



LERCH BATES

*Building Insight*

**GREENSPACES PROJECT  
FARIDABAD, DELHI - INDIA**

**SCHEMATIC DESIGN REPORT**

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*Prepared For:*

MR. DENNIS SACHS  
PERKINS + WILL  
84 - 10<sup>TH</sup> STREET SOUTH, SUITE 200  
MINNEAPOLIS, MN 55403  
[DENNIS.SACHS@PERKINSWILL.COM](mailto:DENNIS.SACHS@PERKINSWILL.COM)

*Prepared By:*

BOB LEIBROCK  
REGIONAL MANAGER

LB Project No. 1900001442-01

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# I

## INTRODUCTION

The following lift analysis schematic design report reviews the recommended lift designs for the four (4) 26-story (23 above grade, 3 below grade), office towers and adjacent 8-level parking ramp comprising the GreenSpaces Project located in New Delhi, India. The project, as indicated in schematic design data supplied for this analysis, currently includes 4 office towers connected by walkways at Levels G (ground) and 1. The Ground Floor of Office Towers 2-4 includes data center and retail areas. This level provides the main entry for those accessing the site by way of the adjacent parking ramp and a large percentage entering at this level from the metro connection/drop-off area. The 1<sup>st</sup> Floor provides a second main entry to the lift transportation of the office floors and contains primarily retail establishments and a café eating area. As this level provides an uninterrupted path between the office towers and is an enclosed conditioned space, a large percentage of the population is expected to utilize this floor accessing the lift banks. The population at Floors G and 1, which are resident to those floors, are not included in the analysis calculations. The population accessing these floors will primarily travel directly from grade entry or utilize adjacent stairs and not require lift service. Additional time is included in the calculations, however, to account for light, sporadic travel and/or the occasional stops to the 1<sup>st</sup> Floor indicating service approximately once every 10-12 lift roundtrips. The below grade levels B1, B2 and B3 house primarily storage and mechanical areas. For purposes of the analysis calculations, the travel distance to these floors and associated population are not included. Service to these levels is expected to be extremely light, sporadic and served primarily by service lifts. Typical floors of the eastern-most Office Towers Nos. 3 and 4 include a resident office population of approximately 117 per floor at Floors 2-22. Office Tower No. 2 is identical to Towers 3 and 4 except for a childcare facility located at and encompassing all of Floor 2. The most western Office Tower No. 1 includes a fitness/pool on Floor 2 and 100-key hotel located at Floors 3-7. Typical office space and associated per floor populations of 117 are located at Floors 8-22. The hotel floors are assumed to include 20 keys per floor with the lobby located at Ground Floor. The focus of our studies and calculations included within this report include lift banks arranged to provide service in a common core located between and servicing Office Towers 1-2 and between and servicing Office Towers 3-4 as indicated in the current schematic drawings. Typical floor heights at Office Floors 2-22 are 3.75m per floor.

The adjacent parking ramp includes one level below grade, grade level and 6 levels above grade with an alternate study performed including 7 levels above grade. In both the 6 and 7 levels above grade studies, a total of 2,000 stalls were utilized with a per-auto population estimate of 1.5 passengers per car. Floor heights between lift lobbies located at each parking level are 3.0m.

This schematic design report will establish the selected passenger lift design criteria for the various components within the facilities, recommend the minimum appropriate lift parameters to meet the selected criteria, and summarize the lift schemes which optimize performance.

