FEASIBILITY STUDY

FOR THE REFURBISHMENT OF

TWO ELECTRIC PASSENGER LIFTS

AT

GRENFELL TOWER

LANCASTER ROAD WEST ESTATE

FOR

THE ROYAL BOROUGH OF

KENSINGTON AND CHELSEA

Butler & Young Lift Consultants Ltd
Timber Hall
21 Timber Lane
Caterham
Surrey CR3 6LZ

Tel. [redacted]
Fax.
Email: liftconserv@btinternet.com

The Royal Borough of Kensington and Chelsea
Tenant Management Organisation
The Town Hall
Hornton Street
London
W8 7NX

July 2003

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Prepared By: .....
Date: .....

Checked By: .....
Date: .....

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INTRODUCTION

FEASIBILITY STUDY FOR THE REFURBISHMENT OF TWO ELECTRIC PASSENGER LIFTS AT GRENFELL TOWER

1.0 INTRODUCTION

1.1 The following feasibility study has been prepared for the Royal Borough of Kensington and Chelsea and is based on specific site surveys of the lift equipment, investigation of the log cards and maintenance records, plus discussions with the TMO and local RBKC staff.

The RBKC brief also required an investigation into the possible presence of asbestos within the common areas and the results of this investigation are included under cover of a separate section.

1.2 The principal areas covered are:

1. Specification and life expectancy of the lift equipment,
2. Compliance with current Health and Safety at Work requirements, the recommendations of British Standards and EN81/1,
3. Present condition of the equipment and quality of maintenance standards,
4. Facilities for the Disabled and the requirements of the Disability Discrimination Act 1998, plus the forthcoming EN81/70.
5. Suitability for continued and future use.

1.3 The study provides three principal options for consideration:

Option 1 Complete refurbishment with energy efficient, variable frequency drive, microprocessor control, car and landing door operating equipment, lift car plus operating and display fixtures with facilities for the disabled together with any HASAW and compliance works.

Under this option the car capacity of 8 persons / 630Kg and the lift speed of 1.6 mps would remain as existing.

Option 2 Complete refurbishment as in Option 1, retaining 8 person capacity but with the lift speed increased by some 25% to 2.0 mps.

Option 3 Complete refurbishment with increased lift speed as in Option 2, but also with a 30% + increase in lift car dimensions and an increase in load carrying capacity to 12 persons / 900Kg.

plus

Option A Each of the options have the further option to replace the entrances thus increasing overall clear width by approximately 10% which, with tapered architraves, would increase passenger, pram, buggie, wheelchair and furniture accessibility.

1.4 Each option takes account of and includes:-

1. Lift, building, structural and electrical works.
2. Manufacturing lead-in times.
3. Timescales for on-site work.
4. Budget costings.
5. Qualification and summary.
6. Recommendation.

1.5 Appendix A includes selected photographs of the lift.

BACKGROUND

FEASIBILITY STUDY FOR THE REFURBISHMENT OF TWO ELECTRIC PASSENGER LIFTS AT GRENFELL TOWER

2.0 BACKGROUND

2.1 Grenfell Tower was constructed circa 1971 as part of the Lancaster Road West development and comprises 120 flats located on floors 1-19. The common parts are in good order and the block is well managed with secure entry systems and concierge service during the normal working day.

2.2 The original lifts were installed by Hammond & Champness who were at the time a subsidiary of the Dover Corporation, a company now wholly absorbed into the Thyssen Group.

2.3 Extensive refurbishment was undertaken by the original installer in 1985 at which time the relay based form of control was replaced with Thames Valley microprocessor control, albeit with the standard Hammond & Champness reduced specification software.

2.4 At the time of the refurbishment the original traction drive machines were replaced with Holroyd gears with what was considered to be an energy inefficient variable voltage Thyristor drive. The lift cars and entrances were also replaced at that time.

2.5 Grenfell Tower has a continual and intensive traffic flow on the lifts, as acutely observed during the survey. The building houses a considerable number of young and growing families with prams and buggies plus some elderly residents with shopping trollies.

