Appendix A
Results

VALUE ENGINEERING 1

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	100	70	72
ENGINEERING	86	25	23
MECH&ELECT	97	5	5
TYPE			
LAYOUT	100	59	61
OMISSION	83	17	14
SPECIFICATION	97	25	25
ARCHITECTURAL			
LAYOUT	100	57	59
OMISSION	100	6	7
SPECIFICATION	100	6	6
ENGINEERING			
LAYOUT	0	0	0
OMISSION	69	9	6
SPECIFICATION	95	17	17
MECH&ELECT			
LAYOUT	100	1	1
OMISSION	90	2	1
SPECIFICATION	100	2	2

VALUE ENGINEERING 1

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	5154940	5154940	A	L					
A2	0	0	A	O					
A7	0	0	A	L					
A8	0	0	A	L					
A10	-130730	-130730	A	L					
A12	365570	365570	A	S					
A15	-42960	-42960	A	S					
A16	155220	155220	A	S					
A18	33960	33960	A	S					
A20	0	0	A	L					
A21	0	0	A	L					
A22	0	0	A	L					
A24	0	0	A	L					
A26	565730	565730	A	O					
A27	0	0	A	L					
					6101730	6101730	100	70	72
C2	404130	404130	E	O					
C3	70890	0	E	S					
C6	0	0	E	L					
C8	15290	0	E	O					
C9	574620	574620	E	S					
C10	0	0	E	O					
C13	0	0	E	L					
C14	83400	83400	E	O					
C15	166800	0	E	O					
C17	833760	833760	E	S					
C18	28220	28200	E	O					
C19	51700	0	E	O					
					2228810	1924110	86	25	23
EQ1	10670	10670	ME	O					
EQ4	13460	13460	ME	O					
EQ6	27800	27800	ME	O					
EQ7	0	0	ME	L					
EQ8	126490	126490	ME	S					
EQ9	700	0	ME	O					
EQ11	67610	67610	ME	O					
EQ12	24940	24940	ME	S					
EQ13	5000	5000	ME	O					
M1	13600	0	ME	O					
M2	0	0	ME	L					
M3	0	0	ME	L					
M4	0	0	ME	L					
M5	1950	1950	ME	O					
M6	0	0	ME	L					
M7	-1810	-1810	ME	L					
M8	0	0	ME	L					
M9	0	0	ME	L					
M11	-30580	-30580	ME	L					
E1	145950	145950	ME	L					
E2	0	0	ME	L					
E3	27800	27800	ME	S					
					433580	419280	97	5	5
TOT	8764120	8445120			8764120	8445120	96	100	100

VALUE ENGINEERING 1

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C6	0	0	E	L					
C13	0	0	E	L					
A1	5154940	5154940	A	L					
A7	0	0	A	L					
A8	0	0	A	L					
A10	-130730	-130730	A	L					
A21	0	0	A	L					
A22	0	0	A	L					
A24	0	0	A	L					
A27	0	0	A	L					
EQ7	0	0	ME	L					
M2	0	0	ME	L					
M3	0	0	ME	L					
M4	0	0	ME	L					
M6	0	0	ME	L					
M7	-1810	-1810	ME	L					
M8	0	0	ME	L					
M9	0	0	ME	L					
M11	-30580	-30580	ME	L					
E1	145950	145950	ME	L					
E2	0	0	ME	L					
A20	0	0	A	L					
					5137770	5137770	100	59	61
C2	404130	404130	E	O					
C8	15290	0	E	O					
C10	0	0	E	O					
C14	83400	83400	E	O					
C15	166800	0	E	O					
C18	28220	28200	E	O					
C19	51700	0	E	O					
A2	0	0	A	O					
A26	565730	565730	A	O					
EQ1	10670	10670	ME	O					
EQ4	13460	13460	ME	O					
EQ6	27800	27800	ME	O					
EQ9	700	0	ME	O					
EQ11	67610	67610	ME	O					
EQ13	5000	5000	ME	O					
M1	13600	0	ME	O					
M5	1950	1950	ME	O					
					1456060	1207950	83	17	14
C3	70890	0	E	S					
C9	574620	574620	E	S					
C17	833760	833760	E	S					
A12	365570	365570	A	S					
A15	-42960	-42960	A	S					
A16	155220	155220	A	S					
A18	33960	33960	A	S					
EQ8	126490	126490	ME	S					
EQ12	24940	24940	ME	S					
E3	27800	27800	ME	S					
					2170290	2099400	97	25	25
TOT	8764120	8445120			8764120	8445120	96	100	100

VALUE ENGINEERING 1

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	5154940	5154940	A	L					
A7	0	0	A	L					
A8	0	0	A	L					
A10	-130730	-130730	A	L					
A21	0	0	A	L					
A22	0	0	A	L					
A24	0	0	A	L					
A27	0	0	A	L					
A20	0	0	A	L					
					5024210	5024210	100	57	59
A2	0	0	A	O					
A26	565730	565730	A	O					
					565730	565730	100	6	7
A12	365570	365570	A	S					
A15	-42960	-42960	A	S					
A16	155220	155220	A	S					
A18	33960	33960	A	S					
					511790	511790	100	6	6
C6	0	0	E	L					
C13	0	0	E	L					
					0	0	0	0	0
C2	404130	404130	E	O					
C8	15290	0	E	O					
C10	0	0	E	O					
C14	83400	83400	E	O					
C15	166800	0	E	O					
C18	28220	28200	E	O					
C19	51700	0	E	O					
					749540	515730	69	9	6
C3	70890	0	E	S					
C9	574620	574620	E	S					
C17	833760	833760	E	S					
					1479270	1408380	95	17	17
M2	0	0	ME	L					
M3	0	0	ME	L					
M4	0	0	ME	L					
M6	0	0	ME	L					
M7	-1810	-1810	ME	L					
M8	0	0	ME	L					
M9	0	0	ME	L					
M11	-30580	-30580	ME	L					
E1	145950	145950	ME	L					
E2	0	0	ME	L					
EQ7	0	0	ME	L					
					113560	113560	100	1	1
M1	13600	0	ME	O					
M5	1950	1950	ME	O					
EQ1	10670	10670	ME	O					
EQ4	13460	13460	ME	O					
EQ6	27800	27800	ME	O					
EQ9	700	0	ME	O					
EQ11	67610	67610	ME	O					
EQ13	5000	5000	ME	O					
					140790	126490	90	2	1
E3	27800	27800	ME	S					
EQ8	126490	126490	ME	S					
EQ12	24940	24940	ME	S					
					179230	179230	100	2	2
TOT	8764120	8445120			8764120	8445120	96	100	100

VALUE ENGINEERING 2

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	67	24	21
ENGINEERING	100	30	39
MECH&ELECT	67	47	41
TYPE			
LAYOUT	82	61	66
OMISSION	65	25	22
SPECIFICATION	73	13	13
ARCHITECTURAL			
LAYOUT	56	18	13
OMISSION	100	6	8
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	100	28	37
OMISSION	100	0	0
SPECIFICATION	100	1	1
MECH&ELECT			
LAYOUT	80	15	16
OMISSION	55	19	14
SPECIFICATION	71	12	11

VALUE ENGINEERING 2

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
L4	581000	581000	A	L					
L4	369250	0	A	L					
L9	81030	0	A	L					
L14	299750	299750	A	O					
L20	35390	35390	A	O					
					1366420	916140	67	24	21
S1	10000	10000	E	O					
S2	1619460	1619460	E	L					
S4	56000	56000	E	S					
S2	0	0	E	O					
S3	0	0	E	O					
S4	0	0	E	L					
S5	0	0	E	L					
S6	10000	10000	E	S					
					1695460	1695460	100	30	39
T1	99340	0	ME	L					
T5	75040	0	ME	L					
T6	0	0	ME	L					
M1	117000	117000	ME	L					
M2	245700	245700	ME	L					
M5	0	0	ME	L					
M6	330330	0	ME	O					
M7	63180	0	ME	O					
M8	0	0	ME	O					
M11	15600	0	ME	S					
M15	46800	46800	ME	O					
M17	30110	30110	ME	O					
E1	311000	311000	ME	L					
E2	390000	411180	ME	O					
E3	60840	0	ME	S					
E4	195000	195000	ME	S					
E5	46800	0	ME	S					
E6	228500	228500	ME	S					
E7	115440	0	ME	O					
E8	15600	0	ME	O					
E9	4700	4700	ME	L					
M1	31200	31200	ME	O					
M2	9670	9670	ME	O					
E1	0	0	ME	L					
E2	77700	77700	ME	S					
E4	74000	74000	ME	O					
E5	9500	9500	ME	L					
E7	82800	0	ME	S					
					2675850	1792060	67	47	41
TOT	5737730	4403660			5737730	4403660	77	100	100

VALUE ENGINEERING 2

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
L4	581000	581000	A	L					
L4	369250	0	A	L					
L9	81030	0	A	L					
S2	1619460	1619460	E	L					
S4	0	0	E	L					
S5	0	0	E	L					
T1	99340	0	ME	L					
T5	75040	0	ME	L					
T6	0	0	ME	L					
M1	117000	117000	ME	L					
M2	245700	245700	ME	L					
M5	0	0	ME	L					
E1	311000	311000	ME	L					
E9	4700	4700	ME	L					
E1	0	0	ME	L					
E5	9500	9500	ME	L					
					3513020	2888360	82	61	66
L14	299750	299750	A	O					
L20	35390	35390	A	O					
S1	10000	10000	E	O					
S2	0	0	E	O					
S3	0	0	E	O					
M6	330330	0	ME	O					
M7	63180	0	ME	O					
M8	0	0	ME	O					
M15	46800	46800	ME	O					
M17	30110	30110	ME	O					
E2	390000	411180	ME	O					
E7	115440	0	ME	O					
E8	15600	0	ME	O					
M1	31200	31200	ME	O					
M2	9670	9670	ME	O					
E4	74000	74000	ME	O					
					1451470	948100	65	25	22
S6	10000	10000	E	S					
S4	56000	56000	E	S					
M11	15600	0	ME	S					
E3	60840	0	ME	S					
E4	195000	195000	ME	S					
E5	46800	0	ME	S					
E6	228500	228500	ME	S					
E2	77700	77700	ME	S					
E7	82800	0	ME	S					
					773240	567200	73	13	13
TOT	5737730	4403660			5737730	4403660	77	100	100

VALUE ENGINEERING 2

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
L4	581000	581000	A	L					
L4	369250	0	A	L					
L9	81030	0	A	L					
					1031280	581000	56	18	13
L14	299750	299750	A	O					
L20	35390	35390	A	O					
					335140	335140	100	6	8
S2	1619460	1619460	E	L					
S4	0	0	E	L					
S5	0	0	E	L					
					1619460	1619460	100	28	37
S1	10000	10000	E	O					
S2	0	0	E	O					
S3	0	0	E	O					
					10000	10000	100	0	0
S6	10000	10000	E	S					
S4	56000	56000	E	S					
					66000	66000	100	1	1
T1	99340	0	ME	L					
T5	75040	0	ME	L					
T6	0	0	ME	L					
M1	117000	117000	ME	L					
M2	245700	245700	ME	L					
M5	0	0	ME	L					
E1	311000	311000	ME	L					
E9	4700	4700	ME	L					
E1	0	0	ME	L					
E5	9500	9500	ME	L					
					862280	687900	80	15	16
M6	330330	0	ME	O					
M7	63180	0	ME	O					
M8	0	0	ME	O					
M15	46800	46800	ME	O					
M17	30110	30110	ME	O					
E2	390000	411180	ME	O					
E7	115440	0	ME	O					
E8	15600	0	ME	O					
M1	31200	31200	ME	O					
M2	9670	9670	ME	O					
E4	74000	74000	ME	O					
					1106330	602960	55	19	14
M11	15600	0	ME	S					
E3	60840	0	ME	S					
E4	195000	195000	ME	S					
E5	46800	0	ME	S					
E6	228500	228500	ME	S					
E2	77700	77700	ME	S					
E7	82800	0	ME	S					
					707240	501200	71	12	11
TOT	5737730	4403660			5737730	4403660	77	100	100

VALUE ENGINEERING 5

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	82	63	66
ENGINEERING	42	11	6
MECH&ELECT	87	26	29
TYPE			
LAYOUT	73	47	44
OMISSION	100	22	28
SPECIFICATION	73	31	29
ARCHITECTURAL			
LAYOUT	89	31	35
OMISSION	100	10	3
SPECIFICATION	63	22	18
ENGINEERING			
LAYOUT	0	6	0
OMISSION	-	-	-
SPECIFICATION	100	4	6
MECH&ELECT			
LAYOUT	67	10	9
OMISSION	100	12	15
SPECIFICATION	97	4	5

VALUE ENGINEERING 5

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
P1	246750	246750	A	L					
P4	0	0	A	L					
P7	44000	44000	A	S					
P11	855000	580000	A	L					
P12	529100	529100	A	L					
P13	37500	0	A	L					
P15	125010	125010	A	L					
P16	0	0	A	L					
P18	504000	504000	A	L					
P19	92160	92160	A	L					
P20	726000	726000	A	L					
P21	600300	288000	A	L					
A1	294500	294500	A	L					
A2	62500	62500	A	O					
A5	258500	258500	A	L					
A6	536020	536020	A	O					
A7	486000	486000	A	L					
A10	17640	17640	A	L					
A11	86400	86400	A	L					
A12	25600	0	A	L					
A14	157000	157000	A	L					
A16	527160	527160	A	L					
A17	2038650	1535320	A	S					
A19	173000	173000	A	L					
CC9	162000	162000	A	S					
CC10	63000	63000	A	S					
CC11	73520	73520	A	O					
CC13	100000	100000	A	O					
CC14	26850	0	A	S					
ES1	1007930	0	A	S					
ES2	450000	450000	A	S					
ES3	21360	21360	A	O					
ES4	72940	72940	A	S					
ES5	27700	27700	A	O					
ES6	22400	22400	A	S					
ES7	725660	725660	A	O					
ES8	177700	177700	A	L					
ES9	22000	22000	A	S					
ES11	154000	154000	A	S					
ES14	356000	356000	A	O					
ES17	128350	128350	A	S					
					12014200	9825690	82	63	66
S1	1003000	0	E	L					
S10	166000	0	E	L					
S17	0	0	E	L					
S18	848500	848500	E	S					
CC3	0	0	E	L					
					2017500	848500	42	11	6

VALUE ENGINEERING 5

P5	48000	48000	ME	L					
MH1	20000	20000	ME	O					
MH2	10000	10000	ME	S					
MH3	536000	536000	ME	S					
MH5	-25000	-25000	ME	L					
MH6	75000	0	ME	L					
MH7	0	0	ME	L					
MH8	30000	0	ME	L					
M1	1067310	1067310	ME	L					
M2	453300	0	ME	L					
M4	371000	371000	ME	O					
M5	0	0	ME	S					
M10	12000	12000	ME	S					
M11	5000	5000	ME	L					
M14	200000	200000	ME	L					
M15	351000	351000	ME	O					
M16	-10000	-10000	ME	L					
M17	72000	0	ME	L					
E1	650000	650000	ME	O					
E2	150000	150000	ME	O					
E3	200000	200000	ME	O					
E4	300000	300000	ME	O					
E5	150000	150000	ME	S					
E6	45000	45000	ME	S					
E8	56500	35000	ME	S					
ES12	180000	180000	ME	O					
					4947110	4295310	87	26	29
TOT	18978810	14969500			18978810	14969500	79	100	100

VALUE ENGINEERING 5

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
P1	246750	246750	A	L					
P4	0	0	A	L					
P11	855000	580000	A	L					
P12	529100	529100	A	L					
P13	37500	0	A	L					
P15	125010	125010	A	L					
P16	0	0	A	L					
P18	504000	504000	A	L					
P19	92160	92160	A	L					
P20	726000	726000	A	L					
P21	600300	288000	A	L					
A1	294500	294500	A	L					
A5	258500	258500	A	L					
A7	486000	486000	A	L					
A10	17640	17640	A	L					
A11	86400	86400	A	L					
A12	25600	0	A	L					
A14	157000	157000	A	L					
A16	527160	527160	A	L					
A19	173000	173000	A	L					
ES8	177700	177700	A	L					
S1	1003000	0	E	L					
S10	166000	0	E	L					
S17	0	0	E	L					
CC3	0	0	E	L					
P5	48000	48000	ME	L					
MH5	-25000	-25000	ME	L					
MH6	75000	0	ME	L					
MH7	0	0	ME	L					
MH8	30000	0	ME	L					
M1	1067310	1067310	ME	L					
M2	453300	0	ME	L					
M11	5000	5000	ME	L					
M14	200000	200000	ME	L					
M16	-10000	-10000	ME	L					
M17	72000	0	ME	L					
					9003930	6554230	73	47	44

VALUE ENGINEERING 5

A2	62500	62500	A	O					
A6	536020	536020	A	O					
CC11	73520	73520	A	O					
CC13	100000	100000	A	O					
ES3	21360	21360	A	O					
ES5	27700	27700	A	O					
ES7	725660	725660	A	O					
ES14	356000	356000	A	O					
MH1	20000	20000	ME	O					
M4	371000	371000	ME	O					
M15	351000	351000	ME	O					
E1	650000	650000	ME	O					
E2	150000	150000	ME	O					
E3	200000	200000	ME	O					
E4	300000	300000	ME	O					
ES12	180000	180000	ME	O					
					4124760	4124760	100	22	28
P7	44000	44000	A	S					
A17	2038650	1535320	A	S					
CC9	162000	162000	A	S					
CC10	63000	63000	A	S					
CC14	26850	0	A	S					
ES1	1007930	0	A	S					
ES2	450000	450000	A	S					
ES4	72940	72940	A	S					
ES6	22400	22400	A	S					
ES9	22000	22000	A	S					
ES11	154000	154000	A	S					
ES17	128350	128350	A	S					
S18	848500	848500	E	S					
MH2	10000	10000	ME	S					
MH3	536000	536000	ME	S					
M5	0	0	ME	S					
M10	12000	12000	ME	S					
E5	150000	150000	ME	S					
E6	45000	45000	ME	S					
E8	56500	35000	ME	S					
					5850120	4290510	73	31	29
TOT	18978810	14969500			18978810	14969500	79	100	100

VALUE ENGINEERING 5

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
P1	246750	246750	A	L					
P4	0	0	A	L					
P11	855000	580000	A	L					
P12	529100	529100	A	L					
P13	37500	0	A	L					
P15	125010	125010	A	L					
P16	0	0	A	L					
P18	504000	504000	A	L					
P19	92160	92160	A	L					
P20	726000	726000	A	L					
P21	600300	288000	A	L					
A1	294500	294500	A	L					
A5	258500	258500	A	L					
A7	486000	486000	A	L					
A10	17640	17640	A	L					
A11	86400	86400	A	L					
A12	25600	0	A	L					
A14	157000	157000	A	L					
A16	527160	527160	A	L					
A19	173000	173000	A	L					
ES8	177700	177700	A	L					
					5919320	5268920	89	31	35
A2	62500	62500	A	O					
A6	536020	536020	A	O					
CC11	73520	73520	A	O					
CC13	100000	100000	A	O					
ES3	21360	21360	A	O					
ES5	27700	27700	A	O					
ES7	725660	725660	A	O					
ES14	356000	356000	A	O					
					1902760	1902760	100	10	13
P7	44000	44000	A	S					
A17	2038650	1535320	A	S					
CC9	162000	162000	A	S					
CC10	63000	63000	A	S					
CC14	26850	0	A	S					
ES1	1007930	0	A	S					
ES2	450000	450000	A	S					
ES4	72940	72940	A	S					
ES6	22400	22400	A	S					
ES9	22000	22000	A	S					
ES11	154000	154000	A	S					
ES17	128350	128350	A	S					
					4192120	2654010	63	22	18
S1	1003000	0	E	L					
S10	166000	0	E	L					
S17	0	0	E	L					
CC3	0	0	E	L					
					1169000	0	0	6	0

VALUE ENGINEERING 5

S18	848500	848500	E	S					
					848500	848500	100	4	6
P5	48000	48000	ME	L					
MH5	-25000	-25000	ME	L					
MH6	75000	0	ME	L					
MH7	0	0	ME	L					
MH8	30000	0	ME	L					
M1	1067310	1067310	ME	L					
M2	453300	0	ME	L					
M11	5000	5000	ME	L					
M14	200000	200000	ME	L					
M16	-10000	-10000	ME	L					
M17	72000	0	ME	L					
					1915610	1285310	67	10	9
MH1	20000	20000	ME	O					
M4	371000	371000	ME	O					
M15	351000	351000	ME	O					
E1	650000	650000	ME	O					
E2	150000	150000	ME	O					
E3	200000	200000	ME	O					
E4	300000	300000	ME	O					
ES12	180000	180000	ME	O					
					2222000	2222000	100	12	15
MH2	10000	10000	ME	S					
MH3	536000	536000	ME	S					
M5	0	0	ME	S					
M10	12000	12000	ME	S					
E5	150000	150000	ME	S					
E6	45000	45000	ME	S					
E8	56500	35000	ME	S					
					809500	788000	97	4	5
TOT	18978810	14969500			18978810	14969500	79	100	100

VALUE ENGINEERING 6

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	95	100	100
ENGINEERING	-	-	-
MECH&ELECT	0	0	0
TYPE			
LAYOUT	95	100	100
OMISSION	-	-	-
SPECIFICATION	-	-	-
ARCHITECTURAL			
LAYOUT	95	100	100
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
MECH&ELECT			
LAYOUT	0	0	0
OMISSION	-	-	-
SPECIFICATION	-	-	-

VALUE ENGINEERING 6

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	1430	0	A	L					
A2	19770	19770	A	L					
A4	1070	1070	A	L					
A5	1830	1830	A	L					
A11	760	760	A	L					
B2	2320	1580	A	L					
B4	1400	1400	A	L					
B5	2310	2310	A	L					
B6	3140	3140	A	L					
B8	2370	2370	A	L					
B9	3780	3780	A	L					
B11	10450	4110	A	L					
B12	3160	3160	A	L					
B14	2430	2430	A	L					
B15	710	710	A	L					
B16	0	0	A	L					
B17	3230	3230	A	L					
C1	13960	13960	A	L					
D1	11300	11300	A	L					
D3	4610	4610	A	L					
D4	0	0	A	L					
D6	0	0	A	L					
D7	1370	1370	A	L					
E6	0	0	A	L					
E7	0	0	A	L					
E12	1980	1980	A	L					
E13	0	0	A	L					
E14	16580	16580	A	L					
E15	590	590	A	L					
E17	1060	1060	A	L					
E18	0	0	A	L					
E19	0	0	A	L					
E20	1020	1020	A	L					
E21	0	0	A	L					
F1	1720	1720	A	L					
F3	0	0	A	L					
F4	2810	1520	A	L					
F5	0	0	A	L					
F6	2290	2290	A	L					
F7	1180	1180	A	L					
F8	0	0	A	L					
F9	6300	6300	A	L					
F10	0	0	A	L					
F11	120	120	A	L					
G1	0	0	A	L					
G2	63050	63050	A	L					
G6	0	0	A	L					
G8	0	0	A	L					
G10	0	0	A	L					
G11	0	0	A	L					
G12	0	0	A	L					
G17	0	0	A	L					
G18	0	0	A	L					
G19	0	0	A	L					
G20	0	0	A	L					
G22	0	0	A	L					
					190100	180300	95	100	100
E8	0	0	ME	L					
E9	0	0	ME	L					
E10	0	0	ME	L					
					0	0	0	0	0
TOT	190100	180300			190100	180300	95	100	100

VALUE ENGINEERING 6

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	1430	0	A	L					
A2	19770	19770	A	L					
A4	1070	1070	A	L					
A5	1830	1830	A	L					
A11	760	760	A	L					
B2	2320	1580	A	L					
B4	1400	1400	A	L					
B5	2310	2310	A	L					
B6	3140	3140	A	L					
B8	2370	2370	A	L					
B9	3780	3780	A	L					
B11	10450	4110	A	L					
B12	3160	3160	A	L					
B14	2430	2430	A	L					
B15	710	710	A	L					
B16	0	0	A	L					
B17	3230	3230	A	L					
C1	13960	13960	A	L					
D1	11300	11300	A	L					
D3	4610	4610	A	L					
D4	0	0	A	L					
D6	0	0	A	L					
D7	1370	1370	A	L					
E6	0	0	A	L					
E7	0	0	A	L					
E12	1980	1980	A	L					
E13	0	0	A	L					
E14	16580	16580	A	L					
E15	590	590	A	L					
E17	1060	1060	A	L					
E18	0	0	A	L					
E19	0	0	A	L					
E20	1020	1020	A	L					
E21	0	0	A	L					
F1	1720	1720	A	L					
F3	0	0	A	L					
F4	2810	1520	A	L					
F5	0	0	A	L					
F6	2290	2290	A	L					
F7	1180	1180	A	L					
F8	0	0	A	L					
F9	6300	6300	A	L					
F10	0	0	A	L					
F11	120	120	A	L					
G1	0	0	A	L					
G2	63050	63050	A	L					
G6	0	0	A	L					
G8	0	0	A	L					
G10	0	0	A	L					
G11	0	0	A	L					
G12	0	0	A	L					
G17	0	0	A	L					
G18	0	0	A	L					
G19	0	0	A	L					
G20	0	0	A	L					
G22	0	0	A	L					
E8	0	0	ME	L					
E9	0	0	ME	L					
E10	0	0	ME	L					
					190100	180300	95	100	100
TOT	190100	180300			190100	180300	95	100	100

VALUE ENGINEERING 6

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	1430	0	A	L					
A2	19770	19770	A	L					
A4	1070	1070	A	L					
A5	1830	1830	A	L					
A11	760	760	A	L					
B2	2320	1580	A	L					
B4	1400	1400	A	L					
B5	2310	2310	A	L					
B6	3140	3140	A	L					
B8	2370	2370	A	L					
B9	3780	3780	A	L					
B11	10450	4110	A	L					
B12	3160	3160	A	L					
B14	2430	2430	A	L					
B15	710	710	A	L					
B16	0	0	A	L					
B17	3230	3230	A	L					
C1	13960	13960	A	L					
D1	11300	11300	A	L					
D3	4610	4610	A	L					
D4	0	0	A	L					
D6	0	0	A	L					
D7	1370	1370	A	L					
E6	0	0	A	L					
E7	0	0	A	L					
E12	1980	1980	A	L					
E13	0	0	A	L					
E14	16580	16580	A	L					
E15	590	590	A	L					
E17	1060	1060	A	L					
E18	0	0	A	L					
E19	0	0	A	L					
E20	1020	1020	A	L					
E21	0	0	A	L					
F1	1720	1720	A	L					
F3	0	0	A	L					
F4	2810	1520	A	L					
F5	0	0	A	L					
F6	2290	2290	A	L					
F7	1180	1180	A	L					
F8	0	0	A	L					
F9	6300	6300	A	L					
F10	0	0	A	L					
F11	120	120	A	L					
G1	0	0	A	L					
G2	63050	63050	A	L					
G6	0	0	A	L					
G8	0	0	A	L					
G10	0	0	A	L					
G11	0	0	A	L					
G12	0	0	A	L					
G17	0	0	A	L					
G18	0	0	A	L					
G19	0	0	A	L					
G20	0	0	A	L					
G22	0	0	A	L					
					190100	180300	95	100	100
E8	0	0	ME	L					
E9	0	0	ME	L					
E10	0	0	ME	L					
					0	0	0	0	0
TOT	190100	180300			190100	180300	95	100	100

VALUE ENGINEERING 7

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	72	80	85
ENGINEERING	-	-	-
MECH&ELECT	52	20	15
TYPE			
LAYOUT	73	93	98
OMISSION	0	2	0
SPECIFICATION	19	6	2
ARCHITECTURAL			
LAYOUT	72	80	84
OMISSION	-	-	-
SPECIFICATION	100	0	0
ENGINEERING			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
MECH&ELECT			
LAYOUT	75	13	14
OMISSION	0	2	0
SPECIFICATION	17	6	1

VALUE ENGINEEING 7

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
G1	169470	169470	A	L					
G2	20000	20000	A	S					
G13	0	0	A	L					
G16	2921000	2921000	A	L					
A1	244790	244790	A	L					
A6	66410	66410	A	L					
A8	0	0	A	L					
A9	1402210	1402210	A	L					
A12	222500	222500	A	L					
A16	0	0	A	L					
A21	408480	408480	A	L					
A22	587390	293690	A	L					
A24	969100	484550	A	L					
A26	3426430	1713210	A	L					
A27	1526800	626800	A	L					
A30	0	0	A	L					
A32	1469000	0	A	L					
A34	247960	247960	A	L					
A35	1065950	1065950	A	L					
A36	246700	246700	A	L					
A40	143120	0	A	L					
A43	381490	381490	A	L					
A45	125430	125430	A	L					
A46	294110	294110	A	L					
A47	97900	97900	A	L					
A48	1375930	1375930	A	L					
A49	709170	709170	A	L					
					18121340	13117750	72	80	85

VALUE ENGINEEING 7

G18	-101600	-101600	ME	L					
A4	1793230	1793230	ME	L					
A5	219620	219620	ME	L					
MH1	0	0	ME	L					
MH2	-223520	-223520	ME	L					
MH3	0	0	ME	L					
MH5	740000	740000	ME	L					
MH6	0	0	ME	L					
MH7	0	0	ME	L					
M1	25400	0	ME	L					
M4	-114300	-114300	ME	L					
M5	0	0	ME	L					
M8	304800	0	ME	S					
M9	96250	96520	ME	S					
M11	127000	127000	ME	S					
M13	457000	0	ME	L					
M16	241300	0	ME	S					
M21	0	0	ME	L					
M22	451000	0	ME	S					
M23	381000	0	ME	O					
M24	-152400	-152400	ME	L					
M25	0	0	ME	L					
E2	254000	0	ME	L					
E6	63500	0	ME	S					
					4562280	2384550	52	20	15
TOT	22683620	15502300			22683620	15502300	68	100	100

VALUE ENGINEEING 7

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
G1	169470	169470	A	L					
G13	0	0	A	L					
G16	2921000	2921000	A	L					
A1	244790	244790	A	L					
A6	66410	66410	A	L					
A8	0	0	A	L					
A9	1402210	1402210	A	L					
A12	222500	222500	A	L					
A16	0	0	A	L					
A21	408480	408480	A	L					
A22	587390	293690	A	L					
A24	969100	484550	A	L					
A26	3426430	1713210	A	L					
A27	1526800	626800	A	L					
A30	0	0	A	L					
A32	1469000	0	A	L					
A34	247960	247960	A	L					
A35	1065950	1065950	A	L					
A36	246700	246700	A	L					
A40	143120	0	A	L					
A43	381490	381490	A	L					
A45	125430	125430	A	L					
A46	294110	294110	A	L					
A47	97900	97900	A	L					
A48	1375930	1375930	A	L					
A49	709170	709170	A	L					
G18	-101600	-101600	ME	L					
A4	1793230	1793230	ME	L					
A5	219620	219620	ME	L					
MH1	0	0	ME	L					
MH2	-223520	-223520	ME	L					
MH3	0	0	ME	L					
MH5	740000	740000	ME	L					
MH6	0	0	ME	L					
MH7	0	0	ME	L					
M1	25400	0	ME	L					
M4	-114300	-114300	ME	L					
M5	0	0	ME	L					
M13	457000	0	ME	L					
M21	0	0	ME	L					
M24	-152400	-152400	ME	L					
M25	0	0	ME	L					
E2	254000	0	ME	L					
					20998770	15258780	73	93	98
M23	381000	0	ME	O					
					381000	0	0	2	0

VALUE ENGINEEING 7

G2	20000	20000	A	S					
M8	304800	0	ME	S					
M9	96250	96520	ME	S					
M11	127000	127000	ME	S					
M16	241300	0	ME	S					
M22	451000	0	ME	S					
E6	63500	0	ME	S					
					1303850	243520	19	6	2
TOT	22683620	15502300			22683620	15502300	68	100	100

VALUE ENGINEEING 7

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
G1	169470	169470	A	L					
G13	0	0	A	L					
G16	2921000	2921000	A	L					
A1	244790	244790	A	L					
A6	66410	66410	A	L					
A8	0	0	A	L					
A9	1402210	1402210	A	L					
A12	222500	222500	A	L					
A16	0	0	A	L					
A21	408480	408480	A	L					
A22	587390	293690	A	L					
A24	969100	484550	A	L					
A26	3426430	1713210	A	L					
A27	1526800	626800	A	L					
A30	0	0	A	L					
A32	1469000	0	A	L					
A34	247960	247960	A	L					
A35	1065950	1065950	A	L					
A36	246700	246700	A	L					
A40	143120	0	A	L					
A43	381490	381490	A	L					
A45	125430	125430	A	L					
A46	294110	294110	A	L					
A47	97900	97900	A	L					
A48	1375930	1375930	A	L					
A49	709170	709170	A	L					
					18101340	13097750	72	80	84
G2	20000	20000	A	S					
					20000	20000	100	0	0
G18	-101600	-101600	ME	L					
A4	1793230	1793230	ME	L					
A5	219620	219620	ME	L					
MH1	0	0	ME	L					
MH2	-223520	-223520	ME	L					
MH3	0	0	ME	L					
MH5	740000	740000	ME	L					
MH6	0	0	ME	L					
MH7	0	0	ME	L					
M1	25400	0	ME	L					
M4	-114300	-114300	ME	L					
M5	0	0	ME	L					
M13	457000	0	ME	L					
M21	0	0	ME	L					
M24	-152400	-152400	ME	L					
M25	0	0	ME	L					
E2	254000	0	ME	L					
					2897430	2161030	75	13	14
M23	381000	0	ME	O					
					381000	0	0	2	0

VALUE ENGINEEING 7

M8	304800	0	ME	S					
M9	96250	96520	ME	S					
M11	127000	127000	ME	S					
M16	241300	0	ME	S					
M22	451000	0	ME	S					
E6	63500	0	ME	S					
					1283850	223520	17	6	1
TOT	22683620	15502300			22683620	15502300	68	100	100

VALUE ENGINEERING 9

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	0	6	0
ENGINEERING	1	31	2
MECH&ELECT	20	63	98
TYPE			
LAYOUT	58	14	65
OMISSION	6	69	35
SPECIFICATION	0	17	0
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	0	2	0
SPECIFICATION	0	4	0
ENGINEERING			
LAYOUT	0	4	0
OMISSION	1	23	2
SPECIFICATION	0	4	0
MECH&ELECT			
LAYOUT	79	10	65
OMISSION	9	44	33
SPECIFICATION	0	9	0

VALUE ENGINEERING 9

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	5040	0	A	O					
A3	1231	0	A	S					
A4	1561	0	A	S					
A6	1362	0	A	S					
A9	3509	0	A	S					
A12	983	0	A	S					
					13686	0	0	6	0
C11	3310	0	E	L					
C12	1670	0	E	L					
S5	3470	0	E	L					
C4	51354	0	E	O					
S4	483	483	E	O					
S7	397	0	E	O					
C10	2300	0	E	S					
S1	6745	0	E	S					
					69729	483	1	31	2
E4	16020	16020	ME	L					
M2	0	0	ME	L					
M4	0	0	ME	L					
M6	2390	2390	ME	L					
M9	4760	0	ME	L					
E1	13015	0	ME	O					
E3	8527	5000	ME	O					
E5	4243	4243	ME	O					
M7	71970	0	ME	O					
M1	19162	0	ME	S					
M8	210	0	ME	S					
					140297	27653	20	63	98
TOT	223712	28136			223712	28136	13	100	100

VALUE ENGINEERING 9

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C11	3310	0	E	L					
C12	1670	0	E	L					
E4	16020	16020	ME	L					
M2	0	0	ME	L					
M4	0	0	ME	L					
M6	2390	2390	ME	L					
M9	4760	0	ME	L					
S5	3470	0	E	L					
					31620	18410	58	14	65
A1	5040	0	A	O					
C4	51354	0	E	O					
E1	13015	0	ME	O					
E3	8527	5000	ME	O					
E5	4243	4243	ME	O					
M7	71970	0	ME	O					
S4	483	483	E	O					
S7	397	0	E	O					
					155029	9726	6	69	35
A3	1231	0	A	S					
A4	1561	0	A	S					
A6	1362	0	A	S					
A9	3509	0	A	S					
A12	983	0	A	S					
C10	2300	0	E	S					
M1	19162	0	ME	S					
M8	210	0	ME	S					
S1	6745	0	E	S					
					37063	0	0	17	0
TOT	223712	28136			223712	28136	13	100	100

VALUE ENGINEERING 9

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	5040	0	A	O					
					5040	0	0	2	0
A3	1231	0	A	S					
A4	1561	0	A	S					
A6	1362	0	A	S					
A9	3509	0	A	S					
A12	983	0	A	S					
					8646	0	0	4	0
C11	3310	0	E	L					
C12	1670	0	E	L					
S5	3470	0	E	L					
					8450	0	0	4	0
C4	51354	0	E	O					
S4	483	483	E	O					
S7	397	0	E	O					
					52234	483	1	23	2
C10	2300	0	E	S					
S1	6745	0	E	S					
					9045	0	0	4	0
E4	16020	16020	ME	L					
M2	0	0	ME	L					
M4	0	0	ME	L					
M6	2390	2390	ME	L					
M9	4760	0	ME	L					
					23170	18410	79	10	65
E1	13015	0	ME	O					
E3	8527	5000	ME	O					
E5	4243	4243	ME	O					
M7	71970	0	ME	O					
					97755	9243	9	44	33
M1	19162	0	ME	S					
M8	210	0	ME	S					
					19372	0	0	9	0
TOT	223712	28136			223712	28136	13	100	100

VALUE ENGINEERING 10

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	0	30	0
ENGINEERING	19	47	100
MECH&ELECT	0	23	0
TYPE			
LAYOUT	27	31	93
OMISSION	0	44	0
SPECIFICATION	3	25	7
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	0	27	0
SPECIFICATION	0	3	0
ENGINEERING			
LAYOUT	30	29	93
OMISSION	0	7	0
SPECIFICATION	6	11	7
MECH&ELECT			
LAYOUT	0	2	0
OMISSION	0	10	0
SPECIFICATION	0	11	0

VALUE ENGINEERING 10

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	48900	0	A	O					
A3	348500	0	A	O					
A5	90300	0	A	O					
A6	1468200	0	A	O					
A17	21900	0	A	S					
A18	98600	0	A	S					
A19	83800	0	A	S					
					2160200	0	0	30	0
C1	59500	0	E	S					
C7	37000	0	E	O					
C8	68100	0	E	O					
C11	17700	0	E	O					
C16	50400	0	E	S					
C19	59200	0	E	S					
C22	14400	0	E	S					
C23	26200	0	E	L					
C24	47000	47000	E	S					
SI	781500	0	E	L					
S2	165400	0	E	L					
S3	114400	0	E	O					
S6	479000	0	E	L					
S7	259500	0	E	O					
S8	318200	0	E	S					
S12	609300	609300	E	L					
S13	184300	0	E	S					
S14	0	0	E	L					
A9	82500	0	E	S					
					3373600	656300	19	47	100
A8	343800	0	ME	O					
M1	543400	0	ME	S					
M2	180500	0	ME	O					
M5	131900	0	ME	L					
M7	32600	0	ME	L					
M8	11500	0	ME	O					
M13	3900	0	ME	L					
M15	103800	0	ME	S					
M17	0	0	ME	L					
M18	10350	0	ME	O					
E3	0	0	ME	L					
E4	8000	0	ME	S					
E9	0	0	ME	L					
ES2	117000	0	ME	S					
ES3	193800	0	ME	O					
					1680550	0	0	23	0
TOT	7214350	656300			7214350	656300	9	100	100