## II

**LIFT DESIGN CRITERIA****A. DESIGN CRITERIA****OFFICE TOWER PASSENGER LIFTS**

<u>POPULATION:</u>	See Attached <u>Table A.</u>
<u>AVERAGE INTERVAL:</u>	$\leq$ 30 Seconds
<u>GROUP HANDLING CAPACITY:</u>	$\geq$ 13% of Population Served by Lift Bank
<u>TENANCY TYPE:</u>	Mixed Tenancy
<u>TRAFFIC TYPE STUDIED:</u>	One Way, Morning, Up Peak

**PARKING RAMP SHUTTLE LIFTS**

<u>POPULATION DENSITY:</u>	1.50 Passengers/Automobile
Total Population:	3,000 Based On 2,000 Stalls @ 1.5 Passengers/Automobile
<u>AVERAGE INTERVAL:</u>	$\leq$ 45 Seconds
<u>GROUP HANDLING CAPACITY:</u>	$\geq$ 8% of Population Requiring Lift Service
<u>TENANCY TYPE:</u>	Office Tower Executives, Visitors, Hotel Patrons
<u>TRAFFIC TYPE:</u>	One Way, Morning, Down Peak

**HOTEL PASSENGER LIFTS**

<u>POPULATION:</u>	100 Based on 1.0 Guests/Room
<u>AVERAGE INTERVAL:</u>	$\leq$ 40 Seconds
<u>GROUP HANDLING CAPACITY:</u>	$\geq$ 11% of Total Hotel Population
<u>TENANCY TYPE:</u>	Commercial, Business, Hotel
<u>TRAFFIC TYPE:</u>	Two Way, Evening, Peak

## **B. RESULTS**

The calculated passenger lift analysis results for the various components of the project are summarized in the Appendix 1, Analysis Summary Charts 1-5. In all cases, the recommended solutions include quantities and duties necessary to meet or exceed the recommended design criteria unless noted otherwise.

Based on the summarized results, our recommendations for lift application for each component/core are as follows:

### OFFICE PASSENGER LIFTS

#### Office Towers 1-2 Core

Although our calculation results indicate that the same quantity of lifts are required in this core as the lift core serving Towers 3-4, a smaller population is served due to the hotel located within Office Tower 1 including health club and pool, along with childcare facility located within Office Tower 2. The reduced population does allow smaller capacity cars to be applied while providing the performance necessary to meet our recommended criteria. We therefore recommend an 8-car low rise bank, each with a rated capacity of 2000kg and speed of 3.5 m/s, and a 7-car high rise bank, each with a rated capacity of 1600kg and speed of 3.5 m/s. This configuration, capacity and speed can be expected to provide excellent service for this component of the facility.

#### Office Towers 3-4 Core

The calculation results indicate that 8 low rise and 7 high rise lifts are required to meet our recommended criteria during morning up peak conditions. Although the quantity of lifts indicated on the current schematic design documents is found to be adequate with the duties identified below, the size lifts necessary to meet the handling capacity requirements is unusually large due to the population densities included in the design. We recommend an 8-car low rise bank, each with a rated capacity of 2500kg and rated speed of 3.5 m/s, and a 7-car high rise bank, each with a rated capacity of 2250kg and rated speed also of 3.5 m/s. This configuration, capacity and speed can be expected to provide excellent service for this component of the facility.

### Hotel Passenger Lifts

The hotel lobby is located at the Ground Floor of Tower 1. Hotel floors each housing 20 keys are located on Floors 3-7 for a total of 100 keys. The passenger lifts serving the hotel must also provide transport to Floor 1 for access to the adjacent Office Towers, and Floor 2 which houses an exercise facility and pool. Our calculation results indicate that 2 lifts, each with a rated capacity of 630kg and speed of 1.8 m/s, provide the performance necessary to meet our recommended criteria. These results are based on providing a dedicated service lift for transport of guest baggage and housekeeping services along with any incidental food deliveries provided by hotel services. If, as a cost-saving measure, 2 lifts are considered, with one being a dual purpose passenger/service lift, we recommend one car be sized as a 1600kg capacity with the remaining car provided with the noted 630kg capacity, and the speed of both cars increased to 2.0 m/s. This will provide service very nearly meeting our recommended criteria for passengers when the service car is removed from bank operation.