2.6 The residents and visitors lift usage is hampered both by the speed of the lifts and by the restricted size of the lift cars, which at 8 person capacity is nowadays considered to be totally inadequate to facilitate ease of movement in such a high and busy block.

2.7 This problem is further exacerbated by the fact that once the lift car has, say, one mother, shopping bags, pushchair and another child accommodated there is scarcely room for any other intending passenger.

This was frequently observed throughout the survey.

2.8 When a lift car is normally filled to capacity with passengers this initiates a load sensor which activates a 'non-stop' feature. This allows the lift car return to the Ground Floor without making any further stops for passengers waiting on landings who could not possibly be accommodated as the car is full.

2.9 Unfortunately, whilst the lift car may be full having only mother, pushchair and child plus, perhaps, one other passenger the load sensor does not recognise this as fully loaded and a lift under these conditions will then make many redundant stops in response to landing calls where upon the waiting, aggravated passenger is unable to enter and needs to summon the alternative lift.

Such circumstances extend the already excessive waiting times even further.

2.10 The original lifts were installed over 30 years ago and even the refurbishment equipment has now been in service for over seventeen years, but with the huge workload imposed, all components appear to be far more aged than their actual years would normally indicate, with many parts being completely worn.

This was evidenced by the inordinate number of malfunctions recorded in the site log cards over the previous years.

2.11 The lift is currently maintained under cover of a fully comprehensive maintenance agreement by Independent Lift Services Limited.

2.12 Continuity of service within Grenfell Tower is of paramount importance to the residents and the TMO and, due to the condition and operation of the lifts, recent performance has proven to be somewhat erratic leading to shutdowns and concern in respect of current and future reliability.

2.13 In consequence, complete refurbishment is to be considered, with alternatives for increasing speed and car size to avoid some of the problems described above.

2.14 Butler & Young Lift Consultants Ltd have been commissioned to undertake a feasibility study and to prepare a report with options for future usage.

SUMMARY

AND

RECOMMENDATION

FEASIBILITY STUDY FOR THE REFURBISHMENT OF TWO ELECTRIC PASSENGER LIFTS AT GRENFELL TOWER

3.0 SUMMARY AND RECOMMENDATION

3.1 The lifts were originally installed in 1971 by Hammond & Champness to a reasonable standard at which time the contractor would have no doubt utilised their own limited intelligence controllers together with Dupar door operating equipment, these always prone to frequent malfunctions.

3.2 It is assumed that the original lifts would have incorporated fluted aluminium finishes to the cars, architraves and landing doors.

3.3 The lift underwent a significant refurbishment in 1985 at which time the control system was replaced utilising a Thames Valley VAC microprocessor based control panel, Holroyd traction machines with GAL door operating equipment and Dupar operating fixtures. At that time the fluted aluminium finishes to the car, doors and architraves were replaced with those fabricated from patterned stainless steel.

3.4 Regular monitoring and adjustment is now required to attempt to achieve reasonable operating parameters and reliability, but from the machine room record cards the recorded malfunctions would appear to be excessive.

3.5 Other equipment such as transformers, rectifiers, relay coils and trailing cables etc. will undoubtedly be subject to further failures over the coming years, these failures being neither readily anticipated or prevented by maintenance or adjustment.

3.6 At the time of the 1985 refurbishment of the lifts, facilities for the disabled were not considered an issue and as such there are a number of areas where the requirements for full facilities for the disabled are not achieved. This is of particular concern considering the impending enforcement of the DDA regulations.

3.7 In addition, there are a number of areas where the lifts are not compliant with Health and Safety requirements and current lift standards.

3.8 The traffic analysis included within Part 6 of this report demonstrates the difficulty with which the two lifts endeavour to provide good service within Grenfell Tower utilising the existing 1.6 mps speed and 8 person load carrying capacities.

3.9 The traffic analysis calculations made were based on certain assumptions, notably the population figures, but do serve to illustrate the inordinate waiting times and thus to demonstrate the comparative performances of the three options.

