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Report to

Pretoria Portland Cement Company Limited

on

A Survey on Cement Costs in Building Projects

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1. Introduction

PPC contracted the School of Construction Economics and Management at the University of Witwatersrand via Wits Commercial Enterprise (Pty) Ltd to undertake a survey to determine the cost of cement relative to the total construction cost of projects to determine the effect of cement prices increases on overall construction costs.

2. The Survey

2.1 Goals

The goal of the survey is also to determine the significance of changes in the cement price as a factor influencing construction cost.

2.2 Previous Studies

National Government commissioned a study in 1993 to establish the influence of the price of cement on construction cost on low income housing.¹ A low income house was defined as a house between 45 and 50m². In summary the investigation found the following:

- The material content in a low cost house is 40% to 50% of total costs.
- Cement represents 10.8% of the material cost per standard house using cement bricks/block to construct the house (9 tons of cement).
- If clay bricks are used the cement contribution drops to 4.5 tons or 4%.

It should be noted that clay stocks are generally 7 to 10% more expensive depending on the area/location. Cement bricks can be manufactured almost anywhere clay deposits are available. Transportation cost can result in a higher than 10% difference between the cost of clay and cement brick.

2.3 Limitations

This survey is limited to commercial and residential buildings and does not include civil infrastructure or external works.

2.4 Types of buildings surveyed

Two main categories of building are surveyed: residential housing and commercial/industrial buildings.

¹ The South African Building materials Industry. The case of Cement and Bricks. Moses Ngoasheng. September 1993

(a) Residential housing

- Low cost
 - RDP house (36m²)
(Note: The Alexandra Ext 7 house of 36m², as measured, is a typical RDP house.)
 - Concrete raft foundation (floated – no screed)
 - Brickwork using concrete maxi bricks (Walls bag-washed both sides - no plaster)
 - Steel roof structure with fibre-cement roof sheeting (No ceilings, gutters or fascias)
 - Plumbing – single toilet and wash-trough
 - Windows and doors
 - Bonded house (60m²)
 - Bonded house (70m²)
 - Bonded house (86m²)
- Medium cost
 - Multistorey townhouse development in Sunnyside Johannesburg, 108 units of 45m² average size.
- High cost
 - House du Plooy in Pretoria, 1200m², concrete roof. Note that as roof tiles contain cement this will not affect the result.

(b) Commercial/industrial buildings:

- Shopping centre
 - Carlswald Shopping Centre, total area of 14260m².
- Low rise office block
 - Pretoria Magistrate Court additions, two story 4741m² office block.
- Multistorey office building
 - New Head Office for G5, Jukskei View, total area of 9810m².
- Industrial warehouse building
 - Factory for Hennops Glass and Aluminium, total factory size of 1925m².

3. Construction versus project cost

Conventionally “Works” means the works described in general terms in the schedule of works detailed in the contract documents, ordered in contract instructions, and including the contractor’s and his subcontractors’ temporary works. “Works” further include materials and goods and those supplied free or otherwise by the employer to the contractor and exclude work or installations to be executed by direct contractors. This must be differentiated from total project Cost which includes components such as land, fees, finance costs, etc.

3.1 Construction cost

Construction cost is defined as the total mandatory value payable to deliver the completed works to the Employer.

The “Works” is described in general terms in the schedule, detailed in the contract documents, ordered in contract instructions and including the contractor’s and his subcontractors’ temporary works. “Works” shall further include materials and goods and those supplied free or otherwise by the employer to the contractor – JBCC document.

Direct sub-contractors, generally include specialists such as electronic installations, shopfitting etc. The cement content in these items is negligible and is thus not taken into consideration.

The construction cost excludes Value Added Tax for commercial/industrial buildings but includes VAT for residential housing.

3.2 Project cost

Construction cost is one element of the project cost. Research has shown that construction cost is approximately 75% of the project cost.

Project cost generally consists of

- Construction cost
- Land
- Development cost
- Professional fees (Architects, Engineers, Quantity Surveyors and Project Managers)
- Bulk services contribution
- Connection Fees
- Legal and transfer cost
- National Home Builders Regulatory Council (NHBRC) levy for residential developments
- Financing cost

This survey analyses the cost of cement as a factor of the project and the construction cost. Investment decisions are, however, made taking the total project cost and not construction cost into account. Thus to determine the influence of the cost of cement as a factor of the development cost, project cost should be used.

(a) Residential category

The selling price of residential units includes 14% VAT and 1.3% National Home Builders Regulatory Council (NHBRC) levy. The latter is calculated on a percentage of the selling price.

(b) Commercial/industrial category

VAT is generally claimed as an input credit for commercial and Industrial buildings since VAT is charged on the rental charged over the life of building.

NHBRC levies are not charged on the sale or development of these categories of buildings

4. Survey methodology

- Primary data was analysed for the survey. Bills of quantities prepared by different Quantity Surveyors and priced by different Main Contractors were analysed.
- The lowest tender was used for each project.
- The items containing cement in the bills of Quantities were identified. The cement content of each item was determined and priced at the average cement price at the time of tender.
- The cost of cement in the various projects was calculated as a percentage of construction and project cost.

5. Survey findings

Table 1 is a summary table showing the area of the building, the project cost, the construction cost, the cement cost, cement cost as a percentage of the project and construction costs, and the project, construction and cement costs per square metre of building. The cement cost used was R0.73 per kg. Figures 1 to 5 present this information graphically.