### Parking Ramp Shuttle Lifts

The parking ramp shuttle lifts were studied to consider both an 8-level and 9-level facility, each with a total automobile capacity of 2,000. The results of our calculation indicate that for each of the scenarios studied, 4 traction lifts, each with a rated capacity of 1600kg and rated speed of 1.8 m/s, meet our recommended criteria and can be expected to provide excellent service for this facility.

**III****PASSENGER LIFT DESIGNS**

Based on the passenger analysis summaries as shown in Appendix 1, the following can be summarized:

- The passenger lift design criteria has been established to provide the minimum performance levels necessary to meet Class A office building and World Class Service for the identified components of the project. In studying office facilities, the design criteria for a project with a diversified tenancy requires a minimum 12% group handling capacity. With a completely diversified tenancy, no zone tenants are related to one another and there is no more than a single tenant occupying a single floor. The GreenSpaces Project is designed for mixed tenancy zones where a single tenant might occupy 2-3 floors within a zone. We find that this type occupancy requires a minimum 13% group handling capacity to provide excellent lift service. A single tenancy zone that is completely occupied by a single tenant could have a minimum 14-15% group handling capacity requirement. We recommend the 13% group handling capacity criteria due to the potential for mixed tenancy and to account for the facility's proximity to a downtown metro station which will also tend to increase the frequency of pedestrian arrivals at the Office Towers' main lobbies.
- Our recommended criteria for the office zones of the project meets the minimum World Class Service standard (average interval  $\leq 30$  seconds, and 5-minute group handling capacity  $\geq 13\%$ ). If the passenger lift banks can meet or exceed these design standards, then the upper floor average waiting times should be appropriate for the desired level of service.
- To increase the efficiency of the lift systems and provide the most cost effective lift solution, we have not included a common transfer floor between the low rise and high rise office passenger lift banks. This arrangement provides the most efficient lift service but precludes locating a single tenant on multiple adjacent upper floors served by both the low rise and high rise lifts.
- The most efficient lobby arrangement for a passenger group of lifts with up to 8 cars per group is 4 opposite 4. The lift lobbies should be a minimum of approximately 4.0m wide or approximately 2 times the inside lift car depth. This will allow space for queuing and efficient passenger transfer on and off the lifts during loading/unloading.



#### IV

### SERVICE LIFT CONSIDERATIONS

Based upon the building height, number of floors, and approximately 21,000m<sup>2</sup> of office space served per lift core, we recommend each core be provided with 1 service lift having stops at all floors. Based on the European EN81 Code, utilized by most Indian jurisdictions, a dedicated firefighter lift is required which must be capable of reaching the top landing from the ground floor within one minute (60 seconds). This lift may double as the service lift and is recommended to have a rated capacity of approximately 2,000kg and speed of 4.0 m/s serving each building level including basements. The recommendation to provide a 2000kg capacity for each service lift is made in order to accommodate large freight items, carpet rolls, tenant furniture and drywall sheets. If any specific requirements for material movement of large or heavy material to either rooftop equipment or mechanical equipment located at lower basement levels are necessary, specific requirements must be identified so as to size the service lifts accordingly. Examples of such equipment may include transformer cores, heavy or large motors, salt, filters, etc.