Whilst calculation No. 3 for the 12 person / 900Kg @ 2.0 mps configuration extends the interval term compared No. 1 this is due to the ability to transport a greater number of passengers in a given period, and emphasises the requirement to increase speed and carrying capacity of the lifts to the maximum within the building constraints.

The traffic study is unable to accommodate the ability of the larger car pick up a greater number of passengers at landings with a minimal number of redundant stops, as described in clauses 2.6 through 2.9

3.10 This report has been principally concerned with establishing the relative merits of each of the three options with the following particular considerations:

1. Compliance with the Health and Safety at Work Act and BS7255, Safe Working on Lifts.

2. Compliance with the requirements of relevant British Standards and EN81/1, where appropriate.

3. That means of control and overall door operation shall improve significantly, thus meeting the continued demand for reliable service.

4. That the contract speed, contract load and the overall size of the lift cars and entrances is investigated in depth.

5. That energy efficient and cost saving control systems are incorporated.

6. That the Facilities for the Disabled are provided in accordance with the Disability Discrimination Action 1998, where practical.

    1. Adequate access for wheelchair users.

    2. Accurate floor levelling and ride control.

    3. Variable speed door operation with electronic passenger detection.

    4. Tactile identification of pushes which shall be half illuminance at all times, fully illuminated when pressed.

    5. Hands-free autodialling unit, in lieu of telephone, connecting direct to a nominated area when the alarm push is used.

    6. Scrolling position indicators to both cars and all landings which shall also scroll messages viz 'Lift on Car Preference, 'Lift Undergoing Maintenance' when the lift is being maintained etc.

    7. Voice synthesiser announcing floor levels, door activity, messages etc.

7. That continuity and reliability of service will be provided for a minimum period of twenty five years.

3.10 RECOMMENDATION

3.10.1 Option 1: Complete Refurbishment - Maintaining Existing Capacity and Speed

This option incorporates current micro processor control, an energy efficient variable frequency drive, car enclosure, operating and display fixtures with facilities for the disabled, car and landing doors and operating equipment, plus upward safety gears and all compliance works.

Option Budget Cost
including 5% Contingency - £165,000.00 per lift

This is not the recommended Option.

3.10.2 Option 2: Complete Refurbishment Increased Speed

This option incorporates the refurbishment of the lifts, all as in Option 1, but also offers a 25% increase in contract speed to 2.0 mps.

Option Budget Cost
including 5% contingency - £180,000.00 per lift

This is not the recommended Option.

3.10.3 Option 3: Complete Refurbishment Including Enhanced Car Dimensions, Increased Carrying Capacity Plus Increased Speed.

This option incorporates the refurbishment of the lifts as in Option 2, but with the car dimensions increased to by more than 30% to 12 persons and the load increased to 900Kg carrying capacity, all at the increased speed of 2.0 mps.

Option Budget Cost
including 5% contingency - £215,000.00 per lift

This is the recommended Option, together with Option A below.

3.10.5 Option A:

The option to replace the narrow entrances this achieving a 10% increase in clear opening which with tapered uprights to the architraves would further enhance accessibility, could be appended to any of the above options.

Option Budget Cost
including 5% contingency - £30,000.00 per lift

3.10.6 All budgets +/- 10% nett at this stage.

THE RECOMMENDED LIFT

4.0 THE RECOMMENDED LIFTS

Type	:	Duplex electric passenger lifts
Capacity	:	12 person / 900Kg
Serving	:	21 floors, 21 openings
Levels	:	Ground, Walkway and First to Nineteenth Floors inclusive.
Travel	:	62.75m
Control System	:	Microprocessor duplex collective with full analogue devices, plus the facility for remote monitoring and firemans control.
Drive Machine	:	Geared traction with energy efficient, variable frequency motor.
Speed	:	2.0 mps.
Car	:	1400mm wide x 1450mm deep x 2200high clear approximately.
	:	Patterned stainless steel panels.
Doors	:	Single panel side opening in patterned stainless steel 900mm wide x 2000mm high.
Architraves	:	Stonehenge design with tapered uprights in patterned stainless steel
Sills	:	Extruded manganese bronze.
Door Operator	:	Power operated, variable frequency drive with variable speed control.
Passenger Protection	:	Electronic multi beam detector.
Car Station	:	Linished stainless steel faceplates incorporating the full range of Facilities for the Disabled:
	:	Tactile identification of pushes, to be half illuminance at all times, full illuminance when pressed.
	:	Handsfree autodialling unit with induction loop facility, in lieu of telephone, connecting direct to a nominated area when the alarm push is used.