Table 1: Summary table for cement price of R0.73/kg

TYPE OF BUILDING	Area in m ²	Project cost	Construction cost	Cement cost	Cement cost / Project cost	Cement cost / Construction cost	Project cost per m ²	Construction cost per m ²	Cement cost per m ²
LOW COST HOUSING (RDP)	36	R 41,867	R 23,653	R 3,386	8.1%	14.3%	1163	657	94
BONDED HOUSING (60m2)	60	R 139,848	R 97,339	R 7,422	5.3%	7.6%	2331	1622	124
BONDED HOUSING (70m2)	70	R 161,770	R 114,755	R 8,041	5.0%	7.0%	2311	1639	115
BONDED HOUSING (86m2)	86	R 183,648	R 132,135	R 10,814	5.9%	8.2%	2135	1536	126
MEDIUM COST HOUSING DEVELOPMENT	4860	R 30,248,367	R 22,413,308	R 335,513	1.1%	1.5%	6224	4612	69
HIGH COST HOUSE	1200	R 9,055,879	R 5,523,013	R 233,350	2.6%	4.2%	7547	4603	194
SHOPPING CENTRE DEVELOPMENT	14260	R 82,766,606	R 45,866,183	R 1,302,730	1.6%	2.8%	5804	3216	91
LOW RISE OFFICE BLOCK	4741	R 30,098,977	R 22,667,863	R 615,978	2.0%	2.7%	6349	4781	130
MULTISTOREY OFFICE BUILDING	9810	R 27,692,099	R 24,631,371	R 734,978	2.7%	3.0%	2823	2511	75
INDUSTRIAL WAREHOUSE DEVELOPMENT	1925	R 4,190,673	R 3,114,000	R 107,406	2.6%	3.4%	2177	1618	56

Figure 1: Cement cost as a percentage of Project cost for various structures

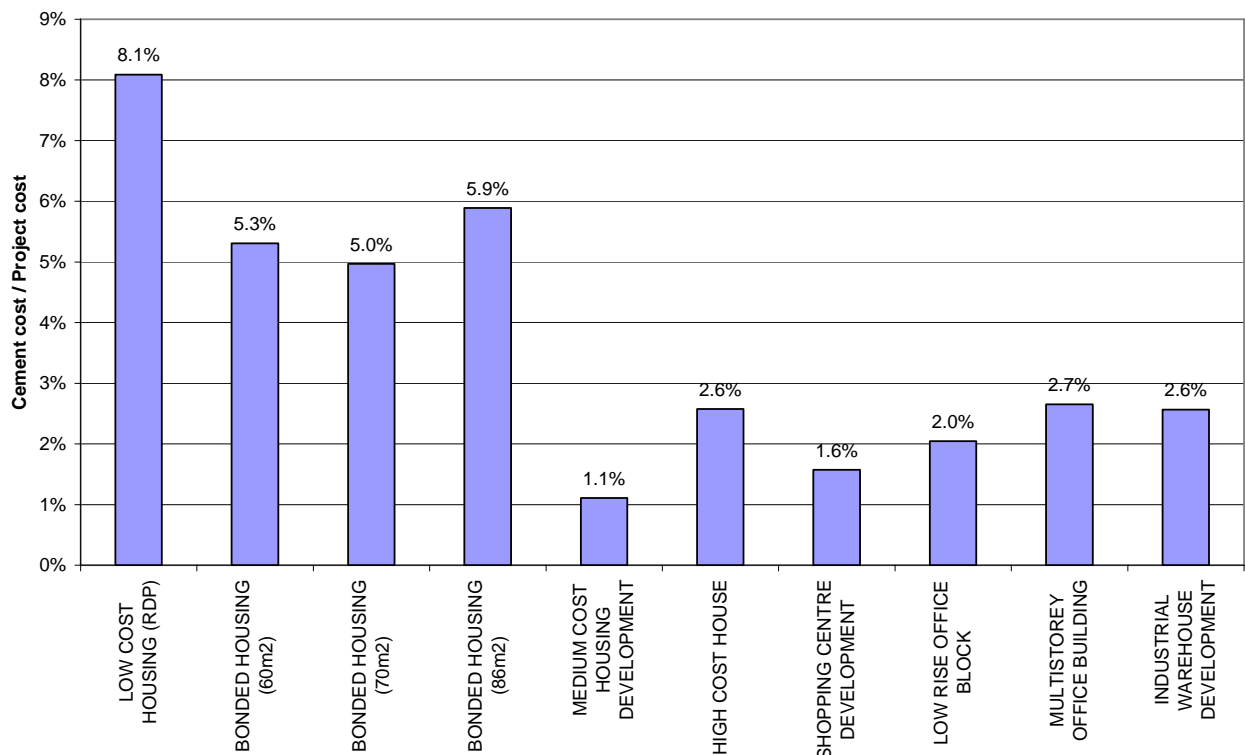


Figure 2: Cement cost as a percentage of Construction cost for various structures