VALUE ENGINEERING 10

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C23	26200	0	E	L					
SI	781500	0	E	L					
S2	165400	0	E	L					
S6	479000	0	E	L					
S12	609300	609300	E	L					
S14	0	0	E	L					
M5	131900	0	ME	L					
M7	32600	0	ME	L					
M13	3900	0	ME	L					
M17	0	0	ME	L					
E3	0	0	ME	L					
E9	0	0	ME	L					
					2229800	609300	27	31	93
C7	37000	0	E	O					
C8	68100	0	E	O					
C11	17700	0	E	O					
S3	114400	0	E	O					
S7	259500	0	E	O					
A2	48900	0	A	O					
A3	348500	0	A	O					
A5	90300	0	A	O					
A6	1468200	0	A	O					
A8	343800	0	ME	O					
M2	180500	0	ME	O					
M8	11500	0	ME	O					
M18	10350	0	ME	O					
ES3	193800	0	ME	O					
					3192550	0	0	44	0
C1	59500	0	E	S					
C16	50400	0	E	S					
C19	59200	0	E	S					
C22	14400	0	E	S					
C24	47000	47000	E	S					
S8	318200	0	E	S					
S13	184300	0	E	S					
A9	82500	0	E	S					
A17	21900	0	A	S					
A18	98600	0	A	S					
A19	83800	0	A	S					
M1	543400	0	ME	S					
M15	103800	0	ME	S					
E4	8000	0	ME	S					
ES2	117000	0	ME	S					
					1792000	47000	3	25	7
TOT	7214350	656300			7214350	656300	9	100	100

VALUE ENGINEERING 10

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	48900	0	A	O					
A3	348500	0	A	O					
A5	90300	0	A	O					
A6	1468200	0	A	O					
					1955900	0	0	27	0
A17	21900	0	A	S					
A18	98600	0	A	S					
A19	83800	0	A	S					
					204300	0	0	3	0
C23	26200	0	E	L					
SI	781500	0	E	L					
S2	165400	0	E	L					
S6	479000	0	E	L					
S12	609300	609300	E	L					
S14	0	0	E	L					
					2061400	609300	30	29	93
C7	37000	0	E	O					
C8	68100	0	E	O					
C11	17700	0	E	O					
S3	114400	0	E	O					
S7	259500	0	E	O					
					496700	0	0	7	0
C1	59500	0	E	S					
C16	50400	0	E	S					
C19	59200	0	E	S					
C22	14400	0	E	S					
C24	47000	47000	E	S					
S8	318200	0	E	S					
S13	184300	0	E	S					
A9	82500	0	E	S					
					815500	47000	6	11	7
M5	131900	0	ME	L					
M7	32600	0	ME	L					
M13	3900	0	ME	L					
M17	0	0	ME	L					
E3	0	0	ME	L					
E9	0	0	ME	L					
					168400	0	0	2	0
A8	343800	0	ME	O					
M2	180500	0	ME	O					
M8	11500	0	ME	O					
M18	10350	0	ME	O					
ES3	193800	0	ME	O					
					739950	0	0	10	0
M1	543400	0	ME	S					
M15	103800	0	ME	S					
E4	8000	0	ME	S					
ES2	117000	0	ME	S					
					772200	0	0	11	0
TOT	7214350	656300			7214350	656300	9	100	100

VALUE ENGINEERING 11

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	33	33	46
ENGINEERING	2	35	2
MECH&ELECT	38	32	51
TYPE			
LAYOUT	49	17	34
OMISSION	33	23	32
SPECIFICATION	14	60	34
ARCHITECTURAL			
LAYOUT	23	10	9
OMISSION	100	8	32
SPECIFICATION	8	16	5
ENGINEERING			
LAYOUT	-	-	-
OMISSION	0	2	0
SPECIFICATION	2	32	2
MECH&ELECT			
LAYOUT	84	7	25
OMISSION	0	13	0
SPECIFICATION	53	12	27

VALUE ENGINEERING 11

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
S1	15720	15720	A						
S6	5500	0	A						
A1	37570	0	A						
A9	0	0	A						
A17	9500	0	A						
C7	0	0	A						
S7	11770	11770	A						
S10	21910	21910	A						
A15	0	0	A						
A19	19860	19860	A						
S9	9150	9150	A						
A2	14760	0	A						
A4	64850	0	A						
A5	0	0	A						
A12	0	0	A						
A13	24910	0	A						
A14	0	0	A						
					235500	78410	33	33	46
S2	17590	0	E						
C14	0	0	E						
S5	1430	0	E						
C1	224960	0	E						
C3	0	0	E						
C5	3960	3960	E						
					247940	3960	2	35	2

M7	0	0	ME						
M9	0	0	ME						
M12	0	0	ME						
M13	0	0	ME						
M14	7780	0	ME						
E2	7630	7630	ME						
E3/4	10000	10000	ME						
E6***	0	0	ME						
E7	0	0	ME						
E11	24550	24550	ME						
X1	0	0	ME						
X2	0	0	ME						
M2	77960	0	ME						
X6	0	0	ME						
X7	14490	0	ME						
M5	0	0	ME						
M11	30530	30530	ME						
M15	4260	0	ME						
M17	4550	4550	ME						
M22	2550	0	ME						
E1	10010	10010	ME						
E5	28590	0	ME						
E9	4660	0	ME						
X13	0	0	ME						
					227560	87270	38	32	51
TOT	711000	169640			711000	169640	24	100	100

VALUE ENGINEERING 11

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
S1	15720	15720	A	L					
S6	5500	0	A	L					
A1	37570	0	A	L					
A9	0	0	A	L					
A17	9500	0	A	L					
C7	0	0	A	L					
M7	0	0	ME	L					
M9	0	0	ME	L					
M12	0	0	ME	L					
M13	0	0	ME	L					
M14	7780	0	ME	L					
E2	7630	7630	ME	L					
E3/4	10000	10000	ME	L					
6***	0	0	ME	L					
E7	0	0	ME	L					
E11	24550	24550	ME	L					
X1	0	0	ME	L					
X2	0	0	ME	L					
					118250	57900	49	17	34
S7	11770	11770	A	O					
S10	21910	21910	A	O					
A15	0	0	A	O					
A19	19860	19860	A	O					
S2	17590	0	E	O					
C14	0	0	E	O					
M2	77960	0	ME	O					
X6	0	0	ME	O					
X7	14490	0	ME	O					
					163580	53540	33	23	32

S9	9150	9150	A	S					
A2	14760	0	A	S					
A4	64850	0	A	S					
A5	0	0	A	S					
A12	0	0	A	S					
A13	24910	0	A	S					
A14	0	0	A	S					
S5	1430	0	E	S					
C1	224960	0	E	S					
C3	0	0	E	S					
C5	3960	3960	E	S					
M5	0	0	ME	S					
M11	30530	30530	ME	S					
M15	4260	0	ME	S					
M17	4550	4550	ME	S					
M22	2550	0	ME	S					
E1	10010	10010	ME	S					
E5	28590	0	ME	S					
E9	4660	0	ME	S					
X13	0	0	ME	S					
					429170	58200	14	60	34
TOT	711000	169640			711000	169640	24	100	100

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
S1	15720	15720	A	L					
S6	5500	0	A	L					
A1	37570	0	A	L					
A9	0	0	A	L					
A17	9500	0	A	L					
C7	0	0	A	L					
					68290	15720	23	10	9
S7	11770	11770	A	O					
S10	21910	21910	A	O					
A15	0	0	A	O					
A19	19860	19860	A	O					
					53540	53540	100	8	32
S9	9150	9150	A	S					
A2	14760	0	A	S					
A4	64850	0	A	S					
A5	0	0	A	S					
A12	0	0	A	S					
A13	24910	0	A	S					
A14	0	0	A	S					
					113670	9150	8	16	5
S2	17590	0	E	O					
C14	0	0	E	O					
					17590	0	0	2	0
S5	1430	0	E	S					
C1	224960	0	E	S					
C3	0	0	E	S					
C5	3960	3960	E	S					
					230350	3960	2	32	2
M7	0	0	ME	L					
M9	0	0	ME	L					
M12	0	0	ME	L					
M13	0	0	ME	L					
M14	7780	0	ME	L					
E2	7630	7630	ME	L					
E3/4	10000	10000	ME	L					
6***	0	0	ME	L					
E7	0	0	ME	L					
E11	24550	24550	ME	L					
X1	0	0	ME	L					
X2	0	0	ME	L					
					49960	42180	84	7	25
M2	77960	0	ME	O					
X6	0	0	ME	O					
X7	14490	0	ME	O					
					92450	0	0	13	0

M5	0	0	ME	S					
M11	30530	30530	ME	S					
M15	4260	0	ME	S					
M17	4550	4550	ME	S					
M22	2550	0	ME	S					
E1	10010	10010	ME	S					
E5	28590	0	ME	S					
E9	4660	0	ME	S					
X13	0	0	ME	S					
					85150	45090	53	12	27
TOT	711000	169640			711000	169640	24	100	100

VALUE ENGINEERING 12

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	5	37	6
ENGINEERING	84	30	91
MECH&ELECT	3	33	3
TYPE			
LAYOUT	3	29	3
OMISSION	16	8	4
SPECIFICATION	41	63	93
ARCHITECTURAL			
LAYOUT	0	2	0
OMISSION	0	2	0
SPECIFICATION	5	33	6
ENGINEERING			
LAYOUT	0	3	0
OMISSION	46	3	4
SPECIFICATION	100	24	86
MECH&ELECT			
LAYOUT	4	24	3
OMISSION	0	3	0
SPECIFICATION	0	6	0

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A6	0	0	A	L					
A8	0	0	A	L					
A10	0	0	A	L					
A12	0	0	A	L					
A16	0	0	A	L					
C26	15960	0	A	L					
C9	8160	0	E	L					
C10	0	0	E	L					
C11	0	0	E	L					
C31	18230	0	E	L					
C24	6350	6350	ME	L					
M2	172300	0	ME	L					
M11	0	0	ME	L					
M13	0	0	ME	L					
E12	2320	0	ME	L					
					223320	6350	3	29	3
A2	0	0	A	O					
A7	16210	0	A	O					
C20	1320	0	A	O					
C6	9160	9160	E	O					
C16	7330	0	E	O					
C19	3320	0	E	O					
E1	0	0	ME	O					
E3	0	0	ME	O					
E4	3100	0	ME	O					
E9	10330	0	ME	O					
E11	3160	0	ME	O					
E16	4780	0	ME	O					
					58710	9160	16	8	4
A1	0	0	A	S					
A3	35060	0	A	S					
A5	11420	0	A	S					
A11	16540	0	A	S					
A13	13690	13690	A	S					
A15	174340	0	A	S					
A20	0	0	A	S					
C5	28130	28130	E	S					
C12	86810	86810	E	S					
C13	30670	30670	E	S					
C27	37490	37490	E	S					
M9	21200	0	ME	S					
M10	13920	0	ME	S					
E5	0	0	ME	S					
E6	9630	0	ME	S					
E17	4150	0	ME	S					
					483050	196790	41	63	93
TOT	765080	212300			765080	212300	28	100	100

M9	21200	0	ME	S					
M10	13920	0	ME	S					
E5	0	0	ME	S					
E6	9630	0	ME	S					
E17	4150	0	ME	S					
					48900	0	0	6	0
TOT	765080	212300			765080	212300	28	100	100

VALUE ENGINEERING 24

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	80	72	83
ENGINEERING	44	20	13
MECH&ELECT	34	8	4
TYPE			
LAYOUT	83	70	84
OMISSION	25	3	1
SPECIFICATION	37	27	14
ARCHITECTURAL			
LAYOUT	88	63	81
OMISSION	59	1	1
SPECIFICATION	14	7	1
ENGINEERING			
LAYOUT	0	0	0
OMISSION	0	0	0
SPECIFICATION	46	20	13
MECH&ELECT			
LAYOUT	42	6	4
OMISSION	0	2	0
SPECIFICATION	-	-	-

VALUE ENGINEERING 24

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C5	8700	7000	A	S					
C10	15690	15690	A	O					
L6	145720	0	A	L					
L7	369120	369120	A	L					
L9	468390	450000	A	L					
L10	572220	570000	A	L					
A5	157700	0	A	S					
A6	9080	0	A	L					
A10	26660	26660	A	L					
B3	22210	0	A	L					
B10	13930	0	A	O					
B18	30130	30130	A	L					
D3	18040	18040	A	S					
O1	8550	7000	A	O					
O3	6430	0	A	L					
					1872570	1493640	80	72	83
C1	4960	0	E	O					
C2	4380	0	E	S					
C3	75710	75710	E	S					
C6	6250	0	E	L					
C8	156440	156440	E	S					
A3	75850	0	E	S					
A8	6280	0	E	O					
B1	146410	0	E	S					
O2	49750	0	E	S					
					526030	232150	44	20	13
B21	93330	0	ME	L					
D1	68030	68030	ME	L					
P2	40160	0	ME	O					
					201520	68030	34	8	4
TOT	2600120	1793820			2600120	1793820	69	100	100

VALUE ENGINEERING 24

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
L6	145720	0	A	L					
L7	369120	369120	A	L					
L9	468390	450000	A	L					
L10	572220	570000	A	L					
A6	9080	0	A	L					
A10	26660	26660	A	L					
B3	22210	0	A	L					
B18	30130	30130	A	L					
O3	6430	0	A	L					
C6	6250	0	E	L					
B21	93330	0	ME	L					
D1	68030	68030	ME	L					
					1817570	1513940	83	70	84
C10	15690	15690	A	O					
B10	13930	0	A	O					
O1	8550	7000	A	O					
C1	4960	0	E	O					
A8	6280	0	E	O					
P2	40160	0	ME	O					
					89570	22690	25	3	1
C5	8700	7000	A	S					
A5	157700	0	A	S					
D3	18040	18040	A	S					
C2	4380	0	E	S					
C3	75710	75710	E	S					
C8	156440	156440	E	S					
A3	75850	0	E	S					
B1	146410	0	E	S					
O2	49750	0	E	S					
					692980	257190	37	27	14
TOT	2600120	1793820			2600120	1793820	69	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
L6	145720	0	A	L					
L7	369120	369120	A	L					
L9	468390	450000	A	L					
L10	572220	570000	A	L					
A6	9080	0	A	L					
A10	26660	26660	A	L					
B3	22210	0	A	L					
B18	30130	30130	A	L					
O3	6430	0	A	L					
					1649960	1445910	88	63	81
C10	15690	15690	A	O					
B10	13930	0	A	O					
O1	8550	7000	A	O					
					38170	22690	59	1	1
C5	8700	7000	A	S					
A5	157700	0	A	S					
D3	18040	18040	A	S					
					184440	25040	14	7	1
C6	6250	0	E	L					
					6250	0	0	0	0
C1	4960	0	E	O					
A8	6280	0	E	O					
					11240	0	0	0	0
C2	4380	0	E	S					
C3	75710	75710	E	S					
C8	156440	156440	E	S					
A3	75850	0	E	S					
B1	146410	0	E	S					
O2	49750	0	E	S					
					508540	232150	46	20	13
B21	93330	0	ME	L					
D1	68030	68030	ME	L					
					161360	68030	42	6	4
P2	40160	0	ME	O					
					40160	0	0	2	0
TOT	2600120	1793820			2600120	1793820	69	100	100

VALUE ENGINEERING 26

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	40	33	19
ENGINEERING	100	23	32
MECH&ELECT	78	44	49
TYPE			
LAYOUT	64	23	21
OMISSION	95	17	23
SPECIFICATION	66	60	56
ARCHITECTURAL			
LAYOUT	45	13	8
OMISSION	46	2	1
SPECIFICATION	36	18	9
ENGINEERING			
LAYOUT	100	0	0
OMISSION	100	6	8
SPECIFICATION	99	17	24
MECH&ELECT			
LAYOUT	89	10	13
OMISSION	100	9	14
SPECIFICATION	65	25	23

VALUE ENGINEERING 26

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	14510	14510	A	L					
A2	-3770	-3770	A	L					
A6	0	0	A	L					
A7	256400	0	A	L					
A9	3730	3730	A	O					
A10	137670	137670	A	L					
A13	9470	0	A	L					
A14	15170	15170	A	L					
A15	12000	12000	A	L					
A17	75550	60000	A	S					
A20	4310	4310	A	O					
A22	14880	14880	A	O					
A25	1000	1000	A	S					
A26	22810	22810	A	S					
A28	33520	0	A	O					
A34	5260	5260	A	O					
A37	0	0	A	S					
A38	428090	0	A	S					
A39	19190	19190	A	S					
A40	0	0	A	S					
A42	38400	38400	A	L					
A44	11390	11390	A	S					
A58	117630	117630	A	S					
A61	11270	11270	A	S					
A62	1980	1980	A	S					
					1230460	487430	40	33	19
S4	0	0	E	S					
S4A	603980	603980	E	S					
S10	0	0	E	L					
S16	3500	0	E	S					
S21	0	0	E	S					
S23	17425	17425	E	S					
S32	218680	218680	E	O					
S42	0	0	E	S					
S43	-2600	-2600	E	L					
					840985	837485	100	23	32

E1	26750	26750	ME	S					
E3	62125	62125	ME	S					
E6	2150	2150	ME	S					
E11	0	0	ME	O					
E12	50000	50000	ME	O					
E13	98000	98000	ME	O					
E15	100000	100000	ME	L					
E18	0	0	ME	S					
E22	0	0	ME	O					
E23	4500	4500	ME	O					
E24	0	0	ME	S					
E25	1470	1470	ME	L					
E26	20000	20000	ME	S					
E27	0	0	ME	O					
E28	0	0	ME	S					
E29	0	0	ME	S					
E30	0	0	ME	S					
E33	20060	20060	ME	S					
E37	13000	13000	ME	S					
E38	2000	2000	ME	S					
E39	0	0	ME	S					
E41	9890	9890	ME	S					
E42	33250	33250	ME	S					
E45	5620	5620	ME	S					
E46	0	0	ME	L					
E47	-29000	-29000	ME	S					
E49	0	0	ME	L					
E50	0	0	ME	L					
E51	1900	1900	ME	L					
E52	37710	37710	ME	L					
E53	17520	17520	ME	L					
E54	18980	18980	ME	L					
E55	3980	3980	ME	L					
E56	10130	10130	ME	L					
E57	840	840	ME	L					
M2	75500	75500	ME	S					
M3	30000	0	ME	S					
M5	250000	0	ME	S					
M8	240000	240000	ME	S					
M10	30000	30000	ME	S					
M15	28000	28000	ME	O					
M16	10200	10200	ME	O					
P2	1120	1120	ME	S					
P3	5200	0	ME	S					
P7	15000	15000	ME	S					
P8	6740	6740	ME	S					
P13	11000	11000	ME	O					
P15	6870	6870	ME	S					
FP1	15000	15000	ME	S					
FP3	2500	2500	ME	S					
FP4	18000	18000	ME	S					
FP7	41160	41160	ME	O					
FP8	9580	9580	ME	O					
EL1	0	0	ME	L					
EL2	1000	1000	ME	L					
EL3	95000	95000	ME	L					
EL4	99000	50000	ME	L					
EL5	6000	6000	ME	S					
EL6	9000	0	ME	S					
EL7	19000	0	ME	S					
EL8	22000	22000	ME	S					
EL9	0	0	ME	L					
EL10	0	0	ME	L					
EL11	5000	5000	ME	S					
EL12	15000	0	ME	S					
SE1	101500	101500	ME	O					
SE2	-17000	-7000	ME	L					

SE3	-7000	-7000	ME	L					
SE4	4200	4000	ME	L					
					1659445	1292045	78	44	49
TOT	3730890	2616960			3730890	2616960	70	100	100

VALUE ENGINEERING 26

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	14510	14510	A	L					
A2	-3770	-3770	A	L					
A6	0	0	A	L					
A7	256400	0	A	L					
A10	137670	137670	A	L					
A13	9470	0	A	L					
A14	15170	15170	A	L					
A15	12000	12000	A	L					
A42	38400	38400	A	L					
S10	0	0	E	L					
S43	-2600	-2600	E	L					
E15	100000	100000	ME	L					
E25	1470	1470	ME	L					
E46	0	0	ME	L					
E49	0	0	ME	L					
E50	0	0	ME	L					
E51	1900	1900	ME	L					
E52	37710	37710	ME	L					
E53	17520	17520	ME	L					
E54	18980	18980	ME	L					
E55	3980	3980	ME	L					
E56	10130	10130	ME	L					
E57	840	840	ME	L					
EL1	0	0	ME	L					
EL2	1000	1000	ME	L					
EL3	95000	95000	ME	L					
EL4	99000	50000	ME	L					
EL9	0	0	ME	L					
EL10	0	0	ME	L					
SE2	-17000	-7000	ME	L					
SE3	-7000	-7000	ME	L					
SE4	4200	4000	ME	L					
					844980	539910	64	23	21

A9	3730	3730	A	0					
A20	4310	4310	A	0					
A22	14880	14880	A	0					
A28	33520	0	A	0					
A34	5260	5260	A	0					
S32	218680	218680	E	0					
E11	0	0	ME	0					
E12	50000	50000	ME	0					
E13	98000	98000	ME	0					
E22	0	0	ME	0					
E23	4500	4500	ME	0					
E27	0	0	ME	0					
M15	28000	28000	ME	0					
M16	10200	10200	ME	0					
P13	11000	11000	ME	0					
FP7	41160	41160	ME	0					
FP8	9580	9580	ME	0					
SE1	101500	101500	ME	0					
					634320	600800	95	17	23

A17	75550	60000	A	S					
A25	1000	1000	A	S					
A26	22810	22810	A	S					
A37	0	0	A	S					
A38	428090	0	A	S					
A39	19190	19190	A	S					
A40	0	0	A	S					
A44	11390	11390	A	S					
A58	117630	117630	A	S					
A61	11270	11270	A	S					
A62	1980	1980	A	S					
S4	0	0	E	S					
S4A	603980	603980	E	S					
S16	3500	0	E	S					
S21	0	0	E	S					
S23	17425	17425	E	S					
S42	0	0	E	S					
E1	26750	26750	ME	S					
E3	62125	62125	ME	S					
E6	2150	2150	ME	S					
E18	0	0	ME	S					
E24	0	0	ME	S					
E26	20000	20000	ME	S					
E28	0	0	ME	S					
E29	0	0	ME	S					
E30	0	0	ME	S					
E33	20060	20060	ME	S					
E37	13000	13000	ME	S					
E38	2000	2000	ME	S					
E39	0	0	ME	S					
E41	9890	9890	ME	S					
E42	33250	33250	ME	S					
E45	5620	5620	ME	S					
E47	-29000	-29000	ME	S					
M2	75500	75500	ME	S					
M3	30000	0	ME	S					
M5	250000	0	ME	S					
M8	240000	240000	ME	S					
M10	30000	30000	ME	S					
P2	1120	1120	ME	S					
P3	5200	0	ME	S					
P7	15000	15000	ME	S					
P8	6740	6740	ME	S					
P15	6870	6870	ME	S					
FP1	15000	15000	ME	S					
FP3	2500	2500	ME	S					
FP4	18000	18000	ME	S					
EL5	6000	6000	ME	S					
EL6	9000	0	ME	S					
EL7	19000	0	ME	S					
EL8	22000	22000	ME	S					
EL11	5000	5000	ME	S					
EL12	15000	0	ME	S					
					2251590	1476250	66	60	56
TOT	3730890	2616960			3730890	2616960	70	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	14510	14510	A	L					
A2	-3770	-3770	A	L					
A6	0	0	A	L					
A7	256400	0	A	L					
A10	137670	137670	A	L					
A13	9470	0	A	L					
A14	15170	15170	A	L					
A15	12000	12000	A	L					
A42	38400	38400	A	L					
					479850	213980	45	13	8
A9	3730	3730	A	O					
A20	4310	4310	A	O					
A22	14880	14880	A	O					
A28	33520	0	A	O					
A34	5260	5260	A	O					
					61700	28180	46	2	1
A17	75550	60000	A	S					
A25	1000	1000	A	S					
A26	22810	22810	A	S					
A37	0	0	A	S					
A38	428090	0	A	S					
A39	19190	19190	A	S					
A40	0	0	A	S					
A44	11390	11390	A	S					
A58	117630	117630	A	S					
A61	11270	11270	A	S					
A62	1980	1980	A	S					
					688910	245270	36	18	9
S10	0	0	E	L					
S43	-2600	-2600	E	L					
					-2600	-2600	100	0	0
S32	218680	218680	E	O					
					218680	218680	100	6	8
S4	0	0	E	S					
S4A	603980	603980	E	S					
S16	3500	0	E	S					
S21	0	0	E	S					
S23	17425	17425	E	S					
S42	0	0	E	S					
					624905	621405	99	17	24

E15	100000	100000	ME	L					
E25	1470	1470	ME	L					
E46	0	0	ME	L					
E49	0	0	ME	L					
E50	0	0	ME	L					
E51	1900	1900	ME	L					
E52	37710	37710	ME	L					
E53	17520	17520	ME	L					
E54	18980	18980	ME	L					
E55	3980	3980	ME	L					
E56	10130	10130	ME	L					
E57	840	840	ME	L					
EL1	0	0	ME	L					
EL2	1000	1000	ME	L					
EL3	95000	95000	ME	L					
EL4	99000	50000	ME	L					
EL9	0	0	ME	L					
EL10	0	0	ME	L					
SE2	-17000	-7000	ME	L					
SE3	-7000	-7000	ME	L					
SE4	4200	4000	ME	L					
					367730	328530	89	10	13
E11	0	0	ME	O					
E12	50000	50000	ME	O					
E13	98000	98000	ME	O					
E22	0	0	ME	O					
E23	4500	4500	ME	O					
E27	0	0	ME	O					
M15	28000	28000	ME	O					
M16	10200	10200	ME	O					
P13	11000	11000	ME	O					
FP7	41160	41160	ME	O					
FP8	9580	9580	ME	O					
SE1	101500	101500	ME	O					
					353940	353940	100	9	14

E1	26750	26750	ME	S					
E3	62125	62125	ME	S					
E6	2150	2150	ME	S					
E18	0	0	ME	S					
E24	0	0	ME	S					
E26	20000	20000	ME	S					
E28	0	0	ME	S					
E29	0	0	ME	S					
E30	0	0	ME	S					
E33	20060	20060	ME	S					
E37	13000	13000	ME	S					
E38	2000	2000	ME	S					
E39	0	0	ME	S					
E41	9890	9890	ME	S					
E42	33250	33250	ME	S					
E45	5620	5620	ME	S					
E47	-29000	-29000	ME	S					
M2	75500	75500	ME	S					
M3	30000	0	ME	S					
M5	250000	0	ME	S					
M8	240000	240000	ME	S					
M10	30000	30000	ME	S					
P2	1120	1120	ME	S					
P3	5200	0	ME	S					
P7	15000	15000	ME	S					
P8	6740	6740	ME	S					
P15	6870	6870	ME	S					
FP1	15000	15000	ME	S					
FP3	2500	2500	ME	S					
FP4	18000	18000	ME	S					
EL5	6000	6000	ME	S					
EL6	9000	0	ME	S					
EL7	19000	0	ME	S					
EL8	22000	22000	ME	S					
EL11	5000	5000	ME	S					
EL12	15000	0	ME	S					
					937775	609575	65	25	23
TOT	3730890	2616960			3730890	2616960	70	100	100

VALUE ENGINEERING 27

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	10	33	20
ENGINEERING	14	19	16
MECH&ELECT	21	49	64
TYPE			
LAYOUT	25	30	47
OMISSION	14	35	31
SPECIFICATION	10	35	21
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	100	0	0
SPECIFICATION	10	33	20
ENGINEERING			
LAYOUT	12	18	14
OMISSION	80	0	1
SPECIFICATION	100	0	0
MECH&ELECT			
LAYOUT	44	12	33
OMISSION	14	35	30
SPECIFICATION	12	2	1

VALUE ENGINEERING 27

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	38775	0	A	S					
2	24775	24775	A	S					
3	38950	0	A	S					
4	172630	0	A	S					
5	85747	50000	A	S					
7	1000	1000	A	S					
8	0	0	A	S					
9	99169	30000	A	S					
10	0	0	A	S					
11	75564	0	A	S					
12	1000	1000	A	O					
13	2318	1000	A	S					
19	580000	0	A	S					
					1119928	107775	10	33	20
1	70200	70200	E	L					
2	70200	0	E	L					
5	2500	2500	E	S					
6	4663	4663	E	O					
7	5533	3500	E	O					
14	9300	0	E	L					
15	0	0	E	O					
3	196650	0	E	L					
4	169850	0	E	L					
10	0	0	E	S					
12	10847	7500	E	L					
14	103700	0	E	L					
					643443	88363	14	19	16
1	4672	4672	ME	O					
2	187738	80000	ME	O					
5	249630	150000	ME	L					
7	49142	49142	ME	O					
9	3154	3154	ME	O					
10	67305	0	ME	O					
13	23339	0	ME	L					
14	21562	0	ME	O					
16	0	0	ME	O					
20	3836	0	ME	L					
26	14317	0	ME	S					
28	7516	7516	ME	S					
1	308577	0	ME	O					
2	517188	0	ME	O					
3	20880	20000	ME	O					
5	15000	5000	ME	O					
7	61027	30000	ME	L					
8	72960	0	ME	L					
9	42156	0	ME	S					
					1669999	349484	21	49	64
TOT	3433370	545622			3433370	545622	16	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	70200	70200	E	L					
2	70200	0	E	L					
14	9300	0	E	L					
5	249630	150000	ME	L					
13	23339	0	ME	L					
20	3836	0	ME	L					
7	61027	30000	ME	L					
8	72960	0	ME	L					
3	196650	0	E	L					
4	169850	0	E	L					
12	10847	7500	E	L					
14	103700	0	E	L					
					1041539	257700	25	30	47
12	1000	1000	A	O					
6	4663	4663	E	O					
7	5533	3500	E	O					
15	0	0	E	O					
1	4672	4672	ME	O					
2	187738	80000	ME	O					
7	49142	49142	ME	O					
9	3154	3154	ME	O					
10	67305	0	ME	O					
14	21562	0	ME	O					
16	0	0	ME	O					
1	308577	0	ME	O					
2	517188	0	ME	O					
3	20880	20000	ME	O					
5	15000	5000	ME	O					
					1206414	171131	14	35	31
1	38775	0	A	S					
2	24775	24775	A	S					
3	38950	0	A	S					
4	172630	0	A	S					
5	85747	50000	A	S					
7	1000	1000	A	S					
8	0	0	A	S					
9	99169	30000	A	S					
10	0	0	A	S					
11	75564	0	A	S					
13	2318	1000	A	S					
19	580000	0	A	S					
5	2500	2500	E	S					
26	14317	0	ME	S					
28	7516	7516	ME	S					
9	42156	0	ME	S					
10	0	0	E	S					
					1185417	116791	10	35	21
TOT	3433370	545622			3433370	545622	16	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
12	1000	1000	A	O					
					1000	1000	100	0	0
1	38775	0	A	S					
2	24775	24775	A	S					
3	38950	0	A	S					
4	172630	0	A	S					
5	85747	50000	A	S					
7	1000	1000	A	S					
8	0	0	A	S					
9	99169	30000	A	S					
10	0	0	A	S					
11	75564	0	A	S					
13	2318	1000	A	S					
19	580000	0	A	S					
					1118928	106775	10	33	20
1	70200	70200	E	L					
2	70200	0	E	L					
14	9300	0	E	L					
3	196650	0	E	L					
4	169850	0	E	L					
12	10847	7500	E	L					
14	103700	0	E	L					
					630747	77700	12	18	14
6	4663	4663	E	O					
7	5533	3500	E	O					
15	0	0	E	O					
					10196	8163	80	0	1
5	2500	2500	E	S					
10	0	0	E	S					
					2500	2500	100	0	0
5	249630	150000	ME	L					
13	23339	0	ME	L					
20	3836	0	ME	L					
7	61027	30000	ME	L					
8	72960	0	ME	L					
					410792	180000	44	12	33
1	4672	4672	ME	O					
2	187738	80000	ME	O					
7	49142	49142	ME	O					
9	3154	3154	ME	O					
10	67305	0	ME	O					
14	21562	0	ME	O					
16	0	0	ME	O					
1	308577	0	ME	O					
2	517188	0	ME	O					
3	20880	20000	ME	O					
5	15000	5000	ME	O					
					1195218	161968	14	35	30

26	14317	0	ME	S					
28	7516	7516	ME	S					
9	42156	0	ME	S					
					63989	7516	12	2	1
TOT	3433370	545622			3433370	545622	16	100	100

VALUE ENGINEERING 28

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	-	-	-
ENGINEERING	-	-	-
MECH&ELECT	9	100	100
TYPE			
LAYOUT	0	0	0
OMISSION	0	12	0
SPECIFICATION	10	88	100
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
MECH&ELECT			
LAYOUT	0	0	0
OMISSION	0	12	0
SPECIFICATION	10	88	100

VALUE ENGINEERING 28

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	0	0	ME	L					
5	0	0	ME	L					
6	334192	0	ME	S					
1	138279	0	ME	S					
2	161376	0	ME	S					
3	60775	0	ME	O					
4	263575	0	ME	S					
5	102700	102700	ME	S					
7	80580	0	ME	O					
16	5000	0	ME	S					
17	0	0	ME	S					
					1146477	102700	9	100	100
TOT	1146477	102700			1146477	102700	9	100	100

VALUE ENGINEERING 28

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	0	0	ME	L					
5	0	0	ME	L					
					0	0	0	0	0
3	60775	0	ME	O					
7	80580	0	ME	O					
					141355	0	0	12	0
6	334192	0	ME	S					
1	138279	0	ME	S					
2	161376	0	ME	S					
4	263575	0	ME	S					
5	102700	102700	ME	S					
16	5000	0	ME	S					
17	0	0	ME	S					
					1005122	102700	10	88	100
TOT	1146477	102700			1146477	102700	9	100	100

VALUE ENGINEERING 29

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	-	-	-
ENGINEERING	-	-	-
MECH&ELECT	17	100	100
TYPE			
LAYOUT	72	5	21
OMISSION	0	0	0
SPECIFICATION	15	95	79
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
MECH&ELECT			
LAYOUT	72	5	21
OMISSION	0	0	0
SPECIFICATION	15	95	79

VALUE ENGINEERING 29

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
E1	0	0	ME	S					
E1A	1077800	0	ME	S					
E1B	0	0	ME	S					
E2	663990	0	ME	S					
E3/7A	0	0	ME	S					
E3/7B	1774120	0	ME	S					
E6	279380	200000	ME	L					
E9	562540	562540	ME	S					
E10	281880	181880	ME	S					
E13	0	0	ME	S					
E16	771930	0	ME	S					
E21	0	0	ME	L					
E22	0	0	ME	O					
E23	0	0	ME	O					
E26	0	0	ME	S					
					5411640	944420	17	100	100
TOT	5411640	944420			5411640	944420	17	100	100

VALUE ENGINEERING 29

NO.	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
E6	279380	200000	ME	L					
E21	0	0	ME	L					
					279380	200000	72	5	21
E22	0	0	ME	O					
E23	0	0	ME	O					
					0	0	0	0	0
E1	0	0	ME	S					
E1A	1077800	0	ME	S					
E1B	0	0	ME	S					
E2	663990	0	ME	S					
E3/7A	0	0	ME	S					
E3/7B	1774120	0	ME	S					
E9	562540	562540	ME	S					
E10	281880	181880	ME	S					
E13	0	0	ME	S					
E16	771930	0	ME	S					
E26	0	0	ME	S					
					5132260	744420	15	95	79
TOT	5411640	944420			5411640	944420	17	100	100

VALUE ENGINEERING 30

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	-	-	-
ENGINEERING	44	28	54
MECH&ELECT	15	72	46
TYPE			
LAYOUT	0	11	0
OMISSION	32	15	20
SPECIFICATION	25	74	80
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	0	6	0
OMISSION	-	-	-
SPECIFICATION	55	23	54
MECH&ELECT			
LAYOUT	0	6	0
OMISSION	32	15	20
SPECIFICATION	12	51	26

VALUE ENGINEERING 30

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C1	65000	25000	E	S					
C2	26000	26000	E	S					
C5	44900	44900	E	S					
C6	212300	79000	E	S					
C8	52500	50000	E	S					
C12	8000	0	E	S					
C13	100000	0	E	L					
					508700	224900	44	28	54
E2	102300	85000	ME	S					
E3	558700	0	ME	S					
E4	194000	0	ME	S					
E5	65500	22000	ME	S					
E10	107100	0	ME	L					
E11	84500	84500	ME	O					
E12	181600	0	ME	O					
					1293700	191500	15	72	46
TOT	1802400	416400			1802400	416400	23	100	100

VALUE ENGINEERING 30

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C13	100000	0	E	L					
E10	107100	0	ME	L					
					207100	0	0	11	0
E11	84500	84500	ME	O					
E12	181600	0	ME	O					
					266100	84500	32	15	20
C1	65000	25000	E	S					
C2	26000	26000	E	S					
C5	44900	44900	E	S					
C6	212300	79000	E	S					
C8	52500	50000	E	S					
C12	8000	0	E	S					
E2	102300	85000	ME	S					
E3	558700	0	ME	S					
E4	194000	0	ME	S					
E5	65500	22000	ME	S					
					1329200	331900	25	74	80
TOT	1802400	416400			1802400	416400	23	100	100

VALUE ENGINEERING 30

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C13	100000	0	E	L					
					100000	0	0	6	0
C1	65000	25000	E	S					
C2	26000	26000	E	S					
C5	44900	44900	E	S					
C6	212300	79000	E	S					
C8	52500	50000	E	S					
C12	8000	0	E	S					
					408700	224900	55	23	54
E10	107100	0	ME	L					
					107100	0	0	6	0
E11	84500	84500	ME	O					
E12	181600	0	ME	O					
					266100	84500	32	15	20
E2	102300	85000	ME	S					
E3	558700	0	ME	S					
E4	194000	0	ME	S					
E5	65500	22000	ME	S					
					920500	107000	12	51	26
TOT	1802400	416400			1802400	416400	23	100	100

VALUE ENGINEERING 31

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	100	4	12
ENGINEERING	25	84	67
MECH&ELECT	52	13	21
TYPE			
LAYOUT	100	5	17
OMISSION	16	69	35
SPECIFICATION	58	25	48
ARCHITECTURAL			
LAYOUT	100	4	12
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	-	-	-
OMISSION	15	62	30
SPECIFICATION	51	22	36
MECH&ELECT			
LAYOUT	100	1	5
OMISSION	20	8	5
SPECIFICATION	98	4	12

VALUE ENGINEERING 31

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	64000	64000	A	L					
A1.1	0	0	A	L					
					64000	64000	100	4	12
S1	22780	0	E	O					
S2	167770	153000	E	O					
S3	366256	0	E	O					
S3.1	0	0	E	O					
S3.2	0	0	E	O					
S4	19404	10000	E	S					
S5	22094	22094	E	S					
S6	5604	5604	E	O					
S7	36453	0	E	S					
S8	34633	0	E	O					
S9	2925	0	E	S					
S10	128719	0	E	O					
S11	23965	0	E	S					
S12	46670	0	E	S					
S13	109520	0	E	O					
S14	79750	0	E	O					
S15	114426	0	E	O					
S16	14375	1000	E	S					
S17	14810	0	E	O					
S18	200000	155000	E	S					
					1410154	346698	25	84	67
1	3542	0	ME	O					
2	1371	0	ME	S					
1	88228	0	ME	O					
2	35500	25500	ME	O					
3	60000	60000	ME	S					
4	24950	24950	ME	L					
					213591	110450	52	13	21
TOT	1687745	521148			1687745	521148	31	100	100

