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Technical recommendations in effect

BULLETIN N. 16
(edition 2000)

RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF CONVEYORS INTENDED AS A BOARDING HELP FOR CHAIRLIFTS

This Recommendation is not mandatory but provides guidance to the profession. Its application would be desirable in all countries, however, without prejudice to national standards as well as requirements specified by public authorities.

International Organisation for Transportation by Rope

O.I.T.A.F.

**RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF
CONVEYORS INTENDED AS A BOARDING HELP FOR CHAIRLIFTS**

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O.I.T.A.F. Committee n° 1

RECOMMENDATIONS FOR THE DESIGN AND CONSTRUCTION OF CONVEYORS INTENDED AS BOARDING HELP FOR CHAIRLIFTS

This type of conveyors is being installed with the purpose to improve boarding conditions and make it easier for passengers with downhill gliding outfit strapped to their feet to board a chairlift.

The following recommendations are based on the type of passenger conveyors that have already been installed and on operational experience made with conveyor assisted chairlifts. The application of the following recommendations, together with faultless performance of the technical equipment and thoughtful behaviour of passengers will help them to board the chairlift safely and without problems.

Summary

1. Principles of design of passenger conveyors intended as boarding help for chairlifts
- 2 Succession of boarding movements
2. Recommendations for fixed grip chairlifts
3. Recommendations for detachable grip chairlifts
4. Control and Monitoring
5. Operation
6. Annex

1. Principles of design of passenger conveyors intended as boarding help for chairlifts

- 1.1 Conveyor transportation of passengers to the to the point where passengers can board the chair requires the arrival of passengers to be orderly and regulated by a controlled access gate.
- 1.2 The approach incline (or approach ramp) leading from the controlled access gate to the beginning of the conveyor should be slightly sloping and have a good gliding surface. The length of the ramp should be kept as short as possible to prevent the boarding condition at the boarding point to be negatively affected by the irregular behaviour of passengers.

Reference value for the length of the approach ramp	1,0 m
Reference value for the slope of the approach ramp	10 %

- 1.3 Guides should be fitted on both sides of the approach ramp so as to progressively reduce its width and adjust it to the width of the conveyor. Care should be taken to avoid any shape or execution of guides that might cause the user to stumble or suffer injury by falling.
- 1.4 The length of the conveyor depends on the following variables : type of chairlift (fixed grip or detachable grip chairlift), operating speed of the chairlift, the speed of the conveyor, which in turn depends on the operating speed of the chairlift, the clocking values of the gates of the controlled access, the time interval between chairs and the behaviour of the passengers. Reference values of these variables are given in clause 2, 4 and 5.
- 1.5 The conveyor should have a width which is the sum of the width of the chair and of an additional width on both sides of the chair. For passengers to be able to position themselves in front of the seat to be occupied it is recommended to mark the conveyor with marks permitting to identify the width of the conveyor that corresponds to the the seats of the chair..

Reference value for the additional width	0.10 – 0.15 m
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- 1.6 Steps shall be taken to make sure that any inspection or maintenance that need to be carried out on the traveling conveyor may be carried out easily and in safe conditions.
- 1.7 Care shall be taken to adopt a proper design of the conveyor, its fixed structures and lateral guards to eliminate the hazard of passenges falling and getting trapped between the conveyor, its fixed structures and lateral guards.
- 1.8 Appropriate measures should be taken to limit a likely lateral drift of the conveyor (for instance lateral guides)
- 1.9 Steps should be taken to maintain the boarding height (vertical distance from the central point of the leading edge of the seat of an empty chair to the surface of the conveyor) constant along the whole length of the boarding area.

Reference value for the boarding height	50 to 55 cm
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- 1.10 The layout of the conveyor shall be designed so as to make it possible to maintain the required clearance between the conveyor and the lowered footrest of a chair carrying its useful load. This applies also to chairs which are deflected from their rest position to the extent that guides, if any, permit this distance to be maintained

Reference value for the required distance **> 0**

- 1.11 If for any reason which is independent of the chairlift the travel of the conveyor is stopped (for instance power failure or in the case mentioned in clause 5.1) the intrinsic deceleration of the conveyor shall not exceed a speed which is not tollerable for passengers.

