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Critical Factors Affecting Cost Overrun in Foreign Funded Road Construction Projects in Sri Lanka

A Case Study of Road Development Authority and Provincial Road Development Authorities

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Abstract: Foreign funded road projects are rampant with cost overrun, and through the identification of critical factors affecting cost overrun, this problem can be mitigated. In this research, a literature review has been carried out to identify 33factors causing cost overrun in construction, and through interviews with experts, eight significant factors causing cost overrun in road construction projects have been identified. Altogether 37 factors were considered and classified into five groups: Natural conditions, Client and/or consultant, Client, Contractor and 'Beyond the control of all parties'. These were adopted to analyse the cost overrun in the selected 17 foreign funded road projects. The impact of these factors on the increase in BOQ items and Variations were examined using the documentary evidence and interviews with the personnel involved in these projects. The analysis revealed that only 11 factors had an impact on at least one project. Of these factors, the five most significant factors causing cost overrun, in the descending order of significance, are as follows (the number of projects affected by the factor is given in the parenthesis); Price escalation (13), New instructions issued by the client (9), Unforeseen site requirements (8), Items not identified in the BOQ (8) and Estimation errors in the BOQ (6). The study also analyses these factors in detail and makes recommendations.

Keywords: Cost overrun, Road projects, Road construction, Foreign funded project

1. Introduction

The road construction sector in Sri Lanka plays a vital role by providing the much needed transportation infrastructure for the economic development and social existence of the country. Therefore, this sector is considered to be one of the most economically important sectors in a country (Herrera et al.2020).

The foreign funding is the key source of funding available for the development of road sector in Sri Lanka. Accordingly, a high percentage of major road construction projects is funded through various funding agencies such as Asian Development Bank (ADB), World Bank (WB), Japan International Cooperation Agency (JICA), Exim Bank of China (EBC) and the Organisation for Petroleum Exporting Countries (OPEC) etc.

Cost overrun occurs in most road construction projects in Sri Lanka, and the magnitude of cost overrun in these varies considerably from project to project. So, it is important to determine the significant factors causing cost overrun in the foreign funded road projects, and how to contain the severity of these factors in order to minimise the cost escalation.
The objectives of this research are;

i). To identify various factors causing cost overrun in road construction projects.

ii). To identify and rank various factors (based on their severity) causing cost overrun in pre-construction and construction phases of foreign funded road projects.

2. Literature Review

This section is devoted to review literature concerning the cost overrun in construction projects in order to determine the factors that cause cost overrun in construction. It is essential that each phase of implementation of road projects from the start (starting with the feasibility) until the end (ending with the handing over of the completed project by the contractor to the owner) should be formulated with precision in order to minimise delays, disputes and additional costs.

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It is observed that most road construction projects are not completed within the specified cost and time (Halwatura and Ranasingha, 2013; Wijekoon and Attanayake, 2012). Only a few projects get completed on time and within budget due to reasons such as: uncertainty in environment where construction projects are executed; complexity in construction; presence of diverse interest groups such as project owners, end users, consultants, contractors, financiers, shortages in material and equipment, issues in project funding, erratic behaviour of climatic environment, uncertainties in the economic and political environment, and statutory regulations (Halwatura and Ranasingha, 2013; Wijekoon and Attanayake, 2012; Jeyakanthan and Jayawardena, 2012; Pathiranage and Halwatura, 2010).

The adoption of a standard Conditions of Contract facilitates the successful completion of the contract, reducing time and cost overrun. In foreign funded road projects in Sri Lanka, the most widely adopted Conditions of Contract is the FIDIC.

There are numerous causes for the cost overrun in road construction projects (Parikh, 2019). According to various studies conducted by researchers all over the world, there are a number of reasons for the cost overrun in road and other construction projects. Table 1 presents a list of significant factors causing cost overrun, extracted from the local and international studies conducted with regard to cost overrun in road construction projects.

