

Conference Paper

An Analysis of Critical Variables Affecting Working Capital in Infrastructure Projects

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Abstract

The research aims at exploring the critical variables that affect public works contractors' working capital in the delivery of infrastructure projects. Effective financial management has long been recognized as the 'lifeblood' of construction contractors, especially during economic periods of recession. The main reason for insolvency in the built environment is the lack of working capital to support contractors' site operations. Therefore, it is vital to accurately predict the project working capital requirements at the pre-tender stage and closely monitor project cash-flow during the physical production process. The proposed methodology entails the development of a cash-flow/ working capital calculation process based on spreadsheet modelling and the Gantt chart for the derivation of project disbursements S-curves, revenue step function curves, and maximum/net cash-flow profiles. The model is implemented to a recently delivered typical infrastructure project – the construction of a new peripheral highway reinforced concrete bridge – and a sensitivity analysis is conducted to reach useful conclusions concerning the significance in infrastructure working capital of the following variables examined: the retention percentage, the 'front-end rate loading' by the contractor, and the premium advance incentive by the owner. The lowest maximum working capital requirement results from the provision of an advance mobilization payment by the owner to the contractor at project start-up and the selection of the latest start times site work execution program. The herein presented study is expected to assist both researchers and practitioners operating within the public construction sector in decision-making towards more effective financial management of infrastructure projects.

Keywords: infrastructure projects, public works contractors, cash-flow management, working capital, Gantt chart, S-curve

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1. Introduction

The construction industry usually experiences a proportionally greater number of insolvencies than other industries. According to the latest figures in the Creditsafe Watchdog Report [1], the rate of failure among construction contractors operating in the United Kingdom increased by around 73 percent in the first three months of 2018. One of the main causes of failure is inadequate cash resources with a failure to convince creditors and possible lenders of money that this inadequacy is only temporary [9]. Other reasons for the high rate of construction company failures include: the high risks involved; the policy of pricing the product before it is produced; tendering used as a method of pricing; the low fixed capital requirements; and a tendency to operate with too low a *working capital* (which can be done but requires a finely-balanced operation and can go wrong easily with changes in business conditions) [2]. The global financial crisis has exacerbated the problem due to falling demand for public infrastructure, governments with financial instability and funding issues as banks withdraw overdraft facilities or impose capital controls. Public sector's demand for construction is affected, primarily, by the Government's use of monetary and fiscal measures to regulate domestic economy. Most construction work is financed by loan capital and, where monetary policy tightens the availability of loans and raises the cost of borrowing, demand for construction is likely to be significantly reduced. The dependence of the built environment on the state of domestic economy and on the Government's policy, results in considerable *fluctuations* in demand for social infrastructure projects and makes difficult the prediction of future trends in public works contractors' workload [3]. Figure 1 shows the gross value added (in million EUR) by the Greek construction industry to the National economy's GDP for the period from 2000 to 2015 [4].

Unexpected liabilities can be catastrophic for public works contractors, especially during recessionary periods. Whenever the market takes a downward turn, the competition for contracts becomes fierce resulting in underpriced tenders ('buying work'). Any unforeseen difficulties occur during the contract's execution, insufficient capital resources are available to pay the creditors and then insolvency follows [5]. The common behavior of contracting firms during recession periods is to accept several risks, beyond their power to mitigate them, only to stay in business. To be successful in tendering, they are bidding at cost (and sometimes lower than cost) which makes them vulnerable to unexpected events during the execution of contracts, especially from financial aspects [6].

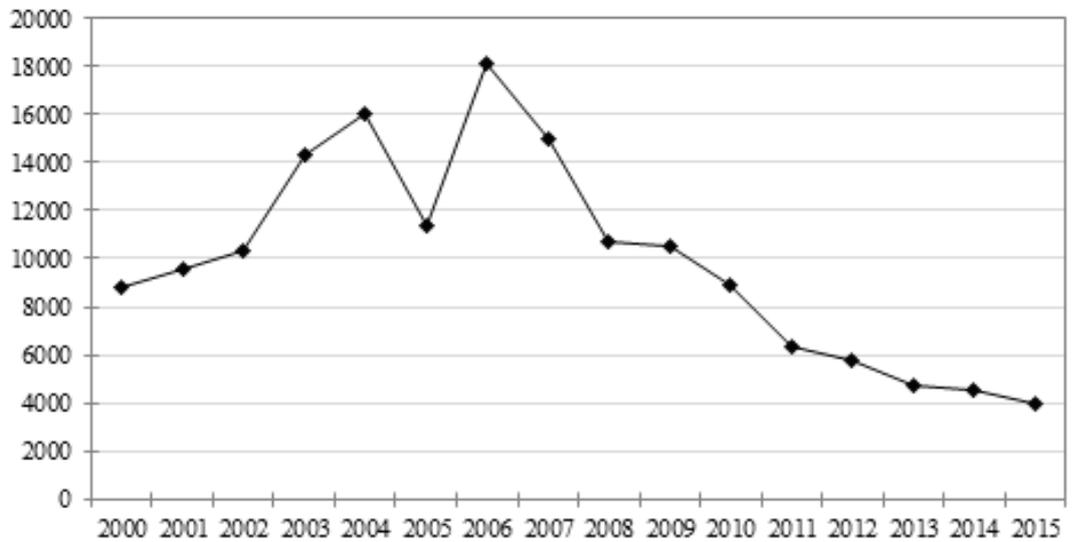


Figure 1: Gross value added by Greek construction industry, 2000–2015 [4].