Deceleration reference value **0.5 m/s²**

2 Succession of boarding movements

- 2.1 Movements made by the passenger while boarding and by the chair while it is boarded shall have to meet the following requirements :
1. Any passenger, whose behaviour is reasonable, should be able to board the chair and get seated on the seat within the limits of the boarding area whatever the speed of the chairlift **(boarding condition)**
 2. No passengaer, whose behaviour is reasonable, should ever collide with the preceding chair **(condition of no collision)**
- 2.2 For the verification of the boarding condition of fixed grip chairlifts and of the condition of no collision of fixed grip and detachable grip chairlifts the effect of operational acceleration and operation deceleration shall have to be considered as well as the precision tolerance of the devise that monitors the synchronism of chairlift and passenger conveyor.
- 2.3 The approach ramp is given by the distance passengers have to cover on their way from the controlled access gate to the first possible boarding point
- 2.4 The time taken by the passenger to cover the distance from the controlled access gate to the passenger conveyor varies from one passenger to another. For the purpose of verifying the boarding condition and the condition of no collision it is therefore necessary to assume two different successions of movement of the passengers who board the chairlift with downhill gliding outfit strapped to their feet. The “quick starter” who starts and rushes down the approach ramp and onto the conveyor even before the gate is fully open and the “slow starter” who takes his time and waits till the gate is fully open and then moves slowly down the approach ramp and onto the passenger conveyor.
- 2.5 The lowest possible operational speed of the chairlift that meets the requirements of the boarding condition and condition of no collision shall have to be specified.
- 2.6 The condition of no collision shall be deemed to have been satisfied as long as a given safety distance is maintained between a “quick starter” and the preceding chair.
For the determination of the safety distance between passenger and preceding chair the cupola of the covered chair, if any, shall be assumed to be open.

Reference value for the safety distance **50 cm**

- 2.7 The geometrical earliest possible boarding point is the point in which the travel of the front edge of the seat takes a direction that is parallel to the line of travel of the passenger conveyor.

- 2.8 The direction of the chair travel and of the passenger conveyor shall be parallel throughout the boarding area and the safety stretch of the track.
- 2.9 In order to meet requirements for the boarding condition and condition of non collision it is essential to regulate in an appropriate way the clocking values of the controlled access gates (opening signal, time needed to open and time during which gates remain open). If on one side it is important to have the shortest possible time to open and time during which the gate remains open in order to reduce to a minimum the differences of the times needed by the quick or respectively by the slow starter, on the other side the clocking time should be long enough for passengers to have comfortable conditions of approach. Reference values for the clocking time of the controlled access gates are based on experience made with conveyor assisted chairlifts.

Reference value for the time needed by the the controlled access gates to open

approx. 0.5 m/s to 0.7 m/s

Reference value for the time during which the controlled access gates are kept in the fully open position

aprox. 2.0 to 2.2 m/s

- 2.10 The time needed by the passenger to cover the whole distance of the approach ramp depends on the slope of the ramp, the surface quality of the ramp (frozen or soft) and skill and behaviour of the passenger. Reference values for the time needed are based on the experience made with conveyor assisted chairlifts.

Reference value for the time needed on an average by passengers to cover the approach ramp

approx. 0.7 m/s to 1.2 m/s

3. Regulations for fix ed grip chairlifts

- 3.1 The determination of the length of the passenger conveyor shall be based on the following data
- structural details of the layout of the chairlift (e.g. track gauge, width of the chair, slope of the approach ramp, position of the of the controlled access gates)
 - operating conditions of the chairlift (e.g. operating speed, time between chairs, deceleration values)
 - set clocking values of the controlled access (opening signal, time needed to open, time during which the gate remains open)
 - movement of the passenger (fast or slow movement, quick or slow start)
- 3.2 The length of the passenger conveyor is made up of the following three stretches :
- feeder stretch (initial point of the conveyor till the initial point of the boarding area)
 - boarding stretch (initial point of the boarding area till the tail end of the boarding area)
 - safety stretch
- 3.3 The safety stretch shall be at least 1,0 m long.
- 3.4 The maximum permissible travel speed of the passenger conveyor shall be 1.0 m/s-