	:	Scrolling position indicator, which shall also scroll messages viz 'Lift Undergoing Maintenance' etc. when the lift is being serviced.
	:	Voice synthesiser announcing floor levels, door activities, messages etc.
	:	Communication system to security office
Auxiliary Car Station	:	Incorporating the full range of car pushes.
Landing Push Stations	:	Stainless steel faceplates incorporating tactile pushes, to be half illuminance at all times and full illuminance when pressed.
Landing Indicators	:	Within the landing push station and engraved with the floor level incorporating a scrolling position indicator which shall also scroll messages viz 'Lift Undergoing Maintenance' etc. when the lift is being serviced.
	:	The unit shall also incorporate vertically scrolling arrows to indicate direction of travel plus a bleep system to advise the same when the lift arrives at the floor in response to a landing call.
Machine Room	:	Above.
Shaft Construction	:	Reinforced concrete framework with block infill.
Last Level Served to Soffit of Shaft	:	3950mm
Pit Depth	:	1550mm
Maintenance	:	12 months until completion of the extended defects liability period on all lifts.

Note! The specification shall be generically led, with component parts being generally available to the whole UK lift industry, thus allowing simple access to replacement parts in the future.

This will allow maintenance to be undertaken by any competent lift contractor for a minimum 25 year period.

OPTION APPRAISALS

FEASIBILITY STUDY FOR THE REFURBISHMENT
OF TWO ELECTRIC PASSENGER LIFTS AT
GRENFELL TOWER

5.0 OPTION APPRAISALS

5.1 Option 1: Complete Refurbishment - Maintaining Existing Capacity and Speed

5.1.1 This options includes for the complete refurbishment of two lifts introducing energy efficient drive systems, drive machines, robust lift car enclosures with hand rails and bump rails, fixtures will facilitate the disabled, landing doors plus energy efficient door operating equipment.

This option would also address all environmental compliances not encompassed by the refurbishment works.

5.1.2 Prior to any refurbishment works a complete re-test of the 2nd phase lift would be undertaken to ensure as near as possible continuity of service on the aged lift.

5.1.3 The following equipment would be included, all generic and selected for proven performance, with a high level of product support and availability of replacement parts:

1. Microprocessor control system with facilities for remote monitoring.
2. Control system fault logging.
3. Closed loop variable frequency a.c. motor, motor drive and traction machine.
4. Electronic floor encoder.
5. Robust, fire assessed, patterned stainless steel doors.
6. Variable frequency a.c. door operator and ancillary door equipment.
7. Robust, patterned stainless steel panelled car with handrails and bump rails to the rear at skirt height.
8. Linish and polish all architraves.
9. Car and landing stations with pushes, indicators and all communication systems to suit facilities for the disabled.
10. Auxiliary car station.
11. Upward motion safety gear.
12. All electrical requirements.
13. Complete test in accordance with BS5655 Part 10 and issue of certification.
14. All builders, electrical and other associated works.

5.1.4 The tender would be specific for six day working to minimise disruption and downtime with noisy works at limited hours.

5.1.5 Facilities for the Disabled as far as practical.

5.1.6 Achievement of compliance with BS5655 and BS7255, Safe Working on Lifts.

5.1.7 This option retains:

Car and counterweight guides plus bracketry.	Counterweight.
Landing sills and entrance support steelwork.	Car sling.
Machine support steelwork.	Architraves.