It could be argued that there exist several reasons for insolvencies of construction contracting firms, but *lack of liquidity*, cash or 'near cash', seems to be the major problem [8]. It is this lack of liquidity of contractors to meet their short-term and unexpected liabilities which is the most common cause of failures within the industry [7]. Nonetheless, shortage of cash need not lead to bankruptcy if contractors could convince creditors and possible lenders of money that this inadequacy is only temporary. However, without convincing and accurate financial forecasts, contractors have little evidence to support the above contention. The need for the use of an effective system of financial management in construction is, therefore, vindicated [9].

These issues force construction companies to better forecast any cash demand that would be required for operational activities. The timing of cash flow is also important. There will be a time lag between the entitlement to receive a cash payment and actually receiving it. There will be a time lag between being committed to making a payment and really paying it. These time lags are the credit arrangements that contractors have with their creditors and debtors. The need therefore to forecast cash requirements becomes an essential aspect for profitable public works contracting.

A study on Singapore construction revealed that among the top general risks that contractors are normally facing, the following financial risk factors exist: the lack of contractor's financial resources; the financial instability of the client; and the project cost overruns [10].

The purpose of the research is to investigate the critical variables that affect public works contractors' working capital in the delivery of infrastructure projects. The objectives of the study are: a). to develop a coherent project cash flow/working capital calculation process; b). to analyze the critical factors that impact contractors' working capital; and c). to assist contractors towards more effective financial decision-making in infrastructure projects construction. The research methodology entails: a). construction of a spreadsheet model based on the Gantt chart in order to calculate project cash flow/working capital; b). practical implementation of the developed methodology to a recently completed typical infrastructure project – the construction of a new highway bridge – to establish a base-case scenario; c). sensitivity analysis to explore the level of significance of critical variables in working capital in accordance with the work execution method selected, i.e. earliest start (ES) or latest start (LS) times for the site field activities and to draw conclusions on how to improve contractors' cash-flow/working capital in the delivery of infrastructure projects.

2. Financial Issues in Infrastructure Projects

The construction industry is notorious for high levels of liquidations, a considerable proportion of which have been attributed to the problems associated with the lack of funds at the right time [11]. Operating a successful public works contracting company requires a specialized set of financial management skills, because of the unique nature of the construction industry [12]. The three main project financial management processes are [6]:

1. financial planning, i.e. identification of financial needs, understanding contract requirements, estimating financing costs, establishing the financing points, sensitivity analysis, developing and testing the financial project plan, assigning responsibilities;
2. financial control, i.e. monitoring key influences, taking corrective actions when necessary;
3. administration and records, i.e. designing and maintaining a financial information database.

The financial function plays a significant role in ensuring that company objectives are compatible with its resources. By its very nature, financial management performs two complementary roles in ensuring the survival of a corporate establishment: monitoring

and evaluating the implementation of its business strategy, involving a reporting role, and serving as a basic instrument for future planning of organizational objectives, which assumes a predictive status [13].

High dependence on debtors results from the industry's common payment procedures. Contractor's income is dependent on periodic (usually monthly) contractual payments arising from interim certificates of completed work. At the simplest, it may be payment on account of some proportion of work done (stage payments). Receipt of payment generally takes up to one month. Moreover, because latent defects may emerge after the construction work has been completed, it is usual for the client to retain a part of the payment (retention) until a defects-liability period has expired [14]. In addition, a contractor seldom enjoys interest from the future owner. In fact, the latter is financing the project by using the contractor's funds since the contractor is '... required to finance at any time the difference between the cumulative contractual value of work done, less retention monies, and the cumulative cost of doing the work [14:41]'.

The money paid by the public owner to the contractor is the contractor's price for providing the project and represent revenue for the contractor. The price of an infrastructure project is assumed to cover the contractor's direct costs of executing the work, the company's head-office overheads, the profit considered to be possible in the existing market conditions and the risk if the probability of making a loss is assessed as being greater than that of breaking-even [5].

Contractors incur costs as the construction progresses. Thus, contractors have to meet the ongoing weekly payroll and monthly material payment obligations while waiting for owners' discrete payments. The gap between cumulative expenses and actual payments received needs to be financed. Contractors usually recover such financing interest charges through overhead, fees or large up-front mobilization charges [15]. Results from a recent study on contractors' cash-flows showed that 'financial management', at nearly 28 percent, plays the most important role in cash-flow forecasting and that special caution must be taken in anticipating the occurrence of the following project factors: change of progress; payment duration; project delay; improper planning; inability to manage change orders; number of claims. These factors contributed very high percentages on cash-flow risk compared with the other factors [16].