- 3.5 Chairlifts that are boarded by passengers having a downhill gliding outfit strapped to their feet shall be permitted to run with the following maximum permissible travel speed
- | | |
|----------------------------------|---------|
| two seater chairlifts | 2.8 m/s |
| three seater and quad chairlifts | 2.6 m/s |
| chairs with more than four seats | 2.2 m/s |
- 3.6 The maximum permissible difference in traveling speed of chair and passenger conveyor of chairlifts that are boarded by passengers having a downhill gliding outfit strapped to their feet shall be as follows
- | | |
|----------------------------------|---------|
| two seater chairlifts | 2.5 m/s |
| three seater and quad chairlifts | 2.3 m/s |
| chairs with more than four seats | 2.0 m/s |
- Experience made with conveyor assisted chairlifts has shown that for reasons of boarding and traveling comfort it is advisable to admit no difference greater than 1.8 m/s.
- 3.7 The maximum permissible traveling speed of chairlifts that take on board passengers on foot without disactivating the passenger conveyor shall be as follows :
- | | |
|---------------------------------|---------|
| two seater chairlifts | 1.6 m/s |
| chairs with more than two seats | 1.0 m/s |
- In such a case the travel speed of the passenger conveyor shall not exceed 0.6 m/s.
- 3.8 Operation of passenger conveyor shall have to be stopped if the conveyor assisted chairlift is frequently used by passengers on foot. Passengers on foot shall have to take a lateral access to the boarding point of the conveyor. It shall be permitted to keep the conveyor going if transportation of passengers on foot is sporadic. In such a case passengers shall have to take the controlled access gate to reach the boarding point, the surface finish of the conveyor shall be such as to make it possible for passengers on foot to take a ride with the conveyor, while it is advisable to fit the passenger conveyor with a function selector.
- 3.9 For continuous operation of a chairlift with the passenger conveyors idle the chairlift shall have to be fitted with an automatic switch which automatically adjusts the traveling speed of the chairlift to the specified traveling speed of chairlifts that are not conveyor assisted.
- 3.10 A maximum permissible tilt of 10 % shall be maintained over the full length of the boarding area by a chair that is but partially occupied and carries an eccentric load. The distance between the passenger conveyor and the front edge of the tilted chair shall never get down to a distance of less than 40 cm and never exceed the distance of 60 cm. Should the need arise technical solutions will have to be devised to limit the tilt of the chair or excessive variations of the boarding height.
- 3.11 Due allowance shall have to be made for a possible variation of the distance between the sheave of the carrying hauling rope and the controlled access gate. A measuring device shall be installed to measure the order of magnitude of the variation and tell whether the conveyor needs to be displaced.
- 3.12 The signal for the opening of the controlled access gate should preferably be activated by the chair that has reached the boarding point and is about to be occupied.

4. Recommendations for detachable grip chairlifts.

- 4.1 It shall be permitted to choose a point situated on the conveyor belt as initial point of the boarding area. Steps shall be taken to prepare a horizontal gliding surface at the tail end of the passenger conveyor. Its first meter length shall be regarded as an extension of the boarding area.
- 4.2 Steps shall be taken to prepare a horizontal gliding surface at the tail end of the passenger conveyor.

Reference value for this additional stretch at the tail end of the conveyer :

2.0 m

- 4.3 The maximum permissible traveling speed of the passenger conveyor shall be set to be 1.0 m/s
- 4.4 The maximum permissible traveling speed of the passenger conveyor shall be set to be as follows :
 Passengers boarding the chairlift with the downhill gliding outfit strapped to their feet : 1.3 m/s
 Passengers on foot who board the chairlift in the axis of the chairlift while the passenger conveyor has been stopped : 1.0 m/s
 Lateral boarding of passengers on foot : 0.5 m/s
- 4.5 Where the function of the controlled access gates is not governed by the chair that is about to be boarded the verification of the boarding condition and of the condition of no collision shall be made by assuming a slight variation of the time between chairs in the order of the variation that can be detected by the monitor of the time interval between chairs placed ahead of the boarding area (for a rule - 10 %)
- 4.6 If passengers on foot are taken on board of the chairlift while the passenger conveyor is running, they shall be left to board the chair laterally from a boarding area arranged after the tail-end of the passenger conveyor.

