PARAMETRIC ESTIMATING - THE HISTORY, THEORY AND APPLICATION THEREOF IN THE SOUTH AFRICAN BUILDING INDUSTRY.

DRAFT THESIS ON THE ABOVE

SUBMITTED TO FULFILL THE REQUIREMENTS OF THE DEGREE MSc. (Q.S)

BY

KEVIN DONALD PAIGE

TO

THE UNIVERSITY OF THE ORANGE FREE STATE

BLOEMFONTEIN

FOREWORD

Good "Estimating on Building Cost Forecasting" is the lifeblood of the Construction Industry and those concerned therewith. Many schemes are ruined before commencement or during construction by a bad "Estimate". As a profession I believe Quantity Surveyors are always striving to improve the "technique" or "art" of estimating and I hope that in some small way this thesis may form part of Quantity Surveyors' striving.

I would like to express my thanks to those many people for the encouragement and advice, some unwittingly, they have given me over the past years while I was busy studying for and writing what is embodied in the pages that follow. I must especially mention Prof. W.H. Malan of the U.O.F.S. without whose nagging I doubt whether I would ever have completed this thesis and Mr. John Southwell of Bristol, England for the valuable time and advice he gave me on one occasion when I was bogged down, also to Elaine Boshoff and Sina Wepener who have typed the draft of this thesis.

Last but not least to my wife Yvonne, I promise not to start another of these crazy ideas - not until the next time!

K.D. PAIGE
JOHANNESBURG

January 1979

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GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

Area/S.P.U. Area		Total floor space area measured over external walls
"Spacial Element"/ "Parameter"		A unit or element containing various part components to make the whole
"Preliminary & General"	P. & G.	That part of a tender document where the Tenderer has the opportunity to allow for contractual and other conditions
"Provisional Sums"	P.S.	Amounts allowed in tender documents for certain specialist items
"Source Parameter" "Source Parameter Unit"	S.P.U.	A theoretical unit of 100 m2 in area made up of weighted averages of the elements therein
"Source Parameter Unit Cost"	S.P.U.C.	The total cost of all the elements/ components or parts of the unit
"Affect Variation Factor" "Enhancement Factor"	A.V.F.	That factor by which "S.P.U." costs must be multiplied to allow for those outside influences which affect the cost of buildings
Rate in use factor		That factor by which a cost of an element in the S.P.U. must be multiplied to allow for sundry and other work not directly included in the make-up of the element
Non-included unit factor		That factor which makes allowance for the elements not included in the S.P.U.
High and Low Rise Buildings		Buildings of high rise are those generally of over 10 storeys in number while low rise is 9 storeys and under
"Shape Ratio"	S.R.	Ratio of length to breadth of outside dimensions of the building

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SECTION 1

INTRODUCTION

* ESTIMATING is the approximate judgement of a number or an amount or a Contractor's statement of a sum for which he will undertake certain works.

From the above definitions it is clear that there is a vast difference in the meaning of the word when applied to the Construction Industry. It is either the approximate judgement of the cost of a building as used by some of the professions, or tender amount when used by a contractor.

For the purpose of this thesis the words "Estimate" or "Estimating" shall be taken to mean "The approximate judgement of a number or an amount".

Because of the possible confusion in the work, some members of the Profession prefer to use the term "Building Cost Forecasting" which term is more readily used and understood in the United Kingdom. In the United States of America the words in common use are "Estimate" for the building cost forecast and "Bid" for the tender.

Estimating of the building costs has been used for as long as there has been a building industry, but with the advent of more sophisticated methods of "Property Investment Appraisal" the requirement of the initial estimate to be as accurate as possible has been very real. In this day and age time has also become very important and the developer may not have this commodity at his disposal when deciding whether or not to purchase a piece of land for development. It has therefore become necessary for the building construction cost to be reasonably accurately arrived at in a relatively short space of time for the developer to include in his first preliminary feasibility study on which a piece of land may or may not be purchased.

Because of the requirements of accuracy and time the art of estimating has changed over the years, many different methods having been used, improved or discarded.

* OXFORD ENGLISH DICTIONARY

Various types of estimates have been used over the years with reasonable degrees of success or otherwise, each becoming more scientific than the last and more time consuming.

Hereunder are listed some of the better known methods used over the years in reasonable chronological order:

i) Super method - based on the area of the building. While this system works under ideal conditions it is very limited for adjusting the estimate for different types of structure finishes, etc. and makes no allowance for the shape of the building.

ii) Cube method - based on the cubic volume of the building. The same comments apply equally to this method of estimating as i) above.

iii) Storey enclosure system - based on area volume and factors, the system is an accurate method of arriving at cost, but for complete accuracy relies on updating the basic rates from time to time.

iv) Elemental system of estimating - a very accurate method of estimating but can be time consuming. Very flexible and allows changes to be made to accommodate finishes, shapes, types of structures, etc.

v) Rough quantities - also a time consuming method which requires a fair detail of drawings, which are not always available at the estimate stage.

As can be seen from the above the more accurate the science or art of estimating becomes, even with modern aids, the more time consuming. With these problems in mind a further type of estimate has been developed, known as the "Parametric Estimate".

SECTION 2

PARAMETRIC ESTIMATING

PARAMETRIC ESTIMATING

"Parametric" is derived from the word "Parameter" - "a line or quantity which serves to determine a point, line, figure or quantity in a class of such things" or "a constant quantity in the equation of a curve".

Two well known researchers in this field are Dr. J.E. Tumarkin of the U.S.A. and Mr. John Southwell of England, both having published papers on the subject.

As the basis on which contracts are let in the U.S.A. differs widely from that in this country the information obtained from contracts under construction is not of great value for use in the R.S.A.

The elements into which buildings are catagorised in the U.S.A. are:

i) General
ii) Structural
iii) Electrical
iv) Mechanical
v) Elevators
vi) Others

With the exception of (i) and (vi) all these elements are self-explanatory. Heading (i) applies to those trades or works carried out by the main contractor and (vi) those carried out by sub-contractors to the main contractor.

It is of interest to note the fact that Electrical, Mechanical and Elevator installations are all treated as separate units or elements. These items amount to approximately 30% of the total building cost in South Africa while the structure amounts to 17% (average) gross 23% (average) net, giving a total of 47% which means that more than half the total cost of the building (by South African standards) is covered in two elements i.e. (i) the work carried out by the main contractor and (vi) the work carried out by these sub-contractors.

These should be compared with the elements as used in elemental estimating in South Africa which are approximately 21, although this can be reduced to 17 if certain very similar or related elements are combined. Dr. Tumarkin has also had to take into account other such costs as "Union" or "Non Union" labour, the various types of contracts, etc. It is interesting to note that in the U.S.A., the basis of the estimate was either the

1) area - total floor space;
2) S.F.C. - square feet of construction, i.e. walls, slabs, etc.

/Method... ...

Method 2 has the effect of approaching the elemental system of measuring when factors are used.

Mr. Southwell in one of his papers on the subject has used a different parameter for each element. This does minimise the error percentage but has, in my opinion, no advantage over the elemental system of estimating.

In a later paper written by Mr. Southwell entitled "Spatial Elemental Cost Control" he uses six parameters, viz.:

1) Substructure.
2) Roof.
3) Suspended floors.
4) External walls.
5) Internal walls.
6) Services.

To use only one parameter to prepare an estimate would be of great advantage. This parameter when used with the building area and the necessary formula should enable the estimator to arrive at a reasonably accurate estimate quickly.

Each of these "parameters" or "spatial elements" contain the following components:

(1)	substructure	foundations
		ground level
		abnormals
		ground floor finishings
(2)	roof	roof construction, including storey frame
		roof finishings
		roof drainage
		roof lights
		ceilings

/(3) ... ...

(3)	suspended floors	floor construction, including storey frame floor finishings ceilings
(4)	external walls	walls, including facings wall finishings windows external doors
(5)	internal walls	walls, partitions wall finishings doors
(6)	services	sanitary plumbing building drainage hot and cold water services heating installation electrical installation

This system allows for all components of the building to be included under the different parameters, making the element more accurate and, as there are less parameters than in his previous system, the time expended in the estimate is that much less.

Theory.

The theory of this method of estimating is that the average cost of particular unit, element or component bears a definite relationship with the cost of the overall building in some proportion or ratio.

This can be applied in large proportions, i.e. structure to total cost, or small proportions, i.e. doors to total costs, e.g. if the cost of the doors on a project is 5%(y) then the cost of the project is 20(y).

/Whichever ... ...

Whichever relationship is used however, its cost in comparison to the total building cost must be meaningful; it would be of little use for example to use a parameter having a low unit cost/overall percentage value, that even by doubling same would have little effect on the total building cost. Similarly to use the total structural cost would involve considerable effort and time which would destroy the use of this type of estimate.

By what percentage should an estimate be accurate - this depends on the client, the type of building, the position of the building, etc. Upon the accuracy factor required of the estimate depends the parameter to be used, e.g. if a $\pm$ 5% accuracy, which I feel should be the extreme variation, is required, then any total unit cost of under this figure would give unsatisfactory results.

The parameter used must have an inbuilt flexibility of rate which will allow the estimator to vary the costs from time to time.

The basis of doing an estimate on today's rates both for building cost and income is valid as any projected building cost would also have to use a projected income scale.

As a 5% inaccuracy in building costs leads to a difference in return of 1/20 on the total percentage return the estimator must endeavour to be within this percentage.

Because any modern estimating system (other than square or cube methods) is generally based on building elements (these elements generally are those as defined in "GUIDE TO ELEMENTAL COST ANALYSIS"), I have investigated the percentage cost of these elements in contracts being handled by a firm of Q.S.'s in Johannesburg. The percentages are all those used in the preparation of estimates.

/As ... ...

As can be seen from the accompanying schedules "A1" - "A5", the percentages of elements, "P. & G." and "Provisional Sums" vary considerably. The different percentages of "P. & G." can be attributed to the different estimating approaches. In an effort to rationalise the percentages it was decided to spread the P. & G. percentage over all the building elements pro rata to their percentage value. In addition, because of the practice of obtaining separate specialist Provisional Sums, the Provisional Sums were divided into two categories:

i) Specialist - Electrical, Air Conditioning, Lifts.
ii) All other.

(see Schedules"B").

It is interesting to note that the percentage of ii) above does not exceed 2,5% of the total cost.

(Note: Provisional sums for items such as ceilings, partitions, etc. have been placed under the component to which they belong)

Because of the fact that specialist Provisional Sums and P. & G. costs were normally catered for at the end of an estimate it was decided that the most useful way of applying the percentage of elements would be to use only the percentage of actual work of the Contractor i.e. exclude i) Specialist Provisional Sums
ii) P. & G. Allowance.

The percentages from the schedules A1-A5 were therefore recalculated spreading the percentage of (i) and (ii) above in proportion to the element value which resulted in the revised schedules C1-C5 (see Section 4).

SECTION 3

SCHEDULES

The five different types of buildings investigated are -

A 1	-	Office blocks (High Rise)
A 2	-	Office blocks (Low Rise)
A 3	-	Flats/Apartments
A 4	-	Shopping Centres
A 5	-	Factories

The buildings used in the analysis are not all located in the same area of the Republic. However, as it is the percentage cost of the elements that is being investigated, the difference in cost from one area to another tends to be minimised.

The percentages do not easily show any of the characteristics which affect the costs of construction (see Section 8) and thus for the percentages to be meaningful a full investigation of the various buildings was carried out (see Section 9).

PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE OFFICE BLOCKS (HIGH RISE)

REF NUMBER	1	2	3	4	5	6	7	8	9	10
TOTAL VALUE	18 447 559	6238805	5 085 628	20 317 465	5 021 614	9438391	3 131 856	15 465 000	201 7209	22 067 000
APPROX AREA	55274	29751	22774	109552	15362	31654	17223	46027	11598	93369
	-		-							
FOUNDTS	1·33	0·44	-	0·48	0·53	0·55	1·54	0·35	1·42	0·27
PILING	-	-	-	-	-	-		0·12	-	-
BSEMNT	3·18	4·81	-	4·29	2·93	3·63	1·20	5·48	0·24	2·10
GRD FLR	-	-	-	-	-	-	0·52	-	-	-
S-TRUCT	14·99	19·36	18·53	15·17	16·32	17·22	15·68	12·52	23·36	14·91
ROOFS	0·70	0·87	0·34	0·41	0·52	0·16	2·21	0·45	1·30	0·27
FRONT ELEV	13·80	9·90	13·59	14·22	21·71	16·08	17·18	14·54	12·75	17·36
SIDE ELEV	-	-	-	0·24	-	-	0·95	-	-	0·21
INT DIVS	5·93	4·47	6·27	4·52	4·46	2·74	6·98	5·24	15·28	4·11
FLRS	3·04	4·19	3·32	2·74	3·09	2·88	4·92	3·04	5·13	3·77
CEILINGS	3·13	4·03	2·64	3·25	2·44	2·24	3·50	2·90	3·42	2·84
INT FINS	1·49	3·04	2·20	1·92	1·93	4·01	2·10	2·05	2·42	1·59
FITTINGS	0·14	0·07	0·38	0·06	0·12	1·49	0·72	2·70	0·24	0·05
PLUMBING	2·46	2·22	2·21	3·19	1·58	2·09	2·18	4·36	1·26	2·61
FIRE SERVICE	1·97	2·22	0·25	0·43	0·43	2·42	0·56	0·32	1·62	0·31
SUNDRIES	0·06	1·04	0·27	0·15	0·49	0·26	0·81	1·15	0·86	0·11
SOIL DRNS	-	-	-	0·10	0·01	-	0·06	-	-	-
STORM WTR	0·11	-	-	0·19	0·07	-	0·13	0·09	-	0·14
SITE WKS	0·63	-		0·74	-	0·93	0·12	-	0·33	1·80
ORD. PROV. SUMS	1·50	-	1·05	1·44	2·46	0·98	1·29	1·80	-	1·19
SPEC PROV SUMS	31,16	34·09	33·41	31·80	22·59	27·83	25·51	32·49	20·29	31·17
P&G	14·33	9·22	15·06	14·64	18·28	15·19	8·83	10·43	18·10	15·19

BUILDING TYPE

OFFICE BLOCKS (HIGH RISE)

SCHEDULE OF

PROVISIONAL SUM

ALLOWANCES

REF NUMBER	1	2	3	4	5	6	7	8	9	10
ELECT	8.16	8.58	8.52	10.09	5.19	8.10	8.35	9.13	10.20	7.46
LIFTS/ESCAL	10.25	9.62	12.91	8.65	8.55	9.45	4.25	5.60	8.64	11.13
A.C. INST	12.75	15.89	11.98	13.06	8.85	9.58	15.91	17.76	1.45	12.53
SPEC INST										
OTHER SUNDRY										
TOTAL	31.16	34.09	33.41	31.80	22.59	27.13	28.51	32.49	20.29	31.17

AVG R2G

W
W

SCHEDULE B1

PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE OFFICES (LOW RISE)

REF NUMBER	1	2	3	4	5	6	7	8	9	10
TOTAL VALUE	2585013	885706	1747162	2435100	1197600	350354	639803	1614000	1099500	746103
APPROX E AREA	10708	4641	8612	20761	5074	2245	2904	5884	6276	5943
LOCATION										
FOUNDTS	6.01	0.46	0.74	2.51	1.70	2.56	0.94	1.01	0.73	2.13
PILING	1.47	-	-	-	11.36	-	2.27	1.86	2.55	-
BASEMNT	2.83	2.36	6.04	2.62	0.61	-	5.30	5.48	2.96	8.06
GRD FLR	1.62	0.35	-	2.19	0.50	1.56	-	0.06	-	-
STRUCT	14.89	21.98	13.76 H	31.77	19.31	17.09	18.97	16.50	15.01	24.70
ROOFS	6.26	1.10	1.21	2.52	2.03	1.80	2.77	1.91	0.64	1.88
FRONT ELEV	13.34	23.31	13.03	12.79	12.59	17.43	26.33	12.14	24.15	9.81
SIDE ELEV	-	-	-	-	-	-	-	-	-	-
INT DIVS	7.24	10.62	8.06	2.27	15.42	6.58	1.22	5.68	5.79	3.88
FLRS	5.18	5.24	3.17	5.61	4.39	5.76	3.63	4.25	3.26	3.31
CEILINGS	3.30	3.92	3.31	11.10	1.95	3.61	3.67	3.23	3.59	2.30
INT FINS	3.18	1.59	2.94	1.24	1.75	1.84	1.64	2.33	2.51	2.40
FITTINGS	1.47	0.86	0.45	0.23	0.15	0.23	0.23	1.85	0.98	0.34
PLUMBING	1.87	2.30	3.90	1.33	4.28	2.47	1.87	1.82	2.85	2.60
FIRE SERVICE	0.77	0.38	0.65	0.25	0.56	1.99	1.32	1.03	0.14	0.57
SUNDRIES	0.46	0.90	0.45	-	0.57	0.22	0.43	1.39	0.41	0.75
SOIL DRNS	0.35	-	-	-	0.26	0.33	-	-	-	-
STORM WTR	0.83	0.56	-	0.12	0.48	0.71	-	-	0.12	-
SITE WKS	4.28	2.52	0.21	-	0.06	2.56	-	0.26	-	-
ORD. PROV. SUMS	1.50	0.90	0.86	-	-		-	2.31	1.78	2.31
SPEC PROV SUMS	12.97	13.24	27.95	23.45	19.79	24.77	18.65	23.05	27.01	31.04
P.C.S.	9.67	1.91	13.04	-	9.22	9.67	10.71	13.32	5.52	3.92

BUILDING TYPE
OFFICES LOW RISE

SCHEDULE OF
PROVISIONAL SUM
ALLOWANCES

REF NUMBER	1	2	3	4	5	6	7	8	9	10
ELECT	10 41	.9 43	7.92	6.18	9.75	4.79	UNAVAILABLE	6.94	7.39	6.39
LIFTS/ESCAL	1.01	8.47	8.43	4.32	9.59			5.11	4.93	8.30
A.C INST	1.55	0.34	11.60	12.95	0.47	19.98		11.00	14.69	16.35
SPEC INST										
OTHER SUNDRY										
TOTALS	12.97	18.24	27.95	23.45	19.77	24.77	18.65	23.05	27.01	31.04

SCHEDULE B2

PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE - FLATS

REF NUMBER	1	2	3	4	5	6	7	8	9	10
TOTAL VALUE	R.3,3M	R372915	R1087124	R1145570	R2364677	R379728	R460513	R1087728	R128456	R1082494
APPROX E AREA	19366	1707	5859	6670	2340	1895	1952	4331	750	6900
FOUNDTS	3.91	10.20	4.31	1.20	1.49	6.37	6.44	4.88	3.75	4.16
PILING	-	-	-	1.18	0.98	-	-	-	-	-
BSEMNT	-	-	-	3.08	-	-	-	-	-	1.80
GRD FLR	1.21	1.46	2.20	0.47	0.39	1.61	2.17	0.29	2.10	-
STRUCT	13.78	8.77	6.94	18.33	13.47	6.87	12.89	22.55	7.28	15.53
ROOFS	4.34	4.72	8.13	3.50	3.71	9.77	5.16	3.55	7.22	2.29
FRONT ELEV	17.93	12.33	17.62	10.99	18.50	14.44	18.63	14.38	26.15	15.27
SIDE ELEV	-	-	-	-	-	-		-		
INT DIVS	7.93	6.15	7.00	6.33	7.86	5.93	4.92	3.72	6.14	4.02
FLRS	8.38	4.51	3.52	7.17	4.81	6.75	5.05	5.23	4.86	3.05
CEILINGS	2.93	2.99	3.10	2.66	2.88	2.45	2.05	1.42	2.00	1.90
INT FINS	6.16	7.12	7.76	5.87	8.28	8.85	5.14	3.32	7.24	7.15
FITTINGS	3.35	4.21	5.75	5.76	5.81	2.85	4.58	4.96	5.04	2.69
PLUMBING	5.92	9.26	7.55	6.94	9.84	9.11	5.06	8.74	7.92	6.79
FIRE SERVICE	0.09	0.55	-	0.58	0.66	1.35	0.34	-	-	0.86
SUNDRIES	0.43	0.90	0.64	2.51	1.81	1.25	1.80	3.13	0.28	0.94
SOIL DRNS	0.61	-	2.05	0.17	0.27	1.04	1.27	-	1.17	0.52
STORM WTR	0.30	-	0.74	0.20	0.14	0.68	2.09	-	-	0.73
SITE WKS	6.68	-	5.22	2.01	1.44	11.14	7.03	4.60	0.75	2.93
ORD PROV SUMS	0.63	5.31	-	-	0.11	-	-	-		
SPEC PROV SUMS	4.27	9.39	8.33	13.54	9.62	9.56	7.37	7.49	6.62	6.47
P & G	11.73	9.09	9.09	7.51	7.41	-	9.08	11.73	11.24	22.84

BUILDING TYPE

FLATS

SCHEDULE OF

PROVISIONAL SUM

ALLOWANCES

REF NUMBER	1	2	3	4	5	6	7	8	9	10
ELECT	4.27	9.39	8.35	10.05	7.62	9.56	7.37	7.49	6.62	6.47
LIFTS/ESCAL	-	-	-	3.49	-	-	-	-	-	-
A.C INST	-	-	-	-	-	-	-	-	-	-
SPEC INST	-	-	-	-	-	-	-	-	-	-
OTHER SUNDRY	-	-	-	-	-	-	-	-	-	-

SCHEDULE B3

PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE - SHOPPING CENTRES

REF NUMBER	1	2	3	4	5	6	7	8
TOTAL VALUE	770659	2553637	2006193	479748	1525833	357174	411488	1280764
APPROX E AREA	3599	10739.6	17955	3454	8448	2977	1388	8448
LOCATION								
FOUNDTS	3.37	1.91	3.94	3.37	1.32	5.15	0.10	1.57
PILING	2.62	0.71	1.67	-	-	-	-	
BSEMNT	-	-	-	5.25	1.81	-	-	1.92
GRD FLR	4.02	2.67	3.35	1.00	2.36	3.39	-	2.82
STRUCT	13.20	13.76	17.13	20.37	11.53	0.50	10.36	14.71
ROOFS	4.31	1.92	9.75	3.53	6.95	23.25	3.82	10.10
FRONT ELEV	8.32	2.46	5.89	18.18	8.72	21.00	7.59 5.32	9.93
SIDE ELEV	-	-	-	-	-	-	-	-
INT DIVS	1.28	9.16	3.62	4.45	0.78	2.61	2.66	0.37
FLRS	2.70	3.18	4.38	4.39	3.33	5.70	1.50	4.51
CEILINGS	4.03	2.83	4.09	4.23	1.41	5.68	1.50	2.49
INT FINS	2.34	2.13	3.33	5.20	1.89	2.08	2.43	2.13
FITTINGS	0.13	0.12	0.01	1.54	-	-	0.35	-
PLUMBING	1.18	2.49	1.36	4.69	1.27	2.46	1.49	1.25
FIRE SERVICE	0.56	2.17	1.48	1.19	0.33	0.69	0.08	-
SUNDRIES	0.99	0.23	1.08	1.22	1.61	0.91	0.09	0.80
SOIL DRNS	0.10	-	-	-	0.24	-	-	0.29
STORM WTR	0.14	0.51	-	-	1.03	-	-	1.23
SITE WKS	3.22	4.21	1.21	2.60	10.88	2.38	-	15.07
ORD. PROV. SUMS	2.01	5.54	0.90	-	1.78	0.56	-	1.33
SPEC PROV SUMS	34.20	25.32	26.63	8.64	23.81	13.33	59.16	23.35
P & G	10.71	18.67	10.10	9.09	18.35	10.10	10.37	5.63

BUILDING TYPE
SHOPPING CENTRES

SCHEDULE OF
PROVISIONAL SUM
ALLOWANCES

REF NUMBER	1	2	3	4	5	6	7	8
ELECT	10·10	8·81	12·53	8·64	5·81	13·33	14·58	5·08
LIFTS/ESCAL	7·74	3·98	4·98		4·65		28·19	3·90
A.C INST	16·27	12·53	9·17		13·35		14·37	14·37
SPEC INST								
OTHER SUNDRY	34·20	25·32	26·68	8·64	23·81	13·33	57·16	23·35

SCHEDULE B4

PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE - FACTORIES.

REF NUMBER	1	2	3	4	5	6	7	8	9	10
TOTAL VALUE	402635	364311	712433	607396	269587	327653	535692	307728		
APPROX E AREA	4252	2401	4534	5056	1485	3303	3973	3024		
LOCATION										
FOUNDTS	5·26	5·83	1·81	5·77	6·00	3·03	5·71	7·36		
PILING	-	5·01	-	-	-	-	-	-		
BASEMNT	-	-	-	-	-	-	-	-		
GRD FLR	6·16	3·51	6·89	7·18	3·40	6·91	6·99	9·10		
STRUCT	23·58	23·53	18·47	17·47	18·78	26·27	19·87	15·58		
ROOFS	8·57	7·01	9·31	15·28	8·72	17·93	7·95	8·71		
FRONT ELEV	7·89	11·71	6·57	8·83	14·31	10·71	17·65	11·84		
SIDE ELEV	-	-	-	-	-	-	-	-		
INT DIVS	5·62	7·34	7·69	4·29	4·40	7·37	5·20	4·55		
FLRS	2·04	3·85	4·29	2·83	2·66	3·45	4·22	2·32		
CEILINGS	1·28	2·85	5·89	1·60	3·60	1·60	3·59	3·14		
INT FINS	2·98	2·24	4·81	3·08	3·22	1·02	3·08	4·09		
FITTINGS	0·14	0·17	1·63	0·60	0·18	0·06	0·37	0·24		
PLUMBING	1·60	3·16	5·89	3·74	2·45	2·57	3·12	-		
FIRE SERVICE	5·96	0·51	0·59	5·29	0·56	1·74	0·74	7·96		
SUNDRIES	1·89	1·07	0·23	0·83	0·32	-	2·12	0·74		
SOIL DRNS	0·71	0·31	-	0·44	0·87	-	-	0·54		
STORM WTR	0·59	0·58	-	0·49	2·40	-	-	0·36		
SITE WKS	4·91	4·80	0·13	5·28	9·00	1·12	-	6·57		
ORD. PROV. SUMS	-	-	1·19	-	-	0·21	-	1·73		
SPEC PROV SUMS	11·57	7·39	14·40	7·35	9·92	6·92	10·29	8·37		
P & G	9·43	6·63	10·10	9·09	9·22	9·09	9·09	6·53		
			SCHEDULE A5					3·10		

BUILDING TYPE

FACTORIES

SCHEDULE OF

PROVISIONAL SUM

ALLOWANCES

REF NUMBER	1	2	3	4	5	6	7	8	9	10
ELECT	9.09	.9.89	10.82	6.36	9.92	6.46	8.64	8.39		
LIFTS/ESCAL	-	-	-							
A.C INST	2.48	-	3.58	1.49		0.46	1.65			
SPEC INST		-								
OTHER SUNDRY										
TOTALS	11.57	9.89	14.40	7.85	9.92	6.92	10.29	8.39		

3.11

SCHEDULE BJ

SECTION 4

RATIONALISATION OF PERCENTAGES

Using example 8 from schedule "A4" we have:

1.	Value of Builder's Work	=	69,69% (i.e. all components)
2.	Ordinary Provisional Sums	=	1,33%
3.	Special Provisional Sums	=	23,35%
4.	P. & G. and Contingencies	=	5,63%
			100,00%

If the P. & G. value of 5,63% is to be evenly distributed over 1, 2 and 3, then:

$$1 = \left(69{,}69 + \left(\frac{69{,}69}{94{,}37} \times \frac{5{,}63}{1}\right)\right) = 73{,}85\%$$

$$2 = \left(1{,}33 + \left(\frac{1{,}33}{94{,}37} \times \frac{5{,}63}{1}\right)\right) = 1{,}41\%$$

$$3 = \left(23{,}35 + \left(\frac{23{,}35}{94{,}37} \times \frac{5{,}63}{1}\right)\right) = 24{,}74\%$$

As the specialist Provisional Sums are in the majority of estimates obtained or calculated separately, the percentage values of elements may be further adjusted by spreading the value of those Provisional Sums and the P. & G. proportionately over the elements of builder's work thus:

COMPONENT	ORIGINAL PERCENTAGE	"A" NEW CALCULATION % WITH "P. & G." SPREAD	"B" NEW CALCULATION % WITH "P. & G." & SPEC. "P.S." SPREAD
FDTS.:	1,57	1,66	2,21
BASEM.:	1,92	2,03	2,70
GRD. FLR.:	2,82	2,98	3,96
STRUCT.:	14,71	15,58	20,70
ROOF:	10,10	10,71	14,23
FR. ELEV.:	9,93	10,53	13,99
INT. DIV.:	0,87	0,92	1,22
FLRS.:	4,51	4,77	6,34
CLGS.:	2,49	2,66	3,53
INT. FINS.:	2,13	2,26	3,00
PLUMBG.:	1,25	1,33	1,77
SUND.:	0,80	0,84	1,12
SOIL DRNS.:	0,29	0,31	0,41
STORM WT.:	1,23	1,30	1,73
SITE WKS.:	15,07	15,97	21,22
ORD. P.S.:	1,33	1,41	1,87
SPEC. P.S.:	23,35	24,74	-
P. & G.:	5,63	-	-
PERCENTAGE	100,00	100,00	100,00

/The ... ...