Several financial manipulations that may improve contractors' project cash-flow/working capital have been suggested [5, 18]. A possible reduction in the retainage

percentage, if accepted by the owner, will have a positive effect on contractor's cash-flow/working capital needs. 'Front-end rate loading' is the practice of increasing the rates for items of the construction work that take place early in the project with appropriate reductions for the rates of work items that will take place in the later stages of construction. This keeps the overall cost of the work the same but has the effect of increasing the level of payments early in the project and reducing borrowing costs. Another option for the contractor to enhance their project financial requirements is to manage receiving by the owner a premium advance mobilization payment at project initiation as a percentage of the total contract sum. This payment is then subtracted from the interim payments to the contractor.

3. Spreadsheet Model Development for Working Capital Calculation

It is important for any contractor to know *what* capital is going to be needed for the construction of a project and *when* this capital will be required. In order to ascertain this, contractors at first have to draw up a Gantt (bar) chart program in order to estimate project disbursements and revenues, based on a particular time unit (usually on a monthly basis). The difference between expenditure (cost) and income (value) will then give the amount of capital required at the specific time period.

An S-curve is the piecewise continuous graph showing the accumulated expenditure of completed construction work of a project against its duration from start-up to completion. The S-curve is considered simultaneously with a step function cumulative curve representing the interim payments received by the contractor from the owner according to project progress (Figure 2a). By combining the cost (contractor's expenses) and value (owner's payments) profiles, having made the necessary adjustments for retention and payment delays, one can derive the net cash-flow project profile and, hence, the maximum working capital required by the contractor for the project and the cost of its lock-up working capital; i.e. the amount of interest charged to the contractor due to the execution of the project, if the lock-up working capital is financed by a lending institution (Figure 2b).

The maximum working capital needed by the contractor can be found from Figure 2a by measuring the vertical differences between the contractor's expenses and owner's payments curves at several points on the time axis; then, these differences are compared to identify the largest one. This largest difference, which can also be derived from the cumulative net cash-flow profile in Figure 2b, is the maximum working capital

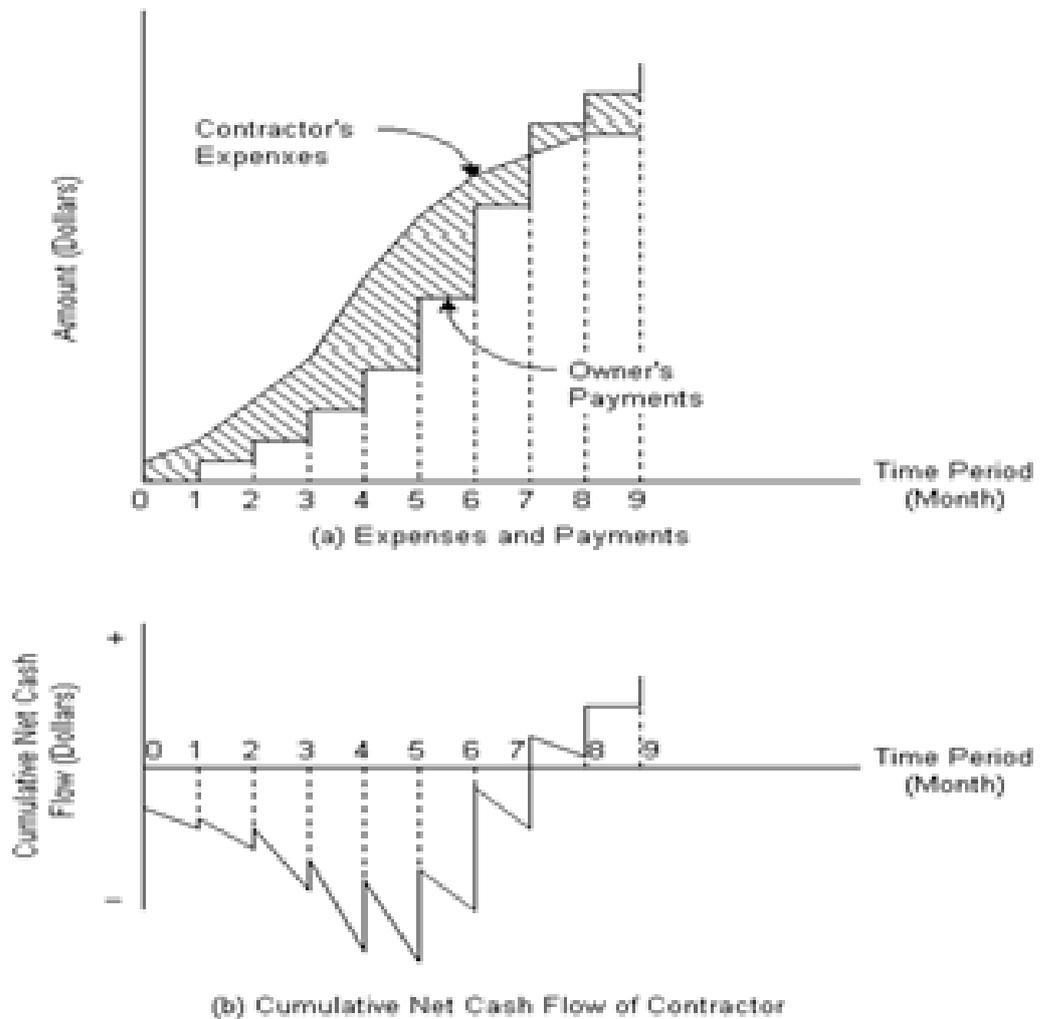


Figure 2: Contractor's expenditure, revenue and cash flow profiles [17].