VALUE ENGINEERING 31

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	64000	64000	A	L					
A1.1	0	0	A	L					
4	24950	24950	ME	L					
					88950	88950	100	5	17
S1	22780	0	E	O					
S2	167770	153000	E	O					
S3	366256	0	E	O					
S3.1	0	0	E	O					
S3.2	0	0	E	O					
S6	5604	5604	E	O					
S8	34633	0	E	O					
S10	128719	0	E	O					
S13	109520	0	E	O					
S14	79750	0	E	O					
S15	114426	0	E	O					
S17	14810	0	E	O					
1	3542	0	ME	O					
1	88228	0	ME	O					
2	35500	25500	ME	O					
					1171538	184104	16	69	35
S4	19404	10000	E	S					
S5	22094	22094	E	S					
S7	36453	0	E	S					
S9	2925	0	E	S					
S11	23965	0	E	S					
S12	46670	0	E	S					
S16	14375	1000	E	S					
S18	200000	155000	E	S					
2	1371	0	ME	S					
3	60000	60000	ME	S					
					427257	248094	58	25	48
TOT	1687745	521148			1687745	521148	31	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	64000	64000	A	L					
A1.1	0	0	A	L					
					64000	64000	100	4	12
S1	22780	0	E	O					
S2	167770	153000	E	O					
S3	366256	0	E	O					
S3.1	0	0	E	O					
S3.2	0	0	E	O					
S6	5604	5604	E	O					
S8	34633	0	E	O					
S10	128719	0	E	O					
S13	109520	0	E	O					
S14	79750	0	E	O					
S15	114426	0	E	O					
S17	14810	0	E	O					
					1044268	158604	15	62	30
S4	19404	10000	E	S					
S5	22094	22094	E	S					
S7	36453	0	E	S					
S9	2925	0	E	S					
S11	23965	0	E	S					
S12	46670	0	E	S					
S16	14375	1000	E	S					
S18	200000	155000	E	S					
					365886	188094	51	22	36
4	24950	24950	ME	L					
					24950	24950	100	1	5
1	3542	0	ME	O					
1	88228	0	ME	O					
2	35500	25500	ME	O					
					127270	25500	20	8	5
2	1371	0	ME	S					
3	60000	60000	ME	S					
					61371	60000	98	4	12
TOT	1687745	521148			1687745	521148	31	100	100

VALUE ENGINEERING 32

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	-	-	-
ENGINEERING	4	2	1
MECH&ELECT	11	98	99
TYPE			
LAYOUT	5	22	10
OMISSION	19	22	39
SPECIFICATION	10	56	51
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	-	-	-
OMISSION	0	2	0
SPECIFICATION	100	0	1
MECH&ELECT			
LAYOUT	5	22	10
OMISSION	20	20	39
SPECIFICATION	10	56	50

VALUE ENGINEERING 32

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
S1	37325	0	E	O					
S2	26342	0	E	O					
S2.1	0	0	E	O					
S2.2	611	611	E	S					
S3	2273	2273	E	S					
					66551	2884	4	2	1
M1	728851	0	ME	L					
M2	451600	0	ME	S					
M2.1	0	0	ME	S					
M3	220048	0	ME	O					
M3.1	0	0	ME	L					
M4	189222	0	ME	S					
M5	170610	170610	ME	S					
M6	189222	0	ME	S					
M7	84566	0	ME	S					
M8	44279	44279	ME	L					
M9	36278	0	ME	S					
M10	39928	25000	ME	S					
M11	31083	0	ME	S					
M12	18189	18189	ME	S					
M13	1459	0	ME	O					
M14	41350	0	ME	O					
M15	43590	43590	ME	O					
M16	34086	34086	ME	O					
M17	252344	0	ME	S					
M17.1	27315	2731	ME	S					
M18	3621	0	ME	S					
M19	106603	35500	ME	O					
M20	206639	0	ME	O					
M21	31811	0	ME	S					
M22	479000	0	ME	S					
M22.1	0	0	ME	O					
M23	53000	0	ME	O					
M24	34151	0	ME	O					
M25	58297	58297	ME	O					
M26	275000	0	ME	S					
E1	89494	0	ME	L					
E2	66519	0	ME	L					
E3	34649	0	ME	O					
E4	10044	0	ME	O					
E5	10442	2000	ME	S					
E6	6593	0	ME	S					
					4069883	434282	11	98	99
TOT	4136434	437166			4136434	437166	11	100	100

VALUE ENGINEERING 32

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
M1	728851	0	ME	L					
M3.1	0	0	ME	L					
M8	44279	44279	ME	L					
E1	89494	0	ME	L					
E2	66519	0	ME	L					
					929143	44279	5	22	10
S1	37325	0	E	O					
S2	26342	0	E	O					
S2.1	0	0	E	O					
M3	220048	0	ME	O					
M13	1459	0	ME	O					
M14	41350	0	ME	O					
M15	43590	43590	ME	O					
M16	34086	34086	ME	O					
M19	106603	35500	ME	O					
M20	206639	0	ME	O					
M22.1	0	0	ME	O					
M23	53000	0	ME	O					
M24	34151	0	ME	O					
M25	58297	58297	ME	O					
E3	34649	0	ME	O					
E4	10044	0	ME	O					
					907583	171473	19	22	39
S2.2	611	611	E	S					
S3	2273	2273	E	S					
M2	451600	0	ME	S					
M2.1	0	0	ME	S					
M4	189222	0	ME	S					
M5	170610	170610	ME	S					
M6	189222	0	ME	S					
M7	84566	0	ME	S					
M9	36278	0	ME	S					
M10	39928	25000	ME	S					
M11	31083	0	ME	S					
M12	18189	18189	ME	S					
M17	252344	0	ME	S					
M17.1	27315	2731	ME	S					
M18	3621	0	ME	S					
M21	31811	0	ME	S					
M22	479000	0	ME	S					
M26	275000	0	ME	S					
E5	10442	2000	ME	S					
E6	6593	0	ME	S					
					2299708	221414	10	56	51
TOT	4136434	437166			4136434	437166	11	100	100

VALUE ENGINEERING 32

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
S1	37325	0	E	O					
S2	26342	0	E	O					
S2.1	0	0	E	O					
					63667	0	0	2	0
S2.2	611	611	E	S					
S3	2273	2273	E	S					
					2884	2884	100	0	1
M1	728851	0	ME	L					
M3.1	0	0	ME	L					
M8	44279	44279	ME	L					
E1	89494	0	ME	L					
E2	66519	0	ME	L					
					929143	44279	5	22	10
M3	220048	0	ME	O					
M13	1459	0	ME	O					
M14	41350	0	ME	O					
M15	43590	43590	ME	O					
M16	34086	34086	ME	O					
M19	106603	35500	ME	O					
M20	206639	0	ME	O					
M22.1	0	0	ME	O					
M23	53000	0	ME	O					
M24	34151	0	ME	O					
M25	58297	58297	ME	O					
E3	34649	0	ME	O					
E4	10044	0	ME	O					
					843916	171473	20	20	39
M2	451600	0	ME	S					
M2.1	0	0	ME	S					
M4	189222	0	ME	S					
M5	170610	170610	ME	S					
M6	189222	0	ME	S					
M7	84566	0	ME	S					
M9	36278	0	ME	S					
M10	39928	25000	ME	S					
M11	31083	0	ME	S					
M12	18189	18189	ME	S					
M17	252344	0	ME	S					
M17.1	27315	2731	ME	S					
M18	3621	0	ME	S					
M21	31811	0	ME	S					
M22	479000	0	ME	S					
M26	275000	0	ME	S					
E5	10442	2000	ME	S					
E6	6593	0	ME	S					
					2296824	218530	10	56	50
TOT	4136434	437166			4136434	437166	11	100	100

VALUE ENGINEERING 33

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	46	13	29
ENGINEERING	18	16	14
MECH&ELECT	16	71	57
TYPE			
LAYOUT	28	33	46
OMISSION	51	15	36
SPECIFICATION	7	53	18
ARCHITECTURAL			
LAYOUT	22	6	7
OMISSION	77	5	19
SPECIFICATION	34	2	3
ENGINEERING			
LAYOUT	8	13	5
OMISSION	7	1	0
SPECIFICATION	87	2	9
MECH&ELECT			
LAYOUT	51	14	34
OMISSION	39	9	17
SPECIFICATION	2	48	6

VALUE ENGINEERING 33

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	0	0	A	S					
A5A	45426	17914	A	L					
A6A	6097	6097	A	O					
A7A	3853	0	A	S					
A8A	8100	8100	A	S					
A9A	13037	0	A	S					
A11A	4956	4956	A	S					
A13A	30621	10207	A	L					
A15A	73069	0	A	L					
A20	0	0	A	L					
A2	0	0	A	S					
A7B	2069	0	A	S					
A8B	5311	5311	A	S					
A9B	10753	0	A	S					
A18B	5503	0	A	S					
M20A	6912	6912	A	L					
C12A	128000	97000	A	O					
					343707	156497	46	13	29
S1A	29035	29035	E	S					
S2A	0	0	E	L					
S5A	296484	0	E	L					
S6A	3993	0	E	S					
S8	0	0	E	S					
CIA	30000	20000	E	L					
C2A	12422	2000	E	L					
C3A	4300	4300	E	L					
C4A	10800	0	E	O					
C5A	3400	1700	E	S					
C6A	9700	9700	E	S					
C8A	3900	1300	E	S					
C9A	4800	4800	E	S					
C10A	2700	0	E	O					
C13A	0	0	E	S					
C17A	0	1000	E	O					
					411534	73835	18	16	14

M2A	42894	42894	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M12A	168145	0	ME	S					
M13A	13839	0	ME	S					
M17A	13799	13799	ME	L					
M18A	63568	0	ME	L					
M21A	166012	0	ME	S					
M23A	161310	0	ME	S					
M25	0	0	ME	L					
M26A	51649	51649	ME	L					
M27A	23556	23556	ME	L					
M28A	7976	7976	ME	L					
M30A	94514	0	ME	S					
M33A	117421	0	ME	S					
M24	0	0	ME	S					
M32	0	0	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M12B	168511	0	ME	S					
M17B	5560	5560	ME	L					
M18B	52944	0	ME	L					
M23B	119854	0	ME	S					
M25	0	0	ME	L					
M26B	45760	0	ME	L					
M24	0	0	ME	S					
M27B	29569	29569	ME	L					
M28B	6381	6381	ME	L					
M30B	95419	0	ME	S					
M33B	111157	0	ME	S					
M35B	11102	0	ME	L					
E1A	6330	3115	ME	S					
E2A	8694	4349	ME	S					
E3A	14175	14175	ME	S					
E4A	5090	5090	ME	O					
E5A	58960	5896	ME	O					
E6A	38030	7600	ME	O					
E7A	31408	31408	ME	O					
E8	0	0	ME	S					
E9	0	0	ME	L					
E1B	2400	0	ME	S					
E3B	8424	8424	ME	S					
E5B	35240	3524	ME	O					
E6B	31691	6400	ME	O					
E7B	29206	29206	ME	O					
E9	0	0	ME	L					
					1840588	300571	16	71	57
TOT	2595829	530903			2595829	530903	20	100	100

VALUE ENGINEERING 33

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5A	45426	17914	A	L					
A13A	30621	10207	A	L					
A15A	73069	0	A	L					
A20	0	0	A	L					
M20A	6912	6912	A	L					
S2A	0	0	E	L					
S5A	296484	0	E	L					
CIA	30000	20000	E	L					
C2A	12422	2000	E	L					
C3A	4300	4300	E	L					
M2A	42894	42894	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M17A	13799	13799	ME	L					
M18A	63568	0	ME	L					
M25	0	0	ME	L					
M26A	51649	51649	ME	L					
M27A	23556	23556	ME	L					
M28A	7976	7976	ME	L					
M32	0	0	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M17B	5560	5560	ME	L					
M18B	52944	0	ME	L					
M25	0	0	ME	L					
M26B	45760	0	ME	L					
M27B	29569	29569	ME	L					
M28B	6381	6381	ME	L					
M35B	11102	0	ME	L					
E9	0	0	ME	L					
E9	0	0	ME	L					
					853992	242717	28	33	46
A6A	6097	6097	A	O					
C12A	128000	97000	A	O					
C4A	10800	0	E	O					
C10A	2700	0	E	O					
C17A	0	1000	E	O					
E4A	5090	5090	ME	O					
E5A	58960	5896	ME	O					
E6A	38030	7600	ME	O					
E7A	31408	31408	ME	O					
E5B	35240	3524	ME	O					
E6B	31691	6400	ME	O					
E7B	29206	29206	ME	O					
					377222	193221	51	15	36

A2	0	0	A	S					
A7A	3853	0	A	S					
A8A	8100	8100	A	S					
A9A	13037	0	A	S					
A11A	4956	4956	A	S					
A2	0	0	A	S					
A7B	2069	0	A	S					
A8B	5311	5311	A	S					
A9B	10753	0	A	S					
A18B	5503	0	A	S					
S1A	29035	29035	E	S					
S6A	3993	0	E	S					
S8	0	0	E	S					
C5A	3400	1700	E	S					
C6A	9700	9700	E	S					
C8A	3900	1300	E	S					
C9A	4800	4800	E	S					
C13A	0	0	E	S					
M12A	168145	0	ME	S					
M13A	13839	0	ME	S					
M21A	166012	0	ME	S					
M23A	161310	0	ME	S					
M30A	94514	0	ME	S					
M33A	117421	0	ME	S					
M24	0	0	ME	S					
M12B	168511	0	ME	S					
M23B	119854	0	ME	S					
M24	0	0	ME	S					
M30B	95419	0	ME	S					
M33B	111157	0	ME	S					
E1A	6330	3115	ME	S					
E2A	8694	4349	ME	S					
E3A	14175	14175	ME	S					
E8	0	0	ME	S					
E1B	2400	0	ME	S					
E3B	8424	8424	ME	S					
					1364615	94965	7	53	18
TOT	2595829	530903			2595829	530903	20	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5A	45426	17914	A	L					
A13A	30621	10207	A	L					
A15A	73069	0	A	L					
A20	0	0	A	L					
M20A	6912	6912	A	L					
					156028	35033	22	6	7
A6A	6097	6097	A	O					
C12A	128000	97000	A	O					
					134097	103097	77	5	19
A2	0	0	A	S					
A7A	3853	0	A	S					
A8A	8100	8100	A	S					
A9A	13037	0	A	S					
A11A	4956	4956	A	S					
A2	0	0	A	S					
A7B	2069	0	A	S					
A8B	5311	5311	A	S					
A9B	10753	0	A	S					
A18B	5503	0	A	S					
					53582	18367	34	2	3
S2A	0	0	E	L					
S5A	296484	0	E	L					
ClA	30000	20000	E	L					
C2A	12422	2000	E	L					
C3A	4300	4300	E	L					
					343206	26300	8	13	5
C4A	10800	0	E	O					
C10A	2700	0	E	O					
C17A	0	1000	E	O					
					13500	1000	7	1	0
S1A	29035	29035	E	S					
S6A	3993	0	E	S					
S8	0	0	E	S					
C5A	3400	1700	E	S					
C6A	9700	9700	E	S					
C8A	3900	1300	E	S					
C9A	4800	4800	E	S					
C13A	0	0	E	S					
					54828	47535	87	2	9
M2A	42894	42894	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M17A	13799	13799	ME	L					
M18A	63568	0	ME	L					
M25	0	0	ME	L					
M26A	51649	51649	ME	L					
M27A	23556	23556	ME	L					
M28A	7976	7976	ME	L					
M32	0	0	ME	L					
M5	0	0	ME	L					
M6	0	0	ME	L					
M7	0	0	ME	L					
M10	0	0	ME	L					
M17B	5560	5560	ME	L					
M18B	52944	0	ME	L					
M25	0	0	ME	L					
M26B	45760	0	ME	L					
M27B	29569	29569	ME	L					
M28B	6381	6381	ME	L					
M35B	11102	0	ME	L					
E9	0	0	ME	L					
E9	0	0	ME	L					
					354758	181384	51	14	34

E4A	5090	5090	ME	O					
E5A	58960	5896	ME	O					
E6A	38030	7600	ME	O					
E7A	31408	31408	ME	O					
E5B	35240	3524	ME	O					
E6B	31691	6400	ME	O					
E7B	29206	29206	ME	O					
					229625	89124	39	9	17
M12A	168145	0	ME	S					
M13A	13839	0	ME	S					
M21A	166012	0	ME	S					
M23A	161310	0	ME	S					
M30A	94514	0	ME	S					
M33A	117421	0	ME	S					
M24	0	0	ME	S					
M12B	168511	0	ME	S					
M23B	119854	0	ME	S					
M24	0	0	ME	S					
M30B	95419	0	ME	S					
M33B	111157	0	ME	S					
E1A	6330	3115	ME	S					
E2A	8694	4349	ME	S					
E3A	14175	14175	ME	S					
E8	0	0	ME	S					
E1B	2400	0	ME	S					
E3B	8424	8424	ME	S					
					1256205	30063	2	48	6
TOT	2595829	530903			2595829	531903	20	100	100

VALUE ENGINEERING 34

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	28	31	51
ENGINEERING	33	19	37
MECH&ELECT	4	50	11
TYPE			
LAYOUT	45	22	59
OMISSION	9	8	4
SPECIFICATION	9	69	37
ARCHITECTURAL			
LAYOUT	48	20	56
OMISSION	0	7	0
SPECIFICATION	-17	4	-4
ENGINEERING			
LAYOUT	34	2	3
OMISSION	45	1	1
SPECIFICATION	32	17	33
MECH&ELECT			
LAYOUT	0	1	0
OMISSION	45	1	3
SPECIFICATION	3	48	9

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	59950	0	A	O					
A2	137752	0	A	O					
A3	94208	0	A	S					
A4	14600	14600	A	L					
A5	363924	181962	A	L					
A6	118932	118932	A	L					
A7	20980	5342	A	L					
A8	4608	0	A	S					
A9	156308	0	A	L					
A10	74910	0	A	S					
A20	30000	0	A	O					
A11	0	0	A	L					
A12	-700	-700	A	L					
A13	0	0	A	S					
A14	0	0	A	L					
A15	1272	1272	A	L					
A16	0	0	A	L					
A17	0	0	A	L					
A18	0	0	A	L					
A19	0	0	A	O					
A21	0	0	A	O					
A22	0	0	A	L					
A23	0	0	A	S					
A25	-26800	-26800	A	S					
A26	-780	-780	A	L					
A27	0	0	A	O					
A28	1325	1325	A	S					
					1050489	295153	28	31	51
C1	34880	34880	E	S					
C3	56670	0	E	S					
C12	13240	3310	E	O					
C14	3810	3810	E	S					
C19	4656	4656	E	O					
C17	0	0	E	L					
C18	0	0	E	L					
S1	17100	0	E	S					
S2	137000	137000	E	S					
S3	217800	0	E	S					
S5	58600	0	E	S					
S6	23600	19000	E	L					
S7	0	0	E	L					
S8	33000	0	E	L					
S9	0	0	E	S					
S10	29200	6000	E	S					
S11	5600	5600	E	S					
S13	0	0	E	L					
S14	0	0	E	S					
S15	23600	0	E	S					
					658756	214256	33	19	37

VALUE ENGINEERING 34

H1	24272	16000	ME	S					
H2	3724	3724	ME	O					
H3	28784	0	ME	S					
H6	679998	0	ME	S					
H8	4080	0	ME	S					
H9	2140	0	ME	L					
H13	13592	0	ME	L					
H20	773352	0	ME	S					
H4	0	0	ME	L					
H7	0	0	ME	L					
H10	0	0	ME	L					
H11	0	0	ME	L					
H14	0	0	ME	L					
H15	0	0	ME	L					
H16	0	0	ME	L					
H17	0	0	ME	L					
H18	0	0	ME	L					
H19	0	0	ME	L					
P2	8042	8042	ME	O					
P3	0	0	ME	L					
P4	0	0	ME	L					
P5	0	0	ME	L					
P6	0	0	ME	O					
P7	0	0	ME	O					
E1	8246	0	ME	L					
E2	19336	0	ME	O					
E3	7317	0	ME	L					
E4	24752	24752	ME	S					
E5	4282	4282	ME	O					
E6	10298	0	ME	S					
E7	3970	0	ME	S					
E9	2220	0	ME	S					
E12	37040	0	ME	S					
E10	0	0	ME	L					
F2	16908	0	ME	S					
F3	8454	8454	ME	S					
					1680807	65254	4	50	11
TOT	3390052	574663			3390052	574663	17	100	100

VALUE ENGINEERING 34

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A4	14600	14600	A	L					
A5	363924	181962	A	L					
A6	118932	118932	A	L					
A7	20980	5342	A	L					
A9	156308	0	A	L					
A11	0	0	A	L					
A12	-700	-700	A	L					
A14	0	0	A	L					
A15	1272	1272	A	L					
A16	0	0	A	L					
A17	0	0	A	L					
A18	0	0	A	L					
A22	0	0	A	L					
A26	-780	-780	A	L					
C17	0	0	E	L					
C18	0	0	E	L					
S6	23600	19000	E	L					
S7	0	0	E	L					
S8	33000	0	E	L					
S13	0	0	E	L					
H9	2140	0	ME	L					
H13	13592	0	ME	L					
H4	0	0	ME	L					
H7	0	0	ME	L					
H10	0	0	ME	L					
H11	0	0	ME	L					
H14	0	0	ME	L					
H15	0	0	ME	L					
H16	0	0	ME	L					
H17	0	0	ME	L					
H18	0	0	ME	L					
H19	0	0	ME	L					
P3	0	0	ME	L					
P4	0	0	ME	L					
P5	0	0	ME	L					
E1	8246	0	ME	L					
E3	7317	0	ME	L					
E10	0	0	ME	L					
					762431	339628	45	22	59

A1	59950	0	A	O					
A2	137752	0	A	O					
A20	30000	0	A	O					
A19	0	0	A	O					
A21	0	0	A	O					
A27	0	0	A	O					
C12	13240	3310	E	O					
C19	4656	4656	E	O					
H2	3724	3724	ME	O					
P2	8042	8042	ME	O					
P6	0	0	ME	O					
P7	0	0	ME	O					
E2	19336	0	ME	O					
E5	4282	4282	ME	O					
					280982	24014	9	8	4
A3	94208	0	A	S					
A8	4608	0	A	S					
A10	74910	0	A	S					
A13	0	0	A	S					
A23	0	0	A	S					
A25	-26800	-26800	A	S					
A28	1325	1325	A	S					
C1	34880	34880	E	S					
C3	56670	0	E	S					
C14	3810	3810	E	S					
S1	17100	0	E	S					
S2	137000	137000	E	S					
S3	217800	0	E	S					
S5	58600	0	E	S					
S9	0	0	E	S					
S10	29200	6000	E	S					
S11	5600	5600	E	S					
S14	0	0	E	S					
S15	23600	0	E	S					
H1	24272	16000	ME	S					
H3	28784	0	ME	S					
H6	679998	0	ME	S					
H8	4080	0	ME	S					
H20	773352	0	ME	S					
E4	24752	24752	ME	S					
E6	10298	0	ME	S					
E7	3970	0	ME	S					
E9	2220	0	ME	S					
E12	37040	0	ME	S					
F2	16908	0	ME	S					
F3	8454	8454	ME	S					
					2346639	211021	9	69	37
TOT	3390052	574663			3390052	574663	17	100	100

VALUE ENGINEERING 34

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A4	14600	14600	A	L					
A5	363924	181962	A	L					
A6	118932	118932	A	L					
A7	20980	5342	A	L					
A9	156308	0	A	L					
A11	0	0	A	L					
A12	-700	-700	A	L					
A14	0	0	A	L					
A15	1272	1272	A	L					
A16	0	0	A	L					
A17	0	0	A	L					
A18	0	0	A	L					
A22	0	0	A	L					
A26	-780	-780	A	L					
					674536	320628	48	20	56
A1	59950	0	A	O					
A2	137752	0	A	O					
A20	30000	0	A	O					
A19	0	0	A	O					
A21	0	0	A	O					
A27	0	0	A	O					
					227702	0	0	7	0
A3	94208	0	A	S					
A8	4608	0	A	S					
A10	74910	0	A	S					
A13	0	0	A	S					
A23	0	0	A	S					
A25	-26800	-26800	A	S					
A28	1325	1325	A	S					
					148251	-25475	-17	4	-4

C17	0	0	E	L					
C18	0	0	E	L					
S6	23600	19000	E	L					
S7	0	0	E	L					
S8	33000	0	E	L					
S13	0	0	E	L					
					56600	19000	34	2	3
C12	13240	3310	E	O					
C19	4656	4656	E	O					
					17896	7966	45	1	1
C1	34880	34880	E	S					
C3	56670	0	E	S					
C14	3810	3810	E	S					
S1	17100	0	E	S					
S2	137000	137000	E	S					
S3	217800	0	E	S					
S5	58600	0	E	S					
S9	0	0	E	S					
S10	29200	6000	E	S					
S11	5600	5600	E	S					
S14	0	0	E	S					
S15	23600	0	E	S					
					584260	187290	32	17	33

H9	2140	0	ME	L					
H13	13592	0	ME	L					
H4	0	0	ME	L					
H7	0	0	ME	L					
H10	0	0	ME	L					
H11	0	0	ME	L					
H14	0	0	ME	L					
H15	0	0	ME	L					
H16	0	0	ME	L					
H17	0	0	ME	L					
H18	0	0	ME	L					
H19	0	0	ME	L					
P3	0	0	ME	L					
P4	0	0	ME	L					
P5	0	0	ME	L					
E1	8246	0	ME	L					
E3	7317	0	ME	L					
E10	0	0	ME	L					
					31295	0	0	1	0
H2	3724	3724	ME	O					
P2	8042	8042	ME	O					
P6	0	0	ME	O					
P7	0	0	ME	O					
E2	19336	0	ME	O					
E5	4282	4282	ME	O					
					35384	16048	45	1	3
H1	24272	16000	ME	S					
H3	28784	0	ME	S					
H6	679998	0	ME	S					
H8	4080	0	ME	S					
H20	773352	0	ME	S					
E4	24752	24752	ME	S					
E6	10298	0	ME	S					
E7	3970	0	ME	S					
E9	2220	0	ME	S					
E12	37040	0	ME	S					
F2	16908	0	ME	S					
F3	8454	8454	ME	S					
					1614128	49206	3	48	9
TOT	3390052	574663			3390052	574663	17	100	100

VALUE ENGINEERING 35

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	31	40	34
ENGINEERING	12	15	5
MECH&ELECT	50	45	61
TYPE			
LAYOUT	26	27	19
OMISSION	59	29	46
SPECIFICATION	30	45	36
ARCHITECTURAL			
LAYOUT	0	14	0
OMISSION	66	7	13
SPECIFICATION	40	19	21
ENGINEERING			
LAYOUT	0	3	0
OMISSION	18	7	3
SPECIFICATION	12	6	2
MECH&ELECT			
LAYOUT	66	10	19
OMISSION	73	15	29
SPECIFICATION	25	20	14

VALUE ENGINEERING 35

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
41	39701	0	A	L					
42	129179	0	A	L					
6	0	0	A	O					
17	10766	0	A	O					
27	14452	0	A	O					
35	0	0	A	O					
46	65421	60000	A	O					
1.1	16292	0	A	S					
1.2	0	0	A	S					
1.3	0	0	A	S					
1.4	0	0	A	S					
3	3212	3212	A	S					
4	9922	9922	A	S					
5.1	0	0	A	S					
5.2	18795	0	A	S					
10	35768	0	A	S					
11	10258	0	A	S					
13	7121	0	A	S					
16	5369	0	A	S					
20	7147	0	A	S					
23	14185	0	A	S					
24	74527	74527	A	S					
26	6624	6624	A	S					
28	25402	0	A	S					
32	0	0	A	S					
					494141	154285	31	40	34
12	35033	0	E	L					
9	6955	0	E	O					
23.2	41997	0	E	O					
26	14317	0	E	O					
1	20117	15000	E	O					
25	17994	0	E	S					
2	4059	0	E	S					
3	3511	0	E	S					
8	14747	0	E	S					
17	10246	0	E	S					
23.1	8000	8000	E	S					
24	3996	0	E	S					
2.1	6483	0	E	S					
					187455	23000	12	15	5

2.2	43260	0	ME	L					
9	0	0	ME	L					
3	85280	85280	ME	L					
2.1	0	0	ME	O					
5	78918	70000	ME	O					
7	16056	16056	ME	O					
11	16996	0	ME	O					
14	22368	0	ME	O					
15	47627	47627	ME	O					
3.1	85588	0	ME	S					
3.2	0	0	ME	S					
3.3	0	0	ME	S					
1	42951	0	ME	S					
2	39370	0	ME	S					
6	4506	0	ME	S					
4	74102	60000	ME	S					
6	5400	2000	ME	S					
					562422	280963	50	45	61
TOT	1244018	458248			1244018	458248	37	100	100

VALUE ENGINEERING 35

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
41	39701	0	A	L					
42	129179	0	A	L					
12	35033	0	E	L					
2.2	43260	0	ME	L					
9	0	0	ME	L					
3	85280	85280	ME	L					
					332453	85280	26	27	19
6	0	0	A	O					
17	10766	0	A	O					
27	14452	0	A	O					
35	0	0	A	O					
46	65421	60000	A	O					
9	6955	0	E	O					
23.2	41997	0	E	O					
26	14317	0	E	O					
1	20117	15000	E	O					
2.1	0	0	ME	O					
5	78918	70000	ME	O					
7	16056	16056	ME	O					
11	16996	0	ME	O					
14	22368	0	ME	O					
15	47627	47627	ME	O					
					355990	208683	59	29	46

25	17994	0	E	S					
1.1	16292	0	A	S					
1.2	0	0	A	S					
1.3	0	0	A	S					
1.4	0	0	A	S					
3	3212	3212	A	S					
4	9922	9922	A	S					
5.1	0	0	A	S					
5.2	18795	0	A	S					
10	35768	0	A	S					
11	10258	0	A	S					
13	7121	0	A	S					
16	5369	0	A	S					
20	7147	0	A	S					
23	14185	0	A	S					
24	74527	74527	A	S					
26	6624	6624	A	S					
28	25402	0	A	S					
32	0	0	A	S					
2	4059	0	E	S					
3	3511	0	E	S					
8	14747	0	E	S					
17	10246	0	E	S					
23.1	8000	8000	E	S					
24	3996	0	E	S					
2.1	6483	0	E	S					
3.1	85588	0	ME	S					
3.2	0	0	ME	S					
3.3	0	0	ME	S					
1	42951	0	ME	S					
2	39370	0	ME	S					
6	4506	0	ME	S					
4	74102	60000	ME	S					
6	5400	2000	ME	S					
					555575	164285	30	45	36
TOT	1244018	458248			1244018	458248	37	100	100

VALUE ENGINEERING 35

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
41	39701	0	A	L					
42	129179	0	A	L					
					168880	0	0	14	0
6	0	0	A	O					
17	10766	0	A	O					
27	14452	0	A	O					
35	0	0	A	O					
46	65421	60000	A	O					
					90639	60000	66	7	13
1.1	16292	0	A	S					
1.2	0	0	A	S					
1.3	0	0	A	S					
1.4	0	0	A	S					
3	3212	3212	A	S					
4	9922	9922	A	S					
5.1	0	0	A	S					
5.2	18795	0	A	S					
10	35768	0	A	S					
11	10258	0	A	S					
13	7121	0	A	S					
16	5369	0	A	S					
20	7147	0	A	S					
23	14185	0	A	S					
24	74527	74527	A	S					
26	6624	6624	A	S					
28	25402	0	A	S					
32	0	0	A	S					
					234622	94285	40	19	21

12	35033	0	E	L					
					35033	0	0	3	0
9	6955	0	E	O					
23.2	41997	0	E	O					
26	14317	0	E	O					
1	20117	15000	E	O					
					83386	15000	18	7	3
25	17994	0	E	S					
2	4059	0	E	S					
3	3511	0	E	S					
8	14747	0	E	S					
17	10246	0	E	S					
23.1	8000	8000	E	S					
24	3996	0	E	S					
2.1	6483	0	E	S					
					69036	8000	12	6	2
2.2	43260	0	ME	L					
9	0	0	ME	L					
3	85280	85280	ME	L					
					128540	85280	66	10	19
2.1	0	0	ME	O					
5	78918	70000	ME	O					
7	16056	16056	ME	O					
11	16996	0	ME	O					
14	22368	0	ME	O					
15	47627	47627	ME	O					
					181965	133683	73	15	29
3.1	85588	0	ME	S					
3.2	0	0	ME	S					
3.3	0	0	ME	S					
1	42951	0	ME	S					
2	39370	0	ME	S					
6	4506	0	ME	S					
4	74102	60000	ME	S					
6	5400	2000	ME	S					
					251917	62000	25	20	14
TOT	1244018	458248			1244018	458248	37	100	100

VALUE ENGINEERING 36

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	38	65	66
ENGINEERING	18	26	12
MECH&ELECT	87	9	21
TYPE			
LAYOUT	22	36	21
OMISSION	95	21	53
SPECIFICATION	23	43	27
ARCHITECTURAL			
LAYOUT	39	16	17
OMISSION	100	16	42
SPECIFICATION	9	33	7
ENGINEERING			
LAYOUT	5	19	2
OMISSION	34	1	1
SPECIFICATION	57	6	9
MECH&ELECT			
LAYOUT	77	1	1
OMISSION	90	4	10
SPECIFICATION	86	5	10

VALUE ENGINEERING 36

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	183217	0	A	L					
A2	290054	0	A	S					
A2.1	0	0	A	S					
A2.2	0	0	A	S					
A2.3	0	0	A	S					
A2.4	88300	53000	A	S					
A2.5	0	0	A	S					
A2.6	0	0	A	S					
A3	70653	0	A	S					
A3.1	0	0	A	S					
A4	91600	0	A	S					
A5	20448	0	A	S					
A6	7123	7123	A	O					
A7	120530	120530	A	L					
A8	7739	0	A	L					
A9	704	700	A	S					
A10	63100	0	A	S					
A11	295640	295640	A	O					
					1239108	476993	38	65	66
S1	30400	0	E	L					
S2	193400	0	E	L					
S3	27736	0	E	S					
S3.1	0	0	E	O					
S4	11800	3000	E	S					
S5	6069	6069	E	O					
S5.1	0	0	E	S					
S6	12000	0	E	O					
S6.1	0	0	E	S					
S7	3282	0	E	S					
S8	28200	20000	E	S					
S9	27800	18000	E	L					
S10	41800	41800	E	S					
S11	114500	0	E	L					
S11.1	0	0	E	L					
					496987	88869	18	26	12
M1	11870	0	ME	S					
M2	69854	69854	ME	O					
M3	725	700	ME	S					
M4	12867	12867	ME	S					
M4.1	0	0	ME	S					
M5	43177	43177	ME	S					
M6	13030	10000	ME	L					
E1	17544	17544	ME	S					
E2	7431	0	ME	O					
					176498	154142	87	9	21
TOT	1912593	720004			1912593	720004	38	100	100

VALUE ENGINEERING 36

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	183217	0	A	L					
A7	120530	120530	A	L					
A8	7739	0	A	L					
S1	30400	0	E	L					
S2	193400	0	E	L					
S9	27800	18000	E	L					
S11	114500	0	E	L					
S11.1	0	0	E	L					
M6	13030	10000	ME	L					
					690616	148530	22	36	21
A6	7123	7123	A	O					
A11	295640	295640	A	O					
S3.1	0	0	E	O					
S5	6069	6069	E	O					
S6	12000	0	E	O					
M2	69854	69854	ME	O					
E2	7431	0	ME	O					
					398117	378686	95	21	53
A2	290054	0	A	S					
A2.1	0	0	A	S					
A2.2	0	0	A	S					
A2.3	0	0	A	S					
A2.4	88300	53000	A	S					
A2.5	0	0	A	S					
A2.6	0	0	A	S					
A3	70653	0	A	S					
A3.1	0	0	A	S					
A4	91600	0	A	S					
A5	20448	0	A	S					
A9	704	700	A	S					
A10	63100	0	A	S					
S3	27736	0	E	S					
S4	11800	3000	E	S					
S5.1	0	0	E	S					
S6.1	0	0	E	S					
S7	3282	0	E	S					
S8	28200	20000	E	S					
S10	41800	41800	E	S					
M1	11870	0	ME	S					
M3	725	700	ME	S					
M4	12867	12867	ME	S					
M4.1	0	0	ME	S					
M5	43177	43177	ME	S					
E1	17544	17544	ME	S					
					823860	192788	23	43	27
TOT	1912593	720004			1912593	720004	38	100	100

VALUE ENGINEERING 36

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	183217	0	A	L					
A7	120530	120530	A	L					
A8	7739	0	A	L					
					311486	120530	39	16	17
A6	7123	7123	A	O					
A11	295640	295640	A	O					
					302763	302763	100	16	42
A2	290054	0	A	S					
A2.1	0	0	A	S					
A2.2	0	0	A	S					
A2.3	0	0	A	S					
A2.4	88300	53000	A	S					
A2.5	0	0	A	S					
A2.6	0	0	A	S					
A3	70653	0	A	S					
A3.1	0	0	A	S					
A4	91600	0	A	S					
A5	20448	0	A	S					
A9	704	700	A	S					
A10	63100	0	A	S					
					624859	53700	9	33	7
S1	30400	0	E	L					
S2	193400	0	E	L					
S9	27800	18000	E	L					
S11	114500	0	E	L					
S11.1	0	0	E	L					
					366100	18000	5	19	2
S3.1	0	0	E	O					
S5	6069	6069	E	O					
S6	12000	0	E	O					
					18069	6069	34	1	1
S3	27736	0	E	S					
S4	11800	3000	E	S					
S5.1	0	0	E	S					
S6.1	0	0	E	S					
S7	3282	0	E	S					
S8	28200	20000	E	S					
S10	41800	41800	E	S					
					112818	64800	57	6	9

M6	13030	10000	ME	L					
					13030	10000	77	1	1
M2	69854	69854	ME	O					
E2	7431	0	ME	O					
					77285	69854	90	4	10
M1	11870	0	ME	S					
M3	725	700	ME	S					
M4	12867	12867	ME	S					
M4.1	0	0	ME	S					
M5	43177	43177	ME	S					
E1	17544	17544	ME	S					
					86183	74288	86	5	10
TOT	1912593	720004			1912593	720004	38	100	100

VALUE ENGINEERING 37

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	7	60	34
ENGINEERING	28	27	59
MECH&ELECT	7	14	8
TYPE			
LAYOUT	0	20	0
OMISSION	35	22	62
SPECIFICATION	8	57	38
ARCHITECTURAL			
LAYOUT	0	15	0
OMISSION	78	1	9
SPECIFICATION	7	43	24
ENGINEERING			
LAYOUT	0	5	0
OMISSION	68	10	53
SPECIFICATION	6	12	6
MECH&ELECT			
LAYOUT	0	0	0
OMISSION	0	11	0
SPECIFICATION	32	3	8