The aforementioned figures have been calculated as follows:

Column "A": $100A\ (100 - PV)^{1/x}$ (Formula i)

Where A = Percentage value of Element

PV = Value of Preliminary & General

Column "B":

$$100A\ \left(\left(\frac{T + (T \times PV)}{T}\right) \times T\right)^{1/x} \times \left(\frac{T + (T \times PV)}{T}\right)$$

(Formula ii)

Where A = Percentage value of Element

T = Percentage total value of Components

PV = Percentage value of P. & G. to be spread.

However, in actual fact the new percentage value of the component is:

$$100A\ (100 - (PV + S))^{1/x}$$

(Formula iii)

Where A = Percentage value of Element

PV = Percentage value of P. & G. to be spread.

S = Percentage value of special Provisional Sums.

The percentage element values in table "A" have now been recalculated using Formula iii above, giving the results as tabulated in schedules "C1" - "C5".

These percentages are the net percentages of builder's work in the elements.

REVISED PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE OFFICE BLOCKS (HIGH RISE)

REF NUMBER	1	2	3	4	5	6	7	8	9	10	AVG	
TOTAL VALUE											%	
APPROX E AREA											DF	
LOCATION											ELEM 1-10	
FOUNDTS	2.44	0.78	-	0.90	0.90	0.95	2.46	0.61	2.04	0.50	1.158	
PILING	-	-	-	-	-	-		0.21	-	-	0.021	
BASEMNT	5.83	8.48	-	8.01	5.04	6.29	1.92	9.61	0.34	3.91	4.943	
GRD FLR	-	-	-	-	-	-	0.83	-	-	-	0.083	
STRUCT	27.50	34.15	35.95	28.32	27.61	29.86	25.02	21.95	33.58	27.82	29.174	29.174
ROOFS	1.28	1.53	0.76	0.77	0.88	0.28	3.53	0.79	1.87	0.50	1.219	
FRONT ELEV	25.32	16.58	26.37	27.00	36.70	27.88	28.94	25.50	18.32	32.75	26.536	26.536
SIDE ELEV	-	-	-		-	-	-	-	-			=81.5
INT DIVS	10.88	7.88	12.28	8.44	7.54	4.75	11.14	9.19	21.95	7.64	10.171	
FLRS	5.58	7.39	6.66	5.12	5.22	4.99	7.85	5.33	7.36	7.03	6.253	25.797
CEILINGS	5.63	7.80	5.92	6.07	4.12	3.88	5.59	5.09	4.91	5.29	5.400	
INT FINS	2.73	5.36	4.47	3.58	3.26	6.95	3.35	3.59	3.48	2.96	3.973	
FITTINGS	0.27	0.12	0.74	0.11	0.20	2.58	1.15	4.73	0.34	0.09	1.033	
PLUMBING	4.51	3.92	4.29	5.96	2.67	3.63	3.48	7.65	1.81	4.87	4.279	
FIRE SERVICE	3.61	3.92	0.49	0.82	0.73	4.20	0.89	0.56	2.33	0.58	1.813	
SUNDRIES	0.11	2.09	0.53	0.28	0.23	0.45	1.29	2.01	1.24	0.21	0.900	
SOIL DRNS	-	-	-	0.20	0.02	-	0.10	-	-	-	0.032	
STORM WTR	0.20	-	-	0.35	0.12	-	0.21	0.02	-	0.26	0.116	
SITE WKS	1.16	-	-	1.38	-	1.61	0.19	-	0.45	3.36	0.815	
ORD PROV SUMS	2.75	-	2.04	2.69	4.16	1.70	2.06	3.16	-	2.21	2.077	
ACT %												
			SCHEDULE C1					43				

REVISED PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE - OFFICES (LOW RISE)

REF NUMBER	1	2	3	4	5	6	7	8	9	10	AVG		
TOTAL VALUE											%		
APPROX E PRED											OF		
LOCATION											ELEM		
FOUNDTS	7.77	0.58	1.25	3.28	2.39	3.70	1.40	1.60	1.08	3.27	2.632		
PILING	1.90	—	—	—	6.14	—	3.21	2.95	3.78	—	1.798		
BASEMNT	3.66	3.55	10.24	3.42	0.86	—	7.50	8.68	4.39	12.39	5.476		
GRD FLR	2.09	0.44	—	2.86	0.70	2.38	—	0.10	—	—	0.857		
STRUCT	19.27	27.53	23.65	41.50	27.20	25.04	26.35	26.14	22.25	37.98	27.741	27.741	
ROOFS	3.09	1.38	2.05	3.29	2.86	2.75	3.92	3.03	0.95	2.89	3.121		
FRONT ELEV	17.24	29.17	22.08	16.70	17.73	26.50	37.27	19.23	35.79	15.08	23.679	23.679	
SIDE ELEV	—	—	—	—	—	—	—	—	—	—			
INT DIVS	9.36	13.30	13.66	2.97	21.72	10.04	1.73	9.00	8.58	5.97	9.630		= 76.196
FLRS	6.70	6.56	5.37	7.33	6.18	8.69	5.14	6.73	4.83	5.09	6.260	34.226	
CEILINGS	4.71	4.91	5.64	14.50	2.75	5.50	5.20	5.12	5.32	3.54	5.739		
INT FINS	4.11	1.99	4.98	1.62	2.47	2.80	2.32	3.77	3.72	3.69	3.147		
FITTINGS	1.90	1.08	0.76	0.30	0.26	0.32	0.33	2.93	1.45	0.52	0.985		
PLUMBING	2.42	2.88	6.61	1.74	6.03	3.67	2.45	2.88	4.22	4.00	3.710		
FIRE SERVICE	1.00	0.48	1.10	0.33	0.79	3.04	1.87	1.63	0.21	0.32	1.133		
SUNDRIES	0.59	1.13	0.76	—	0.80	0.29	0.61	2.10	0.61	1.15	0.804		
SOIL DRNS	0.45	—	—	—	0.36	0.50	—	—	—	—	0.131		
STORM WTR	1.07	0.70	—	0.16	0.68	1.08	—	—	0.18	—	0.387		
SITE WKS	5.53	3.16	0.36	—	0.08	3.70	—	0.41	—	—	1.324		
ORD. PROV. SUMS	1.74	1.13	1.49	—	—	—	—	3.70	2.64	3.55	1.445		

REVISED PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE FLATS.

REF NUMBER	1	2	3	4	5	6	7	8	9	10	AVER		
TOTAL VALUE											%		
APPROX E AREA											of		
LOCATION											ELEM 1-10		
FOUNDTS	4.65	12.51	5.22	1.52	1.80	7.04	7.66	6.04	1.81	5.88	5.713		
PILING	-	-	-	1.49	1.18	-	-	-	-	-	0,267		
BASEMNT	-	-	-	3.90	-	-	-	-	-	2.55	0,645		
GRD FLR	1.44	1.79	2.66	0.60	1.97	1.78	2.60	0.36	2.56	-	1.436		
STRUCT	16.32	10.76	8.40	23.22	16.23	7.60	15.35	27.92	8.87	21.97	15.664	15.664	
ROOFS	5.17	5.78	9.84	4.43	4.47	10.80	6.18	4.39	8.80	3.24	6.310		
FRONT ELEV	21.24	15.14	21.48	13.92	22.30	15.97	22.19	17.80	31.53	21.60	20.347	20.347	
SIDE ELEV	-	-	-	-	-	-	-	-	-	-	-		F 60 943
INT DIVS	9.44	7.54	8.47	8.02	9.47	6.56	5.89	4.64	7.48	5.69	7.320		
FLRS	9.88	5.58	4.21	9.08	5.80	7.46	6.04	6.47	5.92	4.31	6.489	23.952	
CEILINGS	3.49	3.66	3.75	3.37	3.47	2.71	2.45	1.76	2.44	2.69	2.779		
INT FINS	7.33	8.73	9.23	7.44	9.78	9.79	6.15	4.10	8.82	10.11	8.173		
FITTINGS	3.98	5.20	6.96	7.30	7.00	3.15	5.43	6.14	6.14	3.81	5.501		
PLUMBING	7.05	11.35	9.14	8.78	11.86	10.07	6.06	10.82	9.65	9.61	9.239		
FIRE SERVICE	0.11	0.67	-	0.73	0.80	1.47	0.41	-	-	1.22	0.541		
SUNDRIES	0.51	1.10	0.78	3.18	2.18	1.38	1.20	3.87	0.34	1.33	1.587		
SOIL DRNS	0.73	-	2.48	0.22	0.35	1.15	1.52	-	1.43	0.74	0.962		
STORM WTR	0.36	-	0.96	0.25	0.17	0.75	2.50	-	-	1.03	0.602		
SITE. WKS	7.65	-	6.32	2.55	1.74	12.32	8.37	5.69	0.91	4.22	4.777		
ORD. PROV. SUMS	0.75	10.19	-	-	0.13	-	-	-	-		1.107		
ACT DIVS	100.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	TOT 1000.00 %		
	100	(100 - P - S) %											
			SCHEDULE C3					45					

REVISED PERCENTAGE VALUE OF ELEMENTS

BUILDING TYPE - SHOPPING CENTRES

REF NUMBER	1	2	3	4	5	6	7	8	AVG			
TOTAL VALUE									OF ELEM %			
APPROX E AREA												
LOCATION												
FOUNDTS	6.12	3.41	6.23	4.70	2.28	6.73	0.31	2.21	3.99			
PILING	4.76	1.27	2.64	-	-	-	-	-	1.08			
BSEMNT	-	-	-	6.38	3.13	-	-	2.70	1.53			
GRD FLR	7.41	4.77	5.27	1.22	4.08	4.43	-	3.97	3.89			
STRUCT	23.96	24.57	27.14	25.39	19.93	0.65	32.42	20.71	21.85	21.85		
ROOFS	7.82	3.43	15.42	4.29	12.01	30.36	11.95	14.22	12.44			
FRONT ELEV	15.11	4.39	9.32	22.10	15.08	27.43	23.74	13.98	16.39	16.39		
SIDE ELEV	-	-	-	-	-	-	-	-	-			
INT DIVS	2.32	16.35	5.73	5.40	1.35	3.41	8.32	1.23	5.53		=	59.71 %
FLRS	4.90	5.68	6.93	5.34	6.71	7.44	4.69	6.35	6.00	21.47		
CEILINGS	7.32	5.05	6.47	5.20	2.44	7.42	4.69	3.51	5.26			
INT FINS	5.16	3.80	5.27	6.32	3.27	2.98	7.60	3.00	4.68			
FITTINGS	0.24	0.21	0.02	1.87	-	-	1.09	-	0.43			
PLUMBING	2.14	4.45	2.15	5.70	2.20	3.21	4.66	1.76	3.28			
FIRE SERVICE	1.02	3.87	2.34	1.45	0.66	0.90	0.25	-	1.31			
SUNDRIES	1.60	0.43	1.71	1.48	2.78	1.19	0.28	1.13	1.35			
SOIL DRNS	0.13	-	-	-	0.41	-	-	0.41	0.13			
STORM WTR	0.25	0.91	-	-	1.78	-	-	1.73	0.58			
SITE WKS	5.81	7.52	1.94	3.16	16.81	3.11	-	21.22	7.70			
ORD. PROV. SUMS	3.65	9.89	1.42	-	3.08	0.73	-	1.87	2.58			

SCHEDULE C4 4.6

REVISED PERCENTAGE VALUE OF ELEMENTS

2 BUILDING TYPE FACTORIES

REF NUMBER	1	2	3	4	5	6	7	8		AVG		
TOTAL VALUE										%		
APPROX E DATE										OF ELEM		
LOCATION												
FOUNDTS	6.50	6.98	2.40	6.95	7.42	3.62	7.08	8.66		6.20		
PILING	-	6.00	-	-	-	-	-	-		0.75		
BASEMNT	-	-	-	-	-	-	-	-				
GRD FLR	7.80	4.20	9.13	8.64	4.20	8.23	8.67	10.70		7.70		
STRUCT	24.80	28.19	24.47	21.03	23.23	31.28	24.65	18.33		25.12	25.12	
ROOFS	10.80	8.40	12.33	18.40	10.78	21.35	9.86	10.24		12.77		
FRONT ELEV	9.97	14.03	8.70	10.63	17.70	12.75	21.91	13.92		13.70	13.70	
SIDE ELEV	-	-	-	-	-	-	-	-		-		= 57.40%
INT DIVS	7.11	8.79	10.19	5.16	5.44	8.77	6.45	5.35		7.16		
FLRS	2.58	4.64	5.68	3.40	3.29	4.11	5.23	2.73		3.96	18.58	
CEILINGS	1.62	3.41	7.80	1.98	4.45	1.90	4.45	3.69		3.66		
INT FINS	3.77	2.68	6.37	3.74	3.98	1.21	3.82	4.81		3.80		
FITTINGS	0.18	0.20	2.23	0.72	0.22	0.07	0.46	0.28		0.55		
PLUMBING	2.02	3.78	7.80	4.50	3.03	3.06	3.87	-		3.51		
FIRE SERVICE	7.50	0.61	0.78	6.37	0.69	2.07	0.92	9.36		3.54		
SUNDRIES	2.37	1.28	0.37	0.99	0.40	-	2.63	1.11		1.47		
SOIL DRNS	0.97	0.37	-	0.54	1.08	-	-	0.64		0.45		
STORM WTR	2.73	0.69	-	0.59	2.97	1.33	-	0.42		0.84		
SITE WKS	6.22	5.75	0.17	6.36	11.13	0.25	-	7.73		4.70		
ORD. PROV. SUMS	-	-	1.58	-	-	-	-	2.03		0.45		
			SCHEDULE 05					4.7				

SECTION 5

BASE PARAMETER

BASE PARAMETER

It therefore becomes necessary to define one parameter or building unit that occurs in the majority of buildings to enable this type of estimating to be done - to be called the "BASE PARAMETER".

The difficulty lies in obtaining one element or component used for all types of buildings. This element or component should be easily priced or rated to enable the parametric estimate to be done. The cost of this parameter must be able to be accurately calculated as an estimate of the cost of this parameter will mean that the "base" for the estimate may have been inaccurate and this percentage inaccuracy greatly increased in the final cost. This depends on whether items usually covered by specialists, e.g. electrical, lifts, etc. are to be separately inserted in the estimate or included in the parametric estimate; if specialist items are excluded then it may be more preferable to use a "base price", i.e. a price unrelated to any particular element. This has an advantage in as much as the "base price" can be altered at will to coincide with a building price index, or a building location index.

It is possible to have a parameter for each element of the building but this defeats the object of having one parameter written into a formula to be applied to return the desired result.

As the sketch drawings develop, it is possible that in order to obtain a more accurate cost and formula or equation one must take into account this possibility.

In attempting to find a "base parameter" the following building cost units were considered:

/1) ... ...

1) Electrical installation cost.
2) Lift installation cost.
3) Air conditioning cost.
4) Floors.
5) Ceilings.
6) Internal divisions.
7) Plumbing.
8) Roof waterproofing.
9) External facades.
10) Structural.

As can be seen, the costs of items 1 - 9 can be easily obtained or calculated, while 10 would require an amount of work. Consider all the items individually:

1) Electrical Installation.

The cost of this item is usually, on larger projects, obtained from consultant and the figure is in the way of being a budget cost. As can be seen from tables B, the average percentage cost of this item is between 4,27% and 14,58% depending on the type of building, with great variances within one type of building. One difficulty which arises is the widely differing specification in electrical installation - with regard to quality and fittings - which greatly affects the cost of the installation - for these reasons and the fact that I decided to divorce certain items, this being one, from the estimate, the cost of the electrical installation was not considered a valid basic parameter.

2) Lift Installation.

Although the cost of the lift installation has a very direct relationship with the building cost - (good lifts, good building, cheap lifts in inexpensive building) the fact that a large proportion of the costs of the installation originate outside the R.S.A. and are therefore subject to currency fluctuation, make the lift installation unreliable as a basic parameter.

/3) ... ...

3) Air Conditioning Installation.

This unit cost was rejected because of the same reasons as 1) and 2) above.

4) Floors.

Although the type of floors are a very good guide to the type of building, the use of this unit as the basic parameter was rejected because:

i) The value of floors in relationship to the whole was generally about 5% (see tables A). The average percentage of all contracts analysed was 5,86%.

ii) Expensive floors may have to be laid by the tenant and therefore are not included in the estimate.

iii) Types of floors can differ widely in any one building.

5) Ceilings.

Rejected for the same reasons as 4 i) and ii). Average percentage 4,61%.

6) Internal Divisions.

The reason for rejection of this cost unit was because in many cases the internal layout is unknown at time of estimate and that many tenants hire vacant areas and erect their own divisions.

7) Plumbing.

The cost per unit of plumbing fittings can vary greatly according to the type of system being used. Plumbing costs also have many "side costs", e.g. duct walls, duct covers, etc. and the cost per unit becomes difficult to estimate accurately for a basic parameter.

8) Roof Waterproofing.

In the overall this item is similar to floors, i.e. relationship of part to whole was too low.

/9) ... ...

9) External Facades.

This item has one of the largest percentage costs of a building. It was rejected however because of the difficulty of obtaining an accurate cost on which the estimate was to be based.

10) Structural.

The percentage value of the structural cost is approximately $\angle 3\%$ and in almost every analysed building the structural costs are the greatest single cost factor. If the structural element is to be used as the "base parameter", the cost of the structure must be accurately calculated, which could involve the estimator in a great amount of work in calculating his "base".

From the foregoing it would appear that each of the units investigated was for one or other reason unsatisfactory as a base parameter and thus further investigations had to be carried out to establish a wider base or source which could be used.

SECTION 6

AVERAGING OF ELEMENT/COMPONENT PERCENTAGES AND USE THEREOF

AVERAGING OF ELEMENTS/COMPONENTS

When calculating the average percentage of a component, it was found that if one of the results was extreme, i.e. too high or too low, the average was naturally affected. I therefore decided that any result which was above or below the average by a predetermined percentage, would be neglected and the average recalculated. The problem was to determine the percentage. It is obvious that the smaller the percentage value of the component, the larger could be the percentage variance and conversely, e.g.

	"A" % of component
A:	2,82
B:	3,12
C:	1,56
D:	3,00
E:	3,22
F:	2,75
TOTAL:	16,47
AVERAGE:	2,75

Component C is approximately 50% below the average - therefore should not be taken into consideration when obtaining an average if omitted

Total = 14,91
Average = 2,98

By omitting C the average changes only by 0,21 or by 7,64% - the error would therefore be only 7,64% of 2,75% or 0,21% of the whole.

	"B" % of component
A:	20,70
B:	23,66
C:	35,96
D:	25,10
E:	24,75
F:	23,21
TOTAL:	153,38
AVERAGE:	25,56

Component C is approximately 50% above the average - therefore should not be taken into consideration when obtaining an average if omitted

Total = 117,42
Average = 23,48

By omitting C the average changes by 2,08 or by 8,14% - this has the effect of 2,08% on the total.

From the foregoing it can be easily seen that any large variances on a component of small proportion has little effect on the whole but conversely large variances on a component of large proportion have a marked effect on the whole.

What should the allowable variance be. Because we are working with a total of 19 usable components (21 less for allowances and P. & G.) and in order to keep the estimate within the percentage correctness of 5% (see page 2.4) the percentage variance on any particular component must be

$$\frac{a \times b}{100}$$

where a = Actual percentage value of component
b = Required percentage correctness.

This percentage must be used in conjunction with the average percentage obtained to determine the limits of allowable variance.

Using examples "A" and "B" and requiring a 5% correctness, we have -

Variance on

A) $\frac{2{,}75 \times 5}{100} = 0{,}1375\%$

B) $\frac{25{,}56 \times 5}{100} = 1{,}278\%$

The above has the effect of allowing a greater degree of variance in the larger elements which in effect provides the user that much more flexibility.

Using a 5% variance correctness factor we have the following table -

Actual percentage	- Percentage	+ Percentage
1	0,95	1,05
2	1,90	2,10
2,5	2,375	2,625
4	3,80	4,20
5	4,75	5,25
6	5,70	6,30
7	6,65	7,35
8	7,60	8,40
9	8,55	9,45
10	9,50	10,50
12	11,40	12,60
14	13,30	14,70
15	14,25	15,75
17	16,15	17,85
20	19,00	10,50
22	20,90	23,10
25	23,75	26,25
27	25,65	28,35
30	28,50	31,50

By scanning the percentages of a given element it is reasonably easy to see which percentage should be dropped when calculating the average, e.g. using the percentages for plumbing from table "C".

Actual	4.51	(1)
	3.92	(2)
	4.29	(3)
	5.96	(4)
	2.67	(5)
	3.63	(6)
	3.43	(7)
	7.65	(8)
	1.81	(9)
	4.87	(10)

Actual average 4.269

By scanning, it would appear that the mean will be about 4,00/4,50. By consulting the table of allowances at actual 4,00% it is seen that the range is 3,80 - 4,20% which corrected for the higher figure is 4,275 - 4,725%, therefore any percentages falling outside the limits of 3,80 - 4,725% should be disregarded.

The following would therefore be omitted from the calculations (4) (5) (6) (7) (8) (9) (10) this means that the only remaining figures are

(1)	4,51
(2)	3,92
(3)	4,29
TOTAL	12,72
Average	4,24%

This figure is very little different to the average obtained by using the ten results, thus however would only be valid when the spread of percentages varies from high to low.

However, as the "source parameter" (see Section 7) only consists of five elements we should only confine ourselves to these five in an effort to average out the component/element cost. It is also of interest to note the results of adding the various percentages together and comparing same.

When studying the total percentages of the chosen elements to form the "Source Parameter" (See next section) the need to rationalise the percentages falls away for the following reasons -

i) All the elements are averaged thus reducing the differences.

ii) The buildings analysed are of all types and therefore the results take into account the factors affecting building costs.

iii) The variance between the Lowest/Highest and average is not great when viewed with (ii) above.

iv) If each element was averaged separately and handled as suggested problems would arise from the fact that different elemtns would be elemented from different buildings.

v) It is to be assumed that the average pertains to a building which is averagely affected by those factors which have a cost implication.

Because of the above and after redoing the averages on the basis as previously suggested it became apparent that the effect on this system would not be great if a pure average approach was adopted.

SECTION 7

SOURCE PARAMETER

SOURCE PARAMETER

In an effort to minimise the error and to easily use all, or as many as possible of the elements, and to allow for the discrepancies in averages, a "source parameter unit" was designed.
This unit consists of:

1) Structural costs.

2) External facades.
3) Internal divisions (including doors).
4) Internal finishings (floors, ceiling and walls).

The average percentage value of the above elements is as tabled below (see also schedules D1-D5).

SCHEDULE 7.14

		HIGH RISE OFFICE (D1)	LOW RISE OFFICE (D2)	FLATS (D3)	SHOPPING CENTRES (D4)	FACTORIES (D5)
1)	Structural costs =	29,174	27.741	15.614	21.850	25.120
2)	External Facades =	26.536	23.679	20.347	16.370	13.700
3)	Internal divisions =	10.171	9.630	7.320	5.530	7.160
4)	Internal finishes =	15 626	15.146	17.652	15.940	11.420
5)	Doors =					
	TOTALS:	81.507	76.196	60,943	59.710	57.400 %

Other than the above, in percentage value of the remaining elements are:-

SCHEDULE 7.18

		D1	D2	D3	D4	D5
a)	Foundations, including piling	1.179	4.430	7.048	5.070	6.950
b)	Basement	4,909	5.470	0.323	1.530	–
c)	Ground floor	0.117	0.257	1.436	3.370	7.700
d)	Roofs	1.219	3.121	6.310	12.440	12.775
e)	Fittings	1.033	0.985	5.501	0.430	0.550
f)	Plumbing	4.279	3.710	9.437	3.230	3.510
g)	Fire Service	1.813	1.133	0.541	1.310	3,540
h)	Sundries	0.904	0.244	1.537	1.350	1.470
i)	Soil drains	0.032	0.121	0.362	0.130	0.450
j)	Stormwater	0.116	0.337	0.602	0.580	0.840
k)	Site works	0.815	1.324	4.977	7.700	4.720
l)	Provisional Sums (ordinary)	2.077	1.445	1.707	2.530	0.450
	TOTALS:	18.493	23.747	39.783	40.340	42.930 %

/As ... ...

As can be seen in the second table the percentage elements are for the most part less than 5% of the total cost. The notable exceptions being:-

i) Foundations for a) Flats b) Shopping Centres c) Factories.
ii) Basements for office blocks.
iii) Roofs of flats and espcially, shopping centres, factories.
iv) Plumbing to flats.
v) Site works to shopping centres.

Because of the above five parts, some method of adjustment will have to be made when preparing estimates for these categories of buildings.

The following "Source Parameter Unit" was designed to incorporate the six most costly elements of a building. The concept is based on a square 100 metres in area which has,with one exception,the best ratio of external facade to area ratio(see Schedule D Section 8 at end).As can be seen from the following section,it is only the external facade that is affected by shape, the remainder of the elements being used will be affected by factors that can be easily dealt with when arriving at a "Source Parameter Unit Cost" or by using the "Affect variation factor" if so desired. As has been previously explained, the average percentages as reflected in Schedules 7.1A or Schedules D1-D5, are those percentages arrived at by analysing buildings of various designs. These buildings are all in one way or another affected by those factors which have a bearing on the costs and which will be catered for in the factors which emerge in Sections 10 and 11 of this thesis.

Because of spreading of these "affecting factors" over those buildings analysed the averages are those as calculated and reflected in Schedules D1-D5 (see also Section 6).

