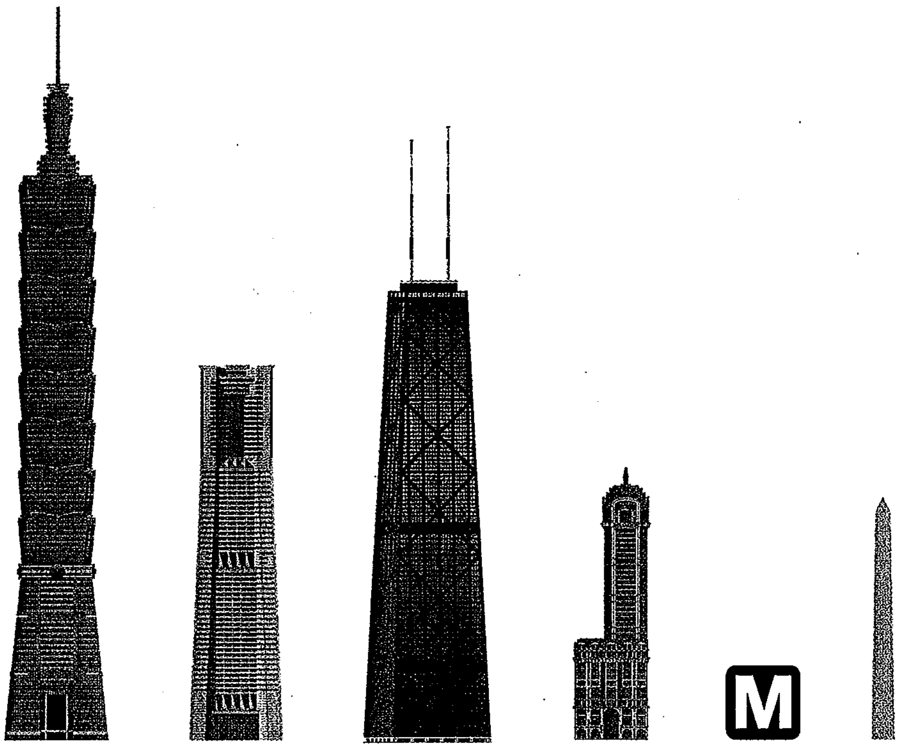


Taipei Financial Center
Fastest Modern Electric
Taiwan
Completed 2003
1667 ft (508.1 m)
61 Elevators

Yokohama Landmark Tower
Second Fastest Modern Electric
Japan
Completed 1993
972 ft (296.3 m)
59 Elevators

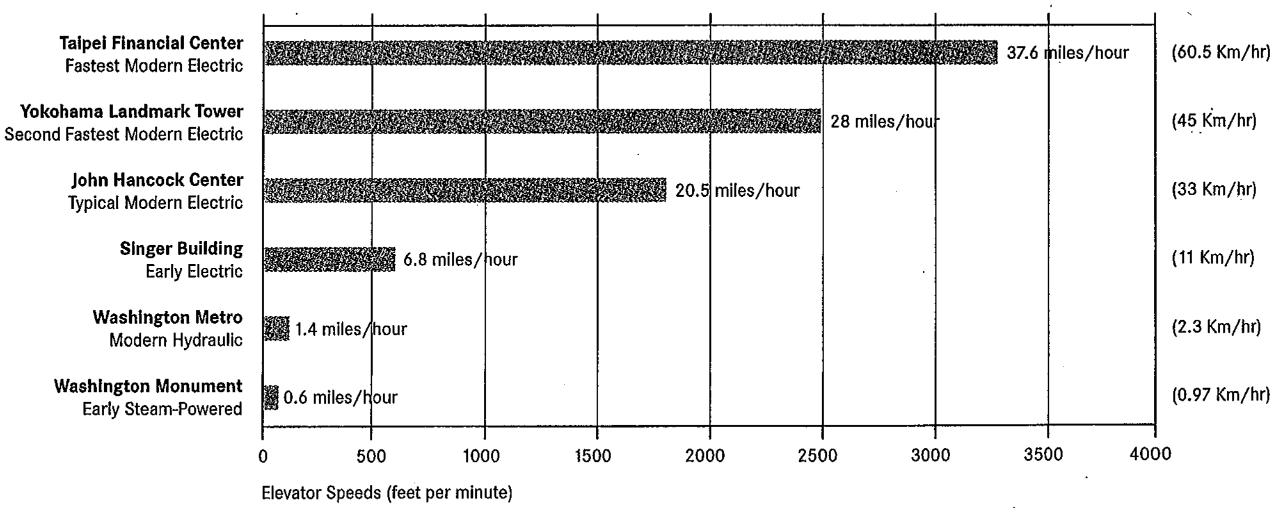
John Hancock Center
Typical Modern Electric
Chicago
Completed 1969
1131 ft (344.7 m)
50 Elevators

