Project Cash Flow

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Scenario Testing

- The Need
  - Cash flows can be estimated by attempting to assess flows from
    1. Project in progress.
    2. Projects under contract but not yet begun.
    3. Potential projects which will start during the coming financial accounting period.

Scenario Testing

- The Need (cont'd)
  - These sources of income can be viewed as:
    1. Birds in the hand.
    2. Birds in the bush, and
    3. Birds flying the sky.
  - In other words, cash flows can be projected from projects in progress and projects which may, with some probability, start in the coming period for which forecasts are being made.

Scenario Testing

- The Need (cont'd0
  - The advent of spreadsheet analysis and high speed computers has led to "scenario testing" of future cash flow expectations.

The Technology

- Spreadsheet (can do probabilistic cash flow projections)
- More advanced analysis can also factor in historical evidence of payment trends and potential impact of macroeconomic factors.
- These techniques can go beyond the typical best-, expected-, and worst-case scenario modeling.

The Technology

- These techniques may also rely on monte Carlo simulation, Markov modeling, or the use of “fuzzy” data sets to build up statistically valid outcomes.
- This level of analysis used to be in the economist’s realm, but is now commonplace in the future in the finance and business development groups of corporations.

Cash Flow Projections

- Life of a project can be used to develop the projection of income and expense during this project life.
- Complexity of the project obviously has an affect on the method used.
- In many contracts (e.g., public contracts such as those used by state agencies), the owner requires the contractor to provide an S-curve of estimated progress and costs across the life of the project.

Cash Flow Projections

- The contractor develops this by constructing a simple bar chart of the project, assigning costs to the bars, and smoothly connecting the projected amounts of expenditures over time.
- Consider the highly simplified project of the next slide in which four major activities are scheduled across a four-month time span.

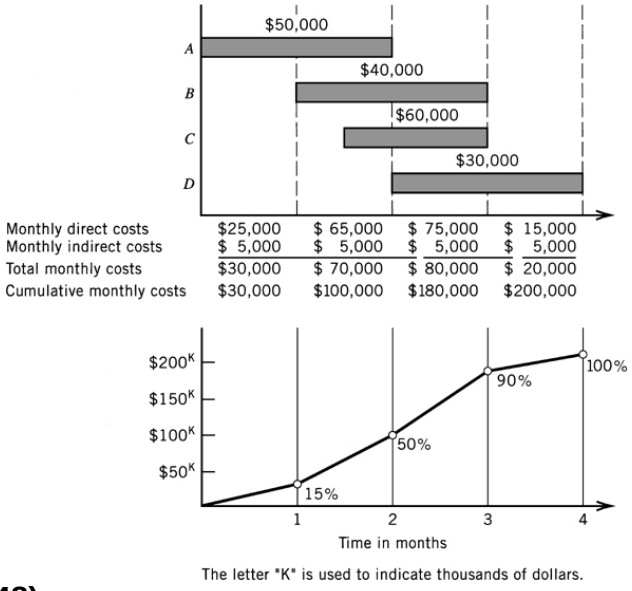


Figure 9.1 (p. 148)
Development of the S-Curve.

Cash Flow Projections

- Bars representing the activities are positioned along a time scale indicating start and finish times.
- The direct costs asociated with each activity are shown above each bar in the figure.
- It's assumed that the monthly cost of indirect charges (i.e., site office costs, telephone, heat, light, which cannot be charged directly to an activity) is $5,000.

Cash Flow Projections

- Assuming that the direct costs are evenly distributed across the duration of the activity, the monthly direct costs can be readily calculated and shown below the time line in the figure.
- The direct charges in the second month, for example, derive from activities A, B, and C, all of which have a portion in the period.