The "Source Parameter Unit" is divided into four basic sections each being sub-divided as required.
The quantities as reflected are based on average quantities for a building of that nature being estimated. The "Rate in use factor" used at the end of each section is that factor by which the simply calculated quantities must be multiplied to allow for sundry items required which are not easily reflected in the element. These figures are obtained by analysing the sundry items value in priced Bills of Quantities and may change from time to time.

/The ... ...

The rates and quantities as used in the "Source Parameter Unit" below are for example only and therefore the costs as calculated is perhaps not realistic as can be seen by the relationship percentage-wise between the elements.

Section One

Structure

		Unit Meas.		Rate.	Cost.	Cost R
i) Columns:	A. Concr.:	8,5	m3	R25,00	R212,50	
	B. Fmwk. :	670	m2	R 5,00	R335,00	
	C. Reinf.:	850	kg	R 0,35	R297,50	
ii) Slabs:	A.	17,5	m3	R24,00	R420,00	
	B.	100	m2	R 4,00	R400,00	
	C.	1 400	kg	R 0,35	R490,00	
iii) Beams:	A.	4	m3	R24,00	R 96,00	
	B.	36	m2	R 5,50	R198,00	
	C.	400	kg	R 0,35	R140,00	
iv) Walls:	A.	0,50	m3	R24,00	R 12,00	
	B.	6,00	m2	R 4,00	R 24,00	
	C.	30	kg	R 0,35	R 10,50	
v)						
				TOTAL	R2 635,50	
	Rate in use factor = 1.10			=	R2 899,05	2 899

Section Two

External Facades

	Unit Meas.		Rate.	Cost.
i) Windows (incl.glass)	20	m2	R55,00	R1 100,00
ii) Spandril Wall	10	m2	R14,00	R 140,00
iii) Ext. for Spandril Wall	10	m2	R 7,00	R 70,00
iv) Int. finish do.	10	m2	R 5,00	R 50,00
v) Sill int.	10	m	R 6,00	R 60,00
vi) Sill ext.	10	m	R 7,50	R 75,00
vii)			R	R
				R1 495,00
Rate in use factor = 1.08			=	R1 614,60

1 615

/Section ... .

Section Three

Internal Divisions

	Unit Meas.		Rate.	Cost.	Cost R
i) Half-bk. walls	20	m2	R 7,00	R 140,00	
ii) One-bk. walls	5	m2	R14,00	R 70,00	
iii) Partitions	30	m2	R40,00	R1 200,00	
iv) Toilet Partitions	3	m2	R40,00	R 120,00	
v) Doors & Frame	1		R55,00	R 55,00	
vi) Door finish & Ironmongery	1		R25,00	R 25,00	
vii)			R	R	
				R1 610,00	
Rate in use factor = 1.06			=	R1 706,60	1 707

Section Four

Internal Finishings

	Unit. Meas.		Rate.	Cost.	
i) Walls	50	m2	R 5,00	R 250,00	
ii) Floors	100	m2	R 8,80	R 880,00	
iii) Ceilings	100	m2	R 7,00	R 700,00	
iv)			R	R	
				R1 830,00	
Rate in use factor = 1.10			=	R2 013,00	2 013

TOTAL COST OF SOURCE PARAMETER: 8 234

SOURCE PARAMETER/M2 = R82,34 i.e. Total Cost

BUILDING ESTIMATED COST

After arriving at the "S.P.U." cost the estimator will then have to calculate the building area. This area is then multiplied by the "S.P.U." The result is then multiplied by $\frac{100}{\text{percentage value of elements in SPU}}$ and a factor obtained by taking into account the factors affecting the costs of building (see Section 8). We thus have:

/Building ... ...

Building area x "S.P.U." x non-included unit factor x affecting building cost factor (Affect Variation factor).

= Estimated cost of building excluding specialist sums and Preliminary and General.

e.g. 22 774 m2 x R82,34 x $\frac{100}{y}$ x 1,025 = R2 921 578

where 22 774 = Building area, i.e. the floor area to the outside of external walls

R82,34 = Calculate "Source Parameter Unit" cost derived from schedules

= $\frac{100}{y}$ = Factor allowing for elements not included in S.P.U.

1.025 = Factor of .025 to allow for "Affect Variation Factor" (see Section Eight).

As can be seen from the schedules 7.1A and 7.1B the percentage value of the elements being used to arrive at the "Source Parameter Unit" vary from 81,507 (highest) to 57,4 (lowest) and therefore the "Source Parameter Unit" should perhaps be changed according to the type of building being estimated. It is of course obvious that the more correct the "Source Parameter Unit" is in the building types where the elements of the "S.P.U." are of a greater total percentage value so the more accurate the estimate when taking into account the "Affect variation factors".

SOURCE PARAMETER

PERCENTAGE VALUE OF ELEMENTS

(BASED ON REVISED PERCENTAGES)

BUILDING TYPE : OFFICE BLOCK (HIGH RISE)

ELEMENT	1	2	3	4	5	6	7	8	9	10		AVG	
STRUCTURE	27.50	34.15	35.95	28.32	27.61	29.81	25.02	21.95	33.56	27.82		29.174	
EXT FACADES	25.32	16.58	26.37	26.55	36.70	27.36	27.42	25.50	18.32	32.75		26.536	
INT. DIVS	10.33	7.33	12.28	8.44	7.54	4.75	11.14	9.19	21.95	7.66			
FLOOR FINS.	5.58	7.39	6.66	5.12	5.22	4.99	7.55	5.33	7.36	7.03		25.797	
CEILINGS	5.83	7.80	5.42	6.07	4.12	3.83	5.54	5.09	4.91	5.29			
INT. FINS.	2.73	5.36	4.47	3.58	3.26	6.75	3.05	3.59	3.48	2.96			
TOTALS	77.84	79.16	91.15	78.08	84.45	78.31	80.37	70.65	89.58	83.12		81.507	%

HIGEST TOTAL OF ELEMENTS = 91.15%

LOWEST TOTAL OF ELEMENTS = 70.65%

VARIANCE = % 20.50%

= + 10.25%, − 10.25%

PERCENTAGE VARIANCE ON AVERAGE 12.58%

SCHEDULE D1

SOURCE PARAMETER

PERCENTAGE VALUE OF ELEMENTS

(BASED ON REVISED PERCENTAGES)

BUILDING TYPE : OFFICE BLOCK (LOW RISE)

ELEMENT	1	2	3	4	5	6	7	8	9	10		AVG	
STRUCTURE	19.27	27.53	23.65	41.50	27.20	25.04	26.35	26.14	28.25	37.98		27.741	
EXT FACADES	17.24	29.17	22.08	16.70	17.73	26.50	37.27	19.23	25.79	15.08		23.679	
INT. DIVS	9.36	13.30	13.66	2.97	21.72	10.04	1.73	9.00	8.58	5.97			
FLOOR. FINS.	6.70	6.56	5.37	7.30	6.18	8.69	5.14	6.73	4.83	5.09		24.776	
CEILINGS	4.91	4.91	5.64	14.50	2.75	5.50	5.20	5.12	5.32	3.54			
INT. FINS.	4.11	1.94	4.98	1.62	2.47	2.80	2.32	2.77	3.72	3.69			
TOTALS	61.59	83.41	75.38	84.62	78.05	78.57	78.57	69.99	80.49	71.35		76.196	%

HIGEST TOTAL OF ELEMENTS = 84.62%

LOWEST TOTAL OF ELEMENTS = 61.59%

VARIANCE = 23.03%

= + 11.52%, − 11.52%

PERCENTAGE VARIANCE ON AVERAGE 15.11%

SCHEDULE D2

SOURCE PARAMETER

PERCENTAGE VALUE OF ELEMENTS

(BASED ON REVISED PERCENTAGES)

BUILDING TYPE : FLATS

ELEMENT	1	2	3	4	5	6	7	8	9	10		AVG
STRUCTURE	16.52	10.76	8.40	23.22	16.23	7.60	15.35	27.92	8.37	21.97		15.664
EXT FACADES	21.24	15.14	21.43	13.92	22.33	15.97	22.19	17.50	31.33	21.60		20.347
INT. DIVS	9.44	7.54	8.47	8.02	7.47	6.56	5.87	4.64	7.48	5.09	}	
FLOOR. FINS.	9.83	5.52	4.26	9.08	5.80	7.46	6.04	6.47	5.92	4.31	}	24.952
CEILINGS	3.49	3.66	3.75	3.37	3.47	2.71	2.45	1.76	2.44	2.69	}	
INT. FINS.	7.33	8.73	9.28	7.44	9.93	9.79	6.15	4.10	8.82	10.11	}	
TOTALS	67.70	50.41	55.64	65.05	67.25	50.09	58.01	62.64	65.36	66.57		60,963 %

HIGEST TOTAL OF ELEMENTS = 67.70 %

LOWEST TOTAL OF ELEMENTS = 50.09 %

VARIANCE = 17.61 %

= + 8.80 %, − 8.80 %

PERCENTAGE VARIANCE ON AVERAGE 14.94 %

SCHEDULE D-3

SOURCE PARAMETER

PERCENTAGE VALUE OF ELEMENTS

(BASED ON REVISED PERCENTAGES)

BUILDING TYPE: SHOPPING CENTRES

ELEMENT	1	2	3	4	5	6	7	8	9	10		AVG	
STRUCTURE	23.96	24.57	27.14	25.37	19.93	0.65	32.42	20.71				21.85	
EXT FACADES	15.11	4.39	7.32	22.10	15.03	27.43	23.74	13.98				16.39	
INT. DIVS	2.32	16.35	5.73	5.40	1.35	3.41	8.32	1.23					
FLOOR. FINS.	4.90	5.63	6.93	5.34	6.71	7.44	4.69	6.35				21.47	
CEILINGS	7.32	5.05	6.47	5.20	2.44	7.42	4.69	3.51					
INT. FINS.	5.16	3.80	5.27	6.32	3.27	2.98	7.60	3.08					
TOTALS	58.77	59.34	60.86	69.75	48.78	49.33	81.46	48.78				59.710	%

HIGEST TOTAL OF ELEMENTS = 81,46%

LOWEST TOTAL OF ELEMENTS = 48.78%

VARIANCE = 32.68 %

= + 16.34%, − 16,34%

PERCENTAGE VARIANCE ON AVERAGE 27,37%

SCHEDULE D4

SOURCE PARAMETER

PERCENTAGE VALUE OF ELEMENTS

(BASED ON REVISED PERCENTAGES)

BUILDING TYPE: FACTORIES

ELEMENT	1	2	3	4	5	6	7	8	9	10		AVG
STRUCTURE	29.60	25.19	24.47	21.03	23.23	31.25	24.65	15.33				25.12
EXT FACADES	9.94	14.03	8.70	10.63	17.70	12.75	21.91	13.92				13.70
INT. DIVS	7.11	3.79	10.19	5.16	5.44	8.77	6.45	5.35				
FLOOR. FINS.	2.58	4.64	5.68	3.40	3.29	4.11	5.23	2.73				18.58
CEILINGS	1.62	3.41	7.80	1.98	4.45	1.90	4.45	3.69				
INT. FINS.	3.77	2.63	6.37	3.74	3.98	1.21	3.82	4.81				
TOTALS	54.87	61.74	63.21	45.94	58.09	60.02	66.51	48.83				57.40 %

HIGEST TOTAL OF ELEMENTS = 66.51 %

LOWEST TOTAL OF ELEMENTS = 45.94 %

VARIANCE = 20.57 %

= + 10.29 %, - 10.29 %

PERCENTAGE VARIANCE ON AVERAGE 17.93 %

SCHEDULE D5

SECTION 8

FACTORS AFFECTING ESTIMATES

FACTORS AFFECTING ESTIMATES

WHAT AFFECTS THE COST OF A BUILDING

If all buildings had elements of the same percentage value estimating would be easy, however as can be seen from table these vary from building to building because of the following conditions - to be known as the "Affect Variation Factor":

The following are the basic factors which affect building costs:

i) Shape or plan of the basic structure.

ii) Openness of structure. (Density of structural divisions etc.)

iii) Height.

iv) No. of basements.

v) Position relative to the city confines - this includes accessibility to the site, storage on site, etc.

vi) Nature of the ground.

vii) Slope of the ground.

viii) Type of internal finishes.

ix) Type of external finishes.

x) Type of building.

There are of course many others e.g. the time in which the building must be constructed but they do not have a marked effect on costs at the estimating stage.

Assuming the source parameter (called X) is 10% of the building cost then once the cost of X is known the building cost becomes $\left(\frac{RX}{10} \times \frac{100}{1}\right)$ X parametric/area = building cost. However, as the factors mentioned above have the effect of either increasing or decreasing the building cost the first portion of the equasion must be multiplied by the "Affect Variation Factor" (AVF).

/Thus ...

Thus we have -

$$\left(\frac{RX}{TO} \times \frac{100}{I}\right) \times \left(AVF\right) \times \text{Parametric Area} = \text{Building Cost.}$$

Let us reflect on each of these:

i) Shape on Plan.

The shape of the building may be dictated by factors which have no bearing on the cost of the building, e.g. a) shape of site, b) client requirements - prestige, etc. circular, c) type of activity conducted in the building - hospital.

It may become a factor that actual cost must be compared with return, e.g. the shape may not readily lend itself for sub-division, etc.

The elements most lightly affected by shape on plan are -

1) External facades.

2) Some of the services.

3) Structure.

Let us investigate each of the above.

1) External facades.

From the list of percentage costs per element of the building one sees that the corrected percentages vary according to type of building.

As a test we have taken a hypothetical building floor and altered the shape on plan, but maintained as near as possible the original area (the variance of area is 5%), we now have the following ratios (see Schedule D). (Note these ratios are not mathematically perfect in the relationship of one shape to another but are considered to be satisfactory in functional use).

From this it can be seen that the most economical shape on plan generating a circumference is a circle and the least economical regular shape that of a U.
Irregular shapes have no definite ratio.

/Because

Because of usage and other factors however, the economies obtained from a circular building are negated and the square and (3:2) rectangular buildings become the most economically acceptable.

2) Services.

The shape on plan does not have as great an affect on services as on external facades. It may be argued that services are calculated on the size of the building (i.e. the area of the building) and therefore the shape of the building has little or no effect on these costs. This does not take into account the convenience factor of the users of the building, but this is really in the province of what type of buildings are being considered. However, it is essential for economical planning for services to be grouped as closely together as possible.

3) Structure.

Structural costs vary according to the shape of the building and the requirements. Because the majority of buildings being erected in the R.S.A. at the moment are of framed concrete construction, the actual shape of the building does not play as important a role as the requirement, e.g. large spans, slim columns, etc. The costs of unsupported slabs and supported slabs of the same span and also of variance of column costs are shown in schedule E.

ii) Openness of Structure.

As with "Shape on Plan" the required openness of a building is dictated by the type of building under consideration. The intensity of work in a hospital far exceeds that of a hall, theatre or cinema. As the element which is most affected by shape on plan is the external facade costs, those which most affect the openness of the structure or building are -

a) Internal divisions.
b) Internal finishings to these divisions.
c) Doors.

/iii) ... ...

iii) Height.

The height of the building has an effect on the following elements:

1) Foundations.
2) Structure.
3) External facades.
4) Services.
5) Lifts.
6) General construction costs.

1) Foundations.

It may be said that the area of foundations of a building are directly proportional to the load being carried, i.e. that the costs of the foundations of a building of X m2 in area, is the same whether the building is vertical or horizontal, i.e. assuming the ground bearing conditions remain constant. However, with additional height, problems begin to arise such as wind loads, etc.

2) Structure.

The item of cost most likely to affect structure is wind bracing or wind walls. The strength of columns is also important and depending on size may be costly. With high buildings a service core is normally included which can be costly with regard to structural costs.

3) External facades.

On the assumption that the most economical shape is being used, the conditions which most affect the facade is the additional glass thickness required on the upper floors to withstand wind loads, although in practice the one thickness of glass would in most cases be used.

4) Services.

High buildings pose problems in the service requirement area. Because of the concentration of area the services will have to be arranged in close proximity, i.e. plumbing, A.C., telephone, etc. will be positioned in ducts which must be large enough to house the services, but of such a size that the percentage of area allocated to service ducts does not become excessive.

Additional pumps may also be required to move the content of the services.

/5) ... ...

5) Lifts.

The installation of lifts in high rise buildings has become very complex. The lifts in a low rise horizontal building are very different to those in a high rise vertical building. The factors affecting the cost of lifts are -

a) speed
b) number of stops
c) size of cars and therefore machinery

On consideration we find that the number of lifts required in buildings of the same floor area whether vertical or horizontal are about the same, but the speeds required and the number of stops are vastly different.

6) Construction Generally.

A high rise building poses particular problems that, although these also apply to low rise buildings, affect the cost, viz.:

i) Safety of workmen and public.
ii) Transportation of workmen and materials from the ground to the work area.
iii) Loss of productivity because of the time taken to transport workmen and materials.
iv) Movement of rubbish.
v) Provision of scaffolding.

iv) Number of Basements.

In many aspects the problems in going up are the same as in going down, the following being the elements affected:

1) Foundation and structure.
2) Services.
3) Lifts.
4) General Construction Costs (Lateral Support).

/1) ... ...

1) Foundations and Structure.

The foundations and structure of a deep basement become more complex as the basement becomes deeper. Ground pressures, underground water, rock in some areas, sand in others, are all problems that are encountered and to be solved and all adding to the cost.

2) Services.

The movement of water and wastes to and from deep basements requires pumping. The concentration of services per m2 of basement area is not as high as that of above ground. Air conditioning may require more changes per hour depending on type of accommodation and lighting will probably remain on 24 hours per day.

3) Lifts.

The comments as under ii(5) are valid.

4) General Construction Costs.

The comments as under ii(6) are valid.

v) Relative Position.

The position relative to the centre of the city should place a premium on the costs of building, but in practice the actual geographical position is more likely to influence the costs - this geographical premium however should not be taken into account when preparing an estimate - it should only be used as a factor at the conclusion so that the total cost of the building can be ascertained.

vi) Nature of the Ground.

This affects only the costs of the foundations of the building and as it may be assumed that the design of the foundations would be the most economical solution to the problem, the factor to be used would not vary the cost to any great extent (see also heading ii)).

/vii) ... ...

vii) Slope of Ground.

Unless there was some specific reason for it being so, the Architect would in the majority of cases design the building to use the ground slope to its best and most economical advantage, as with vi) the factor to be used would not vary the cost to a great extent.

viii) & ix) Internal and External Finishings.

It must be accepted that the internal and external finishings are of similar standard, i.e. an expensively finished building externally would be well finished internally and vice versa. However, as the external and internal finishes are different elements, differentiation can be made between them when estimating. The services in any building would also of necessity be of the same standard as the finishes (see also parts i) and ii) above).

SCHEDULE D

NOTE: Assumed at F to F heights = 3 000 mm

SHAPE	AREA ON PLAN	CIRCUMF. AREA	RATIO
 Circular	400	70,90	1:,1773
 Square	400	80,00	1:,2000
 Rect. 3:2	400	82,00	1:,2050
 Rect. 2:1	406	86,00	1:,2118
 Triang.	420	90,00	1:,2140
 L-Shaped	400	90,00	1:,2250
 T-Shaped	400	90,00	
 U-Shaped	400	100,00	1:,2500

Note the ratios as set out above for Rect. 3:2 and 2:1 are indications of ratio only. thus the ratio factor is not exactly mathematically correct.

SECTION 9

INVESTIGATION OF ANALYSED ESTIMATES

In this section we look at the relationship of those factors which affect estimates with actual estimates prepared.

The results have a twofold use -

i) One is more easily able to understand the changes of percentages in estimates

ii) The "Affect variation Factor" may be derived from the results

When drawing up the schedules used in this section, we have as before differentiated between the five types of buildings being considered and considered the effect the factors will have only on those elements being used in the "Source Parameter".

The factors have been placed in groups and each of these will be used in conjunction with the elements being used for "Source Parameter".

In section eight, ten factors were listed that affect the cost of a building, they are -

i) Shape or plan of the basic structure.

ii) Openness of structure.

iii) Height.

iv) Number of basements.

v) Position relative to the city confines - this includes accessibility to the site, storage on site, etc.

vi) Nature of the ground.

vii) Slope of the ground.

viii) Type of internal finishes.

ix) Type of external finishes.

x) Type of building.

Factor v) is to a large extent not measurable and is best catered for in the "P. & G." amount to be added to an estimate.

Factor x) is catered for by virtue of the five schedules.

Factor i affects the structural element and the external finishing element.

Factor ii affects the internal division element as well as the internal finishing element.

Factor iii	affects the structural element and the external finishing element.
Factors iv, vi & vii	affect the structural element.
Factor viii	affects the internal finishing element.
Factor ix	affects the external finishing element,

To summarise therefore -

1. Structure is affected by factors i, iii, iv, vi and vii.
2. External facades are affected by factors i, iii and ix.
3. Internal divisions are affected by factor ii.
4. Floors are affected by factor viii.
5. Ceilings are affected by factor viii.
6. Internal finishings are affected by factors ii and viii.

] internal finishings

It must be remembered that in the "Source Parameter Unit", 4, 5 and 6 above are all under the collective heading of "INTERNAL FINISHINGS" which means that 6 above must be adjusted for the density of 3 above.

In drawing up the schedules for offices and flats (A1.2.3 etc) the various factors affecting the costs have been sub-divided into various cost categories as follows:-

1. STRUCTURE

a) No. of stories: Each level considered to be one storey e.g. basement + ground + one = 3 stories.

b) Approximate spans: 1) 0 To not exceeding 5 m
2) 5 m to 10 m
3) Exceeding 10 m.

c and d) Walls: Indicates the construction of the building 1 = YES 2 = NO.

e) General: Possible brief description of the building construction -

1) Very simple - flat slab.
2) Framed concrete structure - simple.
3) Framed concrete structure - expensive.
4) Framed concrete structure - coffered slabs.
5) Expensive type structure.

2. EXTERNAL FACADES

a) Description type 1) Inexpensive - plaster and paint with standard steel windows.

2) Face-brickwork with steel windows.

3) Face-brickwork with aluminium windows.

4) Precast stone/marble facings to columns with aluminium windows between expensive.

5) Expensive curtain walling.

b) Shape ratio: All as shapes 1 - 8 as shown on schedule.

3. INTERNAL DIVISIONS

a) Wall ratio to area obtained by dividing the total area of all walls by the floor area of the building.

b) As with walls above, but with partitions.

c) Percentage of one-brick to half-brick walls in building to adjust (a) above.

4. FLOORS

i-v Graded in costs x = percentage.

5. CEILINGS i-v Graded in costs/construction types x = percentage

Note: Suspended ceilings are those considered to have brandering supporting the ceiling board. False ceilings are those constructed with metal hangers and T-sections.

6. INTERNAL FINISHINGS

i-iii Graded as for cost with correction being made if necessary for 3a above, each category make allowance for the fact that finishes to toilet/ablutions/kitchens are normally more expensive

x = type

In the case of Shopping Centres and Factories, certain problems arose which required certain changes to the definitions in the external facade element to

Shopping Centres as follows

1. Plaster and paint with large steel windows.
2. Plaster and paint with large aluminium windows.
3. Face-brick with normal shopfronts.
4. Tiles or precast work with normal shopfronts.
5. Expensive wall finish with high class shopfronts (e.g. Fadeban glass).

Structural element to

Factories. In this category of building the factory section and office section will in all probability differ which make the "No. of Stories" diffifult to define. They are therefore defined as 1/2 i.e. single storey factory/double storey offices.

Where spans are given they refer to the office section and under the heading of general (e) the number 6 denotes the fact that the factory/section is of structural steel and will therefore be denoted 6 /2 i.e. steel structure to factory/simple framed structure to office section.

In the case of external finishing 6 denotes steel sheet cladding. The shape ratio indicator has also been omitted.

Where the total percentage of any element does not total 100%, it denotes that only that percentage of the total area as shown is finished. Schedule 9.6 is used to determine the shape ratio.

In each of the five categories of building elements a) structure and b) external facades, account for the greatest values percentage-wise and therefore cost-wise in the "Source Parameter".

The actual percentages of percentages are as follows:-

1) Offices (high rise) $29,174 + 26,536 \times \frac{100}{81,507} = 68\%$

2) Offices (low rise) $27,741 + 23,679 \times \frac{100}{76,196} = 67\%$

3) Flats $15,664 + 20,347 \times \frac{100}{60,963} = 59\%$

4)	Shopping Centres	$21,85 + 16,39 \times \frac{100}{59,71}$	= 64%
5)	Factories	$25,12 + 13,70 \times \frac{100}{57,40}$	= 67%

On the above basis in each case the remaining four elements account for -

1)	32%	or average	8% per element
2)	33%	or average	8% per element
3)	61%	or average	15% per element
4)	30%	or average	8,5% per element
5)	33%	or average	7,75% per element

of the base parameter.

With the exception of (3) above, this figure when expressed as percentage of the total estimate, is relatively small and the factor to be used to alter these percentages can be easily rationalised depending on the overall type of building/finish, etc.

As the "Source Parameter Unit" is based on averages, let us define the "Average" building in each category, obtained from the analysis which follow.

1) OFFICES - HIGH RISE

Structure

Number of stories	:	28 (2 Basements)
Approximate spans	:	Exceeding 5 m and not exceeding 10 m
Core walls	:	Yes
Wind walls	:	No
Type of structure	:	Reasonably expensive framed structure of flat or coffered slabs

External Facades

Type of finish	:	Expensive stone/marble facings with aluminium windows
Shape on plan	:	Rectangular with ratio of 3:2

Internal Divisions

Internal walls	:	0,1462 m2 of brickwork per m2 of area
Partitions	:	0,3441 m2 of partition per m2 of area
Ratio of one-brick/ half-brick walls	:	56/44

Floors

Granolithic type	:	12%
Vinyl tiles and screed	:	58%
Carpet type and screed	:	13%
Expensive type finish	:	17%

Ceilings

Plaster and paint on concrete	:	19%
Normal false ceilings	:	55%
Expensive false ceilings	:	26%

Wall Finishings

Mainly plaster and paint with small part tiling or other expensive finishings to walls.

Normal hollow or semi-solid core doors in wood or metal frames.

2) OFFICES - LOW RISE

Structure

Number of stories	:	6 (1 Basement)
Approximate spans	:	Not exceeding 5 m
Core walls	:	No
Wind walls	:	No
Type of structure	:	Simple framed concrete structure

External Facades

Type of finish	:	Face-brickwork with aluminium windows
Shape on plan	:	Rectangular with ratio of 1:2

Internal Divisions

Internal walls	:	0,2197 m2 of brickwork per m2 of area
Partitions	:	0,2473 m2 of partition per m2 of area
Wall ratio One/Half-brick	:	62/38

Floors

Granolithic type	:	22%
Vinyl tiles and screed	:	30%
Carpet type and screed	:	32%
Expensive type finish	:	16%

Ceilings

Plaster and paint on concrete	:	40%
Normal false ceilings	:	54%
Expensive false ceilings	:	6%

Wall Finishings

Mainly plaster and paint with small part tiling or other expensive finishing to walls.

Normal hollow or semi-solid core door in wood or steel frames.

3) FLATS

Structure

Number of stories	:	3
Approximate spans	:	Not exceeding 5 m
Core walls	:	No
Wind walls	:	No
Type of structure	:	Simple flat slab

External Facades

Type of finish	:	Face-brickwork with steel windows
Shape on plan	:	Irregular with ratio of exceeding 1:4

Internal Divisions

Internal walls	:	0,8143 m2 of wall per m2 of area
Partitions	:	0,0033 m2 of partition per m2 of area
Ratio of One/Half-brick walls	:	33/67

Floors

Granolithic	:	8%
Vinyl tiles and screed	:	12%
Carpet and screed	:	39%
Expensive type	:	38%
Very expensive type	:	3%

Ceilings

Plaster and paint on concrete	:	67%
Suspended board type ceilings	:	33%

Wall Finishings

Mainly plaster and paint with expensive type finish to certain areas.