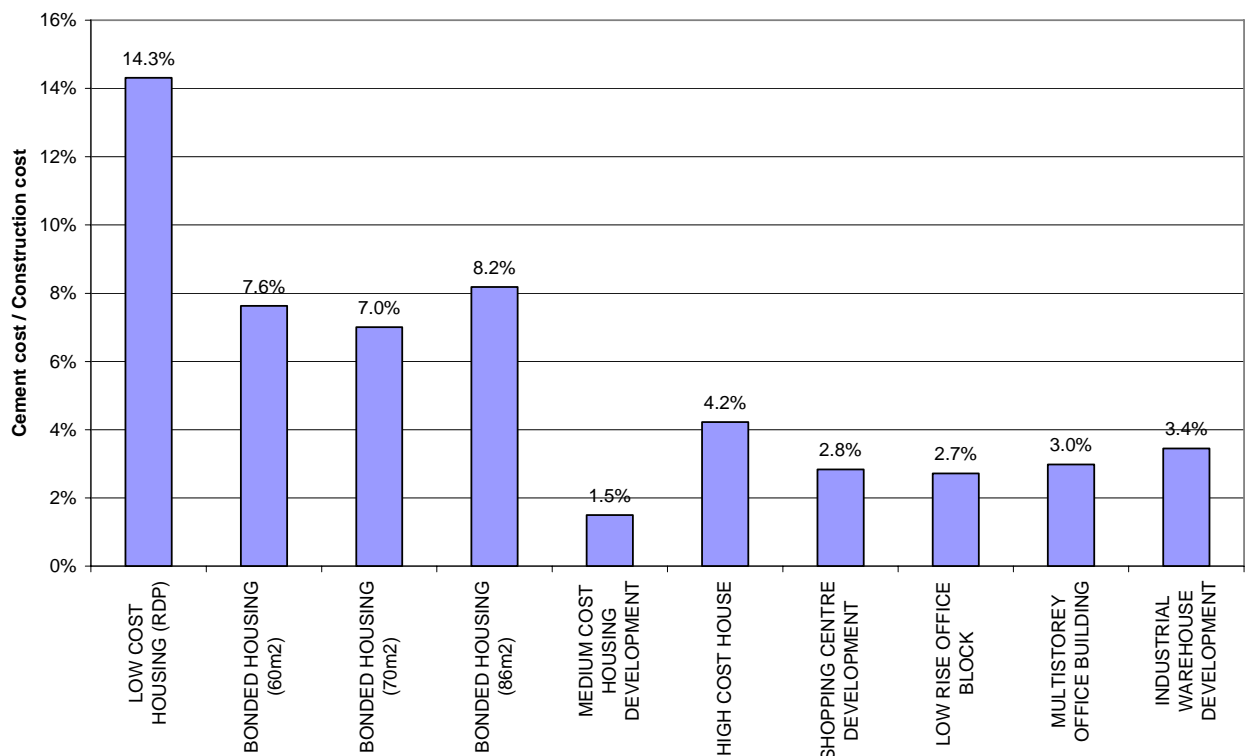


Figure 3: Cement cost as a percentage of Project cost and Construction cost for various structures