Table 1 - Significant Factors Causing Cost Overrun in Road Construction Projects

Researcher	Title	Significant Factors
Simon (2002)	Project Cost Overrun and Risk Management	Non availability of adequate information /Variations introduced
Ibrahim and Amund (2011)	Cost Overrun Causes in Road Construction Projects: ''Consultant's Perspective''	Price escalation in material / insufficient time for estimate/inadequate experience in contracts/size of contract/ and incomplete drawings
Aftab et. al.(2011)	Preliminary Study on Causative Factors Leading to Construction Cost Overrun	Poor design and delays in design/ unrealistic contract duration and requirements imposed and lack of experience/late delivery of materials and equipment/ relationship between management and labour.
Naveenkumar and Prabhu (2016)	Factors Influencing Time and Cost Overruns in Construction Projects	Delay in preliminary handing over of project / wrong or inappropriate choice of site/ inadequate project preparation/ increment of material prices
Chabota et. al.(2008)	Cost Escalation and Schedule Delays in Road Construction Projects in Zambia	Bad or inclement weather due to heavy rains and the resulting floods/ scope changes/environmental protection and mitigation costs/schedule delays
Nabil and Zaydoun (2015)	Delay and Cost Overrun in Road Construction Projects In Jordan	Terrain conditions /weather conditions /variation order/and availability of labour
Rajakumar and Meenakshi (2012)	Analysis of Cost Overrun in Road Construction Activities – A Critical Review	Issues in land acquisition/cost escalation of workers' wages and material/ financing and payments for completed works (delays in payments)/ Force majeure / design changes during construction phase/delays in shifting existing utilities/ increase in quantities of material
Hong et. al.(2016)	Research on Cost Overrun Risk of Construction Phase of Vietnam Highway International Contracting Project	Infrastructure construction investment management system risk/survey and design scheme risk /land acquisition risk/ construction unit fiscal and management ability risk/ capital and contract constraint risk/ macro-economic environment changes risk and supervising moral risk
Wijekoon and Attanayake (2001)	The Cost Overrun in Road Construction Projects in Sri Lanka	Payment delays/ delay in relocation of existing utilities/ cost escalation/design changes during construction /and issues in land acquisitions

3. Research Methodology

In the studies, conducted in various countries, significant factors causing cost overrun in road construction projects have been identified. In addition to the above factors, the authors of this research through interviews they had with the engineers who have had a long experience working in foreign funded road construction projects have identified the following factors causing cost overrun in road construction projects:

1. Inadequate/inaccurate site investigations.
2. Incorrect identification of scope of work in the preliminary design.
3. Errors in the design.
4. Protests by the residents in the vicinity of the construction site.
5. Shortage of technical staff and site workers of the contractor.
6. Lack of qualified and experienced staff to carry out design and supervision work.
7. Delays in progress payment.
8. Delays in granting approvals for variations by the funding agency.

The three main parties involved in the road construction projects are client, consultant and contractor. In addition to the main parties responsible for the cost overrun, there may be 'Natural conditions' for which no party is responsible but still could cause cost overrun in a project. Some of the factors in Table 1 were rephrased to suit the context of road construction projects in Sri Lanka. The factors displayed in Table 1, and the eight factors listed above can be grouped under five categories based on the parties primarily responsible for these various factors. The five categories of factors are: Natural conditions, Client and/or consultant, Client, Contractor and 'Beyond the control of all parties'. The reason for having a separate category 'Client and/or consultant', is because for some factors the responsible party could be either client or consultant, or client and consultant both. Table 2 exhibits the selected factors under different categories.

Table 2 - Categorisation of Factors Based on the Party Primarily Responsibility to Cost Overrun

Item no.	Factors Causing Cost Overrun	Category
1	Adverse weather conditions	Natural Conditions
2	Unforeseen ground conditions	
3	Incomplete design at the time of the tender	Client and / or Consultant
4	Errors in the design	
5	Unforeseen site requirements	
6	Additional work associated with variations	
7	Delays in the design submitted at the construction stage	
8	Changes in material specification	
9	Frequent design changes at the construction stage	
10	Inadequate/inaccurate site investigation	
11	Items not identified in the BOQ	
12	Estimation errors in the BOQ	
13	Incorrect identification of scope of work in the preliminary design	
14	Protests by the residents in the vicinity of the construction site	
15	Lack of qualified and experienced staff to carry out design and supervision work	
16	Non availability of experienced technical staff	
17	Lack of communication/coordination between parties	
18	New Instructions issued by the client	Client
19	Delays in progress payment	
20	Land acquisition problems faced by the client	
21	Delays caused to commencement of work by the client	
22	Interference with consultant's instructions to the contractor	
23	Delays in granting approvals for variations by the funding agency	
24	Inadequate planning and scheduling	Contractor

25	Inadequate monitoring and control	
26	Poor site management and supervision	
27	Additional time taken to complete documentation at the final stages	
28	Delays in material and equipment procurement process	
29	Inaccurate estimation of time and cost	
30	Shortage of materials	
31	Shortage of technical staff and site workers	
32	Low labour productivity	
33	Obsolete and unsuitable construction methods	
34	Dissatisfied suppliers/subcontractors due to payment delays	
35	Political interference	Beyond the Control of all the Parties
36	Price escalation	
37	Labour wage escalation	

In this research a case study approach was adopted, and 17 foreign funded road projects completed by the Road Development Authority (RDA) [12] and Provincial Road Development Authority (PRDA) [5] were engaged. The initial and final cost data of these projects were used, and individual cost items were directly analysed to determine the factors causing cost overrun.