Normal hollow or semi-solid core doors in wood in metal frames.

4) SHOPPING CENTRES

Structure

Number of stories	:	2
Approximate spans	:	Exceeding 5 m and not exceeding 10 m
Core walls	:	No
Wind walls	:	No
Type of structure	:	Simple framed concrete structure

External Facades

Type of finish	:	Face-brickwork with normal shopfronts
Shape on plan	:	Irregular with ratio of exceeding 1:5

Internal Divisions

Walls	:	0,3640 m2 of brickwork per m2 of area
Partitions	:	0,0033 m2 of partition per m2 of area
Ratio of One/Half-brick walls	:	65/35

Floors

Granolithic	:	29%
Vinyl tiles and screed	:	70%
Very expensive type	:	1%

Ceilings

Plaster and paint on concrete	:	59%
Suspended board type	:	12%
Normal false ceilings	:	29%

Wall Finishings

Mainly plaster and paint with small part expensive finish.

Normal hollow and semi-solid core doors in wood or metal frames.

5) FACTORIES

Structure

		Factory Section	Office Section
Number of stories	:	1	1
Approximate spans	:	-	Not exceeding 5 m
Core walls	:	No	No
Wind walls	:	No	No
Type of structure	:	Structural steel	Simple concrete structure

External Facades

Type of finish	:	Metal cladding	Face-brickwork with steel windows
Shape on plan	:	-	-

Internal Divisions

Internal walls	:	0,2502 m2 of wall per m2 of total area
Partitions	:	0,1111 m2 of partitions per m2 of total area
Ratio of One/Half-brick walls	:	63/37

Floors

Granolithic	:	73%
Vinyl tiles and screed	:	15%
Carpet and screed	:	10%
Expensive type	:	2%

of total area

Ceilings

Plaster and paint on concrete	:	22%
Suspended board type	:	31%
Normal false ceiling	:	5%

of total area

Wall Finishings

Plaster and paint with small part expensive finishings.

Normal hollow and semi-solid core doors in wood or metal frames.

While the above definitions may not be exactly correct and obtain some inaccuracies, they suffice for the purposes for which they are intended, i.e. as a base to be entered by a factor to arrive at a figure for use in the calculation of cost by using the "Source Parameter Unit" and their use will become more apparent in section ten.

The following schedules

a) Averages of data
b) Schedules 9.1 to 9.5
c) Schedules a1/1-10, A2/1-10, A3/1-10, A4/1-8 and A5/1-8 are the basis on which these averages were arrived at.

ANALYSIS OF BUILDINGS

BUILDING TYPE AVERAGES OF DATA FROM SCHEDULES 9.1 TO 9.5

		9.1	9.2	9:3	9.4	9.5
STRUCTURE	a.	28	6	3	2	1/1
	b.	2	1	1	2	1
	c.	1	2	2	2	2
	d.	2	2	2	2	2
	e.	3/4	2	1	2	6/1
ACTUAL ELEMENT AVG %		29.174	27.741	15.664	21.850	25.120
EXTERNAL FACADES	a.	4	3	2	3	6/2
	b.	3	4	8	7	–
ACTUAL ELEMENT AVG %		26.526	23 679	20.347	16.390	13.700
INTERNAL DIVISIONS	a.	0.1462	0.2197	0.3143	0.3640	0.2502
	b.	0.3441	0.2473	0.0033	0.0033	0.1111
	c.	56/44	62/38	33/67	65/35	63/37
ACTUAL ELEMENT AVG %		10.171	9 630	7.320	5.530	7.160
FLOORS	i %	12	22	8	29	73
	ii %	58	30	12	70	15
	iii %	13	32	39	–	10
	iv %	17	16	38	–	2
	v %	–	–	3	1	
ACTUAL ELEMENT AVG %		6.253	6.260	6.480	6-000	3 960
CEILINGS	i %	19	40	67	59	22
	ii %	–	–	33	12	31
	iii %	55	54		29	5
	iv %	26	6			
ACTUAL ELEMENT ACT %		5400	5.739	2.989	5.260	3 660
INTERNAL FINISHINGS — WALLS	i	X	X	X	X	X
	ii					
	iii					
DOORS	i	X	X	X	X	X
	ii					
ACTUAL ELEMENT ACT %		3 173	3 147	8.173	4 680	3.800

ANALYSIS OF BUILDINGS

BUILDING TYPE OFFICES (HIGH RISE) SCHEDULE 9.1

		1	2	3	4	5	6	7	8	9	10
STRUCTURE	a.	34	18	16	40	20	25	20	30	13	64 (24)
	b.	2	2	2	2	3	2	2	2	1	3
	c.	1	1	1	1	1	1	1	1	1	1
	d.	1	2	2	2	2	2	2	2	2	2
	e.	3	3	4	4	5	5	4	4	2	5
ACTUAL ELEMENT	%	27.50	34.15	35.45	28.32	27.61	29.26	25.02	21.95	33.56	27.
EXTERNAL FACADES	a.	4	5	5	5	5	5	5	5	3	5
	b.	4	4	4	3	3	2	3	4	2	2
ELEMENT	%	25.32	16.58	26.57	27.00	36.70	27.83	28.94	25.50	18.32	32.
INTERNAL DIVISIONS	a.	0.1488	0.0784	0.1410	0.2211	0.1717	0.1176	0.2973	0.1425	0.1436	-
	b.	0.4495	0.1824	0.2982	0.4171	0.3612	0.14643	0.0684	0.2267	0.4754	0.4
	c.	73/27	66/34	40/60	66/34	50/50	60/40	40/60	60/40	50/50	-
ACTUAL ELEMENT	%	10.33	7.88	12.28	8.44	7.54	4.75	11.14	9.19	21.95	7.
FLOORS	i %	40	23	15	1	4	3	5	5	22	5
	ii %	50	74	12	99	88	90	30	20	73	45
	iii %	-	-	73	-	-	7	-	-	-	50
	iv %	10	3		-	8	-	65	75	5	-
	v %					-	-	-	-	-	-
ACTUAL ELEMENT	%	5.53	7.37	6.66	5.12	5.22	4.99	7.85	5.33	7.36	7.
CEILINGS	i %	25	23	14	35	3	26	5	20	35	5
	ii %	-	-	-	-	-	-	-	-	-	-
	iii %	53	77	86	-	97	74	-	-	65	95
	iv %	22	-	-	65	-		95	80	-	-
ACTUAL ELEMENT	%	5.83	7.80	5.42	6.07	4.12	3.88	5.59	5.09	4.91	5.
INTERNAL FINISHINGS — WALLS	i	X	X		X	X				X	X
	ii			X			X	X	X		
	iii										
DOORS	i	X	X	X	X	X		X		X	X
	ii						X		X		
ACTUAL ELEMENT	%	2.73	5.36	11.47	13.58	3.26	6.95	3.35	3.59	3.48	2.

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A1/1.....

AREA OF BUILDING M2 ...86274.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....34.....
   b) Approximate Spans .....2.....
   c) Concrete Core .....1.....
   d) Wind Walls .....1.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description .....4.....
   .....
   b) Shape Ratio .....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0,1488.....
   b) Partition ditto .....0.4495.....
   c) General One-brick/half-brick ratio ....73/27.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....40%.....
   ii) Vinyl Tiles Type : ....50%.....
   iii) Carpets Type : .....
   iv) Expensive Type : ....10%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....25%.....
   ii) Suspended : .....
   iii) False : ....53%.....
   iv) EXPENSIVE DO : ....22%.....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A1/2.....

AREA OF BUILDING M2 ....29751.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....18.....
   b) Approximate Spans ....2.....
   c) Concrete Core ....1.....
   d) Wind Walls ....2.....
   e) General ....3.....

---

2) EXTERNAL FACADES
   a) General Description ....5.....
   .....
   b) Shape Ratio ....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.0784.....
   b) Partition ditto ....0.1824.....
   c) General One-brick/half-brick ratio ....66/34.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....23%.....
   ii) Vinyl Tiles Type : ....74%.....
   iii) Carpets Type : .....
   iv) Expensive Type : ....3%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....23%.....
   ii) Suspended : .....
   iii) False : ....77%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A1/3.....

AREA OF BUILDING M2 ....22774.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....16.....
   b) Approximate Spans ....2.....
   c) Concrete Core ....1.....
   d) Wind Walls ....2.....
   e) General ....4.....

---

2) EXTERNAL FACADES
   a) General Description ....5.....
   .....
   b) Shape Ratio ....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.1410.....
   b) Partition ditto ....0.2982.....
   c) General One-brick/half-brick ratio ....40/60.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....15%.....
   ii) Vinyl Tiles Type : ....12%.....
   iii) Carpets Type : ....73%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....14%.....
   ii) Suspended : .....
   iii) False : ....86%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : .....
   ii) Wall Cladding : ....✓.....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)... SCHEDULE ...A1/4...

AREA OF BUILDING M2 ...109552...

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...40...
   b) Approximate Spans ...2...
   c) Concrete Core ...1...
   d) Wind Walls ...2...
   e) General ...4...

---

2) EXTERNAL FACADES
   a) General Description ...5...
   ...
   b) Shape Ratio ...3...

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.2211...
   b) Partition ditto ...0.4171...
   c) General One-brick/half-brick ratio ...66/34...

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ...1%...
   ii) Vinyl Tiles Type : ...99%...
   iii) Carpets Type : ...
   iv) Expensive Type : ...
   v) : ...

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ...35%...
   ii) Suspended : ...
   iii) False : ...
   iv) FALSE EXPENSIVE : ...65%...

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ...✓...
   ii) Wall Cladding : ...
   iii) : ...

   b) Doors
   i) Normal : ...✓...
   ii) Expensive : ...

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A1/5.....

AREA OF BUILDING M2 ...15362.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....20.....
   b) Approximate Spans ....3.....
   c) Concrete Core ....1.....
   d) Wind Walls ....2.....
   e) General ....5.....

---

2) EXTERNAL FACADES
   a) General Description ....5.....
   .....
   b) Shape Ratio ....3.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0,1717.....
   b) Partition ditto ....0,3612.....
   c) General One-brick/half-brick ratio ....50/50.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....4%.....
   ii) Vinyl Tiles Type : ....88%.....
   iii) Carpets Type : .....
   iv) Expensive Type : ....8%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....3%.....
   ii) Suspended : .....
   iii) False : ....97%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A176.....

AREA OF BUILDING M2 ....3/654.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....2.5.....
   b) Approximate Spans ....2.....
   c) Concrete Core .....1.....
   d) Wind Walls .....2.....
   e) General .....5.....

---

2) EXTERNAL FACADES
   a) General Description ....5.....
   .....
   b) Shape Ratio .....2.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.1176.....
   b) Partition ditto .....0.4643.....
   c) General One-brick/half-brick ratio .....60/40.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....3%.....
   ii) Vinyl Tiles Type : ....90%.....
   iii) Carpets Type : ....7%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....26%.....
   ii) Suspended : .....
   iii) False : ....74%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : .....
      ii) Wall Cladding : ....✓.....
      iii) : .....

   b) Doors
      i) Normal : .....
      ii) Expensive : ....✓.....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)... SCHEDULE ...A1/.7.....

AREA OF BUILDING M2 ...17223.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...20.....
   b) Approximate Spans ...2.....
   c) Concrete Core ...1.....
   d) Wind Walls ...2.....
   e) General ...4.....

---

2) EXTERNAL FACADES
   a) General Description ...5.....
   .....
   b) Shape Ratio ...3.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.2973.....
   b) Partition ditto ...0.0634.....
   c) General One-brick/half-brick ratio ...40/60.....

---

4) FLOORS
   a) Type/Ratio.
      i) Grano Type : ...5%.....
      ii) Vinyl Tiles Type : ...30%.....
      iii) Carpets Type : .....
      iv) Expensive Type : ...65%.....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ...5%.....
      ii) Suspended : .....
      iii) False : .....
      iv) FALSE EXPENSIVE : ...95%.....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : .....
      ii) Wall Cladding : ...✓.....
      iii) : .....

   b) Doors
      i) Normal : ...✓.....
      ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)... SCHEDULE ...A1/8.....

AREA OF BUILDING M2...46027.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 30
   b) Approximate Spans 2
   c) Concrete Core 1
   d) Wind Walls 2
   e) General 4

---

2) EXTERNAL FACADES
   a) General Description 5
   .....
   b) Shape Ratio 4

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0.1425
   b) Partition ditto 0.2267
   c) General One-brick/half-brick ratio 60/40

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 5% .....
      ii) Vinyl Tiles Type : ..... 20% .....
      iii) Carpets Type : .....
      iv) Expensive Type : ..... 75% .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 20% .....
      ii) Suspended : .....
      iii) False : .....
      iv) FALSE EXPENSIVE : ..... 80% .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : .....
      ii) Wall Cladding : ..... ✓ .....
      iii) : .....

   b) Doors
      i) Normal : .....
      ii) Expensive : ..... ✓ .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A17..?.....

AREA OF BUILDING M2 ....11598.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 13
   b) Approximate Spans 1
   c) Concrete Core 1
   d) Wind Walls 2
   e) General 2

---

2) EXTERNAL FACADES
   a) General Description 3
   .....
   b) Shape Ratio 2

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0.1436
   b) Partition ditto 0.4784
   c) General One-brick/half-brick ratio 50/50

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....23%.....
   ii) Vinyl Tiles Type : ....73%.....
   iii) Carpets Type : .....
   iv) Expensive Type : ....5%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....35%.....
   ii) Suspended : .....
   iii) False : ....65%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ✓
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ✓
   ii) Expensive : .....

CATEGORY OF BUILDING ...OFFICES (HIGH RISE)..... SCHEDULE ....A1/.9.....

AREA OF BUILDING M2 ....93 369.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....62 (TWIN TOWERS).....
   b) Approximate Spans ....3.....
   c) Concrete Core ....1.....
   d) Wind Walls ....2.....
   e) General ....5.....

---

2) EXTERNAL FACADES
   a) General Description ....5.....
   .....
   b) Shape Ratio ....2.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....-.....
   b) Partition ditto ....0.4949.....
   c) General One-brick/half-brick ratio ....-.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....5%.....
   ii) Vinyl Tiles Type : ....45 %.....
   iii) Carpets Type : ....50%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....5%.....
   ii) Suspended : .....
   iii) False : ....95%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

ANALYSIS OF BUILDINGS

BUILDING TYPE _ OFFICES _ (LOW_RISE) SCHEDULE 9.2

		1	2	3	4	5	6	7	8	9	10
STRUCTURE	a.	3	7	11	7	7	3	3	5	7	5
	b.	2	1	2	1	2	1	1	1	2	2
	c.	2	2	2	1	2	2	2	1	2	2
	d.	2	2	2	2	1	2	2	2	2	2
	e.	2	2	4	3	3	2	2	3	2	3
ACTUAL ELEMENT	%	19.27	27.53	23.65	41.50	27.20	25.04	26.35	26.14	22.25	37.9
EXTERNAL FACADES	a.	4	3	4	2	1	3	3	4	5	3
	b.	8	4	3	4	3	4	3	4	4	4
ELEMENT	%	17.24	29.17	22.08	16.70	17.73	26.50	37.27	19.23	35.79	15.8
INTERNAL DIVISIONS	a.	0.2854	0.2687	0.1509	0.1336	0.1577	0.0784	-	0.2684	0.4489	0.404
	b.	0.3463	0.2314	0.2123	-	0.7869	0.3666	-	0.3324	0.1934	-
	c.	46/54	68/40	80/20	100/0	33/67	50/50	-	82/18	33/67	60/4
ACTUAL ELEMENT	%	9.36	13.30	13.66	2.97	21.72	10.04	1.73	9.00	8.58	5.97
FLOORS	i %	30	9	15	50	20	1	17	20	32	24
	ii %	-	9	79	-	70	-	34	20	18	76
	iii %	21	82	6	45	10	-	49	60	50	-
	iv %	49	-	-	5	-	99	-	-	-	-
	v %	-	-	-	-	-		-	-	-	-
ACTUAL ELEMENT	%	6.70	6.56	5.37	7.33	6.18	8.67	5.14	6.73	4.83	5.07
CEILINGS	i %	33	16	17	45	99	1	51	32	13	96
	ii %	-	-	-	-	-	-	-	-	-	-
	iii %	6	84	83	55	1	99	49	68	87	4
	iv %	61	-	-	-	-	-	-	-	-	-
ACTUAL ELEMENT	%	4.71	4.91	5.64	14.50	2.75	5.50	5.20	5.12	5.32	3.54
INTERNAL FINISHINGS — WALLS	i	X	X		X	X	X	X	X	X	X
	ii			X							
	iii										
DOORS	i	X	X	X	X	X	X	X	X	X	X
	ii			(X)							
ACTUAL ELEMENT	%	4.11	1.99	4.98	1.62	2.47	2.80	2.32	3.77	3.12	3.69

CATEGORY OF BUILDING OFFICES (LOW RISE) ..... SCHEDULE ....A2/.1.....

AREA OF BUILDING M2 10703 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 3
   b) Approximate Spans 2
   c) Concrete Core 2
   d) Wind Walls 2
   e) General 2

---

2) EXTERNAL FACADES
   a) General Description 4
   b) Shape Ratio 8

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0.2854
   b) Partition ditto 0.3468
   c) General One-brick/half-brick ratio 46/54

---

4) FLOORS a) Type/Ratio
   i) Grano Type : 30%
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : 21%
   iv) Expensive Type : 49%
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : 33%
   ii) Suspended : .....
   iii) False : 6%
   iv) FALSE EXPENSIVE : 61%

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓
      ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW.RISE)..... SCHEDULE ....M2/.2.....

AREA OF BUILDING .M2.....4644.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 7
   b) Approximate Spans 1
   c) Concrete Core 2
   d) Wind Walls 2
   e) General 2

---

2) EXTERNAL FACADES
   a) General Description 3
   .....
   b) Shape Ratio 4

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0.2687
   b) Partition ditto 0.2314
   c) General One-brick/half-brick ratio 60/40

---

4) FLOORS a) Type/Ratio
   i) Grano Type : 9%
   ii) Vinyl Tiles Type : 9%
   iii) Carpets Type : 82%
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : 16%
   ii) Suspended : .....
   iii) False : 84%
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ..... ✓
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ..... ✓
   ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW.RISE)..... SCHEDULE ....A2/.3.....

AREA OF BUILDING .M2. 8612 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 11
   b) Approximate Spans 2
   c) Concrete Core 2
   d) Wind Walls 2
   e) General 4

---

2) EXTERNAL FACADES
   a) General Description .. 4
   b) Shape Ratio 3

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0,1509
   b) Partition ditto 0,2128
   c) General One-brick/half-brick ratio 80/20

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ..... 15% .....
   ii) Vinyl Tiles Type : ..... 79% .....
   iii) Carpets Type : ..... 6% .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ..... 17% .....
   ii) Suspended : .....
   iii) False : ..... 83% .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : .....
      ii) Wall Cladding : ..... ✓ .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW RISE)..... SCHEDULE ....A2/4.....

AREA OF BUILDING .M2 .....2076/.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....7.....
   b) Approximate Spans .....8/.....
   c) Concrete Core .....1.....
   d) Wind Walls .....2.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description .....2.....1.....
   .....
   b) Shape Ratio .....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0,1336.....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio .....100%.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....50%.....
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : .....45%.....
   iv) Expensive Type : .....5%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : .....45%.....
   ii) Suspended : .....
   iii) False : .....55%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW.RISE)..... SCHEDULE ....A2/.5.....

AREA OF BUILDING .M2.....5074.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....7.....
   b) Approximate Spans .....2.....
   c) Concrete Core .....2.....
   d) Wind Walls .....1.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description .....1.....
   .....
   b) Shape Ratio .....3.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.1577.....
   b) Partition ditto .....0.7869.....
   c) General One-brick/half-brick ratio .....33/62.....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : .....20%.....
      ii) Vinyl Tiles Type : .....70%.....
      iii) Carpets Type : .....10%.....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : .....99%.....
      ii) Suspended : .....
      iii) False : .....1%.....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ✓
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ✓
      ii) Expensive : .....

CATEGORY OF BUILDING OFFICES (LOW RISE) ..... SCHEDULE ....M1/6.....

AREA OF BUILDING M2 2245 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....3.....
   b) Approximate Spans ....1.....
   c) Concrete Core ....2.....
   d) Wind Walls ....2.....
   e) General ....2.....

---

2) EXTERNAL FACADES
   a) General Description ....3.....
   .....
   b) Shape Ratio ....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.0784.....
   b) Partition ditto ....0.3666.....
   c) General One-brick/half-brick ratio ....50/50.....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ....1%.....
      ii) Vinyl Tiles Type : .....
      iii) Carpets Type : .....
      iv) Expensive Type : ....99%.....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ....1%.....
      ii) Suspended : .....
      iii) False : ....99%.....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ✓.....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ✓.....
      ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW RISE)..... SCHEDULE ....M2/.7.....

AREA OF BUILDING .M2.....2904.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....3.....
   b) Approximate Spans .....1.....
   c) Concrete Core .....2.....
   d) Wind Walls .....2.....
   e) General .....2.....

---

2) EXTERNAL FACADES
   a) General Description .....3.....
   .....
   b) Shape Ratio .....3.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... NOT AVAILABLE .....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio .....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....17%.....
   ii) Vinyl Tiles Type : .....34%.....
   iii) Carpets Type : .....47%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : .....51%.....
   ii) Suspended : .....
   iii) False : .....49%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally ✓
   i) Plaster & Paint : .....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors ✓
   i) Normal : .....
   ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW.RISE)..... SCHEDULE ....M2/..8.....

AREA OF BUILDING .M2....5834.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....5.....
   b) Approximate Spans ....1.....
   c) Concrete Core .....1.....
   d) Wind Walls .....2.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description ....4.....
   .....
   b) Shape Ratio .....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.2684.....
   b) Partition ditto .....0.3324.....
   c) General One-brick/half-brick ratio .....82/18.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....20/o.....
   ii) Vinyl Tiles Type : .....20/o.....
   iii) Carpets Type : .....60/o.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : .....32%.....
   ii) Suspended : .....
   iii) False : .....68%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : .....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : .....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING OFFICES (LOW RISE) ..... SCHEDULE ....A2/..9.....

AREA OF BUILDING M2 6276 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 7 .....
   b) Approximate Spans ..... 2 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 5 .....
   .....
   b) Shape Ratio ..... 4 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.4489 .....
   b) Partition ditto ..... 0.1934 .....
   c) General One-brick/half-brick ratio ..... 38/62 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 32% .....
      ii) Vinyl Tiles Type : ..... 18% .....
      iii) Carpets Type : ..... 50% .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 13% .....
      ii) Suspended : .....
      iii) False : ..... 87% .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING .OFFICES.(LOW.RISE)..... SCHEDULE ....A2/.9.....

AREA OF BUILDING .M2...5943.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....5.....
   b) Approximate Spans ....2.....
   c) Concrete Core .....2.....
   d) Wind Walls .....2.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description ....3.....
   .....
   b) Shape Ratio .....4.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.4043.....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio .....60/40.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....24%.....
   ii) Vinyl Tiles Type : .....76%.....
   iii) Carpets Type : .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : .....96%.....
   ii) Suspended : .....
   iii) False : .....4%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : .....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : .....✓.....
   ii) Expensive : .....

ANALYSIS OF BUILDINGS

BUILDING TYPE FLATS SCHEDULE 9.3

		1	2	3	4	5	6	7	8	9	10
STRUCTURE	a.	3	2	2	5	3	2	3	5	2	5
	b.	1	1	1	1	1	1	1	1	1	1
	c.	2	2	2	2	2	2	2	2	2	2
	d.	2	2	2	2	2	2	2	2	2	2
	e.	2	1	1	1	2	1	2	3	2	2
ACTUAL ELEMENT	%	16.32	10.76	8.40	23.22	16.23	7.60	15.35	27.92	8.87	21.7
EXTERNAL FACADES	a.	1	1	1	2	2	2	2	3	2	2
	b.	8	8	8	8	8	8	4	8	8	8
ACTUAL ELEMENT	%	21.24	15.14	21.48	13.72	22.30	15.17	22.19	17.80	31.83	21.6
INTERNAL DIVISIONS	a.	0.7558	0.9338	0.8838	0.3225	0.8850	0.4018	0.6321	0.8655	0.8533	0.66
	b.	-	-	-	-	-	-	-	0.0329	-	-
	c.	50/50	31/69	52/48	2/98	54/46	31/69	47/53	20/80	35/65	10/
ACTUAL ELEMENT	%	9.44	7.54	8.47	8.02	9.47	6.56	5.89	4.64	7.48	5.6
FLOORS	i %	-	-	24	-	2	16	-	11	-	23
	ii %	-	-	-	-	-	-	33	-	10	77
	iii %	-	-	76	-	98	-	66	61	90	-
	iv %	72	100	-	100	-	84	-	28	-	-
	v %	28	-	-	-	-	-	-	-	-	-
ACTUAL ELEMENT	%	9.88	5.58	4.26	9.03	5.80	7.46	6.04	6.47	5.92	4.3
CEILINGS	i %	66	50	55	100	68	43	66	94	50	80
	ii %	34	50	45	-	32	57	33	6	50	20
	iii %	-	-	-	-	-	-	-	-	-	-
	iv %	-	-	-	-	-	-	-	-	-	-
ACTUAL ELEMENT	%	3.49	3.66	3.75	3.37	3.47	2.71	2.45	1.76	2.44	2.6
INTERNAL FINISHINGS — WALLS	i	X	X	X	X	X	X	X	X	X	X
	ii										
	iii										
DOORS	i	X	X	X	X	X	X	X	X	X	X
	ii										
ACTUAL ELEMENT	%	7.33	5.13	9.28	7.44	9.95	7.77	6.15	4.10	8.02	10

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/1 .....

AREA OF BUILDING ..... M2 ..... 19366 .....

DESCRIPTION OF:

1) STRUCTURE
- a) No. of Stories ..... 3 .....
- b) Approximate Spans ..... 1 .....
- c) Concrete Core ..... 2 .....
- d) Wind Walls ..... 2 .....
- e) General ..... 2 .....

---

2) EXTERNAL FACADES
- a) General Description ..... 1 .....
- b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
- a) Wall Ratio to Area ..... 0.7558 .....
- b) Partition ditto ..... - .....
- c) General One-brick/half-brick ratio ..... 50/50 .....

---

4) FLOORS
- a) Type/Ratio
  - i) Grano Type : .....
  - ii) Vinyl Tiles Type : .....
  - iii) Carpets Type : .....
  - iv) Expensive Type : ..... 72% .....
  - v) EXTRA EXPENSIVE : ..... 28% .....

---

5) CEILINGS
- a) Type/Ratio
  - i) Plaster & Paint : ..... 66% .....
  - ii) Suspended : ..... 34% .....
  - iii) False : .....
  - iv) : .....

---

6) INTERNAL FINISHINGS
- a) Walls Generally
  - i) Plaster & Paint : ..... ✓ .....
  - ii) Wall Cladding : .....
  - iii) : .....
- b) Doors
  - i) Normal : ..... ✓ .....
  - ii) Expensive : .....

CATEGORY OF BUILDING ....FLATS..... SCHEDULE ...A3/...2.....