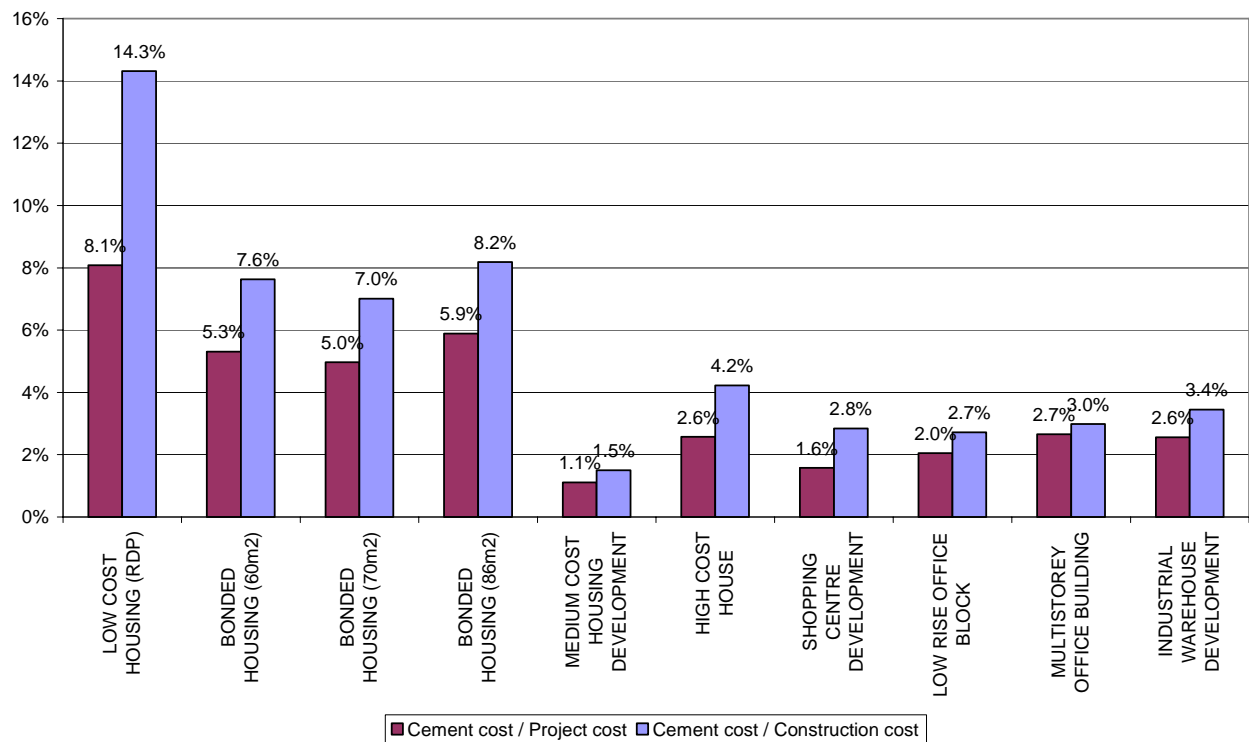
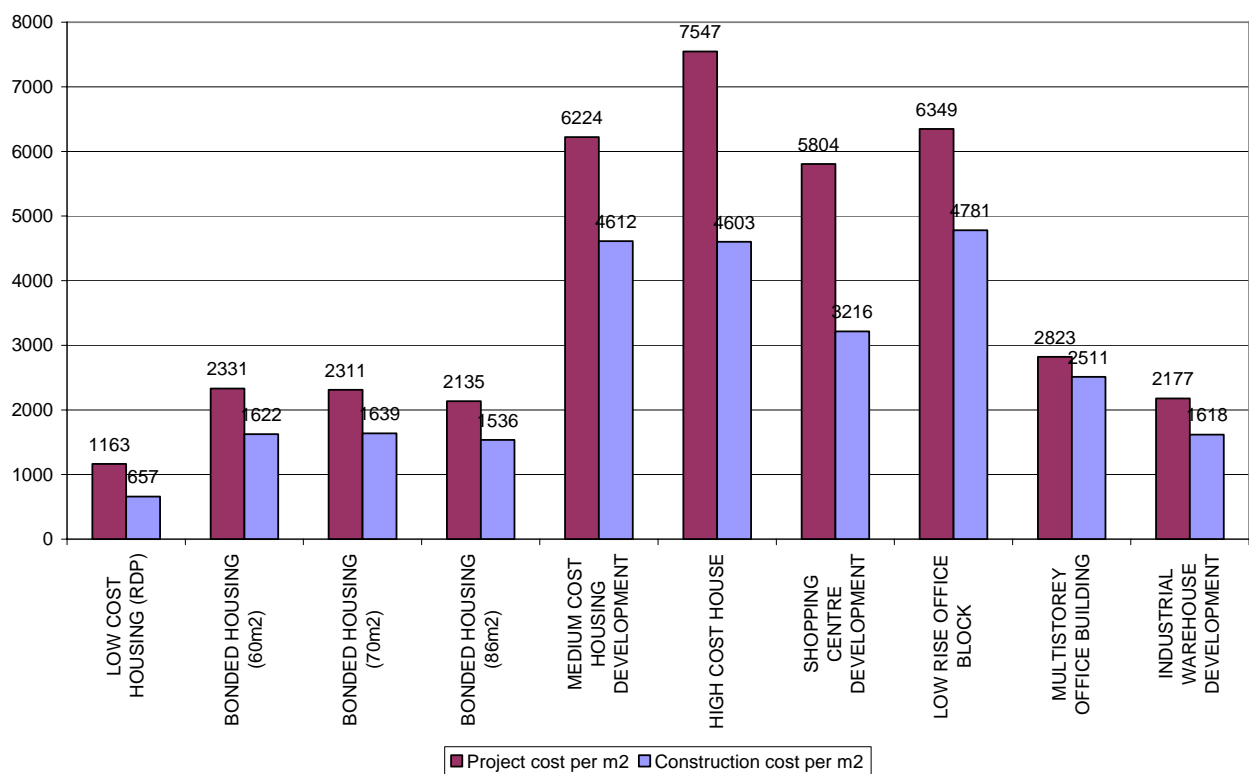
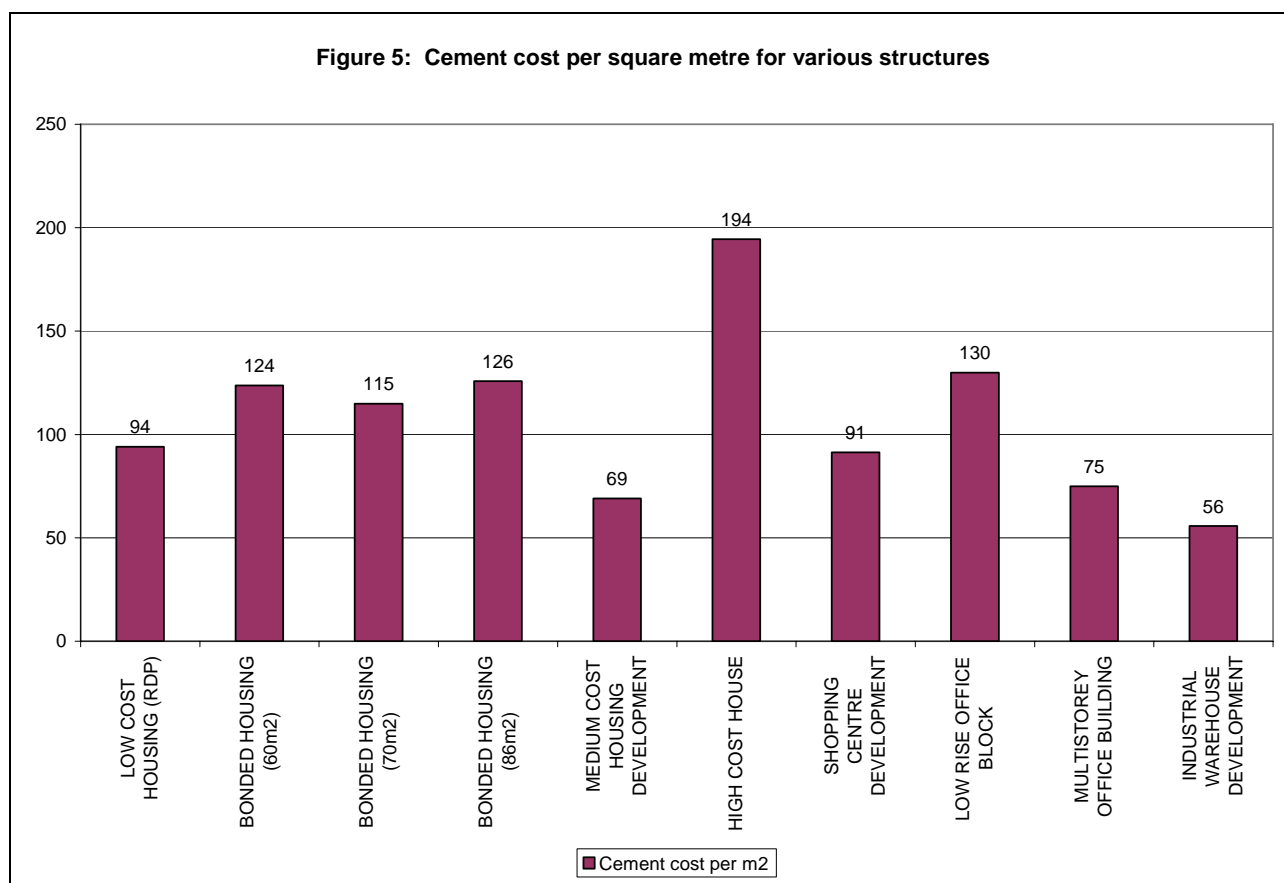


