Dedicated to People Flow™

KONE

PLANNING GUIDE FOR

KONE Escalators & Autowalks

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Every minute of every day, somewhere in the world, millions of people are using escalators and autowalks. In department stores, shopping centers, cinemas, sports complexes, exhibition halls, airports, railway stations, metro stations and a host of other buildings, escalators and autowalks are quietly, efficiently, safely and unobtrusively transporting large numbers of people. The key to their smooth and successful operation is efficient planning, installation and quality maintenance.

1. Welcome to the KONE Escalators and Autowalks Planning Guide

Dear Reader,

Our objective is to deliver a performance edge to our customers by creating the best user experience with innovative People Flow solutions in the fast developing urban environment. This allows people to move around smoothly, safely and eco-efficiently in and between buildings.

For decades KONE has been providing industry-leading escalators and autowalks and we are one of the global leaders in the industry. This Planning Guide demonstrates our vast experience and expertise in this area. It is a clear, easy-to-understand and comprehensive guide to all the main process stages, from initial project planning to final commissioning.

It will help you select the correct solution for each specific application, and recommend ways to optimize the People Flow within your building. It will also help you understand the relevant building regulations and the North American escalator and autowalk safety code.

In short, this Planning Guide will be your companion in each and every project you are involved with. I hope you find it helpful, and I wish you a successful escalator or autowalk project. Where you still have questions, please contact your local KONE Sales Representative, who will be delighted to give you the necessary support.

Sincerely,

Matti Alahuhta
President & CEO

2. How to use this Planning Guide

There is no set method for using this Planning Guide. You can flick through the table of contents and quickly access the relevant information you need. The initial chapters deal with an introduction to escalators and autowalks and how to optimize people flow within your building. The guide then takes you through how to configure your solution and addresses key construction considerations. We also explain the options and methods regarding modernization and look at some of the most pertinent changes to the ASME A17.1 2010 code.

At the end of the Planning Guide are lists of figures and tables. Again, these are added so you can quickly and easily access the figures and tables you need. For more product-specific information you may look at the accompanying product vs. segment matrix. This will allow you to see which KONE products we recommend for certain segments, such as public transportation, airport, retail, office, hotel, medical or leisure.

Based on our recommendations you can then look at the appropriate product-specific module to analyze the technical specifications of the product. You will immediately be able to see which product will best suit your particular project.

InfoPack™
The InfoPack is a memory stick that contains the complete Planning Guide in an easy to read electronic format. This makes it easier for you to take the information with you to meetings, to project it on a screen or to use as appropriate. The latest version of the Planning Guide can be downloaded directly from the InfoPack which is linked to www.us.KONE.com.

KONE.com
The Planning Guide can also be accessed from the www.us.KONE.com website.

National Grand Theatre,
Beijing, China
36 KONE escalators

Designing your new project

A Optimizing the People Flow – Defining how many units are needed

- Calculate traffic capacity *(Chapter 4)*
- Typical configurations per type of building *(Chapter 4)*
- Arranging the escalators or inclined autowalks *(Chapter 4)*

B Defining the right solution for your project

- Different characteristics of an escalator or autowalk *(Chapter 5)*
- Product recommendations per segment
- Product-specific modules including specifications, options and dimensions

C Obtaining the dimensions

- Construction considerations in relation to safety code *(Chapter 6)*
- Escalator design tools found on InfoPack and www.us.kone.com

3. An introduction to escalators and autowalks

3.1 Definitions and components

An escalator is a moving staircase for transporting people between floors of a building. It is generally agreed that an escalator is the most efficient means to move large numbers of people between floors.

Item	Component	Item	Component
1	Handrail	10	Handrail drive
2	Skirting	11	Transition radii
3	Steps/pallets	12	Truss
4	Decking	13	Side cladding
5	Balustrade	14	Step chain
6	Horizontal steps/pallets	15	Tracks
7	Drive station	16	Return station
8	Controller	17	Access cover plate
9	Front plate	18	Newel

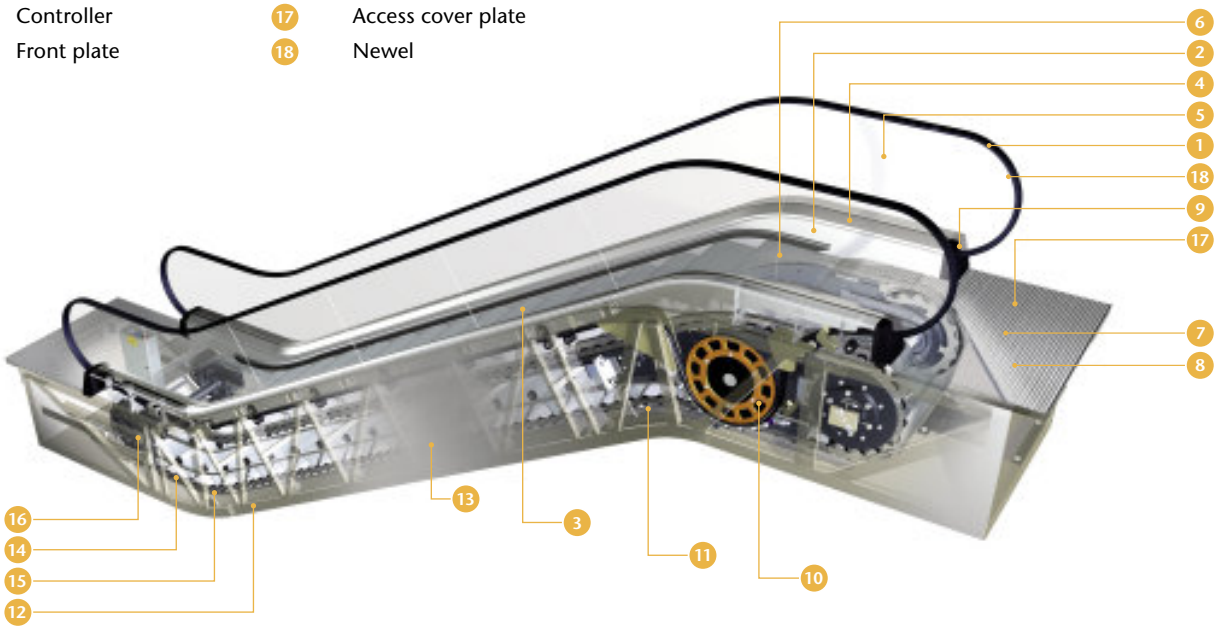


Figure 3.1 Escalator components

KONE's escalators come in a diverse range of specifications:

- Inclination 30°
- Step width 24 in. (600 mm) | 32 in. (800 mm) | 40 in. (1000 mm)
- Speed 100 fpm (0.5 m/s)
- Level steps 2 | 3 | 4*
- Environment Indoor | semi-outdoor | fully outdoor

** only for infrastructure escalators*

A horizontal autowalk is a conveyor belt that transports people horizontally. Autowalks are generally provided in areas where people need to walk long distances with luggage, baggage carts or shopping carts. An autowalk is generally flat, but can be slightly inclined.

KONE's horizontal autowalks cover all the standard requirements:

- Inclination — from 0° to 6°
- Pallet width — 40 in. (1000 mm) | 48 in. (1200 mm) | 56 in. (1400 mm)
- Speed — 100 fpm (0.5 m/s)
- Environment — Indoor | semi-outdoor | fully outdoor

Figure 3.2 Horizontal autowalk components

By conveying people continuously, escalators and autowalks ensure a smooth flow of people through a building. They have the capacity to handle high traffic, and in multi-level retail centers they play a vital role in ensuring that all floors are visited evenly. Escalators and autowalks, along with elevators and automatic doors, are a total people and goods transportation solution. However, escalators, autowalks and elevators each have their own strengths, as shown in *Table 3.1*, which will help you understand whether you need an escalator or an autowalk (or even an elevator).

Table 3.1 The main transportation characteristics of escalators, autowalks and elevators

Escalators	Horizontal autowalks	Elevators
Continuous	Continuous	Interrupted
Mass transport	Mass transport	Limited number
Short-medium distances	Medium-long distances	Higher rises
In between floors	On one floor	In between floors
Steer people flow	Save time and effort	Improve accessibility

3.2 The main safety code to consider

The safe structural design and installation of escalators and autowalks in buildings is defined and regulated in North America by the ASME A17.1/B44 Code.

Elsewhere in the world, regional or local country-specific codes as well as the ASME A17.1 2010 code may apply.

Your local KONE sales organization will be delighted to provide you with details of your local regulations.

In this Planning Guide, we refer to the latest version of the ASME A17.1 2010 code.

Berlin Central Station
Berlin, Germany
54 KONE escalators

4. Optimizing the People Flow within the building

4.1 Analyzing People Flow

People flow varies immensely in each type of building. Understanding people flow will help you select the correct type and number of escalators and autowalks, and configure them correctly for the building.

The easiest way to understand people flow is to look at two buildings where the people flow is widely different: a multi-floor shopping center and a 24-hour metro station (see the case studies later in this chapter).

What is People Flow?
By 2030 there will be two billion more people living in cities than there are now, making the urban population almost five billion. To support this influx of people into cities, the importance of building comfortable and efficient urban environments is paramount. At the same time, increased environmental awareness is demanding more eco-efficient and environmentally-friendly solutions. And let's not forget that an aging population requires more focus on better accessibility, safety and security.

KONE is dedicated to the development of sustainable urban living, and is committed to making urban environments better places for people to live in.

Our vision is to deliver the best People Flow experience. By People Flow we mean:

- Moving people smoothly, safely, comfortably and without waiting in and between buildings
- Ensuring high-quality accessibility for everyone

Furthermore, People Flow gives us direction for developing our offering to meet our customers' needs, and enables us to credibly sell, deliver and maintain complete solutions instead of just products.

4.2 Calculating traffic capacity

An important first step is to calculate the number of passengers you expect your escalator to transport.

More detailed information on step width and speed can be found in *chapters 5.3 and 5.4. Table 4.1* displays the information given within ASME A17.1 2010 for traffic flow planning purposes. However, these figures are only relevant if the escalator is running at full load, which only occurs during peak hours.

Table 4.1 Traffic capacity calculations

Step/pallet width	Nominal speed
	100 fpm (0.5 m/s)
24 in. (600 mm)	3,600 persons/h
32 in. (800 mm)	4,800 persons/h
40 in. (1000 mm)	6,000 persons/h

When carrying out such traffic capacity calculations for your projects, please take into consideration that some other important factors come into play which may influence your traffic capacity:

- Every step is not likely to be 100% occupied
- In reality, many passengers leave at least one clear step between themselves and the passenger in front
- As the speed of the step band increases, step occupancy decreases, because passengers hesitate longer before boarding

The conclusion therefore is that traffic capacity calculations are complicated as they are affected by a number of criteria. KONE experts are available to help you calculate the exact traffic capacity of your escalator or autowalk, to ensure it perfectly matches the requirements of the building.

Example:

Consider a metro station escalator, with a speed of 100 fpm (0.5 m/s) and a 40 in. (1000 mm) step width, in continuous operation in both directions for a period of 20 hours a day, 7 days a week and 365 days per year. If it was running at full load for the whole of its 20 hours of operation, its traffic capacity would be:

- 20 hours x 6,000 persons/hour
- = 120,000 persons per day

In reality, during its 20 hours of operation per day, its passenger load will vary as follows:

- 40% full load (2,400 persons) for 3 hours = 7,200 persons
- 100% full load (6,000 persons) for 2 hours = 12,000 persons
- 50% full load (3,000 persons) for 8 hours = 24,000 persons
- 100% full load (6,000 persons) for 2 hours = 12,000 persons
- 40% full load (2,400 persons) for 5 hours = 12,000 persons

This makes a total of 67,200 persons carried over its 20 hours of daily operation at 61.2% equivalent load profile.

Berlin Central Railway Station
Berlin, Germany

Kamppi shopping center
Helsinki, Finland
45 KONE escalators

Case 1: Shopping center

As seen in *Figure 4.1* the shopping center experiences three peaks:

- The first is at the beginning of the day and consists of employees and early shoppers, coffee shop visitors and people who cut through the center on their way to work
- The second is during lunch hour when people access the food court area (not on ground level) or stop at the shopping center during their lunch break
- The third is the time after work when most shoppers enter the center

After the third peak the number of visitors quickly decreases until the center closes for the night. See *Chapter 4.6* for more information on this subject.

