Traffic Analysis Report

Marshall Avenue 10 - 12, St. Leonards

Schindler

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23 November 2021

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Summary

The traffic simulation is based on details provided by Mr. Roger Luo of Ericon Building Pty Ltd on the 22nd of November 2021.

Generally the building criteria is based on the International Standard ISO 8100-32 - 2020 guidelines for residential buildings with a target:-

5-minute handling capacity (HC5) of > or = to 7% (HC5 > or = 7%) and a waiting time (WT) of < or = 60 seconds.

For the simulation the following elevator criteria were applied:

Conventional Control system

Number of elevators - 2

Lift rated load - 1179kg

Elevator Speeds - 1.50 m/s
Door widths - 900 mm

1 Analysis

Lifts: 2 Conventional, 1179 kg, 1.50 m/s

Traffic Situation	Floors	Population	P5	HC5	WT	DT	IS	LW
Two-Way Residential	-4..12	279	20	7.0 %	46.0 s	88.8 s	1.3	11.6 %

Legend

Setup		Abbreviations	
Traffic Situation:	See Section 2	P5:	Persons transported on average within 5 minutes
Floors:	Floors served by lifts	HC5:	P5 relative to group population
Population:	Population served by lifts	WT:	Average waiting time per passenger
		DT:	Average destination time per passenger
		IS:	Average number of intermediate stops per passenger
		LW:	Passengers waiting more than 90 seconds [%]

The result of the simulation with Conventional Control shows that the performance guidelines for the 5-minute handling capacity of > or = 7% (HC5 > or = 7%) will be met.

The result of the simulation with Conventional Control shows that the performance guidelines for the waiting time of < or = 60 seconds (WT < or = 60 seconds) will be met.

Standards and Recommendations

Every analysis covers a full range of traffic intensities, reporting handling capacity HC5 and average waiting time WT as main criteria. As a general guideline, Schindler defines recommendations based on these criteria:

Schindler Traffic Analysis Recommendations (conforming to ISO 8100-32:2020)

	Traffic Definition			Standard Requirements	
Traffic Situation	**Incoming**	**Outgoing**	**Inter-floor**	**HC5**	**WT**
Two-Way Residential	50 %	50 %	0 %	≥ 7 %	≤ 60 s

Details

3.1 Analysis

3.1.1 Building and Population

Number of Floors: 17
Building Population: 279

Floor Name	Floor Height	Floor Level	Description	Quantity	Density	Net Population ∑
12	3.10 m	110.60 m	Residential	25.0 persons	1.0 *	25 persons +
11	3.10 m	107.50 m	Residential	21.6 persons	1.0 *	22 persons +
10	3.10 m	104.40 m	Residential	21.6 persons	1.0 *	22 persons +
9	3.10 m	101.30 m	Residential	21.6 persons	1.0 *	22 persons +
8	3.10 m	98.20 m	Residential	21.4 persons	1.0 *	21 persons +
7	3.10 m	95.10 m	Residential	21.4 persons	1.0 *	21 persons +
6	3.10 m	92.00 m	Residential	21.4 persons	1.0 *	21 persons +
5	3.10 m	88.90 m	Residential	20.6 persons	1.0 *	21 persons +
4	3.10 m	85.80 m	Residential	25.8 persons	1.0 *	26 persons +
3	3.10 m	82.70 m	Residential	25.8 persons	1.0 *	26 persons +
2	3.10 m	79.60 m	Residential	25.8 persons	1.0 *	26 persons +
1	3.10 m	76.50 m	Residential	27.4 persons	1.0 *	27 persons +
0	6.20 m	70.30 m	Lobby			
-1	4.49 m	65.82 m	Parking	21.0 parking lots	1.2 pers. / lot	25 persons
-2	3.00 m	62.82 m	Parking	28.0 parking lots	1.2 pers. / lot	34 persons
-3	3.00 m	59.82 m	Parking	28.0 parking lots	1.2 pers. / lot	34 persons
-4	3.00 m	56.82 m	Parking	28.0 parking lots	1.2 pers. / lot	34 persons