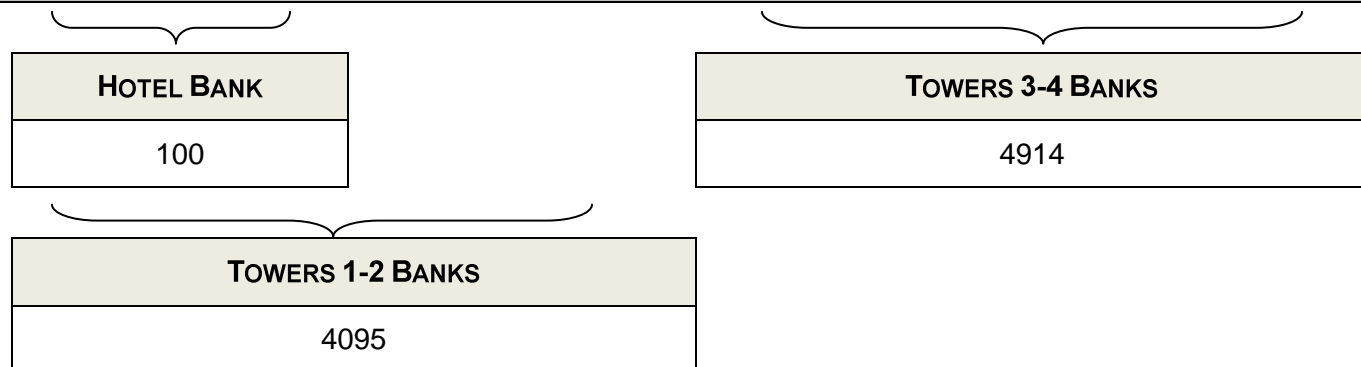
We recommend an individual dedicated service lift located and servicing the hotel portion of Office Tower 1 to provide transport of guest baggage, housekeeping materials and carts, along with any food services provided by the hotel. If a swing service/passenger lift is included as part of the 2-car lift arrangement recommended, cab finishes for this dual purpose lift car should be chosen for the durability necessary to withstand its dual function.

## TABLE A POPULATIONS

**OFFICE (& HOTEL):**

FLOORS	TOWER 1	TOWER 2	TOWER 3	TOWER 4
8-22	117/floor (1755 total)	117/floor (1755 total)	117/floor (1755 total)	117/floor (1755 total)
3-7	20/floor; hotel (100 total)	117/floor (585 total)	117/floor (585 total)	117/floor (585 total)
2	0 (fitness center/pool)	0 (childcare)	117	117
1	0 (retail/commercial)	0 (retail/commercial)	0 (retail/commercial)	0 (retail/commercial)
G	0 (entry/hotel lobby)	0 (entry/cafe)	0 (entry/building services)	0 (entry/escalator lobby)

**TOTAL  
POPULATION  
REQUIRING  
LIFT SERVICE:**



## TABLE A (Cont'd)

### POPULATIONS

#### PARKING RAMP:

LEVEL	# AUTOS (8 LEVEL)	# AUTOS (9 LEVEL)	POPULATION @ 1-5 PASSENGER/AUTO 8 LEVEL / 9 LEVEL	USE FACTOR *	LIFT POPULATION 8 LEVEL / 9 LEVEL
P7 (Alternate)	0	230	0 / 345	100%	0 / 345
P6	268	230	402 / 345	100%	402 / 345
P5	268	230	402 / 345	100%	402 / 345
P4	268	230	402 / 345	100%	402 / 345
P3	268	230	402 / 345	90%	362 / 311
P2	268	230	402 / 345	70%	281 / 242
P1	268	230	402 / 345	50%	201 / 173
G	184	184	276	0%	0
P-1	208	208	312	50%	156
<b>TOTALS:</b>	<b>2000</b>	<b>2002</b>	<b>3000 / 3003</b>		<b>2206 / 2262</b>

\* % of Total population utilizing lifts. Remaining % of population assumed to utilize stairwells and not require lift service.

## **APPENDIX 1**

### **LIFT ANALYSIS CALCULATION SUMMARY TABLES**

**TABLE 1**  
**GreenSpaces Project**  
 Faridabad, Delhi - India

**HOTEL ANALYSIS**

LIFT ANALYSIS SUMMARY

October 15, 2008

**HOTEL PASSENGER – TOWER 1**

COMPONENT	DUTY	LEVELS SERVED	PROJECTED POPULATION REQUIRING LIFTS (PERSONS)	INDIVIDUAL CAR LOAD (PERSONS) (UP/DOWN)	CALCULATED ROUND-TRIP TIME (SECONDS)	NUMBER OF LIFTS	CALCULATED PEAK ELEVATORING GROUP 5-MINUTE		MEETS THE DESIGN CRITERIA ?
							AVERAGE INTERVAL (SECONDS)	HANDLING CAPACITY (PERSONS/PERCENTAGE)	
HOTEL PASSENGER	630 KG @ 2.0 M/S	G. 1-7	132	1 / 1	44.0	1	44.0	13.6 / 10.3	NO
HOTEL PASSENGER	630 KG @ 1.8 M/S	G, 1-7	132	1 / 1	46.5	2	23.3	25.8 / 19.5	YES