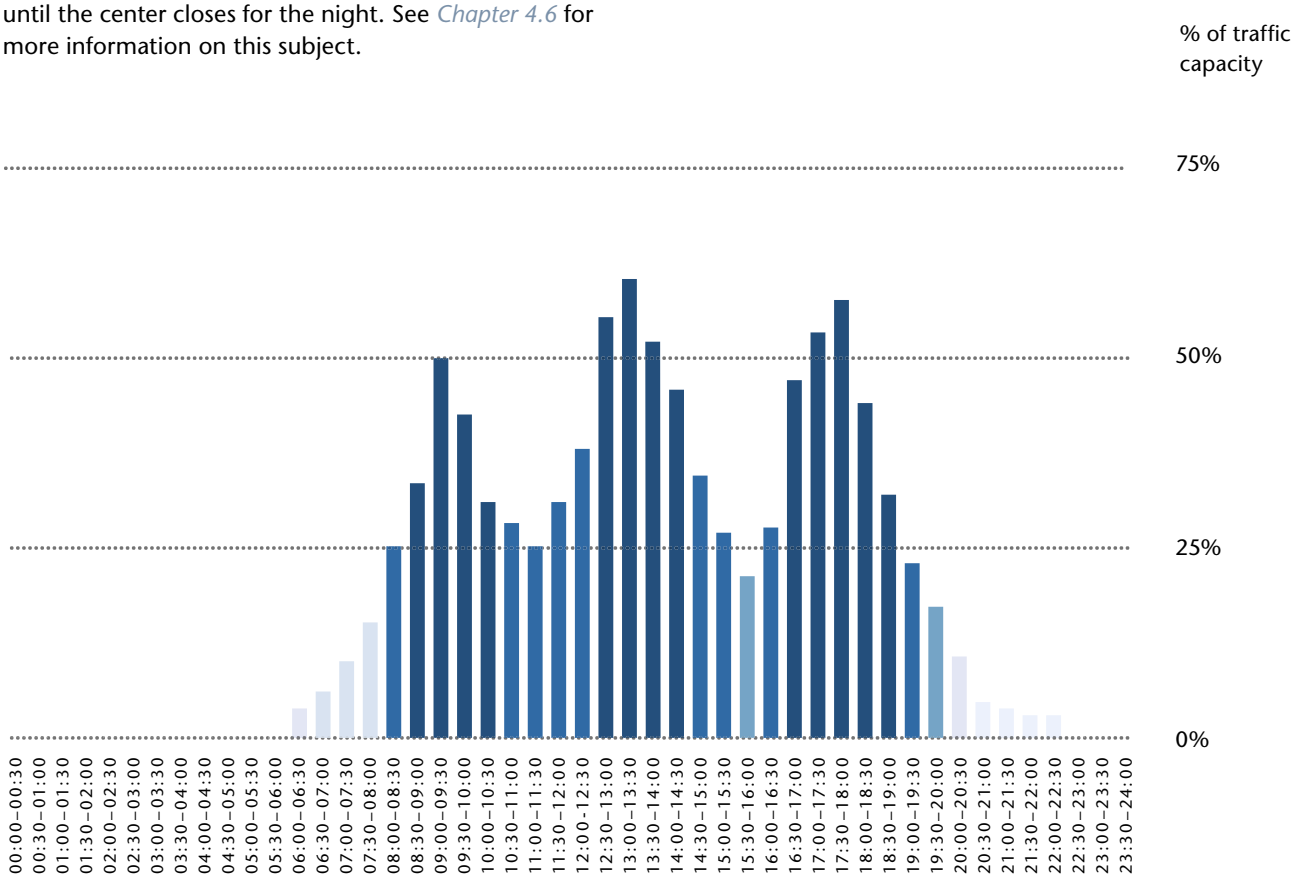


Figure 4.1 Typical people flow in a multi-level shopping center, showing three major peaks

Bishan Station
Singapore
16 KONE escalators

Case 2: 24-hour Metro station

For a typical 24-hour metro station in a metropolitan city, two peaks are experienced; one for each rush hour when people travel to work and back, as shown in *Figure 4.2*.

Both peaks are preceded and followed by a build-up period, which stretches longer into the evening as people either stay or travel for dinner, social meetings, overtime, etc.

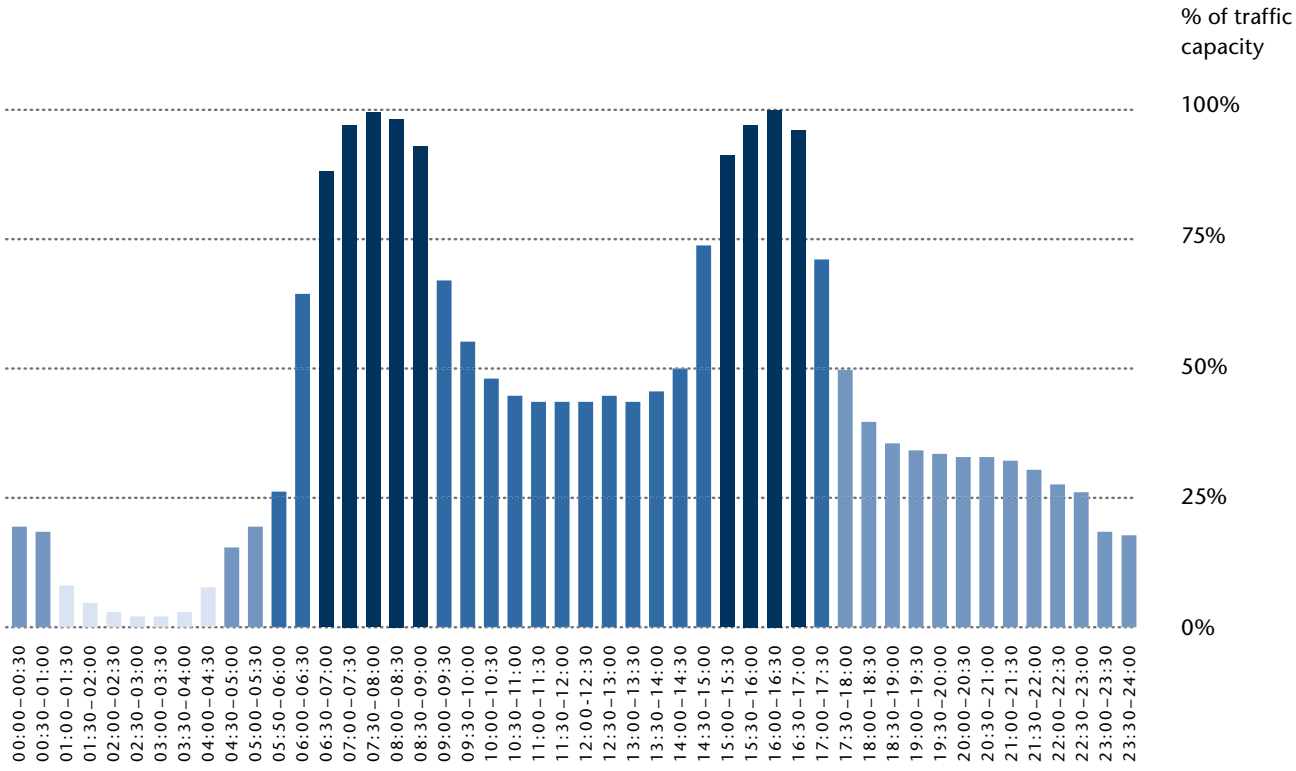


Figure 4.2 Typical people flow in a 24-hour metro station with two major peaks

Note that not only the number but the magnitude of the peaks are different between the two environments; in the metro station, the number of people using the escalator at peak times is significantly higher. This means that the escalator is under a much higher load. More on load profile is discussed in Chapter 5.1.

A clear distinction can be made between escalators for a commercial environment, such as a shopping center, and escalators for an infrastructure environment, such as a railway or metro station:

Commercial escalators

In shopping centers, supermarkets and department stores, escalators play a vital role in routing shoppers to the right location, such as particular shops in a mall or specific aisles in a store.

Infrastructure escalators and horizontal autowalks

In public transportation environments such as airports and transit centers, the challenge is to get passengers and their luggage to their destination on time. To meet this challenge, escalators and horizontal autowalks are being increasingly used in these buildings.

The specific KONE solutions that are recommended for each segment can be found in the product vs. segment matrix. *Table 4.2* presents some typical configurations for commercial units, while *Table 4.3* highlights typical configurations for infrastructure units.

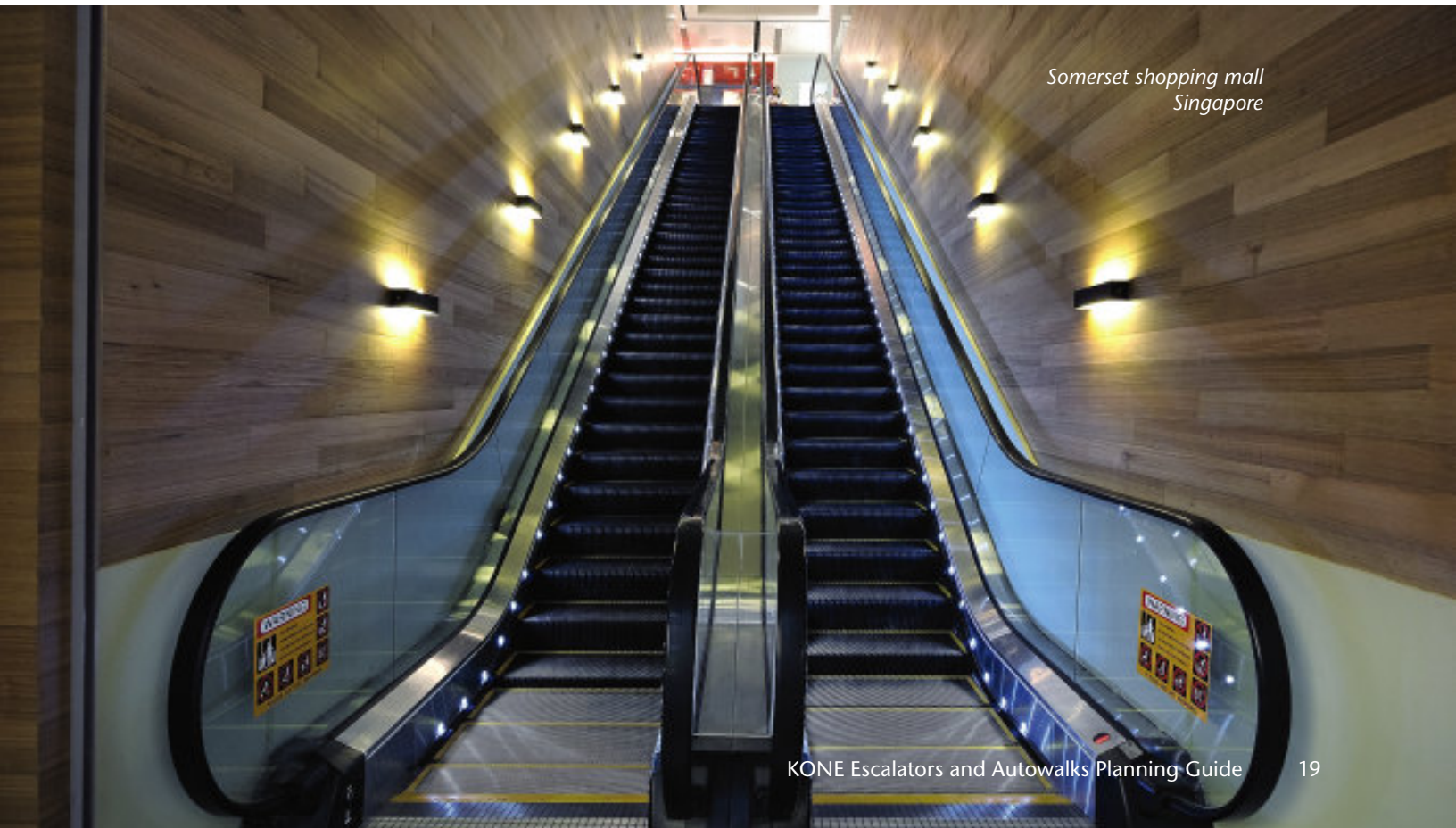
Table 4.2 Typical configurations for commercial units

Small retail shops	Large shopping malls
30° escalator	30° escalator
32 in. (800 mm) step width	40 in. (1000 mm) step width
100 fpm (0.5 m/s)	100 fpm (0.5 m/s)
Standby speed	Continuous
Glass balustrade	Glass balustrade
Primed sheet steel side cladding	Customized or stainless steel side cladding

Table 4.3 Typical configurations for infrastructure units

Railway station	Metro station	Airport	Airport
30° escalator	30° escalator	30° escalator	0° horizontal autowalk
40 in. (1000 mm) step width	40 in. (1000 mm) step width	40 in. (1000 mm) step width	40 in. (1000 mm) step width
100 fpm (0.5 m/s)	100 fpm (0.5 m/s)	100 fpm (0.5 m/s)	100 fpm (0.5 m/s)
Continuous, standby[1]	Continuous, standby[1]	Continuous, standby[1]	Continuous, standby[1]
Glass or solid inclined balustrade	Glass or solid inclined balustrade	Glass balustrade	Glass balustrade
Stainless steel side cladding	Stainless steel side cladding	Customized or stainless steel side cladding	No cladding