Singer Building
Early Electric
New York
Completed 1908
672 ft (204.8 m)
15 Elevators

Washington Metro
Modern Hydraulic
Washington, D.C.
Completed 2001
165 Hydraulic
40 Others

Washington Monument
Early Steam-Powered†
Washington, D.C.
Completed 1888
555 ft (169.2 m)
1 Elevator

Elevator Speeds in Some Well-Known Installations [1,6]



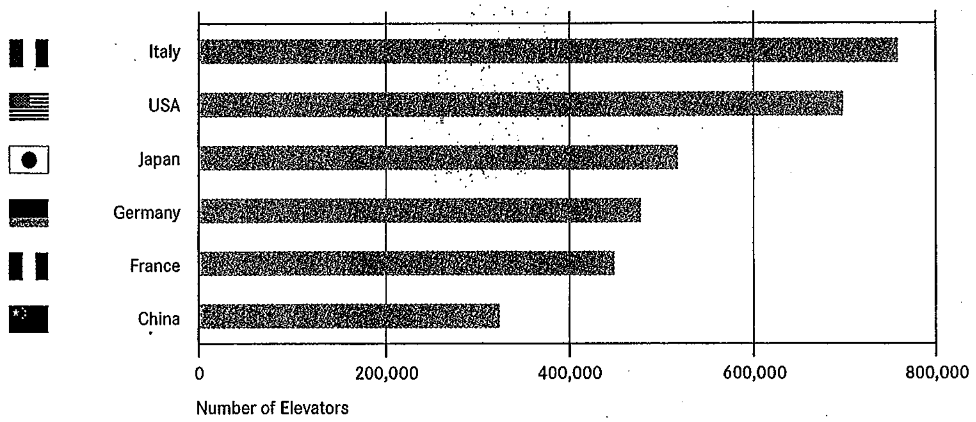
† In 2001 an electric elevator was installed in the Washington Monument that runs at 500 feet per minute (2.54 m/second) but can be slowed to 150 feet per minute (0.76 m/second), giving visitors the chance to view inscribed stones through the transparent elevator walls.

Appendix II

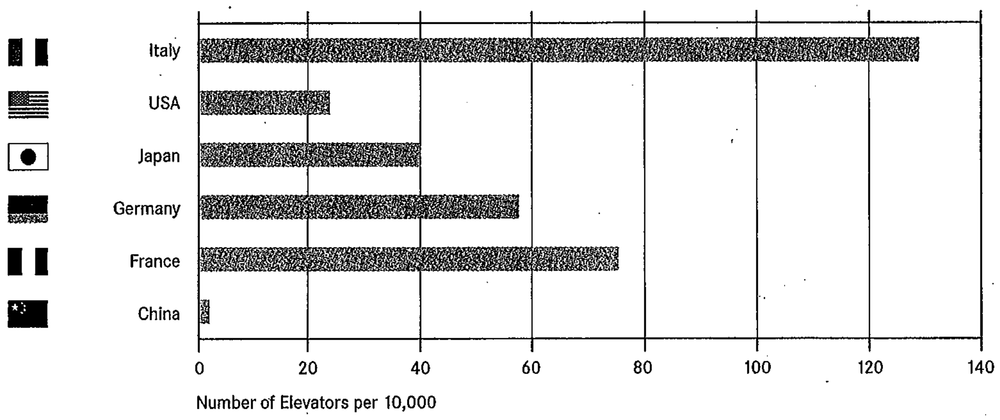
Statistics

Richard Evans

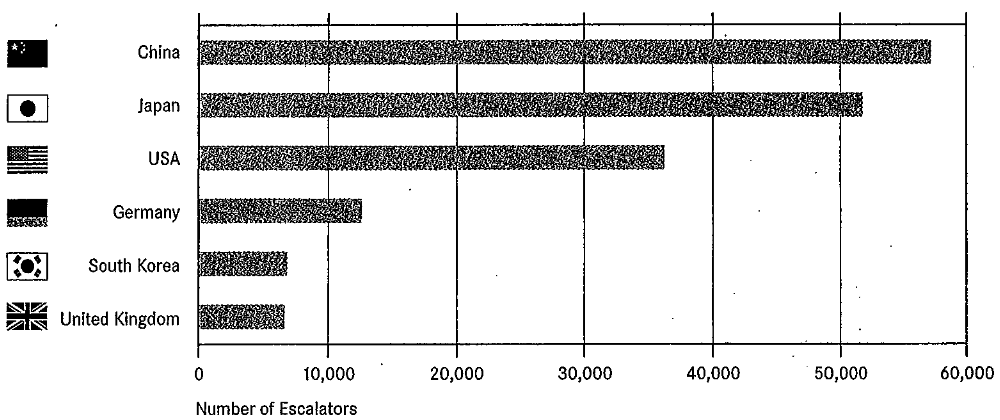
Countries with Greatest Number of Elevators[6]