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	35020	0	A	L					
A2	6500	0	A	L					
A3	3724	0	A	L					
A4	14703	0	A	L					
A6	3710	0	A	L					
A7	6245	6245	A	O					
A8	1739	0	A	O					
A9	17405	0	A	L					
A10	44503	14000	A	S					
A11	50434	0	A	S					
A12	119373	0	A	S					
A14A	0	0	A	S					
A14B	6001	0	A	S					
A15	0	0	A	O					
A18	8683	2300	A	S					
					318040	22545	7	60	34
S2	0	0	E	L					
C1B	39690	4000	E	S					
C3	0	0	E	L					
C4	1336	0	E	O					
C5	10050	0	E	O					
C6	0	0	E	S					
C7	0	0	E	S					
C8	0	0	E	S					
C10	2320	0	E	S					
C11	1329	0	E	O					
C13A	2720	0	E	O					
C13B	0	0	E	O					
C14	27900	0	E	L					
C15	1202	0	E	O					
C16	0	0	E	L					
C18	35020	35000	E	O					
C19	19874	0	E	S					
C20	0	0	E	L					
					141441	39000	28	27	59
P1	5210	1000	ME	S					
P2	4535	0	ME	S					
P3	0	0	ME	S					
P4	12670	0	ME	O					
P5	5850	4000	ME	S					
P6	0	0	ME	L					
M1	0	0	ME	L					
E1	29700	0	ME	O					
E2	16240	0	ME	O					
					74205	5000	7	14	8
TOT	533686	66545			533686	66545	12	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	35020	0	A	L					
A2	6500	0	A	L					
A3	3724	0	A	L					
A4	14703	0	A	L					
A6	3710	0	A	L					
A9	17405	0	A	L					
S2	0	0	E	L					
C3	0	0	E	L					
C14	27900	0	E	L					
C16	0	0	E	L					
C20	0	0	E	L					
P6	0	0	ME	L					
M1	0	0	ME	L					
					108962	0	0	20	0
A7	6245	6245	A	O					
A8	1739	0	A	O					
A15	0	0	A	O					
C4	1336	0	E	O					
C5	10050	0	E	O					
C11	1329	0	E	O					
C13A	2720	0	E	O					
C13B	0	0	E	O					
C15	1202	0	E	O					
C18	35020	35000	E	O					
P4	12670	0	ME	O					
E1	29700	0	ME	O					
E2	16240	0	ME	O					
					118251	41245	35	22	62
A18	8683	2300	A	S					
A10	44503	14000	A	S					
A11	50434	0	A	S					
A12	119373	0	A	S					
A14A	0	0	A	S					
A14B	6001	0	A	S					
C1B	39690	4000	E	S					
C6	0	0	E	S					
C7	0	0	E	S					
C8	0	0	E	S					
C10	2320	0	E	S					
C19	19874	0	E	S					
P1	5210	1000	ME	S					
P2	4535	0	ME	S					
P3	0	0	ME	S					
P5	5850	4000	ME	S					
					306473	25300	8	57	38
TOT	533686	66545			533686	66545	12	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	35020	0	A	L					
A2	6500	0	A	L					
A3	3724	0	A	L					
A4	14703	0	A	L					
A6	3710	0	A	L					
A9	17405	0	A	L					
					81062	0	0	15	0
A7	6245	6245	A	O					
A8	1739	0	A	O					
A15	0	0	A	O					
					7984	6245	78	1	9
A18	8683	2300	A	S					
A10	44503	14000	A	S					
A11	50434	0	A	S					
A12	119373	0	A	S					
A14A	0	0	A	S					
A14B	6001	0	A	S					
					228994	16300	7	43	24
S2	0	0	E	L					
C3	0	0	E	L					
C14	27900	0	E	L					
C16	0	0	E	L					
C20	0	0	E	L					
					27900	0	0	5	0
C4	1336	0	E	O					
C5	10050	0	E	O					
C11	1329	0	E	O					
C13A	2720	0	E	O					
C13B	0	0	E	O					
C15	1202	0	E	O					
C18	35020	35000	E	O					
					51657	35000	68	10	53
C1B	39690	4000	E	S					
C6	0	0	E	S					
C7	0	0	E	S					
C8	0	0	E	S					
C10	2320	0	E	S					
C19	19874	0	E	S					
					61884	4000	6	12	6

P6	0	0	ME	L					
M1	0	0	ME	L					
					0	0	0	0	0
P4	12670	0	ME	O					
E1	29700	0	ME	O					
E2	16240	0	ME	O					
					58610	0	0	11	0
P1	5210	1000	ME	S					
P2	4535	0	ME	S					
P3	0	0	ME	S					
P5	5850	4000	ME	S					
					15595	5000	32	3	8
TOT	533686	66545			533686	66545	12	100	100

VALUE ENGINEERING 38

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	66	48	59
ENGINEERING	37	39	27
MECH&ELECT	62	13	14
TYPE			
LAYOUT	76	31	43
OMISSION	42	11	8
SPECIFICATION	45	58	48
ARCHITECTURAL			
LAYOUT	63	20	23
OMISSION	0	2	0
SPECIFICATION	74	26	36
ENGINEERING			
LAYOUT	100	9	16
OMISSION	0	0	0
SPECIFICATION	19	30	11
MECH&ELECT			
LAYOUT	91	3	5
OMISSION	56	8	8
SPECIFICATION	45	2	1

VALUE ENGINEERING 38

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
2.1	200790	133860	A	L					
3	67343	67343	A	S					
5	4856	2000	A	S					
8	0	0	A	S					
8.1	39600	13000	A	S					
11	92398	83781	A	S					
12	0	0	A	S					
13	0	0	A	S					
15	18350	10000	A	S					
16	13942	8000	A	S					
19	27927	0	A	O					
23	2664	0	A	S					
25	9273	9273	A	S					
35	35832	16000	A	S					
36	27246	22000	A	S					
43	13376	0	A	L					
46	17179	12000	A	L					
1	0	0	A	L					
2	0	0	A	L					
3	0	0	A	L					
					570776	377257	66	48	59
1	30577	30577	E	L					
2	63429	63429	E	L					
3	2275	2275	E	S					
4	7463	7463	E	L					
5	3201	0	E	O					
1	230900	0	E	S					
2	0	0	E	S					
4	123417	66000	E	S					
					461262	169744	37	39	27
4	91624	50000	ME	O					
10	2960	2960	ME	O					
1	33097	30000	ME	L					
2	4221	0	ME	S					
5	5735	0	ME	S					
6	1645	0	ME	S					
9	9570	9570	ME	S					
					148852	92530	62	13	14
TOT	1180890	639531			1180890	639531	54	100	100

VALUE ENGINEERING 38

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
2.1	200790	133860	A	L					
43	13376	0	A	L					
46	17179	12000	A	L					
1	0	0	A	L					
2	0	0	A	L					
3	0	0	A	L					
1	30577	30577	E	L					
2	63429	63429	E	L					
4	7463	7463	E	L					
1	33097	30000	ME	L					
					365911	277329	76	31	43
19	27927	0	A	O					
5	3201	0	E	O					
4	91624	50000	ME	O					
10	2960	2960	ME	O					
					125712	52960	42	11	8
3	67343	67343	A	S					
5	4856	2000	A	S					
8	0	0	A	S					
8.1	39600	13000	A	S					
11	92398	83781	A	S					
12	0	0	A	S					
13	0	0	A	S					
15	18350	10000	A	S					
16	13942	8000	A	S					
23	2664	0	A	S					
25	9273	9273	A	S					
35	35832	16000	A	S					
36	27246	22000	A	S					
3	2275	2275	E	S					
1	230900	0	E	S					
2	0	0	E	S					
4	123417	66000	E	S					
2	4221	0	ME	S					
5	5735	0	ME	S					
6	1645	0	ME	S					
9	9570	9570	ME	S					
					689267	309242	45	58	48
TOT	1180890	639531			1180890	639531	54	100	100

VALUE ENGINEERING 38

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
21	200790	133860	A	L					
43	13376	0	A	L					
46	17179	12000	A	L					
1	0	0	A	L					
2	0	0	A	L					
3	0	0	A	L					
					231345	145860	63	20	23
19	27927	0	A	O					
					27927	0	0	2	0
3	67343	67343	A	S					
5	4856	2000	A	S					
8	0	0	A	S					
81	39600	13000	A	S					
11	92398	83781	A	S					
12	0	0	A	S					
13	0	0	A	S					
15	18350	10000	A	S					
16	13942	8000	A	S					
23	2664	0	A	S					
25	9273	9273	A	S					
35	35832	16000	A	S					
36	27246	22000	A	S					
					311504	231397	74	26	36
1	30577	30577	E	L					
2	63429	63429	E	L					
4	7463	7463	E	L					
					101469	101469	100	9	16
5	3201	0	E	O					
					3201	0	0	0	0
3	2275	2275	E	S					
1	230900	0	E	S					
2	0	0	E	S					
4	123417	66000	E	S					
					356592	68275	19	30	11
1	33097	30000	ME	L					
					33097	30000	91	3	5
4	91624	50000	ME	O					
10	2960	2960	ME	O					
					94584	52960	56	8	8
2	4221	0	ME	S					
5	5735	0	ME	S					
6	1645	0	ME	S					
9	9570	9570	ME	S					
					21171	9570	45	2	1
TOT	1180890	639531			1180890	639531	54	100	100

VALUE ENGINEERING 39

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	68	51	61
ENGINEERING	65	21	24
MECH&ELECT	31	29	16
TYPE			
LAYOUT	52	17	15
OMISSION	47	15	13
SPECIFICATION	60	68	72
ARCHITECTURAL			
LAYOUT	50	4	3
OMISSION	73	7	9
SPECIFICATION	69	40	48
ENGINEERING			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	65	21	24
MECH&ELECT			
LAYOUT	53	13	12
OMISSION	24	8	3
SPECIFICATION	0	7	0

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A3	16760	8400	A	L					
M2	55142	27571	ME	L					
M3	3268	3268	ME	L					
M4	0	0	ME	L					
					75170	39239	52	17	15
A2	22877	14200	A	O					
A7	9543	9543	A	O					
M1	8760	8760	ME	O					
E1	28387	0	ME	O					
					69567	32503	47	15	13
A1	19537	0	A	S					
A4	59746	35847	A	S					
A5	93192	87000	A	S					
A6	5583	0	A	S					
S1	3045	1845	E	S					
S2	15540	0	E	S					
S3	3051	3051	E	S					
S4	3982	3982	E	S					
S5	6030	6030	E	S					
S6	61032	45000	E	S					
E2	33686	0	ME	S					
					304424	182755	60	68	72
TOT	449161	254497			449161	254497	57	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A3	16760	8400	A	L					
					16760	8400	50	4	3
A2	22877	14200	A	O					
A7	9543	9543	A	O					
					32420	23743	73	7	9
A1	19537	0	A	S					
A4	59746	35847	A	S					
A5	93192	87000	A	S					
A6	5583	0	A	S					
					178058	122847	69	40	48
S1	3045	1845	E	S					
S2	15540	0	E	S					
S3	3051	3051	E	S					
S4	3982	3982	E	S					
S5	6030	6030	E	S					
S6	61032	45000	E	S					
					92680	59908	65	21	24
M2	55142	27571	ME	L					
M3	3268	3268	ME	L					
M4	0	0	ME	L					
					58410	30839	53	13	12
M1	8760	8760	ME	O					
E1	28387	0	ME	O					
					37147	8760	24	8	3
E2	33686	0	ME	S					
					33686	0	0	7	0
TOT	449161	254497			449161	254497	57	100	100

VALUE ENGINEERING 40

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	0	12	0
ENGINEERING	19	73	59
MECH&ELECT	64	15	41
TYPE			
LAYOUT	22	44	41
OMISSION	23	29	28
SPECIFICATION	26	27	31
ARCHITECTURAL			
LAYOUT	0	4	0
OMISSION	0	8	0
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	0	31	0
OMISSION	31	21	28
SPECIFICATION	33	22	31
MECH&ELECT			
LAYOUT	100	10	41
OMISSION	0	0	0
SPECIFICATION	0	5	0

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	137000	0	A	O					
A3	7957	0	A	O					
A5	71500	0	A	L					
A7	0	0	A	L					
					216457	0	0	12	0
C2.1	4000	0	E	O					
C2/3	64000	64000	E	O					
C4	84310	84300	E	S					
C6	11000	3000	E	O					
C7	48650	0	E	S					
C11	9226	0	E	O					
C13	0	0	E	O					
C14	69000	0	E	O					
C17	0	0	E	L					
C16	47000	47000	E	O					
C18	5587	5500	E	O					
S1 1	47900	47000	E	S					
S1 2	33100	0	E	S					
S3	23000	0	E	O					
S5	30500	0	E	L					
S9	170500	0	E	L					
S10 1	0	0	E	L					
S10 2	360000	0	E	L					
S12	150000	0	E	O					
S13	183000	0	E	S					
					1340773	250800	19	73	59
M1	0	0	ME	L					
M2	0	0	ME	L					
E1	0	0	ME	S					
E2	2700	0	ME	S					
E3	0	0	ME	O					
E4	75000	0	ME	S					
E7 1	0	0	ME	L					
E7 2	175000	175000	ME	L					
E8	22000	0	ME	S					
					274700	175000	64	15	41
TOT	1831930	425800			1831930	425800	23	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5	71500	0	A	L					
A7	0	0	A	L					
C17	0	0	E	L					
S5	30500	0	E	L					
S9	170500	0	E	L					
S10 1	0	0	E	L					
S10 2	360000	0	E	L					
M1	0	0	ME	L					
M2	0	0	ME	L					
E7 1	0	0	ME	L					
E7 2	175000	175000	ME	L					
					807500	175000	22	44	41
A2	137000	0	A	O					
A3	7957	0	A	O					
C2.1	4000	0	E	O					
C2/3	64000	64000	E	O					
C6.	11000	3000	E	O					
C11	9226	0	E	O					
C13	0	0	E	O					
C14	69000	0	E	O					
C16	47000	47000	E	O					
C18	5587	5500	E	O					
S3	23000	0	E	O					
S12	150000	0	E	O					
E3	0	0	ME	O					
					527770	119500	23	29	28
C4	84310	84300	E	S					
C7	48650	0	E	S					
S1 1	47900	47000	E	S					
S1 2	33100	0	E	S					
S13	183000	0	E	S					
E1	0	0	ME	S					
E2	2700	0	ME	S					
E4	75000	0	ME	S					
E8	22000	0	ME	S					
					496660	131300	26	27	31
TOT	1831930	425800			1831930	425800	23	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5	71500	0	A	L					
A7	0	0	A	L					
					71500	0	0	4	0
A2	137000	0	A	O					
A3	7957	0	A	O					
					144957	0	0	8	0
C17	0	0	E	L					
S5	30500	0	E	L					
S9	170500	0	E	L					
S10.1	0	0	E	L					
S10 2	360000	0	E	L					
					561000	0	0	31	0
C2.1	4000	0	E	O					
C2/3	64000	64000	E	O					
C6	11000	3000	E	O					
C11	9226	0	E	O					
C13	0	0	E	O					
C14	69000	0	E	O					
C16	47000	47000	E	O					
C18	5587	5500	E	O					
S3	23000	0	E	O					
S12	150000	0	E	O					
					382813	119500	31	21	28
C4	84310	84300	E	S					
C7	48650	0	E	S					
S1 1	47900	47000	E	S					
S1 2	33100	0	E	S					
S13	183000	0	E	S					
					396960	131300	33	22	31
M1	0	0	ME	L					
M2	0	0	ME	L					
E7 1	0	0	ME	L					
E7 2	175000	175000	ME	L					
					175000	175000	100	10	41
E3	0	0	ME	O					
					0	0	0	0	0
E1	0	0	ME	S					
E2	2700	0	ME	S					
E4	75000	0	ME	S					
E8	22000	0	ME	S					
					99700	0	0	5	0
TOT	1831930	425800			1831930	425800	23	100	100

VALUE ENGINEERING 41

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	42	42	25
ENGINEERING	57	10	8
MECH&ELECT	98	48	67
TYPE			
LAYOUT	66	66	62
OMISSION	54	6	5
SPECIFICATION	84	27	33
ARCHITECTURAL			
LAYOUT	0	22	0
OMISSION	0	2	0
SPECIFICATION	100	18	25
ENGINEERING			
LAYOUT	-	-	-
OMISSION	100	0	0
SPECIFICATION	55	10	8
MECH&ELECT			
LAYOUT	99	44	62
OMISSION	79	4	5
SPECIFICATION	-	-	-

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	120000	120000	A	S					
A3	1980	1980	A	S					
A4	7679	0	A	O					
A5	0	0	A	L					
A6	155000	0	A	L					
A7	0	0	A	L					
A8	7000	0	A	O					
					291659	121980	42	42	25
S1	1000	1000	E	O					
S2	0	0	E	S					
S3	0	0	E	S					
S4	0	0	E	S					
S5	0	0	E	S					
C1	500	0	E	S					
C2	200	0	E	S					
C3	1020	1000	E	S					
C4	1000	1000	E	O					
C5	30000	0	E	S					
C6	900	900	E	S					
C7	1400	1400	E	S					
C8	35000	35000	E	S					
					71020	40300	57	10	8
E1	20000	20000	ME	O					
E2	4000	0	ME	O					
E3	1000	1000	ME	O					
E4	1000	1000	ME	O					
E5	2000	0	ME	O					
E6	4000	4000	ME	L					
E7	300000	300000	ME	L					
M1	2200	0	ME	L					
					334200	326000	98	48	67
TOT	696879	488280			696879	488280	70	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5	0	0	A	L					
A6	155000	0	A	L					
A7	0	0	A	L					
E6	4000	4000	ME	L					
E7	300000	300000	ME	L					
M1	2200	0	ME	L					
					461200	304000	66	66	62
A4	7679	0	A	O					
A8	7000	0	A	O					
S1	1000	1000	E	O					
C4	1000	1000	E	O					
E1	20000	20000	ME	O					
E2	4000	0	ME	O					
E3	1000	1000	ME	O					
E4	1000	1000	ME	O					
E5	2000	0	ME	O					
					44679	24000	54	6	5
A1	120000	120000	A	S					
A3	1980	1980	A	S					
S2	0	0	E	S					
S3	0	0	E	S					
S4	0	0	E	S					
S5	0	0	E	S					
C1	500	0	E	S					
C2	200	0	E	S					
C3	1020	1000	E	S					
C5	30000	0	E	S					
C6	900	900	E	S					
C7	1400	1400	E	S					
C8	35000	35000	E	S					
					191000	160280	84	27	33
TOT	696879	488280			696879	488280	70	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A5	0	0	A	L					
A6	155000	0	A	L					
A7	0	0	A	L					
					155000	0	0	22	0
A4	7679	0	A	O					
A8	7000	0	A	O					
					14679	0	0	2	0
A1	120000	120000	A	S					
A3	1980	1980	A	S					
					121980	121980	100	18	25
S1	1000	1000	E	O					
C4	1000	1000	E	O					
					2000	2000	100	0	0
S2	0	0	E	S					
S3	0	0	E	S					
S4	0	0	E	S					
S5	0	0	E	S					
C1	500	0	E	S					
C2	200	0	E	S					
C3	1020	1000	E	S					
C5	30000	0	E	S					
C6	900	900	E	S					
C7	1400	1400	E	S					
C8	35000	35000	E	S					
					69020	38300	55	10	8
E6	4000	4000	ME	L					
E7	300000	300000	ME	L					
M1	2200	0	ME	L					
					306200	304000	99	44	62
E1	20000	20000	ME	O					
E2	4000	0	ME	O					
E3	1000	1000	ME	O					
E4	1000	1000	ME	O					
E5	2000	0	ME	O					
					28000	22000	79	4	5
TOT	696879	488280			696879	488280	70	100	100

VALUE ENGINEERING 42

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	57	19	48
ENGINEERING	13	57	33
MECH&ELECT	18	24	19
TYPE			
LAYOUT	92	14	54
OMISSION	21	23	21
SPECIFICATION	9	64	25
ARCHITECTURAL			
LAYOUT	90	12	45
OMISSION	2	3	0
SPECIFICATION	10	5	2
ENGINEERING			
LAYOUT	100	2	8
OMISSION	28	4	4
SPECIFICATION	9	51	20
MECH&ELECT			
LAYOUT	0	0	0
OMISSION	23	16	17
SPECIFICATION	8	8	2

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	5014	0	A	O					
4	1995	1995	A	S					
10	84285	84285	A	L					
13	17812	8000	A	L					
22	13311	0	A	S					
25	9386	400	A	O					
32	5418	2000	A	S					
48	9963	0	A	O					
49	0	0	A	S					
50	21122	0	A	S					
					168306	96680	57	19	48
1	8982	8000	E	S					
2	6980	0	E	O					
4	6313	0	E	O					
6	2904	0	E	S					
7	23446	23446	E	S					
10	50831	0	E	S					
12	8449	0	E	O					
14	170656	0	E	S					
16	0	0	E	S					
33	9113	9113	E	O					
34	3948	3948	E	S					
35	179278	0	E	S					
9	17082	17082	E	L					
14	4085	4085	E	S					
16	2781	1800	E	S					
24	1940	0	E	O					
28	3662	0	E	S					
					500450	67474	13	57	33

4	1740	1740	ME	O					
6	9809	9809	ME	O					
13	4362	0	ME	S					
18	5810	0	ME	O					
30	0	0	ME	L					
40	15849	0	ME	S					
42	236	0	ME	S					
43	630	0	ME	S					
45	12204	0	ME	S					
46	3147	0	ME	S					
51	5014	5014	ME	S					
55	24712	22240	ME	O					
56	17254	0	ME	S					
2	5286	0	ME	O					
4	43338	0	ME	O					
8	1949	0	ME	O					
15	37627	0	ME	O					
16	11739	0	ME	O					
17	551	0	ME	S					
24	2587	0	ME	O					
25	4067	0	ME	S					
26	3261		ME	S					
					211172	38803	18	24	19
TOT	879928	202957			879928	202957	23	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
10	84285	84285	A	L					
13	17812	8000	A	L					
9	17082	17082	E	L					
30	0	0	ME	L					
					119179	109367	92	14	54
1	5014	0	A	O					
25	9386	400	A	O					
48	9963	0	A	O					
2	6980	0	E	O					
4	6313	0	E	O					
12	8449	0	E	O					
33	9113	9113	E	O					
24	1940	0	E	O					
4	1740	1740	ME	O					
6	9809	9809	ME	O					
18	5810	0	ME	O					
55	24712	22240	ME	O					
2	5286	0	ME	O					
4	43338	0	ME	O					
8	1949	0	ME	O					
15	37627	0	ME	O					
16	11739	0	ME	O					
24	2587	0	ME	O					
					201755	43302	21	23	21

4	1995	1995	A	S					
22	13311	0	A	S					
32	5418	2000	A	S					
49	0	0	A	S					
50	21122	0	A	S					
1	8982	8000	E	S					
6	2904	0	E	S					
7	23446	23446	E	S					
10	50831	0	E	S					
14	170656	0	E	S					
16	0	0	E	S					
34	3948	3948	E	S					
35	179278	0	E	S					
14	4085	4085	E	S					
16	2781	1800	E	S					
28	3662	0	E	S					
13	4362	0	ME	S					
40	15849	0	ME	S					
42	236	0	ME	S					
43	630	0	ME	S					
45	12204	0	ME	S					
46	3147	0	ME	S					
51	5014	5014	ME	S					
56	17254	0	ME	S					
17	551	0	ME	S					
25	4067	0	ME	S					
26	3261		ME	S					
					558994	50288	9	64	25
TOT	879928	202957			879928	202957	23	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
10	84285	84285	A	L					
13	17812	8000	A	L					
					102097	92285	90	12	45
1	5014	0	A	O					
25	9386	400	A	O					
48	9963	0	A	O					
					24363	400	2	3	0
4	1995	1995	A	S					
22	13311	0	A	S					
32	5418	2000	A	S					
49	0	0	A	S					
50	21122	0	A	S					
					41846	3995	10	5	2
9	17082	17082	E	L					
					17082	17082	100	2	8
2	6980	0	E	O					
4.	6313	0	E	O					
12	8449	0	E	O					
33	9113	9113	E	O					
24	1940	0	E	O					
					32795	9113	28	4	4
1	8982	8000	E	S					
6	2904	0	E	S					
7	23446	23446	E	S					
10	50831	0	E	S					
14	170656	0	E	S					
16	0	0	E	S					
34	3948	3948	E	S					
35	179278	0	E	S					
14	4085	4085	E	S					
16	2781	1800	E	S					
28	3662	0	E	S					
					450573	41279	9	51	20

30	0	0	ME	L					
					0	0	0	0	0
4	1740	1740	ME	O					
6	9809	9809	ME	O					
18	5810	0	ME	O					
55	24712	22240	ME	O					
2	5286	0	ME	O					
4	43338	0	ME	O					
8	1949	0	ME	O					
15	37627	0	ME	O					
16	11739	0	ME	O					
24	2587	0	ME	O					
					144597	33789	23	16	17
13	4362	0	ME	S					
40	15849	0	ME	S					
42	236	0	ME	S					
43	630	0	ME	S					
45	12204	0	ME	S					
46	3147	0	ME	S					
51	5014	5014	ME	S					
56	17254	0	ME	S					
17	551	0	ME	S					
25	4067	0	ME	S					
26	3261		ME	S					
					66575	5014	8	8	2
TOT	879928	202957			879928	202957	23	100	100

VALUE ENGINEERING 43

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	0	35	0
ENGINEERING	16	21	39
MECH&ELECT	12	44	61
TYPE			
LAYOUT	1	36	4
OMISSION	33	14	51
SPECIFICATION	8	50	45
ARCHITECTURAL			
LAYOUT	0	22	0
OMISSION	0	2	0
SPECIFICATION	0	11	0
ENGINEERING			
LAYOUT	3	14	4
OMISSION	21	4	9
SPECIFICATION	62	4	26
MECH&ELECT			
LAYOUT	0	0	0
OMISSION	44	9	42
SPECIFICATION	5	35	19

VALUE ENGINEERING 43

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	173245	0	A	L					
A4 1	103315	0	A	L					
A7	95614	0	A	S					
A13	9928	0	A	S					
A14	22056	0	A	S					
A15	7036	0	A	S					
A19	47284	0	A	L					
A21	0	0	A	L					
A22	22540	0	A	O					
A23	3715	0	A	S					
A24	0	0	A	L					
A29	16737	0	A	S					
A33	2113	0	A	O					
A41	20636	0	A	L					
A42	17624	0	A	S					
					541843	0	0	35	0
S1	91248	0	E	L					
S2	6902	6900	E	S					
S6	63883	0	E	L					
S8	54236	0	E	L					
S10	5231	0	E	S					
S12	5463	5463	E	L					
S14	6941	0	E	S					
S19	0	0	E	L					
C5	0	0	E	L					
C6 1	7258	0	E	O					
C7	36200	12000	E	O					
C12	14952	0	E	O					
C17	40714	30000	E	S					
					333028	54363	16	21	39

M1	55670	55670	ME	O					
M7	3781	3781	ME	S					
M10	9432	0	ME	S					
M11	4245	0	ME	S					
M12	435391	0	ME	S					
M17	17251	0	ME	O					
M18	2370	2370	ME	S					
M20	54730	0	ME	O					
M21	0	0	ME	S					
M24	16334	0	ME	S					
M27	2670	0	ME	O					
E1	16996	0	ME	S					
E2	2584	0	ME	L					
E4	4583	0	ME	S					
E5	3244	3244	ME	S					
E8	28621	14000	ME	S					
E10	10256	0	ME	S					
E13	2082	0	ME	S					
E14	1675	0	ME	S					
E16	6862	0	ME	S					
E17	2677	2677	ME	S					
E22	3471	3471	ME	O					
					684925	85213	12	44	61
TOT	1559796	139576			1559796	139576	9	100	100

/ALUE ENG NEER NG 43

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	173245	0	A	L					
A4 1	103315	0	A	L					
A19	47284	0	A	L					
A21	0	0	A	L					
A24	0	0	A	L					
A41	20636	0	A	L					
S1	91248	0	E	L					
S6	63883	0	E	L					
S8	54236	0	E	L					
S12	463	5463	E	L					
S19		0	E	L					
C5		0	E	L					
E2	2584	0	ME	L					
					561894	5463	1	36	4
A22	22540	0	A	O					
A33	-113	0	A	O					
C6 1	7258	0	E	O					
C7	36200	12000	E	O					
C12	14952	0	E	O					
M1	55670	55670	ME	O					
M17	17251	0	ME	O					
M20	54730	0	ME	O					
M27	2670	0	ME	O					
E22	3471	3471	ME	O					
					216855	71141	33	14	51

A7	95614	0	A	S					
A13	9928	0	A	S					
A14	22056	0	A	S					
A15	7036	0	A	S					
A23	3715	0	A	S					
A29	16737	0	A	S					
A42	17624	0	A	S					
S2	6902	6900	E	S					
S10	5231	0	E	S					
S14	6941	0	E	S					
C17	40714	30000	E	S					
M7	3781	3781	ME	S					
M10	9432	0	ME	S					
M11	4245	0	ME	S					
M12	435391	0	ME	S					
M18	2370	2370	ME	S					
M21	0	0	ME	S					
M24	16334	0	ME	S					
E1	16996	0	ME	S					
E4	4583	0	ME	S					
E5	3244	3244	ME	S					
E8	28621	14000	ME	S					
E10	10256	0	ME	S					
E13	2082	0	ME	S					
E14	1675	0	ME	S					
E16	6862	0	ME	S					
E17	2677	2677	ME	S					
					781047	62972	8	50	45
TOT	1559796	139576			1559796	139576	9	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	173245	0	A	L					
A4 1	103315	0	A	L					
A19	47284	0	A	L					
A21	0	0	A	L					
A24	0	0	A	L					
A41	20636	0	A	L					
					344480	0	0	22	0
A22	22540	0	A	O					
A33	2113	0	A	O					
					24653	0	0	2	0
A7	95614	0	A	S					
A13	9928	0	A	S					
A14	22056	0	A	S					
A15	7036	0	A	S					
A23	3715	0	A	S					
A29	16737	0	A	S					
A42	17624	0	A	S					
					172710	0	0	11	0
S1	91248	0	E	L					
S6	63883	0	E	L					
S8	54236	0	E	L					
S12	5463	5463	E	L					
S19	0	0	E	L					
C5	0	0	E	L					
					214830	5463	3	14	4
C6 1	7258	0	E	O					
C7	36200	12000	E	O					
C12	14952	0	E	O					
					58410	12000	21	4	9
S2	6902	6900	E	S					
S10	5231	0	E	S					
S14	6941	0	E	S					
C17	40714	30000	E	S					
					59788	36900	62	4	26

E2	2584	0	ME	L					
					2584	0	0	0	0
M1	55670	55670	ME	O					
M17	17251	0	ME	O					
M20	54730	0	ME	O					
M27	2670	0	ME	O					
E22	3471	3471	ME	O					
					133792	59141	44	9	42
M7	3781	3781	ME	S					
M10	9432	0	ME	S					
M11	4245	0	ME	S					
M12	435391	0	ME	S					
M18	2370	2370	ME	S					
M21	0	0	ME	S					
M24	16334	0	ME	S					
E1	16996	0	ME	S					
E4	4583	0	ME	S					
E5	3244	3244	ME	S					
E8	28621	14000	ME	S					
E10	10256	0	ME	S					
E13	2082	0	ME	S					
E14	1675	0	ME	S					
E16	6862	0	ME	S					
E17	2677	2677	ME	S					
					548549	26072	5	35	19
TOT	1559796	139576			1559796	139576	9	100	100

VALUE ENGINEERING 44

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	18	20	14
ENGINEERING	28	30	34
MECH&ELECT	27	50	52
TYPE			
LAYOUT	56	24	54
OMISSION	35	17	24
SPECIFICATION	10	58	22
ARCHITECTURAL			
LAYOUT	7	11	3
OMISSION	34	1	2
SPECIFICATION	30	8	9
ENGINEERING			
LAYOUT	100	0	1
OMISSION	64	9	22
SPECIFICATION	13	22	11
MECH&ELECT			
LAYOUT	95	13	50
OMISSION	0	7	0
SPECIFICATION	2	29	2

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	3187	0	A	O					
4	1715	1715	A	S					
5	87001	0	A	L					
8	0	0	A	L					
13	23712	12000	A	L					
19	7826	7000	A	O					
20	23194	0	A	S					
21	56060	0	A	L					
22	19513	0	A	S					
25	10534	400	A	O					
32	9378	9000	A	S					
34	23967	23967	A	S					
48	11491	0	A	S					
49	0	0	A	S					
50	28041	0	A	S					
					305619	54082	18	20	14
1	13552	6761	E	S					
2	10508	0	E	S					
4	9503	0	E	O					
6	3696	0	E	S					
7	11847	11847	E	S					
10	50128	50128	E	O					
12	12690	0	E	S					
16	0	0	E	O					
26	35064	0	E	O					
33	13720	13720	E	S					
34	5725	5725	E	S					
35	246101	0	E	S					
2	0	0	E	S					
9	10086	10086	E	O					
13	18921	16500	E	O					
14	2339	2339	E	L					
16	7201	5300	E	S					
23	1386	1386	E	S					
24	994	0	E	O					
25	3398	3398	E	O					
26	4367	4367	E	O					
28	6449	0	E	S					
					467675	131557	28	30	34

VALUE ENGINEERING 44

2	72124	0	ME	S					
4	2052	0	ME	O					
5	9102	0	ME	O					
10	198686	0	ME	S					
13	5830	0	ME	S					
18	10933	0	ME	L					
20	51669	0	ME	S					
31	0	0	ME	L					
40	14302	0	ME	S					
42	336	336	ME	S					
43	899	0	ME	S					
45	32218	0	ME	S					
46	1626	0	ME	S					
51	7358	7358	ME	S					
54	37493	0	ME	S					
2	9214	0	ME	S					
4	43648	0	ME	O					
6	304	0	ME	S					
8	2274	0	ME	O					
10	73790	73790	ME	L					
11	122268	122268	ME	L					
15	35035	0	ME	O					
17	1050	0	ME	S					
22	12035	0	ME	O					
24	7955	0	ME	O					
25	7103	0	ME	S					
26	5746	0	ME	S					
					765050	203752	27	50	52
TOT	1538344	389391			1538344	389391	25	100	100

VALUE ENGINEERING 44

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
5	87001	0	A	L					
8	0	0	A	L					
13	23712	12000	A	L					
21	56060	0	A	L					
14	2339	2339	E	L					
18	10933	0	ME	L					
31	0	0	ME	L					
10	73790	73790	ME	L					
11	122268	122268	ME	L					
					376103	210397	56	24	54
1	3187	0	A	O					
19	7826	7000	A	O					
25	10534	400	A	O					
4	9503	0	E	O					
10	50128	50128	E	O					
16	0	0	E	O					
26	35064	0	E	O					
9	10086	10086	E	O					
13	18921	16500	E	O					
24	994	0	E	O					
25	3398	3398	E	O					
26	4367	4367	E	O					
4	2052	0	ME	O					
5	9102	0	ME	O					
4	43648	0	ME	O					
8	2274	0	ME	O					
15	35035	0	ME	O					
22	12035	0	ME	O					
24	7955	0	ME	O					
					266109	91879	35	17	24

4	1715	1715	A	S					
20	23194	0	A	S					
22	19513	0	A	S					
32	9378	9000	A	S					
34	23967	23967	A	S					
48	11491	0	A	S					
49	0	0	A	S					
50	28041	0	A	S					
1	13552	6761	E	S					
2	10508	0	E	S					
6	3696	0	E	S					
7	11847	11847	E	S					
12	12690	0	E	S					
33	13720	13720	E	S					
34	5725	5725	E	S					
35	246101	0	E	S					
2	0	0	E	S					
16	7201	5300	E	S					
23	1386	1386	E	S					
28	6449	0	E	S					
2	72124	0	ME	S					
10	198686	0	ME	S					
13	5830	0	ME	S					
20	51669	0	ME	S					
40	14302	0	ME	S					
42	336	336	ME	S					
43	899	0	ME	S					
45	32218	0	ME	S					
46	1626	0	ME	S					
51	7358	7358	ME	S					
54	37493	0	ME	S					
2	9214	0	ME	S					
6	304	0	ME	S					
17	1050	0	ME	S					
25	7103	0	ME	S					
26	5746	0	ME	S					
					896132	87115	10	58	22
TOT	1538344	389391			1538344	389391	25	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
5	87001	0	A	L					
8	0	0	A	L					
13	23712	12000	A	L					
21	56060	0	A	L					
					166773	12000	7	11	3
1	3187	0	A	O					
19	7826	7000	A	O					
25	10534	400	A	O					
					21547	7400	34	1	2
4	1715	1715	A	S					
20	23194	0	A	S					
22	19513	0	A	S					
32	9378	9000	A	S					
34	23967	23967	A	S					
48	11491	0	A	S					
49	0	0	A	S					
50	28041	0	A	S					
					117299	34682	30	8	9
14	2339	2339	E	L					
					2339	2339	100	0	1
4	9503	0	E	O					
10	50128	50128	E	O					
16	0	0	E	O					
26	35064	0	E	O					
9	10086	10086	E	O					
13	18921	16500	E	O					
24	994	0	E	O					
25	3398	3398	E	O					
26	4367	4367	E	O					
					132461	84479	64	9	22
1	13552	6761	E	S					
2	10508	0	E	S					
6	3696	0	E	S					
7	11847	11847	E	S					
12	12690	0	E	S					
33	13720	13720	E	S					
34	5725	5725	E	S					
35	246101	0	E	S					
2	0	0	E	S					
16	7201	5300	E	S					
23	1386	1386	E	S					
28	6449	0	E	S					
					332875	44739	13	22	11

18	10933	0	ME	L					
31	0	0	ME	L					
10	73790	73790	ME	L					
11	122268	122268	ME	L					
					206991	196058	95	13	50
4	2052	0	ME	O					
5	9102	0	ME	O					
4	43648	0	ME	O					
8	2274	0	ME	O					
15	35035	0	ME	O					
22	12035	0	ME	O					
24	7955	0	ME	O					
					112101	0	0	7	0
2	72124	0	ME	S					
10	198686	0	ME	S					
13	5830	0	ME	S					
20	51669	0	ME	S					
40	14302	0	ME	S					
42	336	336	ME	S					
43	899	0	ME	S					
45	32218	0	ME	S					
46	1626	0	ME	S					
51	7358	7358	ME	S					
54	37493	0	ME	S					
2	9214	0	ME	S					
6	304	0	ME	S					
17	1050	0	ME	S					
25	7103	0	ME	S					
26	5746	0	ME	S					
					445958	7694	2	29	2
TOT	1538344	389391			1538344	389391	25	100	100

VALUE ENGINEERING 45

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	36	8	21
ENGINEERING	77	12	72
MECH&ELECT	1	80	7
TYPE			
LAYOUT	5	21	9
OMISSION	9	23	17
SPECIFICATION	17	56	75
ARCHITECTURAL			
LAYOUT	62	2	9
OMISSION	2	3	0
SPECIFICATION	52	3	12
ENGINEERING			
LAYOUT	0	0	0
OMISSION	72	3	16
SPECIFICATION	79	9	56
MECH&ELECT			
LAYOUT	0	19	0
OMISSION	0	18	0
SPECIFICATION	2	44	7

VALUE ENG NEER NG 45

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
1	1377	J	A	O					
4	740	740	A	S					
13	11251	7000	A	L					
22	8682	0	A	S					
25	7835	400	A	O					
34	8551	8551	A	S					
48	8546	0	A	O					
49		0	A	S					
					46982	16691	36	8	21
1	5795	4636	E	S					
2	4528	0	E	S					
4	4097	0	E	O					
6	1517	0	E	S					
10	33750	33750	E	S					
16	0	0	E	S					
33	5912	5912	E	O					
34	2472	2472	E	S					
35		0	E	S					
9	253	0	E	L					
16	7814	7000	E	O					
23	4533	4533	E	S					
28	4777	0	E	S					
					75448	58303	77	12	72
1	31602	0	ME	L					
2	86159	0	ME	L					
4	1740	0	ME	O					
5	6692	0	ME	O					
10	131512	0	ME	S					
19	35236	0	ME	S					
31	0	0	ME	L					
33	2283	2283	ME	S					
40	33808	0	ME	S					
45	6390	0	ME	S					
51	3171	3171	ME	S					
54	47463	0	ME	S					
2	4463	0	ME	S					
8	43882	0	ME	O					
15	42122	0	ME	O					
16	12789	0	ME	O					
17	336	0	ME	S					
24	1492	0	ME	O					
25	3066	0	ME	S					
26	4591	0	ME	S					
					498797	5454	1	80	7
TOT	621227	80448			621227	80448	13	100	100