(net cash outflow) required for the project. In the above example, the largest difference occurs at the end of month 4 (or immediately before beginning of month 5).

Whether the cash resources are available within the contracting company or should be borrowed from external sources, the cost of interest payments should always be considered. Even if the firm's own capital is used, the 'time value of money' dictates that it is equally important to allow for the cost of interest payments, as the money could have been invested elsewhere. The contractor's *true* profit is, therefore, the difference between the total contract sum and the contractor's total expenses for executing the project, minus the interest charged for this lock-up working capital. The unit for the (negative) *finance* area between the horizontal time axis and the cumulative net cash-flow curve below this axis is EUR-months. This area is also known as *captim*, standing for capital-time [5]. The (positive) region above the abscissa represents the

contract surplus also in EUR-months. Multiplication of the negative captim areas by the nominal interest rate in percentage per month, or percentage per annum (p.a.) divided by 12, results in the cost of working capital.

It is worthwhile to determine which of the work execution programs, according to the earliest start or latest start times for the work packages/elements, is the most effective when considering the cost of interest payments. Furthermore, it is valuable to explore at the end of which month the project becomes self-financing. The technique can also be useful in establishing the cash-flow/ working capital for all projects being undertaken by a contractor.

Following the aforementioned analysis, a spreadsheet model is constructed based on the Gantt chart for calculating the working capital requirements. The model can produce periodic and cumulative project disbursements (*S*-curve) and income (step curve) graphs together with the accumulated maximum and net cash-flow profiles. From the above graphs, the maximum working capital needs according to the site work execution programs and the associated costs of capital lock-up can be derived. A 'snapshot' of the application of the developed spreadsheet model to the construction of a new highway bridge (see subsequent Section 4) is illustrated in the Appendix (Figure 13).

4. Case Study: Construction of a New Highway Bridge

The cash-flow/working capital spreadsheet model is implemented to an actual typical infrastructure project under a traditional unit rate contract: the construction of a new highway reinforced concrete bridge within the area of a Greek Prefecture. The duration agreed by the contractor to complete and hand-over the project to the public owner is 11 months and the contract sum/contractor's winning bid is EUR 1.112.740,00. The defects-liability period (or maintenance period) is 15 months. The percentage for contractor's general overheads (OH) plus profit is 18 percent and a contingency reserve/value (bid) mark-up of 15 percent has been allocated to all unit rates of the Bill of Quantities (BoQ) items contained in the contract documents (Table 1).

According to the traditional contract signed, interim payments have been arranged on a monthly basis; at the end of each month, quantities are measured, and the interim payment certified less 5 percent retention amount is paid to the contractor one month later. Half of the accumulated retention sum is released three months after the project completion.

TABLE 1: Main variables/parameters for the new highway bridge construction project.

Contract Sum/Winning Bid (EUR):	1.112.740,00
Contract Duration (months):	11
Defects Liability Period (months):	15
Retention (%):	5
General Overheads (OH) + Profit (%):	18
Contingency Reserve/Value (Bid) Mark-up (%):	15
Nominal Interest Rate (%):	10

Work Package/Element	Duration (months)	Expenditure (€)	Revenue (€)	Construction Period (months)																			
				1	2	3	4	5	6	7	8	9	10	11									
Excavations for abutment wall foundation (West)	2	50000	30000	30000	0																		
Excavations for abutment wall foundation (East)	2	60000	30000	30000																			
Centering (Falsework)	3	90000	30000	30000	30000	0	0																
Foundations for abutment wall (West)	1	80000			80000	0																	
Foundations for abutment wall (East)	1	80000			80000																		
Reinforced concrete abutment wall (West)	1	90000				90000	0																
Reinforced concrete abutment wall (East)	2	100000					50000	50000															
Formwork to bridge deck	1	20000								20000													
Reinforced concrete bridge deck	2	140000									70000	70000											
Bridge deck surfacing	1	40000																			40000	0	
Parapet safety barriers	2	40000																				20000	20000
Dismantle centering, clean-up and hand-over	1	20000																					20000
General OH + Profit	-	147600	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418
		169740	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431	15431
Total Expenditure		967600																					
Total Revenue		1112740																					
Total Expenditure per month			103418	103418	203418	153418	63418	33418	83418	83418	73418	33418	33418										
Total Revenue per month			118931	118931	233931	176431	72931	38431	95931	95931	84431	38431	38431										
Retention on Revenue per month			5947	5947	11697	8822	3647	1922	4797	4797	4222	1922	1922										
Total Retention		55637																					
Revenue less Retention (time adjusted)			0	112984	112984	222234	167609	69284	36509	91134	91134	80209	36509										
Cumulative Expenditure		0	103418	206836	410255	563673	627091	660509	743927	827345	900764	934182	967600										
Cumulative Revenue		0	112984	225969	448203	615812	685097	721606	812741	903875	984084	1020594											
Interim Valuation no.:		0	1	2	3	4	5	6	7	8	9	10	11										
Maximum Cash-Flow (Revenue minus Expenditure):		0	-103418	-206836	-297270	-377704	-178888	-44697	-58830	-105739	-88023	-30307	16484										
Interim Valuation no.:		0	1	2	3	4	5	6	7	8	9	10	11										
Net Cash-Flow (Revenue minus Expenditure):		0	0	-93852	-184286	-115470	-11278	24588	-22321	-14605	3111	49902	52994										

Figure 3: Spreadsheet Gantt chart/working capital model for ES times (construction period).