Elevators per 10,000 Population for the Above Countries[6]



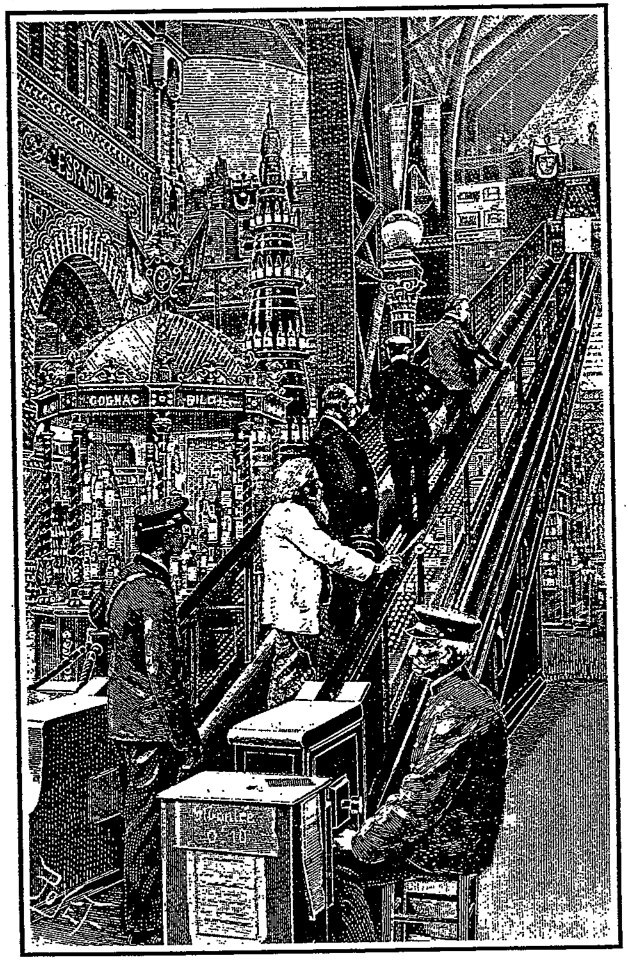
Countries with Greatest Number of Escalators[6]



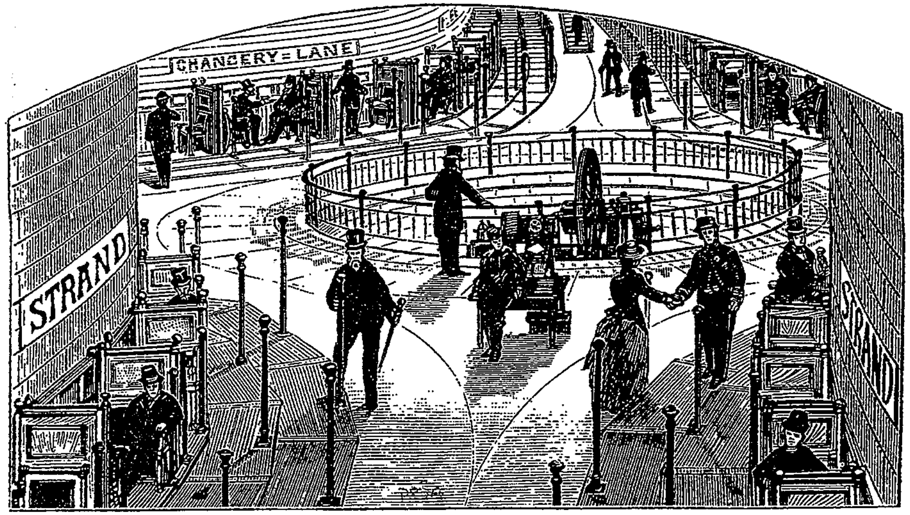
Lifts & Escalators

Commuters in Hong Kong's prosperous Mid-Levels can now catch an escalator to work...... The system, which is nearly half a mile long, will operate in the descent mode between 6am and 10am. It will then switch into reverse, carrying people halfway up the territory's famous Peak. It consists of 20 separate escalators and three travelators.

Daily Telegraph, 14 October 1993.