Figure 4: Project and Construction cost per square metre for various structures





6. Impact of cement price changes

6.1 Assuming no increase in other costs

Figure 6 shows the impact of an increase in the cement price of between 3% and 15% on the cement cost as a percentage of project cost. The project cost and construction costs are assumed to only increase by the amount of the cement cost increase (i.e. all other prices remain the same).

Figure 7 shows the impact of between 3% and 15% increases in the cement price on project cost. Figure 8 presents the same information in a different way. Again, the project cost and construction costs are assumed to only increase by the amount of the cement cost increase (i.e. all other prices remain the same).

Figure 6: Impact of cement price increase on Cement cost as a percentage of Project cost (assuming all other prices remain the same)

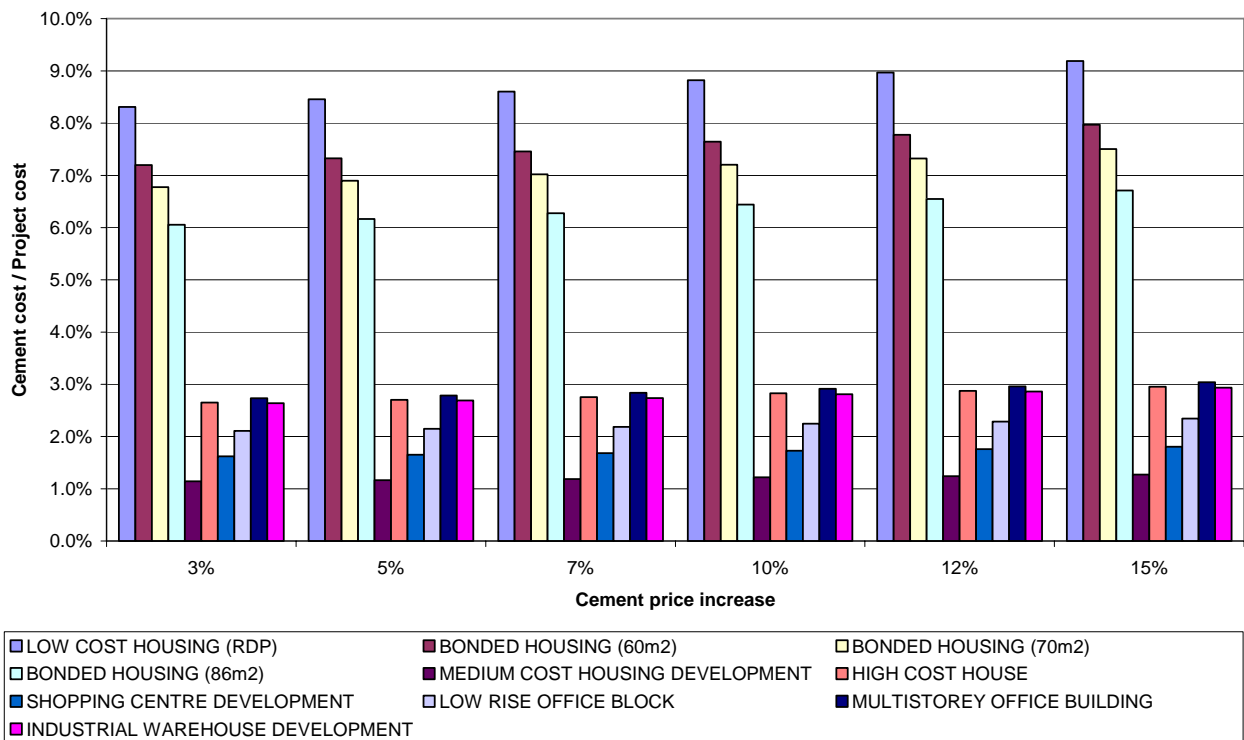
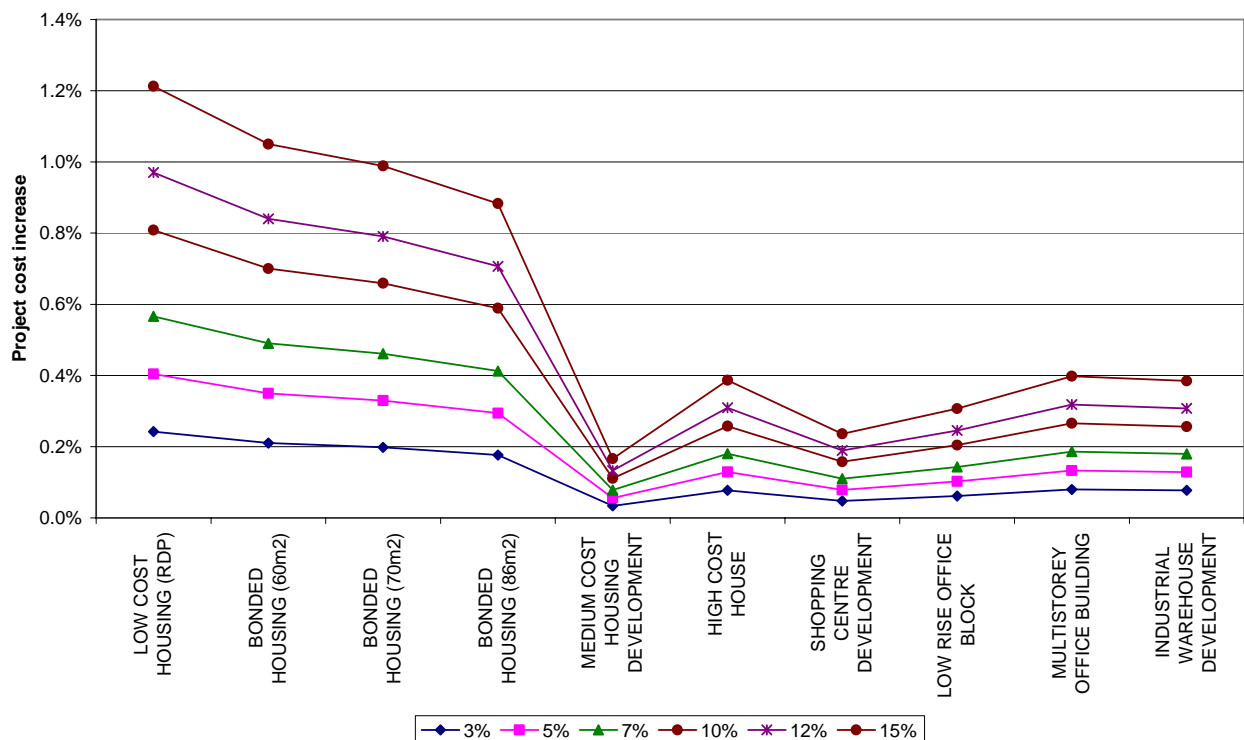
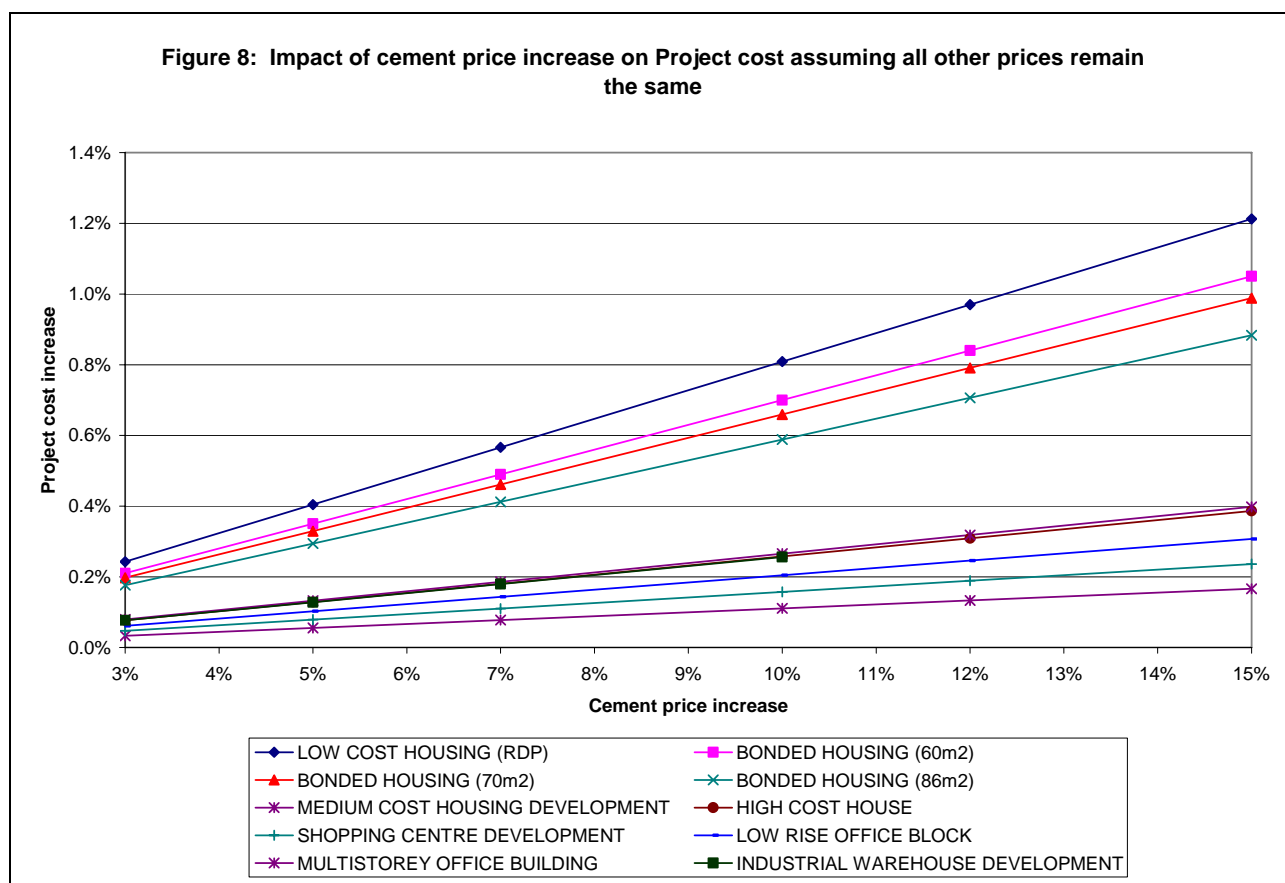