5 Control and monitoring of the passenger conveyor

- 5.1 In the event of a failure of the controlled access gates it shall be forbidden to operate the chairlift with the passenger conveyor running.
 When establishing safety requirements for the monitoring systems of the controlled access gates, controls and components which in the case of a failure of the controlled access gates activate functions that bring the conveyor to stop or prevent it being started again, consideration shall be given to the fact that a malfunction of the gates may cause passengers to suffer irreversible injury. However the probability of occurrence of this danger situation is extremely low, its duration in time very short, whilst both the passenger and the attendant can take action to prevent the hazard from arising.
- 5.2 It shall be possible to adjust the required traveling speed of the passenger conveyor to the traveling speed of the chairlift by means of an appropriate system of controls capable of fulfilling this function even in the case of speed variations of the chairlift (acceleration and deceleration). The device that monitors the synchronism of passenger conveyor and chairlift shall have to fulfill its monitoring function even if the speed of the chairlift is varied.

When establishing safety requirements for the monitoring device, controls and components, which in the case of a failure activate the functions that bring the chairlift to stop, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of their occurrence is very low and its duration in time very short, but neither passenger nor attendant have hardly a possibility to prevent the hazard from arising.

- 5.3 Whenever the operating speed of the chairlift is such that there is some probability that the passenger would not be taken on board of a chair within the boarding area or probability of a collision with the preceding chair (operating speed of the chairlift smaller than the minimum speed which ought to be specified according to clause 2.5) the controlled access gates shall be kept closed.

When establishing safety requirements for the measuring device, controls and components, which activate the functions that keep the gates closed, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of their malfunction is very low and its duration in time very short, but neither passenger nor attendant have hardly a possibility to prevent the hazard from arising.

- 5.4 Controls of the controlled access gates shall be devised so as to offer the possibility to select at least the following three different control commands

- “automatic control”
- “gates open”
- “gates closed”

- 5.5 A system shall be devised that brings automatically the conveyor to a halt when the controlled access gates are kept permanently in the open position (control command “gates open”)

When establishing safety requirements for the monitoring device, controls and components, which activate the the functions that bring the passenger conveyor to stop or prevent it being started again, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is very low and its duration of time very short, whilst the attendant can prevent the hazard from arising.

- 5.6 The passenger conveyor shall be kept idle whenever the chairlift is running backwards.

When establishing safety requirements for the monitoring device, controls and components, which activate the functions that bring the passenger conveyor to stop or prevent it from being started again, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is very low and its duration in time very short, whilst the attendant or the passenger can prevent the hazard from arising.

- 5.7 The control value set by the chairlift for the control of the traveling speed of the passenger conveyor shall be set by the chairlift independently from its system that monitors the synchronism of chairlift and passenger conveyor.

When establishing safety requirements for the monitoring device, controls and components, which in the case of a failure activate the functions that bring the chairlift to stop, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is

very low and its duration in time very short, but neither attendant, nor the passenger have hardly a possibility to prevent the hazard from arising.

- 5.8 Provision shall be taken to fit the conveyor with independent stopping devices capable of bringing at any time the passenger conveyor to a halt quite independently and without being affected by the chairlift. Care shall be taken to give these stopping devices a distinct make and aspect so as to make sure they can be clearly distinguished from the stopping devices of the chairlift.

One of these conveyor stopping devices shall be placed close to the controlled access gates and another at the entrance into the inspection room, if there is one.

When establishing safety requirements for the stopping devices, controls and components, which activate functions that bring the passenger conveyor to stop, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is very low and its duration in time very short, whilst the attendant or the passenger have hardly a possibility to prevent the hazard from arising.