[1] *See Chapter 5.2 for the description of operational modes.*



Somerset shopping mall
Singapore

4.3 Understanding your building segment

Not all buildings can be described as either commercial or infrastructure; there are many building segments, each with their own people transportation requirements. Before choosing an escalator or autowalk, it is important to be aware of the key differences between major types of buildings, as their use and their people flow affect the solution you will specify. KONE is fully aware of these differing requirements and offers complete equipment and service solutions for any people flow challenge. Please contact KONE for any people flow planning support you may require. The main segments and their most common people transportation requirements are shown below:

Public transportation segment

- High availability is vital
- High speed (100 fpm [0.5 m/s]) increases safety by allowing passengers to leave the platform quickly
- Linked to building management systems
- Standby speed
- Heavy indoor, semi-outdoor and fully outdoor use
- 20-24 hours running time per day

Airport segment

- High speed is usually required, especially for horizontal autowalks
- Visual design is very important; airports are key reference sites
- Availability is extremely important
- Linked to building management systems
- Mainly indoor
- 18-20 hours running time per day

Retail segment

- Visual design and lighting options important
- Very often belongs to the transport system of the building and linked to elevators
- Lowest possible speed to retain shoppers in the building
- Continuous operation very important to guide shoppers to other floors
- Mainly indoor
- 12-14 hours running time per day

Office/hotel/medical segment

- Visual quality outlook important as it represents the luxury level of the building
- Finishing often done by customer (office/hotel)
- Very often belongs to the transport system of the building and is linked to elevators
- Low running speed needed for passenger comfort
- Standby speed operational mode
- Mainly indoor and air-conditioned
- 10-12 hours running time per day

Leisure segment

- Availability is extremely important
- Amusement parks often have busy retail center type of traffic but in an outdoor environment
- Stadiums where the duty cycle is short but with peak loads require a heavier solution, similar to the public transportation segment
- Indoor, semi-outdoor and fully outdoor use
- 12-14 hours running time per day

4.4 Deciding how many escalators and/or autowalks are needed

The number of units required is determined by the people flow requirements (the number of people transported per hour). This depends on parameters such as:

- The type of building
- The traffic flow within the building
- Peak traffic times
- The level of travel comfort required

In addition, factors such as safety, evacuation, accessibility and even the marketing potential (of a retail center) come into play. The next consideration is where to locate your escalators and autowalks.

4.5 Locating your escalators and autowalks – indoors or outdoors?

To ensure the reliability and availability of your escalators and autowalks over their lifetime, it is essential that their specifications match the environmental conditions.

Most escalators and autowalks will normally be installed indoors. They are designed for such an environment as standard. An indoor environment is defined as a weather-tight, temperature-controlled environment where the escalator or autowalk will not be exposed to the elements such as rain and snow.

An outdoor environment can be either semi-outdoor or fully outdoor

Semi-outdoor is an uncontrolled environment in which the unit might be exposed at times to the elements. However, as it is covered with a roof and walls, the escalator is not directly exposed to the elements.

Fully outdoor is an uncontrolled environment where the unit will be fully exposed to the elements. A key consideration is therefore the temperature; heaters and/or coolers may have to be installed, depending on the climate.

Figure 4.3 The outdoor escalator should be covered by a roof to improve passenger safety and convenience

Example:

The average energy consumption of heaters:

- 15 ft. (4.5 m) high-rise escalator = 3,900 kWh/year
- 27 ft. (8.0 m) high-rise escalator = 5,700 kWh/year

The above figures are based on a 4-month winter period and operating for 20 hours/day, 7 days/week and 52 weeks/year.

ASME A17.1 2010 recommends that outdoor escalators are covered by a roof. This is for safety reasons. For example, passengers on a fully outdoor escalator when it is raining are likely to hold umbrellas as well as shopping bags and therefore not the handrail, which could be dangerous.

Sala Daeng Station
Bangkok, Thailand

The operational environment does not restrict the use of KONE escalators and autowalks. If they are to be installed in a semi-outdoor or a fully outdoor environment, numerous features are available to upgrade the specification of the unit to suit the environment and ensure lifetime performance. These features are listed in *Table 4.4* and *Table 4.5*.

Table 4.4 Recommended specifications for a semi-outdoor escalator

Application	This specification is for escalators installed in an uncontrolled environment, but which are covered with a roof and walls, thereby preventing them from being directly exposed to rainwater, snow, etc.
Recommended options	■ Bicomponent epoxy zinc dust anti-corrosion paint and synthetic resin finishing coat ■ Water drain and oil collection channels in truss ■ Stainless steel skirts with clear anti-friction coating ■ Automatic step-chain lubrication, not required with lubrication-free chains ■ Weatherproof electrical system ■ NEMA 4X motor ■ Step-chain covers ■ Stainless steel handrail guide ■ Step & step-chain rollers with sealed bearings ■ NEMA 4X exposed electrical components
Remarks	In hot (>104°F) or cold (<39.2°F) climates, appropriate cooling or heating options need to be selected.

Table 4.5 Recommended specifications for a fully outdoor escalator

Application	This specification is for an escalator installed in a fully outdoor environment, and as such will be exposed to rainwater, snow, etc.
Recommended options	■ Hot-dipped galvanized truss with non-decorative galvanized sheet steel truss side panels, including corrosion protection for all necessary steel components ■ Stainless steel handrail guide ■ Stainless steel skirts with clear anti-friction coating ■ Automatic step-chain lubrication, not required with lubrication-free step chains ■ Step-chain covers to prevent rainwater penetrating the step connector (stub axle) brushes ■ Step rollers with sealed bearings ■ Optional lubrication-free step chain with sealed chain roller bearings ■ Water drain and oil collection channels in truss with oil/water separator, to prevent step-chain oil polluting the drainage system. The pit must be 7.9 in. (200 mm) deeper to accommodate this feature ■ Water level safety switch in lower machine compartment to stop the escalator in the event of the pit flooding with rainwater ■ Weatherproof electrical system ■ All exposed electrical components NEMA 4X rated
Remarks	In hot (>104°F) or cold (<39.2°F) climates, appropriate cooling or heating options need to be selected.

The product-specific modules in this Planning Guide contain information about which escalators and autowalks have the possibility to be installed in uncontrolled environments.

4.6 Arranging your escalators or autowalks in the building

Escalators are generally acknowledged as being the most effective method of transporting large numbers of people between two floor levels, but how your escalators are arranged within the building has a huge impact on the flow of people. More specific information on this topic and how it relates to construction considerations is provided in *Chapter 6*.

In infrastructure buildings

- Escalators are normally positioned on the main routes through the building
- The over-riding requirement is speed and efficiency of people transportation within a safe environment

In retail stores

- Positioning an escalator next to the main entrance is the most effective way to encourage customers to use a sales area on another floor level
- In a retail environment the goal is not merely to convey passengers to another floor as quickly as possible. An escalator can lead people through a promotional area or alongside displays of goods

Note that the actual arrangement of the escalator installation can have a dramatic impact on the interior design of the building. The most common escalator arrangements are shown on the following pages, along with advantages and disadvantages of each configuration. KONE escalators are designed to be operated in both directions, so at this stage you do not necessarily have to stipulate the direction of travel.

Canary Wharf Station
London Underground
United Kingdom
20 KONE escalators


CANARY WHAR

A single escalator arrangement, free-standing or against the wall

+ An inexpensive method of transporting passengers between two floor levels
+ Particularly suitable for small retail stores where available floor space is restricted
+ Only one side of decorative truss side cladding is required if against the wall

– Only really suitable for installations where passenger flow is in one direction, although on-demand starting can be utilized to allow travel in both directions
– An easily accessible staircase is required for passengers to return to the ground floor level
– Restricts traffic flow within the building

Escalators in parallel arrangement

+ Passenger flow within the building is maximized by moving the users between the two floors
+ Increased passenger comfort in comparison to single arrangement
+ Both sides can be used for promotional purposes

Escalators in one travel direction (interrupted traffic flow)

+ Cost-effective method for transporting passengers between three floors
+ In retail installations, passengers have to make a short detour to the next escalator; strategically placed displays alongside the route of this detour can help to increase sales by encouraging impulse buying

– Only really suitable for installations where passenger flow is in one direction
– Passenger flow through the building is interrupted, so overall traveling time to higher floor levels is increased
– Readily accessible staircases are required for passengers to return to the ground floor level

Multi-level scissor arrangement (continuous traffic flow)

+ Cost-effective and efficient method for transporting passengers between three floor levels
+ Continuous arrangement allows the fastest movement of passengers over two or more floor levels, so is particularly suitable for public service buildings, office buildings or large department stores

With a single multi-level scissor escalator arrangement:

– Only really suitable for installations where passenger flow is in one direction
– Readily accessible staircases are required for passengers to return to the ground floor level

Multi-level criss-cross arrangement (continuous traffic flow)

+ Continuous arrangement allows the fastest movement of passengers over two or more floor levels, so is particularly suitable for public service buildings, office buildings or large department stores
+ Reduces congestion at the landing areas by separating upwards and downwards traveling passengers
+ Frequently used to make an attractive feature of the escalators in the center of retail stores

Multi-level parallel arrangement (interrupted traffic)

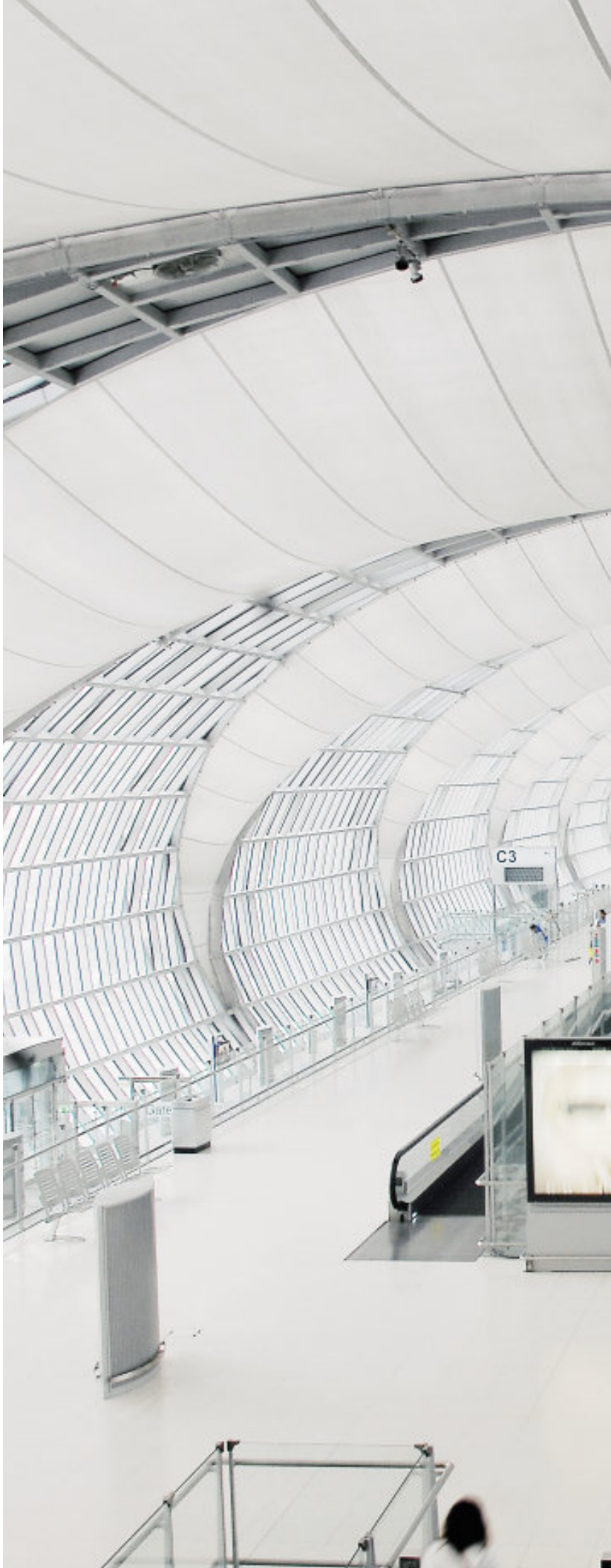
+ In retail installations, passengers have to make a short detour to the next escalator; strategically placed displays alongside the route of this detour can help to increase sales by encouraging impulse buying
+ The possibility to reverse the direction of travel of both escalators depending on the usage or traffic flow

– Passenger flow through the building is interrupted, so overall traveling time to higher floor levels is increased

If you need traffic planning data or recommendations on how to improve the people flow within a particular building, please contact your local KONE sales organization.

Summary

Having decided on the number, location and arrangement of the escalators and autowalks needed to provide the most efficient traffic flow in the building, you can now turn your attention to the detailed specifications of the selected equipment, which is the subject of the next chapter.



Suvarnabhumi Airport
Bangkok, Thailand
24 KONE autowalks

Debenhams department store
Liverpool, United Kingdom
10 KONE escalators

5. Configuring your escalator or autowalk

Each escalator or autowalk is a complex combination of components and technical characteristics. Many of these characteristics – such as speed, step width, inclination, vertical rise, etc. – are available in various specifications. To make the selection of equipment as straightforward as possible, we have standardized many of these characteristics in our range of commercial escalators and autowalks. However, our infrastructure units are less easy to standardize due to a more diverse spectrum of requirements.