Cash Flow Projections

- The direct charge is simply calculated based on portion of the activity scheduled in the second month as:

$$\text{Activity A}: \frac{1}{2} \times 50{,}000 = \$25{,}000$$

$$\text{Activity B}: \frac{1}{2} \times 40{,}000 = \$20{,}000$$

$$\text{Activity C}: \frac{1}{3} \times 60{,}000 = \underline{\$20{,}000}$$

$$\$65{,}000$$

Cash Flow Projections

- The figure shows the total monthly and cumulative monthly expenditures across the life of the project.
- The S-curve is nothing more than a graphical presentation of the cumulative expenditures over time.
- A curve is plotted below the time-scaled bars through the points of cumulative expenditures.

Cash Flow Projections

- As activities come on-line, the level of expenditures increases and the curve has a steeper middle section.
- Toward the end of a project, activities are winding down and expenditures flatten again.

Cash Flow to the Contractor

- The flow of money from the owner to the contractor is in the form of progress payments.
- As already noted, estimates of work cmpleted are made by the contractor periodically (usually monthly) and verified by the owner's representative.
- Depending on the type of contract (e.g., lump sum, unit price, etc.), the estimates are based on evaluations of the percentage of total contract completion or actual field measurements of quantities placed.

Cash Flow to the Contractor

- This process is best demonstrated by further consideration of the four-activity example just described.
- Assume that the, contractor originally included a profit or markup in his bid of $50,000 (i.e., 25%) so that the total bid price was $250,000.
- The owner retains 10% of all validated progress payment claims until one-half of the contract value (i.e., $125,000) has been built and approved as an incentive for the contractor to complete the contract.

Cash Flow to the Contractor

- The retainage will be deducted from the progress payments on the first $125,000 and eventually paid to the contractor on satisfactory completion of the contract.
- The progress payment will be billed at the end of the month, and the owner will transfer the billed amount minus any retainage to the contractor's acount 30 days later.

Cash Flow to the Contractor

- The amount of each progress payment can be calculated as:

$$\text{Pay} = 1.25\,(\text{indirect expense} + \text{direct expense})$$
$$= -0.10\left[1.25(\text{indirect expense} + \text{direct expense})\right]$$

Cash Flow to the Contractor

- The minus term for retainage drops out of the equation when 50% of the contract has been completed.
- Because of the delay in payment of billings by the owner and retainage withheld, the revenue profile lags behind the expense S-curve as shown in the following figure of the next slide.

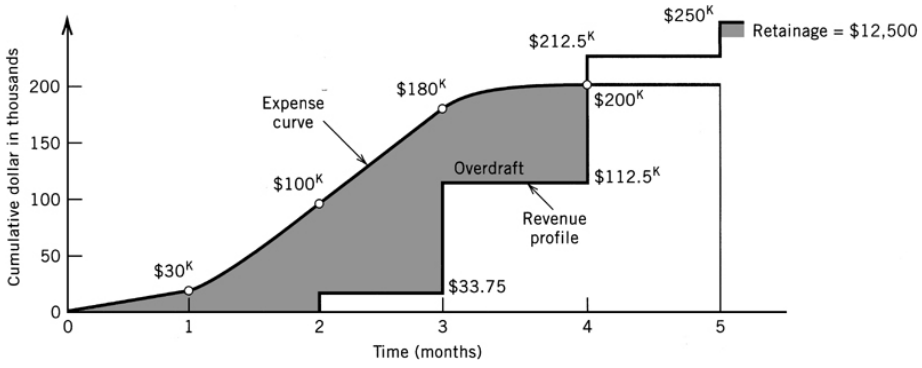


Figure 9.2 (p. 149)
Expenses and income profiles.

Cash Flow to the Contractor

- The revenue profile has a stair-step appearance since the progress payments are transferred in discrete amounts based on the preceding equation.
- The shaded area of the previous figure between the revenue and expense profiles indicates the need on the part of the contractor to finance part of the construction until such time as he is reimbursed by the owner.