SUGGESTED DESIGN CRITERIA

AVERAGE INTERVAL: ≤ 40 SECONDS  
 GROUP HANDLING CAPACITY: MIN ≥ 11%, OF ZONE POPULATION MOVED  
 TENANCY TYPE: BUSINESS HOTEL  
 MEASUREMENT PERIOD: P.M., 2-WAY PEAK (5 MIN.)

**TABLE 2**  
**GreenSpaces Project**  
 Faridabad, Delhi - India  
**OFFICE TOWER ANALYSIS**

LIFT ANALYSIS SUMMARY

October 15, 2008

**CENTRAL CORE – TOWERS 1-2**

COMPONENT	DUTY	LEVELS SERVED	PROJECTED POPULATION REQUIRING LIFTS (PERSONS)	INDIVIDUAL CAR LOAD (PERSONS) (UP/DOWN)	CALCULATED ROUND-TRIP TIME (SECONDS)	NUMBER OF LIFTS	CALCULATED PEAK ELEVATORING GROUP 5-MINUTE		MEETS THE DESIGN CRITERIA ?
							AVERAGE INTERVAL (SECONDS)	HANDLING CAPACITY (PERSONS/PERCENTAGE)	
LOW RISE	2000 KG @ 4.0 M/S	G. 1-14	2223	24 / 0	196.5	7	28.1	256.5 / 11.5	NO
LOW RISE	2000 KG @ 3.5 M/S	G. 1-14	2223	24 / 0	198.1	8	24.8	290.8 / 13.1	YES
HIGH RISE	1600 KG @ 5.0 M/S	G, 1, 15-22	1872	22 / 0	178.9	6	29.8	221.4 / 11.8	NO
HIGH RISE	1600 KG @ 3.5 M/S	G, 1, 15-22	1872	22 / 0	184.8	7	26.4	250.0 / 13.4	YES

SUGGESTED DESIGN CRITERIA

AVERAGE INTERVAL: ≤ 30 SECONDS  
 GROUP HANDLING CAPACITY: MIN ≥ 13%, OF ZONE POPULATION MOVED  
 TENANCY TYPE: MIXED  
 MEASUREMENT PERIOD: A.M., 5 MIN. PEAK

**TABLE 3**  
**GreenSpaces Project**  
 Faridabad, Delhi - India  
**OFFICE TOWER ANALYSIS**

LIFT ANALYSIS SUMMARY

October 15, 2008

**LIFT CORE – TOWERS 3-4**

COMPONENT	DUTY	LEVELS SERVED	PROJECTED POPULATION REQUIRING LIFTS (PERSONS)	INDIVIDUAL CAR LOAD (PERSONS) (UP/DOWN)	CALCULATED ROUND-TRIP TIME (SECONDS)	NUMBER OF LIFTS	CALCULATED PEAK ELEVATORING GROUP 5-MINUTE		MEETS THE DESIGN CRITERIA ?
							AVERAGE INTERVAL (SECONDS)	HANDLING CAPACITY (PERSONS/PERCENTAGE)	
LOW RISE	2500 KG @ 5.0 M/S	G. 1-13	2808	34 / 0	220.4	7	31.5	324.0 / 11.5	NO
LOW RISE	2500 KG @ 3.5 M/S	G. 1-13	2808	34 / 0	223.5	8	27.9	365.2 / 13.0	YES
HIGH RISE	2250 KG @ 3.5 M/S	G, 1, 14-22	2106	28 / 0	209.2	7	29.9	281.0 / 13.3	YES