VALUE ENGINEERING 45

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
13	11251	7000	A	L					
9	253	0	E	L					
1	31602	0	ME	L					
2	86159	0	ME	L					
31	0	0	ME	L					
					129265	7000	5	21	9
1	1377	0	A	O					
25	7835	400	A	O					
48	8546	0	A	O					
4	4097	0	E	O					
33	5912	5912	E	O					
16	7814	7000	E	O					
4	1740	0	ME	O					
5	6692	0	ME	O					
8	43882	0	ME	O					
15	42122	0	ME	O					
16	12789	0	ME	O					
24	1492	0	ME	O					
					144298	13312	9	23	17
4	740	740	A	S					
22	8682	0	A	S					
34	8551	8551	A	S					
49	0	0	A	S					
1	5795	4636	E	S					
2	4528	0	E	S					
6	1517	0	E	S					
10	33750	33750	E	S					
16	0	0	E	S					
34	2472	2472	E	S					
35	0	0	E	S					
23	4533	4533	E	S					
28	4777	0	E	S					
10	131512	0	ME	S					
19	35236	0	ME	S					
33	2283	2283	ME	S					
40	33808	0	ME	S					
45	6390	0	ME	S					
51	3171	3171	ME	S					
54	47463	0	ME	S					
2	4463	0	ME	S					
17	336	0	ME	S					
25	3066	0	ME	S					
26	4591	0	ME	S					
					347664	60136	17	56	75
TOT	621227	80448			621227	80448	13	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
13	11251	7000	A	L					
					11251	7000	62	2	9
1	1377	0	A	O					
25	7835	400	A	O					
48	8546	0	A	O					
					17758	400	2	3	0
4	740	740	A	S					
22	8682	0	A	S					
34	8551	8551	A	S					
49	0	0	A	S					
					17973	9291	52	3	12
9	253	0	E	L					
					253	0	0	0	0
4	4097	0	E	O					
33	5912	5912	E	O					
16	7814	7000	E	O					
					17823	12912	72	3	16
1	5795	4636	E	S					
2	4528	0	E	S					
6	1517	0	E	S					
10	33750	33750	E	S					
16	0	0	E	S					
34	2472	2472	E	S					
35	0	0	E	S					
23	4533	4533	E	S					
28	4777	0	E	S					
					57372	45391	79	9	56

1	31602	0	ME	L					
2	86159	0	ME	L					
31	0	0	ME	L					
					117761	0	0	19	0
4	1740	0	ME	O					
5	6692	0	ME	O					
8	43882	0	ME	O					
15	42122	0	ME	O					
16	12789	0	ME	O					
24	1492	0	ME	O					
					108717	0	0	18	0
10	131512	0	ME	S					
19	35236	0	ME	S					
33	2283	2283	ME	S					
40	33808	0	ME	S					
45	6390	0	ME	S					
51	3171	3171	ME	S					
54	47463	0	ME	S					
2	4463	0	ME	S					
17	336	0	ME	S					
25	3066	0	ME	S					
26	4591	0	ME	S					
					272319	5454	2	44	7
TOT	621227	80448			621227	80448	13	100	100

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	32	28	35
ENGINEERING	4	37	7
MECH&ELECT	44	34	58
TYPE			
LAYOUT	1	7	0
OMISSION	21	20	16
SPECIFICATION	30	72	83
ARCHITECTURAL			
LAYOUT	0	3	0
OMISSION	15	3	2
SPECIFICATION	38	23	33
ENGINEERING			
LAYOUT	0	4	0
OMISSION	0	4	0
SPECIFICATION	6	29	7
MECH&ELECT			
LAYOUT	16	0	0
OMISSION	29	13	15
SPECIFICATION	54	21	43

VALUE ENGINEERING 46

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	20375	0	A	S					
A5	24500	24500	A	S					
A7	0	0	A	S					
A8	0	0	A	S					
A10	0	0	A	S					
A11	249913	40000	A	S					
A19	24190	0	A	L					
A20	0	0	A	S					
A21	0	0	A	S					
A22	49387	0	A	S					
A23	17169	0	A	L					
A25	41311	41000	A	S					
A26	35257	35257	A	S					
A28	52000	0	A	O					
A36	43361	30000	A	S					
A38	5670	5670	A	S					
A48	9198	9198	A	O					
A49	3399	3399	A	S					
A54	16217	0	A	L					
					591947	189024	32	28	35
C2	5607	0	E	O					
C4	0	0	E	S					
C6	14500	0	E	O					
C8	20900	0	E	O					
C12	3760	0	E	O					
C13	7120	0	E	O					
C14	17650	0	E	O					
C15	0	0	E	S					
C16	15500	0	E	O					
C17	16000	0	E	S					
S1	47609	0	E	L					
S2	10048	7000	E	S					
S3	9340	0	E	S					
S4	21280	0	E	L					
S5	4439	0	E	L					
S8	9159	0	E	S					
S10	28895	28000	E	S					
S11	187856	0	E	S					
S13	1933	0	E	O					
S18	336519	0	E	S					
S19	5400	0	E	S					
S24	3511	0	E	S					
S26	12483	0	E	L					
					779509	35000	4	37	7

E1	146785	146785	ME	S					
E2	6868	0	ME	O					
E3	10091	0	ME	S					
E4	37888	37888	ME	S					
E5	2496	2496	ME	O					
E6	4104	0	ME	L					
E7	3000	3000	ME	O					
E8	12968	0	ME	O					
E9	16386	16000	ME	S					
E10	14827	0	ME	O					
E13	2272	0	ME	S					
E14	2157	1000	ME	L					
M1	56266	4000	ME	S					
M5	88691	0	ME	S					
M8	18301	0	ME	O					
M9	0	0	ME	O					
M10	0	0	ME	O					
M11	37510	37000	ME	O					
M14	5450	0	ME	O					
M17	5000	5000	ME	S					
M20	24273	24000	ME	S					
M22	93100	0	ME	O					
M23	44399	0	ME	O					
M34	43456	0	ME	S					
M40	36500	36500	ME	O					
					712788	313669	44	34	58
TOT	2084244	537693			2084244	537693	26	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A19	24190	0	A	L					
A23	17169	0	A	L					
A54	16217	0	A	L					
S1	47609	0	E	L					
S4	21280	0	E	L					
S5	4439	0	E	L					
S26	12483	0	E	L					
E6	4104	0	ME	L					
E14	2157	1000	ME	L					
					149648	1000	1	7	0
A28	52000	0	A	O					
A48	9198	9198	A	O					
C2	5607	0	E	O					
C6	14500	0	E	O					
C8	20900	0	E	O					
C12	3760	0	E	O					
C13	7120	0	E	O					
C14	17650	0	E	O					
C16	15500	0	E	O					
S13	1933	0	E	O					
E2	6868	0	ME	O					
E5	2496	2496	ME	O					
E7	3000	3000	ME	O					
E8	12968	0	ME	O					
E10	14827	0	ME	O					
M8	18301	0	ME	O					
M9	0	0	ME	O					
M10	0	0	ME	O					
M11	37510	37000	ME	O					
M14	5450	0	ME	O					
M22	93100	0	ME	O					
M23	44399	0	ME	O					
M40	36500	36500	ME	O					
					423587	88194	21	20	16

A2	20375	0	A	S					
A5	24500	24500	A	S					
A7	0	0	A	S					
A8	0	0	A	S					
A10	0	0	A	S					
A11	249913	40000	A	S					
A20	0	0	A	S					
A21	0	0	A	S					
A22	49387	0	A	S					
A25	41311	41000	A	S					
A26	35257	35257	A	S					
A36	43361	30000	A	S					
A38	5670	5670	A	S					
A49	3399	3399	A	S					
C4	0	0	E	S					
C15	0	0	E	S					
C17	16000	0	E	S					
S2	10048	7000	E	S					
S3	9340	0	E	S					
S8	9159	0	E	S					
S10	28895	28000	E	S					
S11	187856	0	E	S					
S18	336519	0	E	S					
S19	5400	0	E	S					
S24	3511	0	E	S					
E1	146785	146785	ME	S					
E3	10091	0	ME	S					
E4	37888	37888	ME	S					
E9	16386	16000	ME	S					
E13	2272	0	ME	S					
M1	56266	4000	ME	S					
M5	88691	0	ME	S					
M17	5000	5000	ME	S					
M20	24273	24000	ME	S					
M34	43456	0	ME	S					
					1511009	448499	30	72	83
TOT	2084244	537693			2084244	537693	26	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A19	24190	0	A	L					
A23	17169	0	A	L					
A54	16217	0	A	L					
					57576	0	0	3	0
A28	52000	0	A	O					
A48	9198	9198	A	O					
					61198	9198	15	3	2
A2	20375	0	A	S					
A5	24500	24500	A	S					
A7	0	0	A	S					
A8	0	0	A	S					
A10	0	0	A	S					
A11	249913	40000	A	S					
A20	0	0	A	S					
A21	0	0	A	S					
A22	49387	0	A	S					
A25	41311	41000	A	S					
A26	35257	35257	A	S					
A36	43361	30000	A	S					
A38	5670	5670	A	S					
A49	3399	3399	A	S					
					473173	179826	38	23	33
S1	47609	0	E	L					
S4	21280	0	E	L					
S5	4439	0	E	L					
S26	12483	0	E	L					
					85811	0	0	4	0
C2	5607	0	E	O					
C6	14500	0	E	O					
C8	20900	0	E	O					
C12	3760	0	E	O					
C13	7120	0	E	O					
C14	17650	0	E	O					
C16	15500	0	E	O					
S13	1933	0	E	O					
					86970	0	0	4	0
C4	0	0	E	S					
C15	0	0	E	S					
C17	16000	0	E	S					
S2	10048	7000	E	S					
S3	9340	0	E	S					
S8	9159	0	E	S					
S10	28895	28000	E	S					
S11	187856	0	E	S					
S18	336519	0	E	S					
S19	5400	0	E	S					
S24	3511	0	E	S					
					606728	35000	6	29	7

E6	4104	0	ME	L					
E14	2157	'000	ME	L					
					6261	1000	16	0	0
E2	6868	0	ME	O					
E5	2496	2496	ME	O					
E7	3000	3000	ME	O					
E8	12968	0	ME	O					
E10	14827	0	ME	O					
M8	18301	0	ME	O					
M9	0	0	ME	O					
M10	0	0	ME	O					
M11	37510	37000	ME	O					
M14	5450	0	ME	O					
M22	93100	0	ME	O					
M23	44399	0	ME	O					
M40	36500	36500	ME	O					
					275419	78996	29	13	15
E1	146785	146785	ME	S					
E3	10091	0	ME	S					
E4	37888	37888	ME	S					
E9	16386	16000	ME	S					
E13	2272	0	ME	S					
M1	56266	4000	ME	S					
M5	88691	0	ME	S					
M17	5000	5000	ME	S					
M20	24273	24000	ME	S					
M34	43456	0	ME	S					
					431108	233673	54	21	43
TOT	2084244	537693			2084244	537693	26	100	100

VALUE ENGINEERING 47

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	-	-	-
ENGINEERING	31	47	78
MECH&ELECT	8	53	22
TYPE			
LAYOUT	0	26	0
OMISSION	4	48	11
SPECIFICATION	64	26	89
ARCHITECTURAL			
LAYOUT	-	-	-
OMISSION	-	-	-
SPECIFICATION	-	-	-
ENGINEERING			
LAYOUT	0	10	0
OMISSION	10	19	11
SPECIFICATION	71	18	68
MECH&ELECT			
LAYOUT	0	16	0
OMISSION	0	29	0
SPECIFICATION	48	8	22

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C1	500000	0	E	O					
C2	171518	0	E	L					
C4	26747	0	E	O					
C5	68969	0	E	L					
C6	22249	0	E	O					
C11	7353	7353	E	S					
C12	92412	0	E	O					
C14	58841	0	E	L					
C15	270528	200239	E	S					
C18	0	0	E	S					
C19	148546	148546	E	S					
C20	72260	72260	E	O					
C21	108489	108489	E	S					
C24	0	0	E	L					
C10 1	58452	0	E	L					
C12 1	0	0	E	L					
C15 1	114945	0	E	S					
C12 3	0	0	E	L					
O1	0	0	E	L					
					1721309	536887	31	47	78
E1	90813	0	ME	O					
E2	0	0	ME	O					
E3	27994	0	ME	L					
E4	566321	0	ME	L					
E5	72109	0	ME	S					
E8	77849	77849	ME	S					
E11	0	0	ME	S					
E15	503538	0	ME	O					
E18	72129	0	ME	S					
E19	71090	0	ME	O					
E22	0	0	ME	S					
E23	280768	0	ME	O					
E24	0	0	ME	L					
E11 1	28950	28950	ME	S					
M1	0	0	ME	L					
M2	0	0	ME	O					
M3	0	0	ME	O					
M4	41000	41000	ME	S					
M8	62914	0	ME	O					
M9	31921	0	ME	O					
M11	11754	0	ME	S					
M4 1	0	0	ME	L					
M8	0	0	ME	O					
M8 1	15841	0	ME	O					
					1954991	147799	8	53	22
TOT	3676300	684686			3676300	684686	19	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C2	171518	0	E	L					
C5	68969	0	E	L					
C14	58841	0	E	L					
C24	0	0	E	L					
C10 1	58452	0	E	L					
C12.1	0	0	E	L					
C1 2.3	0	0	E	L					
01	0	0	E	L					
E3	27994	0	ME	L					
E4	566321	0	ME	L					
E24	0	0	ME	L					
M1	0	0	ME	L					
M4.1	0	0	ME	L					
					952095	0	0	26	0
C1	500000	0	E	O					
C4	26747	0	E	O					
C6	22249	0	E	O					
C12	92412	0	E	O					
C20	72260	72260	E	O					
E1	90813	0	ME	O					
E2	0	0	ME	O					
E15	503538	0	ME	O					
E19	71090	0	ME	O					
E23	280768	0	ME	O					
M2	0	0	ME	O					
M3	0	0	ME	O					
M8	62914	0	ME	O					
M9	31921	0	ME	O					
M8	0	0	ME	O					
M8 1	15841	0	ME	O					
					1770553	72260	4	48	11
C11	7353	7353	E	S					
C15	270528	200239	E	S					
C18	0	0	E	S					
C19	148546	148546	E	S					
C21	108489	108489	E	S					
C15 1	114945	0	E	S					
E5	72109	0	ME	S					
E8	77849	77849	ME	S					
E11	0	0	ME	S					
E18	72129	0	ME	S					
E22	0	0	ME	S					
E11 1	28950	28950	ME	S					
M4	41000	41000	ME	S					
M11	11754	0	ME	S					
					953652	612426	64	26	89
TOT	3676300	684686			3676300	684686	19	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
C2	171518	0	E	L					
C5	68969	0	E	L					
C14	58841	0	E	L					
C24	0	0	E	L					
C10 1	58452	0	E	L					
C12.1	0	0	E	L					
C1 2.3	0	0	E	L					
O1	0	0	E	L					
					357780	0	0	10	0
C1	500000	0	E	O					
C4	26747	0	E	O					
C6	22249	0	E	O					
C12	92412	0	E	O					
C20	72260	72260	E	O					
					713668	72260	10	19	11
C11	7353	7353	E	S					
C15	270528	200239	E	S					
C18	0	0	E	S					
C19	148546	148546	E	S					
C21	108489	108489	E	S					
C15.1	114945	0	E	S					
					649861	464627	71	18	68
E3	27994	0	ME	L					
E4	566321	0	ME	L					
E24	0	0	ME	L					
M1	0	0	ME	L					
M4 1	0	0	ME	L					
					594315	0	0	16	0
E1	90813	0	ME	O					
E2	0	0	ME	O					
E15	503538	0	ME	O					
E19	71090	0	ME	O					
E23	280768	0	ME	O					
M2	0	0	ME	O					
M3	0	0	ME	O					
M8	62914	0	ME	O					
M9	31921	0	ME	O					
M8	0	0	ME	O					
M8 1	15841	0	ME	O					
					1056885	0	0	29	0
E5	72109	0	ME	S					
E8	77849	77849	ME	S					
E11	0	0	ME	S					
E18	72129	0	ME	S					
E22	0	0	ME	S					
E11 1	28950	28950	ME	S					
M4	41000	41000	ME	S					
M11	11754	0	ME	S					
					303791	147799	49	8	22
TOT	3676300	684686			3676300	684686	19	100	100

VALUE ENGINEERING 48

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	54	37	70
ENGINEERING	20	28	20
MECH&ELECT	7	35	9
TYPE			
LAYOUT	15	16	8
OMISSION	42	43	65
SPECIFICATION	18	40	26
ARCHITECTURAL			
LAYOUT	0	9	0
OMISSION	89	16	53
SPECIFICATION	46	11	18
ENGINEERING			
LAYOUT	100	1	3
OMISSION	22	12	10
SPECIFICATION	15	15	8
MECH&ELECT			
LAYOUT	26	6	6
OMISSION	6	15	3
SPECIFICATION	0	14	0

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	40753	40703	A	O					
A2	26226	0	A	L					
A3	25831	0	A	L					
A7	22775	22775	A	S					
A10	0	0	A	O					
A11	25640	5000	A	S					
A12	2378	0	A	S					
A14	3082		A	S					
A16	7731	0	A	O					
A17	38927	38927	A	O					
A19	1992	0	A	O					
A21	0	0	A	L					
A25	0	0	A	L					
A28	1552	1552	A	O					
A29	6360	0	A	S					
					203247	108957	54	37	70
S1	3328	0	E	S					
S2	0	0	E	L					
S3	4230	4230	E	L					
S4	8192	0	E	O					
S5	12010	10000	E	S					
S6	9010	0	E	S					
S8	0	0	E	L					
S9	50500	0	E	S					
S10	0	0	E	L					
S11	0	0	E	S					
S12	2590	2590	E	S					
S13	0	0	E	S					
S14	0	0	E	S					
S15	0	0	E	O					
S16	0	0	E	L					
C1A	6900	0	E	O					
C1B	14800	14800	E	O					
C2	0	0	E	L					
C3	6706	0	E	S					
C4	0	0	E	L					
C5A	21646	0	E	O					
C5B	0	0	E	L					
C6	0	0	E	O					
C8	0	0	E	L					
C9A	15500	0	E	O					
C9B	0	0	E	L					
C10	0	0	E	L					
					155412	31620	20	28	20

M1	2270	1500	ME	O					
M3	23832	0	ME	S					
M4	8051	0	ME	O					
M7	15293	0	ME	O					
M8	0	0	ME	L					
M9	0	0	ME	L					
M10	13047	0	ME	L					
M11	0	0	ME	L					
M12	0	0	ME	L					
M14	9900	0	ME	S					
M15	0	0	ME	L					
M16	0	0	ME	L					
M17	0	0	ME	S					
M18	40052	0	ME	S					
M19	28934	0	ME	O					
M21	0	0	ME	L					
E1	20885	0	ME	O					
E3	7367	0	ME	L					
E5	3264	0	ME	S					
E7	3591	3591	ME	O					
E8	2105	0	ME	S					
E13	3422	0	ME	O					
E16	4893	4893	ME	L					
E23	8293	4000	ME	L					
					195199	13984	7	35	9
TOT	553858	154561			553858	154561	28	100	100

VALUE ENGINEERING 48

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	26226	0	A	L					
A3	25831	0	A	L					
A21	0	0	A	L					
A25	0	0	A	L					
S2	0	0	E	L					
S3	4230	4230	E	L					
S8	0	0	E	L					
S10	0	0	E	L					
S16	0	0	E	L					
C2	0	0	E	L					
C4	0	0	E	L					
C5B	0	0	E	L					
C8	0	0	E	L					
C9B	0	0	E	L					
C10	0	0	E	L					
M8	0	0	ME	L					
M9	0	0	ME	L					
M10	13047	0	ME	L					
M11	0	0	ME	L					
M12	0	0	ME	L					
M15	0	0	ME	L					
M16	0	0	ME	L					
M21	0	0	ME	L					
E3	7367	0	ME	L					
E16	4893	4893	ME	L					
E23	8293	4000	ME	L					
					89887	13123	15	16	8
A1	40753	40703	A	O					
A10	0	0	A	O					
A16	7731	0	A	O					
A17	38927	38927	A	O					
A19	1992	0	A	O					
A28	1552	1552	A	O					
S4	8192	0	E	O					
S15	0	0	E	O					
C1A	6900	0	E	O					
C1B	14800	14800	E	O					
C5A	21646	0	E	O					
C6	0	0	E	O					
C9A	15500	0	E	O					
M1	2270	1500	ME	O					
M4	8051	0	ME	O					
M7	15293	0	ME	O					
M19	28934	0	ME	O					
E1	20885	0	ME	O					
E7	3591	3591	ME	O					
E13	3422	0	ME	O					
					240439	101073	42	43	65

A7	22775	22775	A	S					
A11	25640	5000	A	S					
A12	2378	0	A	S					
A14	3082	0	A	S					
A29	6360	0	A	S					
S1	3328	0	E	S					
S5	12010	10000	E	S					
S6	9010	0	E	S					
S9	50500	0	E	S					
S11	0	0	E	S					
S12	2590	2590	E	S					
S13	0	0	E	S					
S14	0	0	E	S					
C3	6706	0	E	S					
M3	23832	0	ME	S					
M14	9900	0	ME	S					
M17	0	0	ME	S					
M18	40052	0	ME	S					
E5	3264	0	ME	S					
E8	2105	0	ME	S					
					223532	40365	18	40	26
TOT	553858	154561			553858	154561	28	100	100

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A2	26226	0	A	L					
A3	25831	0	A	L					
A21	0	0	A	L					
A25	0	0	A	L					
					52057	0	0	9	0
A1	40753	40703	A	O					
A10	0	0	A	O					
A16	7731	0	A	O					
A17	38927	38927	A	O					
A19	1992	0	A	O					
A28	1552	1552	A	O					
					90955	81182	89	16	53
A7	22775	22775	A	S					
A11	25640	5000	A	S					
A12	2378	0	A	S					
A14	3082	0	A	S					
A29	6360	0	A	S					
					60235	27775	46	11	18
S2	0	0	E	L					
S3	4230	4230	E	L					
S8	0	0	E	L					
S10	0	0	E	L					
S16	0	0	E	L					
C2	0	0	E	L					
C4	0	0	E	L					
C5B	0	0	E	L					
C8	0	0	E	L					
C9B	0	0	E	L					
C10	0	0	E	L					
					4230	4230	100	1	3
S4	8192	0	E	O					
S15	0	0	E	O					
C1A	6900	0	E	O					
C1B	14800	14800	E	O					
C5A	21646	0	E	O					
C6	0	0	E	O					
C9A	15500	0	E	O					
					67038	14800	22	12	10
S1	3328	0	E	S					
S5	12010	10000	E	S					
S6	9010	0	E	S					
S9	50500	0	E	S					
S11	0	0	E	S					
S12	2590	2590	E	S					
S13	0	0	E	S					
S14	0	0	E	S					
C3	6706	0	E	S					
					84144	12590	15	15	8

M8		0	ME	L					
M9	0	0	ME	L					
M10	13047	0	ME	L					
M11	0	0	ME	L					
M12	0	0	ME	L					
M15	0	0	ME	L					
M16	0	0	ME	L					
M21	0	0	ME	L					
E3	7367	0	ME	L					
E16	4893	4893	ME	L					
E23	8293	4000	ME	L					
					33600	8893	26	6	6
M1	2270	1500	ME	O					
M4	8051	0	ME	O					
M7	15293	0	ME	O					
M19	28934	0	ME	O					
E1	20885	0	ME	O					
E7	3591	3591	ME	O					
E13	3422	0	ME	O					
					82446	5091	6	15	3
M3	23832	0	ME	S					
M14	9900	0	ME	S					
M17	0	0	ME	S					
M18	40052	0	ME	S					
E5	3264	0	ME	S					
E8	2105	0	ME	S					
					79153	0	0	14	0
TOT	553858	154561			553858	154561	28	100	100

VALUE ENGINEERING 49

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	9	33	68
ENGINEERING	3	49	30
MECH&ELECT	1	17	2
TYPE			
LAYOUT	5	50	52
OMISSION	8	13	23
SPECIFICATION	3	37	25
ARCHITECTURAL			
LAYOUT	7	23	36
OMISSION	51	2	23
SPECIFICATION	5	8	8
ENGINEERING			
LAYOUT	3	22	14
OMISSION	0	10	0
SPECIFICATION	4	17	17
MECH&ELECT			
LAYOUT	2	5	2
OMISSION	2	1	0
SPECIFICATION	0	12	0

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	853380	0	A	L					
A13	23296	23296	A	S					
A17	143640	143640	A	L					
A18	68400	0	A	L					
A19	39084	0	A	O					
A2	56778	0	A	L					
A20	36790	0	A	S					
A24	53786	0	A	L					
A25	40572	0	A	S					
A26	66528	66528	A	O					
A27	47818	0	A	O					
A30	4118	2500	A	S					
A31	84820	0	A	S					
A32	127075	0	A	S					
A33	48875	0	A	S					
A34	36341	0	A	S					
A37	651000	0	A	L					
A38	0	0	A	L					
A4	230950	0	A	S					
A5	19608	0	A	S					
A6	42625	0	A	S					
A7	214989	0	A	L					
A9	22004	7500	A	S					
CS17	23140	23140	A	O					
					2935617	266604	9	33	68
CS10	13999	0	E	S					
CS13	47825	0	E	L					
CS15	62759	0	E	L					
CS16	9631	9361	E	L					
CS9	4617	0	E	O					
S1	661100	0	E	O					
S10	65217	65217	E	S					
S11	1502552	0	E	L					
S12	239478	0	E	S					
S13	8544	0	E	S					
S14	512515	0	E	S					
S15	0	0	E	L					
S16	234709	0	E	O					
S2	289168	0	E	S					
S3	414899	0	E	S					
S4	186821	0	E	L					
S5	84150	0	E	L					
S6	44430	44430	E	L					
					4382414	119008	3	49	30

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	853380	0	A	L					
A17	143640	143640	A	L					
A18	68400	0	A	L					
A2	56778	0	A	L					
A24	53786	0	A	L					
A37	651000	0	A	L					
A38	0	0	A	L					
A7	214989	0	A	L					
CS13	47825	0	E	L					
CS15	62759	0	E	L					
CS16	9631	9361	E	L					
S11	1502552	0	E	L					
S15	0	0	E	L					
S4	186821	0	E	L					
S5	84150	0	E	L					
S6	44430	44430	E	L					
E14	7245	7245	ME	L					
M10	0	0	ME	L					
M15	0	0	ME	L					
M18	0	0	ME	L					
M20	0	0	ME	L					
M6	410347	0	ME	L					
					4397733	204676	5	50	52
A19	39084	0	A	O					
A26	66528	66528	A	O					
A27	47818	0	A	O					
CS17	23140	23140	A	O					
CS9	4617	0	E	O					
S1	661100	0	E	O					
S16	234709	0	E	O					
E1	36300	0	ME	O					
E12	1950	0	ME	O					
E13	1253	0	ME	O					
E2	1638	1638	ME	O					
M9	60855	0	ME	O					
					1178992	91306	8	13	23

A13	23296	23296	A	S					
A20	36790	0	A	S					
A25	40572	0	A	S					
A30	4118	2500	A	S					
A31	84820	0	A	S					
A32	127075	0	A	S					
A33	48875	0	A	S					
A34	36341	0	A	S					
A4	230950	0	A	S					
A5	19608	0	A	S					
A6	42625	0	A	S					
A9	22004	7500	A	S					
CS10	13999	0	E	S					
S10	65217	65217	E	S					
S12	239478	0	E	S					
S13	8544	0	E	S					
S14	512515	0	E	S					
S2	289168	0	E	S					
S3	414899	0	E	S					
E10	142320	0	ME	S					
E6	4356	0	ME	S					
E7	0	0	ME	S					
M1	0	0	ME	S					
M16	0	0	ME	S					
M2	0	0	ME	S					
M3	0	0	ME	S					
M4	707644	0	ME	S					
M7	51097	0	ME	S					
M8	43700	0	ME	S					
P1	49681	0	ME	S					
P5	0	0	ME	S					
P6	27628	0	ME	S					
					3287320	98513	3	37	25
TOT	8864045	394495			8864045	394495	4	100	100

VALUE ENGINEERING 49

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	853380	0	A	L					
A17	143640	143640	A	L					
A18	68400	0	A	L					
A2	56778	0	A	L					
A24	53786	0	A	L					
A37	651000	0	A	L					
A38	0	0	A	L					
A7	214989	0	A	L					
					2041973	143640	7	23	36
A19	39084	0	A	O					
A26	66528	66528	A	O					
A27	47818	0	A	O					
CS17	23140	23140	A	O					
					176570	89668	51	2	23
A13	23296	23296	A	S					
A20	36790	0	A	S					
A25	40572	0	A	S					
A30	4118	2500	A	S					
A31	84820	0	A	S					
A32	127075	0	A	S					
A33	48875	0	A	S					
A34	36341	0	A	S					
A4	230950	0	A	S					
A5	19608	0	A	S					
A6	42625	0	A	S					
A9	22004	7500	A	S					
					717074	33296	5	8	8
CS13	47825	0	E	L					
CS15	62759	0	E	L					
CS16	9631	9361	E	L					
S11	1502552	0	E	L					
S15	0	0	E	L					
S4	186821	0	E	L					
S5	84150	0	E	L					
S6	44430	44430	E	L					
					1938168	53791	3	22	14
CS9	4617	0	E	O					
S1	661100	0	E	O					
S16	234709	0	E	O					
					900426	0	0	10	0
CS10	13999	0	E	S					
S10	65217	65217	E	S					
S12	239478	0	E	S					
S13	8544	0	E	S					
S14	512515	0	E	S					
S2	289168	0	E	S					
S3	414899	0	E	S					
					1543820	65217	4	17	17

E14	7245	7245	E	L					
M10			ME	L					
M15		0	ME	L					
M18	0	0	ME	L					
M20	0	0	ME	L					
M6	410347	0	ME	L					
					417592	7245	2	5	2
E1	36300	0	ME	O					
E12	1950	0	ME	O					
E13	1253	0	ME	O					
E2	1638	1638	ME	O					
M9	60855	0	ME	O					
					101996	1638	2	1	0
E10	142320	0	ME	S					
E6	4356	0	ME	S					
E7	0	0	ME	S					
M1	0	0	ME	S					
M16	0	0	ME	S					
M2	0	0	ME	S					
M3	0	0	ME	S					
M4	707644	0	ME	S					
M7	51097	0	ME	S					
M8	43700	0	ME	S					
P1	49681	0	ME	S					
P5	0	0	ME	S					
P6	27628	0	ME	S					
					1026426	0	0	12	0
TOT	8864045	394495			8864045	394495	4	100	100

VALUE ENGINEERING 106

	IMPLEMENTED	%TOTAL PROP	%TOTAL IMP
DISCIPLINE			
ARCHITECTURAL	46	23	20
ENGINEERING	56	63	64
MECH&ELECT	62	14	16
TYPE			
LAYOUT	23	18	8
OMISSION	45	35	29
SPECIFICATION	75	47	64
ARCHITECTURAL			
LAYOUT	0	5	0
OMISSION	87	13	20
SPECIFICATION	0	5	0
ENGINEERING			
LAYOUT	0	8	0
OMISSION	6	17	2
SPECIFICATION	90	38	63
MECH&ELECT			
LAYOUT	87	5	8
OMISSION	64	6	7
SPECIFICATION	14	3	1

VALUE ENGINEERING 106

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	57730	0	A	L					
A2	6850	0	A	L					
A4	38180	38180	A	O					
A6	7800	0	A	O					
A7	55707	0	A	S					
A9	2940	0	A	O					
A13	10980	0	A	O					
A16	11950	11950	A	O					
A20	91000	91000	A	O					
A21	0	0	A	L					
A22	7114	0	A	S					
					290251	141130	49	23	20
C1	17158	0	E	L					
C2	3609	0	E	S					
C3	2706	2706	E	O					
C7	145000	0	E	O					
C9	24600	24600	E	S					
C28	9553	0	E	O					
C5	7653	7653	E	O					
C10	11880	0	E	S					
C13	23773	0	E	S					
C14	0	0	E	L					
C18	58667	0	E	L					
C20	29268	29268	E	S					
C21	38169	0	E	O					
C26	2023	2023	E	O					
C30	387400	387400	E	S					
C31	7679	0	E	O					
C32	30177	0	E	L					
S1	5324	0	E	S					
S4	2015	2015	E	S					
S6	2304	0	E	S					
S7	788	0	E	S					
S8	816	0	E	S					
					810562	455665	56	63	64

M1	50853	50853	ME	L					
M3	31248	31248	ME	O					
M4	1249	1249	ME	S					
M9	2009	0	ME	L					
M6	17000	0	ME	S					
M7	698	0	ME	S					
M12	-3992	-3392	ME	S					
M13	2906	2906	ME	S					
M19	8467	0	ME	S					
M21	386	0	ME	S					
E1	16991	16991	ME	O					
E2	13160	0	ME	O					
E3	10847	0	ME	O					
E8	2337	2337	ME	L					
E9	2592	2592	ME	O					
E10	9080	0	ME	S					
E16	3394	0	ME	L					
E19	2822	0	ME	L					
E21	4927	4927	ME	S					
					176974	109711	62	14	16
TOT	1277787	706506			1277787	706506	55	100	100

A7	55707	(	A	S					
A22	7114	0	A	S					
C2	3609	0	E	S					
C9	24600	24600	E	S					
C10	11880	0	E	S					
C13	23773	0	E	S					
C20	29268	29268	E	S					
C30	387400	387400	E	S					
S1	5324	0	E	S					
S4	2015	2015	E	S					
S6	2304	0	E	S					
S7	788	0	E	S					
S8	816	0	E	S					
M4	1249	1249	ME	S					
M6	17000	0	ME	S					
M7	698	0	ME	S					
M12	-3992	-3392	ME	S					
M13	2906	2906	ME	S					
M19	8467	0	ME	S					
M21	386	0	ME	S					
E10	9080	0	ME	S					
E21	4927	4927	ME	S					
					595319	448973	75	47	64
TOT	1277787	706506			1277787	706506	55	100	100

VALUE ENG NEER NG 106

NO	PROPOSED	ACTUAL	DIS	TYPE	PROPOSED	ACTUAL	%IMP	%TOT	%TOT
A1	57730	0	A	L					
A2	6850	0	A	L					
A21	0	0	A	L					
					64580	0	0	5	0
A4	38180	38180	A	O					
A6	7800	0	A	O					
A9	2940	0	A	O					
A13	10980	0	A	O					
A16	11950	11950	A	O					
A20	91000	91000	A	O					
					162850	141130	87	13	20
A7	55707	0	A	S					
A22	7114	0	A	S					
					62821	0	0	5	0
C1	17158	0	E	L					
C14	0	0	E	L					
C18	58667	0	E	L					
C32	30177	0	E	L					
					106002	0	0	8	0
C3	2706	2706	E	O					
C7	145000	0	E	O					
C28	9553	0	E	O					
C5	7653	7653	E	O					
C21	38169	0	E	O					
C26	2023	2023	E	O					
C31	7679	0	E	O					
					212783	12382	6	17	2
C2	3609	0	E	S					
C9	24600	24600	E	S					
C10	11880	0	E	S					
C13	23773	0	E	S					
C20	29268	29268	E	S					
C30	387400	387400	E	S					
S1	5324	0	E	S					
S4	2015	2015	E	S					
S6	2304	0	E	S					
S7	788	0	E	S					
S8	816	0	E	S					
					491777	443283	90	38	63

M1	50853	50853	ME	L					
M9	2009	0	ME	L					
E8	2337	2337	ME	L					
E16	3394	0	ME	L					
E19	2822	0	ME	L					
					61415	53190	87	5	8
E2	13160	0	ME	O					
M3	31248	31248	ME	O					
E1	16991	16991	ME	O					
E3	10847	0	ME	O					
E9	2592	2592	ME	O					
					75068	48239	64	6	7
M4	1249	1249	ME	S					
M6	17000	0	ME	S					
M7	698	0	ME	S					
M12	-3992	-3392	ME	S					
M13	2906	2906	ME	S					
M19	8467	0	ME	S					
M21	386	0	ME	S					
E10	9080	0	ME	S					
E21	4927	4927	ME	S					
					40721	5690	14	3	1
TOT	1277787	706506			1278017	703914	55	100	100

Appendix B
Workshops

WORKSHOPS

Introduction

Four workshops were attended and observed. The first of the four was a training workshop and the remaining three were live studies.

The workshops are detailed under the following headings, -

1. Outline of scheme.
2. Format of the workshop.
3. Interviews with the VE team.
4. Interviews with the design team.
5. Interviews with the client.
6. Conclusions.

Value engineering workshop 1
Holiday Inn, Springfield, New Jersey
26th June 1989

1. Outline of the scheme

1.1 General project description

The project, a research facility, consisted of two main elements:-

818, 000 sq. ft. of research laboratory made up of five, four storey laboratory blocks, one single storey support block and one four storey animal facility.

100, 000 sq. ft. of support office space in one, three storey block.

1.2 Cost

A firm budget was not available.

1.3 Design stage

The project was at sketch design stage. Plans, elevations and outline specifications were available.

1.4 VE Consultants

The VE consultants were made up of employees of Torcon Limited,- a construction management company. The purpose of the workshop was to train the Torcon employees in VE methodology by examination of a live project. The workshop leader was Al Dell'Isola, a certified value specialist of Smith Hinchman and Grylls, Washington DC.

1.5 Client

The client for the scheme was Schering Plough, a drugs manufacturer.

2. Format of the workshop

The workshop was carried out over five days, starting in the afternoon and running through until late evening. This was to accommodate the employer who did not wish his staff to be absent from work for an entire week.

2.1 Monday June 26th 1989

2.1.1 1.00 pm - 8.00 pm Introduction to value engineering.

The workshop leader gave an introduction to VE outlining the history, methodology and current government programmes. The teams were then given drawings and information relating to the project and were allocated time to familiarise themselves with the details.

2.2 Tuesday 27th June 1989

2.2.1 1. 00 pm - 9.00pm Information phase

The workshop leader presented the techniques that were to to be used in the VE study. These in the main consisted of three techniques,

cost models,
graphical function analysis and
function analysis and cost worth ratios

The value engineering team for the duration of the study were split down into three groups with the purpose of concentrating on one section of the work each, namely:-

sitework, structural and architectural systems,
administration building and
laboratory towers heating,ventilating and air conditioning.

Each of the groups then applied the three techniques outined above to their section of the project. These sections will be dealt with separately.

1. Sitework, structural and architectural systems

A. Cost models

The cost model was constructed by taking the project estimate and allocating the cost contained therein over the building elements. Once apportioned the team then assigned their own estimate of cost to the elements. As the majority of the team were estimators they had a great deal of experience on which to draw. The allocation of their own costs was subjective and basically amounted to the team asking if the original estimate was high, low or 'about right.' Once this cost model was completed the team carried out a similar exercise comparing elemental costs per sqare foot. The first model is shown in Example 1.

The team were not correcting the original estimate, they were allocating costs to the elements based on what they believed the element could be constructed for.

B. Graphical function analysis

Once the cost models were completed the team drew up a graphical function analysis. This bore no resemblance to function analysis as defined in VE texts. It was merely a graphical representation of the cost models or estimates. The graphical representation highlighted elements of the building that the team felt were more expensive than usual.

The graphical function analysis produced is shown in Example 2.

C. Function analysis and cost worth ratios

Once the cost models and graphical function analysis were completed the team moved to function analysis. The main cost elements of the building, as highlighted by the cost model, were allocated a function. Based on the figures calculated in the cost model each function was assigned a cost worth ratio. This was calculated by dividing the cost allocated in the original estimate by the cost apportioned by the VE team. The following functions and ratios were allocated, PROJECT ____________

COST MODEL

SHEET ____ OF ____

Construction	+	Contingency	+	Escalation	=	Construction @ Bid Date

Bldg. Type ____ Const. Type ____ Use Units ____

Date ____ Phase ____ GSF ____ NSF ____ Floors ____

Comparative Ratios: Parameter ____ Target ____ ACT/EST ____

Legend: Target ____ Actual/Estimated - - - -

12 Site	Building
8,627,000	
12,043,400	

12 Site	Structural	Architectural	08 Mech.	09 Elec.	11 Equip.	10 Gen.Cond. Ovhd.& Profit
Overhead & Profit	Structural	Architectural	08 Mech.	09 Elec.	11 Equip.	10 Gen.Cond. Ovhd.& Profit
PRORATE	18939600	19,951,100			15,307,300	17,219,300
PRORATE	22,172,100	22,854,100			15,307,300	17,219,300
Site Preparation	01 Found.	04 Exterior Closure	HVAC	Service & Distribution	Fixed Equip.	Mobilization Expenses
2,938,800	5,159,500	7,406,500			5,740,500	205,600
3,962,200	5,567,300	8,151,500			5,740,500	205,600
Site Improvement	Special Foundations	05 Roofing	Plumbing	Lighting & Power	Furnishings	Job Site Overheads
1,269,300	2,435,600	643,100			9,566,800	16,302,900
3,121,300	2,788,000	643,100			9,566,800	16,302,900
Site Utilities	02 Sub-structure	06 Interior Construction	Fire Protection	Spec. Elec. Systems	Spec. Const.	Demobil-ization
4,418,900	343,900	10,981,500			0	0
4,958,900	343,900	13,139,500			0	0
Off Site Work	03 Super-structure	07 Conveying Systems	Spec. Mech. Systems			Off Expense & Profit
0	11,000,000	920,000			0	710800
0	13,473,700	920,000			0	710800

FINISHES - 5,271,300
PARTITIONS - 1,868,200

WS-2B

Example 1.