AREA OF BUILDING M2 ...1707.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....2.....
   b) Approximate Spans ....1.....
   c) Concrete Core ....2.....
   d) Wind Walls ....2.....
   e) General ....1.....

---

2) EXTERNAL FACADES
   a) General Description ..1.....
   .....
   b) Shape Ratio ....3.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.9333.....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio ...31/69.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : .....
   iv) Expensive Type : ...100%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ...50%.....
   ii) Suspended : ...50%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ...✓.....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ...✓.....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/3 .....

AREA OF BUILDING ..... M2 ..... 5837 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 2 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 1 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 1 .....
   .....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.8853 .....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio ..... 52/48 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 24% .....
      ii) Vinyl Tiles Type : .....
      iii) Carpets Type : ..... 76% .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 55% .....
      ii) Suspended : ..... 45% .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/4 .....

AREA OF BUILDING M2 ..... 6670 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 5 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 1 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 2 .....
   ....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.8225 .....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio ..... 2/98 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : .....
      ii) Vinyl Tiles Type : .....
      iii) Carpets Type : .....
      iv) Expensive Type : ..... 100% .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 100% .....
      ii) Suspended : .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/5 .....

AREA OF BUILDING M2 ..... 2340 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 3 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 2 .....
   ....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.8850 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 54/46 .....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ..... 2% .....
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : ..... 98% .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ..... 68% .....
   ii) Suspended : ..... 32% .....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ..... ✓ .....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ..... ✓ .....
   ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/6 .....

AREA OF BUILDING ..... M2 ..... 1395 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 2 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 1 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 2 .....
   .....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.9018 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 31/69 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 16% .....
      ii) Vinyl Tiles Type : .....
      iii) Carpets Type : .....
      iv) Expensive Type : ..... 84% .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 43% .....
      ii) Suspended : ..... 57% .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/7 .....

AREA OF BUILDING M2 ..... 1252 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 3 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 2 .....
   .....
   b) Shape Ratio ..... 4 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0,6321 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 47/53 .....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : .....
   ii) Vinyl Tiles Type : ..... 33% .....
   iii) Carpets Type : ..... 66% .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ..... 66% .....
   ii) Suspended : ..... 33% .....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally ✓
   i) Plaster & Paint : .....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors ✓
   i) Normal : .....
   ii) Expensive : .....

CATEGORY OF BUILDING ....FLATS..... SCHEDULE ....A3/3.....

AREA OF BUILDING M2 ....A3.3/.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....5.....
   b) Approximate Spans .....1.....
   c) Concrete Core .....2.....
   d) Wind Walls .....2.....
   e) General .....3.....

---

2) EXTERNAL FACADES
   a) General Description .....3.....
   .....
   b) Shape Ratio .....8.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.8055.....
   b) Partition ditto .....0.0349.....
   c) General One-brick/half-brick ratio ....20/80.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....10%.....
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : ....60%.....
   iv) Expensive Type : ....30%.....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....94%.....
   ii) Suspended : ....6%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ..... FLATS ..... SCHEDULE ..... A3/ 9 .....

AREA OF BUILDING ..... 112 ..... 750 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 2 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 2 .....
   .....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.8533 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 35/65 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : .....
      ii) Vinyl Tiles Type : ..... 10% .....
      iii) Carpets Type : ..... 90% .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 50% .....
      ii) Suspended : ..... 50% .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ...PARTS SHOPPING CENTRES..... SCHEDULE ...A7/10...

AREA OF BUILDING M2 ...913.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...5.....
   b) Approximate Spans ...1.....
   c) Concrete Core ...2.....
   d) Wind Walls ...2.....
   e) General ...2.....

---

2) EXTERNAL FACADES
   a) General Description ...2.....
   .....
   b) Shape Ratio ...8.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.667!.....
   b) Partition ditto ...-.....
   c) General One-brick/half-brick ratio ...10/90.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ...23%.....
   ii) Vinyl Tiles Type : ...77%.....
   iii) Carpets Type : .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ...80%.....
   ii) Suspended : ...20%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors ✓
   i) Normal : .....
   ii) Expensive : .....

ANALYSIS OF BUILDINGS

BUILDING TYPE - SHOPPING CENTRES — SCHEDULE 9.4

		1	2	3	4	5	6	7	8	9	10
STRUCTURE	a.	2	2	3	3	3	1	1	3		
	b.	2	2	2	1	1	Σ	2	1		
	c.	2	2	2	2	2	2	2	2		
	d.	2	2	2	2	2	2	2	2		
	e.	2	3	3	2	2	2	4	2		
ACTUAL ELEMENT	%	23.96	24.57	27.14	25.37	19.93	0.65	32.42	20.71		
EXTERNAL FACADES	a.	4	4	3	3	3	3	4	3		
	b.	8	8	3	8	8	8	4	8		
ACTUAL ELEMENT	%	15.11	4.39	9.32	22.10	15.08	27.43	23.74	13.98		
INTERNAL DIVISIONS	a.	0.2956	0.4648	0.2531	0.5431	0.2830	0.2254	0.5793	0.2678		
	b.	0.0267	-	-	-	-	-	-	-		
	c.	66/34	72/28	66/34	19/81	66/34	93/7	66/34	68/32		
ACTUAL ELEMENT	%	2.32	16.35	5.73	5.40	1.35	3.41	3.32	1.23		
FLOORS	i %	48	6	68	18	5	10	75	5		
	ii %	52	83	30	82	95	90	25	95		
	iii %	-	-	-	-	-	-	-	-		
	iv %	-	-	2	-	-	-	-	-		
	v %	-	11	-	-	-	-	-	-		
ACTUAL ELEMENT	%	4.90	5.63	6.93	5.34	6.71	7.44	4.69	6.35		
CEILINGS	i %	21	9	68	100	95	-	80	100		
	ii %	-	-	-	-	-	100	-	-		
	iii %	79	91	32	-	5	-	20	-		
	iv %	-	-	-	-	-	-	-	-		
ACTUAL ELEMENT	%	7.32	5.05	6.47	5.20	2.44	7.42	4.69	3.51		
INTERNAL FINISHINGS — WALLS	i	X	X	X	X	X	X	X	X		
	ii										
	iii										
DOORS	i	X	X	X	X	X	X	X	X		
	ii				(PVC)						
ACTUAL ELEMENT	%	5.16	3.50	5.27	6.32	3.27	2.58	7.60	3.00		

CATEGORY OF BUILDING ..... SHOPPING CENTRES ..... SCHEDULE ..... A4/1 .....

AREA OF BUILDING ..... M2 ..... 3599 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 2 .....
   b) Approximate Spans ..... 2 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 4 .....
   .....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.2956 .....
   b) Partition ditto ..... 0 0267 .....
   c) General One-brick/half-brick ratio ..... 66/34 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 48% .....
      ii) Vinyl Tiles Type : ..... 52% .....
      iii) Carpets Type : ..... - .....
      iv) Expensive Type : ..... - .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 21% .....
      ii) Suspended : .....
      iii) False : ..... 79% .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..SHOPPING CENTRES.. SCHEDULE ..N4/2..

AREA OF BUILDING M2 ..107896..

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..2..
   b) Approximate Spans ..2..
   c) Concrete Core ..2..
   d) Wind Walls ..2..
   e) General ..3..

---

2) EXTERNAL FACADES
   a) General Description ..4..
   b) Shape Ratio ..8..

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..0.4648..
   b) Partition ditto
   c) General One-brick/half-brick ratio ..72/28..

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..6%..
      ii) Vinyl Tiles Type : ..83%..
      iii) Carpets Type :
      iv) Expensive Type :
      v) VERY EXPENSIVE : ..11%..

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..9%..
      ii) Suspended :
      iii) False : ..91%..
      iv) :

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ✓
      ii) Wall Cladding :
      iii) :
   b) Doors
      i) Normal : ✓
      ii) Expensive :

CATEGORY OF BUILDING ..... SHOPPING CENTRES ..... SCHEDULE ..... M/3 .....

AREA OF BUILDING ..... M2 ..... 17955 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 3 .....
   b) Approximate Spans ..... 2 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 3 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 3 .....
   .....
   b) Shape Ratio ..... 3 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.2531 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 66/34 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 63% .....
      ii) Vinyl Tiles Type : ..... 35% .....
      iii) Carpets Type : .....
      iv) Expensive Type : ..... 2% .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 68% .....
      ii) Suspended : .....
      iii) False : ..... 32% .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... SHOPPING CENTRES ..... SCHEDULE ..... A4/4 .....

AREA OF BUILDING M2 ..... 3454 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 3 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 3 .....
   .....
   b) Shape Ratio ..... 8 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.543 .....
   b) Partition ditto ..... - .....
   c) General One-brick/half-brick ratio ..... 19/81 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 18% .....
      ii) Vinyl Tiles Type : ..... 82% .....
      iii) Carpets Type : .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 100% .....
      ii) Suspended : .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ...SHOPPING CENTRES... SCHEDULE ...M/S...

AREA OF BUILDING M2 ...5448...

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...3...
   b) Approximate Spans ...1...
   c) Concrete Core ...2...
   d) Wind Walls ...2...
   e) General ...2...

---

2) EXTERNAL FACADES
   a) General Description ...3...
   ...
   b) Shape Ratio ...8...

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.2830...
   b) Partition ditto ...-...
   c) General One-brick/half-brick ratio ...66/34...

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ...5%...
      ii) Vinyl Tiles Type : ...95%...
      iii) Carpets Type : ...
      iv) Expensive Type : ...
      v) : ...

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ...95%...
      ii) Suspended : ...
      iii) False : ...5%...
      iv) : ...

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ...✓...
      ii) Wall Cladding : ...
      iii) : ...

   b) Doors
      i) Normal : ...✓...
      ii) Expensive : ...

CATEGORY OF BUILDING ..... SHOPPING CENTRES ..... SCHEDULE ..... A4/5 .....

AREA OF BUILDING M2 ..... 2777 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 1 .....
   b) Approximate Spans ..... ? .....
   c) Concrete Core ..... ? .....
   d) Wind Walls ..... ? .....
   e) General ..... ? .....

---

2) EXTERNAL FACADES
   a) General Description ..... 3 .....
   .....
   b) Shape Ratio ..... 3 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.2254 .....
   b) Partition ditto ..... ? .....
   c) General One-brick/half-brick ratio ..... 93/7 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 10% .....
      ii) Vinyl Tiles Type : ..... 70% .....
      iii) Carpets Type : .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... % .....
      ii) Suspended : ..... 100% .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ..... SHOPPING CENTRES ..... SCHEDULE ..... A4/7 .....

AREA OF BUILDING M2 ..... 1388 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 1 .....
   b) Approximate Spans ..... 2 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 4 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 4 .....
   .....
   b) Shape Ratio ..... 4 .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.5793 .....
   b) Partition ditto .....
   c) General One-brick/half-brick ratio ..... 66/34 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 75% .....
      ii) Vinyl Tiles Type : ..... 25% .....
      iii) Carpets Type : .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 80% .....
      ii) Suspended : .....
      iii) False : ..... 20% .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally ✓
      i) Plaster & Paint : .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors ✓
      i) Normal : .....
      ii) Expensive : .....

CATEGORY OF BUILDING ...SHOPPING CENTRES... SCHEDULE ...A4/3...

AREA OF BUILDING M2 ...8948...

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...3...
   b) Approximate Spans ...1...
   c) Concrete Core ...2...
   d) Wind Walls ...2...
   e) General ...2...

---

2) EXTERNAL FACADES
   a) General Description ...3...
   ...
   b) Shape Ratio ...8...

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.2678...
   b) Partition ditto ...-...
   c) General One-brick/half-brick ratio ...68/32...

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ...5%...
      ii) Vinyl Tiles Type : ...95%...
      iii) Carpets Type : ...
      iv) Expensive Type : ...
      v) : ...

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ...100%...
      ii) Suspended : ...
      iii) False : ...
      iv) : ...

---

6) INTERNAL FINISHINGS
   a) Walls Generally ✓
      i) Plaster & Paint : ...
      ii) Wall Cladding : ...
      iii) : ...

   b) Doors ✓
      i) Normal : ...
      ii) Expensive : ...

ANALYSIS OF BUILDINGS

BUILDING TYPE — FACTORIES — SCHEDULE H 95

		1	2	3	4	5	6	7	8	9	10
STRUCTURE	a.	1/2	1/1	1/2	1/2	1/-	1/2	1/2	1/1		
	b.	1	1	1	1	-	1	1	2		
	c.	2	2	2	2	2	2	2	2		
	d.	2	2	2	2	2	2	2	2		
	e.	6/2	6/1	1/1	6/2	6/-	6/2	6/2	6/1		
ACTUAL ELEMENT	%	29.30	28.19	24.47	21.03	23.23	31.28	24.65	18.33		
EXTERNAL FACADES	a.	6/2	2/3	2/2	6/2	2/-	6/3	6/2	6/2		
	b.	-	-	-	-	-	-	-	-		
ELEMENT	%	7.99	14.03	8.70	10.63	17.70	12.75	21.91	13.92		
INTERNAL DIVISIONS	a.	0.3010	0.1849	0.5187	0.1436	0.3704	0.2047	0.0448	0.2535		
	b.	0.0729	0.2411	0.0576	0.0552	0.0606	0.1350	0.2064	0.0577		
	c.	90/10	55/45	86/14	100/0	66/34	33/68	0/100	75/25		
ACTUAL ELEMENT	%	7.11	8.79	10.19	5.16	5.44	8.77	6.45	5.35		
FLOORS	i %	87	65	74	89	53	78	56	85		
	ii %	13	15	13	11	34	22	-	15		
	iii %	-	20	13	-	-	-	44	-		
	iv %	-	-	-	-	13	-	-	-		
	v %	-	-	-	-	-	-	-	-		
ACTUAL ELEMENT	%	2.58	4.64	5.68	3.40	3.29	4.11	5.23	2.73		
CEILINGS	i %	13	80	18	17	34	11	-	-		
	ii %	-	-	61	15	66	11	44	50		
	iii %	-	20	21	-	-	-	-	-		
	iv %	-	-	-	-	-	-	-	-		
ACTUAL ELEMENT	%	1.62	3.41	7.80	1.98	4.45	1.90	4.45	3.69		
INTERNAL FINISHINGS — WALLS	i	X	X	X	X	X	X	X	X		
	ii										
	iii										
DOORS	i	X	X	X	X	X	X	X	X		
	ii				(9)						
ACTUAL ELEMENT	%	3.27	2.68	6.37	3.74	3.98	1.21	3.82	4.81		

CATEGORY OF BUILDING ..... FACTORIES ..... SCHEDULE ..... A5/.1 .....

AREA OF BUILDING M2 ..... 4252 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 1/2 .....
   b) Approximate Spans ..... 1 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 6/2 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 6/2 .....
   .....
   b) Shape Ratio .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0.3010 .....
   b) Partition ditto ..... 0.0129 .....
   c) General One-brick/half-brick ratio ..... 90/10 .....

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ..... 87% .....
      ii) Vinyl Tiles Type : ..... 13% .....
      iii) Carpets Type : .....
      iv) Expensive Type : .....
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ..... 13% .....
      ii) Suspended : .....
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : .....
      ii) Wall Cladding : ..... ✓ .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

CATEGORY OF BUILDING ...FACTORIES... SCHEDULE ...A5/2...

AREA OF BUILDING M2 ...2401...

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ...1/+-...
   b) Approximate Spans ...1...
   c) Concrete Core ...2...
   d) Wind Walls ...2...
   e) General ...6...

---

2) EXTERNAL FACADES
   a) General Description ...2/3...
   ...
   b) Shape Ratio ...-...

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ...0.184...
   b) Partition ditto ...0.241...
   c) General One-brick/half-brick ratio ...55/45...

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : ...65%...
      ii) Vinyl Tiles Type : ...15%...
      iii) Carpets Type : ...20%...
      iv) Expensive Type : ...
      v) : ...

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : ...80%...
      ii) Suspended : ...
      iii) False : ...20%...
      iv) : ...

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ...✓...
      ii) Wall Cladding : ...
      iii) : ...

   b) Doors
      i) Normal : ...✓...
      ii) Expensive : ...

CATEGORY OF BUILDING ..FACTORIES..... SCHEDULE ....A5/3.....

AREA OF BUILDING M2 ....4534.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....1/2.....
   b) Approximate Spans ....1.....
   c) Concrete Core ....2.....
   d) Wind Walls ....2.....
   e) General ....1/1.....

---

2) EXTERNAL FACADES
   a) General Description ....2/2.....
   .....
   b) Shape Ratio ....—.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.5187.....
   b) Partition ditto ....0.0596.....
   c) General One-brick/half-brick ratio ....86/14.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....74%.....
   ii) Vinyl Tiles Type : ....13%.....
   iii) Carpets Type : ....13%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....18%.....
   ii) Suspended : ....61%.....
   iii) False : ....21%.....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally ✓
   i) Plaster & Paint : .....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors ✓
   i) Normal : .....
   ii) Expensive : .....

CATEGORY OF BUILDING ..FACTORIES..... SCHEDULE ....A5/4.....

AREA OF BUILDING M2 ....5056.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....1/2.....
   b) Approximate Spans ....1.....
   c) Concrete Core ....2.....
   d) Wind Walls ....2.....
   e) General ....6/2.....

---

2) EXTERNAL FACADES
   a) General Description ....6/2.....
   .....
   b) Shape Ratio .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.1436.....
   b) Partition ditto ....0.0558.....
   c) General One-brick/half-brick ratio ....100%.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....89%.....
   ii) Vinyl Tiles Type : ....11%.....
   iii) Carpets Type : .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....17%.....
   ii) Suspended : ....15%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ..FACTORIES..... SCHEDULE ....A5/5.....

AREA OF BUILDING M2 ..1485.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories 1/-
   b) Approximate Spans ..... -
   c) Concrete Core 2
   d) Wind Walls 2
   e) General 6

---

2) EXTERNAL FACADES
   a) General Description 2/-
   b) Shape Ratio ..... -

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area 0.3704
   b) Partition ditto 0.006
   c) General One-brick/half-brick ratio 66/34

---

4) FLOORS
   a) Type/Ratio
      i) Grano Type : 53%
      ii) Vinyl Tiles Type : 34%
      iii) Carpets Type : .....
      iv) Expensive Type : 13%
      v) : .....

---

5) CEILINGS
   a) Type/Ratio
      i) Plaster & Paint : 34%
      ii) Suspended : 66%
      iii) False : .....
      iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓
      ii) Expensive : .....

CATEGORY OF BUILDING ..FACTORIES..... SCHEDULE ....A5/6.....

AREA OF BUILDING ..M2 3303.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ....1/2.....
   b) Approximate Spans ....1.....
   c) Concrete Core ....2.....
   d) Wind Walls ....2.....
   e) General ....6.....

---

2) EXTERNAL FACADES
   a) General Description ....6/3.....
   .....
   b) Shape Ratio .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ....0.2047.....
   b) Partition ditto ....0.1350.....
   c) General One-brick/half-brick ratio ....32/68.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....73%.....
   ii) Vinyl Tiles Type : ....27%.....
   iii) Carpets Type : .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ....11%.....
   ii) Suspended : ....11%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ..FACTORIES..... SCHEDULE ....A5/.7.....

AREA OF BUILDING M2 ..3773.....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories .....1/2.....
   b) Approximate Spans .....1.....
   c) Concrete Core .....2.....
   d) Wind Walls .....2.....
   e) General .....6/2.....

---

2) EXTERNAL FACADES
   a) General Description .....6/2.....
   .....
   b) Shape Ratio .....-.....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area .....0.0442.....
   b) Partition ditto .....0.2064.....
   c) General One-brick/half-brick ratio .....0/100.....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ....56%.....
   ii) Vinyl Tiles Type : .....
   iii) Carpets Type : ....44%.....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : .....
   ii) Suspended : ....44%.....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
   i) Plaster & Paint : ....✓.....
   ii) Wall Cladding : .....
   iii) : .....

   b) Doors
   i) Normal : ....✓.....
   ii) Expensive : .....

CATEGORY OF BUILDING ..... FACTORIES ..... SCHEDULE ..... A5(.8 .....

AREA OF BUILDING M2 ..... 3084 .....

DESCRIPTION OF:

1) STRUCTURE
   a) No. of Stories ..... 1/1 .....
   b) Approximate Spans ..... 3 .....
   c) Concrete Core ..... 2 .....
   d) Wind Walls ..... 2 .....
   e) General ..... 6/1 .....

---

2) EXTERNAL FACADES
   a) General Description ..... 6/2 .....
   .....
   b) Shape Ratio ..... - .....

---

3) INTERNAL DIVISIONS
   a) Wall Ratio to Area ..... 0,2335 .....
   b) Partition ditto ..... 0,0577 .....
   c) General One-brick/half-brick ratio ..... 75/25 .....

---

4) FLOORS a) Type/Ratio
   i) Grano Type : ..... 85% .....
   ii) Vinyl Tiles Type : ..... 15% .....
   iii) Carpets Type : .....
   iv) Expensive Type : .....
   v) : .....

---

5) CEILINGS a) Type/Ratio
   i) Plaster & Paint : ..... 9 .....
   ii) Suspended : ..... 50% .....
   iii) False : .....
   iv) : .....

---

6) INTERNAL FINISHINGS
   a) Walls Generally
      i) Plaster & Paint : ..... ✓ .....
      ii) Wall Cladding : .....
      iii) : .....

   b) Doors
      i) Normal : ..... ✓ .....
      ii) Expensive : .....

SCHEDULE 9.6

NOTE: Assumed at floor to floor heights = 3 000 mm

	SHAPE	AREA ON PLAN	CIRCUMF. AREA	RATIO
1.	 Circular	400	70,90	1:,1773
2.	 Square	400	80,00	1:,2000
3.	 Rect. 3:2	400	82,00	1:,2050
4.	 Rect. 2:1	406	86,00	1:,2118
5.	 Triang.	420	90,00	1:,2140
6.	 L-Shaped	400	90,00	1:,2250
	 T-Shaped	400	90,00	
7.	 U-Shaped	400	100,00	1:,2500
8.	Irregular	-	-	-

SECTION 10

INTERPOLATION OF SECTION EIGHT WITH SECTIONS NINE AND FOUR

SECTION EIGHT	=	FACTORS AFFECTING ESTIMATES
SECTION NINE	=	INVESTIGATION OF ANALYSED ESTIMATES
SECTION FOUR	=	RATIONALISATION OF PERCENTAGES

In this section we must investigate and arrive at some method of calculating the percentage by which the elements of the "Source Parameter Unit" cost must be enhanced to obtain a more realistic cost figure for use with the building area.

As can be noted from section nine only eight of the ten basic factors which affect the costs of estimates have a bearing on the "Source Parameter Unit".

Some factors can easily be catered for when calculating rates for use in the "Source Parameter Unit". These are those factors which are directly dependant on quantity or cost of that element or unit within the "Source Parameter Unit" e.g. ultra high buildings tend as a rule to have structures which differ from those of a lower height in that central cores and windwalls are more likely to be included in the designs as well as the quantity of reinforcing steel per m3. These two factors can be catered for by increasing the volume of concrete and weight of reinforcement in "SECTION 1", Part iv of the "Source Parameter Unit". The same applies to slabs or columns of the "Source Parameter Unit".

The four elements of the "Source Parameter Unit" are -

1. Structural
2. External Facades
3. Internal Divisions
4. Internal Finishings.

From Section nine (page 9.2) we note that the

1. STRUCTURAL ELEMENT is affected by factors -

   i) Shape or plan
   iii) Height
   iv) Number of basements
   vi) Nature of ground
   vii) Slope of ground

   Of these five factors i) and iii) can and should be catered for within the "Source Parameter Unit" rates and quantities as they are part and parcel of this element. Factors iv), vi) and vii) have no direct representation in the "Source Parameter Unit" and therefore must be catered for in the "Affect Variation Factor". Factor iv) - Basements and vi) and vii) - Foundations, must be catered for separately.

Factors i and iii

The shape on plan which we assume will affect the spans of beams and slabs does not appear to greatly affect the percentage cost of the structural element nor does the height of the structure under normal circumstances.

Factor iv

From schedules C1-C5 we note that the average percentage value of basements is -

C1	C2	C3	C4	C5
4.909	5.470	0.323	1.530	-

Because of the small or non-existent value in C3-5 they can possibly be ignored. This is because the buildings analysed had small simple basements or none at all. However, should a scheme be encountered where multi basements exist, then allowance would have to be made in the same way as for C1 and C2.

It is of interest to note that in the buildings analysed, basements occured as follows -

Offices (high rise)	8 of 10
Offices (low rise)	9 of 10
Flats	2 of 10
Shopping centres	3 of 10
Factories	0 of 10

Because of the fact that by having a percentage for any element the percentage of the remaining element reduces in proportion, some way must be found of adding or enhancing the value of the elements being used in the "Source Parameter Unit".

From investigation of the previous schedules, we found that the percentage value of basements increases according to their depth and complexity.

It is of course only possible to investigate this fact with categories 1 and 2 as they have a great proportion of basements.

In the case of 1 (offices - high rise) the percentage varies
from 1.92 for one basement
to 9.61 for five basements.

In the case of category 2 (Offices - Low Rise) the percentage varies from 0.86 to 12.39 varying from half basement to 3 basements. These higher figures are not unexpected when one compares the total percentages in the "Source Parameter" of "Offices" high rise with those of low rise as the basements will cost the same irrespective of the

structure..../

structure above although the difference is greater than was to be expected. Because of the fact that a ratio adjustment is made when arriving at the total cost using the "Source Parameter" the actual enhancement of the cost must be done when in conjunction with the calculation. One could reason that no adjustment should be made for basements. I believe that this assumption is correct only if the number of basements of the building to be estimated, is less than the average number of basements in the analysed buildings. The average number of basements in the analysed buildings are -

i)	Offices (high rise)	1.8 - 2 per building
ii)	Offices (low rise)	1 - 1.5 per building
iii)	Flats	0.2 per building
iv)	Shopping Centres	0.3 per building
v)	Factories	NIL

What therefore is the percentage increase or enhancement factor? This will change from building to building with the basic factor of 1.