SUGGESTED DESIGN CRITERIA

AVERAGE INTERVAL:            ≤ 30 SECONDS  
 GROUP HANDLING CAPACITY:    MIN ≥ 13%, OF ZONE POPULATION MOVED  
 TENANCY TYPE:                MIXED  
 MEASUREMENT PERIOD:        A.M., 5 MIN. PEAK

**TABLE 4**  
**GreenSpaces Project**  
 Faridabad, Delhi - India  
**PARKING RAMP ANALYSIS**

LIFT ANALYSIS SUMMARY

October 15, 2008

COMPONENT	DUTY	LEVELS SERVED	PROJECTED POPULATION REQUIRING LIFTS (PERSONS)	* INDIVIDUAL CAR LOAD (PERSONS) (UP/DOWN)	CALCULATED ROUND-TRIP TIME (SECONDS)	NUMBER OF LIFTS	CALCULATED PEAK ELEVATORING GROUP 5-MINUTE		MEETS THE DESIGN CRITERIA ?
							AVERAGE INTERVAL (SECONDS)	HANDLING CAPACITY (PERSONS/PERCENTAGE)	
PARKING RAMP	1600 KG @ 2.0 M/S	P-1, G, P1-P6	2050	0 / 18	119.3	3	39.8	135.8 / 6.6	NO
PARKING RAMP	1600 KG @ 1.8 M/S	P-1, G, P1-P6	2050	0 / 18	120.3	4	30.1	179.6 / 8.8	YES
PARKING RAMP	1600 KG @ 1.8 M/S	P-1, G, P1-P7	2106	0 / 20	135.5	4	33.9	177.2 / 8.4	YES

\* TIME WAS ADDED TO EACH ROUND TRIP (APPROX 3.9 SEC.) TO ACCOUNT FOR TRAVEL TO P-1 LEVEL APPROX. EVERY 12 ROUND TRIPS.

SUGGESTED DESIGN CRITERIA

AVERAGE INTERVAL: < 45 SECONDS  
 GROUP HANDLING CAPACITY: MIN > 8%, OF ZONE POPULATION MOVED  
 MEASUREMENT PERIOD: A.M., 5 MIN. PEAK



## APPENDIX 2

### LIFT DESIGN DEFINITIONS

In order to define the standards for proper lift design, it is helpful to review our terminology so that those who read this report will be cognizant of those performance levels that constitute "well-elevated" buildings.

Average Interval (A.I.) is the average frequency of lifts being dispatched from the main terminal loading floor, in seconds, measured during the peak periods identified within this report. A.I. is calculated by dividing the round-trip time of a single lift by the number of lifts proposed for the group.

Round-Trip Time (R.T.T.) is the average theoretical time it takes a lift with a full-load complement of people (individual car load) when leaving the loading lobby to transit through the local stops, discharging passengers and return to the lobby ready to pick up another load.

Individual Car Load (I.C.L.) is the number of persons carried on the lift during the round-trip time calculation. Lift Engineers rate the most-commonly used passenger lift sizes as follows:

LIFT SIZE (KG)	MAXIMUM NET AREA (SQ. M)	MAXIMUM CAR CAPACITY (PERSONS)	NOMINAL CAR CAPACITY (PERSONS)
630 KG	1.66	8	6-7
1150 KG	2.70	15	12-14
1350 KG	3.13	18	15-17
1600 KG	3.53	21	18-20
1800 KG	3.92	24	20-22
2000 KG	4.21	26	22-24
2250 KG	4.60	31	28-30
2500 KG	5.00	36	32-34

The maximum nominal car loads work out to about .2m per person with an average body ellipse, including the "no touch" barrier we all project in front of us. The calculated individual car load is based upon the group handling capacity required and the Average Interval desired.

Group Handling Capacity (H.C.) is the number of persons being transported from the main terminal lobby during the same peak, 5-minute increment used to measure Average Interval. Group handling capacity can be measured in numbers of people or as a percentage of the zone population served by each lift group.