Documents such as final valuation documents, BOQs, conditions of contract and drawings relevant to each project were obtained from the relevant parties. By analysing the final valuation documents in conjunction with the other contract documents, the cost items that cause the cost overrun were identified. With the use of these documents, the individual cost items where costs have exceeded the BOQ value were analysed to determine the exact causes for cost escalation. In this process, the following resources were useful: the knowledge of one of the authors who has served in eight of the above projects and the discussions this author had with senior professionals who were directly involved in the respective projects. Data was summarised and presented in the spread sheet format. Every item in the BOQ where the final cost has exceeded the BOQ value was analysed and causes for the cost increase were determined.

Table 3 shows the original estimated cost, the final cost and cost overrun of the seventeen projects of this research.

Table 3 - Estimated Cost, Final Cost and Cost Overrun for the Selected Projects

Road Name	Funding Agency	Client	Original Cost of BOQ Rs. M (A)	Final cost of BOQ Rs. M (B)	Variation Cost Rs. M (C)	Total Final Cost Rs. M (B+C)	Cost Overrun (B+C)/A*100%
Uva A	WB	PRDA*	598	667	182	849	142
Uva B	WB	PRDA*	434	432	95	527	121
Uva C	WB	PRDA*	733	680	172	852	116
Uva D	WB	PRDA*	558	589	116	705	126
Trinco 1	ADB	RDA	2592	2586	2225	4811	186
North 1	ADB	RDA	1184	1195	45	1240	105
North 2	ADB	RDA	914	987	83	1070	117
North 3	ADB	RDA	628	612	26	638	102
North 4	ADB	RDA	586	598	14	612	104
North 5	ADB	RDA	928	890	103	993	107
Anu 1	WB	RDA	1267	1949	15	1964	155
Anu 2	ADB	RDA	1446	1328	341	1669	115
Put 1	WB	RDA	1405	2282	67	2349	167
Put 2	WB	RDA	1149	1738	38	1776	155
Med 1	WB	RDA	567	889	111	1000	176
Rat 1	CB	RDA	4626	4891	87	4978	108
Panu	ADB	PRDA+	178	194	11	205	115

Note: * Uva Province, + North Central

4. Results and Discussion

4.1 Categories that had a Minimum Impact on Cost Overrun

4.1.1 Contractor

All the foreign funded road projects in Sri Lanka are administrated by means of an international Conditions of Contract type called FIDIC, with minor modifications made therein to suit the conditions in Sri Lanka.

According to the Conditions of Contract, if the contractor fails to comply with the time for completion, then the contractor should pay the employer the relevant sum stipulated in the tender documents as liquidated damages for such default, subjected to the applicable limit stated in the appendix to the tender. Seldom this limit is exceeded, and evidently, there are no reported cases where this limit has been exceeded and liquidated damages have been claimed.

The amount stipulated is a fixed per/day amount for every additional day beyond the agreed contract completion date. As per the Conditions of Contract, the contractor is not entitled to claim any additional cost incurred during the extended period. Therefore, there is no obligation on the part of the client to pay for the costs incurred by the contractor during the extended period. Hence, it can be concluded that no cost overrun would occur due to the faults of contractor, as listed in Table 2 or any other fault of contractor that results in cost escalation.

4.1.2 Natural Conditions

Adverse weather conditions

In this research, it was expected to examine whether adverse weather has any effect on the cost overrun. Therefore, data collection was done with regard to the adverse weather conditions for the selected seventeen projects. The Extension of Time (EOT) due to the adverse weather conditions concerning the 17 projects are presented in Table 4.

The above EOTs have been determined by the respective consultants of the above projects based on statistical evaluation of past rainfall data and the data recorded at the sites in the weather charts. According to the data given in the above table, only 09 projects out of 17, have been affected due to adverse weather conditions.