3.1.2 Lifts

Control: Conventional

		1	2
Lift		A	B
Rated Load	[kg]	1179	1179
Weight per Person	[kg]	75	75
Pass./Deck gross		15	15
Max. Car Filling		80 %	80 %
Pass./Deck net		12	12
Drive Type			
Max. Speed	[m/s]	1.50	1.50
Max. Acceleration	[m/s2]	0.70	0.70
Drive Jerk	[m/s3]	1.00	1.00
Door Type		S	S
Door Width	[mm]	900	900
Opening Time	[s]	2.5	2.5
Closing Time	[s]	3.0	3.0
Door and Drive Delays	[s]	1.0	1.0
Transfer Time per Person	[s]	1.0	1.0
Min. Transfer Time	[s]	1.0	1.0
Number of Decks		1	1
Travel Height	[m]	53.78	53.78
12 Residential			
11 Residential			
10 Residential			
9 Residential			
8 Residential			
7 Residential			
6 Residential			
5 Residential			
4 Residential			
3 Residential			
2 Residential			
1 Residential			
0 Lobby			
-1 Parking			
-2 Parking			
-3 Parking			
-4 Parking			

3.1.3 Two-Way Residential

3.1.3.1 Traffic Definition

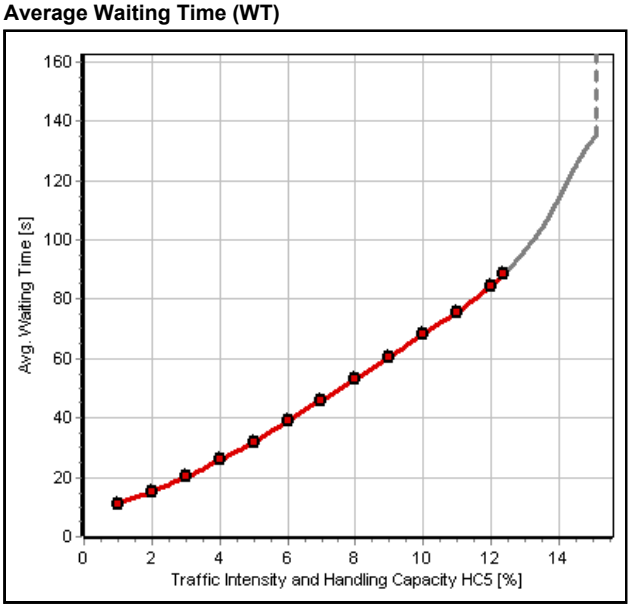
Population served by lifts: 279

Passenger Flows

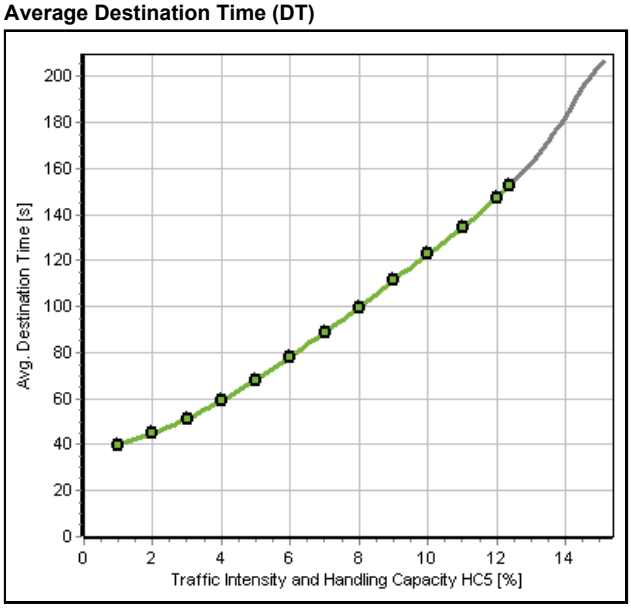
Floor	Description	Incoming 50 %		Outgoing 50 %	
12	Residential		8.9 %	8.9 %	
11	Residential		7.7 %	7.7 %	
10	Residential		7.7 %	7.7 %	
9	Residential		7.7 %	7.7 %	
8	Residential		7.7 %	7.7 %	
7	Residential		7.7 %	7.7 %	
6	Residential		7.7 %	7.7 %	
5	Residential		7.4 %	7.4 %	
4	Residential		9.2 %	9.2 %	
3	Residential		9.2 %	9.2 %	
2	Residential		9.2 %	9.2 %	
1	Residential		9.8 %	9.8 %	
0	Lobby	54.9 %			54.9 %
-1	Parking	9.0 %			9.0 %
-2	Parking	12.0 %			12.0 %
-3	Parking	12.0 %			12.0 %
-4	Parking	12.0 %			12.0 %