General Work Sheet

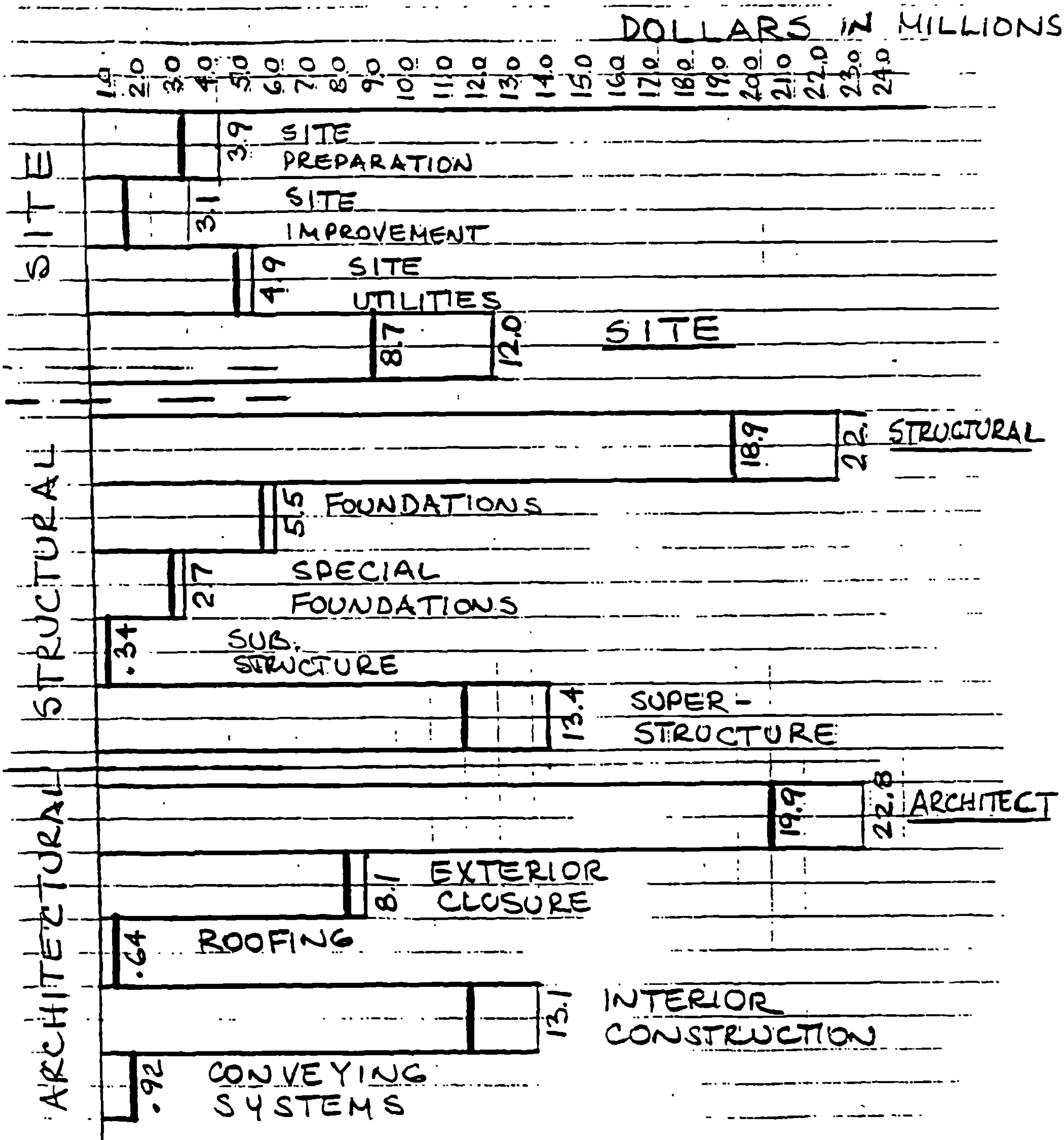
SH&G
Smith, Hinchman & Grylls Associates, Inc.
Architects Engineers Planners
455 West Fort Street
Detroit, Michigan 48226
313/964-3000

Subject: GRAPHICAL FUNCTION ANALYSIS.

Date

Project No

Drawn By



1-21-80

Example 2.

Component	Function	Cost/Worth
Site preparation	Prepare site	1. 35
Site improvements	Improve site	2. 6
Site Utilities	Provide utilities	1. 13
Exterior closure	Enclose space	1. 1
Roofing	Weatherproof building	1. 0

2. Administration building

The team working on the administration building employed the same methodology as the previous group in formulating a cost model. However, they then selected only certain areas from the model for additional study. These areas were those with the largest difference between the original and VE estimates and amounted to four elements; exterior enclosure, roofing, interior construction and electrical work. Each of these elements was then split into smaller components which were allocated a function and cost worth ratio as before. For example with the interior construction,

Component	Function	Cost Worth Ratio
Granite	Cover floors	4. 74
Brick paviors	Cover floors	1. 46
SS column covers	Enclose columns	3. 4
SS foldback doors	Enclose space	4. 0
Marquee	Provide light	5. 0

3. Laboratory towers, heating, ventilating and air conditioning.

The final section of laboratory towers, heating, ventilating and air conditioning was carried out in a similar manner to those described above.

Although the agenda listed this early work as the information phase it could not in reality be separated from the speculation phase. As the teams went through the cost models, graphical function analysis, function analysis and cost worth ratios they tended to generate alternatives. For example, granite flooring was costed at $379, 000 in the original estimate but allocated a worth of $80, 000. This worth was based on the cost of quarry tiles which were viewed as a viable alternative. Likewise the cost worth ratio of stainless steel columns were based on changing to drywall.

In addition to this information stage there was a more formal speculative phase that involved the teams in generating ideas and alternatives. This was done on a team by team basis without involving the whole group. It was not brainstorming in the manner illustrated in most VE texts but was merely a search for alternatives by more conventional methods.

The following is a summary of the alternatives generated.

2.2.2 Alternatives generated

1. Siteworks, structural and architectural systems.

1. Leave abandoned utilities in place rather than remove.

2. Stone in lieu of paviors.

3. Light dry in lieu of heavy dry for carparking.

4. Reduce landscaping.

5. Delete decorative paviors.

6. Use on site material for backfill.

7. Precast superstructure in lieu of concrete.

8. Delete lean concrete fill under slab.

9. Delete interior granite.

10. Drywall in lieu of aluminium.

11. Paint in lieu of panelling.

12. Reduce number of borrowed lights by 50 %.

13. Use 6" blocks in lieu of 8".

14. Use stud in lieu of blocks.

2. Administration building.

S2. 4" slab in lieu of 6".

S10 . Metal deck in lieu of cellular.

AE3 Metal panel in lieu of masonry.

AI 1. Quarry tiles in lieu of granite.

AI 6. Mahogany in lieu of cherry wood.

AI 9. Reduce partition height.

AR 2. Ballast in lieu of paviors.

EP 2. Eliminate clock system.

EP 2. Reduce security system.

EL1. Reduce size of light fixtures.

MH 4. Use fan powered VAV in lieu of steam.

3. Laboratory towers. HVAC

H1. Combine VAV boxes.

H2. Revise shaft geometry.

H3. Change to variable inlet vanes.

H4. Change to heat recovery around coils in lieu of air to air.

2.3 Wednesday 28th June to Friday 30th June 1989

2.3.1 1.00 pm Wednesday to 4.00 pm. Friday. Analytical and proposal phases

The workshop leader explained, mainly through the use of sample projects, methods of evaluation for proposals generated. These included criteria selection and weighting, matrix evaluation techniques and life cycle costing. A great deal of time was spent on life cycle costing, a technique which most of the team appeared wholly unfamiliar with. Once these techniques were outlined the team then evaluated the ideas they had developed in the earlier phases. This evaluation did not however, with few exceptions, employ the sophisticated techniques outlined by the workshop leader. It basically involved listing the major advantages and disadvantages of each proposal and based on this allocating each proposal a rating of between one and ten. The rating was based on the opinion of the team members and involved no scientific method of evaluation. An example of a proposal that was given the maximum rating of ten was 'substitute the stairs with prefabricated stairs'. The advantages were savings in cost and time and the disadvantage that quality was reduced. The lessor quality was not seen as sufficient however to reduce the weighting below ten.

Once the rating was completed all ideas over a certain ranking were written up formally and collected together in a VE study document.

3. Interviews with the VE team.

No members of the VE team had any previous knowledge of the process. In view of this interviews were not carried out.

4. Interviews with the design team.

The design team were not present at any time during the study.

5. Interviews with the Client

The client was not present at any time during the study.

6. Conclusions

1. Function was not correctly defined correctly and related to either elements of the building or components of the estimate. Function definition appeared merely an appendage to the task of highlighting areas of above average cost.

2. Function evaluation was not based on the lowest cost to achieve function but on the estimators opinion of the average cost of the defined solution.

3. Creativity was limited and did not rely on group dynamics.

4. All proposals generated were cost cuts - that is, they were either omissions of items or substitution of a higher quality specification with a lower one.

5. The job plan did not consist of rigid areas and phases tended to run into one another.

6. Evaluation methods were subjective.

7. Over 50% of workshop time was spent evaluating and writing up proposals.

Value engineering workshop 2
Holiday Inn, Washington DC
11th July 1989

(NB. In this project the abbreviation VA refers to the client, the Veterans Administration)

1. Outline of the scheme

1.1 General project description.

The project consisted of five basic sections on two sites,

West tenth Street.
West tenth Street alteration.
Parking garage.
Cold spring road division.
Cold spring road division alteration.

1.2 Cost.

Total cost $87, 720, 552 including design fees.
$89, 720, 552 including design fees and asbestos abatement.

It was hoped that the project cost could be reduced by $5m to $84m
Work was phased.

Estimate was based on a $/sq ft of each element.

1.3 Design stage

The value engineering and design teams agreed the project was at slightly less than 35% design. This appeared to be accurate.

1.4 VE Consultants

The VE consultants were SHG of Washington DC. The actual team members were made up from SHG Construction Management Division in Detroit. VE team members as employees of SHG join a VE study 3 or 4 times a year, the rest of their time being spent on construction management or design work.

A previous VE study had been carried out on the project at concept stage.

1.5 Client

The client was the Veterans Association (VA) who are involved mainly in hospital development.

The VA have very strict design criteria. In order to deviate from these special permission is required.

2. Format of the workshop.

The workshop was to be carried out over four days.

2.1 Tuesday 11th of July

2.1.1 9.00 am - 10.00 am Presentation of consultants reports

Present were the design team, value engineering team and a representation from the client. The VE leader gave no introduction and asked the design team to give a presentation of the scheme. This clearly took them by surprise.

The design team presented an outline of the scheme. Presentation was generally unstructured and poor. There were many interruptions for questions on very detailed points. The workshop leader did not appear to be in full control of the proceedings. (He had been substituted at very short notice.) A detailed cost estimate was not available at this stage. There was confusion regarding the agenda. After the presentation the design team and the client left the workshop. The design team were surprised at being asked to leave. They were requested to come back again on Wednesday.

2.1.2 10.00 am - 12.00 pm Familiarisation period.

The VE group familiarised themselves with the drawings and specifications on a individual basis.

2.1.3 12.00 pm - 4.30 pm Ideas listing

The VE team split into disciplines(amounting to one or two persons), examined the design work of their own discipline and listed individually their ideas. Present were the workshop leader, a structural engineer, an architect, two mechanical engineers, an electrical engineer, and a lift engineer. There was no interaction between the VE team.

2.2 Wednesday 12th of July

2.2.1 9.00 am - 10.00 pm Continuation of ideas listing

2.2.2 10.00 am - 2.30 pm Ideas collection

Individual disciplines put forward their VE proposals which were listed on wall charts by the VE leader. Proposals referred only to the discipline of the VE team member. As an exception to this the structural engineer did put forward some architectural ideas. The cost estimator made no suggestions but did comment that the project was underestimated. There was no function analysis or brainstorming. The workshop leader was dictated the proposals by the team members and did not involve himself in discussion. He appeared keen to increase the number of proposals. Often as each discipline gave their proposals other team members were not listening or took the opportunity to take a coffee break. None of the proposals put forward were developed or built upon by other team members. The session was very unstructured.

The following is a summary of the proposals put forward.

1. Architectural.

L1. Reduce elevator core height (there was an error on the drawings showing two different core heights).

L2. Remove external canopy; use internal corridor.

L3. Use precast limestone on external walls.

L4. Change curtain walling to precast concrete.

L5. Reduce entrance canopy.

L6. Relocate intensive care unit.

L7. Eliminate enclosures for generators.

L8. Demolish existing walkway and rephase work.

L9. Reduce area of basement thereby reducing underpinning.

L10. Check availability of foam board.

2. Civil engineering.

C1. Eliminate planter boxes and reduce floor load.

C2. Eliminate plant on level A.

C3. Eliminate exhaust tunnel.

C4. Consider changing parking deck to in-situ concrete from post tensioned.

3. Structural engineering.

S1. Reduce span of floors.

S2. Incorporate basement airway (cost increase).

S3. Reduce slab thickness by rearranging beams.

4. Mechanical engineering.

M1. Use steam directly to building.

M2. Convert to hydraulic heating.

M3. Delete chilled water coil pumps.

M4. Use electric boiler for mechanical steam supply in lieu of distant steam.

M5. Use energy miser BAC cooling towers.

M6. Use stand AHU in lieu of custom AHUs.

M7. Reduce heating and cooling loads.

M8. Reduce number of VAV boxes.

M9. Increase chilled water temperature range.

5. Electrical engineering.

The electrical engineer had split his proposals into corresponding sections of the building.

WTS.

E1. Delete medium voltage switchgear.

E2. Lighting levels are very high.

E3. Reduce use of incandescent room lights.

E4. Delete critical power to receptacles in examination rooms.

E5. Delete hinge covers for spiral stairways.

E6. Revise substation layout.

E7. Relocate all automatic transfer switches.

E8. Relocate operating room ceilings and simplify.

E9. Consider use of one isolating panel per OR.

E10. Use 2x3 KVA panels in lieu of 2x7.5 KVA.

E11. Revise typical recovery calimetry and nursing and nurse call systems.

E12. Provide local circuit breakers for ICU, MICU, and CICU.

E13. Revise feeder for FBEMCCI.

E14. Change transfer switches EQ2 EQ3 to 3 pole in lieu of 4 pole.

E15. Change panel to 480V 3 phase.

E16. Combine transfer switches EQ2 and EQ3 into one switch.

E17. Re-evaluate the provision of panels at every riser closet.

E18. Delete conduit interconnection of stack; vertical telephones risers sleeves are sufficient.

E19. Lighting in parking deck is excessive; reduce by 30%.

E20. Revise estimate to reflect design. Present cost is $10. 90 should be $18 for general construction plus $2 for interstitial floors.

E21. Revise electrical estimate from $1. 30 to $3. 00 for parking deck.

CSR

E1. Delete breakers for distribution panels.

E2. Lighting in exam room and office is excessive.

E3. Reduce panic buttons in secure rooms .

E4. Delete hinge covers for spiral stairways.

E5. Revise power distribution.

E6. Revise electrical estimate for renovated areas from $18. 50 to $12. 00.

6. Elevator engineering.

T1. Redesign passenger elevators to 4000lb capacity with a wide and shallow design rather than narrow and deep.

T2. Eliminate all lift openings for the cart lift except at 2 locations.

T3. Review vertical alignment of dumb waiters from medical records to emergency.

T4. Doors for cart lift should be six feet high according to VA standards, not 4ft as shown on the drawings.

T5. Passenger elevators should have centre opening doors in lieu of side openings.

T6. Three service elevators are required but none are shown in the design, at least two are needed with a blank for future expansion.

T7. Co-ordinate the number of elevators required with the estimate, numbers do not tally.

T8. Drawings or estimate do not show linen shoot .

2.2.3 2.30 pm - 5.15 pm Presentation of proposals to design team and client

The design team and client return to the workshop with the intention of looking at all ideas and discussing which could be developed further. Each VE team member gave a presentation of the proposals in his discipline. These, and the subsequent discussion, are summarised below.

1. Architectural.

The VE architect explained to the design architect that there had been a brainstorming session and then went through the ideas produced by it. He tried not to be challenging but did not always succeed. His presentation was directed towards the architect rather than the team. The following discussion took place on the proposals made.

L1 L2 L4. No comment was made by the design architect.

L3. Design architect said he was thinking of doing that anyway.

L5 L6. This promoted a great deal discussion . The design architect's main argument was that the Intensive Care Unit had to be accommodated somewhere. The VA project manager insisted that the alternative must be investigated.

L7 The design architect argued that the generator was too important to be incorporated in a flimsy structure. Likewise as CSR was an historical building then it needed to be brick built. A definite decision was not reached.

2. Civil and Structural engineering

The VE structural engineer did not follow the order of his ideas that were pasted to the walls. It was sometimes difficult to know which proposal he was talking about, as he flitted back and forward. There was no input from the design team and the VE leader eventually asked for it. The following comments were made.

C10. Design engineer said he was checking this item anyway. The client expressed the need to maximise car parking spaces.

3. Mechanical Engineering

A lot of technical discussion took place between the VE and design team mechanical engineers. There was little input from anywhere else. The designer stressed that he wanted life cycle costing backup to the VE proposals.

4. Electrical engineering

The VE electrical engineer had a very challenging approach and the designer let him go through all proposals without interruption. On completion the design engineer put forward his 'defence'. An argument followed and the VE engineer began finger pointing at the designer. The designer argued that he had only complied with VA criteria. The VE engineer argued that he had not. There was general confusion about what the criteria were. The situation began to get very heated and there was some embarrassment and sniggering. The VE leader did not intervene.

5. Elevator engineering

Conflicts between design information were highlighted and it was agreed that there ought to be further study. There was a great deal of confusion regarding the lifts generally. The workshop leader fell asleep during this session which was by now becoming very oppressive. It was approaching 5.00 pm and there had been no break since the start of the presentation.

2.3 Thursday 13th July & Friday 14th July 1989

The VE now team concentrated on working up the proposals they had generated into a written report .

The proposals developed during the creative phase were given a rating of 1 to 10 depending on VE and design team discussion. However as the discussion had been so limited it was difficult for the VE team to rate the proposals. All proposals were eventually graded and those rating over 6 were written into the report. The rating was done on an individual basis. The VE team now realised that they should have got more input from the design team as they felt they might be wasting time developing ideas that could never be implemented.

3. Interviews with the VE team

Originally it was intended to have a fairly structured interview with the VE team, concentrating on methodology and the nature of the proposals put forward. However it was obvious from very early in the study that there were problems with the client and VE team, particularly the VE leader. The interview by highlighting methodology and principles that had not been used in the study appeared critical and the first two people interviewed became slightly defensive. It was therefore decided to have a semi structured approach obtaining general comments and opinion, based very loosely on the questions in the interview. The following is the questions that were broadly asked.

1. How many VE studies have you been involved in ?

What are your opinions of the following techniques:-

2. Function analysis (FA)?

3. FAST?

4. Job plan?

5. Brainstorming?

6. Life cycle costing?

7. Cost worth ratios?

8. Workshops?

9. Evaluation?

10. When in your opinion is the best time to do a VE study?

11. How familiar are you with the project prior to a VE study?

12. Of the proposals put forward by the team, could you have done some of them on your own without the aid of the workshop?

13. Do you find that proposals are duplicated at workshops?

14. Of the workshops you have been to, do they follow VE methodology?

15. Is this study a typical VE workshop?

16. How to you rate your VE knowledge?

17. Do you keep any implementation data on the proposals that you put forward?

18. How do you feel about VE generally?

The following answers were obtained.

3.1 Workshop leader

1. 30 -35 studies, two as leader.
2. FA is not always necessary, but is used in the majority of cases. FA removes tunnel vision.
3. FAST is used in 50% of cases
6. Often do not bother with life cycle costing.
13. There is a certain amount of duplication of ideas from previous projects.

3.2 Architect

1. Has been involved with VE workshops/studies for some time
2. FA is a good idea and he attempted to do some on his own in this workshop.
8. The advantage of the workshop is that it brings the design team together earlier than would normally be the case.
11. The VE team ought to be as familiar with the design documents as the design team.
15. The lack of team effort in this study was very unusual. A problem with this study was that no one really knew what the budget was. As one VE study had already been carried out, the design should have been developed in greater detail prior to to this study.
17. No implementation data is collected.
18. He was apprehensive/defensive about VE at first but now considers it a good thing. It is a bad idea to have the design team present as they will not put forward ideas that a VE team will take credit for. Also they deliberately lead the VE team up false paths, away from items they do not want omitted.

3.3 Structural engineer

1. 10-20 VE studies.
2. "Function analysis-is that the form that you fill in, I stay away from them as much as possible".
3. Not familiar with FAST diagrams.
4. Familiar with the job plan.
5. Brainstorming helps generate ideas.
6. Life cycle costing is no use for structural work.
7. The cost worth ratio is a good quality test.
9. Weighted evaluation is no use since it is easy to fiddle.
10. 35% can have the best effect on cost as earlier than this there is not enough information for a VE study.
11. He looked at the drawings for six hours prior to the study.
12. He could have thought of all his proposals, except one, without the rest of the VE team.
13. Duplication of proposals is about 30%.

15. This workshop was not typical in that it was less structured than usual and the drawings were not up to scratch.
16. He considers his VE knowledge to be average.
17. Implementation of VE is of no consequence to him, its the leaders job.
18. VE is over rated. Workshops are not enough. VE ought to be an ongoing process. A good design team will do it anyway.

3.4 Mechanical engineer

The mechanical engineer was a Certified Value Specialist.

1. 40 to 50 studies.
2. Function analysis lends itself better to mechanical systems than it does to buildings. It helps generate ideas and helps keep in line what you are trying to do. It is important to value engineer the function and not the item. FA is an eyeglass.
3. FAST is not really useful, however he may never have truly understood it.
5. Brainstorming is the key to VE. It needs the untrained eye to see the wood in the forest. It is the seed that produces other ideas.
6. Life cycle costing is carried out on all proposals where there is a significant impact.
7. Cost worth ratios show the greatest potential for savings.
8. The team approach is fundamental, it is what separates VE from cost cutting.
9. Weighted evaluation is a good forcing technique to provide order and value on criteria.
10. VE is best at concept, anything after 35% is definitely too late.
11. He had looked through the drawings for one day prior to study.
12. 50% of the proposals he could have carried out on his own.
13. There is a lot of duplication of proposals.
15. This workshop is not typical, in that it is unstructured. Normal procedure is to have a brief overview of VE, then a project description, then to collect ideas jointly.
16. He is better qualified than the average VE team member. People in the workshops are not suitably trained and methodology is often sacrificed to get a result

17. Is not aware of any implementation data on the workshops he has been involved with.
18. VE is an applicable science that can save money.

3.5 Electrical engineer

1. 25 studies.
2. Function analysis is a good technique for opening up the mind.
10. VE is best early on in the project since conceptual changes of greater cost saving can be proposed.
13. Often VE proposals repeat from one study to another, especially on those projects carried out later in the design process.
15. This workshop was typical except there is usually more interaction with the team than there was at this study.

3.6 Lift Engineer

1. 3 VE workshops.
2. Function analysis is good at the concept stage for aiding team interaction.
3. FAST is never used.
5. Brainstorming can generate good ideas.
6. Uses life cycle costing where applicable.
7. Uses cost worth ratios.
8. Team approach works well.
10. VE is best at 20 % design.
11. Generally examines drawings for three to four days prior to the workshop.
12. Could have come up with the same proposals in his own office in half the time, as there was limited interaction between the team.
15. This workshop was less structured than usual.
17. He gets no implementation feedback on the studies.
18. VE provides avenue for exploration, although it does tend to duplicate design team effort.

3.7 Lift engineer

1. First VE study.
12. She could have though of at least 50% of the lift proposals herself.
18. The study was too late. It would have been much better at concept stage. The problems with the lifts were so serious that had it not been for the VE it may have been impossible to put the lifts in at the construction stage. VE helps you see things you would normally miss.

3.8 Cost estimator

1. 6 studies so far.
2. Function analysis removes the one track mind approach.
7. He is not sure where the worth comes from in a cost worth ratio.
8. The team approach is needed to see if all proposals are viable.
10. VE is best at 35% design as a lot more information is available and it is not too expensive to make changes. The ideal situation is to do it twice.
11. He generally gets information one or two weeks before the workshop and would look at it for one or two days.
15. This is not a typical workshop, generally they are more structured with the workshop leader getting more involved in generating proposals and ideas.
18. VE is good and should be used more. Some workshop leaders however don't like VE cost engineers to say if the original estimate is high, as this creates problems.

4. Interviews with the design team

It was intended to interview the design team in greater detail than was actually possible. This was because the time they actually spent at the study was very limited. The number of questions was therefore kept to a minimum. As previous proceedings show, the electrical engineer was very upset and was not prepared to be interviewed. The following were the questions posed to the design team.

1. How many VE studies have you been involved with.

2. What is your opinion of VE methodology, Function analysis, FAST, brainstorming etc.

3. What is your opinion of the proposals put forward.

4. How do you regard the timing of the study.

5. What particular problems do you feel there were with the study.

6. Do you expect to implement many of the proposals put forward.

The following answers were obtained.

4.1 Architect (1)

1. First ever VE study.
2. He was not familiar with function analysis, cost worth ratios or VE methodology generally.
3. Proposals should have been priced when they were presented. Generally they were too subjective. There were too many low cost proposals. Some ideas were valid. On the whole he could have come up with the same proposals given the opportunity.
4. The study was too late.
5. VA criteria is the problem with both the design and the VE study.
6. To change the design at this stage would be counterproductive.

4.2 Architect (2)

1. First VE study.
2. No knowledge of VE methodology and he could not see how proposals were arrived at. In addition he could not see how VE was any different from what a cost estimator would do. The workshop approach was a good idea but it was an overkill.
3. There were no architectural comments on his work.
5. Conflict with VA requirements was clearly a problem. Another problem is that the VE team should be as familiar with the documents as the design team, so that they can talk at the same level. Overall it was a good exercise but the VE team had not familiarised themselves with the project

as much as they should have. He did not like being excused on the first day as he thought it was supposed to be a team effort. He had thought he would be involved for two whole days. He was disappointed that the design teams input was not felt necessary.

6. VE is a good idea, however they are not expecting any major design changes.

4.3 Structural and civil engineer and cost estimator

1. First formal VE.
2. Would like to have had a better understanding of VE methodology.
3. Proposals were legitimate, however he would have come up with the proposals himself, plus more, given the opportunity. The omission of planter boxes is an obvious example, it really is very easy to eliminate. The VE team did not look at the big dollar items.
5. He expected to be involved in the study for the whole two days . The design was too well developed to do an effective study. Overall it was worthwhile but the structural proposals were not that great.

4.4 Mechanical engineer

1. First formal VE.
2. Did not know what to expect of the study and would have liked it explained.
3. Could have come up with same proposals himself and more. The real money lies in changing the VA criteria. Its inflexibility makes VE difficult. There was some regurgitation of the first studies proposals.
4. The study was too late, however a fresh look is always helpful.
5. There were too many low cost items.The VE team should not have considered anything less than $100, 000.

5. Interviews with the client

Interviews with the client were unstructured. The following is a broad summary of their opinions.

5.1 Project manager

1. Second workshop he had been involved with. The first one was more structured, with more team interaction and with greater involvement of the design team. The suggestions were of bigger dollar items even though the design stage was the same. There was not such a challenging approach.
2. VA criteria is stringent, mainly to avoid high maintenance costs. The VA design buildings so that changes in equipment can be carried out with minimum disruption and expense. Basically it is a 'loose fit long life approach.' Having the high specification works, the user is more satisfied than he used to be and they have less maintenance and replacement problems. Adapting for future growth is also very important, hospitals are built for 60 years whereas industry only builds for 20 years.
3. They have carried out VE on the VA criteria.
5. The proposals put forward at this VE were fairly typical.
6. Sometimes VE proposals when incorporated on site do not work. There is more thought involved in the design process than in the VE process.
7. VE is never effective after 35% design.
8. VE is not only about cost reduction. The elevator engineer for example highlighted problems that may not have come to light until they were on site, when it would have been to late.
9. Implementation of ideas is about 10 to 20 %
10. VE gets people thinking.
11. Design teams do not like VE.
12. The VA design process is slow enough to at least try and get it right.

5.2 Value engineering co-ordinator

1. The VA have been doing VE for 17 years with an in house multi-disciplinary team of 4. In the last year they have done 55 projects, all over \$15m. The multi-discipline team does not use FA, brainstorming, the job plan or any other VE methodology. On these in house studies they simply go through the projects making recommendations in their own disciplines to reduce cost. Some years ago the VA recognised that they were not doing VE properly so decided to start using outside VE consultants.

2. Implementation of proposals is about 20 to 30%
3. All projects have two VE studies. P1 at 10% design and P2 at 30%design. Some even have a third study. In addition all contracts incorporate VECPs. These have a very low submission rate .
4. VE is not worth doing on projects less than $2m.
5. Architects reaction to VE is split 50/50; some don't mind whilst some are very defensive.

6. Conclusions

1. The VE team did not understand the project as well as the design team. Excluding the design team from the study was a waste of expertise and knowledge.

2. Strict design criteria make VE difficult, especially for an outside team unfamiliar with the regulations.

3. Workshop leaders must be strong personalities in firm control of the proceedings. It is also important that they are impartial.

4. VE and it's methodology must be explained to the VE and design team if full benefit is to be accrued.

5. The budget must be well defined so that the VE team can appreciate the task that is in hand.

6. Studies should not be rigidly planned to five days as on smaller and less complex projects a shorter period may be more appropriate.

7. Expected roles and inputs ought to be very clearly defined prior to the study.

8. When there is a large amount of money to be saved a minimum limit needs to be put on proposals. Small dollar items waste time and appear nit picking.

9. Nothing in a workshop ought to be done on a personal level but through the VE leader. This removes confrontation.

10. A firm structure is required for the study. In this study the job plan, although roughly followed, was not explained to the team or strictly adhered to.

11. Design input is vital on the rating of proposals in order, primarily, to avoid working up proposals that are wholly impossible to implement.

12. VE can highlight conflicts in design information.

13. Having the right personalities is vital to a successful study, "I told you so types" are ineffective and create problems with the design team.

14. The number of proposals generated appeared to be an important issue in the workshop.

15. 50 % of workshop time was spent in evaluation or writing up of proposals.

16. The level of VE knowledge within the team was lower than would have been expected.

17. The proposals made by the VE team consisted of design changes and cost cuts.

Value engineering workshop 3
City Hall, New York.
23rd July 1989

1. Outline of scheme

1.1 General project description

The project comprised the refurbishment of a police precinct, a listed building in Central Park. It was vital that the historic nature of the building was maintained.

1.2 Cost

$6m construction cost with a $600,000 contingency which the client was not prepared to spend.

1.3 Design stage

35% design stage. An earlier study had been carried out three years previously at feasibility stage. Since then the scheme had changed dramatically and there was a different architect.

1.4 VE Consultants

The VE consultants were selected by the client from various consultants practising in New York.The workshop leader was Lee Murray from SHG, Oklahoma.

1.5 Client

The client was the General Services Administration (GSA) New York.

2. Format of the workshop

2.1 Monday 24th July 1989

On the Tuesday and Wednesday prior to the VE study an orientation meeting had taken place .

2.1.1 9.00 am - 9.30am General introduction

The client introduced the project to the VE and design teams. The workshop leader up until this time had not met the VE team, who had been selected by the client.

2.1.2 9. 30 am - 11.30 am Presentation of architect's report.

The Architect outlined the scheme. The building was originally a stable but is now used as a police precinct. It is listed and had been refurbished very badly during the 1930's. The client were keen to maintain the historic nature of the building particularly its external facade. However this, along with the walls and structure were in a very poor state of repair. The roof however was sound.

A principal design constraint was that everyone entering the building goes via one central control desk. The building must fulfil two functions, that of the 22nd police precinct and that of a listed building.

After this general introduction the VE team directed questions to the design team on any queries that they had about the project. Many of the questions raised substantial design issues about the layout of the building and the criteria of design. In addition to the VE and design team the client, police department and parks department were present and this highlighted very clearly, the difficulties the design team had faced. The police department's primary concern lay with the security of the building. Given the opportunity they would have erected a twelve foot wall around the building. The parks department on the other hand were keen that the structure was visible to the public using the park. The client were concerned primarily with the preservation of the historic nature of the building. The question and answer session highlighted other problems such as phasing and parking. The architect for example suggested that the work could be phased but the police department ruled this out on the grounds of security. They wanted to make two 'clean' moves, one into temporary accommodation and one back to the main building. The discussions also covered the siting of the temporary accommodation. Until now this had not been discussed with the police department although they had very strong feelings about it. Likewise, problems regarding parking were also ironed out. The police department were adamant that the car park must provide adequate space to swing a police car around at speed in an emergency. The architect had not been aware of this prior to the study.

The question and answer session was in full swing when at 11.15 am the GSA VE manager stopped it, as "he was keen to get to work".

2.1.3 11.30 am - 1.00pm Estimate validation

The workshop leader handed out copies of the two estimates, one prepared by the design team and one by the VE estimator. The design team estimate was \$5.5m whilst the VE estimate was \$3.7m. It was agreed that VE proposals would be priced at the lower estimates rates and prices.

At this stage the workshop became dominated by the GSA VE manager as opposed to the workshop leader. He made comparisons of prices within the two estimates often on items as low as \$9000, and tried to extract explanations as to why there were differences.

2.1.4 1.00 pm - 2.30 pm Function analysis

Function analysis was carried out on the elements of the building and had been compiled by the workshop leader prior to the study. Function analysis consisted of the workshop leader listing components, along with their functions, on charts on the wall. The team were not asked for their opinions regarding the functions of elements. The leaders charts consisted of six columns.

Element	Function	Kind	Cost	Worth	Ratio
Int walls	Divide space	B	258, 000	258, 000	1

The first four columns were complied solely by the workshop leader who informed the team of the component, function, function type and cost. The team then jointly decided a worth.

The examination of worth was based solely on whether or not the team felt the estimate was comparable with average values. Discussion was based solely on experience of costs of previous projects. Where an element was of a relatively low value, say $25,000, it was not allocated a worth as it was seen that the maximum saving that could be achieved did not warrant spending time on it.

The function analysis did not appear to serve any useful purpose. It was difficult to believe that the internal walls of a police station only had the function of dividing space. Furthermore the functions did not bear any relationship to the buildings use, but only to the estimate. For example,

Exterior enclosure	**Waterproof windows**
	Restore windows
	Waterproof masonry

In the original estimate a cost element of exterior enclosure was included. This was further divided into sub-headings of waterproofing, windows and masonry, and restoring windows. The workshop leader had merely used these sub-cost areas to describe the functions of the main element.

One member of the team did question one function. The workshop leader had said that the function of the masonry was to enclose space. One member of the team argued that this was not the case, as the space was already enclosed by the existing walls. The cost of the masonry was only directed at the restoration of the buildings original appearance. This clearly put the cost of the masonry in a different light, since many of the team regarded the costs of the masonry to be connected with the structural stability of the wall, which it was not. The workshop leader therefore changed the component and function from,

Masonry	**Enclose space**

to

Exterior enclosure	**Restore masonry**

The team member had been arguing for,

Masonry	**Restore originality**

he was clearly confused by the workshop leaders new function definition.

In another example of function analysis the workshop leader highlighted the function of the second floor as 'support load.' This however is the function of any floor, it is not the function of the second floor of the 22nd police precinct in Central Park, New York.

Another confusing issue on the function analysis was which costs should be used when calculating the cost worth ratio. With the masonry example highlighted above the VE team felt that the amount included by the architect in the original estimate was too low. The cost of the masonry was allocated on the basis of the original estimate. The worth was assigned the figure that the VE team thought it should have been. Worth was therefore more than cost.

Another problem arose with function analaysis in that as the design team were not present the VE team lacked information. For example, the architect had used Vicuclad as a wall finish. This could have been for any number of reasons; fire protection, security or acoustics. When calculating a cost worth ratio for this, cost was based on installing Vicuclad whilst worth was based on plasterboard.This made a nonsense of the cost worth ratio since the VE team were allocating a worth to something they did not understand.

Plasterboard would not fulfil the criteria of fire protection or security if that was indeed the function of the Vicuclad. It could not therefore form the basis of worth.

During this entire exercise most of the VE team looked either confused or disinterested.

2.1.5 2.40 pm - 5.30 pm Brainstorming

The brainstorming session was carried out as a team effort with VE members pulling on the information they had gathered so far. Suggestions were interdisciplinary and did appear to relate to much more than simple technical suggestions. For example,

C2. The rehabilitation expert saw danger in the police pulling straight off the car park, often in a hurry, into the road. Some parking therefore ought to be eliminated to increase the line of vision.

C4. The team considered the length of time that a scooter would loose by the indirect assess provided by the current arrangement. This they estimated at three minutes, which in the case of crime apprehension or prevention could prove vital.

C5. As the fence was to provide security it was not, at 6ft, high enough and ought to be made bigger.

The proceedings at this stage were still dominated by the GSA VE manager who had a tendency to overpower, interrupt and judge ideas. For example, one member of the team suggested that the temporary accommodation for the police be rented instead of purchased. The GSA VE manager immediately dismissed the suggestion as *they* wouldn't buy it. The workshop leader did not intervene to develop the suggestion. The majority of proposals put forward were judged upon by the GSA VE leader.

2.2 Tuesday 25th July 1989

2.2.1 8.30 am - 11.00 am Brainstorming

The group continued their interaction with one another in the brainstorming session. The GSA VE manager was still passing judgment on all ideas.

2.2.2 11.00 am - 1.00 pm Evaluation

The workshop leader explained that the evaluation of proposals generated was to be based on a rating of 1 to 10 depending on,

The probability of acceptance.
Ease of implementation.
Amount of savings.
Effect on historical preservation.
State of the art.

With the exception of 'amount of savings' which was weighted two, all other criteria were weighted one. The leader advised that starting from ten, two points be deducted for each disadvantage, with one point deducted if the saving was not great or significant. The judgment phase was carried out by the whole team with the GSA VE manager once again dominating the proceedings.

2.2.3 1.00 pm - 2.30 pm Writing up of proposals

The team wrote up the proposals starting with those having the highest rating. They intended writing up those proposals that rated seven or over, including additional ones if time allowed. The following is a summary of the proposals presented.

1. Civil/site.

C2. Reduce courtyard parking and relocate entrance.

C3. Rebuild stair to park.

C5. Raise height of fence at park.

C6. Use wrought iron in lieu of solid fence.

C7. Use brick in lieu of stone for wall.

C8. Use parks department pumps and delete installation of project pump.

C10. Clarify agreement between parks and police department.

2. Architectural

A1. Use brick for repairs in lieu of stone.

A2. Use gypsum board in lieu of vermiculite.

A3. Use gypsum board in lieu of masonry.

A5.&6. Relocate lockers.

A7. Reuse salvageable lockers.

A8. Purchase loose equipment separately.

A9. Relocate boiler.

A10. Use glass transom.

A11. Make better use of edge space.

A12. Use gypsum board in lieu of CMU.

A13. Use brick in lieu of stone for repairs.

A14. Infill north wall with wood panelling.

A15. Use construction manager with restoration experience.

A16. Provide slope in flat roof with insulation thickness.

A17. Simplify toilet layouts.

A20. Relocate mechanical room.

A21. Combine police toilets with staff toilets.

A22. Include decontamination in scope of work.

A23. Use epoxy paint in lieu of facing tile.