In the graphs which follow (Schedules 10.1 & 10.2) the line of increase has been plotted for the two categories with the number of basements on the horizontal axis and the percentage cost on the vertical axis. To simplify the graphs, straight lines have been used for the data lines. The factors on the right of the vertical axis have been obtained by multiplying the percentage on the left by the percentage total of the source parameter unit. The resultant percentage is then multiplied by $\frac{100}{\text{percentage value of structural element of S.P.U.}}$

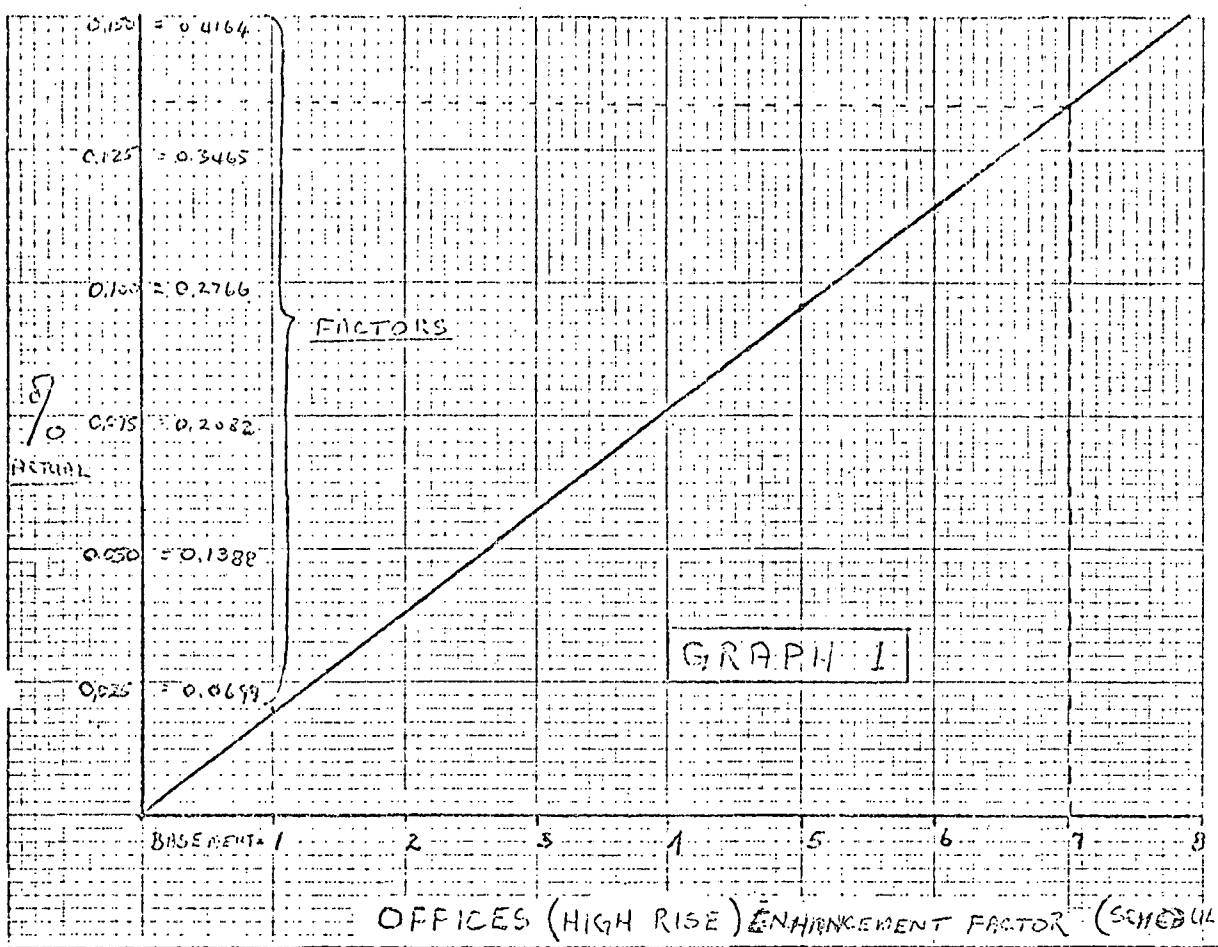
From these graphs we will now read off the "Affect Variation Factor" which must be added to 1.0 when the number of basements exceeds the average number for that category of building.

e.g. High rise office building with seven basements. The "Affect Variation Factor" by which the structural element of the "Source Parameter Unit" would be enhanced would be 0,3698 which figure must be added to 1.0 to give a factor of 1.3698 (see dotted line on graph).

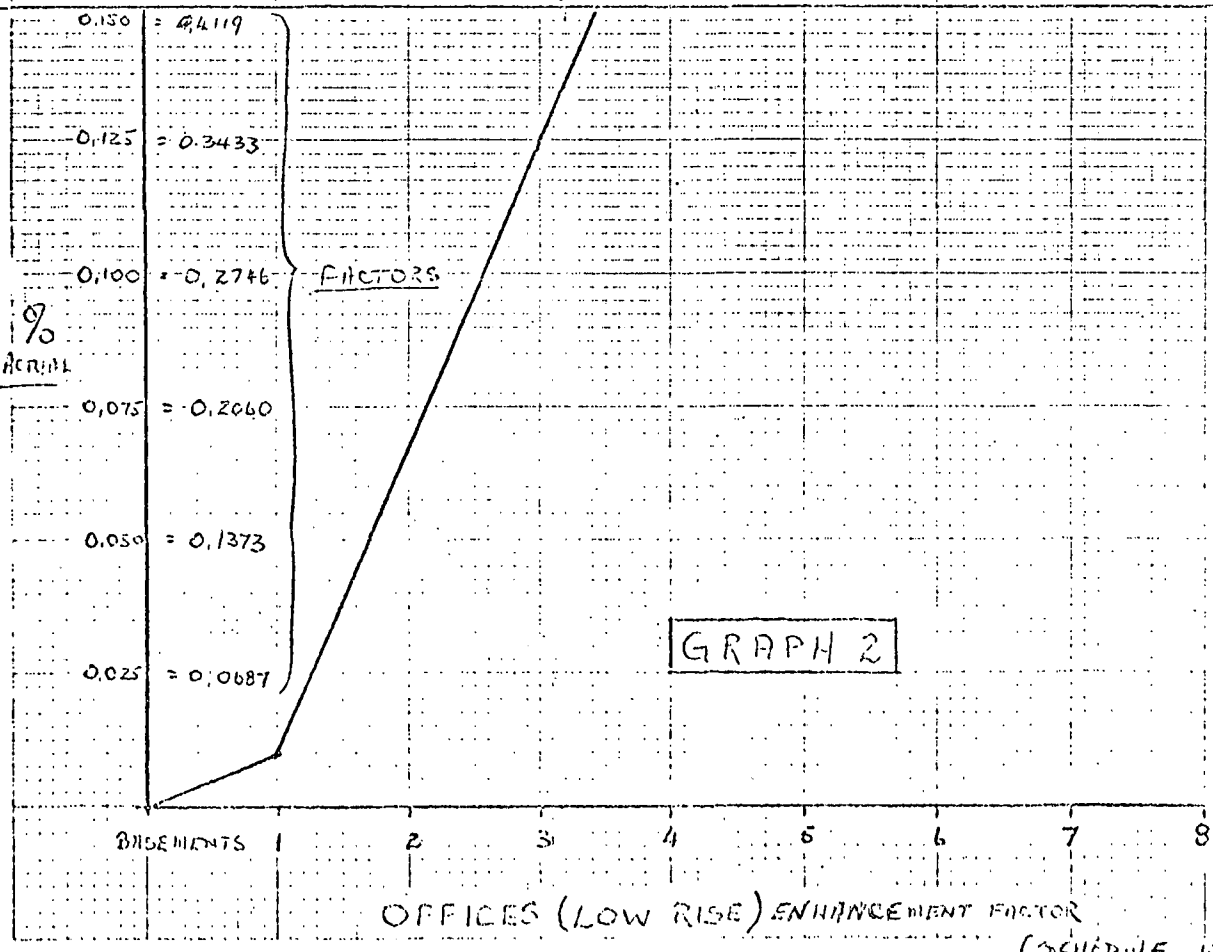
Factors vi and vii

To determine the effect that "Nature" and "Slope" of ground has on foundations is very difficult as these factors in turn are affected by the type, height, shape, etc. of the building being constructed. From the schedule C1-C5 we see that the average percentage value of foundations is -

C1	C2	C3	C4	C5
1.158	2.632	5.713	3.990	6.200



OFFICES (HIGH RISE) ENHANCEMENT FACTOR (SCHEDULE 10.1)



OFFICES (LOW RISE) ENHANCEMENT FACTOR (SCHEDULE 10.2)

With offices both high and low rise, the percentage of foundations is extremely low in the overall and thus to affect any material adjustment to the costs, the changes would have to be extremely harsh.

e.g. A 5% increase in foundations to Offices Low Rise would have the effect of enhancing the basic costs by 1.003. In the case of Offices High Rise this figure would be approximately 1.001 and it would therefore appear that it is unnecessary to make any serious adjustment to the foundations for Offices.

In the case of Flats, Shopping Centres and Factories, because of the higher values of foundations, some adjustment must be made. At the estimating stage it is not usual to have any detail foundation design and therefore any enhancement will have to be made by "feel". A 10% increase on foundations would have the following enhancement factors.

C1	C2	C3	C4	C5
0.0003	0.0007	0.0009	0.0009	0.0016

5% would reflect half the above amounts and 20% double same.

We have not in any of the above discussions taken any account of piling to buildings. From the schedules C1-C5 we see the percentage value of piling to be

C1	C2	C3	C4	C5
0.021	1.789	0.267	1.080	0.750

If the piling value is added to the foundation values, we have

C1	C2	C3	C4	C5
1.179	4.421	5.980	5.07	6.275

this shows a percentage increase of

C1	C2	C3	C4	C5
18%	68%	5%	27%	12%

as can be seen, the above percentages have no constant pattern and therefore I suggest that the inclusion of piling be handled as suggested for founding conditions.

From the schedules C1-C5 we see that the average percentages of

		C1	C2	C3	C4	C5
1.	Foundations =	1.158	2.632	5.713	3.990	6.200
2.	Piling =	0.021	1.789	0.267	1.080	0.750
3.	Basements =	4.909	5.470	0.323	1.530	-
	Totals	6.088	9.891	6.303	6.600	6.950

These figures must be viewed in the light of the value of excluded elements in the "Source Parameter Unit" thus

	C1	C2	C3	C4	C5
1-3	6.088	9.891	6.303	6.600	6.950
Total excluded	18.493	23.797	39.783	40.290	42.930
the ratio being	$\frac{1}{3.038}$	$\frac{1}{2.406}$	$\frac{1}{6.312}$	$\frac{1}{6.105}$	$\frac{1}{6.177}$

When we compare the above ratios with the percentage value of the structural element we have

	Structural Element Source Parameter	Ratio Value	Factor
C1	29.174	3.038	9.60
C2	27.741	2.406	11.53
C3	15.664	6.312	2.48
C4	21.850	6.105	3.58
C5	25.120	6.177	4.07

As can be clearly seen from the above factors the basements and ground conditions have a far greater affect on C1 and C2, i.e. Offices High Rise and Low Rise than on the remaining three categories of buildings.

To sum up therefore adjustments must be made for:-

A) Basements. The "Source Parameter Unit" cost be enhanced by a factor as read off the accompanying graphs for High and Low Rise buildings. In the cases of Flats, Shopping Centres and Factories, it is suggested that graph 2 be used.

B) Foundations. The "Source Parameter Unit" cost be enhanced by a factor to be determined by feel. This factor be a multiplyer of the factor as arrived at by calculating a 10% increase (see following table). Piling be dealt with in the same manner, taking into account the average percentage value of piling.

FOUNDATION ENHANCEMENT FACTOR (SCHEDULE 10.3)

PERCENT INCREASE	BUILDG TYPE C1	BUILDG TYPE C2	BUILDG TYPE C3	BUILDING TYPE C4	BUILDING TYPE C5
2½%	0.0001	0.0002	0.0003	0.0003	0.0004
5%	0.0002	0.0004	0.0005	0.0005	0.0008
7½%	0.0003	0.0006	0.0007	0.0007	0.0012
10%	0.0003	0.0007	0.0009	0.0009	0.0016
12½%	0.0004	0.0009	0.0012	0.0012	0.0020
15%	0.0005	0.0012	0.0015	0.0015	0.0024
20%	0.0006	0.0014	0.0018	0.0018	0.0032
25%	0.0008	0.0020	0.0025	0.0025	0.0040
30%	0.0009	0.0021	0.0027	0.0027	0.0048
40%	0.0012	0.0028	0.0036	0.0036	0.0064
50%	0.0015	0.0035	0.0045	0.0045	0.0080

PILING ENHANCEMENT FACTOR (SCHEDULE 10.4)

	C1	C2	C3	C4	C5
	0.0006	0.0048	0.0005	0.0026	0.0020

All the above adjustments to be made to the Structural Element of the "Source Parameter Unit".

2. EXTERNAL FACADE ELEMENT is affected by factors

i) Shape or plan of the basic structure
iii) Height
ix) Type of External Finishings.

Of the three factors above ix is catered for directly when building up the cost of the "Source Parameter Unit" and therefore no enhancement factor or adjustment is necessary.

As in all previous cases, each category of building will have a separate table of factors but first let us consider the following generalities of arriving at the factors to be used for the "External Facades".

These factors will have to be directly applied to the cost of the "External Facade" of the "Source Parameter Unit" as the factor itself will be affected by the actual cost of the finishings themselves.

COMPARISON OF COST OF HEIGHT/PERIMETER AND AREA OF BUILDING

There is an ideal area per floor of office or other accommodation. Among the factors influencing this area are -

i) Distance from lift core.
ii) Problems of fire fighting.
iii) Layouts of accommodation (external - internal) passages, etc.
iv) Toilet accommodation - services.
v) No. of lifts to service core.
vi) Stairs to service floor.

It is generally accepted that the area per floor normally should be between 1 000 and 2 000 m2 (10 000 - 20 000 f2).

Consider a building of 20 floors, each of 1 000 m2. The total area will be 20 000 m2. If we design the building shape in the L-B ratio of ± 3:2 we obtain a floor of ± 40 m x 25 m. If the floor to floor height is 3 m we obtain a perimeter area of 2(65 x 3) = 390 m2 per floor, or 7 800 m2 for the building. We do now take this to the ridiculous extreme of a single storey building of the same total area of 20 000 m2 with the same L-B ratio of ± 3:2; we have a floor of ± 175 x 115 generating a perimeter area of 2(290 x 3) = 1 740 m2 - this shows a percentage reduction of 78% or 3,9% per floor.

Let us now consider a building of 10 floors to 40 floors of the same total floor area and the same perimeter relationships:

	10 Storeys	30 Storeys	40 Storeys	50 Storeys
Floor size	58 x 35 m	32 x 21 m	28 x 18 m	25 x 16 m
Height F-F	3	3	3	3
Perimeter Area	2(93 x 3) = 558	2(53 x 3) = 318	2(46 x 3) = 276	2(41 x 3)
Perimeter Area of Building	5 580 m2	9 540 m2	11 040 m2	12 300 m2

/On ... ...

On investigation it was found that irrespective of shape on plan the change factor of reducing or increasing the height of the building was identical. The factors obtained were as follows:

No. of Storeys	Factor
1	1,00
5	2,24
10	3,16
15	3,87
20	4,47
25	5,00
30	5,48
35	5,92
40	6,32
45	6,70
50	7,07

Assume the cost of the external perimeter finish of a building 30 storeys high to be R236 000,00. The cost of a building of the same shape and of identical total floor area, but only 25 storeys high, would be -

$$\frac{5,00}{5,48} \times \text{R236 000,00} \quad \text{or} \quad \text{R215 328,00.}$$

Let us now consider the relationship of buildings of the same floor area but of different shapes.

Assuming a circular building to have the best ratio of perimeter to floor area 1 to ,1733 (see Schedule 10.5) to change this to a square building of the same area, the ratio of which is 1 to ,2000, the increased perimeter area or costs would be -

$$\frac{1:2000}{1:1733} \text{ or } \frac{2000}{1733} \quad \frac{(\text{Shape ratio 1})}{(\text{Shape ratio 2})} \quad \frac{(ST(1))}{(ST(2))}$$

this would increase the cost of the perimeter conversely if the original shape was square and changed to circular, the cost would be $\frac{1733}{2000}$ or a resulting saving on area and cost.

/. . To ... ...

. . To change from one height to another -

$$\frac{\text{original cost}}{1} \times \frac{Hf \times (2)}{Hf \times (1)}$$

To change from one shape to another -

$$\frac{\text{shape 2}}{\text{shape 1}} \times \text{original cost}$$

. . To change from one height and shape to another height and shape it is -

$$\frac{\text{original cost}}{1} \times \frac{Hf(2) \times (2)}{Hf(1) \times (1)}$$

Where O = original shape or cost
Hf = height factor (1) being first
(2) being second

ST = shape ratio (1) being first
(2) being second

SCHEDULE 10.5

NOTE: Assumed at Floor to Floor heights = 3 000 mm

Shape		Area on Plan	Circumf. Area	Ratio
S1	Circular	400	70.90	1:.1773
S2	Square	400	80.00	1:.2000
S3	Rect. 3:2	400	82.00	1:.2050
S4	Rect. 2:1	406	86.00	1:.2118
S5	Triang.	420	90.00	1:.2140
S6	L-Shaped	400	90.00	1:.2250
	T-Shaped	400	90.00	
S7	U-Shaped	400	100.00	1:.2500
S8	Irregular			1:+.3000

All these calculations can be reduced into tables which can be easily read. Problems however exist with the following categories of buildings -

i) Flats
ii) Shopping Centres
iii) Factories

However as the latter two categories rarely exceed two stories in height, a graph can be drawn by which the factor can be obtained. One problem however is that as no average shape ratio has been obtained for ii and iii above, it is difficult to compare the actual with the average.

Because of the complexity of the parimeter/shape ratio height, each of categories C1, C2 and C3 have been separately scheduled. These factors must be directly applied to the cost of the "External Facades".

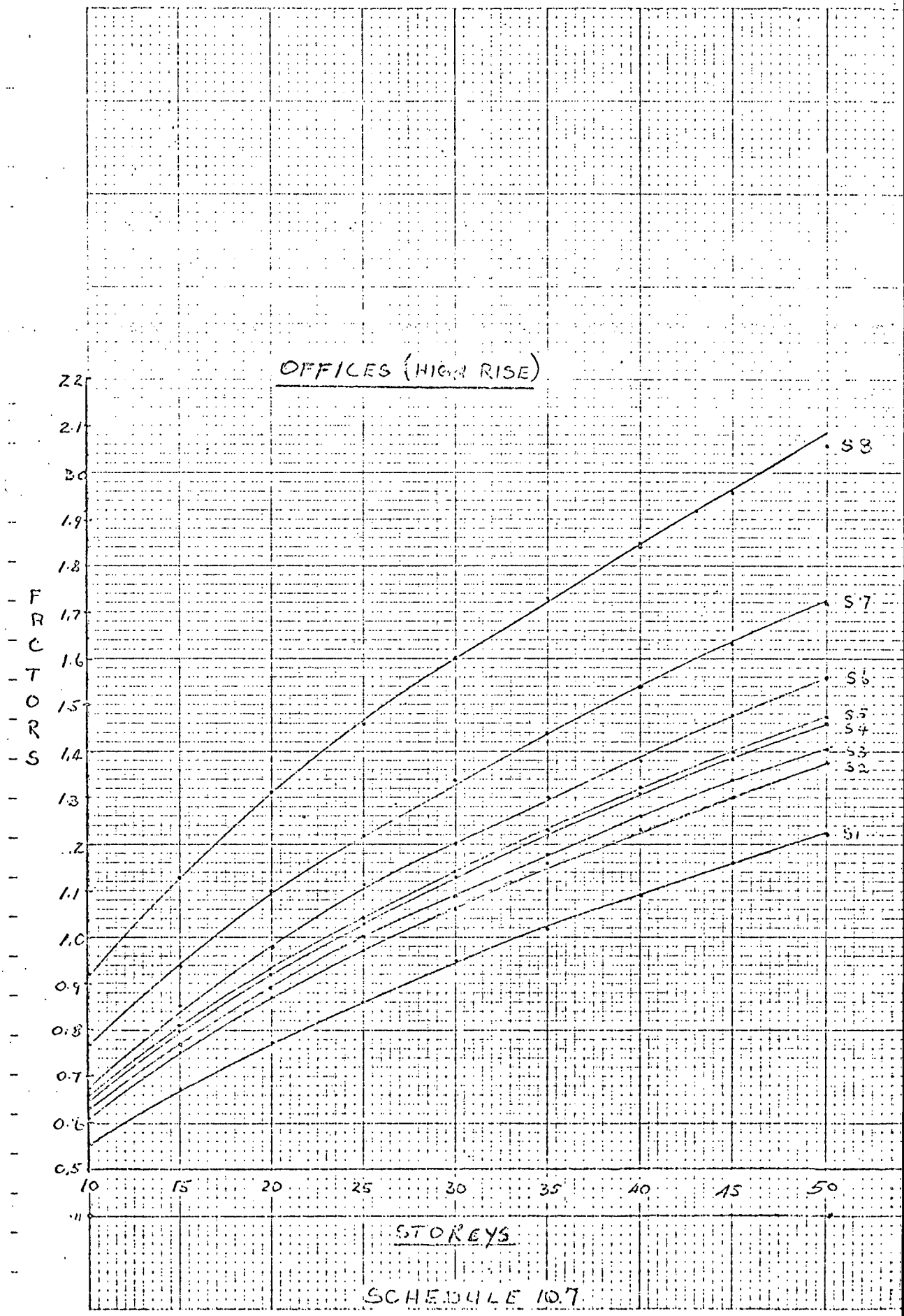
NOTE: In the following schedules the average for that particular building is shown as 1.000 and all factors above the heavy horizontal line diminish the cost of the "External Facades".

OFFICES (HIGH RISE) (Average = 25 stories - Shape ratio 3:2)

No FLRS	SHAPE S1	S2	S3	S4	S5	S6	S7	S8
10	0.5466	0.6166	0.6320	0.6530	0.6597	0.6937	0.7707	0.9249
15	0.6694	0.7550	0.7740	0.7997	0.8080	0.8495	0.9439	1.1327
20	0.7732	0.8722	0.8940	0.9237	0.9332	0.9812	1.0902	1.3083
25	0.8647	0.9756	1.000	1.0332	1.0439	1.0976	1.2195	1.4634
30	0.9479	1.0693	1.0960	1.1324	1.1441	1.2029	1.3366	1.6039
35	1.0241	1.1551	1.1840	1.2233	1.2360	1.2995	1.4437	1.7327
40	1.0932	1.2332	1.2640	1.3059	1.3195	1.3873	1.5415	1.8498
45	1.1589	1.3073	1.3400	1.3844	1.3988	1.4707	1.6341	1.9610
50	1.2220	1.3795	1.4140	1.4609	1.4761	1.5520	1.7244	2.0693

SCHEDULE 10.6

To allow the user to obtain factors for those number of floors not listed, a graph (Schedule 10.7) has been drawn.



SCHEDULE 10.7

OFFICES (LOW RISE) (Average = 5 stories - Shape ratio 1:2)

NO OF FLRS	S1	S2	S3	S4	S5	S6	S7	S8
1	0.3737	0.4216	0.4321	0.4465	0.4511	0.4743	0.5270	0.6324
2	0.5270	0.5944	0.6093	0.6295	0.6360	0.6687	0.7430	0.8917
3	0.6466	0.7293	0.7476	0.7724	0.7804	0.8205	0.9117	1.0940
4	0.7470	0.8432	0.8642	0.8929	0.9022	0.9486	1.0540	1.2648
5	0.8372	0.9444	0.9679	1.0009	1.0104	1.0624	1.1804	1.4165
6	0.9157	1.0328	1.0587	1.0933	1.1052	1.1620	1.2911	1.5493
7	0.9904	1.1172	1.1451	1.1831	1.1954	1.2569	1.3965	1.6758
8	1.0576	1.1931	1.2229	1.2635	1.2766	1.3422	1.4914	1.7896
9	1.1212	1.2648	1.2964	1.3373	1.3533	1.4228	1.5808	1.8971
10	1.1818	1.3322	1.3655	1.4108	1.4255	1.4987	1.6653	1.9983

SCHEDULE 10.8

The above results are based on the following -

No. of Stories	Factor
1	1.00
2	1.41
3	1.73
4	2.00
5	2.24
6	2.45
7	2.65
8	2.83
9	3.00
10	3.16

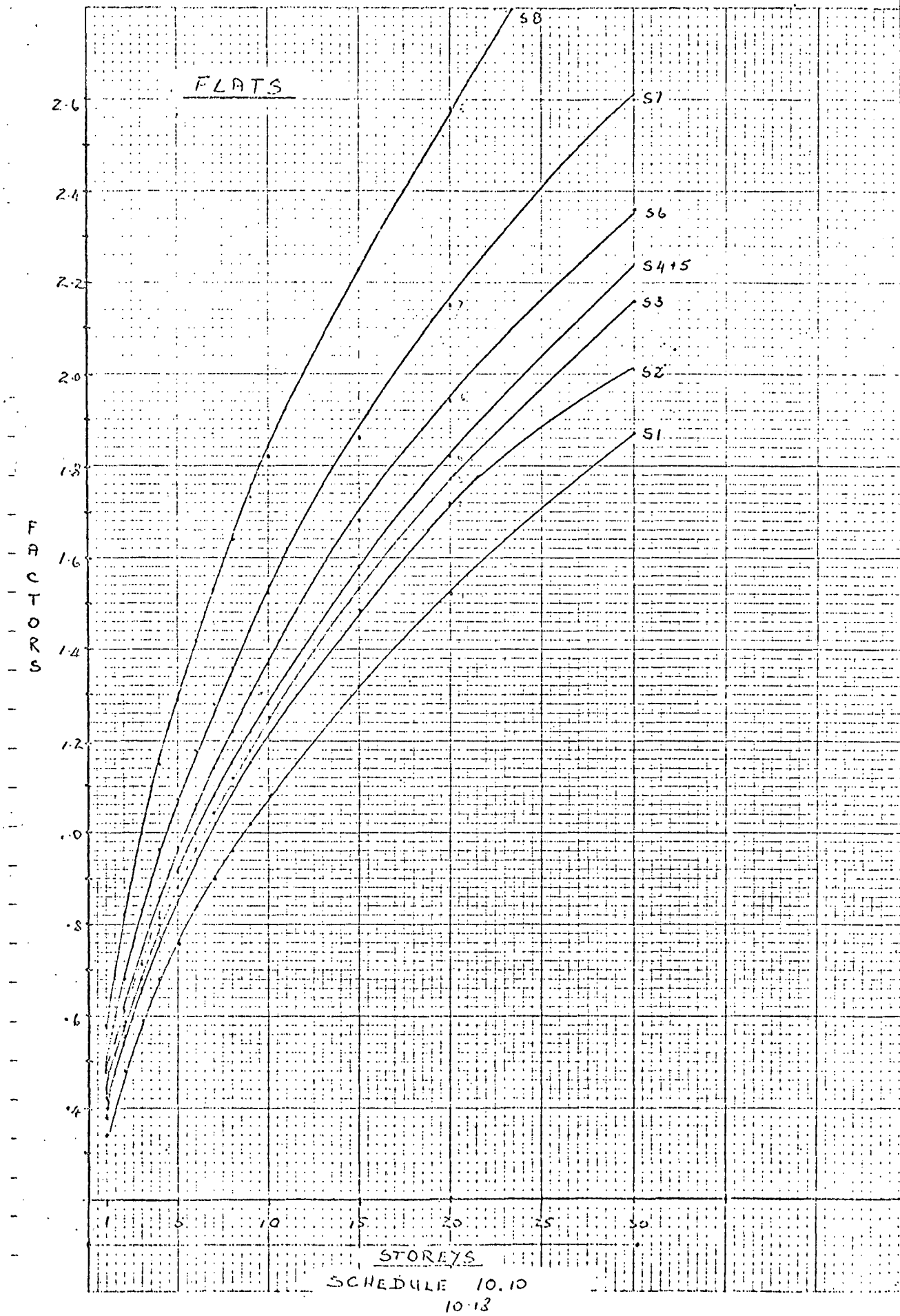
Because of the fact that every storey between 1 and 10 is catered for in the schedule above, no graph has been produced for Offices (Low Rise).

FLATS (Average 3 stories - Shape ratio - irregular - exceeding 1:4)

As can be seen from the above averages, adjustments may prove difficult as well may the estimate if the number of stories exceeds six which may well be the case. This problem has arisen because those blocks of flats analysed, were all of a low number of stories - the greatest being five which occurred three times. When however one consults schedule 7.1A, it is noted that the total percentage value of "External Facades" is 20.347 lower than Office blocks by 6.189 and 3.332 respectively. I feel therefore at this stage that to use the above averages and create factors for buildings of up to twenty stories, would be in order. As factors have been calculated for stories from 1 to 10 and thereafter in fives, a graph will be drawn for this section. (See Schedule 10.10).