4.1. Base-case scenario

The spreadsheet cash-flow/working capital model in Figure 3 shows the Gantt chart when all site operations are programmed at their earliest start times. The amount of float available for each work package/element is also indicated in the model (cells with zero values). The calculated expenditures on and revenues from each work package/element both per month and accumulated are also shown. In addition, the

periodic and total retention sums are ascertained, and for each interim valuation the time-adjusted maximum and net project cash-flow profiles are calculated. Figures 4-5 demonstrate the graphical representation of the aforementioned calculations.

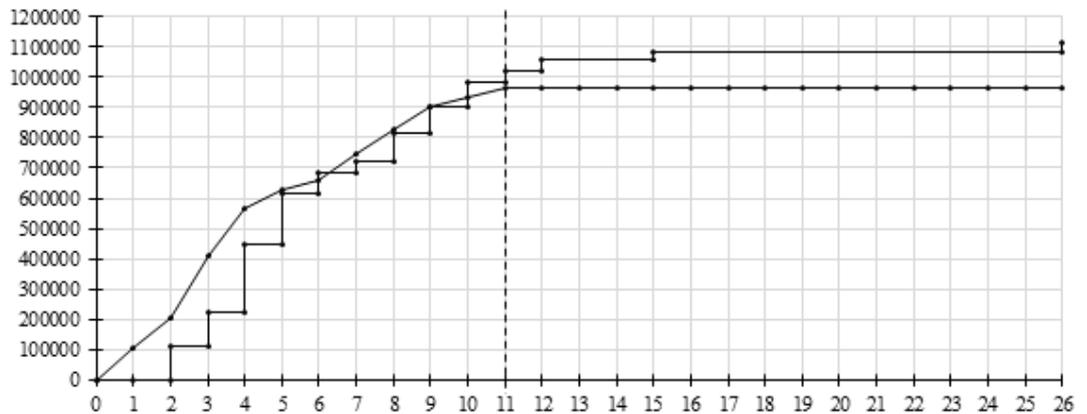


Figure 4: Accumulated expenditure vs. accumulated revenue for ES times.

The calculation of the cumulative expenditure (S-curve) and the cumulative interim payments (step curve) for ES times are shown in Figure 4. The project becomes entirely self-financing at the end of month 10, i.e. one month prior to project physical completion.

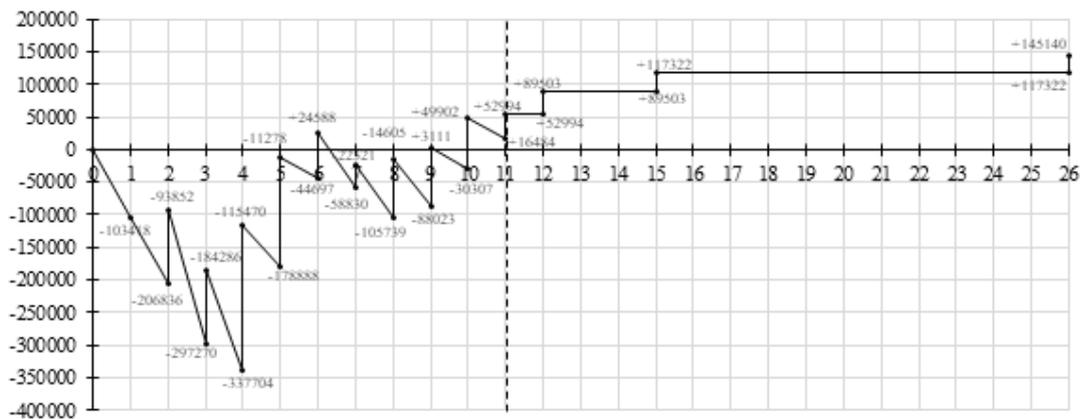


Figure 5: Cash-flow/working capital profile for ES times.

Maximum working capital is -184.286,00 EUR at the end of month 3 (Figure 5). Total working capital lock-up (requirement) in EUR-months (area below time axis) is -801.571,09. The cost of providing this working capital requirement (at an interest rate of 10 percent p.a.) is -6.754,76 EUR.

Figure 6 shows the calculation of working capital for the site field execution program with all operations taking place at their latest start times.