- 5.9 A measuring device which is independent of and unaffected by the drive of the passenger conveyor shall be installed to measure the traveling speed of the conveyor. The permissible tolerance allowed for the accuracy of the traveling speed measurements shall be within $\pm 10\%$ of the maximum permissible traveling speed of the passenger conveyor or within 0.1 m/s.

When establishing safety requirements for the monitoring device, controls and components, which activate the functions that bring the passenger conveyor and the chairlift to stop when the stopping device is activated, due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is very low and its duration in time very short, whilst the attendant or the passenger have hardly a possibility to prevent the hazard from arising.

- 5.10 Actuation of the device that monitors the synchronism of chairlift and passenger conveyor shall at any rate and always cause

- the chairlift to be brought to a halt
- the passenger conveyor to be brought to a halt
- the controlled access gates to remain closed

independently one from another.

When establishing safety requirements for the monitoring device, controls and components due consideration shall be given to the fact that the malfunction of these components may cause passengers to suffer irreversible injury. The probability of occurrence of the malfunction is very low and its duration in time very short, whilst the attendant or the passenger have hardly a possibility to prevent the hazard from arising.

- 5.11 A monitor of the maximum permissible lateral displacement of the conveyor shall be provided whenever the layout of the conveyor is such that a lateral drift of the conveyor due to mechanical action is possible.

When establishing safety requirements for the monitoring device, controls and components which activate functions that bring the conveyor to stop, due consideration shall be given to the fact that it is unlikely that the malfunction of these components may cause passengers to suffer injury.

- 5.12 Steps shall be taken to fit the conveyor with fail-safe monitoring devices that can be tested easily.

6. Operation

- 6.1 Symbols shall be used in the access area to the conveyor to draw the passengers' attention to the specific boarding conditions.
- 6.2 In order to facilitate the boarding of passengers wearing downhill gliding outfit strapped to their feet when the conveyor stands idle, the conveyor shall be given a gliding surface (layer of snow). The chairlift shall be fitted with a function selector if the time needed to reach the boarding area is different according to whether the conveyor is idle or traveling.
- 6.3 Operation of a chairlift which had been brought to a halt may be resumed only if the attendant supervising the conveyor has had the possibility to satisfy himself that all chairs have been correctly occupied and has given his consent to the resumption of the operation.
- 6.4 In order to permit maintenance work to be carried out provisions shall be taken permitting to set the conveyor going independently from the chairlift.
- 6.5 The manufacturer of the passenger conveyor shall be required to supply instruction manuals for the operation and maintenance of the conveyor.

7. Annex

festgeklemmte Sesselbahn

Schranken der Zugangssteuerung
Scheibenachse (ev. verschiebbar)
frühest möglicher Einstiegspunkt
Fahrgastförderband (ev. verschiebbar)

kuppelbare Sesselbahn

Schranken der Zugangssteuerung
Zufahrtsrampe
gekrümmter Förderbereich
gerader Förderbereich
frühest möglicher Einstiegspunkt
Fahrgastförderband
gleitfähige Fläche

fixed grip chairlift

controlled access gates
sheave axis (adjustable)
earliest possible boarding point
passenger conveyor (adjustable)

detachable grip chairlift

controlled access gates
approach ramp
round-about path
straight line path
earliest possible boarding point
passenger conveyor
gliding surface