The purpose of this chapter is to walk you through these various possibilities and make recommendations for each type of building. Our goal is to ensure that your escalators and autowalks are properly configured to optimize the required flow of people through the building.

In addition, we also bring your attention to the key code-related restrictions of ASME A17.1 2010, where applicable. This will help you make the best informed decisions for the configuration of your units.

5.1 Load profile

In *Chapter 4.2* (metro station) we briefly mentioned the load profile. This is the indication of the passenger flow in a building and how the escalators and autowalks are stressed. A load profile is based on the quantity of passengers traveling on an escalator or autowalk, and the length of time and frequency they spend riding it. As we have seen, a load profile for a commercial escalator in a retail center is going to be different from that of an infrastructure escalator in a city metro station.

The following factors have an influence on the load profile:

Maximum step load
This is the maximum load on a particular step at any time. It is based on average weights of passengers and takes into consideration:

- Not every step is occupied all the time
- Only the visible steps can be loaded
- The step width, which influences the number of passengers

Average level of use
The level of use of an escalator varies throughout the day. In most public transportation settings, peaks occur during rush hours, but for most of the day there is less traffic. Each load profile has an average percentage based on the height and frequency of these peaks, troughs and plateaus.

Minimum safety factor
Different key components have different set tolerances, which exceed the load by a set factor. In other words, they are stronger or more durable. This is indicated by the safety factor (SF).

Truss
When the length of the escalator or autowalk results in the truss exceeding the maximum permitted deflection between the supports required by the local safety codes and specification requirements etc., you should provide an intermediate truss support. Please contact your local sales organization for more details.

Step chain
Two designs for step chains are available. They differ as to whether the step-chain rollers are inside or outside the step chain. The most commonly used step chains have inside rollers, and are used mainly for low- to mid-traffic applications. Outside rollers are usually used for mid- to high-traffic situations. Both designs fulfill the ASME A17.1 2010 safety factor 10 as a minimum.

A way to increase the availability of your escalator is to locate the step-chain rollers outside the chain links (available in KONE infrastructure escalators), as it leads to multiple benefits:

- It spreads the passenger load over a greater area, thus reducing wear in the step-chain pins and bushes; this is essential in demanding infrastructure environments
- Large diameter 4.0 in. (100 mm) step-chain rollers rotate at a slower speed than smaller diameter 3.0 in. (75 mm) rollers, resulting in a longer tire life
- Damaged or worn rollers can be quickly replaced without splitting the step chains, thereby maximizing availability by minimizing downtime
- The drive and tension carriage sprockets mesh with the step chain, not the step chain roller. This extends the tire and bearing life

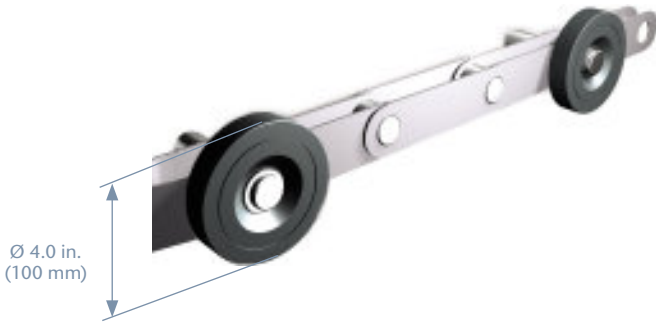


Figure 5.1 Step chain with outside rollers

Figure 5.2 Step chain with inside rollers

Fiera Milano Fairground
Milan, Italy
28 KONE horizontal autowalks

At KONE we take our commitment to eco-efficiency very seriously, which we define as the concept of creating better goods and services while using fewer resources and creating less waste and pollution. Eco-efficiency is therefore an integral part of KONE's processes and our objective is to lead the industry in eco-efficiency. Today we supply the most Eco-efficient™ products and services, and constantly work at minimizing the carbon footprint of our own operations.

5.2 Energy consumption

KONE has developed numerous measures and innovations to significantly cut the energy consumption of escalators and autowalks. Our starting point is obtaining precise information on areas such as:

- Motor power, which is defined by the cutoff rises (the motor power needed per rise limitation) of an escalator platform
- Passenger usage (frequent or low use, leading to load profile calculations)
- Mechanical, electrical and structural energy-saving features
- Energy consumption of optional equipment (lighting, heating, cooling)
- Quality aspects (proper maintenance, adjustments for reduced friction)

In addition, our global manufacturing network has adopted ISO 14001, the most well-known and globally recognized environmental management system standard. All of our North American facilities, including our manufacturing plants in Coal Valley, Ill., and Torreon, Mexico, as well as our supply unit in Allen, Texas, and most of our global manufacturing facilities hold ISO 14001 certification. The KONE Corporation complied with ISO 14001 in early 2009.

To enhance the eco-efficiency of your operations, consider the options listed on the following pages. Many of the solutions described in this chapter are also available as easy-to-install retrofit packages.

KONE has developed an advanced energy consumption tool, that can be utilized to calculate the total energy consumption of the escalator or autowalk. This tool can be used to verify the impact of different operational parameters and product options to the total energy consumption. Please feel free to contact the local KONE sales organization for specific energy consumption fi gures and detailed analysis and recommendations.

1. Energy management

Power feedback units

- Solutions for regeneration of power from the downward running of the passenger-loaded escalator are available where an inverter is installed
- Replaces brake resistors, which generate heat
- Technology for extensively used escalators
- Energy savings[3)]: during peak traffic times, 7100 KWh/year[1)]
- Carbon footprint reduction: 7,496 lbs. (3400 kg) CO_2/year[2)]

2. Operational mode

EcoStart® operation

- Energy performance control device and solid-state soft starter.
- Constantly monitors the load on the escalator. When there is little or no traffic, the EcoStart reduces the voltage and current to meet the necessary workload, while maintaining the designed speed.
- The soft-start feature reduces the in-rush current, gradually increasing power until the motor reaches its operating speed
- Decreased voltage and current enables the motor to run up to 24% cooler and the soft-start feature reduces in-rush of current up to 75%, which extends the equipment life
- Energy savings: up to 40% depending on passenger load, motor and drive, 1900 kWh/year
- Carbon footprint reduction: 2,050 lbs. (930 kg) CO_2/year[2)]

Standby speed operation
(by inverter control)

- Escalator runs at reduced speed with no passengers on the step band (changing from a nominal speed of 100 fpm (0.5 m/s) to a standby speed no less than 10 fpm (0.05 m/s), per ASME A17.1 2010 Code
- Recommended for medium traffic or several peak and non-peak intervals
- Provides additional benefit of reduced wear on the moving parts of the escalator or autowalk
- Energy savings: up to 40% depending on passenger traffic, load, motor and drive, 2560 kWh/year[1)]
- Carbon footprint reduction: 2,734 lbs. (1240 kg) CO_2/year[2)]

3. Safety

Closed-loop brake

- A closed-loop brake controller is utilized to control the deceleration rate of the escalator or autowalk regardless of load
- A smooth, consistent stop throughout the load range of the autowalk or escalator. From no load to full load on the escalator, the brake controller will provide the same smooth stopping profile.
- Reduced brake maintenance; the brake does not require constant adjustments to meet torque specifications
- Longer brake life; the closed-brake controller only, and always, applies the minimum brake torque to meet the programmed deceleration rate
- Compensates for variations in brake torque that can occur over time due to temperature fluctuations, brake wear or other environmental changes

4. Mechanical systems

Lubrication-free step chain

- Permanent greased and sealed chain links do not require extra lubrication with oil
- No oil consumption; the truss stays oil-free
- Reduced wear of chain links and bushings
- Reduced fire risk
- Average oil savings with commercial escalators .25–.5 gallons/month, transit escalators 1.25 gallons/month

5. Aesthetic features

LED lighting

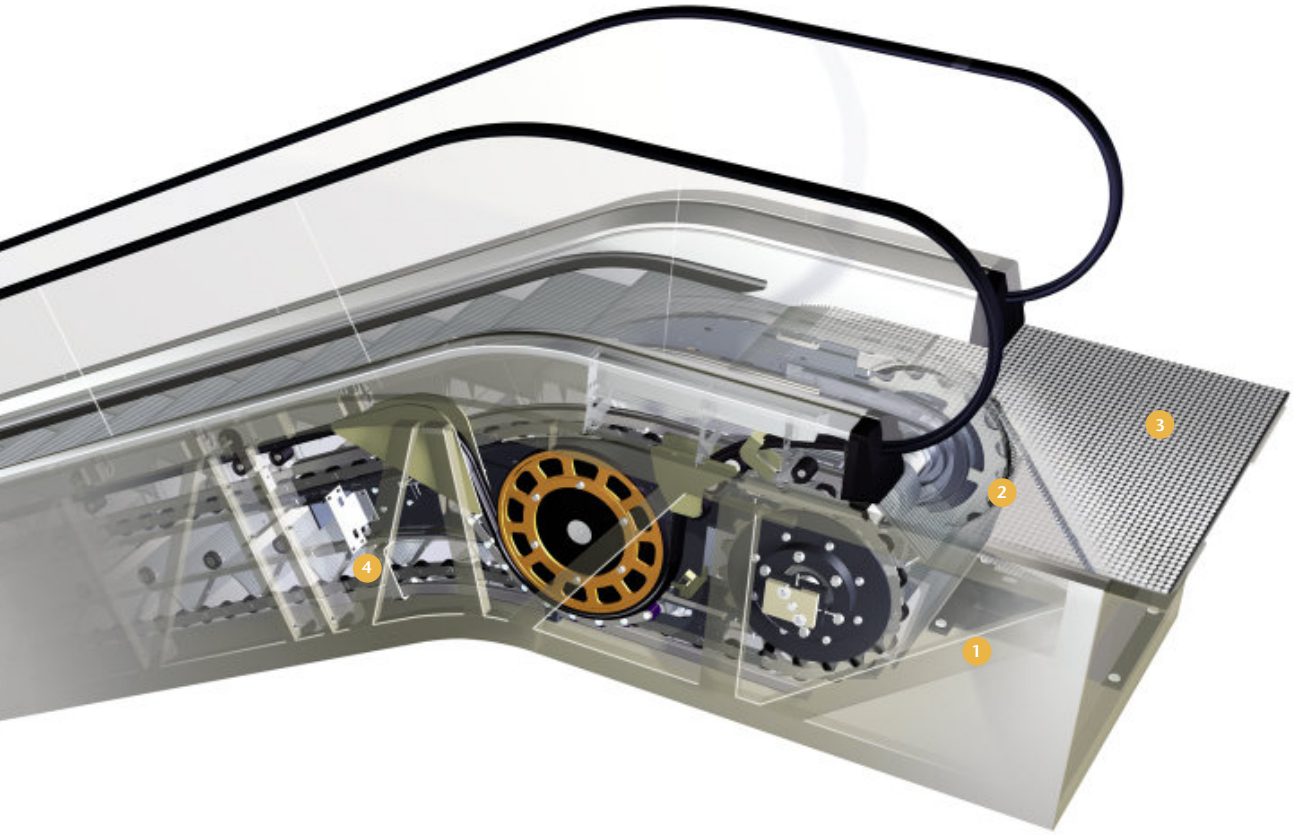
- Significant energy savings: consumption only 2–10 W/m compared to 60 W/m of a fluorescent tube lighting
- Extended service life – up to 50,000 hours
- Energy savings: 80%, 1960 kWh/year compared with conventional lights
- Carbon footprint reduction: up to 2,094 lbs. (950 kg) CO_2/year[2)] depending on application

[1)] Values are based on theoretical calculations concerning a reference escalator: 7.5 kW/worm gear/40 in. (1000 mm) step width /15 ft. (4.5 m) vertical rise/30°/0.5m/s / continuous mode/100kg nominal step load/ load profile: 2h - 0%, 8h - 25%, 2.5h - 50%, 1h - 75%, 0.5h - 100% / operation time: 14 h/day, 6 days/week, 52 weeks/year

[2)] Emission coefficient equal to 17 oz. (485 g) CO_2/kWh based on the EU electrical energy mix

[3)] This is a maximum value for downwards running escalator only. The effective energy saving depends on the passenger traffic and load.

Figure 5.3 LED skirt spotlighting



5.3 Step width

Escalators

Escalators are generally available in three step widths: 24, 32 and 40 in. (600, 800 and 1000 mm).

ASME A17.1 2010 The maximum and minimum permitted step widths under ASME A17.1 2010 are 40 in. (1000 mm) and 22 in. (560 mm), respectiviely.

