that provide risk management services, once the minimum amount has been invested to obtain benefits, and depending upon how much has been investment, for risks that strike the risk cost reductions are between: 30 and 40 %	
	job delay reductions are between: 25 and 30 %	
	If an investment company ceases trading, the amount invested recovered is between: 25 and 85 %	

The **Industry parameters** reveal that if at least 200,000 is invested into companies that provide risk management services for the construction industry, job delays can be reduced by between 25 and 30%, as has been achieved by the investment in Asia Pacific Solutions.

#### **KEY POINTS**

There are 2 tiers of cost reductions, a lower and upper tier. You are not told the investment required to obtain the upper tier saving, and this knowledge can only be acquired as time progresses, but there is a linear increment between the two tiers as the investment increases.



#### 👹 Job 106 (In progress)

Management consultants report Risk analysis

	JOB S	UMMARY	'		JO	B PROGR	ESS							
			Profit analysis											
Planned schedule Actual progress										Ву ре	eriod	Cumulative		
Job period	Planned labour	Cumul % complete	Period	Status	Actual labour	Ineffect due to delays	Ineffect due to overman	Effective labour	Actual % complete	Completion status	Profit	Profit % of cost	Cumul profit	Cumul profit % of cost
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4	41	100 %	10	Current						FINAL planned period of the job				

Total planned labour needed to complete the job is 271.

For a Energy job, the effective labour on site (after delays) cannot be more than 18% above the planned labour level for the period.



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🎲 M/	KING Jo	b progression de	ecisions (I	Labour) for period 9 in the Ea	rly Years													_ 🗆 ×
Chang	e period	Key information	Help															
		IDLE LABOUR	POOL	START OF THE PERI Number in the idle p Number to lay Number available for jobs in progr AFTER DECISIO Net transl Number left in the idle p	00 77 voof: 77 ess: 77 NS vool: 37													
		JOBS IN PROG	IRESS			This pe	riod		( Tos	) wn La ite	abour From	site		Su	bcont	ract La	abour	
Job	Country	Sector	Plan Dur	Remaining planned periods	Progress so far	Status	Plan lab	Last	From	New	ILP	Paid	On site	End last	Take	Lay	On site	Total
106	IND	Energy	4	2 planned periods remaining	Ahead of schedule	3rd period	81	96	0	0	0	0	96	0	0	0	0	96
121	UK	Transport	4	2 planned periods remaining	Ahead of schedule	3rd period	99	137	0	0	0	72	65	- 7	0	7	P	65
146	US	Energy	4	3 planned periods remaining	Ahead of schedule	2nd period	37	34	9	0	0	0	43	1	0	- P	4	44
173	UK	Energy	4	4 planned periods remaining		1st period	26	0	31	0	0	0	31	0	P*		0	31

Delays that occur in the periods before a job is due to complete are not such a concern, apart from the additional site cost. HOWEVER, delays that occur in the period a job is due to complete can be costly because they can prevent a job from completing, with associated late completion penalties, and a waste of resources in terms of the further labour and a project manager to complete the job.

Gong back to the previous period, how could the Construction Manager adjust the labour on site for job 106 to mitigate against the affect of any potential delays ?



Ū.	🖗 Ris	k analysis			Na	vigate to	o "Main menu/Making decisions/Job progression decisions (Labour)/Display job details/Risk analysis"										
		COST	ANAI	YSIS	S		DELAY ANALYSIS	DELAY ANALYSIS									
	Job details						Risk details			Risk s	status	Delays					
	Job Status In Bil			BIM job	Sector	Risk description	Chance	Expected labour reduction	Struck	In period	Affect of Invest	Actual labour reduction					
	106	In progress		IND Ye		ENE	Inadequate site procedures	Medium	2.3 %	No							
RISK		Likelihood	Char	nce it	hits		Local transport problems	Medium	2.4 %	No							
		High	70	to 80	%		Hazardous materials found at site	Low	6.9 %	Yes	7	-30.0 %	4.83 %				
		Medium	40	to 50	%		Inadequate staff training	Medium	2.7 %	Yes	7	-30.0 %	1.89 %				
		Low 20 to 30 %			Site safety issues	Medium	11.3 %	No									
	_																

The **Risk analysis** for job 106 reveals that there are 3 risks that have not yet struck, and which could delay the job if they were to strike, the delay causing a reduction in the labour on site :-

- 'Inadequate site procedures', which has a 'medium' chance of occurring, and an expected labour reduction of 2.3%
- 'Local transport problems', which has a 'medium' chance of occurring, and an expected labour reduction of 2.4%
- 'Site safety issues', which has a 'medium' chance of occurring, and an expected labour reduction of 11.3%

The **Industry parameters** show the chance a risk may strike for each likelihood level.

### Since the risks all have a medium chance of occurring, the Construction Manager decides to take action in all 3 cases.

The combined delay is expected to be 16% if all the risks strike, but the investment in the Asia Pacific Group should reduce the delay by 30% i.e., from 16% To 11.2%. Hence, the required labour level of 96 is adjusted in case of the 11.2% delay, giving a revised labour level of 108.1 labourers (96 / 0.888). Since we cannot have fractions of people, the labour level is adjusted upwards to 109.

## **KEY POINTS**

Targeted investments on the Financial Decisions Screen into risk management companies can reduce the delays caused when risks strike, and reduce the amount of additional labour added to compensate for potential delays.



🎲 MA	KING Jo	b progression deci	isions (I	Labour) for period 9 in the Ea	rly Years													
Chang	je period	Key information He	elp															
		IDLE LABOUR P	<u>00L</u>															
	JOBS IN PROGRESS								C To s	)wn La	abour From	site		Su	bconti	act La	abour	
Job	Country	Sector	Plan Dur	Remaining planned periods	Progress so far	Status	Plan lab	Last per	From ILP	New	To ILP	Paid off	On site	End last	Take on	Lay off	On site	Total
106	IND	Energy	4	2 planned periods remaining	Ahead of schedule	3rd period	81	96	13	0	0	0	109	0	0	0	0	109
121	UK	Transport	4	2 planned periods remaining	Ahead of schedule	3rd period	99	137	0	0	0	72	65	- 7	0	7	-	65
146	US	Energy	4	3 planned periods remaining	Ahead of schedule	2nd period	37	34	10	0	0	0	44	1	0	-	0	44
173	UK	Energy	4	4 planned periods remaining		1st period	26	0	31	0	0	0	31	0			0	31

The adjusted labour level of 109 labourers should compensate if all of the risks strike, and enable the job to complete on time.

## **KEY POINTS**

If the delays do not occur the job will complete earlier than the end of the period, and as all labour is retained on site until the end of the period when a job completes, there will be additional labour costs due to the ineffective labour. **However, at least the job will have completed.**