Figure 7: Impact of cement price increase on Project cost assuming all other prices remain the same





For estimation purposes, the equations in Table 2 can be used to determine the impact of an increase in the cement price on the project and construction costs assuming all other prices remain the same. For example, the impact of an 11% increase in the cement price on the project cost of a high cost house is $0.11 \times 2.5768 = 0.28\%$. Note that in order to limit the numbers after the decimal point, the input must be as a percentage (i.e. 11% is put in as 0.11), but the output result is directly as a percentage (i.e. 0.28 means 0.28%).

Table 2: Equations for estimation of the impact of a cement price increase ASSUMING ALL OTHER PRICES REMAIN THE SAME

	To determine increase in <u>project cost</u> , multiply <u>cement price increase</u> (as a %) by:
LOW COST HOUSING (RDP)	8.0863
BONDED HOUSING (60m ²)	7.0015
BONDED HOUSING (70m ²)	6.5909
BONDED HOUSING (86m ²)	5.8884
MEDIUM COST HOUSING DEVELOPMENT	1.1092
HIGH COST HOUSE	2.5768
SHOPPING CENTRE DEVELOPMENT	1.5740
LOW RISE OFFICE BLOCK	2.0465
MULTISTOREY OFFICE BUILDING	2.6541
INDUSTRIAL WAREHOUSE DEVELOPMENT	2.5630

6.2 Assuming an increase in project costs

Figure 9 shows the impact of an increase in the cement price of 7% on the cement cost/project cost, assuming the project costs rise by 4% and 10% in addition to the cement price increase. Figure 10 shows the impact of varying cement price and project cost on the cement cost/project cost.

Figure 9: Comparison of Cement cost as a percentage of Project cost at 4% and 7% Project cost increases and a 7% cement price increase