148. *Rolling Staircase at the Paris World Exhibition, 1900. Developed by Charles D Seeberger and the Otis Elevator Co in 1892, Otis installed the first step-type escalator for public use at this exhibition. It was subsequently refitted at Gimbel's Department Store in Philadelphia.*
[La Nature, p108, 1900]. VI:p83.



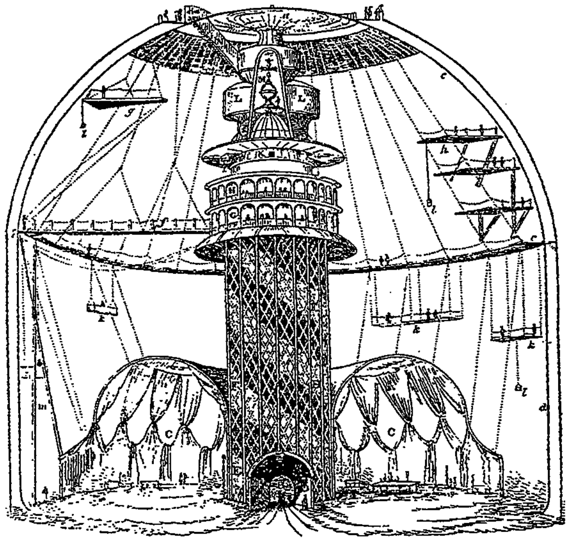
149. *Proposal for a Stepped-Platform Railway for London. [Scientific American, p26, IV, 1890]. VI:p37.*

Lifts & Escalators

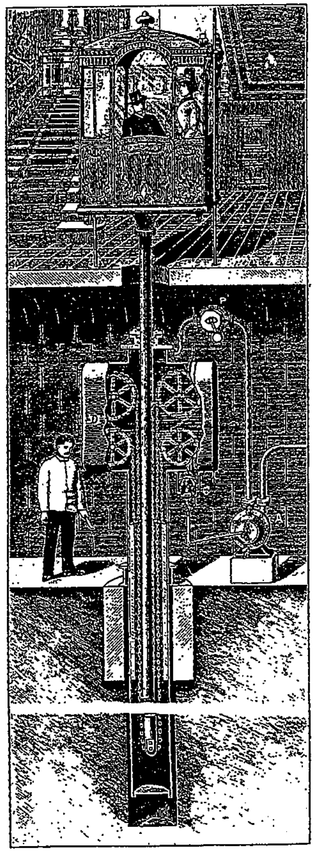
The Roman architect Vitruvius wrote of a hoisting machine (c26 BC). A counterweight lift, the *flying chair,* was invented by the Frenchman, Villayer (17th century). London's Royal Colosseum (1823) was fitted with an *ascending room* [150]. A lift, probably steam-powered, named the *Teagle,* was used in an English factory (1835). The *hydraulic column lift* [152] is credited to Edoux (1876). Steam-powered commercial lifts were introduced in America by Waterman (1850), who also invented the method of control by a rope passing through the lift cage [155]. Elisha Otis contributed to the safety of the lift (1853) when he introduced a safety mechanism to stop the cage falling in the event of rope failure [151]. The first public passenger lift was installed in the Haughwout Store, New York (1857). The first hydraulic column type lift built in England was by Waygood, who also installed England's first passenger lift (1870). Across the Atlantic, the Otis Co introduced a governor operated safety device (1878).

A high pressure hydraulic lift was installed in the Grand Hotel, Charing Cross by Waygood (1880), and about this time the London Hydraulic Power Co was formed, five pumping stations serving a network of high pressure (700 psi) mains operating lifts, machinery and cranes in and around docklands. The year also saw the invention of the first electric lift by Siemens. Hart invented the forerunner of the *paternoster* lift (1883), one built by J & E Hall being installed in Mansion House Chambers. Many early electricity supplies were dc, which made for easy speed control of lifts. Later, with the introduction of ac supplies, the Ward-Leonard ac/dc converter set was employed. Other improvements were made: car switch control, automatic levelling, semi-automatic then automatic doors, and then (1930s) push button control. An *inclined travelator* was installed at Harrods (1898), using a continuous stepless rubber belt. Liveried attendants were stationed at the top, ready to provide smelling salts for the ladies and something stronger for the gentlemen customers. In the 1890s, moving stairways were developed. Finally, came the *escalator,* the patent for which was then acquired by Otis (1899) and exhibited in Paris [148]. London Underground introduced their first escalator at Earl's Court Station (1911).