24 in. (600 mm) step width

- Allows only one adult passenger to stand on each step
- Should only be selected where space for an escalator is restricted, as it is uncomfortable for passengers and presents an old-fashioned appearance
- As space is very restricted between the balustrades, this width is only suitable for installations where passengers will not be carrying large shopping bags or luggage

32 in. (800 mm) step width

- Allows one adult passenger and a small child, or one adult passenger with shopping bags or luggage (i.e. 1.5 passengers) to stand on each step
- Suitable for medium- or low-usage installations, such as shops

40 in. (1000 mm) step width

- Allows two adult passengers to stand on each step
- Maximizes transport capacity for high-usage installations such as large department stores, shopping malls, airports and railway stations

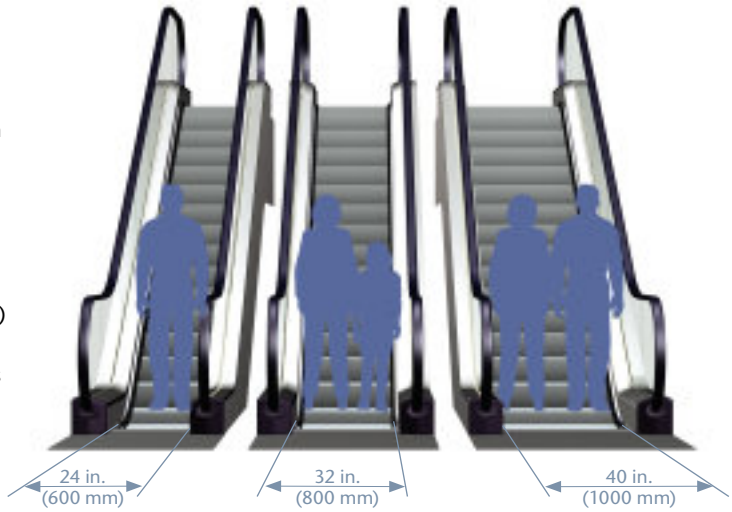


Figure 5.4 Escalator step widths

Horizontal autowalks

KONE horizontal autowalks are available with pallet widths of 32 in. (800 mm), 40 in. (1000 mm), 48 in. (1200 mm) and 56 in. (1400 mm). Per ASME A17.1 2010, autowalks are not permitted to have an angle of inclination greater than 12° at any point.

- Generally available in pallet widths of 32 in. (800 mm), 40 in. (1000 mm), 48 in. (1200 mm) and 56 in. (1400 mm)
- As the majority of autowalks are for high-usage installations, such as airports, a 56 in. (1400 mm) pallet width is always preferable
- 56 in. (1400 mm) pallet allows two adult passengers to stand on each one and thereby maximizes the transport capacity
- 40/48 in. (1000/1200 mm) pallet widths are suitable for medium- or low-usage installations, such as smaller airports or hospitals
- 40/48 in. (1000/1200 mm) pallet width allows one adult passenger and a small child to stand on each pallet or one adult passenger with shopping bags or luggage
- 32 in. (800 mm) pallet width are suitable for medium- or low-usage installations, such as shops. This pallet width allows one adult passenger and a small child to stand on each pallet or one adult passenger with shopping bags or luggage

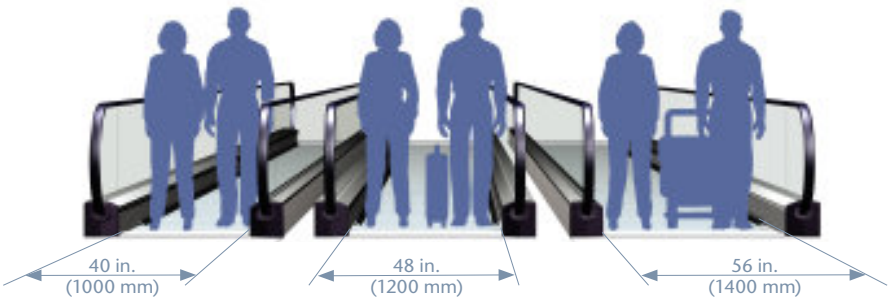


Figure 5.5 Horizontal autowalk pallet widths
**Step width also available in 32 in. (800 mm) width*

5.4 Nominal speed

Escalators
The rated speed shall not be more than 100 fpm (0.5 m/s), measured along the centerline of the steps in the direction of travel.

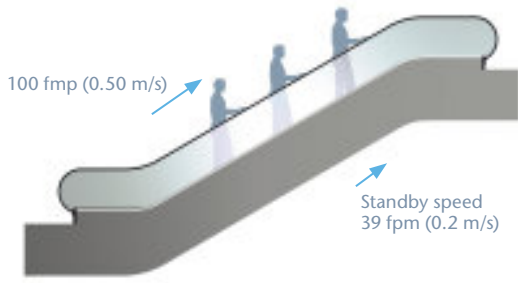


Figure 5.6 The nominal speed for escalators and autowalks

Horizontal autowalks
The two speeds available are:

- 100 fpm (0.5 m/s) – for short autowalks or when other considerations warrant a slower speed and comfort of use
- 130 fpm (0.65 m/s) – normally specified for autowalks as it offers a good compromise between passenger capacity, comfort and energy efficiency

The speeds of KONE escalators and autowalks are summarized in *Table 5.1*.

Table 5.1 Summary of the speeds available with KONE escalators and autowalks

	0.50 m/s	0.65 m/s
Commercial escalators	Standard	N/A
Infrastructure escalators	Standard	N/A
Horizontal vautowalks	Standard	Optional

5.5 Inclination of escalators

ASME A17.1 2010

Angle of inclination
The angle of inclination shall be designed not to exceed 30˚ from the horizontal, but due to field conditions at the site, shall be permitted to exceed this maximum by 1˚. The angle shall be measured at the centerline of the steps.

Used in both commercial and infrastructure applications.

5.6 Inclination of autowalks

ASME A17.1 2010

Angle of inclination
The angle of inclination from the horizontal shall not exceed 3˚ within 36 in. (900 mm) of the entrance and egress ends and shall not exceed 12˚ at any point.

Horizontal autowalks
By definition, a horizontal autowalk has a 0° inclination, although we can adjust between 0˚ and 3˚ at the ends for no wellway applications. A horizontal autowalk is normally used in airports or exhibition centers for the horizontal movement of passengers.

5.7 Horizontal (level) steps/pallets

Horizontal (level) steps are required at each landing of an escalator to enable passengers to safely board and disembark the moving step band. They allow passengers to steady themselves and position their feet correctly on the steps before reaching the transition curve into the inclined section. When disembarking, horizontal steps allow passengers to safely step off the moving step before their feet touch the combs. Escalators must be equipped with horizontal steps on both ends.

Figure 5.6 Horizontal steps enable a passenger to step safely on and off the escalator

Escalators

ASME A17.1 2010

Flat steps

There shall be a minimum of two and a maximum of four flat steps at the entrance and exit of every escalator.

Dimensions of steps

The depth of any step tread in the direction of travel shall be not less than 16 in. (400 mm), and the rise between treads shall not be more than 9 in. (220 mm). The width of a step tread shall not be less than 22 in. (560 mm) nor more than 40 in. (1000 mm).

5.8 Vertical rise (travel height)

Table 5.2 gives an overview of the common vertical rise possibilities for different building segments. For actual product information please refer to the product vs. segment matrix as well as the product-specific modules in the other sections of this Planning Guide.

	Equipment	Rise		Equipment	Rise
	Retail/office/hotel/ medical escalators	7 to 40 ft. (2 to 12 m)		Airport escalators	7 to 40 ft. (2 to 12 m)
	Leisure escalators	7 to 60 ft. (2 to 18 m)		Public transportation escalators	10 to 142 ft. (3 to 40 m)

Table 5.2 The most common vertical rises used in different buildings (others are possible)

Escalators and autowalks

ASME A17.1 2010 puts no limit on the vertical rise of an escalator or maximum length of a horizontal autowalk.

5.9 Transition radii

Various transition radii are available, depending on the environment and the space availability. *Table 5.3* displays our recommended combinations. In the table, 1.5/1.0 refers to a transition radius of 1.5 at the top and 1.0 at the bottom. You are advised to consult the product-specific module to find out what is available per product type.

Table 5.3 Recommended transition radii for escalators

Commercial escalators

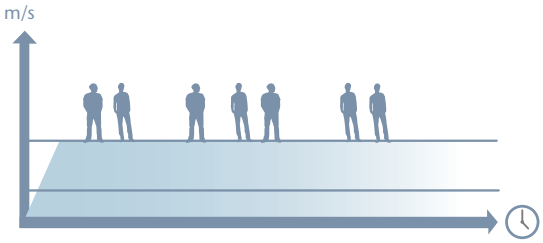
- 1.0/1.0 (Available 30°, 2 horizontal steps)
- 1.5/1.0 (Available 30°, 2 or 3 horizontal steps)

Infrastructure escalators

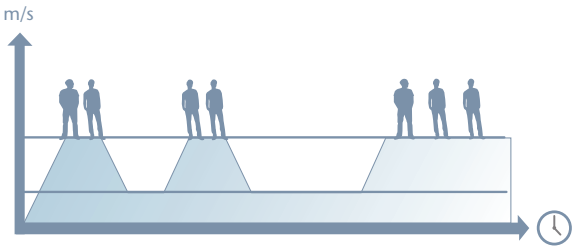
- 1.5/1.0 (Available 30°, 2 or 3 horizontal steps)
- 2.7/2.0 (Available 30°, 3 or 4 horizontal steps)
- 3.6/2.0 (Available 30°, 3 or 4 horizontal steps)

5.10 Operational modes

The operational mode describes the way the unit is operated by the controller.



A Continuous:
The unit is started by a key switch and runs continuously in the selected direction until stopped by a key switch or the emergency stop.



C Standby speed:
This mode of operation allows the inverter to slow the unit down to a standby speed. The standby speed is approximately 40% of nominal speed, namely 39 fpm (0.2 m/s) for an escalator normally operating at 100 fpm (0.5 m/s).

Passenger detection
The passenger detection feature is used for standby speed mode of operation. The most common means of passenger detection are photocells or radar devices.

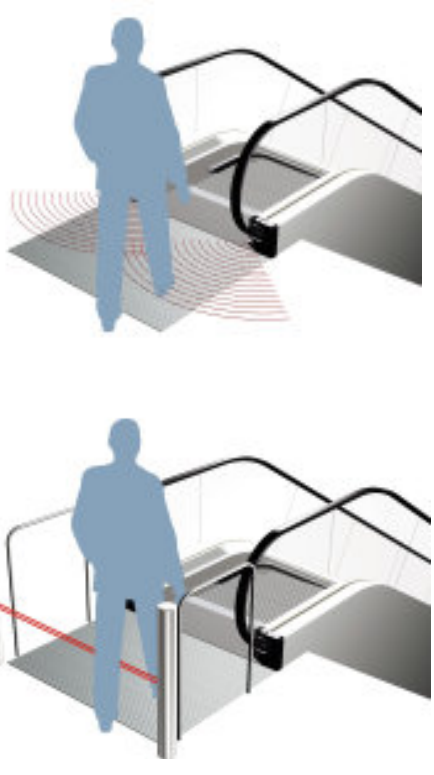


Figure 5.8 Passenger detection by radar or a photocell

5.11 Type of balustrade

Standard glass balustrade

Suitable for shops and airports

- Slim handrail base profile for a visually light appearance preferred by architects and interior designers in modern buildings
- Balustrade panels:
  - 0.4 in. (10 mm) thick clear tempered glass
  - Self-supporting without the need for support mullions
  - Separated into standard lengths
  - Neatly butt up to each other without cover strips
- Can be supplied with one balustrade in glass and the other in stainless steel, or both in stainless steel.

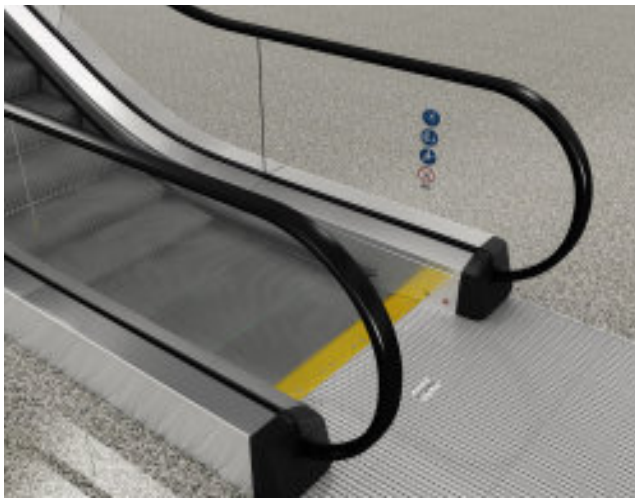


Figure 5.9 A glass balustrade is an attractive option for shops and airports

Vertical or inclined solid balustrade

- Particularly suitable for public transportation, semi-outdoor or fully outdoor installations
- More durable and vandal resistant than a glass balustrade
- Normally manufactured from satin stainless steel
- Only available with a 40 in. (1000 mm) height and not on all KONE escalator types. (Please refer to the product-specific modules.)