Table 4 - Extension of Time (EOT) due to Adverse Weather Conditions

Item No.	Project Name	Funding Agency	EOT due to adverse weather conditions (days)
1	Uva A	WB	9
2	Uva B	WB	7
3	Uva C	WB	8
4	Uva D	WB	7
5	North 1	ADB	0
6	North 2	ADB	0
7	North 3	ADB	0
8	North 4	ADB	0
9	North 5	ADB	0
10	Anu 1	WB	0
11	Anu 2	ADB	5
12	Put 1	WB	3
13	Put 2	WB	2
14	Med 1	WB	4
15	Rat 1	EBC	6
16	Panu	ADB	0
17	Trinco 1	ADB	0

According to the clauses in the Conditions of Contract, the contractor is only entitled to an EOT for delays due to adverse weather conditions, but not entitled to any costs incurred during the period of EOT. It means during the EOT, the cost of client's, consultant's staff and associated facilities such as offices, vehicles etc. have to be borne by the client.

Further, even if there is a delay due to adverse weather, the extent of the delay is extremely

short in the context of long completion period of a road project (range from 12 to 30 months), the additional cost incurred due to delay is negligible. Accordingly, there is no impact on cost overrun due to the EOT granted for the adverse weather conditions in the selected 17 projects.

Unforeseen Ground Conditions
In the 17 projects listed in Table 3, only two projects have been affected due to this factor; even then the effect on the two projects was slight. This was verified through the information obtained from the direct interviews one of the authors had with the senior officers associated with projects and the author's own experience. Hence, it can be concluded that the impact of 'unforeseen ground conditions' on cost overrun of the selected 17 projects is negligible.

4.2 Categorisation of Cost Overrun

4.2.1 Client and/or Consultant

The literature review reveals that there are a number of causes for the cost overrun that originates due to the Client and/or Design Consultant. These factors are included in Table 2 along with the factors that causes cost overrun in foreign funded projects in Sri Lanka.

The above factors are entirely due to faults, shortcomings or decisions of Client and/or Design Consultant, and so it is pertinent to check whether cost overrun in donor funded road projects in Sri Lanka are affected by these factors.

4.2.2 Client

The client being the owner of the project has to meet some of the key requirements such as availability of lands required for the project and settlement of progress payments on time. The clients should also adhere to a convenient mode of payment to ensure timely progress payments. The client also has to give approvals for the variations on time, and should not meddle too much with the original scope of the project. Therefore, the impact of client related causes on cost overrun of the 17 projects should be examined.

4.2.3 Beyond the Control of all Parties

Due to regime changes, government policies can alter, affecting scope of the project, land acquisition, raw material availability, and fluctuation of raw material prices etc. which are beyond the control of even the client. Further, as a result of political inferences too the above issues can occur causing cost overrun. Therefore, it is important to see how these reasons affect the cost overrun in the 17 projects.

4.3 Analysis of Cost Data of All Projects

The reasons for cost overrun were identified by directly analysing the final valuation data of various projects item by item, and information elicited at the interviews conducted with the relevant senior officers of the projects.

Data analysis carried out for a section of the BOQ of project North 1 is shown in Table 5 as a specimen calculation. From the project North 1, six reasons for cost overrun were identified. The summary of 'Contribution of various reasons to cost overrun' for all items of the BOQ including variations of project North 1 are shown in Table 6. When the analysis was carried out for all the 17 projects, 11 common factors causing cost overrun were identified. Table 7 presents the summary of the results of data analysis of all 17 projects.

Table 5 - Analysis of Cost Data of a Section of BOQ (Project North 1, Bill No. 4: Road Pavement]

Bill Item	Description	BOQ				Actual		Factor causing cost overrun
		Unit	Qty.	Rate	Amount	Qty.	Amount	
	Sub bases, capping layers and bases							
1	Sub base - Type 1	m^3	17,666	3,074	54,305,284	23,049	70,854,778	Estimation errors in the BOQ
2	Sub base - Type 2	m^3	3,533	2,415	8,532,195	4.17	10,071	No cost increase
3	Graded agg. base	m^3	27,874	6,614	184,358,636	26,818	177,373,921	No cost increase
4	Scarification of Base	m^2	76,998	42	3,233,916	60,214	2,528,981	No cost increase
	Shoulder Construction							

5	Earthen shoulders	m^3	4,530	2,415	10,939,950	4,845	11,699,999	Estimation errors in the BOQ
	Prime coat & Tack coat							
6	Prime coat MC 30	m^2	135,900	238	32,344,200	144,313	34,346,544	Estimation errors in the BOQ
7	Tack coat CRS 1	m^2	97,875	59	5,744,625	137,647	8,121,158	Estimation errors in the BOQ