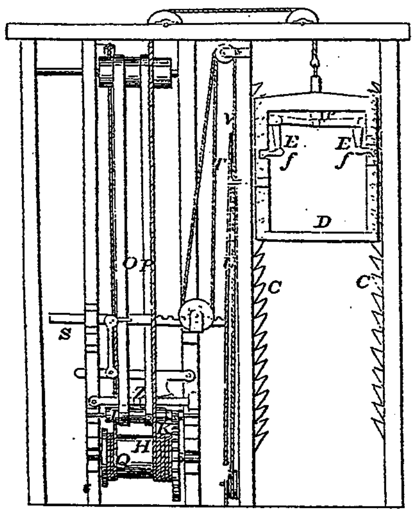
Lifts and Escalators, R E Allen et al, 1968.



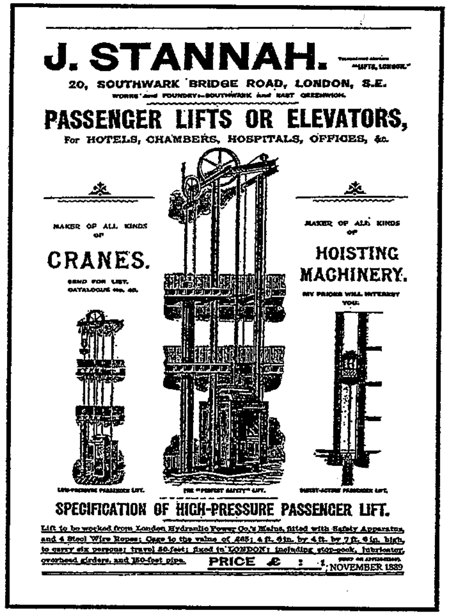
150. *The Ascending Room, Royal Colosseum, London, Regents Park, 1823. Those that wish to ascend to the panorama without the trouble of walking up stairs, may, by paying sixpence, ascend by the moving apartment, which is a small circular room, in which six or eight persons are comfortably seated, and raised by machinery to the proper height for viewing the picture.*
[Library Gazette, 31 January, 1829]. Panoramania, Barbican Exhibition Catalogue, 1989, p81.



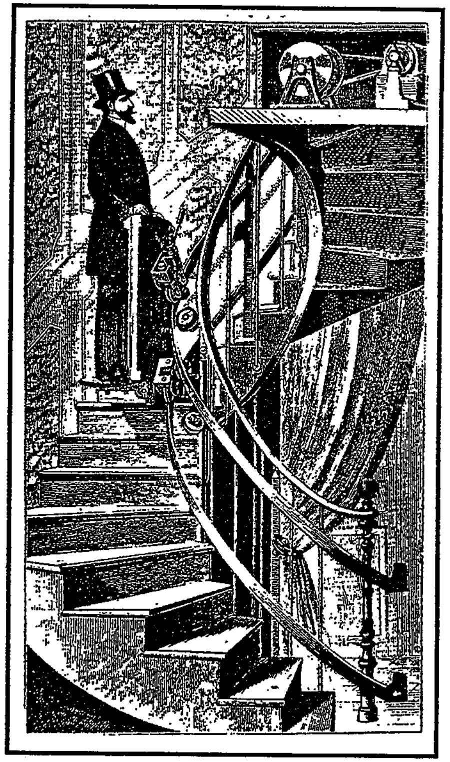
152. *The Edoux Hydraulic Lift, 1888. Leo Edoux, a Frenchman, has designed and constructed a passenger lift, which is pushed upwards by a plunger in a cylinder, the necessary power being provided by water under pressure.*
[Scientific American, p11, ii, 1888]. VI:p82.



151. *Safety Lift of Elisha Graves Otis. "Cut the cable", yelled Otis as he rode a crude elevator platform up a specially built frame at the Crystal Palace Trade Exposition in New York in 1853. The lift (D) dropped an inch and clamped securely on safety ratchets (C). Otis had invented the safety elevator. Patent drawing, Otis Elevator Co, 1854.*
The Technology of Man, D Birdsall & C M Cipolla, 1980, p204.