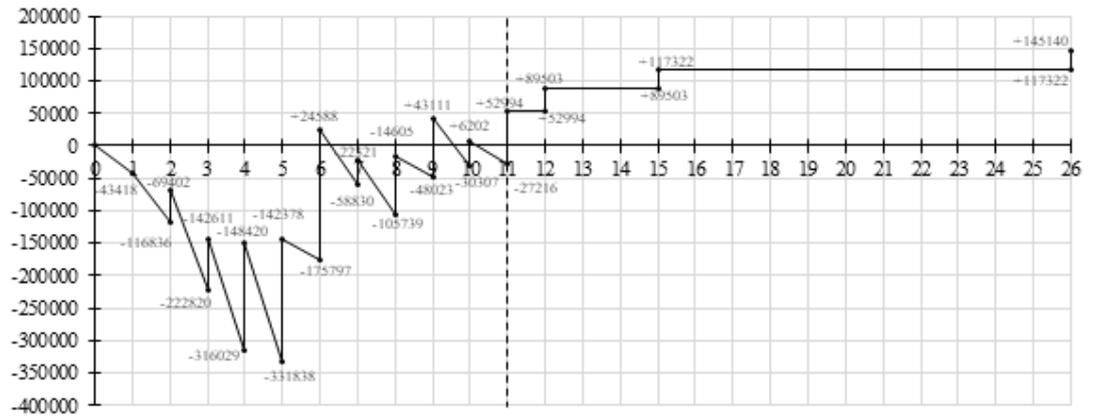


Figure 8: Cash-flow/working capital profile for LS times.

Maximum working capital is -148.420,00 EUR at the end of month 4. Total working capital lock-up (requirement) in EUR-months (area below time axis) is -876.483,64. The cost of providing the above working capital requirement (at an interest rate of 10 percent p.a.) is: -7.303,86 EUR.

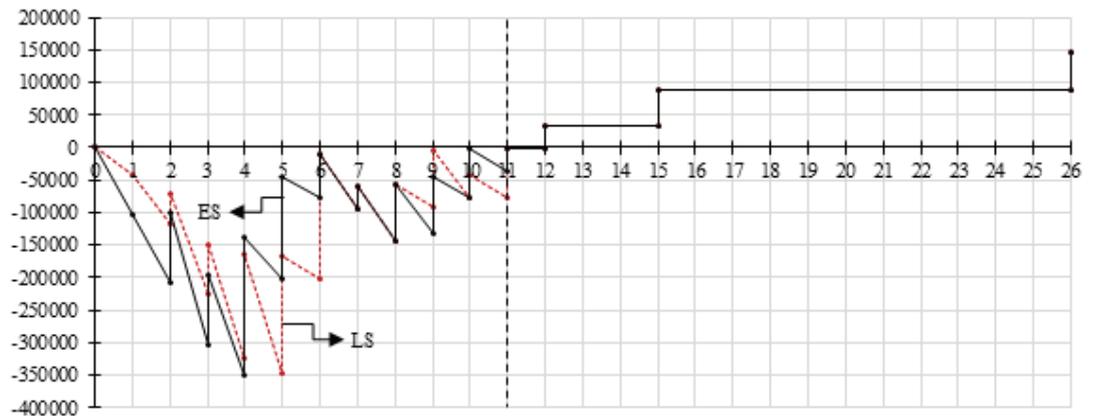


Figure 9: Cash-flow/working capital profiles for ES and LS times combined.

It can be seen that, of the two extremes considered under the base-case scenario calculations, the earliest start times work program, gives the cheapest solution concerning the cost of lock-up working capital (6.754,76 EUR) and the project becomes self-financing one month earlier than the latest start times execution rate. Once the project becomes self-financing, the contractor’s surpluses that result can either be invested on the money market on, say 7 days recall, or used to finance other projects. However, the maximum working capital for LS times (148.420,00 EUR) is much less than the one for ES times (184.286,00 EUR) and is required one month later (month 4 for LS as opposed to month 3 for ES).

4.2. Sensitivity analysis

The critical variables used in the sensitivity analysis to assess their effect on the project maximum working capital requirement include: the retention percentage; the ‘front-end loading’ of BoQ items by the contractor; and the premium advance payment by the owner. The retention percentage is ranging from zero percent to 10 percent (increased by one percent), the ‘front-end loading’ range is from zero percent to 50 percent (increased by five percent) and is applied to the first five months of the construction period, and the premium mobilization payment is ranging from zero percent to 15 percent (increased by five percent). The results are summarized in the following Figures 10-12.

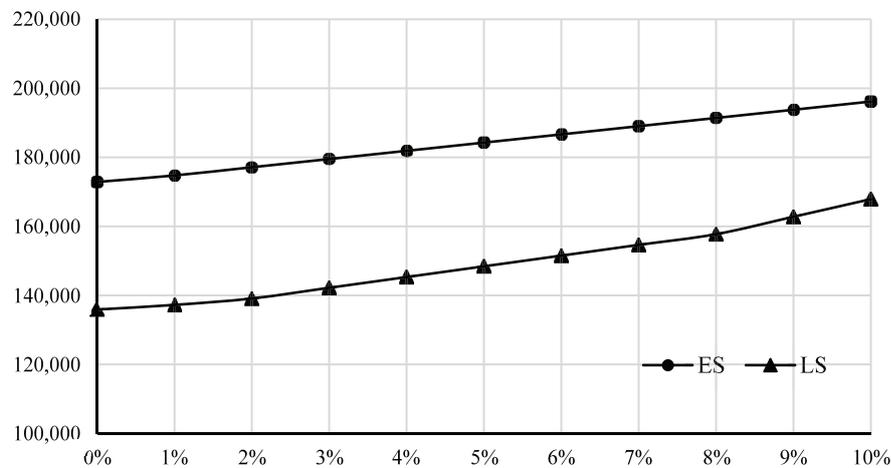


Figure 10: Retention (range: 0–10%) vs. max working capital (base-case: 5%).