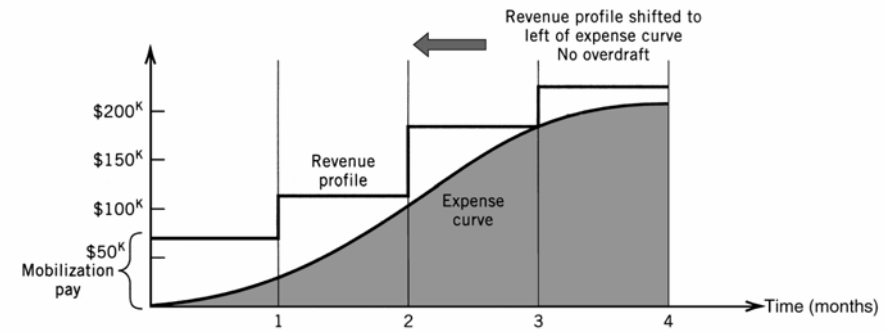


Figure 9.3 (p. 150)
Influence of front, or mobilization, payment on expense or income profiles.

Table 9.1 Overdraft Calculations

	Month											
	1		2		3		4		5		6	
Direct cost	$25,000		$65,000		$75,000		$15,000					
Indirect cost	5,000		5,000		5,000		5,000					
Subtotal	30,000		70,000		80,000		20,000					
Markup (25%)	7,500		17,500		20,000		5,000					
Total billed	37,500		87,500		100,000		25,000					
Retainage withheld (10%)	3,750		8,750		0		0					
Payment received		$33,750		$78,750		$100,000		$37,500				
Total cost to date	30,000		100,000		180,000		200,000		200,000			
Total amount billed to date	37,500		125,000		225,000		250,000		250,000			
Total paid to date		$33,750		112,000		212,500		250,000				
Overdraft end of month	30,000		100,300		147,553		90,279		(8,818)[b]		(46,318)[b]	
Interest on overdraft balance[a]	300		1,003		1,476		903		0		0	
Total amount financed	30,300		101,303		149,029		91,182		(8,818)			

[a] A simple illustration only. Most lenders would calculate interest charges more precisely on the amount/time involved employing daily interest factors.
[b] Parentheses indicate a positive balance in this case.

Table 9.1 (p. 151)
Overdraft calcuations.

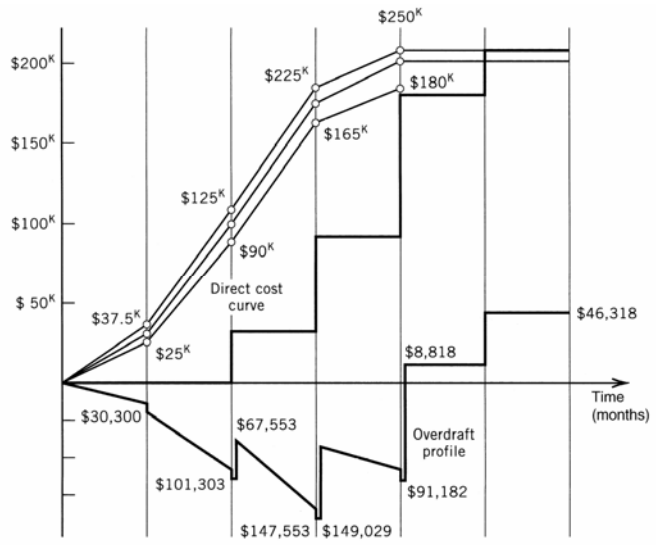


Figure 9.4 (p. 152)
Plot of maximum overdraft.