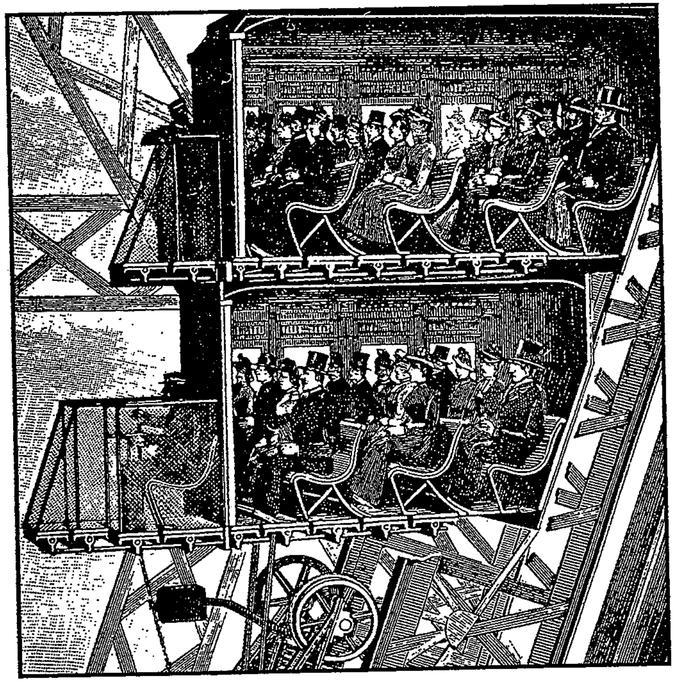


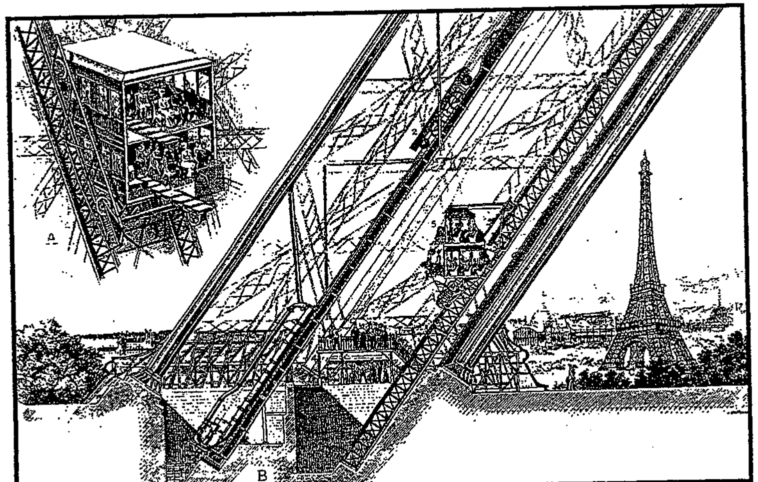
153. *Advert: Hydraulic Passenger Lift, November 1889. J Stannah, London.*
150 Years Building 1843/1993, Feb 1993, p90.



154. *Amiot's Stair Climber. For dwellings and offices where a lift would be too cumbersome or costly.*
[Scientific American, p21, xii, 1889]. VI:p83.

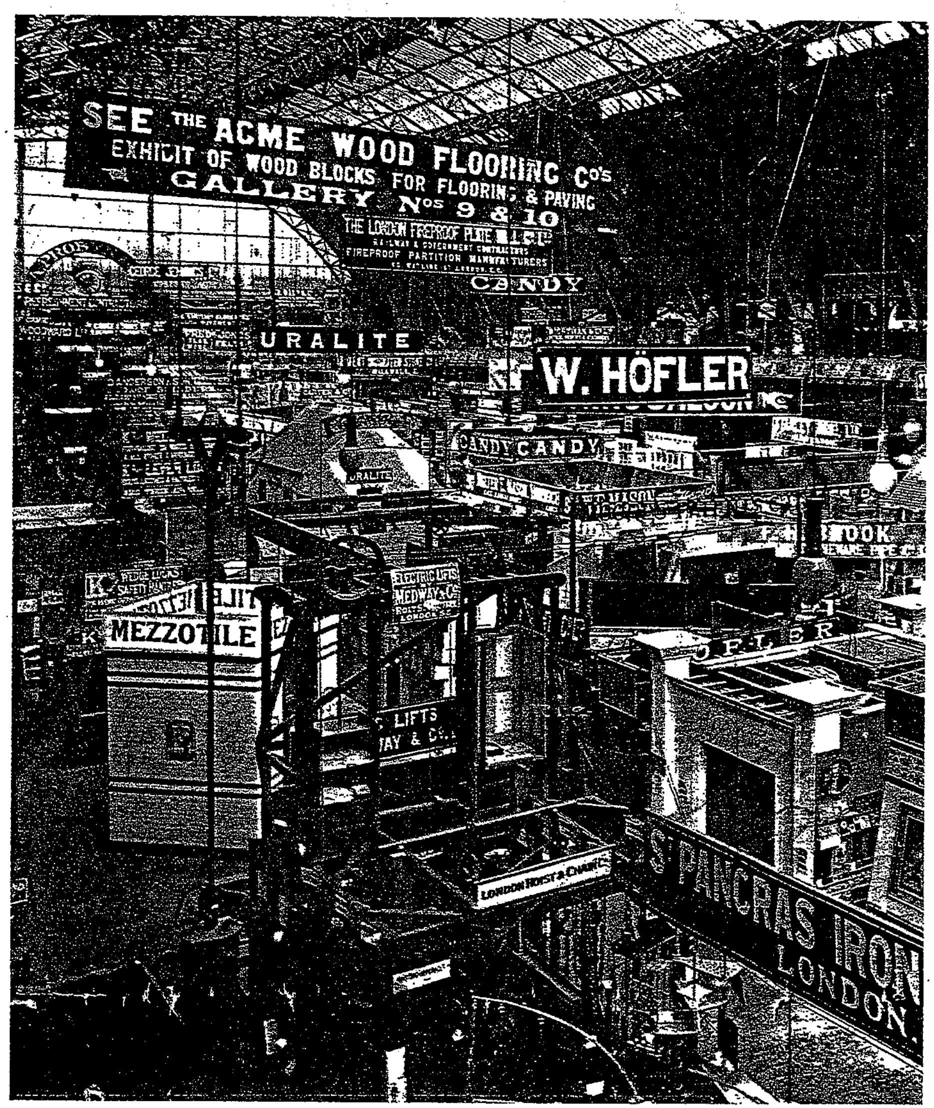
155. *Passenger Lift in Lord & Taylor Department Store, New York, 1872.*
People and Shopping, M Harrison, 1975, p109.