NO FLRS	SHAPE Si S	S2	S3	S4	S5	S6	S7	S8
1	0.3416	0.3854	0.3950	0.4031	0.4123	0.4335	0.4817	0.5730
2	0.4817	0.5433	0.5569	0.5754	0.3814	0.6123	0.6792	0.8150
3	0.5910	0.6666	0.6333	0.7060	0.7133	0.7500	0.8333	1.000
4	0.6832	0.7707	0.7900	0.8162	0.8246	0.8671	0.9634	1.1561
5	0.7652	0.8632	0.8848	0.9141	0.9236	0.9711	1.0790	1.2943
6	0.8370	0.9441	0.9677	0.9998	1.0102	1.0621	1.1802	1.4162
7	0.9053	1.0212	1.0467	1.0814	1.0927	1.1488	1.2765	1.5318
8	0.9663	1.0906	1.1178	1.1549	1.1669	1.2269	1.3632	1.6358
9	1.0249	1.1561	1.1850	1.2243	1.2370	1.3006	1.4451	1.7341
10	1.0795	1.2177	1.2482	1.2896	1.3030	1.3689 1.6777	1.5222	1,8266
15	1.3221	1.4913	1.5286	1.5793	1.1596	1.6777	1.8642	2,2370
20	1.5270	1.7225	1.7656	1.8242	1.8431	1.9379	2.1532	2.5838

SCHEDULE 10.9



SCHEDULE 10.10

10·13

SHOPPING CENTRES. The problem that exists with this category of building is that all major shopping centres analysed were very irregular shape. The average number of stories was 2. Because of the fact that the base factor of 1.000 occurs where the shape ratio is irregular (1 exceeding 1) and of two stories any other shape would in effect reduce the base factor. Examples of this can be seen in schedule 10.9 (FLATS). If it is felt that adjustments must be made then it is suggested that the schedule for flats be used but with one storey added, e.g. an L-shaped irregular building of three stories would yield a factor of 0.8671 (shape S6 stories 4).

FACTORIES. As with shopping centres problems exist with factories. When arriving at the average external facade for factories, an average percentage value was easily calculated but not so averages for

a) The shape b) the number of stories c) the type of finish.

From observations, it would appear that the majority of factories are rectangular in shape with a ratio of either 3:2 or 2:1, the shape ratio factors being .2050 and .2118 respectively, the latter showing only a 3.3% increase on the former. The shape ratio difference can therefore be safely ignored. Evidence of this fact is the closeness of the graphs for S4 and S5 as previously prepared. One additional problem in this category of building is the fact that the analysed factories are a combination of factory areas and office blocks which should of course be separated but were not.

GENERAL. To sum up therefore adjustments should be made to the cost of the "External Facade" element as contained in the "Source Parameter Unit". These adjustments to be made as follows:

i)	Offices (High Rise)	- By Schedule and/or Graph
ii)	Offices (Low Rise)	- By Schedule
iii)	Flats	- By Schedule and/or Graph
iv)	Shopping Centres	- By Schedule (if considered necessary)
v)	Factories	- Nil

3. INTERNAL DIVISION ELEMENT is affected by factor

ii) Openness of Structure.

As at estimate stage it is most unlikely to have detailed layouts. The averages for these units as arrived at in section nine should be used. The only adjustments that need be made are for the mix of walls (half-brick and one-brick) and partitions. The ratio of walls (total) to partitions is as follows:

		Walls	Partitions
i)	Offices (High Rise)	1	2.35
ii)	Offices (Low Rise)	1	1.13
iii)	Flats	1	0.004
iv)	Shopping Centres	1	0.009
v)	Factories	1	0.44

As can be seen from the above it is only in the first two categories that there is any relationship of wall to partition area and note must be taken of this fact. In most if not all of modern office buildings, the division of space is carried out by the use of partitions. Unless the building is completely of "open plan" design the ratio of walls/partitions to floor area must bear some relationship at the design stage. The percentage value of the divisions is in any event not large and a variance in this element will not greatly affect the overall calculated cost.

As with the previous elements discussed, it is preferable that the adjustment/enhancement if any take place within the element of the "Source Parameter Unit".

4. INTERNAL FINISHING ELEMENT is affected by factors

ii) Openness of Structure
viii) Type of finishings.

Factor ii affects the vertical portions of this element only and must be adjusted in accordance with the adjustments done to the "Internal Division Element".

Factor viii affects both the vertical and horizontal portions of the elements and can easily be adjusted by altering the unit rates within the "Source Parameter Unit".

SECTION ELEVEN

USE OF SOURCE PARAMETER (SECTION SEVEN) WITH RESULTS OF SECTION TEN.

In section 7 we evolved a "Source Parameter Unit". In the subsequent sections it became evident that this unit may have to be adapted to obtain a realistic estimate of cost from the "Source Parameter Unit".

The "Source Parameter Unit" is made up of four basic elements which have an inter-relationship of average values. Each of these elements has a variance of percentage value within themselves.

eg.

In Offices (High Rise) the averages and variances are as listed below.

ELEMENT	AVERAGE	LOWEST %	HIGHEST %
Structural	29,174	21,95	35,95
External Facade	26,536	16,58	36,70
Internal Divisions	10,171	4,75	21,95
Internal Finishings	15,626	12,60	20,55

Because of the fact that the system is based on averages a compensating factor is used to allow for the elements not included for in the "Source Parameter Unit", any building in which the total of the elements in the "Source Parameter Unit" exceeds the average will be estimated too high while those which are below the average will be too low. Similarly the ratio of elements must bear some relationship between each other and if the variance is considered to be too large some method must be found to adjust for this difference.

Let us consider examples 8 (lowest average), 3 (highest average) and 2 (closest to average) of Offices (High rise).

ELEMENTS	AVERAGE	EXAMPLE 8	EXAMPLE 3	EXAMPLE 2
Structural	29,174	21,95	35,95	34,15
External Facades	26,536	25,50	26,37	16,58
Internal Divisions	10,171	9,19	12,28	7,88
Internal Finishings	15,626	14,01	16,55	20,55
TOTALS	81,507	70,65	91,15	79,16

From the above let us establish the inter-relationship ratio of elements expressed as a percentage of the "Source Parameter Unit".

ELEMENT	AVERAGE	EXAMPLE 8	EXAMPLE 3	EXAMPLE 2
Structural	35,79	31,07	39,44	43,14
External Facades	32,55	36,09	28,93	20,94
Internal Divisions	12,48	13,00	13,47	9,95
Internal Finishings	19,17	19,83	18,16	25,96

What effect does the difference in "Source Parameter Unit" costs percentage have on the final ultimate building cost.

It is of interest to note that the more easily calculated elements i.e. i) Structural and ii) External Facades amount to the following percentages of the "Source Parameter Unit" costs.

Offices (High Rise)	68,34%
Offices (Low Rise)	67,48%
Flats	59,09%
Shopping Centres	64,04%
Factories	67,63%

These two elements are also more easily defined and therefore adjustments made to the "Source Parameter Unit" should be made taking into account these two elements only.

Let us arrive at the cost of a building using a "Source Parameter Unit" and later altering same by changing the cost of the external facades.

Example 1.

Structural Element = R35,79
External Facades Element = R32,55
Internal Divisions Element = R12,48
Internal Finishings Element = R19,18 = R100,00

$$\text{Total Cost of Building} = \text{Area} \times \text{Rate} \times \frac{100}{81,507} = \text{Cost}$$

$$= 10\,000 \times R100 \times \frac{100}{81,507} = R1\,226\,888$$

Of this amount the External Facades amount to 26,498% (average)

or R325 506.

Example 2.

Reduce the costs of External Facades by 50%.

Structural Element	=	R35,79
External Facades Element	=	R16,28
Internal Divisions Element	=	R12,48
Internal Finishings Element	=	R19,18 = R83,73

Cost is now 10 000 x R83,73 x $\frac{100}{81,507}$ = R1 027 273

In actual fact the second cost should be:

R1 22 (original calculated cost: Example 1) -

$\frac{R325\ 506}{2}$ (50% saving)

= R1 226 888 - R162 753 = R1 064 135

The second calculated amount is R36 832 or 3,59% too low.

An adjustment must therefore be made to take into account any discrepancy which may arise due to the inter-relationship ratio of the elements.

When the costs of the various elements above are expressed as percentages of the total cost of the "Source Parameter Unit" we have the following.

Structural Element	=	42,74%
External Facades Element	=	19,44%
Internal Divisions Element	=	14,91%
Internal Finishings Element	=	22,91%

Compare the total percentage values of the Structural and External Facade elements in the ideal average situation and the revised cost situation.

		IDEAL	REVISED
Structural Element	%	35,79	42,74
External Facades Element	%	32,55	19,44
TOTALS		68,34	62,18

The difference is 6,16% too low.

Example 3.

What would the effect be of adding 50% to the "External Facades Element" cost.

We now have.

	COST	% OF TOTAL
Structural Element	R 35,79	30,78
External Facade Element	R 48,83	42,00
Internal Division Element	R 12,48	10,73
Internal Finishing Element	R 19,18	16,49
	R116,28	

The revised percentage total of the first two elements above is now 72,78 and the difference is 4,44% too high.

In example 2 the answer obtained by simple methods was incorrect by R38 139 or 3,7% what will the effect be using an increased amount for the "Source Parameter Unit".

$$10\,000 \times R116{,}28 \times \frac{100}{81{,}507} = R1\,426\,626$$

in actual effect the cost should be

R1 226 888 + 162 753 = R1 389 641 which amount is R36 985 lower than that calculated which is 2,47% higher than that required.

Therefore to obtain a more realistic "Source Parameter Unit" cost when there is a difference in percentage value of revised against ideal an adjustment must be made to the final cost of the "Source Parameter Unit" this adjustment is made by adding the result obtained from the formula below to the non included unit factor in the equation of the "Source Parameter Unit".

The formula for this adjustment is:

$$(I.P. - R.P.) \times (i)\% \times (ii)\%$$

where I.P. is ideal percentage (Based on average see page 7.1)

R.P. is revised percentage

(i)% is actual percentage value of Structural and External Facade Elements in "Source Parameter Unit"

(ii)% is percentage value of "Source Parameter Unit" in overall context.

where I.P. - R.P. is a positive figure the costs must be increased where negative decreased.

Let us now consider examples 2 and 3 using the above formula adjustment.

Example 2.

$$(68,34 - 62,18) \times .6834 \times .81507$$

$$6,16 \times .6834 \times .81507 = 3,43$$

The adjusted rate now becomes

$$10\ 000 \times R83,73 \times \frac{103,43}{81,507}$$

= R1 062 509 to be compared with R1 06*4 135* the actual cost.

Example 3.

$$(68,34 - 72,78) \times .6834 \times .81507$$

$$- 4.44 \times .6834 \times .81507 = - 2.4732$$

The adjusted rate now becomes

$$10\ 000 \times R116,28 \times \frac{97,5268}{81,507}$$

= R1 391 342 to be compared with R1 *389 641* the actual cost.

In all of the above examples, calculations etc. no adjustment has been made for variances in the "Internal Division" and "Internal Finishings" elements however as problems exist in the actual ascertainment of these elements and the adjustment made by using the "Structural" and "External Facade" elements which cater for between 59 and 68% of the "Source Parameter Unit" appears to be sufficient only these adjustments will be made to the "Source Parameter Unit" calculations.

The value of (i)% x (ii)% (the multiplier) is as follows:

i)	Offices (High Rise)	=	68,34 x 81,507	= 0,5570
ii)	Offices (Low Rise)	=	67,48 x 79,196	= 0,5344
iii)	Flats	=	59,09 x 60,943	= 0,3601
iv)	Shopping Centres	=	64,04 x 59,710	= 0,3824
v)	Factories	=	67,63 x 57,400	= 0,3882

On studying the above multipliers above iii, iv and v appear to be low and will have to be tested.

It must also be noted that in both the "Structural" and "External Facade" elements adjustments are made to the unit cost within the "Source Parameter Unit" cost (see section 10) for those factors which affect the costs of these elements. It was previously (see section 7) decided that the adjustment be made outside the cost and in the final equation itself. What effect does this have on the actual result?

Let us consider example 2 with certain variations, these being i) 3 basements ii) triangular shape.

ELEMENT	BASIC COST	AFFECTING FACTOR	FINAL COST	PERCENTAGE OF 'S.P.U'
	R.		R.	
Structural	35,79	1,1619	41,58	45,86))65,08
External Facade	16,28	1,07	17,42	19,22)
Internal Divisions	12,48	-	12,48	13,77
Internal Finishings	19,18	-	19,18	21,16
TOTALS	R83,73		R90,66	

Method 1.

I.P. - R.P. = 68,34 - 65,08

= 3,26 x 0,5570 (multiply)

= 1,8158

Cost now becomes $10\ 000 \times R90,66 \times \frac{100 + 1,8158}{81,507}$

= R1 132 494 which figure must be

compared with the result of R1 064135 (excluding basements and change in shape)

Method 2.

If however the adjustment is made on the Basic costs i.e. R83,73 total as in the original example 2 we have

$$10\ 000 \times R90,66 \times \frac{100 + (6,16 \times .5570)}{81,507}$$

= R1 150 461 which figure must be

compared with the result of R1 064135.

In case 1 of the revised example 2 the increase is R67 082 and in case 2 the increase is R85 049.

What should the actual increase be?

Using Method 1 the approximate increase would be

Basements	: Total cost (R1 132 494) x 3,75% (2 additional)	= R42 468
External Facade:	(R 162 983 x 1,07%) - (R162 983)	= R11 409
		R53 877

Using Method 2 the approximate increase would be

Basements	: Total cost (R1 150 461) x 3,75% (2 additional)	= R43 142
External Facade:		= R11 409
		R54 551

As can be seen from the above method one appears to give a more accurate result and therefore the adjustment for the difference of percentages will be made using the enhanced costs of the "Source Parameter Unit".

Taking into account the findings of section 10 and those at the start of this section a new "Source Parameter Unit" data sheet was designed with a summary to enable the user to easily obtain a result. These data sheets and summary follow.

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE _____

JOB AREA _____

JOB TYPE _____

JOB DESCRIPTION _____

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL		
2 EXTERNAL FACADES		
3 INTERNAL DIVISIONS		
4 INTERNAL FINISHINGS		
TOTALS		

BUILDING TYPE	I.R (1+Z) %	F
OFFICES (H.R)	68.34	0,5570
OFFICES (L.R)	67,48	0,5344
FLATS	59.09	0,3621
SHOPPING CENTRES	64.04	0,3324
FACTORIES	67,63	0,3832

I.P.(1+Z) - R.P.(1+Z) × F = X	(X+100)/SPU % × S.P.U COST M² × JOB AREA =	TOTAL S.P.U COST
		R

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE	R
B.	AIR CONDITIONING INSTALLATION ESTIMATE	R
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE	R
D.	OTHER	R
	TOTAL	R
E.	PRELIMINARY AND GENERAL ---- %	R
F.	BUILDING CONTINGENCY ---- %	R
G	DESIGN CONTINGENCY ---- %	
H	OTHER	R

TOTAL BUILDING ESTIMATE COST R

SOURCE PARAMETER UNIT DATA SHEET 1 STRUCTURAL ELEMENT

	COMPONENT	DESCRIPTION	U OF M	RATE	COST
i	COLUMNS	A : CONCRETE B : FORMWORK C : REINFORCEMENT D :			
ii	SLABS	A : CONCRETE B : FORMWORK C : REINFORCEMENT D :			
iii	BEAMS	A : CONCRETE B : FORMWORK C : REINFORCEMENT D :			
iv	WALLS	A : CONCRETE B : FORMWORK C : REINFORCEMENT D :			
v.		A B C D			
				R	

RATE IN USE FACTOR	SUB TOTAL 1	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
			R

ENHANCEMENT FACTORS

DESCRIPTION	FACTOR
BASEMENTS	
FOUNDATIONS i NATURE OF GND ii SLOPE OF GRD	
TOTAL	

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

	COMPONENT	DESCRIPTION	U of M	RATE	COST
i	WINDOWS COMPLETE				
ii	SPANDRIL WALLS				
iii	EXTERNAL FINISH ON ii				
iv	INTERNAL FINISH ON ii				
v	INTERNAL CILL				
vi	EXTERNAL CILL				
vii	SUN DRIES				
viii					

R		RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
					R

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE/HEIGHT RATIO	
TOTAL	

SOURCE PARAMETER UNIT — DATA SHEET 3 — INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U OF M	RATE	COST
i HALF BRICK WLS				
ii ONE BRICK WLS				
iii PARTITIONS				
IV DOORS + PRIMES				
V DOOR FIN + IRONMONGERY				
VI SUNDRIES				
VII				
			R	

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
			R

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

SOURCE PARAMETER UNIT DATA SHEET 4 INTERNAL FINISHINGS

COMPONENT	DESCRIPTION	U OF M	RATE	COST
i WALL FINISH				
ii FLOOR FINISH				
iii CEILING FINISH				
iv SUSPENDED CEILINGS				
v SUNDRIES				
VI				

ENHANCEMENT FACTOR	
DESCRIPTION	FACTOR
TOTAL	

R

RATE IN USE PART	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST

SECTION 12

USE OF MANUAL AND COMPUTER METHODS TO OBTAIN RESULTS

MANUAL METHODS

In the previous section (section eleven) a format of the data sheets most likely to be used when preparing an estimate of this type were included. While in the surface the use of these sheets to be reasonably simple, there are never the less a number of calculations and factors all of which must be taken into account and which must be used in arriving at the results.

Let us consider the sheets one by one.

Data sheet 1 - Structural Element

a) The cost of the basis of the element viz items i - iv are relatively simple to calculate and to arrive at the basic cost is an arithmatical exercise.

b) The rate in use factor is a figure which may change from type of structure to type of structure and from time to time depending on various factors.

c) The enhancement factor requires the user of the system to consult with the various schedules or graphs, the results of which must be inserted into the necessary positions and then totalled to give the total enhancement value. The schedules to be used are either 10,1, 10,2 for basements and 10,3, 10,4 for foundations.

To obtain the cost of the element then becomes an exercise in the multiplication of the various numbers.

Data Sheet 2 - External Facades

a) As with the "Structural Element" above, the cost of the basis of the element is an arithmatical exercise.

b) Rate in use factor as (b) above.

c) The enhancement factor requires the user to first establish the shape of the building being estimated - schedules 10,5, and then to arrive at the factor by using either schedule 10,6, 10,8, 10,9 and/ or graphs 10,7 or 10,10 which may become a problem.

Data sheets 3 - Internal Divisions and 4 Internal Finishings

To arrive at the costs of these elements is an arithmatical exercise as there are in the majority of cases no enhancement factors to be considered as any of these should be catered for when arriving at the "Elemental Cost".

SUMMARY SHEET

The summary sheet requires the most amount of work in arriving at the cost.

Firstly, the "Source Parameter Unit" costs of the elements must be transferred onto the summary, these must be totalled and the percentage values of elements 1 and 2 (Structural and External Facades) calculated and added together, this result must be then deducted from the "Ideal Percentage", this resultant answer must be added to 100 and divided by the "Source Parameter Unit" percentage, multiplied by the "Source Parameter Unit" cost and the building area to obtain the "Basic Building" cost to which must be added items A to H to arrive at a total cost.

...../2

General

In practise all the above calculations, while simple in nature, may be time consuming especially in the use of various schedules, graphs, etc.

COMPUTER METHODS

As much of this system is based on the use and comparison of new and historical data, a computer program to carry out all the functions and requirements of the system would be ideal.

The ideal would be a suite of programmes of the conversational type i.e. a question from the computer with an answer from the user.

The first section of the program would cater for data sheets 1 - 4. The machine would ask all the necessary questions e.g.:

Data Sheet 1

It would possibly not be necessary to inform the computer of the units of measurement, the questions could be as follows:

i Thickness of slab
ii Centres of Beams
iii Size of Beams
iv Centres of Columns
v Size of Columns, etc, etc, The computer could be pre-programmed to calculate from the above information the volumes/areas of the components as well as the weight of reinforcement for the various components. Rates must then be fed into the machine which will then enable the computer to calculate the cost.

The following data must then be supplied to the computer:

a) The number of basements
b) The type of foundation problems, if any
c) The "rate in use" factor.

The computer will then assess the data base to compare b) and c) and will thus arrive at an enhancement factor which it will use in obtaining a total element cost.

The same process will then take place for each of the four elements. These results will be automatically carried forward to the summary of data and all the necessary computations, comparisons and other work will be done enabling the user to obtain a basic cost.

Print-outs of the various data sheets would then be obtained as well as the summary.

There is no doubt that a computer could be used to good advantage in the system although the programming and setting up of data banks to cater for all the various comparisons of data coul be more complicated than appears on the surface.

In conclusion, however, we must stress that for any computer system of this type to work efficiently, a good mannual method, even if this method is complicated and complex must be in use prior to the writing of the computer programmes so that any problems, etc. can be ironed out and to enable the results obtained by computer to be verified.

SECTION 13

CONCLUSION

In order to arrive at any conclusion as to whether or not this system is satisfactory to use for estimating the cost of buildings one must test the logic of the system as designed.

In attempting to do this problems were encountered due to the fact that the Property Development Industry in South Africa is going through a period of recession. However, five parametric estimates were done, four of which can be compared with actual updated tender prices and one which can be compared with an elemental estimate of a proposed building. The results were as follows:-

JOB NAME	JOB TYPE	PARAMETRIC ESTIMATE	ACTUAL COSTS	PERCENTAGE VARIANCE
Witbank Shopping Centre	Shopping Centre	R 375 058	R 383 600	-2,28%
Medical Centre *	Office (LR)	R 1 510 024	R 1 548 387	-2,54%
Ermelo Offices	Ditto	R 466 986	R 476 655	-2,07%
Wilson-Rowntree	Factory	R 437 199	R 423 617	+3,11%
Sanlam	Office (HR)	R26 609 347	R27 536 564	-3,49%

(* Actual costs by elemental estimate).

As can be seen from the above schedule the figures obtained were reasonably close to the required results varying from +3,11% to -3,49%.

NOTE. The Parametric Estimate Calculation Sheets are included at the end of this section.

Do the above figures/results prove that this method of estimating building costs is accurate?

To answer that question, one would have to define the accuracy level which one consideres is required.

In Section 2 a figure of 5% accuracy was mentioned and if this is the variation limit then it would appear that the answers obtained by this method will suffice. It is interesting to note that with one exception - example 4 - all the estimate figures obtained were lower than the actual figures obtained. If this was proved to be the case in the majority of estimates than adjustments could be made to the various formulae to increase the final figure obtained. I do not however consider that the five estimates done by this method show that this additional value must be found.

What then are the advantages, disadvantages and the future use of this method of estimating.

1. ADVANTAGES

The greatest advantage of the system is the speed with which a result can be obtained. I think that it is safe to say that the time taken to produce a satisfactory result is about 25% of the time taken to produce a normal elemental estimate.

A second very important advantage is that because of the logic of the system - the use of averages obtained from similar buildings with up-to-date or changed rates - an estimate could be done virtually without drawings as long as all the factors which affect building costs were known together with the size, height, etc. of the proposed building.

DISADVANTAGES

The major disadvantage of the system is in the use of the system. No problem exists in the calculation of either the area of the building or the rates of the elements but problems are encountered in the use of the enhancement factor, i.e. the factor to allow for those items affecting building costs and in the use of the "Summary Sheet" of the estimate I do believe that with use and familiarity of the system, the user will in the end be able to produce a fairly reliable estimate but if too

many...../

many failures are encountered in the initial stages, confidence in the system will be destroyed. With constant use of the system one obtains a "feel" for the use of the various factors viz. "Rate in Use", "Enhancement", "I.P. = Ideal Percentage", "R.P. = Revised Percentage", etc., but I believe this takes a fair amount of time.

With the use of a computer system many of these drawbacks will naturally fall away but the system will then become stereotype and this factor in itself may in the long run lead to results which will be unacceptable.

A second disadvantage is the inability of the system to show actual costs of the various elements of a building. In this day and age when the watchword of the Property Development Industry is "Cost Control", then this system is not for the Building Economist/Quantity Surveyor. This shortcoming also manifests itself in the inability of the system to allow small variations to finish, external facade, etc. to easily be taken into account. In the "Elemental System" this can be done without too much trouble and a new total cost easily calculated - not so with the "Parametric System" where one would have to go back to basics to alter these items. Even with both systems being computerised, I believe that the "Elemental System" would be considered to be the better of the two systems.

The last disadvantage is I believe the Client who would look at this type of estimate with its fomulae, factors, etc., etc., and really wonder if the last figure on the summary sheet is his building. This is all a matter of education but I believe it is difficult enough to educate the user of the system without having to start on his client.

To digress for a moment - the reason for comparing the "Parametric System of Estimating" with the "Elemental System of Estimating", so often is that the latter is the "in system" and as such it is used as a yardstick to judge other systems. The "Elemental System" is also well-known to Clients, Developers, etc. who find it easily able to be understood. A copy of the

"Elemental...../

"Elemental Estimate" prepared for building 2 "Medical Centre" is included for comparison.

What of the future? I believe that in order to make this system acceptable and usable the following must take place -

i) Estimates must be prepared in tandem with an estimate of any other acceptable and tried method and the results obtained listed.

ii) A close watch be kept through the figures obtained in (i) above on the affect of the factors as listed in Section 8 of this thesis.

iii) Research be done into rates for the elements which are used in the "Parametric System" as well as the elements themselves as with the passing of time and various developments in the construction industry, these themselves may change.

CONCLUSION

So what is the final conclusion? While the disadvantages of the system may numerically outweigh the advantages, I believe that there is a need for this type of estimate because of the advantages as listed but for the system to become widely acceptable to Client/Building Professional/Contractor, the research as suggested above be implemented to make a workable system, a system in which all can have confidence.