Figure 5.10 A solid inclined balustrade is more suitable for infrastructure escalators

Extended balustrade

- Used when an escalator is installed in an open wellway, where there is no floor to the sides of the access covers. In this case the building's static balustrades (not provided by KONE) must be turned through 90° to provide a safe interface with the escalator's balustrades. As this type of interface generally looks untidy, extended balustrades are available as an option (28 in. [700 mm]) at either the top landing or at both landings
- Allows static balustrades to neatly interface with the side of the escalator balustrade to offer a more aesthetically pleasing solution
- Is not available for all products; please refer to the product-specific modules.

Figure 5.11 Standard arrangement without extended balustrade requires 90° static railings to be installed for safety reasons

Figure 5.12 An extended balustrade allows railing to neatly butt against the escalator balustrade

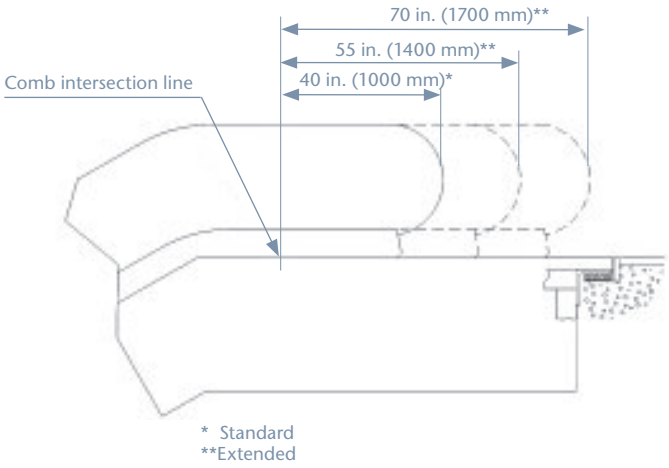


Figure 5.13 Different extended balustrade lengths

5.12 Balustrade height

Balustrade height is measured vertically to the top surface of the handrail from the nose of the steps on the inclined section and from the finished floor level at the landings. The standard balustrade height for escalators is 40 in. (1000 mm).

Our standard balustrade height of 40 in. (1000 mm) is higher than the ASME A17.1 2010 required minimum height of 36 in. (900 mm). The higher balustrade increases safety for adults, as the higher the balustrade, the less likely passengers are to fall over the balustrade if they lose their balance.

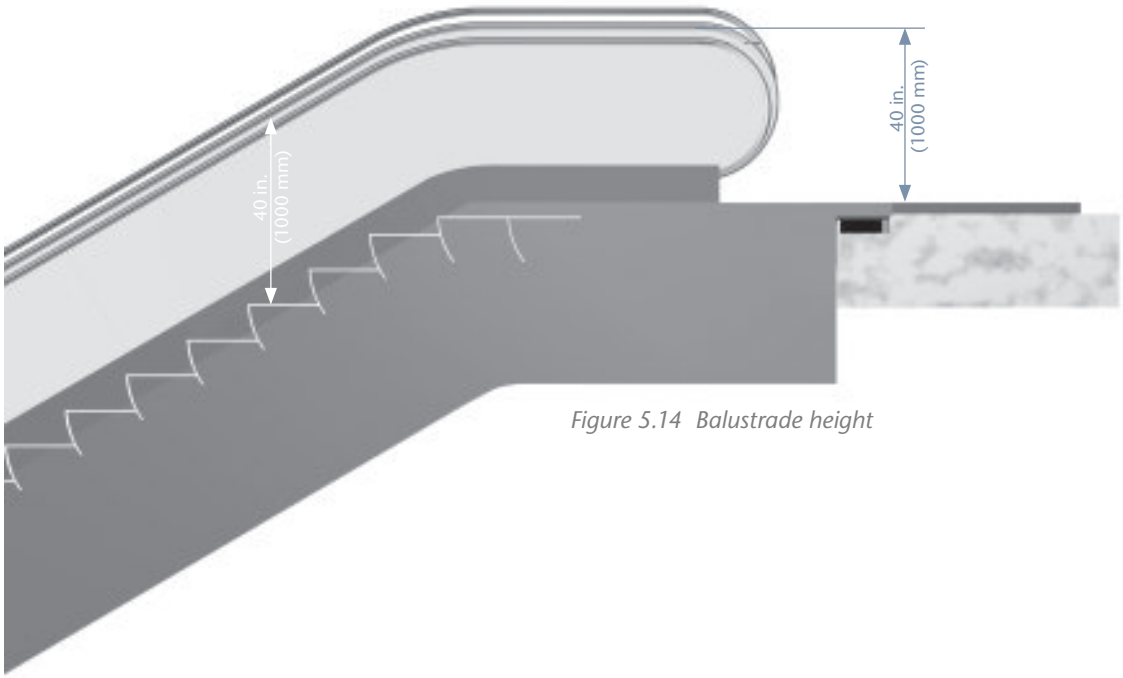


Figure 5.14 Balustrade height

Summary

With the information gathered so far in this Planning Guide, you should be able to specify a certain configuration for your escalators or autowalks. This should include:

- Load profile
- Energy consumption
- Step width, speed and inclination
- Horizontal steps/pallets
- Vertical rise
- Operational modes
- Type and height of balustrade

The construction of your chosen equipment depends on the prevailing standards and regulations in your area, which are generally ASME A17.1 2010, although local standards might apply.

Rome Metro
Rome, Italy

Bras Basah Station
Singapore
12 KONE escalators

6. Construction considerations

At KONE the safety of passengers and service engineers using and maintaining escalators and autowalks is of paramount importance. To ensure their safety, it is therefore imperative that your escalator or autowalk is constructed and installed in full compliance with an internationally recognized safety standard.

The objective of this chapter is to present you with the ASME A17.1 2010 code restrictions and considerations that you should take into account when designing your project and integrating escalators and autowalks within the project.

This chapter clarifies issues such as:

- Passenger circulation area
- Handrail and headroom clearance
- Protective barriers
- Head guards
- Railings

6.1 Passenger circulation area

To ensure that passengers can safely board and disembark the escalator or autowalk, a clear passenger circulation area must be available at each landing to allow their unimpeded movement. The passenger circulation areas for single and adjacent escalators are as follows.

ASME A17.1 2010

Safety zone

The entry and exit zone shall be kept clear of all obstacles. The width of the zone shall not be less than the width between the centerlines of the handrails plus 8 in. (200 mm). The length of the zone, measured from the end of the newel, shall not be less than twice the distance between the centerlines of the handrails (*Figure 6.1*). Space shall be provided to accommodate all traffic in the safety zone.

NOTE: These dimensions are absolute minimums.

For parallel escalators or autowalks the recommended clear passenger circulation area is shown in *Figure 6.2*.

NOTE: For autowalks where shopping or baggage carts are used, we recommend you to increase the passenger circulation area in front of the autowalk as much as possible, for example to 17 ft. (5 m), this to increase the efficient people flow within the building.

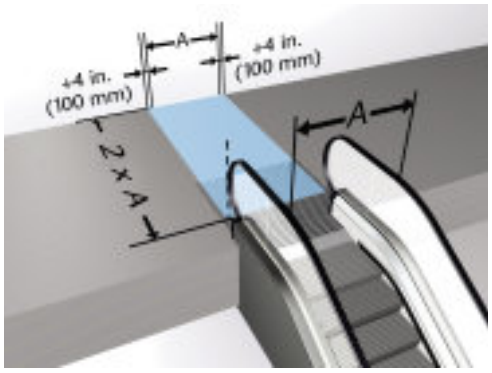


Figure 6.1 Passenger circulation area for single escalators
A = distance between handrail centerlines

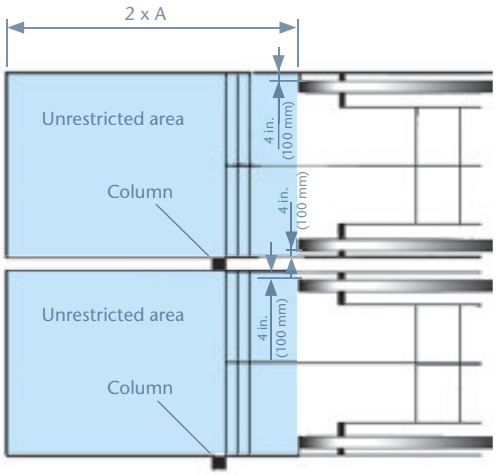


Figure 6.2 Passenger circulation area for parallel escalators

Sokos department store
Lahti, Finland

6.2 Minimum handrail and headroom clearance

The key points regarding handrail and headroom clearance are described below (see *figures 6.3 and 6.4*).

A: The handrail shall be a minimum of 4 in. (100 mm) horizontally and 1 in. (25 mm) vertically away from adjacent surfaces, except that rounded fillets or beveled sides of the handrail stand are permitted to reduce the 1 in. (25 mm) clearance between the handrail and the point where the handrail stand is connected to the balustrade. The centerline of the handrail shall not be more than 10 in. (240 mm), measured horizontally, from the vertical plane through the edge of the exposed step.

B: Headroom. The minimum headroom shall be 84 in. (2130 mm) measured vertically from the step noseline, landing plates and landings.

C: Adjacent Floor Surfaces. The adjacent floor surfaces at each landing shall be continuous with the top of the landing plate with no abrupt change in elevation of more than 0.25 in. (6 mm).

D: Floor Opening Protection Adjacent to Escalator Wellway. Floor openings adjacent to the entire length of the escalator wellway shall be provided with protection in accordance with the applicable building code.

Product-specific information on handrail and headroom clearance will be provided to you by KONE.

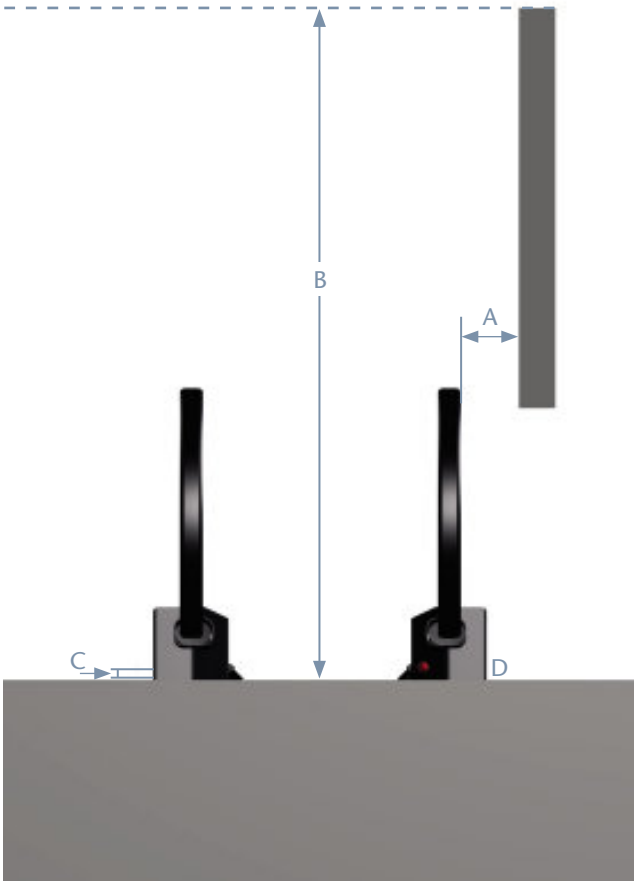


Figure 6.3 Minimum free area around escalators and autowalks

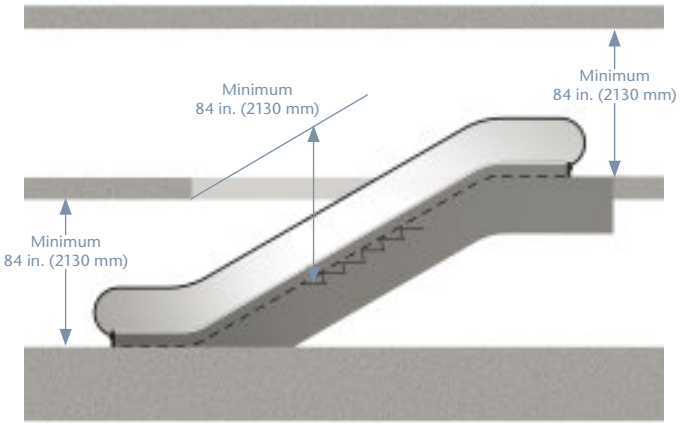


Figure 6.4 Minimum headroom clearances

6.3 Protective barriers

Appropriate structural measures should be installed to prevent people from accessing escalators or autowalks from the side. Protective barriers and guards are to be provided on the balustrades where necessary. To prevent misuse and contact to the building structures, several deflectors have to be installed as mandatory.

Deck barricades

(a) A barricade to restrict access to the outer deck on low deck exterior balustrades shall be provided at the top and bottom ends of each escalator where the outer deck width exceeds 5 in. (125 mm). On parallel abutting units, this protection shall be provided where the combined outer deck width exceeds 5 in. (125 mm). The barricade shall extend to a height that is nominally 4 in. (100 mm) below the top of the handrail.

(b) When an escalator is not located at the edge of a floor surface, the barricade shall be installed on the outer deck at a point 40 in. (1000 mm) above the floor where the bottom of the barricade intersects the outer deck.