3.1.3.2 Performance

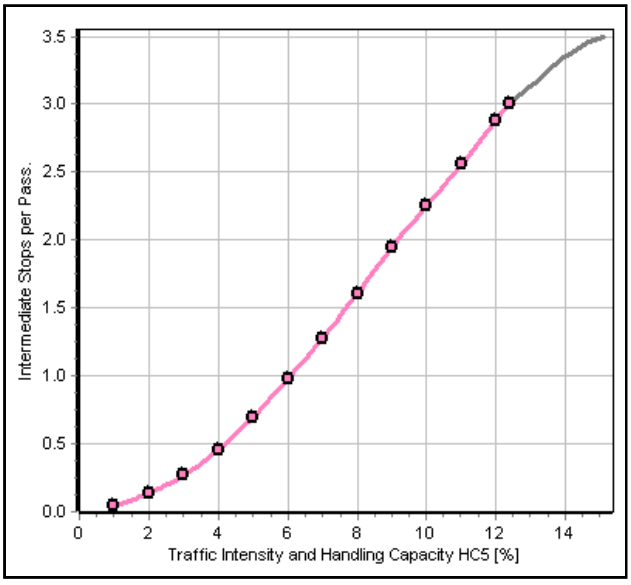
Average Waiting Time (WT)



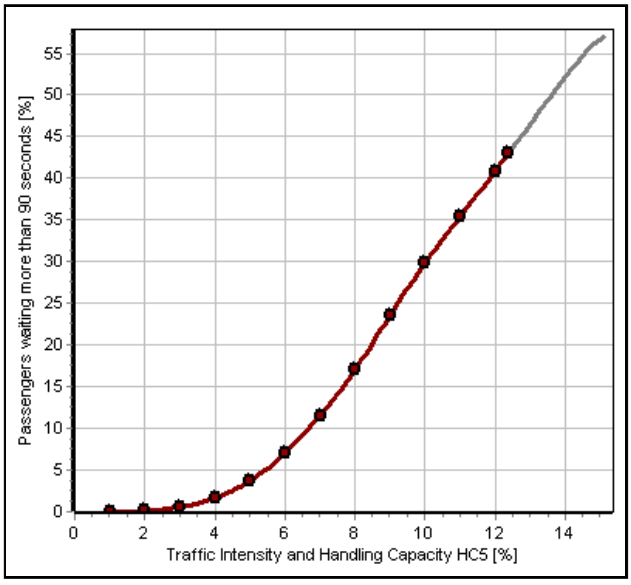
Average Destination Time (DT)



Average Number of Intermediate Stops per Passenger (IS)



Long Waits (LW)



HC5 [%]	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	12.4
P5	2.8	5.6	8.4	11.2	14.0	16.8	19.6	22.4	25.1	27.9	30.7	33.5	34.6
WT [s]	11.2	15.1	20.1	25.8	32.0	38.9	46.0	52.9	60.5	68.1	75.7	84.4	88.3
DT [s]	39.8	44.8	51.3	59.1	68.0	78.1	88.8	99.7	111.4	122.8	134.2	147.1	152.6
IS	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.6	1.9	2.3	2.6	2.9	3.0
LW [%]	0.0	0.1	0.5	1.7	3.7	7.0	11.6	17.0	23.6	29.8	35.4	40.9	43.0

How Schindler Undertakes Traffic Analyses

4.1 Introduction

A traffic analysis studies the performance of a group of lifts, based on assumptions about the expected traffic situation. The main performance measurements are handling capacity and waiting time. Reliable and comparable performance results are found by means of benchmark simulations which reflect the expected real behavior of a group of lifts under a wide range of traffic situations.