156. Otis Lift for the Eiffel Tower, Paris, 1889. Special double-deck elevators, following the difficult lower curve of the Tower's legs, transported up to fifty passengers at a speed of 7 feet per second to the second balcony, located at a height of 116 m. (Top) VI:p82. (Bottom) [Illustrated London News, 1889]. The Technology of Man, D Birdsall & C M Cipolla, 1980, p224.

Large buildings in London and elsewhere today are too often designed in the lift going down to lunch.
Sir William Holford, Observer "Sayings of the Week", 5 June 1960.



157. *Lift Manufacturers at The Building Trades Exhibition, London 1901. (Foreground) London Hoist & Chain Co. (Behind) Medway & Co.*
Interbuild News, 100 Years 1895/1995, No. 2, May 1995.

Source : Barney, G. C, 2003. Elevator Traffic Handbook, Spon Press, London & New York. [621. 877 B 267e]

Circulation Data Tables

Table 1.1 Interpersonal distances

The table shows the empirical psychological classifications.

Classification	Separation
Public distance (far)	> 7.5 m
Public distance (near)	3.6–7.5 m
Social distance (far)	2.1–3.6 m
Social distance (near)	1.2–2.1 m
Personal distance (far)	0.75–1.2 m
Personal distance (near)	0.45–0.75 m
Intimate distance	< 0.45 m

Table 1.2 Density of occupation in waiting areas

Table shows densities for persons waiting in circulation spaces. This may change for queues.

Level	Density
Desirable	0.4 P/m²
Comfortable	1.0 P/m²
Dense	2.0 P/m²
"Crowding"	3.0 P/m²
Crowded	4.0 P/m²

Table 1.3 Possible horizontal pedestrian flows

Flows in persons per minute (P/min) and persons per hour (P/h) and typical pedestrian speeds in metres per second (m/s) for a free flow design density of 0.3 persons per square metre (P/m²) and for a full flow density of 1.4 persons per square metre (P/m²) with grouping.

Traffic type	Free flow (0.3 P/m²) design density			Full flow (1.4 P/m²) design density		
	Speed	P/min	P/h	Speed	P/min	P/h
Commuters, workers	1.5	27	1620	1.0	84	5040
Individual shoppers	1.3	23	1380	0.8	67	4020
Family groups, tourists	1.0	18	1080	0.6	50	3000
School children	1.1–1.8	18–32	1080–1920	0.7–1.1	59–92	3540–5520

Table 1.4 Minimum corridor widths

Minimum width of corridors to accommodate various types of traffic; some compensation can be allowed for mixed two way traffic situations. A 3 m wide corridor is often suitable.

Usage	Minimum width (m)
One way traffic flow	1.0
Two way traffic flow	2.0
Two men abreast	1.2
Man with bag	1.0
Porter with trolley	1.0
Woman with pram	0.8
with child alongside	1.2
Man on crutches	0.9
Wheelchair	0.8

Table 1.5 Reductions in corridor widths

Reductions in corridors widths in metres caused by various obstructions.