(c) On parallel adjacent escalators, where the common low deck between adjacent interior panels exceeds 16 in. (400mm), deck barricades should be spaced evenly up the incline at no greater than 15 ft. (4.6 m) measured on a line parallel to the direction of travel.

(d) Barricades made of glass or plastic shall conform to the requirements of 6.1.3.3.3. All exposed barricade attachment fastener heads shall be of the tamper-resistant type.

Anti-slide devices

On high deck balustrades, anti-slide devices shall be provided on decks or combinations of decks when the outer edge of the deck is greater than 8 in. (200 mm) from the edge of the handrail, or on adjacent escalators when the unobstructed distance between the edge of the facing handrail is greater than 12 in. (300 mm).

These devices shall consist of raised objects fastened to the decks, no closer than 4 in. (100 mm) to the handrail, nor greater than 12 in. (300 mm) from the handrail. They shall not be spaced greater than 78 in. (2000 mm) apart as measured on a line parallel to the direction of travel and not greater than 12 in. (300 mm) as measured on a horizontal line perpendicular to the direction of travel. The height shall not be less than 2 in. (50 mm). There shall be no sharp corners or edges.

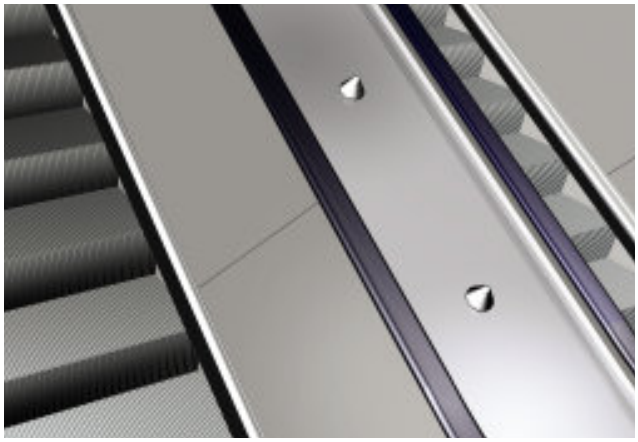


Figure 6.5 Anti-slide devices

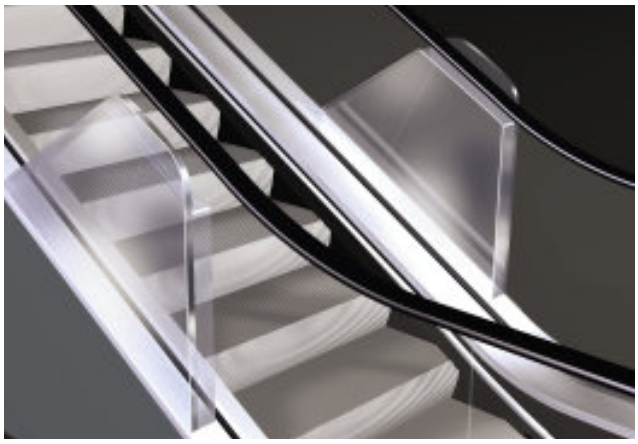


Figure 6.6 Deck guard (Outer decks)

Figure 6.7 Deck guard (Common center deck)

6.4 Head guards

Head/apex guards prevent passengers from getting trapped between the balustrade and building structure or other equipment. It is important that you install head and deck guards as follows.

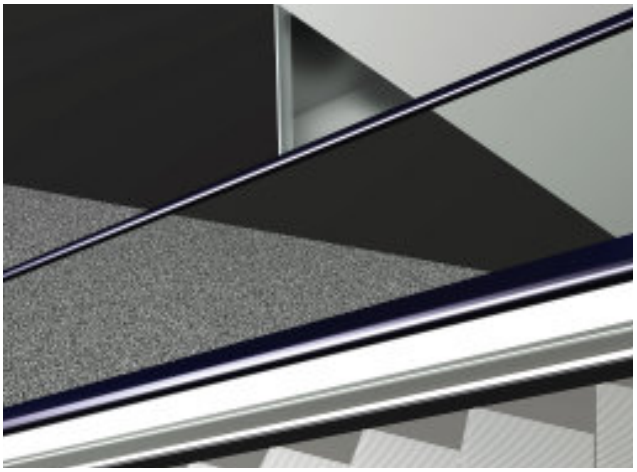


Figure 6.8 Head guard

ASME A17.1 2010

(a) On high deck balustrades, a solid guard shall be provided in the intersection of the angle of the outside balustrade deck and the ceiling or soffit, under the following conditions:

(1) where the clearance between the outside edge of the deck and the ceiling or soffit is 12 in. (300 mm) or less; or

(2) where the projected intersection of the outside deck and the ceiling or soffit is 24 in. (600 mm) or less from the centerline of the handrail.

(b) On low deck balustrades, a solid guard shall be provided to protect the intersection formed by the top of the handrail and the plane of the ceiling or soffit where the centerline of the handrail is 14 in. (350 mm) or less from the ceiling or soffit.

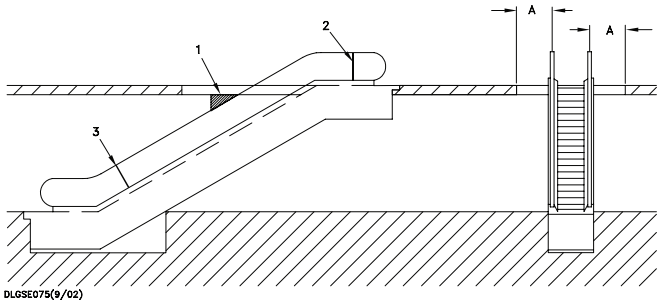
(c) The vertical edge of the guard shall be a minimum of 14 in. (350 mm) in length.

(d) The escalator side of the vertical face of the guard shall be flush with the face of the wellway.

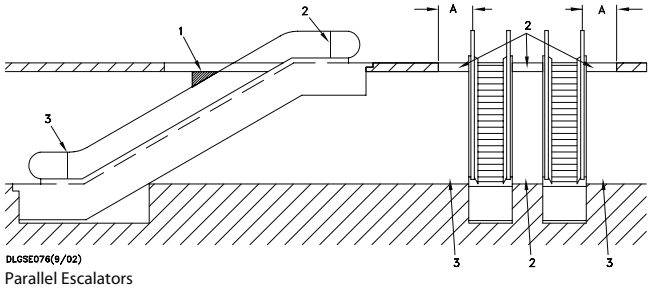
(e) The exposed edge of the guard shall present a minimum width of 1 in. (25 mm) and a minimum radius of 0.5 in. (12 mm).

(f) Guards are permitted to be of glass or plastic.

NOTE: Refer to local governing codes that may supersede dimensions (A, B, and C) described above.



Single Escalator

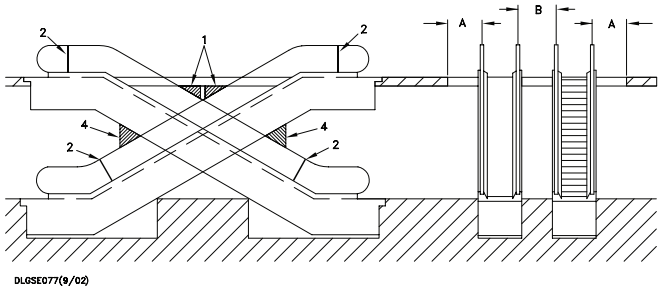


Parallel Escalators

Criss-Cross Escalators

A = Ceiling intersection head (apex) guards are required to protect the intersection formed by the top of the handrail and the plane of the ceiling or soffit where the centerline of the handrail is 14 in. (356 mm) or less from the ceiling or soffit.

B = Escalator truss intersection head (apex) guards are required to protect the intersection formed by the top of the handrail and the plane of the ceiling or soffit where the centerline of the handrail is 14 in. (356 mm) or less from the ceiling or soffit.



All head (apex) guards and deck guards must be installed before handover to the customer.

Please contact Customer Service for detailed dimension and fixing drawings of deflectors and guards.

6.5 Caution signs

A caution sign shall be located at the top and bottom landing of each escalator, readily visible to the boarding passengers. The sign shall include the following wording:

(a) “Caution”

(b) “Passengers Only”

(c) “Hold Handrail”

(d) “Attend Children”

(e) “Avoid Sides”

The sign shall be standard for all escalators and shall be identical in format, size, color, wording and pictorials as shown in *Fig. 6.9*. The sign shall be durable and have a maximum thickness of 0.25 in. (6.4 mm), with rounded or beveled corners and edges.

Figure 6.9 Caution sign

National Grand Theatre
Beijing, China
36 KONE escalators

Summary

In this chapter we looked at considerations surrounding the construction of the escalator or autowalk, such as:

- Passenger circulation area
- Handrail and headroom clearance
- Protective barriers
- Head guards

7. Modernizing your existing escalator

So far in this Planning Guide we have dealt with all the processes involved in planning and specifying a brand new escalator. However, it is not always necessary to go down this route. In many buildings, an escalator is already present. Unfortunately, it may also be outdated and not performing up to acceptable standards.

The approach is not necessarily to rip it out and install a new one. Another solution is to replace a non-performing and costly escalator with the latest and most efficient technology – without the hassle of major construction or changes to the environment. This is a great way to reduce escalator operating costs as well as ensuring that users are not inconvenienced by annoyingly frequent breakdowns.

This is exactly the objective of the KONE EcoMod™ solution.

KONE EcoMod solution

KONE EcoMod is a complete modernization solution that offers an innovative and systematic approach to replacing the entire workings of your escalators. It offers new technology without expensive and disruptive truss removal. The KONE EcoMod solution has been successfully applied to the majority of existing escalator models and in all market segments throughout the U.S. and Europe.

It has led to proven effectiveness in the installation process and measurable energy benefits thanks to a state-of-the-art main drive design and effective control of the operation time by frequency controllers.

Escalator technology has advanced significantly, making new features available that were not thought possible until recently. With the KONE EcoMod solution, you can fully replace your current escalator with the latest KONE technology, while keeping your existing truss.

- Improves reliability and performance
- Enhances safety
- Lowers life-cycle costs
- Increases perceived value through quiet operation, a smooth ride and improved appearance
- Lowers energy consumption
- Reduces risk of environmental contamination

Retaining the truss

- Gives you a new escalator at lower project cost as truss removal is eliminated
- Allows for a faster, cleaner and less disruptive installation
- Eliminates costly structural modifications
- Preserves existing building décor as well as escalator cladding and decking

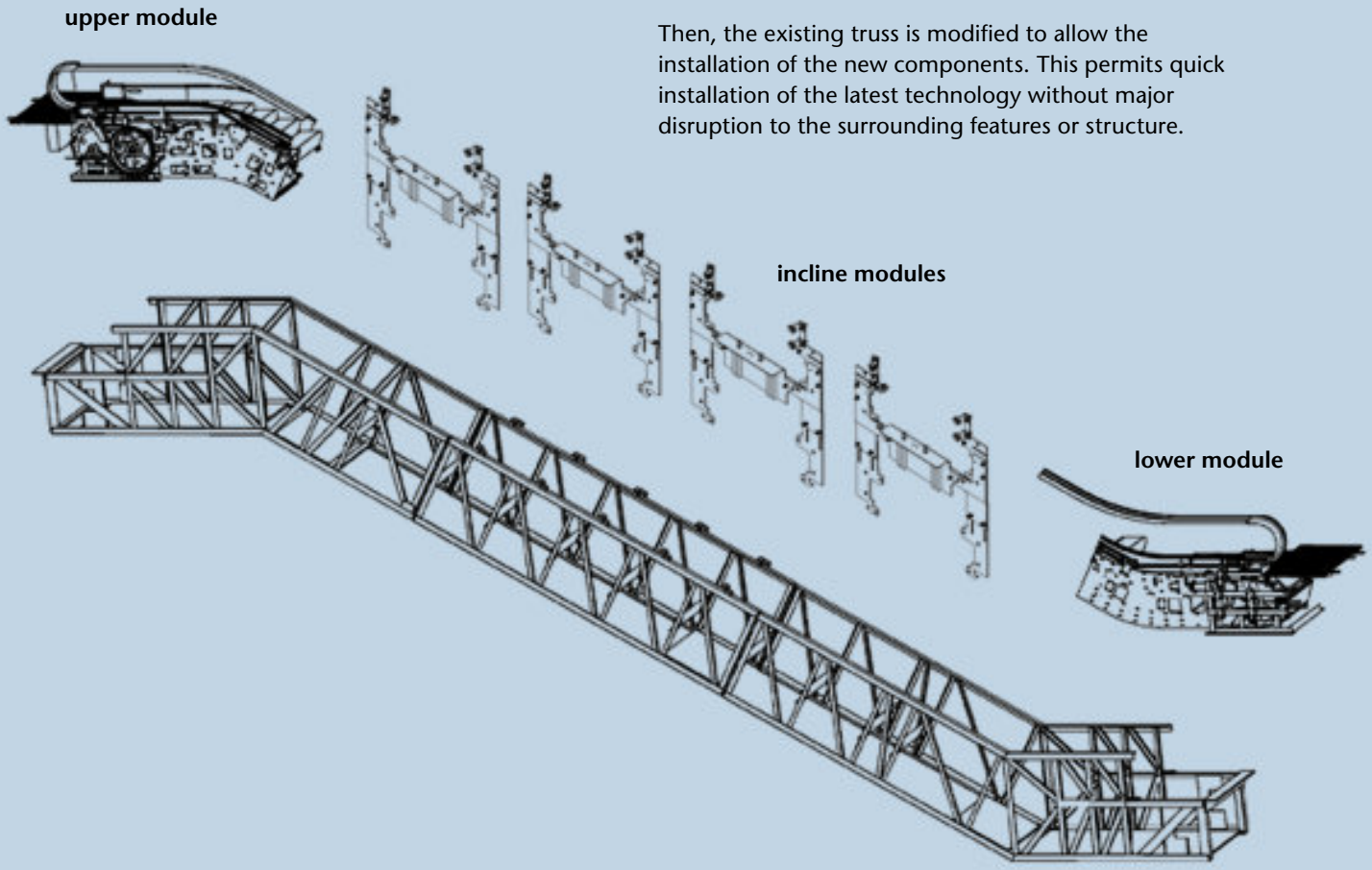
EcoMod: Introducing a New Solution

Phase 1 of the EcoMod process begins with the removal of all existing mechanical and electrical components from INSIDE the existing truss.