5.1.8 Amongst other equipment the following would be provided to achieve full compliance with HASAW requirements:

1. Diffused and emergency lighting to the machine room.
2. Intercom to car, car top and pit.
3. RCD sockets to machine room and pit.
4. All statutory notices.
5. Non / stop switch adjacent machine.
6. Rubber mats to controllers and other electrical equipment.
7. Flat tread access ladder and hand grabs to the upper landing, machine room plinth and lift pits.
8. Harness and points to car top.
9. Maintenance barrier.
10. 3 way switched shaft lighting.
11. Fascias.
12. Compliant vertical top of car control.
13. Total clean down and treatment with dust inhibiting paint.

5.1.9 Following completion of all works a full operational test would be undertaken, all in accordance with British Standard 5655 Part 10 requirements plus NICEIC tests.

5.1.10 Option 1 Budget Cost: - **£165,000.00 nett per lift**

Includes 5% Contingency and all Associated Builders and Electrical Works.

5.1.11 Programme:

Design and Specification	-	6 weeks
Tender Period	-	4 weeks
Tender Analysis and Recommendation for Contract Award	-	2 weeks
Contract Award	-	4 week
Design, Procurement and Manufacture	-	18 weeks
Complete Test of 2nd Phase Lift	-	1 week
Loss of Lift Service During the Contract,	-	22 weeks per lift
Lift Proving Between Phases	-	1 week
Total	-	**80 weeks**

5.1.12 This full refurbishment option extends the life of the lift by a further 25 years, with complete freedom of the maintenance market.

5.1.13 This is not the recommended Option.

5.2 Option 2: Complete Refurbishment Incorporating Increased Speed.

5.2.1 This option incorporates all works as detailed in Option 1.

5.2.2 This option provides a larger traction machine that shall increase the lift operating speed by 25% to 2.0 mps.

5.2.3 This option also provides for Whisper-Flex compensation with dampers.

5.2.4 Option 2 Budget Cost: - **£180,000.00 nett per lift**

Includes 5% Contingency and all Associated Builders and Electrical Works.

5.2.5 Programme:

Design and Specification	-	6 weeks
Tender Period	-	4 weeks
Tender Analysis and Recommendation for Contract Award	-	2 weeks
Contact Award	-	4 weeks
Design, Procurement and Manufacture	-	18 weeks
Complete Test of 2nd Phase Lift	-	1 week
Loss of Lift Service During the Contract	-	22 weeks per lift
Lift Proving Between Phases	-	1 week
Total	-	**80 weeks**

5.2.6 This full refurbishment option extends the life of the lift by a further 25 years, with complete freedom of the maintenance market.

5.2.7 This is not the recommended Option.

5.3 Option 3: Complete Refurbishment Included Enhanced Car Dimensions, Increased Carrying Capacity plus Increased Speed.

5.3.1 This option incorporates all works as detailed in Option 2 but makes full use of the present redundant space within the shaft to the side of the existing lift car.

5.3.2 In order to provide a safe method of works and incorporate improved feasibility in determining the site programme, this option would incorporate shaft scaffolding, possibly with crash decks at a number of floors in order that two teams of engineers would be able to work on the same installation.

5.3.3 The car and counterweight guides shall be repositioned, boned and aligned whilst retaining the existing separator steel brackets, but replacing the sole plates and the combination brackets.

5.3.4 This shall maximise the use of shaft space enabling in excess of 30% increase in car size from the existing 1100mm wide x 1375mm deep to 1400mm wide x 1450mm deep.

5.3.5 This shall also increase the load carrying capacity by some 60% from 8 persons / 570Kg to 12 persons / 900Kg.

5.3.6 In undertaking Option 3 many of the problems identified in this study in Part 2.0 Background, clauses 2.5 - 2.9 shall be eliminated allowing sufficient room in the lift car for two prams, wheelchairs, buggies plus the attendant passengers.

5.3.7 This shall also bring into action the non-stop feature in which the lift by passes floors when full. The persons waiting at those floors shall still be waiting but shall not have the aggravation of doors opening and closing and their being denied access due to the lift being full.