Table 6 - Contribution of Various Reasons to Cost Overrun (Project North 1)

Item	Factor causing cost overrun	Percentage increase in BOQ	Percentage increase due to variation	Total percentage increase
1	Items not identified in the BOQ	29	1	30
2	Estimation errors in the BOQ	(73+37)	10	120
3	New instructions issued by the client	19	6	25
4	Unforeseen site requirements	1	8	9
5	Price escalations	67		67
6	Additional time taken to complete documentation at the final stage	2		2

Table 7 - Summary of Results of Analysis of Cost Data all 17 Projects

No.	Factors causing cost overrun	Uva A	Uva B	Uva C	Uva D	Trico 1	North1	North 2	North 3	North 4	North 5	Anu 1	Anu 2	Put 1	Put 2	Med 1	Rat 1	Panu	Range of percentage cost overrun	Number of projects affected
		Percentage contribution to total cost overrun																		
1	Price escalation	28	40		64		67	154	728	669	221	104		97	104	102		10	10 - 728	13
2	New instruction issued by the client	9	4	12	22	95.00	25						75	7			9		4 - 95	9
3	Unforseen site requirements	6	8	9	3	3.00	9						91				52	8	3 - 91	8
4	Items not identified in the BOQ	17	49	123	41	3.00	31						13				10		3 - 123	8
5	Estimation errors in the BOQ	36			70		120						7				6	41	6 -120	6
6	Inadequate/inaccurate site investigations				23												195	77	23 -195	3
7	Errors in the design												1				236	78	1 - 236	3
8	Delays in commencement	10			11														10 - 11	2
9	Due to unforeseen ground conditions	8																	8	1
10	Additional time taken to complete documentation at the final stages						2												2	1
11	Frequent Design Changes	13																	13	1

4.4 Significant Factors Causing Cost Overrun

According to the summary of analysis of cost data illustrated in Table 7, the following five factors causing cost overrun are found to be significant, and they have been enumerated in the descending order of severity as follows:

- Price escalation
- New instructions issued by the client
- Unforeseen site requirements
- Items not identified in the BOQ
- Estimation errors in the BOQ

4.4.1 Price Escalation

An increase in the cost of materials due to price escalation is one of the main reasons for cost overrun, and in this study out of 17

projects 13 have been affected by this. The material price can escalate because of shortage of supplies, excessive demand or lack of suitable substitutes. Raw materials such as metal, soil, cement and bituminous materials etc., may be in short supply due to production problems or sudden decisions taken by the government. The downturn of the economy can result in a high inflation rate and a high exchange rate for the dollar. Therefore, downturn in the economy could directly affect the price escalation of some locally available materials, and imported materials such as bitumen, steel, and cement etc.

It is difficult or impossible to avoid price escalation totally but by adopting the following mitigatory measures this problem can be minimised. The factors given in the price escalation formula should be reviewed to determine whether they truly represent the construction inputs related to the project. Further, the price contingency item in the BOQ should be reviewed based on the analysis of past data of similar projects. This will enable to work out a more realistic percentage for the price escalation.

4.4.2 New Instructions Issued by the Client

When new instructions are issued by the client time to time, it could affect the scope of the project, and scope changes could invariably result in delays as well as cost overrun. The changes to the project scope could occur due to the following reasons: wrong initial definition of the scope, inherent risk and uncertainties, sudden change of interest, and change of project funding, etc. This could lead to variation requests resulting in changes to project deliverables, budget, and the entire project team. In this study, out of 17 projects, cost overrun has occurred in 9 projects due to this reason.

If project scope changes are not managed properly, it could lead to disputes that make contractor or the client to spend time and money on arbitration and litigation to claim compensation for their losses. This will no doubt lead to delay and cost overrun of the project. In order to mitigate these occurrences, the following measures are proposed:

i) The scope of work needs to be defined correctly at the conceptual design stage itself. The responsibility to do so mainly lies with the client, and should be done accurately considering the future requirements of the road users and development plans of the country.
ii) Experienced professionals should be appointed to lead the design teams at the design stage to define the scope of work more accurately.
iii) Lessons learnt from the previous projects need to be incorporated at the conceptual design stage.

4.4.3 Unforeseen Site Requirements

In this study, out of 17 projects, in 8 projects cost overrun has occurred due to this reason. Unlike a building construction project, a road project runs through a long stretch of land having varying and difficult site conditions. The type of soil in these stretches may vary from peat to hard rock. In this scenario, even a highly experienced engineer may not be able to define the scope of work accurately at the time the BOQ is finalised. As a result, the consultant is compelled to issue site instructions to suit the existing site conditions resulting in variations. Although the cost overrun due to the reason 'Unforeseen site requirements' is inevitable, this can be minimised by conducting sufficient initial site investigations at the site prior to commencement of work.