A24. Change boarding to plywood.

A25. Alternate funding.

A26. Make early purchase of critical materials.

A27. Install additional signage.

A28. Reduce height of partitioning.

A29. Reduce height of ceramic tile.

A30. Limit use of terrazzo floor in public areas.

A31. Use demountable partitions in lieu of CMU in offices.

A32. Existing skylight to remain.

A33. Relocate female lockers.

A34. Eliminate lounge and recreation room, wall and door.

A35. Replace windows with double glazed units.

A36. Use lift for scooters in lieu of ramp.

A37. Reduce toilet room area.

A38. Reduce detention cells.

A39. Revise existing access.

3. Electrical

E1. Use one fuel tank in lieu of two.

E2. Amend lighting levels.

E3. Use ground mounted antenna system.

E4. Use metal halide in lieu of mercury vapour exterior lighting.

E5. Delete lightening protection.

E6. Use EMT flexible conduit in office areas.

4. Mechanical.

M1.&2. Back up toilets.

M3. Evaluate existing boiler.

M4. Use two pipe in lieu of four pipe heating and cooling system.

M5. Use double wall tanks in lieu of single wall fibreglass.

M6. Use existing skylights for exhaust air.

M7. Existing boiler room to remain in existing location.

5. Structural

S1. Alternate wood framing.

S2. Strengthen roof joist frame.

S3. Replace existing floor with steel and concrete.

2.2.4 2.30 pm - 3.30 pm Presentation of ideas to the design team

The VE leader, stressing that he was not being critical, put forward the ideas to the design team that the VE team proposed. He showed the team all the proposals regardless of there rating and at the end requested their opinion on them. He requested they wait until the end as some proposals were repetitive. The design team then gave the follow opinions on the proposals.

A1. Decisions regarding the outside of the building were the remit of the parks department and the historical buildings society. The design team were governed by what they would accept. They appreciated that there were alternatives but it was really out of their hands.

A2. They had used lath because they thought it was cheaper due to the irregular shapes, but had no objection to board if it was cheaper.

A3. They had used masonry because the second floor was concrete. If the floor was timber they would have used stud.

A4. Police department wanted terrazzo.

A5&A6. Very good idea if it will work.

A7. Will look into it but does not think it will work because the size is difficult to fit and it will look shabby.

A8. Might do.

A9. Seems a good idea they will check to see if there is space.

A10. Thinks they have already done it.

A11. If possible will do it.

A12. If possible will do it.

A13. If possible will do it.

A14. Are already looking for an alternative but did expect to change this item.

A15. Good idea.

A16. Already been done.

A17. Will look at it again.

A18. Will look at it again.

A19. Will look at it again.

A20. Will look at it again.

A22. Included.

A23. Possible.

A24. Possible.

A25-A27. No real comment.

C1. Police requirement.

C2. Up to the police.

C3. Up to the police.

C4. Police do not want it.

C5. Up to the parks department.

C6. Will have to ask the police, parks department and historical building society.

C7. Will look at it again.

C8. Possible.

S1-S2 Would need more detail before making a decision.

2.2.5 3.30 pm - 5.30 pm Continued writing up proposals.

The design team left and the VE team continued to write up the proposals.

2.3 Wednesday 26th July 1989

Proposals written up for the entire day.

2.4 Thursday 27th July 1989

2.4.1 9.00 am - 3.00 pm Proposals written up.

2.4.2 3. 00 - 5.30 pm Final presentation to client and design team

There were 21 people present as follows,

1 Workshop leader
6 VE team members
5 Design team members
3 Police department
4 Office of management and budget (OMB - Section of the GSA)
2 GSA

The VE leader gave a final presentation of the VE proposals. The OMB, police and parks department were not happy with the budget and there was a lot of discussion about what was and what was not included. The problems associated with the budget dominated the presentation.

3. Interviews with the VE team

The questions put to the VE team are the same as the earlier study. The following answers were obtained.

3.1 Workshop leader

1. 30 studies.
2. FA gets people thinking functionally and gives them a better understanding of the building, it shows variances in the cost worth and indicates the areas of highest possible savings. Function analysis is the basis of VE, it is what it grew from. It highlights those functions which are basic and those which can be eliminated. That said, however VE on buildings can be done without FA, as it is the same for every building.
3. FAST shows the critical path of building function and can show a sequence not otherwise recognised. It can highlight functions as secondary that may have been regarded as basic and vice versa. Its use in construction is limited.
4. The job plan works well and provides an organised approach.
5. Brainstorming has limited use in that 70% of ideas come from their own discipline. Engineers for example are not very innovative, probably because they are used to fitting in with the design of the architect.
6. Life cycle costing should be used on all projects where there is a significant impact.
7. The cost is the architects estimate and the worth is the VE teams. It is not intended as a true mathematical exercise, it is just to get things going and get people thinking, it is not an exact science. The proposals that are put forward are always based on the VE teams estimate and it some cases this can vary significantly from the original.
8. Synergy definitely produces more ideas. Design teams have too many mental roadblocks, they are too emotionally involved.
9. The evaluation system that we use is a good system because its simple and easy to understand.

10. A study ought to be done twice, once at 15% design and once at 35% design, but never any later than this. 35% design is plans, elevations, typical sections, detailed specification and mechanical and electrical layouts.
11. Generally look at the drawings for four to five days prior to the study.
12. Yes.
13. Some general proposals do come up every time.
14. Yes.
15. This is fairly typical study, except that the client is not always present. His presence is however, a big help.
16. Above average.
17. Implementation data is not collected because the opportunity is not there, we would not be paid for it. However that said we would very much like to.
18. VE is an excellent tool.

3.2 Architect

1. Third workshop.
2. FA concentrates thinking on the relevant issues. Architects and engineers do VE all the time. Every time they design a building they look for the cheapest most economical system. VE can get out of hand if it is only aimed at cost reduction.Life cycle costing and design improvements should also be considered.
3. FAST is not a lot of use in construction as its too complicated.
4. The job plan provides useful method.
5. Cannot see that brainstorming is anything different from how the architect designs in the first place.
6. Life cycle costing is useful for M&E
7. Cost worth ratios represent where cost savings can be produced.
8. Architects do VE anyway, without workshop.
10. If a study is being examined only once then schematics is the best time. Later would produce too much redesign work whilst earlier the information would not be available.
11. Reasonably familiar with a project before the workshop but obviously not as well as the design team.
12. Yes.
13. Yes.

14. Yes.
15. Yes.
16. Average.
17. No.
18. Have had five VE studies done on my own work, three of which were a waste of time because the VE team did not understand the design constraints. They changed the foundations to piles which proved faulty and had to be changed, eventually costing more money. Most architectural proposals are nothing more than cost cutting.

3.3 Structural engineer

1. First VE study.
2. Useless
3. Have not heard of it
4. Would prefer if the job plan was altered so that more time was given to looking at the drawings before the study to generate your own proposals. That way time would not be wasted talking about other disciplines.
5. Not familiar with it.
6. Not a lot of use.
7. Useful in that it highlights areas of high cost.
8. You don't need a workshop to come up with cost savings, given the time the consultants could do it on their own anyway.
9. Useful.
10. Timing does not really make any difference, the proposals would still be the same, it is just a question of whether or not you can implement them.
11. Had examined the drawings for four hours prior to the meeting
12. At least two of the proposals could definitely have been developed without the use of the workshop.
18. Not a lot of use.

3.4 Electrical engineer

1. Three studies
2. It is useful in eliminating unnecessary work.
3. Not familiar.
4. Very useful in that it gives a clear way to approach the project.
5. Very useful.
6. Useful in limited circumstances.
7. Useful to show high cost areas.
8. Very useful.
9. Very useful.
10. 10 % design.
11. Received the drawings only the day before the meeting.
12. Yes.
14. Yes.
15. Very typical.
16. Average.
17. No.

3.5 Mechanical engineer

1. First VE workshop.
2. Not familiar.
3. Not familiar.
4. Not familiar.
5. Not familiar.
6. Limited use.
7. The cost worth ratio can give a false impression as the estimates do not often include the same things. For example, on this job the architect included for a four pipe system, whilst the VE team only allowed for a two pipe.
8. The team approach is a good idea as it promotes discussion without the pressure of criticism, however the VE team do not really understand the project well enough. On the other hand it reassures the client that he has good value for money and gives him a second opinion.
9. Not familiar with the techniques
10. This study was too late and could have come up with a lot more proposals given an earlier opportunity . 10% is the ideal time.

11. Had not seen the drawings at all before coming to the workshop.
12. As all the mechanical proposals were his, he most certainly could have come up with the same proposals on his own, in fact he would have come up with more since he would have had more time.
13. First workshop,so don't know
14. N/A
15. N/A
16. Below average.
17. No.
18. Difficult to say.

3.6 Rehabilitation expert

1. First VE study but used to teach VE at *Columbia University.*
2. FA zero's in on problem areas.
3. Difficult to use in construction.
4. Good system.
5. Brainstorming is good because it allows team members to put forward ideas in the fields that they are not expert in.
6. Useful.
7. Useful.
8. The workshop approach helps people to think of new ideas. In addition it can answer questions very quickly.
9. Very good.
10. This study was too late. VE is very useful early in a project but becomes destructive if carried out too late, in that it creates work and upsets people.
11. Had studied the drawings for about three hours, plus had visited the site prior to the study.
12. Yes.
16. Above average.
18. Good system.

3.7 Cost estimator

1. Fifteen workshops.
2. Shows where cost reductions can be made.
3. Useless.
4. Useless.
5. Useless.
6. Useless.
7. Shows were cost reductions can be made by highlighting the difference between the architects and the VE teams estimate. This is the first time in his experience that there has been such a large difference between his own and the architects estimate. On some drawings they had clearly assumed different things. For example, on the floor finishes the architect had assumed terrazzo and he had assumed PVC. In addition the architect had measured the floor area over the external walls and he had not. In addition he allowed a much smaller percentage markup for overheads, profits and contingency.
8. The politics of New York City require a formal workshop but given the opportunity he could do it on his own. However if he were allowed to do it, it would be viewed as criticising the architects and engineers designs, so in one respect the workshop is good as it removes that confrontation. However if he attends a workshop and has worked for the architect or engineers in the past, and would like to work for them again, then the element of criticism is reintroduced. One good thing about workshops is that they do reduce time. On a large project by getting consultants together you can review a design in a week, whilst on his own it might take him a month. On a small project it does not apply so much.
9. O. K.
10. 35% design.
11. Had spent two to three days looking at the drawings prior to the workshop.
12. Given the opportunity he could have come up with the architectural, civil engineering and structural proposals on his own in a normal cost cutting exercise.
13. Nine out of ten proposals are duplicated at other studies or during a cost cutting exercise.
14. Usually.

15. The workshop is fairly typical but the leader is a bit more laid back than usual, some leaders get people a bit more fired up.
16. Average.
17. No.
18. Useful.

4. Interviews with the design team

The design team that attended the workshop left as soon as the proposals were presented to them. As such it was only possible to interview the architect.

4.1 Architect

1. First VE workshop
2. Not really familiar with the techniques but the idea of brainstorming seems a good one. The project could have benefited tremendously from a weeks brainstorming by the original design team.
3. There were very few proposals that related to the architectural side.
4. Difficult to say since the timing is very confused.
5. The estimate presented a problem. He for one was convinced that it was right and that it could not be built for less. He had worked on this type of project before and knew how expensive it was.
6. He thought the project was being built next year, he had not realised it was going ahead so soon, it is therefore difficult to talk about implementation.

5. Interviews with the client

Interviews with the clients were again unstructured. The following is a summary of their ideas.

5.1 Head of the Office of Management and Budget.

1. The VE leader is the 60% factor in any workshop, the team is the remaining 40%.

2. OMB will carry out up to four studies on a project depending on its size. A small project up to $15m will have only one study. A project of $800m will have four studies at scope, schematics, design development and design completion.
3. VECP's are dangerous because they force you to make a decision too quickly because the contractor is on the job. Also they raise questions regarding corruption which must be avoided by a government agency.
4. Methodology of workshops is similar regardless of the consultant used.
5. Function analysis does not always pay. Above all it is a psychological exercise. The biggest problem with function analysis is the amount of time that it takes. The more time that is spent on function analysis the less time is available to spend on brainstorming. When there is detailed function analysis therefore, less ideas are put forward.
6. The 40 hour workshop generally provides enough time for VE although sometimes it is recommended that the information phase is dealt with before the study commences. Occasionally studies are split into two and three days as this allows more time for judgment.
7. It is not advisable to use the design team as the VE team. VE allows a second look and allows mistakes to be corrected.
8. The personalities of the VE leaders are all important, far more important than methodology.
9. Implementation is more to do with personality than with methodology. All projects have an implementation meeting where the design team are asked if they are going to implement certain proposals. A lot depends on the forcefulness of the character putting forward the proposals. At the OMB we do not take no for an answer. Rejection of VE proposals must be justified. If we do not like it then we simply will not pay for it.
10. The rate of return on value engineering is never less than 1:10.
11. Formal VE training is not required in order to participate in a study.
12. The workshop approach is always used.

6. Conclusions.

1. The budget must be agreed prior to the study. The VE estimator ought to have known what the architect had included and why. Using two estimates creates confusion and raises problems regarding the validity of savings, which may only be adjustments to the estimate. This problem is intensified when there is no standard format and no standard method of measurement for estimating.

2. The workshop leader must be in firm control of the proceedings and individuals, even if they are from the client, must not be allowed to dominate the study.

3. The concept of getting the design team and the client(s) and users together is a good one. Their input at a VE study is invaluable.

4. Function analysis based on major sections of estimates achieves nothing. Likewise carrying out function analysis prior to the study and presenting it as a 'fait accompli' does nothing to aid creativity.

5. Allocating a cost worth ratio based on the comparison of two estimates is incorrect because there can be no certainty of what was included in the original estimate or why.

6. The VE team, although they had concentrated to a large extent on obtaining information, did lack background to the project. The information phase, without the input of the design team, can only tell the VE team what was included and not why.

7. An excessive amount of time is spent in writing up proposals and this seems wasteful. In this study almost two days were allocated to writing and costing the proposals . This appears to have no other benefit other than to justify the existence of the VE team and the study.

8. Interaction of the team does generate proposals. The element of judgment appears restrictive to idea generation.

9. There is a definite shift towards specification and technical changes at the 35% design stage. The VE team could not see the point of making conceptual changes to a design so well developed. For example, the team believed that the concept of the project was wrong and that central park would be better served by mounted police. However they did not feel that they could suggest this.

10. The proposals put forward by the VE study consisted of both design changes and cost cuts.

11. In the evaluation of proposals, probability of acceptance was one basis of evaluation. This did not appear a valid criteria.

12. The organisation which has set the criteria, be it the client or the user, must be present at the study, otherwise there is a tendency to pass responsibility to them.

13. Some proposals put forward by the VE team are merely,

    Estimating errors
    Estimating differences (pvc V terrazzo)
    Design not fully developed resulting in a contingency sum.

14. The quality of the consultants is vital. In this study the structural engineer was not interested and regarded VE as a waste of time. It showed in the proposals he put forward.

15. At the end of this study the most prominent feature was the dissatisfaction of the clients with the budget, which unfortunately, after one week was still not resolved.

16. A forty hour workshop was too long for this project. Most of the team were missing on Wednesday and Thursday afternoon and work proceeded very slowly. The study could have been carried out in three days. This said, there had been an orientation meeting prior to the study.

17. There appeared to be the feeling that the 'real' VE work lay in the production of as many ideas as possible.

Value engineering workshop 4
State Capital Building
Phoenix, Arizona
31st July 1989

1. Outline of the scheme

1.1 General project description

The project was a new archives storage centre in Phoenix Arizona, comprising a three storey building and three levels of underground parking.

1.2 Cost

A firm budget was not available.

1.3 Design stage

The project was at a very early design stage, less than 10%.

1.4 VE Consultants.

The design team were value engineering their own work and therefore made up the VE team. They were from SH&G Construction Management, Phoenix. There were, in addition, four external consultants present. These were a civil, structural and electrical engineer and a cost estimator. The workshop leader was Al Dell'Isola of SH&G, Washington D.C.

1.5 Client

The client was the State of Arizona.

2. Format of the workshop

2.1 Monday 31st July 1989

2.1.1 9.00a.m. - 12.00 p.m. Presentations by the design team

The architect, mechanical, structural and electrical engineers gave an overview of the project and an explanation of the designs.

2.1.2 12.00 - 1.00 p.m. Overview of VE

The workshop leader gave an explanation of how VE operates outlining function analysis, value, cost worth and the job plan.

2.1.3 2.00 p.m. - 5.30 p.m. Brainstorming

The group split into teams of architectural, mechanical, electrical and structural and generated proposals within each discipline.

2.2 Tuesday 1st August 1989

The teams continued to generate ideas and proposals. While they were doing this the workshop leader, along with the estimator, drew up a function analysis and a cost worth ratio. This development of cost worth did appear to have more of a relationship to function than in the previous workshops. For example, the VE leader thought that the function of the archives section of the building could be fulfilled by building it on grade, single storey instead of over three levels of underground parking. The worth of the elevator to serve the archives building from the car park was therefore put at nil. Worth of the car park was allocated on the basis of an above ground, open air structure. With regards other elements worth was typically calculated as follows,

Existing cost external walls = $15. 35 sq. ft. for walls 47ft high. (2 x 14ft 6"+18ft)
Height could be 3 x 12ft 6"= 37ft
47-37 = 10 or approximately 25%
Therefore new cost = $15. 35 - 25% = £11. 50.

What was significant about this section of the study was that the generation of ideas was done completely independently of the function analysis and cost worth ratios.These were produced by the cost estimator and the workshop leader without any interaction with the team.

The following proposals were produced.

2.2.1 Proposals produced

A3. Reduce auditorium and reduce height of archives wing.

A5. Review parking space requirements.

A6. Reduce height of training room.

A9. Reduce floor to floor height from 14ft to 13ft 4".

A17. Question value of porches.

A18. Reduce size of light shaft and skylight.

A20. Question elevator impact on parking structure.

A21. Consider common wall construction for elevators and stairs.

A22. Review need for staircase near elevators to go through garage.

A28. Reduce cost impact of non secure space on fifth floor.

A32. Re-examine track removal from building.

A33. Reduce height of archives storage.

M5. Centralise AHU'S.

M6. Use controllable pitch action fans in lieu of VFD centrifugal fans.

M12. Two chillers in lieu of three.

M29. Use heat extract fixtures in lieu of return air grilles.

M21. Reduce glass area from 25% to 20% of building.

M2. Relocate cooling equipment from penthouse to grade.

E1. Bus duct in lieu of conduit cable.

E2. Review under floor duct.

E3. Review need for UPS system.

E4. 400 KW peak shaving system.

E5. Dual 15KV Primary electrical feeds.

E6. Diesel driven fire pump.

E7. Improved lighting system.

E9. Location for emergency generator.

E10. Fix EM, PWR loads for design.

E11. Review UPS loading.

E12. Relocate service entry doors.

E13. Relocate transformer next to building.

E14. Locate fuel tank above grade.

E15. Reduce use of incandescent lighting.

E16. Reduce lighting impact.

E17. Reduce lighting levels.

E21. Lightening protection system.

E22. Review security W/DPS.

E23. Determine voice data system.

E24. Motion detecting system.

E26. Explosion proof electrics for chemical store.

E27. Electronic ballasts.

E28. Dual switching lighting systems.

C1. Check leased space.

C3. Consider early package for excavation and carparking.

C4. Consider alternatives for disposal of excavated material.

C5. Designate area for contractors mobilisation and parking.

C6. Question schedule requirement of 24 month contract.

2.3 Wednesday 2nd August 1989

The team spent the day writing up the proposals

2.4 Thursday 3rd August 1989

<u>2.4.1 9.00 a. m. - 1.00 p.m. Proposals written up</u>

The team continued to write up the proposals.

2.4.2 2.00p. m. - 6.00 p.m. Presentation to the client

The proposals were presented to the client. There was no discussion.

3. Interviews with the VE and design teams.

With the exception of the cost estimator, no member of the study had not been involved in value engineering previously. The interviews therefore produced little usable information. In addition the workshop was primarily a PR exercise to sell a VE programme to the client. Further, the design team were junior staff of the same company of which the workshop leader was a director. The answers produced therefore were highly suspect.

4. Conclusions

1. The over-riding feature of this study was the personality of the VE leader who had an ability to motivate the team into looking for better alternatives.

2. In this study the client was clearly not interested in saving money. It appeared that funding for the project had been granted by the federal government. This funding had been long awaited and now it was granted, the State of Arizona appeared determined to spend it. The impression given was that implementation of VE proposals would be low.

3. The function analysis in this workshop was produced independently of the design/VE team. Proposals produced were the result of team interaction and the input of the VE leader.

Appendix C
Interviews

Value engineering in the UK

1. Introduction

VE activity in the UK falls into four broad categories:

1. VE services offered by consultants.
2. VE systems operated by clients or developers.
3. VE services offered by construction management consultants.
4. VE systems offered by contracting organisations.

The opinions of these groups were obtained by interview. The number of companies interviewed were as follows;

1.	Consultants	8
2.	Clients	7
3.	Construction managers	4
4.	Contractors	1

The interviews were semi-structured and were basically divided into four main sections.

Section 1 examined the overall approach the company was taking towards value engineering.

Section 2 examined the use of the workshop and the components thereof.

Section 3 examined any alternative value engineering system that the company had developed or was developing.

Section 4 examined the relationship of value engineering to cost planning and quantity surveying.

2. Section 1

Q1. What is the overall approach that the company is taking towards value engineering?

2.1 Consultant 1

VE as employed by us has two approaches,

1. The forty hour workshop.
2. The less formal approach, based on the development of the cost planning process, which is more akin to option appraisal.

2.2 Consultant 2

Basically VE has two approaches; the stand alone and the integrated service. The stand alone service is basically the workshop. The integrated service forms part of a project management service and incorporates two workshops using the design team as opposed to an external team.

2.3 Consultant 3

Our approach to value engineering is a two day study with the client and design team.

2.4 Consultant 4

This company uses three approaches to value engineering

1. The forty hour workshop using an outside team
2. The forty hour workshop using the design team
3. A more ongoing process.

We would inform a potential client of all three VE options as, depending on the circumstances, some are more suitable than others. If for example the project is over budget then the workshop approach is best. It does however have problems relating to the learning curve and to implementation. The big difference with the workshop and the ongoing process is that the latter takes account of both macro and micro changes, that is, changes to both the concept and the specification and elements. The workshop however cannot take account of conceptual changes since the concept cannot be changed at the 35% design stage.

2.5 Consultant 5

VE is really only the next step in the cost planning process. So far we have not been able to ask the client for additional fees for carrying out a cost planning service, but we may be able to for value engineering, even if using the existing design team. The approach we take to VE is to operate it within the cost planning process with the addition of two, two day workshops.

2.6 Consultant 6

Value engineering has two approaches, the American 40 hour workshop approach and the English approach which is closely related to cost planning.

The benefit of the forty hour workshop is, that by using an external team, it provides an alternative view for the client. There can be no benefit in using a workshop approach with an existing design team. An architect is never going to admit that he was wrong. That said it's often the clients fault that the architect is misinformed. If that's the case then the architect ought to be paid for any redesign. The 40 hour workshop approach is cold and cruel but effective, although there are problems of professional pride, psychology and so on. This type of VE can also be very damaging to the design team. The English approach to VE on the other hand is more ongoing, is closely related to cost planning and uses the design team.

2.7 Consultant 7

There are two approaches to value engineering; the workshop (either with or without the design team) and a more integrated approach.

2.8 Consultant 8

We have two systems; the forty hour workshop and a more integrated approach offered as part of our project management service.

2.9 Client 1

The company value engineering effort so far has consisted of one value engineering study carried out on a model store by a VE consultant. An outside team was used as politically this seemed the best solution. The VE programme was not continued after the model study as it was felt that it would delay projects. Also, it was felt that if the model store was right, then 75% of what followed from it would also be right.

2.10 Client 2

The company have been involved with VE for about 2 years and prior to this had a long history in buildability. At the moment VE is very much at the osmosis stage and is slowly filtering through. However it is not yet fully formalised. We have so far completed a workshop and we are investigating the best way to integrate into existing methods.

2.11 Client 3

This section of the organisation deals with US Forces in the UK. The US Department of Defence asked this organisation to carry out value engineering studies for them. We have done 24 studies over the last six years, the last one being this Easter. The studies are based on the forty hour workshop using consultants independent of the design team.

2.12 Client 4

We have an independent system of value engineering.

2.13 Client 5

At this company we operate a very stringent VE programme that we devised ourselves.

2.14 Client 6

Value engineering is carried out using the forty hour workshop with two outside value engineers and the design team.

2.15 Client 7

We have used the workshop approach and a more ongoing system.

2.16 Construction Management 1

For value engineering we use the 40 hour workshop approach and often bring over an American CVS. At present we are trying to qualify some of our own people to CVS standard through the Society of American Value Engineers. Clients usually request that a CVS should run the workshop.

2.17 Construction Management 2

This section of the company is a separate division of construction consultants that is responsible for value engineering. We are appointed alongside the design team to look at the major elements, analyse cost and look for alternative means of construction. There are two levels to VE, that which relates to design concept and that which relates to elemental design. Both of these can be the subject of a value engineering study.

As construction consultants we are brought in at an early stage to have a contractors input into the design. We also advise on the brief and the method of procurement. The advice that we give is much wider than the QS and architect offer. An architect is appointed to get planning permission and the QS to set a budget. We are employed to programme and plan the project.

2.18 Construction Management 3

The forty hour workshop is used.

2.19 Construction Management 4

The potential for value engineering lies where the project manager can force the architect to design to a cost plan.

2.20 Contractor 1

We have used a three day charette and a workshop style approach. The difference between the two being that the Charette does not use function analysis.

3. Section 2

The US style workshop was broken down into components corresponding with earlier research. The companies were asked about their treatment of each component.

3.1 What is the length of the workshop ?

Consultant 1

40 hour, five day.

Consultant 2

3 days.

Consultant 3

Our VE studies are over two days, Friday and Monday. Friday is taken up with FAST diagramming and function analysis. We have a standard set of functions that aid the team in producing FAST diagrams. Once completed we allocate cost to functions. This is done by the QS over the weekend and is ready for Monday for the brainstorming session. We would not regard our workshop as remotely connected with the US style workshop.

Consultant 4

Five days and forty hours.

Consultant 5

We do not use or recommend use of the forty hour workshop as we consider it a sledge hammer. It really only deals with two things; a search for alternatives and the co-ordination of the design team. These are not new problems, there are no new problems in construction merely different versions of old ones. It is not necessary to use a workshop to solve them. We use two, two day studies.

Consultant 6

40 hours.

Consultant 7

This would vary according to the size of the project, it may be two to ten days.

Consultant 8

40 hours.

Client 1

40 hours.

Client 2

Two days.

Client 3

40 hours.

Client 4

We do not use the workshop.

Client 5

We do not use the workshop.

Client 6

40 hours.

Client 7

5 days but it could be more or less. Most of our schemes are very large.

Construction Management 1

40 hours.

Construction Management 2

Formal workshops are not employed.

Construction Management 3

40 hours

Construction Management 4

Formal workshops are not used

Contractor 1

3 days

3.2 Who makes up the personnel of the workshop?

Consultant 1

It depends on the project, sometimes it is better to use an outside team whereas sometimes the design team is more appropriate.

Consultant 2

An external team is made up of consultants from within our multi-discipline practice. The disciplines of the team mirror those of the design team. The client is not present. If the design team were to be used they would have to be totally committed to the process. What might be best is a two stage process whereby an outside team identify the areas of high cost and then work through it with the design team.

Consultant 3

It is not fair to ask a design team to pass their work over to another set of people equally interested in obtaining work from the same client. An external team ought not to be used although the VE leader ought to be independent. The leader must have broad experience and must firmly manage the process. If the building is a speculative development it is worth having the letting agents present as they understand what makes the building sell or rent.

Consultant 4

We see that there are two distinct approaches to the workshop, one using an external team and one using the design team. Both have a valid contribution to make depending on the type of project, client and the relationships that exist in the management structure.

Consultant 5

Although we do not use the workshop we still have formal VE studies. The problem with using an outside team is that they have to justify their existence. When using the design team however the client does not get the benefit of a fresh look. The best solution is to use a different architect/engineer from the same company.

Poor design is often the clients own fault in that he appoints the wrong architect or has not briefed him properly. Doing a VE study with an outside team would overcome these problems, since if the client is not happy with the design team he ought to get another one.

Consultant 6

An outside team is used with the client and design team being present at the beginning and end of the study. The presence of the client is restrictive to the study.

Consultant 7

We prefer to use the design team but if the client insists on an outside team then we would do it that way. It is essential that the client is present at the study. There is definitely a higher level of implementation when using the design team as opposed to an outside team.

Consultant 8

The design team and the client are used for the workshop.

Client 1

The team comprised our own staff, an external team of VE consultants and some external nominated consultants. The design team were not present.

Client 2

We are not certain at this stage whether to use the design team, a separate team, or a combination of both. The leader however needs to be independent.

Client 3

An external team is always used. Usually the design team would attend the start and finish of the study. Generally the design teams do not like the studies but we find a big improvement in their attitude when they are briefed on the process beforehand. Also we found that young designers react worse than the older designers. The design team are paid for any redesign providing it is not an error. The client would not generally attend the study.

Client 4

We do not use the workshop.

Client 5

We do not use the workshop.

Client 6

The design team plus two outside value engineers are used. Good ideas must come from within, otherwise there is too much animosity.

Client 7

The design team and the client. The study was led by ourselves.

Construction Management 1

The workshop is always made up of an external team usually selected from the consultants that we work with. An external team is always used as the design team are committed to their own design and will always try to defend it. A second look with a fresh mind is much more beneficial. We never involve the client as he tends to hamper the process. Likewise the design team do not attend the study since they would give a biased view.

Construction Management 2

Not applicable.

Construction Management 3

We always use an outside team as recommended by SAVE. It removes prejudice and provides a fresh look.

Construction Management 4

Not applicable.

Contractor 1

The design team and the client.

3.3 What is the timing of the study?

Consultant 1

Generally studies are carried out at the 35% design stage, although 10% is more effective.

Consultant 2

35%, any later and there would be problems of implementation.

Consultant 3

Inception is the best stage for VE and anything beyond scheme design is much too late. VE is equivalent to 16 design team meetings of one hour and as such is a great means of team building. The best time for VE is after the design team have reached the optimum solution, as many 'what ifs' have been considered at this stage. For the ideal study you would have floor plans, sections and elevations along with some idea of space, circulation, internal wall layout, M&E schematics and programme. The written brief is not a lot of use in a VE study as it only tells you what it thinks you ought to know. A presentation by the design team is a much better approach as it gives a more open view and a better insight into the project.

It is possible that design should follow VE as opposed to the other way around but that would call for a two stage approach, which would be expensive.

Consultant 4

If there is to be only one workshop then 35% is the best stage.

Consultant 5

Not applicable as we have not done any of these workshops but I would say that 35% is too late.

Consultant 6

The study was at the 35% design stage. I felt that the spatial layout could have benefited from being earlier but for the structural and mechanical systems it was about the right time

Consultant 7

If there is only one study then 35% is the best time.

Consultant 8

So far we have only done one forty hour workshop and this was at the construction stage which was clearly too late. I would say about scheme design.

Client 1

The study that was carried out covered a 'model A' store. It did not include building services, finishes, space planning, layout generally, administrative procedures or form of contract. As such the building was at the 100% design stage for a model store but not designed at all for an individual project.

Client 2

10% is the best time to do a study especially with regard to blue sky issues, a second study should be carried out if required.

Client 3

35%. This is definitely the best time if one only one study is being carried out. I think an ongoing process would be better, however this would be too expensive.

Client 4

We do not use the workshop.

Client 5

We do not use the workshop.

Client 6

90% design complete. This stage was selected as it meant that changes at the construction phase could be avoided. We would not consider doing it earlier as you need something to work from. We tried to avoid conceptual changes and concentrated on omissions and specification changes as these can be easily implemented.

Client 7

Concept stage.

Construction Management 1

The studies are carried out at scheme design. The proposals put forward by a value engineering study mainly relate to systems and materials but layouts may be commented on. If brought in early enough it would be possible to make conceptual changes but we would not make recommendations that we felt would be too disruptive to implement. There is no link between value engineering and brief formulation. A good brief highlights clients needs and it is important to know how to extract the required information, but you cannot value engineer the brief. The value engineer must have a design to work from.

Construction Management 2

Not applicable.

Construction Management 3

There are three possible opportunities to do VE; 10%, 35% and 90%. Of these 35% is the most effective.

Construction Management 4

Not applicable

Contractor 1

Concept stage.

3.4 How do you approach function analysis?

This question was put to all the companies regardless of whether or not they used the workshop.

Consultant 1

With regards to function analysis the better firms do it when they can as a matter of course. The problem is, most QS's do not have the time or the inclination to do function analysis, you cannot stop a job and say lets do this or that, the relationships make it too difficult. This of course only relates to the less formal approach that we employ towards VE. In a workshop if there is no function analysis then you are merely involved in cost cutting. FA with regard to the verb noun is only a means to an end. FA is the ability to interpret the clients wants into the most efficient design. Function analysis relates to function and performance and is the effective interpretation and implementation of the brief

Consultant 2

In the workshop the function analysis is split down into two; high level and low level. High level function analysis might define the function of a car park as 'attract customers'. Low level function however relates to the specific elements of tarmac or kerbs. Functions are arrived at by discussion and definitely help to produce alternative approaches to the design and construction.

Consultant 3

The information phase and the function analysis occupy the first day of the two day study. Function analysis is a very useful tool. Consider the example of a Zoo and how you would design it if it had the function of 'entertain family'. Later you discover the real function is to 'preserve species'. This is a wholly different design concept.

FA even if not costed helps to generate ideas by asking the right questions. Function analysis is not done on the actual elements of the building, that is a waste of time.

The most important factor in the value engineering study is enthusiasm. FA is a great help but it is a tough technique to implement. It is important with function analysis to get the best trade off between time and efficiency.

Consultant 4

FA is a very difficult concept for designers to grasp. If you intend using it then it must be developed with a commercial edge. Function analysis operates with the client and design team present. The brief is then analysed by examining the space layout etc. It is very much an exercise in optimisation. So if the brief requires 400 bedrooms we would ask the question; is the frame best to suit that? The idea is simply to tear the brief apart looking at space requirements, quality, location, funding, and visual requirements. The design team analyse what the brief means, and look at it in a functional way to decide if the brief can be changed and the design optimised.

Consultant 5

I am not familiar with function analysis.

Consultant 6

There was no function analysis in the studies we have been involved with.

Consultant 7

There are two types of function analysis, that which relates to the concept of the design and that which relates to the elements.

The use of function analysis depends on whether or not the client wants it and whether we have time to do it within the fee we are being paid. Function analysis takes up about half a day of the workshop time.

Consultant 8

Function analysis was not used.

Client 1

There was no function analysis.

Client 2

Function analysis is very useful in that it offers discipline to channel thought.

Client 3

Function analysis was not used. Some lectures I have been to did concentrate on function analysis. One particular lecturer....

"got so bogged down with the function analysis that I wondered when he was going to get to the value engineering"

Client 4

We do not use workshops therefore I have not come across function analysis.

Client 5

We have our own version of VE which does not employ function analysis.

Client 6

Function analysis was used as a means of interpreting the brief and brainstorming was used as a means of generating ideas. Value engineering is a problem solving system that examines value, function and cost.

Client 7

Function analysis is used but not by the verb noun. We would list all the components of a project and look at alternatives. For example one of the components of a fume cupboard might be the plating. We would list that as a component and alongside that list alternatives such as ordinary painting.

Construction Management 1

The problem with function analysis is that it is very hard to remove a function from a construction project. You cannot remove the function that the foundations serve, therefore function analysis has very limited use.

Construction Management 2

Not familiar with that.

Construction Management 3

Function analysis provides discipline and gets people thinking.

Construction Management 4

Not familiar with the technique.

Contractor 1

If function analysis is not used the study is only cost cutting.

3.5 How do you approach FAST diagrams?

Once again this question was put to all companies regardless of whether or not they used the technique.

Consultant 1

FAST in the UK is a non starter as it is too academic, too complex and it takes too long.

Consultant 2

These are not used as they are too complicated.

Consultant 3

As a VE leader I look at the project before the study and have some idea of what the FAST diagram should look like.

Consultant 4

FAST may be useful academically but as a commercial tool it cannot be used effectively as it is too complicated.

Consultant 5

We are not familiar with this technique.

Consultant 6

FAST was not used.

Consultant 7

FAST is not used. It may be appropriate for processes but not for buildings.

Consultant 8

FAST was not used.

Client 1

This was not used.

Client 2

FAST is too bureaucratic. If all the team are on the same level there is no need for such a formal structure. The real benefit of VE lies in focusing on objectives. Once this is done the raw tool of function analysis can assist the team in maximising energy to challenge design and get better solutions. If function analysis is not used less results are achieved. FAST however is another matter.

Client 3

FAST diagrams are too complicated and very difficult to follow.

Client 4

Not familiar with this technique.

Client 5

Not familiar with this technique.

Client 6

These were not used.

Client 7

These are not used.

Construction Management 1

Not used.

Construction Management 2

Not familiar with this technique.

Construction Management 3

Too complicated.

Construction Management 4

Not familiar with this technique.

Contractor 1

Not used.

3.6 Evaluating the function

In the light of the limited use of function analysis this question was phrased to take account, not only of function evaluation, but of the means by which areas were selected for study.

Consultant 1

We do not find it necessary to calculate a cost worth ratio. We select the high cost elements and find operating on them is sufficient.

Consultant 2

When evaluating function we allocated cost to the function and not to the element, we found this very difficult to do.

Consultant 3

In the type of study that we use it is the responsibility of the QS on the scheme to allocate cost to functions. Sometimes the QS finds difficulty in pricing the functions but we have produced a set of guidance notes to assist in this. The function evaluation operates by first costing the basic shell of the building. Anything above that is then priced as the additional function. For example, a wall has the function of 'providing security'. That function is costed at extra over the cost of providing a normal 100 mm thick block wall. We show the basic cost of accommodation then add additional functions, concentrating always on extra over cost.

Consultant 4

We use the cost worth ratio in VE studies, this operates as follows:

1. Select the high cost elements and represent them on a pie chart.

2. Generate alternatives to those high cost areas.

3. Evaluate the solutions generated, using a weighted matrix which excludes cost as a criteria.

4. Select the highest two scorers from the matrix and carry out a detailed costing on them ie., calculate the cost of those two alternatives with the greatest worth.

Consultant 5

Not applicable as we have not been involved in that type of study.

Consultant 6

We took the cost plan and brainstormed everything contained in it. We did not reprice the cost plan as that is a QS function, not a VE function. We were not there to check the estimate or cut out the QS's contingency, we were there to appraise the team.

Consultant 7

We do not always allocate a worth to the functions or elements. Usually the high cost elements are selected for brainstorming along with items that look out of the ordinary. You have to zero in on certain areas, you cannot value engineer everything.

Consultant 8

The high cost areas were selected.

Client 1

The areas of high cost were highlighted.

Client 2

We found one of the biggest problems with VE is this evaluation of function, for which we used the cost worth ratio. For example, in the construction of a project an internal light bulkhead can have the function of 'increasing sales'. It is however impossible to say by how much it increases sales. It is therefore impossible to allocate a worth.

Client 3

The basis of the studies was the cost worth ratio. This was devised by starting with the estimated cost and comparing it to what the VE team thought it ought it be. The VE team cost was based on the BCIS and the QS's database. The team then brainstormed those elements that had the largest cost worth ratio.

Client 4

Not applicable.

Client 5

Not applicable.

Client 6

The areas of high cost were highlighted.

Client 7

The workshop leader would decide which areas were to be examined. These would generally be areas of high cost or those which had something unusual about them.

Construction Management 1

The QS present at the study would indicate which of the elements are priced higher than average, then we would concentrate on those.

Construction Management 2

Not applicable.

Construction Management 3

The high cost areas are highlighted.