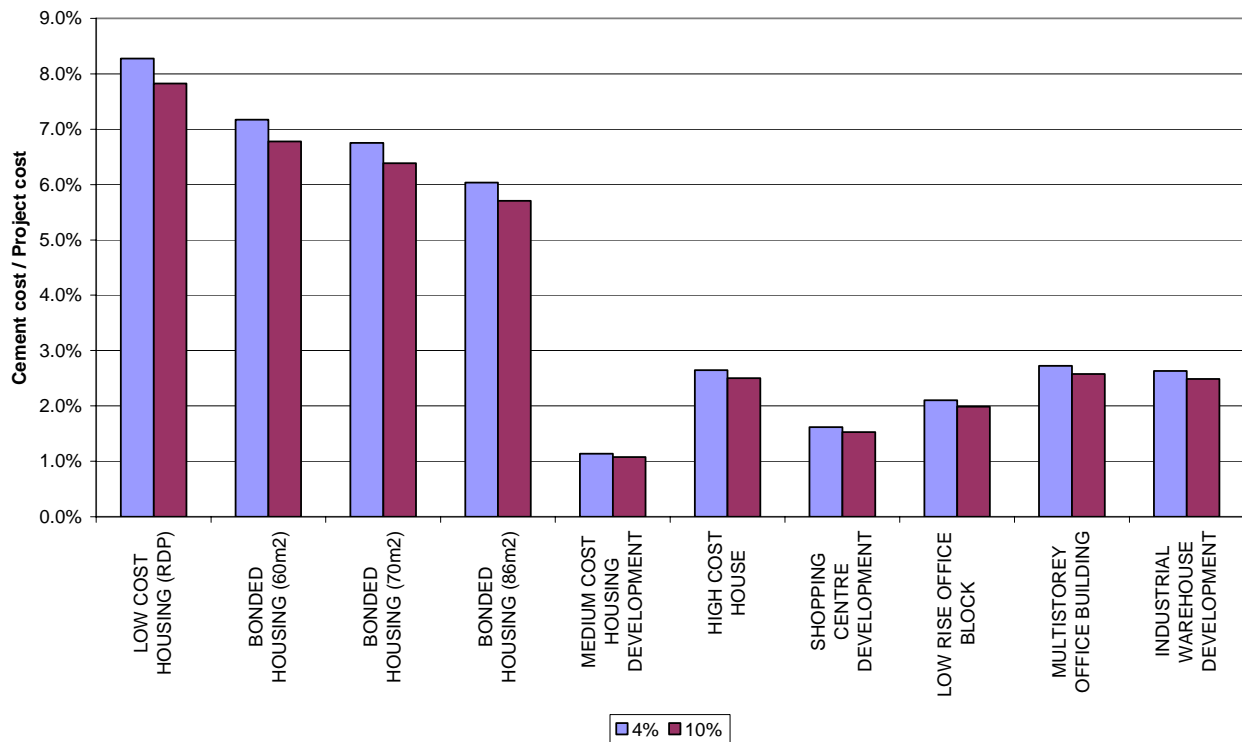
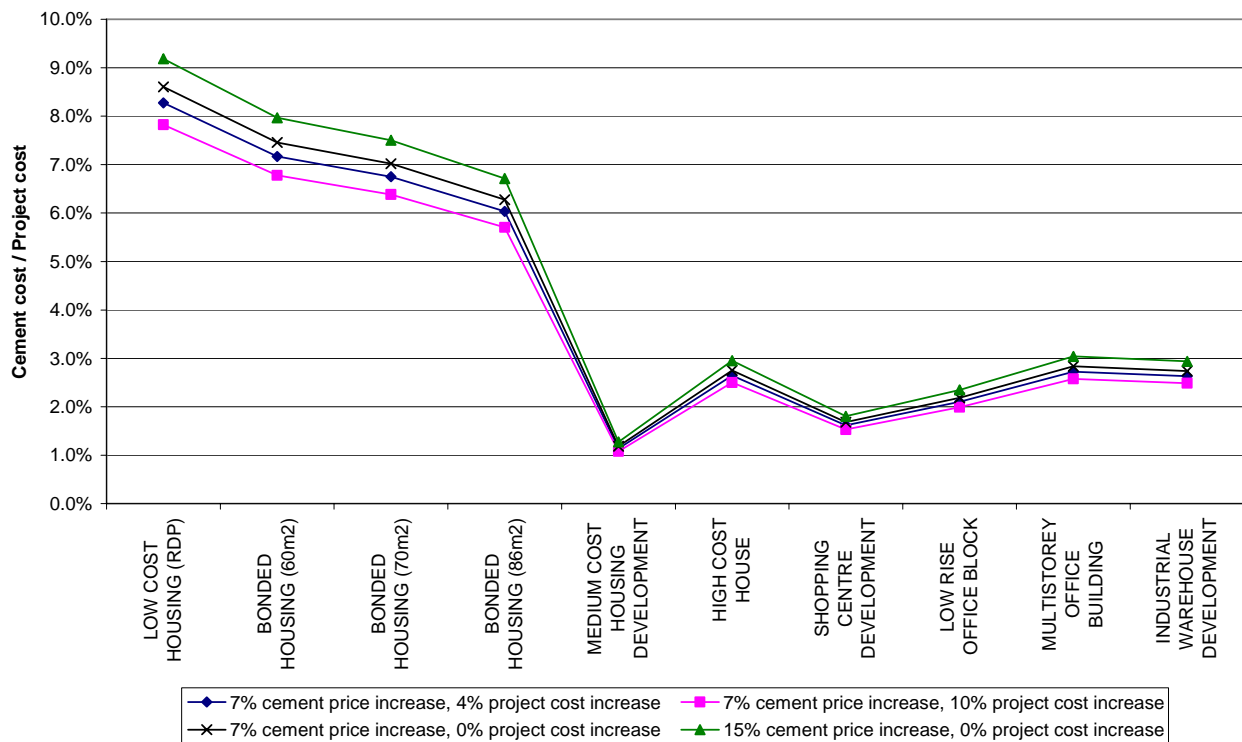


Figure 10: Comparison of Cement cost as a percentage of Project cost with varying cement price and Project cost increases



4. Conclusion

Cement is not a major factor in the cost of housing and commercial/industrial structures. In lower cost housing it has more of an impact than in higher cost housing and commercial/industrial structures. This is because low cost housing has very few finishes and fittings which increase the project costs relative to the cement costs (a typical RDP house will, for example, have bagged walls and no floor finishes). Currently the cement costs are approximately 8.1% of project cost for a 36m² RDP house compared to 2.6% for a 2100m² high cost house and 1.6% for a shopping centre development.

An increase in cement price will thus impact the project and construction costs of low cost housing more. Assuming all other costs remain the same, a 7% increase in cement price will increase the project cost for an RDP house by approximately 0.6% compared to 0.2% for a 2100m² high cost house. However, this is still insignificant compared to the total project cost.

If the overall project costs increase (e.g. due to inflation) the impact of a cement price increase is reduced. So, for example, if the project costs increase by 4%, and the cement price rises by 7%, the cement cost to project cost ratio for an RDP house will be 8.3%, compared to 8.6% if the cement prices rises but the project costs do not increase. For a high cost house, the cement cost to project cost ratio is 2.6% if the project costs increase by 4% and the cement price rises by 7%, compared to 2.8% if the cement prices rises but the project costs do not increase.

If project cost inflation is more than the cement price increase, the cement cost ratio drops below the current ratio. For example, if the project costs increase by 10% and the cement price rises by 7%, the cement cost to project cost ratio for an RDP house is 7.8%, compared to 8.6% if the cement price rises but the project costs do not increase and 8.1% currently. For a high cost house the cement cost to project cost ratio drops to 2.5% compared to 2.8% if the cement prices rises but the project costs do not increase, compared to the current ratio of 2.6%.

In conclusion, the impact of a cement price increase is not significant compared to the total project cost. The impact is higher for low cost housing than for high cost housing and commercial/industrial structures. In an inflationary environment, the cement cost to project cost ratio is reduced if the project cost increase is higher than the cement price increase.

Appendix A:

Raw data