4.2 ISO 8100-32:2020

In June 2020, the International Organization for Standardization (ISO) has published the new standard ISO 8100-32:2020. It is the first modern global standard for planning and selecting of passenger lifts in buildings that was approved by many national standard organizations. Schindler played a decisive role within ISO in setting this standard. The simulation method in ISO 8100-32:2020 follows the principles as introduced and used by Schindler since 2007:

- Run a separate simulation for each traffic mix and passenger demand.
- Use constant traffic demand for each simulation.
- Make long simulations to reduce variation of results. ISO requires at least 2 hours; Schindler outperforms this with at least 8 hours duration.

Furthermore, also the design criteria of Schindler are now endorsed by the global norm, i.e. the requirements in terms of traffic mix, HC5 and WT. This ISO norm underlines Schindler’s leading role in reliable traffic planning. As a trusted partner in the building industry, we are proud to be a front runner enabling a common planning base for selecting lifts. This will simplify the process for architects and building planners, who will benefit from more security when planning lift installations.

For more information on ISO 8100-32:2020, see https://www.iso.org/standard/73084.html.

4.3 Measures and Definitions

The lifts' main task is to manage the traffic, i.e., the transportation needs of passengers and goods, in such a way that the highest possible density of arriving passengers and goods can be transported in the building at the highest possible perceived service quality.

4.3.1 Passenger Demand and Handling Capacity (P5, HC5)

For a specific lift group, passenger demand is the rate of transportation requests, typically stated together with a specific mix of incoming, outgoing and inter-floor traffic. Handling capacity is the highest passenger demand that can be transported sustainably under specified conditions, such as loading constraints. Passenger demand and handling capacity are usually expressed by P5 and HC5:

- P5 is the number of persons that is transported on average within 5 minutes.
- HC5 is the percentage of the population on the floors served by the lift group that is transported on average within 5 minutes:
  HC5 = P5 / (population on floors served by lift group).

Example: Consider a lift group which serves floors with a population of 1000 people. By observation, there are 600 passengers transported within 30 minutes, therefore:

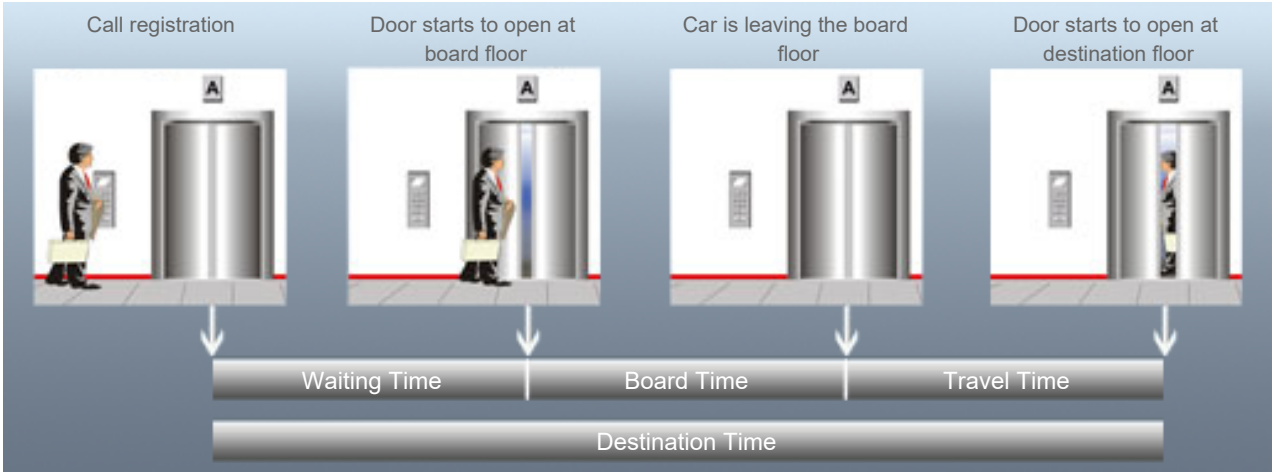
- P5 = 600 persons * (5 minutes / 30 minutes) = 100 persons,
- HC5 = 100 persons / 1000 persons = 10.0 %.