Obstruction	Reduction (m)
Ordered queue	0.6
Un-ordered single queue	1.2–1.5
Row of seated persons	1.0
Coin operated machine:	
one person	0.6
queue	1.0
Person waiting with bag	0.6
Window shoppers	0.5–0.8
Small fire appliance	0.2–0.4
Wall mounted radiator	0.2
Rough/dirty surface	0.2

Circulation Data Tables

Table 1.6 Portal (handling) capacities

Handling capacities in persons per minute (P/min) and persons per hour (P/h) through an opening of 1 m width.

Portal type	P/min	P/h
Gateway	60–110	3600–6600
Clear opening	60–110	3600–6600
Swing door	40–60	2400–3600
Swing door		
(fastened back)	60–90	3600–5400
Revolving door	25–35	1500–2100
Waist high turnstile:		
free admission	40–60	2400–3600
with cashier	12–18	720–1080
single coin operation	25–50	1200–1800

Table 1.9 Handling capacities of passenger conveyors (moving walkways and ramps)

The table indicates the likely handling capacity of passenger conveyors (walkways and ramps) based on a standing density of 2.0 persons/m².

Incline (°)	Speed (m/s)	Width (mm) 1000		Width (mm) 1400	
0	0.50	60	3600	84	5040
0	0.63	76	4560	106	6350
0	0.75	90	5400	126	7560
5	0.70	84	5040	–	–
10	0.65	78	4680	–	–
12	0.50	60	3600	–	–

Table 1.7 Stairway (handling) capacities

Flows in persons per minute (P/min) and persons per hour (P/h) and typical pedestrian speeds in metres per second (m/s) for a free flow design density of 0.6 persons per square metre (P/m²) and for a full flow density of 2.0 persons per square metre (P/m²) with grouping.

Traffic type	Free flow (0.6 P/m²)			Full flow (2.0 P/m²)		
	Speed	P/min.	P/h	Speed	P/min	P/h
Young/middle-aged men	0.9	27	1620	0.6	60	3600
Young/middle-aged women	0.7	21	1260	0.6	60	3600
Elderly people, Family groups	0.5	15	900	0.4	40	2400

Table 1.8 Theoretical escalator handling capacity

Theoretical escalator handling capacities for various factors of *k* in persons per minute (P/min) and persons per hour (P/h).

Speed	Step width 1000 mm		Step width 800 mm		Step width 600 mm	
	P/min	P/h	P/min	P/h	P/min	P/h
0.50	150	9000	113	6750	75	4500
0.65	195	11700	146	8775	98	5850
0.75	225	13500	169	10125	113	6750

Circulation Data Tables

Table 1.11 Stair usage

The table shows the likely attraction of traffic using stairs and using escalators and lifts depending on the distance the person wishes to travel.

Floors travelled	Usage up	Usage down
1	80%	90%
2	50%	80%
3	20%	50%
4	10%	20%
5	5%	5%
6	0%	0%

Table 1.12 Lifts and escalators: division of traffic

The table shows the likely attraction of traffic between escalators and lifts depending on the distance the person wishes to travel.

Floors travelled	Escalator	Lift
1	90%	10%
2	75%	25%
3	50%	50%
4	25%	75%
5	10%	90%

Table 2.2 Actual mall pedestrian speed and flows

The table shows the likely pedestrian flow rates in persons per hour (P/h) and typical pedestrian speeds in metres per second (m/s) for uncrowded conditions of 0.2 persons per square metre (P/m²) and for crowded conditions of 0.45 persons per square metre (P/m²)

Traffic type	Uncrowded (0.2 P/m²)		Crowded (0.45 P/m²)	
	Speed (m/s)	Flow (P/h)	Speed (m/s)	Flow (P/h)
All shoppers	1.3	936	1.0	1620

Table 2.3 Mall stairway capacity

The table shows the pedestrian flows rates in persons per hour (P/h) and pedestrian speeds in metres per second (m/s) for uncrowded conditions of 0.4 persons per square metre (P/m²) and for crowded conditions of 0.8 persons per square metre (P/m²) per metre width of mall.

Traffic type	Speed (m/s)	Uncrowded (0.4 P/m²)	Crowded (0.8 P/m²)
Men	0.8	960	1920
Women	0.7	840	1680
Elderly men	0.5	600	1200
Elderly women	0.6	720	1440
Children	0.8	960	1920
Push chairs	0.5	600	1200

Table 2.4 Actual mall escalator handling capacity

The table shows the likely handling capacity of mall escalators in persons per hour (P/h) for uncrowded and crowded conditions.

Speed	Step width 600 mm		Step width 800 mm		Step width 1000 mm	
	Uncrowded	Crowded	Uncrowded	Crowded	Uncrowded	Crowded
0.50	1500	3000	2250	4500	3000	6000