Obviously, raising the retention percentage has a negative effect on the project maximum working capital requirement. The range of maximum working capital for ES times is 23.286 EUR (196.179 EUR–172.893 EUR) and for LS times is 31.997 EUR (167.890 EUR–135.893 EUR). Therefore, the effect is more significant when LS times are used for executing the project. However, the LS times result in lower maximum working capital figures than ES times.

The application of ‘front-end loading’ to the BoQ items for the first five months of the project, has (as expected) a positive effect on the project maximum working capital needs, for both ES and LS execution times. The above device is more significant when the ES program is adopted; the range of maximum working capital for ES times is 67.987 EUR (184.286 EUR–116.299 EUR) and for LS times is 31.046 EUR (148.420 EUR–117.374

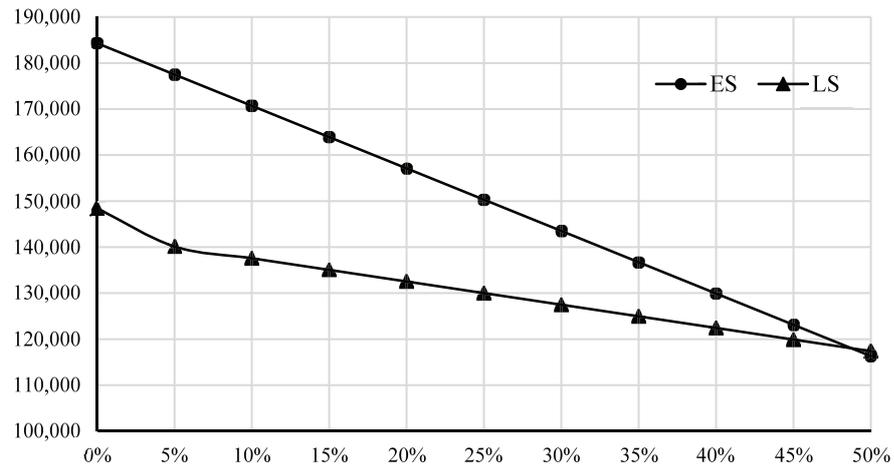


Figure 11: Front-end rate loading (range: 0-50%) vs. max working capital (base-case: 0%).

EUR). Again, however, LS times result in lower maximum working capital figures than ES times.

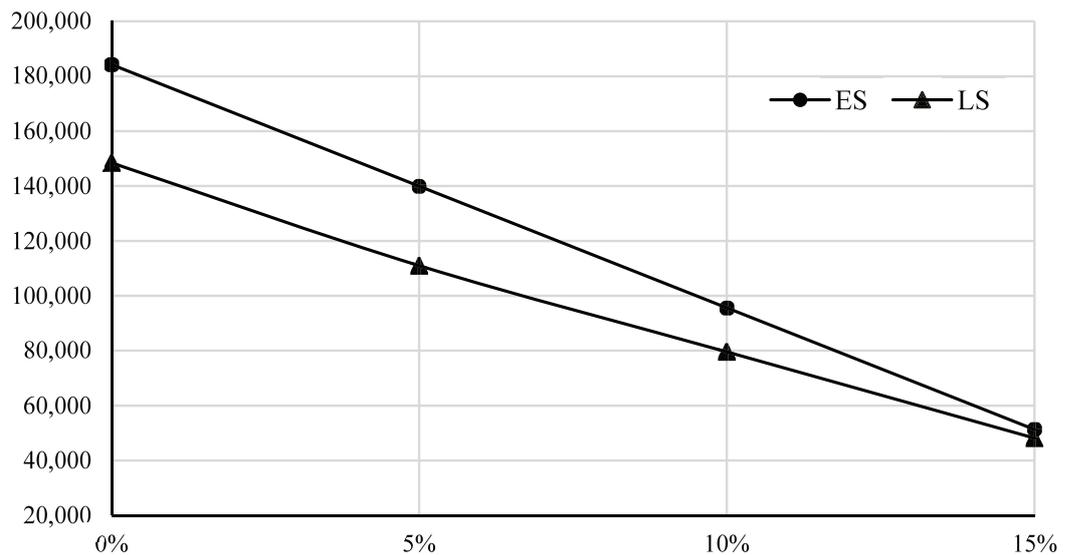


Figure 12: Premium advance payment (range: 0-15%) vs. max working capital (base-case: 0%).

The premium advance payment by the owner, has (as also expected) the greatest positive effect on the project maximum working capital requirement for both ES and LS execution times, when compared with the other two variables examined. The

provision of such an incentive at project start-up is more significant when the ES program is selected; the range of maximum working capital for ES times is 133.016 EUR (184.286 EUR–51.270 EUR) and for LS times is 100.246 EUR (148.420 EUR–48.174 EUR). Nevertheless, the *lowest* working capital figure (48.174 EUR) is achieved through the application of the maximum possible premium percentage according to the Greek public works legislation (15 percent) and the LS times rate of construction.