The result is a brand new escalator, however…

1) The existing truss is preserved…
2) The existing finishes remain in place…
3) No antiquated parts are reused…

Then, the existing truss is modified to allow the installation of the new components. This permits quick installation of the latest technology without major disruption to the surrounding features or structure.



7.1 A step-by-step process

The patented step-by-step installation process of the KONE EcoMod solution is based on modules that allow replacement to be made quickly with minimal impact on the building. This ensures that your improvement project can be implemented in a way that will both meet your financial constraints and reduce escalator downtime.

With the EcoMod product, all main areas of the escalator are addressed:

Mechanical

The energy-saving KONE ECO3000® Drive with a planetary gear replaces the old worm gear for significant performance improvements.

Electrical

A new microprocessor-based controller significantly improves the operation and energy efficiency of your escalator.

Step Chain

The unique lubrication-free and environment-friendly KONE ECO3000 chain eliminates service interruptions for lubrication and reduces safety hazards.

Safety Solutions

State-of-the-art technology for braking, safety switches, brush systems and demarcation lines bring your escalator in line with the latest safety standards.

Aesthetics

Options include new balustrades; new access covers, comb plates, skirts and deckings; new steps; and attractive lighting systems.

7.2 Safety solutions

When comparing today's safety code and technology to the code and technology in place when your escalators were installed, it is quickly apparent that different and more exacting requirements have become stipulated and superior technology has emerged. State-of-the-art technology for braking, safety switches, brush systems and demarcation lines bring your escalator in line with the latest safety standards. Some of the key requirements are:

- A brush system on each side of the steps can prevent shoes from becoming trapped between the steps and skirting panels
- Contrasting demarcation lines on your steps will increase visibility for users
- New safety switches enhance safety
- New braking system maintains the specified stopping distances under all load conditions in both directions, which increases safety
- Older escalators are often equipped with smooth step risers. New steps are installed (with cleated step treads and risers that intermesh) that are designed to reduce the possibility of objects becoming entrapped
- All escalator machine spaces – and other areas where access to the escalator is provided – are furnished with a stop switch to enable safe access by authorized personnel. Safety regulations require a handrail entry device, to detect an object prior to it entering the handrail inlet area. When activated, this device is designed to turn the motor off and activate the escalator brake.
- Comb impact devices at the upper and lower end to prevent combplate movement in either the horizontal or vertical direction
- Missing step detectors to detect a missing step and remove power from the motor, while activating the brake
- Step level device to detect a step that is about to enter the comb area at a lower elvation that the combplate

7.3 Mechanical

The energy-saving KONE ECO3000 Drive with a planetary gear replaces the old worm gear for significant performance improvements. The KONE ECO3000 Drive is chainless, even for the handrail drive, so drive chains no longer need to be greased (as is the case with the handrail drive on standard escalators). The KONE ECO3000 Drive only requires an oil change after 30,000 operating hours (twice as long as conventional drive systems). This reduces downtime and oil disposal costs, and increases availability. And compared to conventional drives, oil leaks and their associated odors belong to the past.

The innovative planetary gear arrangement is 96% efficient, resulting in lower energy consumption and reduced environmental impact. This is highly favorable when compared with the 82% efficiency of a worm gear and chain system. One direct drive machine powers both steps and handrails. Fully synchronized step and handrail movement enhances safety. A closed-loop, permanent-magnet brake compensates for load, continually adjusting to ensure smooth, constant deceleration for enhanced passenger safety.

An escalator equipped with a KONE ECO3000 Drive is distinguished by a smooth, comfortable ride, and a remarkable lack of vibration and noise. The motor, gear unit, step band and handrail drive units are combined to form an integrated chainless unit. This makes the KONE ECO3000 Drive the most reliable escalator drive unit on the market. The KONE ECO3000 Drive is monitored for excess speed, excess temperature and reversal of the motor direction, thus protecting the escalator against unnecessary damage.

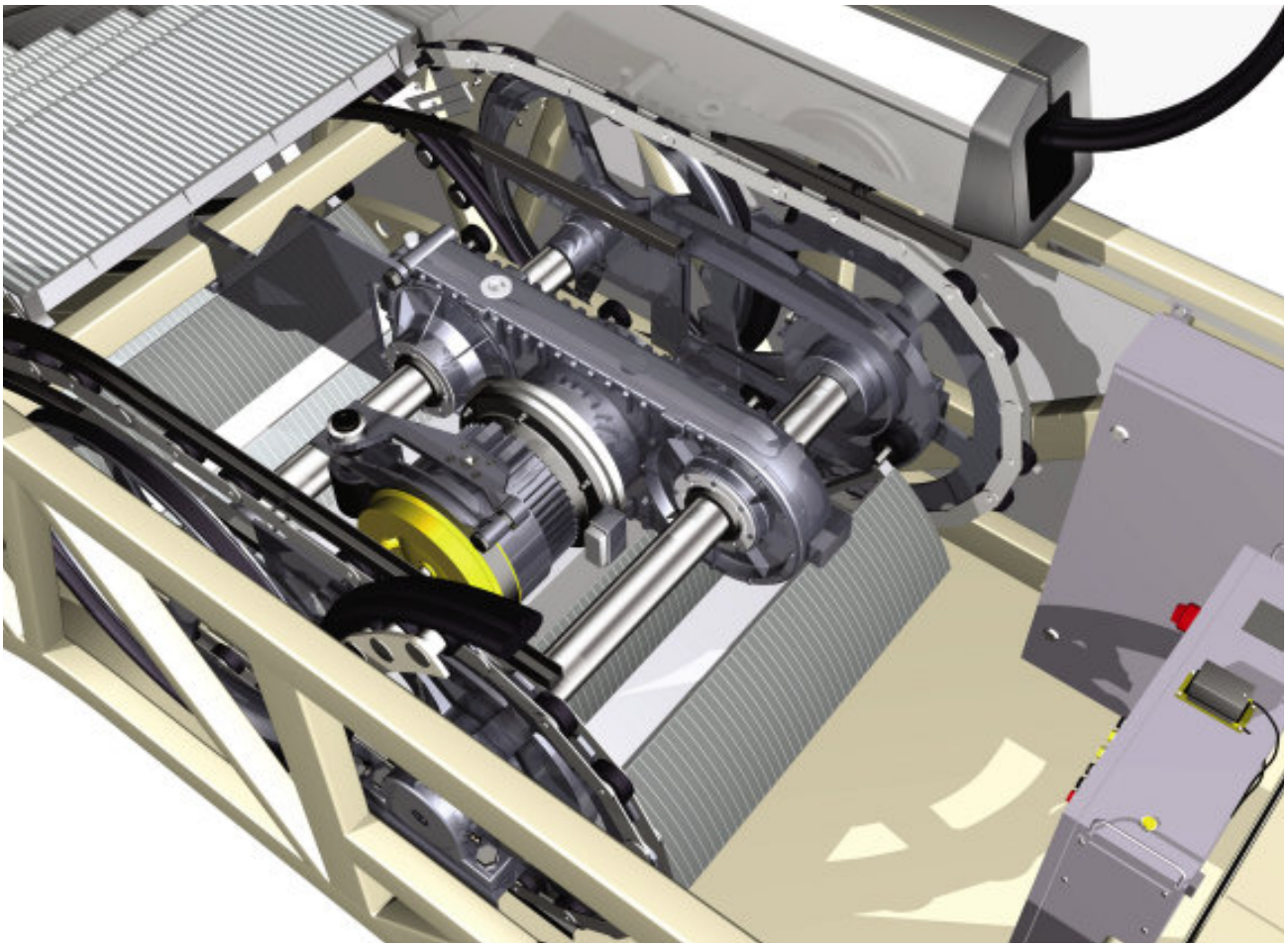


Figure 7.1 The heart of the escalator is the innovative KONE ECO3000 Drive, which provides increased reliability, reduced energy consumption, extended service intervals and a longer operating life

7.4 Electrical

A new microprocessor-based controller will significantly improve the operation and energy efficiency of your escalator. It can connect your escalators to building monitoring systems for more responsive management of safety and operational status, and can be used in conjunction with an electrical inverter to reduce energy consumption.

The new controller enables standby operation. It adjusts the speed based on usage, reduces the service interruptions of the escalator, and reduces energy consumption considerably.

Remote monitoring enables the operation of the escalator to be constantly monitored from a distance so that maintenance staff at a remote KONE service center immediately become aware of a problem.

A handrail speed monitoring device is designed to measure the variation in speed between the steps and the handrail. If the speed variation exceeds a pre-defined value, the escalator stops, guaranteeing a high standard of safety.

Braking system improves safety and reduces service interruptions, by ensuring that the braking distance is the same, irrespective of the number of passengers on the escalator.

7.5 Lubrication-free chain

KONE's patented KONE ECO3000 lubrication-free chain is an option which further reduces oil use and life-cycle costs while making your building even safer for the environment.

As its name suggests, a lubrication-free chain does not require regular oil lubrication. This significantly reduces maintenance time. Furthermore, as there is no accumulation of oil within the truss, internal truss cleaning requirements are minimal.

Lifetime lubrication of the KONE ECO3000 chain means no oil leaks, no oil smells and no risk of oil infiltrating through the cladding. The absence of leaking oil reduces potential smoke and fire hazards. Lubrication-free precision roller plate-link chains are made from high-grade tempered steel alloys. Cleaner escalators mean less downtime for cleaning, and increased availability. The absence of oil enhances the safety of the escalator and leads to significant environmental benefits.

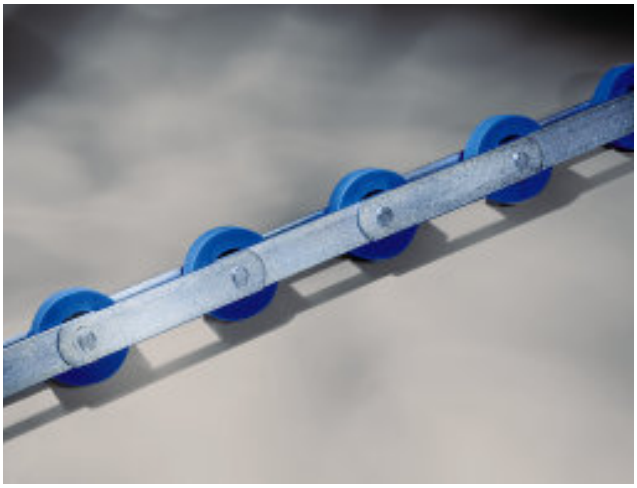


Figure 7.2 KONE is the only escalator manufacturer capable of supplying an escalator with "no free oil" in the system

7.6 Aesthetics

Architects and interior designers want to smoothly integrate escalators into their building designs, and are therefore interested in modernization options that allow this possibility. The KONE EcoMod solution keeps your escalator looking good for many years to come.

These options include the following:

- New glass or stainless steel balustrade panels
- New black or stainless steel skirt panels
- New stainless steel decking for glass or solid balustrade units
- New handrails with different color options
- New frontplates, combplates and access covers
- Skirt lighting and under-handrail lighting are also available options

Planning Guide Summary

We hope that you have found this Planning Guide helpful in planning and implementing your escalator or autowalk project. For more product-specific information please look at the accompanying product vs. segment matrix. This will allow you to see which KONE products we recommend for certain segments, such at public transportation, airport, retail, office, hotel, medical or leisure.

Based on our recommendations you can then look at the appropriate product-specific module to analyze the technical specifications of the product. You will immediately be able to see whether this product is suitable for you.

And remember that an electronic version of the Planning Guide is available as an InfoPack – our credit card sized memory stick – as well as on the www.us.KONE.com website.

List of figures:

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