Further, experienced professionals should be appointed to the estimation team to foresee varying conditions that can emerge at site. Similarly, past data and BOQs, and specifications etc. of projects need to be referred to sufficiently before the estimation is carried out in order to avoid omission of various items in the estimation. Also, by paying enough attention to the lessons learnt from previous projects all future estimations can be made more accurate.

4.4.4 Items not Identified in the BOQ

The road projects with a high degree of complexity usually result in intricate plans, schedules and estimations. In this study, out of 17 projects, cost overrun has occurred in 8 projects due to this reason. If adequate precautions are not taken the tendency for accidental omission of some aspects of the project plans and/or estimation is inevitable, resulting in variations. This could lead to delays and cost escalations. The lack of experience of the professionals involved in the preliminary estimation stage of the project could result in some items being overlooked.

Similarly, due to the professionals concerned, not paying enough attention to refer the documents related to previous estimations made in similar projects too, some items could be omitted from the original estimate.

In order to mitigate the cost overrun due to this reason, the following measures are recommended:
(i) Site inspections need to be carried out adequately by the estimators before the BOQ is prepared.
(ii) Experienced professionals should be appointed to lead the estimation team. Further, past data and BOQs, and specifications etc. of projects need to be referred to sufficiently before the estimation is carried out.
(iv) Lessons learnt from the previous projects need to be considered to identify different items involved in a road project.

4.4.5. Estimation Errors in the BOQ
Accurate cost estimates are important to avoid cost overrun occurring in construction projects. Errors in making cost estimates can create serious problems to the cash flow. Mostly, cost estimates become inaccurate due to the following reasons: erroneous measurements taken from approved drawings, incorrect material prices and arithmetic mistakes. Due to errors in making cost estimates, final cost may exceed the estimated cost resulting in insufficient funds to complete the remaining items of the work programme. The ensuing time delay will lead to cost overrun. In this study, out of 17 projects, cost overrun has occurred due to this reason in six projects.

The tender documents form the basis for project cost estimations. Although a tender consists of project specifications, it may lack some details. A good practice is to clarify these details before finalising the costs. Sometimes, the details omitted are from areas other than technical specifications and from entirely different areas. These omissions could often result in inaccurate estimation of the project.

In order to mitigate the effects due to this reason some actions are recommended. Site inspections and surveys need to be carried out adequately by the estimators before the BOQ is prepared in order to ensure that sufficient information is available to determine the items to be included in the BOQ. Further, investigation of sub surface should be carried out sufficiently to identify various types of soil and presence of rock to determine the quantities of various materials to a reasonable accuracy. Also, experienced professionals should be appointed to lead the estimation team. Further, lessons learnt from previous projects need to be considered to get an idea about various items involved. Similarly, estimates prepared need to be reviewed by a different set of experienced professionals to minimise errors at the preparation stage.

5. Conclusion and Recommendations

The research has been conducted by adopting a case study approach, by involving 17 foreign funded road construction projects undertaken by the RDA and two PRDAs. As the first objective, from a comprehensive literature review and a series of interviews one of the authors had with above professional, 37 factors causing cost overrun in road construction were determined. These factors were grouped into five categories: Natural conditions, Client and or Contractor, Client, Contractor and Beyond the control of all parties.

The cost overrun experienced in 17 foreign funded road projects were analysed, and it was found that eight factors are mainly responsible for cost overrun in these projects. As the second objective, the percentage contribution of each of these factors to the overall cost overrun was determined and ranked in the descending order of significance for each project separately. This outcome is presented in Table 7 along with a range of percentage cost overrun.

Of these factors, the five most significant factors causing cost overrun, in the descending order of significance, are as follows (the number of projects affected by the factor is given in the parenthesis); Price escalation (13), New instructions issued by the client (9), Unforeseen sire requirements (8), Items not identified in the BOQ (8) and Estimation errors in the BOQ (6). The factors such as 'Inadequate/inaccurate site investigations' (3) and 'Errors in the design' (3) have moderate effect on the cost overrun. Evidently, factors such as Delays in commencement (2), Additional time taken to complete documentation at the final stage (1), Frequent Design Changes (1), Due to

unforeseen ground conditions (1) are not significant enough in the context of Sri Lankan foreign funded road projects.

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