BUILDING 1

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE WITBANK SHOPPING CENTRE

JOB AREA 2977

JOB TYPE SHOPPING CENTRE

JOB DESCRIPTION SIMPLE TYPE STRUCTURE NORMAL FINISHINGS SINGLE STOREY

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL	1·68	3·06
2 EXTERNAL FACADES	28·02	51·05
3 INTERNAL DIVISIONS	6·36	11·59
4 INTERNAL FINISHINGS	18·83	34 30
TOTALS	54 89	1000

BUILDING TYPE	IR (1+Z) %	F
OFFICES (H.R)	68.34	0,5570
OFFICES (L.R)	67,48	0,5344
FLATS	59.09	0,3601
SHOPPING CENTRES	64.04	0,3324
PICTORIES	67,63	0,3332

I.P.(1+Z) − R.P.(1+Z) × F = X				(X+100)/SPU %	× S.P.U COST M2 R	× JOB AREA	= TOTAL S.P.U. COST
64.04	54.11	9,93	0.3524	103 50 / 59 71	R 54 89	2977	R 284 068

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE		R 50 000
B.	AIR CONDITIONING INSTALLATION ESTIMATE		R —
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE		R —
D.	OTHER		R —
	TOTAL		R 334 068
E.	PRELIMINARY AND GENERAL	9 %	R 30 066
F.	BUILDING CONTINGENCY	3 %	R 10 924
G	DESIGN CONTINGENCY	— %	—
H	OTHER		R —

TOTAL BUILDING ESTIMATE COST R 375 058

SOURCE PARAMETER UNIT DATA SHEET 1 STRUCTURAL ELEMENT

	COMPONENT	DESCRIPTION	Q OF M	RATE	COST.
i	COLUMNS	A: CONCRETE	1 m3	36.00	36.00
		B: FORMWORK	8,4 m2	8.00	67.20
		C: REINFORCEMENT	120 kg	0,41	49.20
		D:			
ii	SLABS	A: CONCRETE			
		B: FORMWORK			
		C: REINFORCEMENT			
		D:			
iii	BEAMS	A: CONCRETE			
		B: FORMWORK			
		C: REINFORCEMENT			
		D:			
iv	WALLS	A: CONCRETE			
		B: FORMWORK			
		C: REINFORCEMENT			
		D:			
v.		A			
		B			
		C			
		D			

1½ COLS PER 100 m²

SIZE 400 x 400 x 3.500 =

ENHANCEMENT FACTORS

DESCRIPTION	FACTOR
EXCAVATION	0,2032 -
FOUNDATIONS i WIDTH OF FOOT ii SLOPE OF SIDES	-
TOTAL	

R 152,40

RATE IN USE FACTOR	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	167,64	-	R 167.64

R 1.68/m²

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

	COMPONENT	DESCRIPTION	U OF M	RATE	COST
i	WINDOWS COMPLETE	SHOP FRONTS / STEEL	35 m²	R 50 00	R 1750
ii	SPANDRIL WALLS	WCS	35 m²	R 15·00	525
iii	EXTERNAL FINISH ON ii	SEMI FACE	35 m²	R 6·00	210
iv	INTERNAL FINISH ON ii	PL + PT.	35 m²	R 4·50	158
v	INTERNAL CILL	–	–	–	
vi	EXTERNAL CILL	–	–	–	
vii	SUN DRIES	–	–	/	
viii					

SHOP FRONTS = 50% OF AREA = R 90 00
WDWS 10% OF AREA = R 20·00

= R 45 / 5 / 50.00

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE / HEIGHT RATIO	
TOTAL	

R 2643

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.06	R 2802	–	R 2802

R 28.02 / m²

SOURCE PARIMETER UNIT — DATA SHEET 3 — INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i HALF BRICK WLS				
ii ONE BRICK WLS		37	R 12.38	458
iii PARTITIONS	—	—	—	—
IV DOORS + FRAMES		1	R 40	40
V DOOR FIN + IRONMONGERY		1	R 30	30
VI SUNDRIES				50
VII				
			R	578

R

65 x 15 = 975
35 x 7.5 = 262.50
1237.50

= R12.38/m²

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	R636	-	R 636

R 6.36/m²

SOURCE PARAMETER UNIT — DATA SHEET 4 — INTERNAL FINISHINGS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i WALL FINISH		74 m²	4.50	333
ii FLOOR FINISH		100	8.50	850
iii CEILING FINISH				
iv SUSPENDED CEILINGS		100	7.00	700
v SUNDRIES				
vi				

3.5 x 10 x 50

ENHANCEMENT FACTOR					RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
DESCRIPTION	FACTOR		R	1883	-	1883		1883
TOTAL								

R 18.83/m².

BUILDING 2

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE MEDICAL CENTRE PRETORIA

JOB AREA 6568 m²

JOB TYPE LOW RISE OFFICE BUILDING

JOB DESCRIPTION NORMAL PRIMED CONCRETE STRUCTURE WITH 1 BASEMENT
EXT WDW. WLS. NORMAL FINISHINGS.

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL	37.18	36.04
2 EXTERNAL FACADES	30.23	29.20
3 INTERNAL DIVISIONS	21.03	
4 INTERNAL FINISHINGS	14.72	
TOTALS	103.16	65.34

BUILDING TYPE	I.R (1+2) %	F
OFFICES (H.R)	68.34	0,5570
OFFICES (L.R)	67,48	0,53444
FLATS	59.09	0,3601
SHOPPING CENTRES	64.04	0,3324
FACTORIES	67,63	0,3332

I.P.(1+2) - R.P.(1+2) × F = X				X+100 / SP4.% × S.P.U COST M2 × JOB AREA = TOTAL S.P.U COST
67.48	65.34	0.5344	1.1436	101.1436 / 76.196 × R 103.16 × 6568 = R 899 395

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE	R 167 000
B.	AIR CONDITIONING INSTALLATION ESTIMATE	R 188 000
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE	R 90 000
D.	OTHER	R
	TOTAL	R 1344 395
E.	PRELIMINARY AND GENERAL 8 %	R 107 551
F.	BUILDING CONTINGENCY 4 %	R 58 077
G	DESIGN CONTINGENCY --- %	
H	OTHER	R —

TOTAL BUILDING ESTIMATE COST R 1 510 024

SOURCE PARAMETER UNIT DATA SHEET 1 STRUCTURAL ELEMENT

	COMPONENT	DESCRIPTION	U OF M	RATE	COST.
i	COLUMNS	A : CONCRETE	6 m³	R36.00	R216
		B : FORMWORK	58 m²	R 8.00	464
		C : REINFORCEMENT	~~570~~ kg 364	R 0.41	~~233~~ 354
		D :			
ii	SLABS	A : CONCRETE	20 m³	R36.00	720
		B : FORMWORK	100 m²	R 5.00	500
		C : REINFORCEMENT	1500	R 0.41	615
		D :			
iii	BEAMS	A : CONCRETE	3 m³	R36.00	108
		B : FORMWORK	17 m²	R 9.00	153
		C : REINFORCEMENT	~~450~~ kg	R 0.41	185
		D			
iv	WALLS	A : CONCRETE	2 m³	R36	72
		B : FORMWORK	20 m²	R 8	160
		C : REINFORCEMENT	200 kg	R 0.41	82
		D			
v.		A			
		B			
		C			
		D			

3mm cnt = 12/0.40, 0.40, 3.00 = 5.76

3mh. = ~~5.76~~ 3.51 m³

3mh = 2/2/0.20, 2.00 = 5.76

Reinf

10.00
0.50
0.60

ENHANCEMENT FACTORS

DESCRIPTION	FACTOR	
BASEMENTS	-0.0687	NIL -
FOUNDATIONS: i NATURE OF SOIL ii SLOPE OF SITE		NIL. -
TOTAL		

R 3629

RATE IN USE FACTOR	SCIB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	R 3992	0.9313	R 3718

= R37.18/m²

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

	COMPONENT	DESCRIPTION	U OF M	RATE	COST
i	WINDOWS COMPLETE		32 m²	R60	1920
ii	SPANDRIL WALLS		10 m	R60	600
iii	EXTERNAL FINISH ON ii				
iv	INTERNAL FINISH ON ii				
v	INTERNAL CILL				
vi	EXTERNAL CILL				
vii	SUNDRIES	Hollow WL	50m²	R10	500
viii					

10 x 32.

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE/HEIGHT RATIO	0.9444
TOTAL	

R 30,20

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.06	R3201	0.9444	R 3023

R 30.23/m²

SOURCE PARIMETER UNIT DATA SHEET 3 INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i HALF BRICK WLS		24m²	R12.15	291.60
ii ONE BRICK WLS				
iii PARTITIONS		25m²	R60.00	1500.00
IV DOORS + PRIMES		1	R 40.00	40.00
V DOOR PIN + IRONMONGERY		1	R 30	30.00
VI SUNDRIES				50.00
VII				

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

R 1911.60

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	2102.76	-	R 2102.76

= R21.03/m²

=

SOURCE PARAMETER UNIT DATA SHEET 4 — INTERNAL FINISHINGS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i WALL FINISH		48	4.20	202
ii FLOOR FINISH		100 m2	8.50	850
iii CEILING FINISH		100 m2	4.20	420
iv SUSPENDED CEILINGS		-	-	
v SUNDRIES				
vi				

ENHANCEMENT FACTOR	
DESCRIPTION	FACTOR
TOTAL	

R 1472

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
-	-	-	R 1472.

R 14.72/m2

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE UBS ERMELO

JOB AREA 2252

JOB TYPE LOW RISE OFFICES.

JOB DESCRIPTION BUILDING OF TWO STOREYS NO BASEMENT
PROVISION FOR FUTURE GOOD FINISHES

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL	44.07	45.71
2 EXTERNAL FACADES	13.90	14.42
3 INTERNAL DIVISIONS	18.09	18.76
4 INTERNAL FINISHINGS	20.35	21.11
TOTALS	96.41	100

BUILDING TYPE	I.R (1+2) %	F
OFFICES (H.R)	68.34	0,5570
OFFICES (L.R)	67,48	0,5344
FLATS	59.09	0,3601
SHOPPING CENTRES	64.04	0,3324
FACTORIES	67,63	0,3332

I.P.(1+2) - R.P.(1+2) × F = X				X+100 / S.P.U %	× S.P.U COST M2 R	× JOB AREA	= TOTAL S.P.U COST
67.48	60.13	0,5344	3,928	103.928 / 96.196	96.41	2252	R 296 135

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE		R 45 000
B.	AIR CONDITIONING INSTALLATION ESTIMATE		R 44 000
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE		R
D.	OTHER SHOPFITTERS WORK		R 38 000
		TOTAL	R 423 135
E.	PRELIMINARY AND GENERAL	8 %	R 33 850
F.	BUILDING CONTINGENCY	— %	R 10 000
G	DESIGN CONTINGENCY	— %	
H	OTHER		R
	TOTAL BUILDING ESTIMATE COST		R 466 936

SOURCE PARAMETER UNIT DATA SHEET 1 STRUCTURAL ELEMENT.

	COMPONENT	DESCRIPTION	U OF M	RATE	COST.
i	COLUMNS	a: CONCRETE	6 m³	R 36.00	216
		b: FORMWORK	56 m²	8.00	448
		c: REINFORCEMENT	720 kg	0.41	295
		d:			
ii	SLABS	a: CONCRETE	10 m³	R 36.00	360
		b: FORMWORK	66 m²	5.00	330
		c: REINFORCEMENT	300 kg	0.41	123
		d:			
iii	BEAMS	a: CONCRETE	9 m³	R 36.00	324
		b: FORMWORK	100 m²	9.00	900
		c: REINFORCEMENT	1350 m³	0.41	554
		d			
iv	WALLS	a: CONCRETE			
		b: FORMWORK	—		
		c: REINFORCEMENT			
		d.			
v.	CANOPYS.	a CONCR	2.5 m³	R 36.00	90
		b FORMWORK	10 m²	3.00	30
		c REINT	200 kg	0.41	82
		d			
				R	38.02

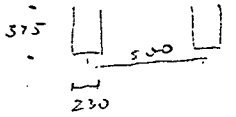
5 PER 100 m².

2/5/50p × 300 × 350 = 2.62 m²

SLABS AVG ± 100 mm.

OF SLOPED PLANES

per m² = 1.00 / .375 / .23 = 2.62 m²/100 m²



ENHANCEMENT FACTORS

DESCRIPTION	FACTOR
BASEMENTS	− 0.034
FOUNDATIONS i NARROW OR GRD ii SLOPE OF GRD	/
TOTAL	

RATE IN USE FACTOR	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
* 1.20	4562	0.966	R 4407.

NOTE * CONST = 1 300 Rm FROM 248.

R 44.07/m².

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

	COMPONENT	DESCRIPTION	U OF M	RATE	COST
i	WINDOWS COMPLETE	ALUMINIUM	12 m²	R 100	1200
ii	SPANDRIL WALLS	BWK + ~~PLCH~~	24 m²	R 15	360
iii	EXTERNAL FINISH ON ii	FACES	24	R 8	192
iv	INTERNAL FINISH ON ii	PL + PT	24	R 4.50	108
v	INTERNAL CILL	REVEALS 3	3	R 5.	15
vi	EXTERNAL CILL	BWK 2	3	R 5.	15
vii	SUN DRIES				
viii					

NOTE SHOPFRONTS [illegible]

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE/HEIGHT RATIO	0.6687
TOTAL	0.6687

(L SHAPED 2 FLOORS)

		RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
R	1890	1.10	2079	0.6687	R 1390

R 13.90/m²

SOURCE PARAMETER UNIT — DATA SHEET 3 — INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i HALF BRICK WLS				
ii ONE BRICK WLS		22	R 12.15	267
iii PARTITIONS		25	R 50	1250
IV DOORS + FRAMES		2	R 40	80
V DOOR FIN + IRONMONGERY		2	R 30	60
VI (131) SUNDRIES			R 50	50
VII				

62 x 15 = 930
38 x 750 = 285
12.15

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

R 1707

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.06	1809	-	R 1809

R 18.09 / m²

SOURCE PARAMETER UNIT DATA SHEET 4 INTERNAL FINISHINGS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i WALL FINISH	PL+PT	44	R4.20	185
ii FLOOR FINISH		100	10.00	1000
iii CEILING FINISH		-		
iv SUSPENDED CEILINGS		100	8.50	850
V SUNDRIES				
VI				

ENHANCEMENT FACTOR	
DESCRIPTION	FACTOR
TOTAL	

R 2035

RATE IN USE PART	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
-	-	-	-

R20.35/m²

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE WILSON ROWNTREE

JOB AREA 3175 m²

JOB TYPE FACTORY / WAREHOUSE

JOB DESCRIPTION SINGLE STOREY FACTORY WITH OFFICES TO FRONT PORTION FACED EXT NORMAL FINS INT

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL	7.79	12.50
2 EXTERNAL FACADES	29.96	48.07
3 INTERNAL DIVISIONS	11.50	18.45
4 INTERNAL FINISHINGS	13.08	20.98
TOTALS	R 62.33	100.

BUILDING TYPE	IR (1+2) %	F
OFFICES (H.R)	68.34	0.5570
OFFICES (L.R)	67.48	0.5344
FLATS	57.09	0.3601
SHOPPING CENTRES	64.04	0.3824
FACTORIES	67.63	0.3332

I.P.(1+2) - R.P.(1+2) × F = X				X+100 / SPU %	× S.P.U COST M² (R)	× JOB AREA	= TOTAL S.P.U COST
67.63	60.57	[illegible]	2.74	102.74 / 57.40	62.33	3175	R 354 216

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE		R 26 000
B.	AIR CONDITIONING INSTALLATION ESTIMATE		R 28 000
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE		R —
D.	OTHER		R —
		TOTAL	R 408 216
E.	PRELIMINARY AND GENERAL	5 %	R 20 410
F.	BUILDING CONTINGENCY	2 %	R 8 573
G	DESIGN CONTINGENCY	— %	
H	OTHER		R

TOTAL BUILDING ESTIMATE COST R 437 199

SOURCE PARAMETER UNIT — DATA SHEET 1 — STRUCTURAL ELEMENT

	COMPONENT	DESCRIPTION	U OF M	RATE	COST.
i	COLUMNS	A : CONCRETE	m3 2	36.00	72
		B : FORMWORK	m2 24	8.00	192
		C : REINFORCEMENT	kg 300	0.41	123
		D :			
ii	SLABS	A : CONCRETE	m3 2.5	36.00	90
		B : FORMWORK	m2 16	5.00	80
		C : REINFORCEMENT	kg 250	0.41	103
		D :			
iii	BEAMS	A : CONCRETE	m3 0.25	36.00	9
		B : FORMWORK	m2 2.00	9.00	18
		C : REINFORCEMENT	kg 50	0.41	21
		D			
iv	WALLS	A : CONCRETE			
		B : FORMWORK			
		C : REINFORCEMENT			
		D :			
v.		A			
		B			
		C			
		D			
				R	708

COLS 2 PER 100 m² NOTE 1 STATE BASEMENT
SAME COST HEIGHT 3.5m
⇒ 350×350×3.50×2 = 2 m³.

1/6 OF AREA : CONCR SLAB.
1/6 × 10.00 × 10.00 × 0.150.

1%

ENHANCEMENT FACTORS

DESCRIPTION	FACTOR
BASEMENTS	N/C
FOUNDATIONS i HEIGHT OF FOUND ii SLOPE OF AREA	/
TOTAL	—

RATE IN USE FACTOR	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	R 779	—	R 779

R 7.79/m²

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

COMPONENT	DESCRIPTION	u of m	RATE	COST
i WINDOWS COMPLETE	STD STEEL	m2 26	R50	1300
ii SPANDRIL WALLS	BWK	m2 59	R14	826
iii EXTERNAL FINISH ON ii	PAGGS	m2 59	R7	413
iv INTERNAL FINISH ON ii	PL + PT	m2 59	R4.20	248
v INTERNAL CILL	a.c	m 4	R5.00	20
vi EXTERNAL CILL	AC	m4	R5.00	20
vii SUNDRIES				-
viii				
			R	2827

10 x 8.5 = 85 m2 + 30% =

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.06	R2996	-	R 2996

R 2996/m2

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE/HEIGHT RATIO	
TOTAL	

SOURCE PARIMETER UNIT — DATA SHEET 3 — INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i HALF BRICK WLS		25 m²	R12.22	306
ii ONE BRICK WLS				
iii PARTITIONS		11 m²	R50	550
iv DOORS + FRAMES		2	R40	80
v DOOR FIN + IRONMONGERY		2	R30	60
VI SUNDRIES				50
VII				
			R	1046

63 % R15 =
37 % R7.50 =
} R12.22

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	R1150	-	R 1150

R 11.50/m²

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

SOURCE PARAMETER UNIT — DATA SHEET 4 — INTERNAL FINISHINGS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i WALL FINISH	PL + PT	m2 50	R4.20	R 210
ii FLOOR FINISH		m2 100	R4.38	438
iii CEILING FINISH		m2 16	R 4.50	72
iv SUSPENDED CEILINGS		m2 84	R 7.00	588
V SUNDRIES				
VI				

75% = 3.00 = 225
25% = 8.50 = 213
438

ENHANCEMENT	FACTOR
DESCRIPTION	FACTOR
TOTAL	

R 1308

RATE IN USE PAST	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
-		—	R1308

R 12.08/m2

PARAMETRIC ESTIMATE SUMMARY SHEET

JOB TITLE SANLAM JHB

JOB AREA 85274 M2

JOB TYPE HIGH RISE OFFICE BLOCK

JOB DESCRIPTION CONCRETED CONCRETE STRUCTURE + BASEMENTS.
MARBLE + ALUM WDWS EXT NORMAL FINISHINGS

SOURCE PARAMETER UNIT

ELEMENT SUMMARY	COST	%
1 STRUCTURAL	49.52	29.53
2 EXTERNAL FACADES	65.30	38.94
3 INTERNAL DIVISIONS	26.25	
4 INTERNAL FINISHINGS	26.50	
TOTALS	167.67	68.47

BUILDING TYPE	IR (1+2) %	F
OFFICES (H.R)	68.34	0,5570
OFFICES (L.R)	67,48	0,5344
FLATS	59.09	0,3621
SHOPPING CENTRES	64.04	0,3324
FACTORIES	67,63	0,3332

I.P.(1+2) - R.P.(1+2) × F = X				(X+100)/S.P.U.% × S.P.U COST M2 R × JOB AREA =		TOTAL S.P.U COST
68.34	68.47	0.5570	-0.07261	99.27376 / 81.207	R 167 67	85274	R 17 529 215

ADD.

A.	ELECTRICAL INSTALLATION ESTIMATE	R
B.	AIR CONDITIONING INSTALLATION ESTIMATE	R 3 609 348
C.	LIFTS + ESCALATOR INSTALLATION ESTIMATE	R
D.	OTHER	R
	TOTAL	R
E.	PRELIMINARY AND GENERAL ---- %	R
F.	BUILDING CONTINGENCY ---- %	R 3 470 784
G	DESIGN CONTINGENCY ---- %	
H	OTHER	R

TOTAL BUILDING ESTIMATE COST R 21 609 347

SOURCE PARAMETER UNIT DATA SHEET 1 STRUCTURAL ELEMENT

	COMPONENT	DESCRIPTION	Q OF M	RATE	COST.
i	COLUMNS	A: CONCRETE	3.4 m³	R 36.00	122.40
		B: FORMWORK	33.6 m²	R 8.00	268.80
		C: REINFORCEMENT	680 kg	R 0.41	278.80
		D:			
ii	SLABS	A: CONCRETE	20 m³	R 36.00	720.00
		B: FORMWORK	100 m²	5.00	500.00
		C: REINFORCEMENT	2000 kg	0.41	820.00
		D:			
iii	BEAMS	A: CONCRETE	5 m³	R 36.00	180.00
		B: FORMWORK	35 m²	9.00	315.00
		C: REINFORCEMENT	1250 kg	0.41	512.50
		D:			
iv	WALLS	A: CONCRETE	5 m³	R 36.00	180.00
		B: FORMWORK	50 m²	8.00	400.00
		C: REINFORCEMENT	500 kg	0.41	205.00
		D:			
v.		A			
		B			
		C			
		D			
				R	4502.50

COLS. SM CONT. 400×400 F-F. 3.5m.

6/ 0.40 × 0.40 × 3.50 = 3.36 m³.

Beams. 500 × 200 × 25m.

RATE IN USE FACTOR	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	R4952.	-	R 4952

= R 49.52/m²

ENHANCEMENT FACTORS

DESCRIPTION	FACTOR
BASEMENTS	+ NIL.
FOUNDATIONS:	
i NATURE OF GROUND	-
ii SLOPE OF SITE	-
TOTAL	

SAME NUMBER AS ABOVE.

SOURCE PARAMETER UNIT DATA SHEET 2 EXTERNAL FACADES

	COMPONENT	DESCRIPTION	U of M	RATE	COST
i	WINDOWS COMPLETE	EXPENSIVE CURTAIN WLS 75%	26.25m2	R110.00	2887.50
ii	SPANDRIL WALLS	25% OF AREA = 8.7..	8.87	R70.00	665.25
iii	EXTERNAL FINISH ON ii				
iv	INTERNAL FINISH ON ii				
v	INTERNAL CILL		7.5m	5.00	37.50
vi	EXTERNAL CILL				
vii	SUNDRIES	SUNCONT	35m2	R60.00	2100.00
viii					

10 × 3.5 × .75.

	RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
R 5690.00	1.03	5860.96	1.1142	R 6530.28

R 65.30/m²

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
SHAPE/HEIGHT RATIO	1.1142
TOTAL	

ratio of above bel.... 53254.

1.076
1.1374
2)2.2284

SOURCE PERIMETER UNIT — DATA SHEET 3 — INTERNAL DIVISIONS

COMPONENT	DESCRIPTION	U of M	RATE	COST
i HALF BRICK WLS		15	R 11.70	R 175.50
ii ONE BRICK WLS				
iii PARTITIONS		35	R 60.00	2100.00
IV DOORS + FRAMES		1	R 40.00	40.00
V DOOR FIN + IRONMONGERY		1	R 30.00	30.00
VI SUNDRIES		1	R 50.00	50.00
VII				
			R	2395.50

56% @ R15 = 8.40
44% @ R7.50 = 3.30
11.70

RATE IN USE FACT	SUB TOTAL	ENHANCEMENT FACTOR	TOTAL ELEMENT COST
1.10	2635.05	—	R 2635.05

= R 96.35/m²

ENHANCEMENT FACTOR

DESCRIPTION	FACTOR
TOTAL	

BORCKENHAGEN & LOUW ESTIMATING SYSTEM - COST BY COMPONENT

PAGE NO 1

13/10/78

JOB TITLE PROJECT 363 PRETORIA
REFERENCE NUMBER P1
JOB TYPE CODE LSO
PROJECTED DATE 09/78
BUILDING AREA 6568.00 M2
USER PAIGE/CO

EL/CPT	DESCRIPTION	COMMENT	UNIT	MEASUREMENT	UNIT PRICE	TOTAL COST	COST AREA	%
BBA	FDTS		M2	1278.00	17.00	21726.00	3.31	1.40
					** BB	21726.00	3.31	1.40
BBA	LOWER FLR		M2	1278.00	5.00	6390.00	.97	.41
					** BB	6390.00	.97	.41
FFA	STRUCT		M2	6386.00	40.00	255520.00	38.90	16.50
					** FF	255520.00	38.90	16.50
GGA	ROOF WPG	ALL	M2	1278.00	12.00	15336.00	2.33	.99
					** GG	15336.00	2.33	.99
HHA	WLS		M2	252.00	15.00	3780.00	.58	.24
HHB	PIN		M2	240.00	4.20	1008.00	.15	.07
HHD	SPEC PIN		M2	64.00	24.20	2032.80	.31	.13
HHH	WDWS		M2	2048.00	60.00	122880.00	18.71	7.94
HHL	SUN CONT		M2	320.00	65.00	20800.00	3.17	1.34
HHO	ENT DOOR		M2	16.00	100.00	1600.00	.27	.12
HHP	HONEY COMB		M2	384.00	10.00	3840.00	.58	.25
					** HH	156140.80	23.77	10.09
KKA	HALF B WL		M2	1380.00	7.50	10350.00	1.58	.67
KKC	DOORS		NO	15.00	70.00	1050.00	.16	.07
KKH	PARTITIONS		M2	4360.00	60.00	262800.00	40.01	16.97
KKJ	TOIL PTS		NO	28.00	150.00	4200.00	.64	.27
KKN	FIRE DRS		NO	15.00	250.00	3750.00	.57	.24
					** KK	282150.00	42.96	18.22

EL/CPT	DESCRIPTION	COMMENT	UNIT	MEASUREMENT	UNIT PRICE	TOTAL COST	COST AREA	%
LLA	POWER FLOAT		M2	1278.00	1.80	2300.40	.35	.15
LLB	VINYL		M2	5112.00	8.50	43452.00	6.62	2.81
LLC	SPECIAL		M2	300.00	10.00	3000.00	.46	.19
LLH	STRS		M2	125.00	12.00	1500.00	.23	.10
					** LL	50252.40	7.66	3.25
MMA	SLAB FIN	]]	M2	6390.00	4.20	26838.00	4.09	1.73
					** MM	26838.00	4.09	1.73
NNC	WL FIN		M2	3420.00	4.20	14364.00	2.19	.93
NND	FIN EXP		M2	660.00	15.00	9900.00	1.51	.64
NNE	TILING		M2	500.00	13.00	6500.00	.99	.42
NNF	PER DUCT		L	640.00	20.00	12800.00	1.95	.83
					** NN	43564.00	6.64	2.82
PPO	CUPBDS		NO	12.00	250.00	3000.00	.46	.19
					** PP	3000.00	.46	.19
QQA	PLUMBG	ALL	NO	100.00	580.00	58000.00	8.83	3.75
					** QQ	58000.00	8.83	3.75
RRA	FIRE SERV		NO	16.00	465.00	7440.00	1.13	.48
					** RR	7440.00	1.13	.48
SSB	BALUST		M	95.00	35.00	3325.00	.51	.21
					** SS	3325.00	.51	.21
XXG	PAVGS		M2	400.00	8.50	3400.00	.52	.22
XXJ	KERBS		M	78.00	6.00	468.00	.07	.03
					** XX	3868.00	.59	.25

1642

C3 S1

EL/CPT	DESCRIPTION	COMMENT	UNIT	MEASUREMENT	UNIT PRICE	TOTAL COST	COST AREA	%
YYA	ELECT		NO	167.00	100.00	16700.00	2.54	1.08
YYA			M2	1503.00	100.00	150300.00	22.88	9.71
YYB	AIC INST		NO	1880.00	100.00	185000.00	28.02	12.14
YYC	LIFTS		NO	900.00	100.00	90000.00	13.70	5.81
					** YY	445000.00	67.74	28.74
ZZA	-PRG					110284.07	16.79	7.12
ZZB	CONTG					59553.32	9.07	3.85
					** ZZ	169837.39	25.85	10.97
		****GRAND TOTAL****				1548387.59	235.75	100.00

C

1331