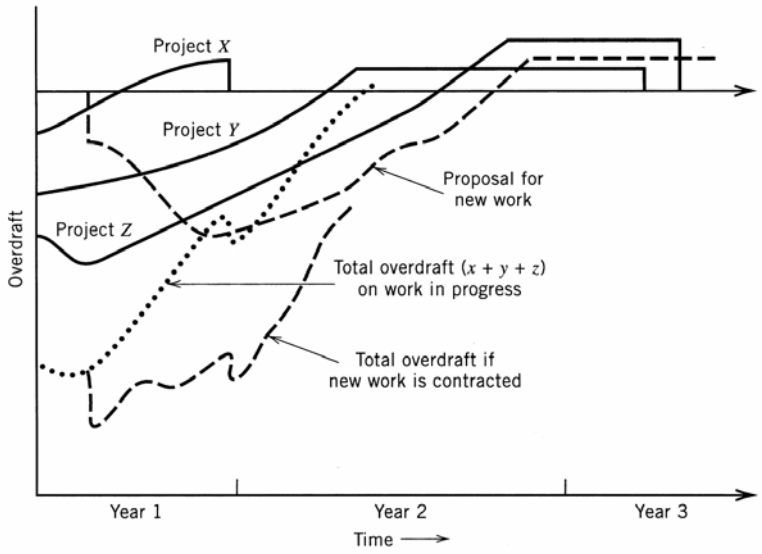


Figure 9.5 (p. 153)
Composite overdraft profiles.

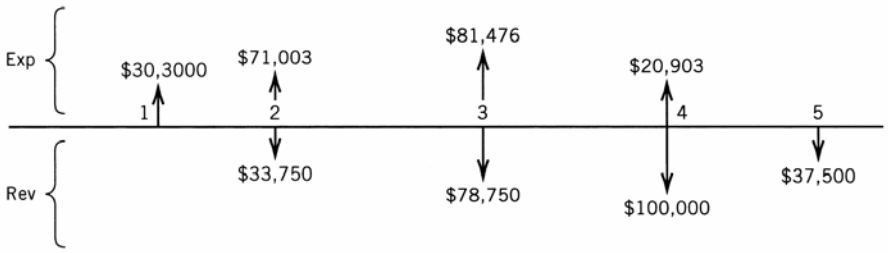


Figure 9.6 (p. 153)
ROR for small bar chart problem.

Table 9.2 ROR Calculations for Small Project

N	NET[a]	PWF[b] @ 20%	Total @ 20%	PWF @ 25%	Total @ 25%	PWF @ 22%	Total @ 22%
1	−30300	.8333	−25249	.8000	−24240	.8196	−24834
2	−37253	.6944	−25868	.6400	−23842	.6719	−25030
3	−2726	.5787	−1577	.5120	−1396	.5507	−1501
4	79097	.4822	38140	.4096	32398	.4514	35704
5	37500	.4019	15071	.3277	12289	.3700	13875
			$\sum = +517$		$\sum = -4971$		$\sum = -1786$

$$\frac{X}{2\%} = \frac{517}{(1786 + 517)}$$

$$X = 0.45\%$$

$$\text{ROR} = 20\% + 0.45\%$$

$$= 20.45\%$$

[a] A negative net value indicates expenses exceed revenue for this period.
[b] PWF = Present Worth Factor.

Table 9.2 (p. 154)
ROR Calculations for Small Project.

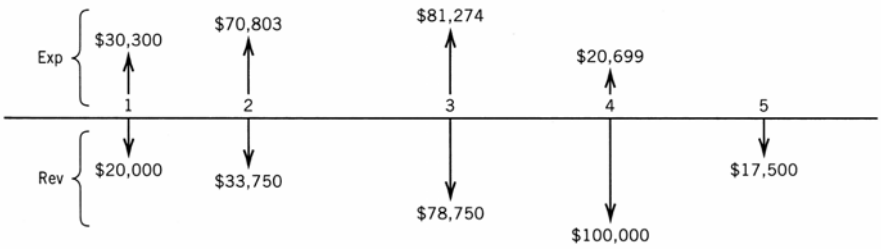


Figure 9.7 (p. 154)
ROR for small bar chart problem with mobilization payment.

Table 9.3 Overdraft Calculations with Mobilization Payment

	Month					
	1	2	3	4	5	6
Direct cost	$25,000	$65,000	$75,000	$15,000		
Indirect cost	5,000	5,000	5,000	5,000		
Subtotal	30,000	70,000	80,000	20,000		
Markup (25%)	7,500	17,500	20,000	5,000		
Total billed	37,500	87,500	100,000	25,000		
Retainage withheld (10%)	3,750	8,750	0	0		
Payment received		$20,000	$33,750	$78,750	$100,000	$17,500
Total cost to date	30,000	100,000	180,000	200,000	200,000	
Total amount billed to date	37,500	125,000	225,000	250,000	250,000	
Total paid to date		$20,000	$53,750	$132,000	$232,500	$250,000
Overdraft end of month	30,000	80,300	127,353	69,877	(29,424)[a]	(46,924)[a]
Interest on overdraft balance	300	803	1,274	699	0	0
Total amount financed	$30,300	$81,103	$128,627	$70,576	(29,424)	

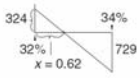
[a]Parentheses indicate a positive balance.