Construction Management 4

Not applicable.

Contractor 1

Cannot remember

3.7 How are alternatives generated?

Consultant 1

Brainstorming is used in all workshops in order to generate alternatives.

Consultant 2

Brainstorming occupies day two of a three day study and is very much a team effort. The morning is occupied with the generation of ideas and the afternoon with evaluation of them.

Consultant 3

On Monday morning the team go through the FAST diagram as costed by the QS. They follow this with a brainstorming session that lasts one to one-and-a-half hours. Brainstorming is the fundamental technique of VE and function analysis is the preparation for it.

Consultant 4

Brainstorming is used as a means of generating alternatives.

Consultant 5

Not applicable as we have not been involved in this type of study.

Consultant 6

Brainstorming followed the design team presentation and there was no function analysis. It was very much a team approach that lasted for about four hours. The overall concept of the scheme was questioned, along with the elemental design.

Consultant 7

A brainstorming session is always included and lasts about half a day in a five day study.

Consultant 8

Brainstorming is used. This is really the basis of all value engineering.

Client 1

Brainstorming.

Client 2

VE is ultimately about the generation of alternatives to provide better value.

Client 3

Brainstorming was carried out on all studies.

Client 4

Not applicable.

Client 5

Not applicable.

Client 6

Brainstorming is used. This is really the basis of the whole study.

Client 7

Brainstorming is very much connected with the function analysis. We list the work that is forming the project and then look for alternatives. Generally for these brainstorming sessions we would split into disciplines.

Construction Management 1

Value engineering is ultimately about the generation of alternatives.

Construction Management 2

Not applicable

Construction Management 3

Brainstorming is used on all studies.

Construction Management 4

Not applicable

3.8 How do you evaluate proposals?

Consultant 1

Generally by allocating a rating of one to ten.

Consultant 2

By allocating a number between one and ten.

Consultant 3

Evaluation is done on the basis of team and client discussion. Evaluation is based on the team and clients opinion. They select ideas for further examination.

Consultant 4

We use the cost worth ratio to highlight high cost areas. We then brainstorm these and evaluate them without costing. Finally we select the two or three highest scorers and do a costing on those.

We do this as sometimes capital cost is not that important. If you consider a prison, the capital cost is only a fraction of the costs of staffing it. If you can design to cut down the number of men that you need to staff it then you can save much more than the capital cost. This is what value engineering is about.

Consultant 5

Not applicable as we have not been involved with this type of study.

Consultant 6

The proposed ideas were evaluated on the basis of 1 to 10 with all present discussing their merits or disadvantages.

Consultant 7

We use many different methods of evaluation, sometimes a rating of one to ten and sometimes a matrix.

Consultant 8

A matrix was used as a means of evaluation.

Client 1

Proposals were given a rating of one to ten.

Client 2

Evaluation was by consensus.

Client 3

Based on a rating of one to ten.

Client 4

Not applicable.

Client 5

Not applicable.

Client 6

Cannot remember.

Client 7

Evaluation would be by the client outside the workshop.

Construction Management 1

The basis of evaluation is the ease with which the proposal can be implemented without the need to incur redesign fees.

Construction Management 2

Not applicable.

Construction Management 3

Based on a rating of one to ten.

Construction Management 4

Not applicable

Contractor 1

Based on a rating of one to ten.

3.9 How do you approach the writing up of proposals?

Consultant 1

This usually takes the final two or three days of a forty hour workshop and is necessary to show what the client is getting for his money.

Consultant 2

Writing up of proposals occupied one day of a three day study.

Consultant 3

Once the study is complete the leader does a full appraisal of all the proposals and presents the study to the client within two weeks.

Consultant 4

It is important to write up VE proposals as the client needs to see that he is getting something for his money. This is particularly true when using an external team. It is not as vital with the design team.

Consultant 5

Not applicable as we have not been involved in this type of study.

Consultant 6

Three and a half days of a five day *workshop were spent working up the* proposals for inclusion in the final document. During this time most people divided their time between the study and their own office.

Consultant 7

All proposals are written into the study, this takes about three days in a five day workshop.

Consultant 8

All proposals were written up which took about half of the study time.

Client 1

All proposals were written up and included into a very large document.

Client 2

The formal write up of proposals was carried out but is not really necessary. Two days is about the right length for a VE study.

Client 3

All proposals were written into a formal report.

Client 4

Not applicable.

Client 5

Not applicable.

Client 6

All developed proposals were written up.

Client 7

We would write up proposals. The client would select those ideas he wanted included and then tell the design team.

Construction Management 1

All proposals are written up and included in the report.

Construction Management 2

Not applicable.

Construction Management 3

All proposals are written up.

Construction Management 4

Not applicable

Contractor 1

This is not really necessary when using the design team.

4. Section 3

Outline any alternative approach you have to value engineering?

4.1 Consultant 1

In addition to the workshop we employ a less formal approach to VE.

The operation of this less formal approach is instigated by the nature of the QS appointment. It occurs where we as QS's are either appointed first, where the project is cost led, or where our appointment includes an involvement with something other than cost.

This less formal approach to VE is similar to cost planning but has one distinct difference. With normal cost planning by the time we get to cost the project 80% of the cost is already decided and we can only influence 20%. With the less formal VE approach we are involved much earlier. We therefore have a greater influence on the cost decisions even to the extent that we could say build a supermarket instead of an office.

When involved earlier than normal and therefore using the value engineering approach, we would firstly cost the various design options available to the client. If there were no drawings available we would give a price without the drawing, broken down into elements. These elemental costs would be based on our own cost data and the BCIS data base.

As the design develops, because we have been involved from a much earlier stage, we can lean on the architect more than we usually could. We can assure him that we have developed realistic elemental costs and that his design solution ought to be within that budget. Each month we give the client a statement showing any changes and recommending where money needs to be moved from one element to another.

As the design develops further we would do another cost plan, this time using approximate quantities. We would be constantly checking back to the elemental costs to see they were within budget. We would immediately inform the architect or the client if they were over the top. We would continue cost checking all through the detailed design.

When an element or project is over budget we would convene a meeting with the design team and client and decide to either increase the budget or to make savings in the scope, performance, brief or specification.

In addition to these ad hoc meetings, there are design team meetings which we as QS's also attend. At these we present a summary of cost showing any changes from the previous month. We discuss the reasons for the changes and check that all members of the team have perceived the problem correctly. Then we decide whether to go forward with it or to make changes, always considering the impact on other elements.

With the normal cost planning service the opportunity to influence what to build, number of storeys, shape and so on, is lost. This ability to influence function is restricted and the QS role becomes one of costing the design produced by the architect. The process becomes reactive where as we prefer to be proactive, that is, to help the architect produce a design with a realistic expenditure. After all, it is useless building a hotel and then finding out that you cannot afford to fit it out. The advantage of the less formal VE over the cost planning process is that it has greater potential to control costs and therefore gives better value for money.

Within the less formal VE approach there would still be limited use of the workshop. If for example something drastic happens, such as increases in costs due to changes in taxation.

Less than 10% of our appointments use this less formal VE approach. Education of clients is a slow process but it is progressive. Change is predominately public sector led. The private sector tend to take the attitude that you should do it anyway.

The future of VE lies in the less formal approach, especially in the private sector. In the public sector however, there is more room for the more formal approach of the forty hour workshop.

4.2 Consultant 2

We provide value engineering as an integrated part of a project management service. There are two workshops, one at sketch and one at scheme design, using the existing design team. The project manager needs to be appointed early in the project development. Parallel with the workshops the QS produces a cost plan and elemental breakdown and cost checks throughout the whole process. If the project goes over budget then the team review alternatives that would produce a saving. The QS goes to every design team meeting.

4.3 Consultant 3

Although the approach used by the company is a workshop, it is similar in name only to the US workshop. It operates on a two day approach either side of a weekend using the design team and the client. The workshop is led by an independent VE leader using function analysis and FAST diagrams to help search for better solutions.

4.4 Consultant 4

We recommend a more ongoing approach to value engineering. This operates with the design team and consists of a 2 day study at the brief stage, a mini workshop at the 15% stage to check that the design has not moved away from the concept produced at the brief stage and a 40 hour workshop at the 35% design stage. This last workshop questions everything done so far. This approach takes account of the fact that there are two levels to VE, the macro and the micro. The macro relates to the concept of the design whereas the micro relates to the elemental design.

With this ongoing system the VE leader also attends all the design team meetings and questions the design solution. As described earlier the function analysis relates to interpreting the brief to get a most effective design.

4.5 Consultant 5

VE can be carried out within the cost planning process with the addition of two, two-day workshops; one at outline planning and one at pre-appointment of the contractor.

The problem with the contractor under traditional procurement is that he has an adversarial role. Involving him in the design overcomes this. In the UK a contractor is never expected to take the initiative. In a depressed market he will not consider any buildability aspects but try to profit from them when they are made into formal variations. Likewise in the UK tendering has become an art in that an estimator will, if he can, distort rates and look for what's missing in the tender. The contractor takes the view that he will build what's there and that design problems are not his. The pre-appointment meeting could solve this. Design and build is an obvious alternative to solve these problems but is disadvantageous in that it passes over too much authority to the contractor.

The purpose of the pre outline planning workshop is to have a cost influence before the overall appearance of the building is set by the granting of outline planning permission.

4.6 Consultant 6

We have an alternative to the forty hour workshop which we will call the English approach.

The English approach to VE is applicable in two circumstances. Firstly when the project is over budget and secondly when the project is QS driven.

When a project is over budget the team meet together to produce a shopping list of savings. In comparison with the workshop there are fewer and less radical proposals. There are many roadblocks to stop implementation as the designers are afraid to be seen to have made mistakes. This approach only puts resources in when they are required.

The QS driven approach helps to keep the project within budget. The QS produces a cost plan allocating elemental costs within which the team must design. The cost is driven from the front end. The QS guarantees that providing the design team do not over design then the project will remain on budget. As the design develops it is constantly cost checked against these elemental costs. This approach depends so much on the QS relationship and position in the team. A one man band is not going to take on Ove Arup. This approach is vastly superior to the fire brigade approach described above. If this cost planning system is up and running then VE is only required on the base architectural concept (BAC), that is the net lettable, the building size, the number of storeys, and the shape. Everything else would then fall into line.

The VE therefore operates on the BAC and the cost plan is produced on the basis of the VE. The idea is to avoid going over budget and having to call the fire brigade to do a forty hour workshop or a cost cutting exercise.

VE is only the next progressive step to cost planning. The area in the cost planning process that has been missing is the QS input on the BAC. VE can allow the QS a way into this.

Any good QS at the moment is operating the full cost planning service, we would not work under anything else. The problem lies in the late involvement of the QS which makes it difficult to get at the BAC. This is however changing. Slowly.

4.7 Consultant 7

In addition to the forty hour workshop we also have a more integrated service that we sell as part of the standard QS service. With this system we offer a mini workshop at the brief stage and then a full forty hour workshop at RIBA C (35%)

4.8 Consultant 8

The forty hour workshop although effective on very large schemes is difficult to market as it takes so long. We offer VE as an integral part of our project management service. This integral service consists of a series of one day meetings with the design team and client and is centred around a brainstorming and evaluation session. There may only be one of these meetings which would ideally be at concept stage but very often is, unfortunately, much later. On a larger project there may be several of these studies. This type of VE is now offered as standard on all our project management commissions.

4.9 Client 1

The forty hour workshop is the only system we employ.

4.10 Client 2

So far we have only employed the shorter style workshop but we are investigating all possibilities.

4.11 Client 3

In an ideal world I would have value engineering as a more ongoing process that allowed the design team to participate (but not do) the study. I would always keep the design team fully informed of what was going on and why. However this is only a personal opinion and it is unlikely that the client will take it on board. Ours is an American client therefore we adhere to the American system.

4.12 Client 4

The company's value engineering system works on the following lines;

Prior to land purchase we do a feasibility study that checks that the purchase price can be recovered by sale or rental received in future years. The sale price or rental received is based on the figures given to us by our estate agents.

A second feasibility study or appraisal is carried out around the time of outline planning. This would include the cost of construction, fees and so on. The cost of construction is based on the estimate of the QS who is appointed at the same time as the architect.

We have a series of design team meetings and the QS can (often to the architects annoyance) advise on alternative materials, structures or services. The client is usually present at these meetings.

As the architect develops the design the QS produces a cost plan. We are not really concerned with elemental breakdowns at this stage and are more concerned with the bottom line figure.

We find that almost all our projects go over budget at the design stage due to the following,

Design enhancement or variation.
Client enforced changes.
Inflation.
Other external reasons.

Undoubtedly the biggest of these areas are design enhancements and variations. Client initiated changes are generally quite small, as are external influences. The QS does keep costs down but this is very much as a damage minimisation exercise.

4.13 Client 5

The value engineering system we use operates as follows;

The developer includes in his brief the cost /m2 within which the architect must design. The architect produces a design and we then produce a cost plan. There is some interaction between the two processes. At this stage the project is usually over budget and we therefore examine all aspects of the design in order to make savings. This is not a linear process and there is much interaction as the cost plan is refined. This exercise is not one of cost reduction as the brief does not change, it is more an exercise in optimisation. We would look at the overall concept, number of floors and so on.

Once the project has been brought within budget (or the developer has increased the budget), then we are given the go ahead to design to 35%. Once again a cost plan is produced based on what the design team have developed.

At 70% design we do a third cost plan. If at the 35% or 70% design stages we are over budget then we rethink the design and either omit items, make specification or conceptual changes. The consultants are not paid for redesign.

There are no formal design team meeting but there are two formal reviews, one at concept and one at 70%. The architect would organise his own team meetings and some of these would be attended by us.

The end result of value engineering is the 70% cost plan.

Every discussion that takes place is value engineering. VE is getting what you want at least cost, that is, optimising the value of the building.

VE is about going into the design at an earlier stage.

4.14 Client 6

We only use the forty hour workshop.

4.15 Client 7

Firstly we would carry out a workshop as described earlier . This would be at the concept of the scheme and would comprise the design team and the client. It would, in the main, be a brainstorming session and would not use function analysis. The idea of this session is to act as a test of user requirements. After this we would have a review of the major elements of the building by the people involved (structural engineer, mechanical engineer or whatever). They would meet for a day to review the drawings and discuss alternatives that could provide a cheaper solution. After this meeting we would get costings for the alternatives and have another meeting to discuss the costings. Our approach to VE is very unstructured.

4.16 Construction Management 1

The best approach to VE in the UK is to do two studies, one prior to outline planning and one at 35% design. This is because outline planning dictates the external appearance of the building which once established is very hard to change. Another study should be done at 35% or scheme design when there is enough information to make changes to the mechanical, electrical and structural systems.

4.17 Construction Management 2

Our value engineering system operates on a series of meetings between ourselves and the design team.

The first meeting is at concept. At this stage we would comment on the general issues. We would not know the elemental design therefore it would be too early for value engineering.

The next meeting is at scheme design and this is where the VE comes in. We have all the drawings issued to us. We then set aside an afternoon and analyse the drawings with all the disciplines present. This is usually a six hour session.

On a complex job we may have up to twelve of these sessions. We would generally examine one element at a time. The client would not always be present but all disciplines would.

In a typical study of say, the structure, the engineer would outline his design and then show a series of alternatives. Each alternative is then brainstormed to look at the consequences of that design on the overall project.This would include the effect on other elements, ordering, delivery, site access and so on. The QS would then cost the alternatives including an examination of the peripheral costs such as tower cranes.

These sessions do not include any external designers, only members of the team. The study is not formal so may be led by ourselves or by the particular discipline under study.

The next stage after the afternoon sessions described, is to examine the detailed design from a buildability aspect. At this stage we are not looking for alternatives but for the most cost effective means of building. This stage must involve the contractor and the supplier, along with the appropriate discipline. The sessions are a similar format to the earlier sessions.

This VE approach can only be employed when using the construction management system. This arrangement is similar to management contracting except that trade contractors have a relationship with the client and not the managing contractor. The trade contractors do the final design.

In the sessions we do examine function. The function of a foundation is always the same, to transfer load, so we ask the question how else can the load be transferred? We then do a VE analysis to see which gives the best solution. If you can list all the functions of an element, then you can get the best value for money, since you can examine if there is a cheaper solution that fulfils all the functions.

4.18 Construction Management 3

Only the workshop approach is used.

4.19 Construction Management 4

VE offered by us is integrated into a project management service and operates in the following way:

The brief is written by the project manager and the client. It examines all possible aspects and includes any required user studies. It is a lengthy exercise. Once the brief is developed it is given to the architect. The design is then developed by the three of them (PM, architect and client).

Once this stage is complete the cost plan is developed which dictates good value. As the elemental design develops the PM checks the work of the designer against the cost plan.

Brainstorming can be used when an alternative is needed. Function analysis is built into the process.

4.20 Contractor 1

The value engineering offered by us operated on the basis of a three day Charette, where we looked at the overall design and then brainstormed without the use of function analysis. At this stage there was no actual design, we merely brainstormed the brief and from that session produced the design. The idea was not to produce savings, it was to produce a concept that would work. The VE really helped the client to get the building that they wanted. It created a good team atmosphere.

VE must be an ongoing process. The 40 hour workshop is inconvenient, expensive and does not cover all possibilities because it is carried out too late. Having been to the American style workshop I would say they do not work, all they do is look for a long list of proposals. We however are more concerned with implementation.

5. Section 4

What do you see as the relationship between cost planning and value engineering?

5.1 Consultant 1

There is only one difference between value engineering and cost planning. With value engineering the QS is involved earlier and can therefore comment on the design concept.

5.2 Consultant 2

In an ideal world with cost planning up and running correctly there would be no need for value engineering.

5.3 Consultant 3

The cost plan is necessary only in so far as it makes it easier to price the FAST diagram, however you could do without it.

5.4 Consultant 4

When we cost plan we are not concerned with quantities, we calculate the budget from the database then allocate elemental costs. QS's are very aware when designers are wasting money and will question that as part of their normal remit. In addition to this they will do a cost cutting exercise when the project is over budget. I cannot really see a link however between cost planning and VE.

5.5 Consultant 5

Basically we follow the pattern of outline cost plan, cost plan and a very stringent cost checking system. We inform the architect and client immediately an elemental design is going over budget. We then decide jointly whether to except the change, save elsewhere, or omit it. With the exception of increased design team co-ordination there is very little difference between this and value engineering.

5.6 Consultant 6

Ultimately if you have cost planning you don't need VE. That said you could never sell cost planning separately. The future of VE lies in the separate service, that is the forty hour workshop, with an external team, where the client has not had the full cost planning service.

5.7 Consultant 7

Cost planning is reactive whereas VE is proactive. Cost planning is cost orientated, whereas VE is value orientated. VE is more intensive and structured. When a cost plan presents alternatives it will not do it formally with calculations to back it up. VE however will do this.

5.8 Consultant 8

Cost planning is an integral part of the VE service. It is necessary in order to see what the high cost elements are, and to enable a Pareto analysis.

5.9 Client 1

We do not employ cost planning and I do not see any relationship between that and value engineering.

5.10 Client 2

With regards to cost planning, the company from their sales figures know how much they can spend in order to get the right return on investment. Based on this we request our QS's to produce a value model outlining the elemental costs of the project. We then request that the design team design within those elemental costs. Value engineering is more than this, it examines function which cost planning does not.

5.11 Client 3

With regards to cost planning we find it difficult to implement the system effectively, since if the QS gives elemental costs to the architect he takes exception to it. Some of the more sensible architects meet the QS half way.

They start the design but then take advice if something is costing too much. Our approach to VE, being the forty hour workshop is entirely different to cost planning.

5.12 Client 4

We do not employ cost planning.

5.13 Client 5

VE is proactive, normal cost planning is reactive.

5.14 Client 6

Cost planning is sometimes used instead of bills of quantities but has nothing to do with value engineering.

5.15 Client 7

I am not familiar with cost planning.

5.16 Construction Management 1

I cannot see any connection.

5.17 Construction Management 2

Cost planning and value engineering are separate processes. VE is a process of getting value for money. Cost planning is about taking a set of drawings and putting a cost to them, then adding preliminaries and so on. VE takes the cost plan, looks at the elements, looks at the alternatives for that element and then makes changes. VE is formal process for examining design in order to refine the cost plan. In formulating that original cost plan you use a system called estimating.

The difference between a cost plan and an estimate is that a cost plan is elemental, it measures a door and includes the opening, painting, ironmongery and so on. Estimating on the other hand would separate the door into BQ items. With estimating you know the details but with a cost plan you do not.

5.18 Construction Management 3

Some QS's do VE under the guise of cost planning using VE as a buzzword. This does not include the 40 hour workshop which is totally different from cost planning.

5.19 Construction Management 4

There is no real connection.

5.20 Contractor 1

It is much more difficult to get results from VE if cost planning is done properly.

Where do you see the quantity surveyor fitting into the value engineering process

6.1 Consultant 1

It is a natural role for the QS. He does a certain amount of it already.

6.2 Consultant 2

The QS is changing and becoming more proactive. The QS does a certain amount of VE anyway. VE is definitely a QS role.

6.3 Consultant 3

The problem with QS's and VE is that the QS does not have the correct terms of reference. He cannot call meetings and he cannot incur the client in additional cost. VE is a project management function.

In my experience of VE architects are the most flexible, followed by engineers and then QS's, who are extremely intransigent. The reason they do not like VE is that the process shows up the bunce that they have in the estimate.

The alternatives produced by a VE study fall into two categories, wholesale redesign or cosmetic factors, such as reducing specifications. Only the second of these is currently within the grasp of the QS.

6.4 Consultant 4

It is not really relevant. VE builds a team environment and adopts a questioning approach within which the client is more likely to listen. A good design team does not need VE. The real problem with design teams is the relationships they have with one another. In addition they all have a different idea of what the brief is all about. VE is a catalyst for change. Value engineering ought to become a separate discipline.

6.5 Consultant 5

The company is in the process of changing its letterhead from cost consultants to value engineers as we do not see any real difference. Value engineering is the ability to reduce cost whilst maintaining aesthetics and quality. The QS must start to consider value instead of just generating quantities. Value is concerned with increased communications and reduced delays and design problems. The QS is in the best position to take up the role that can resolve these problems. One of the most serious difficulties of the current system is that Architects hate being interfered with by QS's, they are still very arrogant.

The QS who is doing his job properly is not really doing anything different from value engineering except that VE allows him to consider more alternatives. The cost planning process sometimes gives alternatives and always includes a specification, which is the QS's cost model of the project. Design team meetings could help team coordination but they tend to get bogged down with detail and become only progress reports, the team do not stand back to examine the design.

Some QS's have no real design input, they are not prepared to take responsibility for the cost planning process. Throughout all projects we have cost meetings and fully cost check all the way through the design.

We will sell VE as an integrated part of our existing very specific costing system. We try and concentrate on being useful instead of producing reams of documentation. The bill of quantities encourages the architect not to fully design prior to tender as he feels that the QS can cover it for him.

6.6 Consultant 6

The QS cost planning function is not that far removed from value engineering.

6.7 Consultant 7

Quantity surveying and VE are not synonymous. Personality is the most important thing to a good value engineer.

6.8 Consultant 8

Good quantity surveying is critical to the operation of good VE, as ultimately it is all about cost. I do not think however that the discipline of the individual is relevant to whether he makes a good value engineer. VE is about teamwork, it is about getting the most out of people. If you are good at man management then you will most likely be good at VE.

6.9 Client 1

VE is an implied criticism of the QS but they are not alert enough to see that. A QS will only measure what's there, he will not give cost advice because he cannot. If you ask a QS which is the best design he will say give me the designs first and then I will tell you. We use QS's for estimates, Bills of Quantities, pricing variations and managing the final account. We do not ask for cost planning because cost planning is useless, it only apportions an estimate among the elements of the building. It does not consider that the original estimate may be too high to begin with.

6.10 Client 2

There are two aspects to the notion of the QS doing value engineering. One is that some of them cannot do it because they are locked into the BQ mentality. Others can do it but are not given the opportunity. There is no doubt that some QS's do it, in that they will tell the architect that there is a more economical shape and so on. Those that do this achieve the majority of VE. Overall there are three things a QS can do. He can not challenge the architect at all, he can challenge him in which case he will achieve x% of VE, or he can do VE proper. The QS who is doing the second stage has the right cultural philosophy to move into the third stage.

6.11 Client 3

QS's could do what a value engineering study does, the problem is that they are not in a position to do so. If the QS is brought in early enough then he can provide much more than just technical data. He can provide value and control and monitor costs. The problem with the design team is that the architect/ QS relationship is not an equal one, particularly when a project is within budget. In such a situation, where the QS tries to make savings, the architect says 'why should I, the scheme is within budget and the client is happy so there is no problem. 'The fact that the client is probably not happy does not seem to come into it. When a scheme is over budget the QS has the upper hand. The answer to the problem may lie in the introduction of a project manager, as the designer is not really a good central agent. VE gets around the political problem of the architect and QS relationship. Politically implementation of QS ideas is difficult, but in a VE study could be more plausible.

6.12 Client 4

They are one in the same thing.

6.13 Client 5

A QS only understands cost, not construction, that is why we do not use them. A QS is not a builder, unlike a construction manager who has a rounded eye. A construction manager is the best person to say what a building should cost.

6.14 Client 6

Value engineering has nothing to do with quantity surveying.

6.15 Client 7

We use quantity surveyors for costing VE proposals and for doing estimates. That is the only connection that I see. The QS is not in a position to make judgments on what the client wants, he is there to monitor costs and is not expected to do anything else.

6.16 Construction Management 1

QS's in the UK add to the cost of construction. They retard subcontractors from managing themselves by giving them bills of quantities. A BQ also retards the design. The architect takes the view that he can produce any drawing and the QS will make allowance to cover it. The QS does however have a useful input in controlling the cost of the design. The problem with British QS's is that they are too academic and analyse cost to death. They do not understand construction because they do not supervise.

6.17 Construction Management 2

There is no relationship between value engineering and quantity surveying.

6.18 Construction Management 3

Some QS's now have a separate VE division. As QS's are the most disciplined of the design team it falls naturally into there camp. That does not mean a highly motivated architect could not do VE.

6.19 Construction Management 4

VE is a project management and not a QS function.

The QS is too concerned with money. If he were asked to do VE he would simply cost cut.

6.20 Contractor 1

QS's do not understand function only cost. That said however, the QS is the ideal person to take up the VE role.

A QS in his normal work will do one of two things. He will either make an omission or change the specification. Value engineering on the other hand uses function analysis to reduce cost and improve value. There is no reason why the QS could not do this given the appropriate training and the opportunity.

Appendix D
Survey

Q1.What method do you use for carrying out a value engineering study.

- [ ] 40 hour workshop
- [ ] Charette
- [ ] Other (please specify) ______________________

Q2. At what stage of the design do you usually carry out a value engineering study.

- [ ] 10% Concept
- [ ] 35% Schemmatics
- [ ] 60-90% Production
- [ ] Other (please specify) ______________________

Q3. Who is generally responsible for carrying out the value engineering study.

- [ ] The design team
- [ ] An external value engineering team
- [ ] Other (please specify) ______________________

Q4.What forms the agenda of value engineering studies.

- [ ] The job plan
- [ ] Other (please specify) ______________________

Q5.What percentage of your studies contain a FAST diagram.

[ ] %

Q6. Which of the following most closely represents the function analysis that you use.

- [ ] Foundations....Support load
- [ ] Casualty....Treat emergency
- [ ] Other (please specify) ______________________
- [ ] Function analysis not used.

Q7.What method do you use for highlighting areas of poor value.

- [ ] The cost worth ratio
- [ ] Value mismatches
- [ ] Other (please specify) ______________________

Q8.What is the basis of evaluation when highlighting areas of poor value.

- [ ] The cost of a cheaper alternative
- [ ] The cost of the cheapest alternative
- [ ] The lowest cost to achieve function
- [ ] Client perception of worth
- [ ] Other(please specify) ______________________

Q9.On which areas of projects do you generate VE proposals.

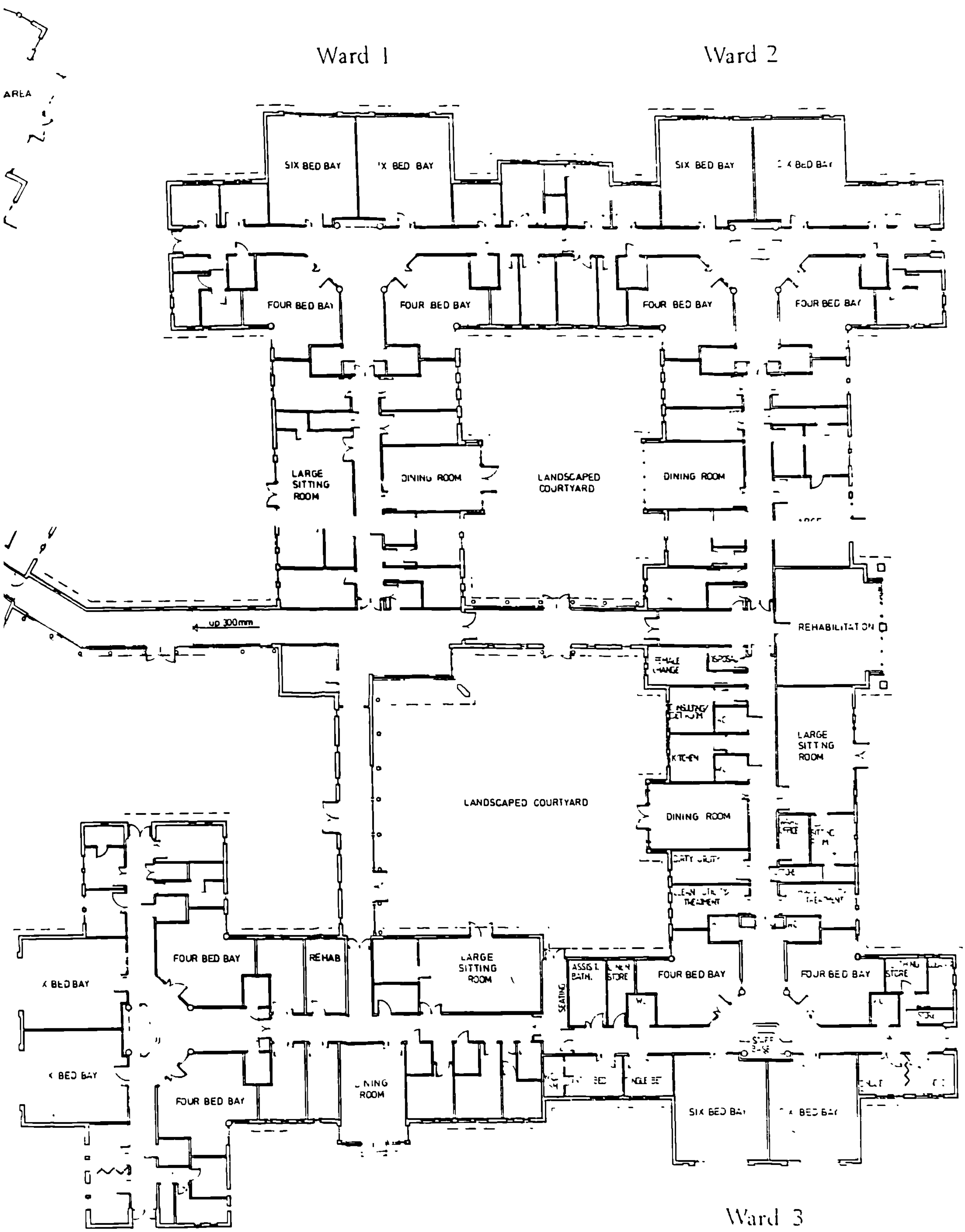
- [ ] All areas
- [ ] Areas highlighted as ones of poor value
- [ ] Other (please specify) ______________________

Q10. Who do you consider to be the United States leading VE consultant.

Q11. Who do you consider to be the United States leading VE client.

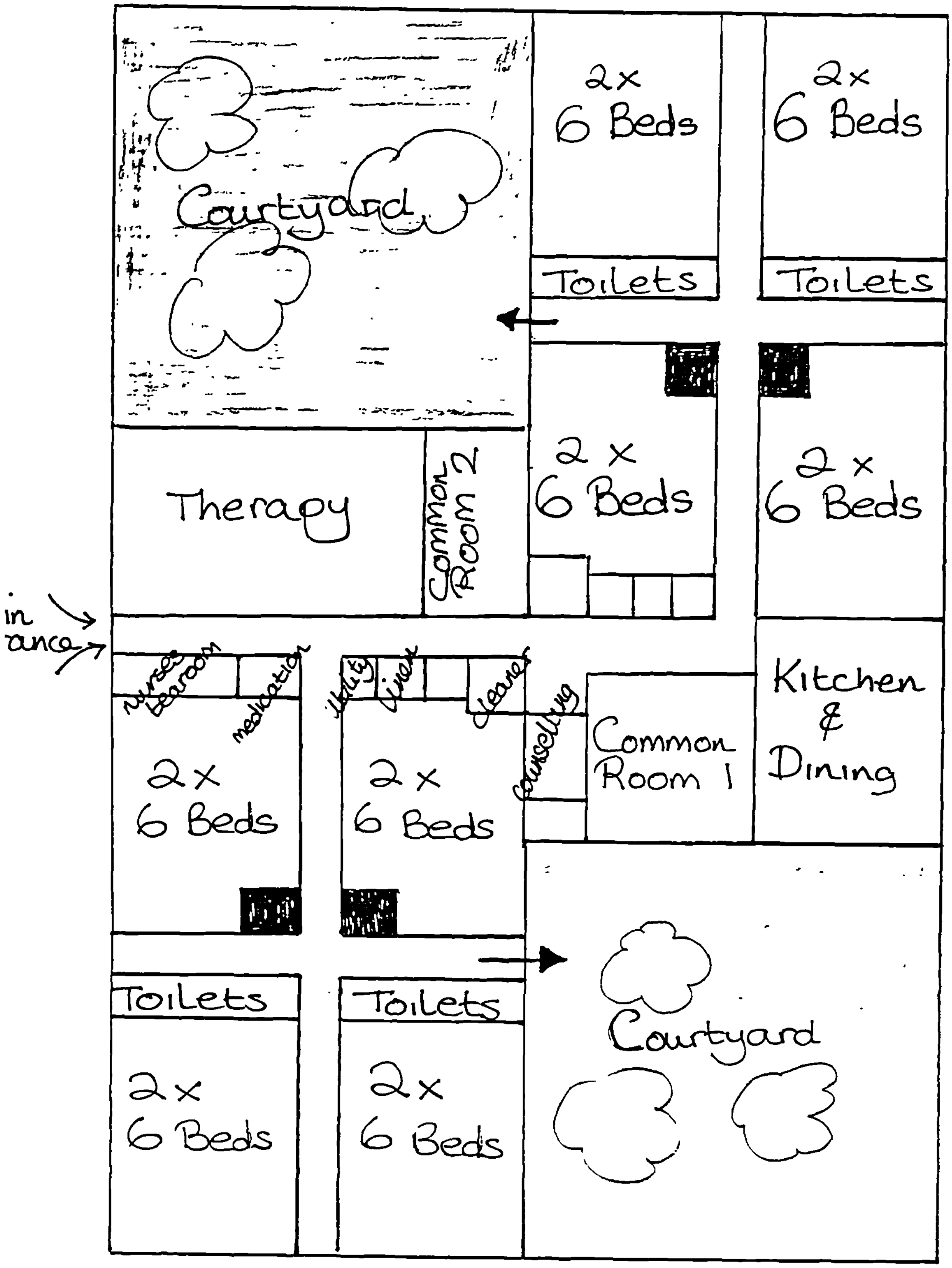
Appendix E
Function Analysis 1

1t



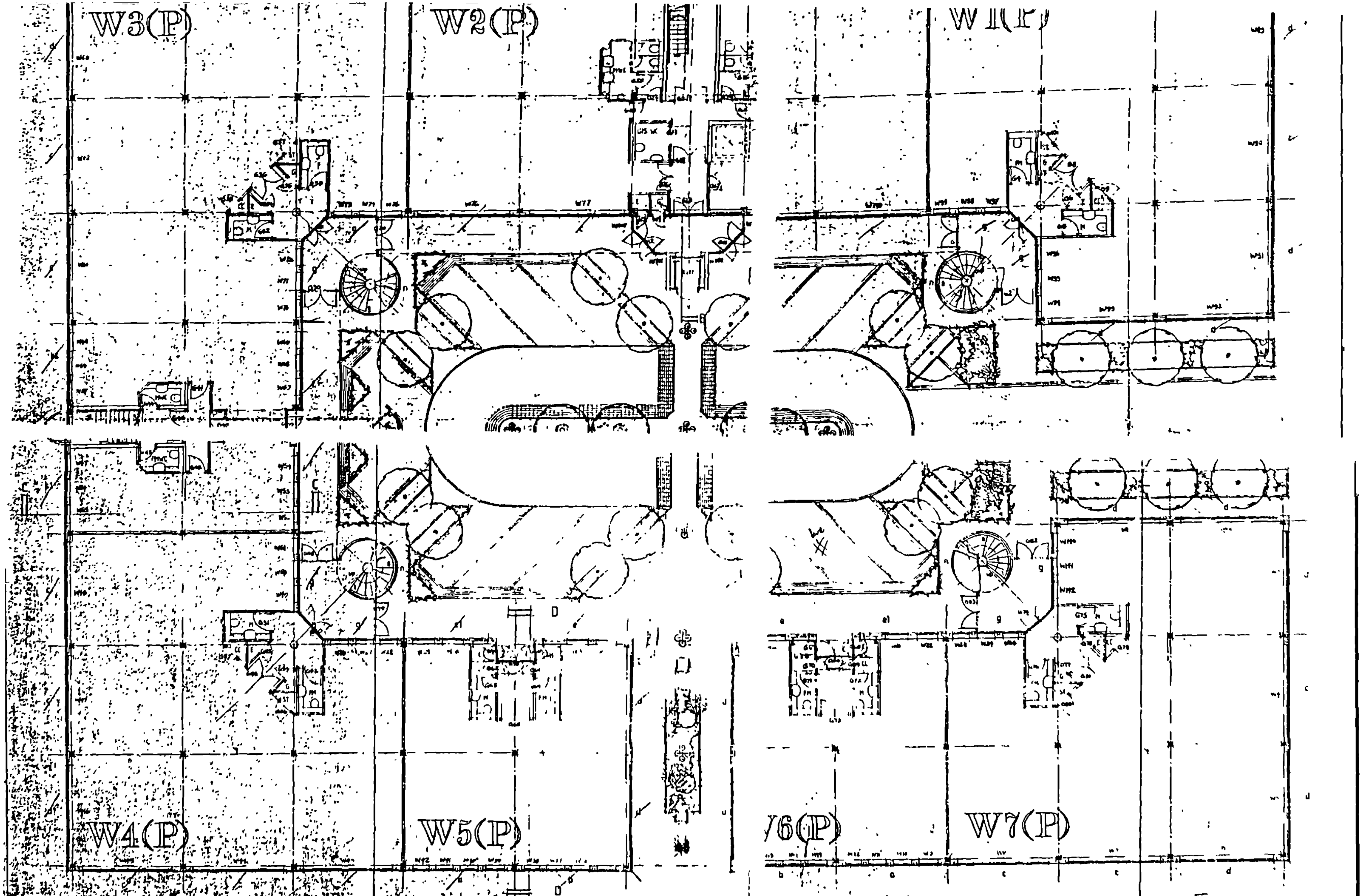
Ward 1
Ward 2
AREA
SIX BED BAY
FOUR BED BAY
LARGE SITTING ROOM
DINING ROOM
LANDSCAPED COURTYARD
up 300mm
REHABILITATION
LANDSCAPED COURTYARD
KITCHEN
DINING ROOM
LARGE SITTING ROOM
REHAB
LARGE SITTING ROOM
ASSIST. BATH.
SEATING
FOUR BED BAY
STORE
SIX BED BAY
Ward 3

Appendix F
Function Analysis 1



Scale 1:200
Nursing Station.

Appendix G
Function Analysis 2



PIAZZA LEVEL