For passenger demand exceeding handling capacity, waiting queues will occur and grow over the duration of the excess demand. Furthermore, for passenger demand near (but below) handling capacity traffic jams may occur temporarily. Both conditions are unsatisfactory for passengers and will be marked as excess demand in Schindler traffic analysis reports.

4.3.2 Waiting Time (WT) and Destination Time (DT)

Waiting time and destination time for an individual passenger are defined as follows:

- waiting time: time from when the passenger registers a landing call (or joins a queue) until the door of the serving lift begins to open on the boarding floor (zero if the door is not closed when the passenger arrives)
- destination time: time from when the passenger registers a landing call (or joins a queue) until the door of the serving lift begins to open on the destination floor



For a number of served passengers in an observed period of time, the average waiting time WT and the average destination time DT are defined in the usual way as mean values of the passengers' individual waiting time and destination time, respectively.

4.3.3 Number of Intermediate Stops (IS)

The number of intermediate stops for an individual passenger is the number of times a lift stops with the passenger between boarding floor and destination floor. For example, for a passenger with a direct (non-stop) trip from boarding floor to destination floor the number of intermediate stops is zero.

For a number of served passengers in an observed period of time, the average number of intermediate stops IS is defined in the usual way as mean value of the passengers' individual number of intermediate stops.

4.3.4 Long Waits (LW)

We define the amount of long waits LW as the percentage of passengers with a waiting time longer than 90 seconds.

4.4 Methods of Traffic Analysis

A traffic analysis should cover a variety of important traffic situations, especially when planning new buildings. Reported values should be as reliable and comparable as possible. However, performance values depend on the methods of the traffic analysis and the basic traffic assumptions.

4.4.1 Simulation vs. calculation methods

In *simulation methods,* a real passenger flow is being replaced by a virtual one, which was created with the help of a random generator and loaded into the same control algorithm as used in a real lift controller. Thus the results can be measured under different traffic conditions and reflect the expected reality to a very large extent.

In contrast, *calculation methods* are based on formulas which only cover a very limited range of traffic situations (usually, only up-peak traffic). The formulas reflect theoretical assumptions rather than a realistic behavior of lift groups, and results are usually too optimistic. Therefore, calculation results should not be compared with simulation results.

Schindler Traffic Analysis Reports are based on simulations in order that the reported results are the most reliable and realistic achievable. Schindler simulations keep the traffic intensity constant over an extended period of time.

4.4.2 Wide Range of Traffic Assumptions

The traffic flow in a building keeps changing all the time; no two days are the same. As a rule, traffic depends on many factors (such as location of building, tenant structure, etc.) and may vary considerably during operation of the building. A traffic analysis should take such factors into consideration and try as far as possible to cover future traffic situations.

In a complex building, a single traffic assumption is not sufficient. E.g., it is not sufficient to apply a traffic pattern measured in some other existing building for the design of a new building. In particular, the limits of the handling capacity of the lifts cannot be found by such "spot light" examinations.

Predictions about the range of handling capacity of a lift group can only be made by actually simulating a wide range of traffic situations. A benchmark method applies a reference traffic situation from low to very high traffic intensity; by this, the limits of the lifts' handling capacity can be detected. Schindler uses a benchmark method which gives a neutral system assessment.

Schindler Traffic Analysis Reports are based on different traffic situations (see Section 2) tested by benchmark methods. This ensures that the traffic analysis covers a full range of applications and reports reliable and comparable performance predictions.