Table 1 and Figures 3–12 as appeared in the main text of the paper, and Figure 13 in the Appendix are Authors' own work.

5. Conclusions

The financial management of infrastructure projects is as vital to their successful delivery by public work contractors as their technical management. The main cause of financial failure in construction is due to too much work in progress for the available capital such that individual work activities lack enough cash resources to be continued in the working capital cycle. Cash-flow forecasting provides a valuable early-warning system to predict possible insolvency and enables preventative measures to be considered and proactive actions taken. It is advantageous for contractors to have a prior knowledge of cash-flow/working capital requirements and understand the impact of critical factors involved.

The contractual financial specific terms can cause very different cash-flow profiles. Some of the critical factors that affect infrastructure project cash-flows are: the (early start or late start) work execution schedule adopted; the delay in receiving payments from public owners; the retention percentage agreed; the 'front-end rate loading' of items in the BoQ documents; and the inclusion (or not) of an advance mobilization incentive at project start-up.

The advantage of the herein presented working capital spreadsheet model stems from its capability to facilitate sensitivity analysis, where the user, after making the default (base-case) forecast, can alter the inputs and conditions for the proposed project in a number of 'what-if' analyses to support and identify potential financial risks associated with the project. In addition, once the cash-flow profile has been established and approved by the owner, a continuous comparison of the actual achievement with that planned is possible, highlighting any deviations from the plan so that actions can be taken either to bring things back on course or to alter the plan.

Reducing the retention percentage obviously causes a decrease in the maximum working capital required to execute the project. The research results showed that this

decrease is more significant when the latest start times are used to programming the execution of the project.

The 'front-end rate loading' manipulation by the contractor is, according to the analysis results, more effective when planning the project based on the earliest start times.

The premium advance mobilization incentive is probably the best option to reduce working capital and to improve cash-flows, especially at the earlier stages of the project. Nonetheless, it is not a common practice in the Greek construction industry despite the relevant public works legislation provisions. The analysis indicated that the above advance payment by the owner to the contractor is more sensitive to the earliest start times work execution method.

This study explored the quantitative impact of critical variables affecting the financial management of infrastructure projects, through a deterministic view. A probabilistic perspective to the analysis with the use of Monte Carlo simulation and the study of the combined effect of all the important factors is recommended as future work; this method may result in better insight concerning the effect of uncertainty that is endemic in the construction process.

Appendix

Work Package/Element	Duration (months)	Expenditure (£) Revenue (£)	Construction Period (months)											Defects Liability Period (months)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
Excavations for abutment wall foundation (West)	2	60000 69000	30000	30000	0																								
Excavations for abutment wall foundation (East)	2	60000 69000	30000	30000	0																								
Centering (Falsework)	3	90000 103500	30000	30000	30000	0	0																						
Foundations for abutment wall (West)	1	80000 92000	80000	0																									
Foundations for abutment wall (East)	1	80000 92000	80000	0																									
Reinforced concrete abutment wall (West)	1	90000 103500	90000	0																									
Reinforced concrete abutment wall (East)	2	100000 115000	50000	50000																									
Formwork to bridge deck	1	20000 23000					20000																						
Reinforced concrete bridge deck	2	140000 161900					70000	70000																					
Bridge deck surfacing	1	40000 46000					80500	80500																					
Parapet safety barriers	2	40000 46000											40000	0															
Dismantle centering, clean-up and hand-over	1	20000 23000																											
General OH + Profit	-	147900 169740	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418	13418		
Total Expenditure		967600																											
Total Revenue		112740																											
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Revenue less Retention (time adjusted)			0	112984	112984	222234	167609	69284	36509	91134	91134	80209	36509	36509	0	0	27819	0	0	0	0	0	0	0	0	0	27819		
Cumulative Expenditure			0	103418	206836	410255	563673	627091	665099	743927	827345	900764	934182	967600	967600	967600	967600	967600	967600	967600	967600	967600	967600	967600	967600	967600	967600		
Cumulative Revenue			0	112984	229969	448203	615812	685097	721906	812741	903875	984084	1020569	1057103	1057103	1057103	1084922	1084922	1084922	1084922	1084922	1084922	1084922	1084922	1084922	1084922	112740		
Interim Valuation no.			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Maximum Cash-Flow (Revenue minus Expenditure)			0	-103418	-206836	-297270	-337704	-178898	-44937	-68030	-105739	-80023	-30307	16464	52984	89503	89503	89503	117322	117322	117322	117322	117322	117322	117322	117322	117322	117322	117322
Interim Valuation no.			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Net Cash-Flow (Revenue minus Expenditure)			0	0	-93852	-184286	-115470	-11278	24588	-22321	-14605	3111	49902	52984	89503	89503	89503	117322	117322	117322	117322	117322	117322	117322	117322	117322	117322	117322	145140

Figure 13: Spreadsheet model development based on the Gantt chart.

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