L_{FB} = length of the passenger conveyor

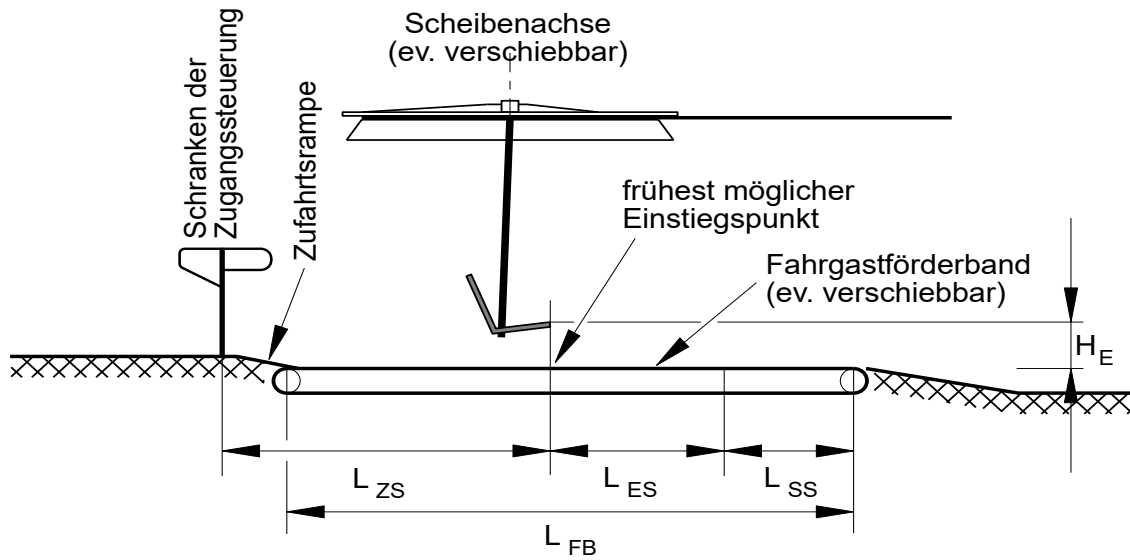
L_{ZS} = length of the approach ramp

L_{ES} = length of the boarding area

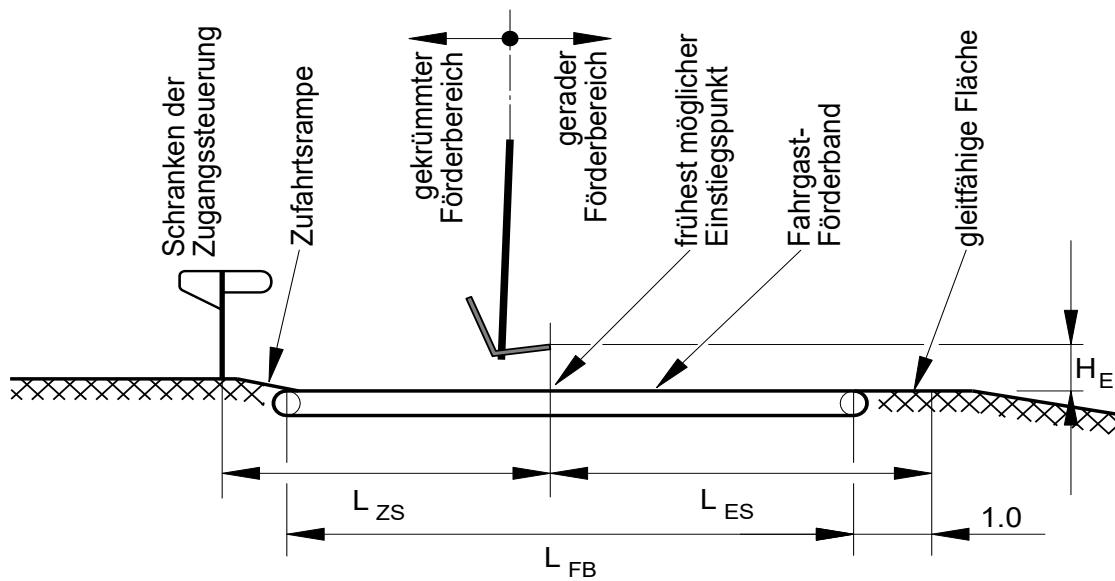
L_{SS} = length of the safety stretch

H_E = boarding height

festgeklemmte Sesselbahn:



kuppelbare Sesselbahn:



- L_{FB} = Länge (Fahrgast-) Förderband
- L_{ZS} = Länge Zufahrtsstrecke
- L_{ES} = Länge Einstiegsstrecke
- L_{SS} = Länge Sicherheitsstrecke
- H_E = Einstiegshöhe