Table 9.3 (p. 155)

Overdraft Calculation with Mobilization Payment

Table 9.4 ROR Calculations to Include Mobilization Payment

N	Net[a]	PWF[b] 30%	Total @ 30%	PWF 32%	Total @ 32%	PWF 34%	Total @ 34%
1	−10300	.7692	−7923	.7575	−7802	.7463	−7687
2	−37053	.5917	−21925	.5739	−21265	.5569	−20635
3	−2524	.4552	−1149	.4348	−1097	.4156	−1049
4	79301	.3501	27765	.3294	26122	.3101	24591
5	17500	.2693	4713	.2495	4366	.2315	4051
			$\sum = 1482$		$\sum = 324$		$\sum = -729$



$$\frac{X}{2\%} = \frac{324}{(324 + 729)}$$

$$X = 0.62$$

$$\text{ROR} = [32 + .62]\%$$

$$= 32.62\%$$

[a]A negative net value indicates expenses exceed revenue for this period.
[b]PWF = Present Worth Factor

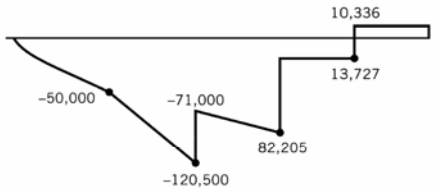
Table 9.4 (p. 156)

ROR Calculations to Include Mobilization Payment

Month	1	2	3	4
Indirect + Direct Cost ($)	$69,000	$21,800	$17,800	$40,900

Problem 9.1 (p. 156)

Overdraft	−50,000	−120,500	−82,205	−13,727	+10,336
Interest	−500	−1,205	−822	−137	—
Cumulative	−50,500	−121,705	−83,027	−13,864	+10,336



	1	2	3	4	5
Direct cost					
Indirect cost	10,000	10,000	5,000		
Total cost					
Markup					
Total worth					
Retainage					
Pay received					

Problem 9.2 (p. 157)

Timing and allocation	$25,000	$65,000	$75,000	$15,000	
			Total direct costs		$180,000
Indirect costs $5000/month	5,000	5,000	5,000	5,000	
			Total indirect costs		$20,000
	$30,000	$70,000	$80,000	$20,000	$200,000

Problem 9.3 (p. 157)

Month	Mobilization Demobilization	Subcontractors	Materials	Payroll	Equipment	Field Overhead
0	$40,000	$0	$0	$0	$0	$0
1	0	10,000	10,000	10,000	20,000	1,000
2	0	30,000	20,000	15,000	10,000	5,000
3	0	30,000	30,000	20,000	20,000	6,000
4	0	40,000	30,000	20,000	30,000	6,000
5	0	50,000	40,000	40,000	20,000	6,000
6	0	50,000	40,000	40,000	15,000	6,000
7	0	40,000	30,000	40,000	10,000	6,000
8	0	40,000	10,000	20,000	10,000	6,000
9	0	70,000	10,000	10,000	10,000	6,000
10	0	30,000	5,000	5,000	10,000	6,000
11	0	30,000	5,000	5,000	5,000	6,000
12	20,000	50,000	0	5,000	5,000	5,000
Total	$60,000	$470,000	$230,000	$230,000	$165,000	$65,000

Total cost = $60,000 + $470,000 + $230,000 + $230,000 + $165,000 + $65,000 = $1,220,000
Profits + overhead @ 10% = $122,000
Bid price = $1,342,000

Problem 9.4 (p. 157)