5.3.8 Under such circumstances the scrolling indicators on the landings shall advise 'Lift on Non Stop' or 'Lift Returning to Ground Floor' so the waiting passengers shall be aware.

5.3.9 Apart from provision of guide sole plates and combination brackets all other equipment in this option would remain as Option 2, but in the case of the lift car and drive motor they would be of larger size.

5.3.10 Option 3 Budget Cost: - **£205,000.00 nett per lift ***

Includes 5% Contingency and all Associated Builders and Electrical Works.

5.3.11 Shaft Scaffolding and Crash Decks - **£10,000.00 nett per lift**

5.3.12 Programme:

Design and Specification	-	6 weeks
Tender Period	-	4 weeks
Tender Analysis and Recommendation for Contract Award	-	2 weeks
Contact Award	-	4 weeks
Complete Test of 2nd Phase Lift	-	1 week
Design, Procurement and Manufacture	-	18 weeks
Loss of Lift Service During the Contract	-	17 weeks per lift *
Total	-	**84 weeks**

* Allows for two team working

5.3.13 As in Option 2, the life of the lift extends to 25 years.

5.3.14 This is the recommended Option.

5.4 Option A

5.4.1 This option can be appended to any of the three previously detailed options and includes for the provision of complete new fire rated entrances having manganese bronze thresholds and Stonehenge designed architraves with tapered uprights all fabricated in patterned stainless steel.

5.4.2 The existing narrow entrance width on a 12 person car would be increased by approximately 10% and the car accessibility would be further enhanced by the tapering of the architraves which would also deflect a certain proportion of potential damage from prams, buggies, trollies, furniture etc.

5.4.3 Option A Budget Cost - **£30,000.00 per lift**

Includes 5% Contingency and all Associated Builders Works.

5.4.4 Programme:

- 6 weeks additional per lift
- (Options 1 & 2)

- 4 weeks additional per lift
- (Option 3)

TRAFFIC STUDY

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FEASIBILITY STUDY FOR THE REFURBISHMENT OF TWO ELECTRIC PASSENGER LIFTS AT GRENFELL TOWER

6.0 TRAFFIC STUDY

6.1 Detailed overleaf are traffic calculations for each of the three options.

6.2 As described in Part 3 clause 10, the figures used in the calculations are for comparison purposes only to demonstrate the relatively poor service provided by the existing configuration which, even when refurbished, emphasises the recommendation for enhancement of Option 1 as far as practicable within the structural constraints of Grenfell Tower itself.

STRUCTURAL

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FEASIBILITY STUDY FOR THE REFURBISHMENT OF TWO ELECTRIC PASSENGER LIFTS AT GRENFELL TOWER

7.0 STRUCTURAL

Machine Room

Because of the proposed new layout and loadings to be supplied by the lift contractor, the proposal is to remove the existing concrete upstands adjacent to the external 200mm thick concrete walls and find an alternative means of support.

This means that the end reactions from the three structural steel beams supporting the traction machine and diverter sheave shall have to be transferred to the concrete walls. Pockets or holes shall have to be cut into these walls to supply bearings for the beams.

There is no reason to assume that the walls could not carry the load, but as a safety factor it is proposed that a steel channel shall be fixed to the walls, below the steel beams, as a further means of support. The channel shall be bolted to the walls.

Final decisions on the supporting structure shall be confirmed by the contractor when final loadings are confirmed and a final site survey is completed.

Pit

Based on the information on loading and layout to be supplied by the contractor, the bearing pressures expected shall not affect the structural integrity of the lift pit but the final loadings shall have to be confirmed.

DRAWINGS

ADVISORY NOTE

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9.0 ADVISORY NOTE

The options given and recommendations made in this report are for consideration and information only and would need to be detailed in a comprehensive specification before any costings may be sought from lift contractors.

The study has been based on a visual and operational survey of the lift equipment, the adjoining fabric of the building, the associated services and relates to our observations at the date of the survey.

No tests have been undertaken of an electrical, mechanical or structural nature and these would be required in the development of the specification as part of any subsequent contract.

APPENDIX A

PHOTOGRAPHS