

ANALYSIS OF RESIDUAL RISKS FOR LIFT

Doc. Ing. Marianna Tomašková, PhD¹,

Technical University of Košice, Engineering Faculty, Department of Safety and Quality of Production, Letná 9, 042 00 Košice
 marianna.tomaskova@tuke.sk

Abstract: The paper analyses risk in the selected type of passenger lifts. The method of analysis is chosen according to standard EN 81-80, dealing with residual risks. It highlights the risks associated with the selected type of lift.

Keywords: PASSENGER LIFT RISKS, CLASSIFIED TECHNICAL EQUIPMENT, SAFETY, TECHNICAL CONDITION

1. Introduction

With specific technical equipment in the present day a great deal of attention is devoted to their use during work activities. It is therefore necessary to be familiar with legislation as well as safe use in order to avoid various risks, dangers and incorrect handling, which may lead to accidents and other dangerous situations. An example is electric traction passenger elevators, which are the subject of this contribution. Nearly every one of us uses such a lifting device every day for moving in different tall buildings, schools, hospitals, as well as residential buildings, etc. Therefore, it is necessary that passenger elevators be capable of safe and breakdown-free operation, given that they are used to transport a great many people.

Table 1: European legal framework for passenger lift [1]

Selection from the European legal framework	
Standard labelling	Name of document
STN EN 81-1+A3 (27 4003)	Safety regulations for construction and assembly of lifts. Part 1 : Electric elevators
STN EN 81-2+A3	Safety regulations for construction and assembly of lifts Part 2: Hydraulic elevators
STN EN 81-21+A1	Safety regulations for construction and assembly of lifts. Lifts for carrying passengers and freight
STN EN 81-3+A1	Electric and hydraulic small freight lifts
STN EN 81-80	Safety regulations for construction and assembly of lifts, existing lifts.
STN EN 13015+A1	Maintenance of elevators and escalators, rules of instructions for maintenance.
STN EN ISO 12100	Safety devices, general principles for construction of machines, method of assessing and reducing risk (ISO 14798:2009)

The basic division of passenger lifts according to driving mechanism is shown in the following Fig. no. 1.

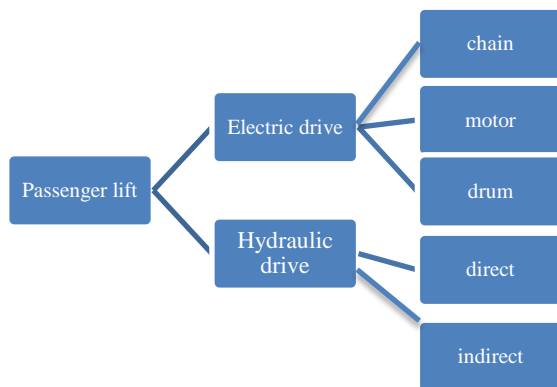


Fig. 1 Basic division of passenger lifts according to driving mechanism [2]

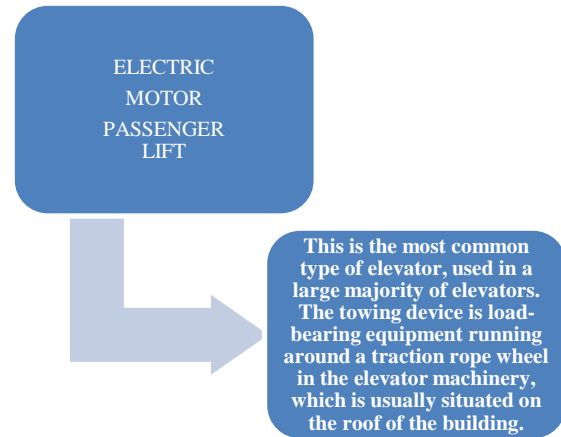


Fig. 2 Brief description of the electric driving mechanism of a passenger lift [2]

Several risks result in old elevators from the fact that they are designed to be as simple as possible from a construction point of view. The safety risks of these lifts are very high, and therefore it will be necessary to deal with them as soon as possible.

1.1 Standard STN EN 81-80

In 2004 standard STN EN 81-80, which sets the rules for increasing the safety of existing elevators intended for the transport of persons or persons and freight, was issued. It is a component of the group of EN 81 standards "Safety regulations for construction and assembly of elevators". This standard compares the safety of an old elevator with a new one and proposes solutions for reducing or removing the risks found. It recommends that dangerous risks be removed immediately and less dangerous risks within 5 years. It also recommends reconstruction or replacement of equipment within 10 years in order to fully satisfy the level of safety required. The current situation of different levels of safety in elevators in Europe is causing increasingly more accidents. The reasons for introducing the STN EN 81-80 standards and its purposes are shown in Tab. 2.

Table 2: Reasons for introducing and the purpose of the standards STN EN 81-80 [4]

The most frequent safety deficiencies of elevator operation [5]
<ul style="list-style-type: none"> • Small upper and lower safety space • Shaft doors with a single-action door closing • Unsuitable shaft and car doors and unsound enclosure of elevator shaft • Missing or inappropriate grippers and buffers • Unsuitable electric driving mechanism for elevator • Unsuitable protection of motor, single-action brake, emergency signalization, electronic control of elevator running • Netting enclosure of elevator shafts
Deficiencies perceived by users
<ul style="list-style-type: none"> • Imprecise stopping of elevator car • High noise level of elevator machinery • High noise level of closing shaft doors • Disadvantageous in energy use • Frequent outages due to repairs
Reasons for introducing standard STN EN 81 -80
<ul style="list-style-type: none"> • The majority of elevators are not designed for physically disabled persons • More than 3 million elevators are in use in EU countries and 50% of them are more than 20 years old
Purpose of standard STN EN 81-80
<ul style="list-style-type: none"> • Categorizes various dangers and dangerous situations from which each assessed risk is analyzed • Enables analysis to be performed on each elevator and safety measures to be set and gradually introduced • Provides corrective measures for gradual and selected improvement, so that all lifts intended for transporting persons or freight are brought up to a current state of safety

For existing elevators approximately 82 so-called safety risks have been recorded.

A **safety risk** is considered to be the difference between the technical equipping of an existing elevator made and installed according to previous provisions, with the requirements of contemporary standards, mainly with regard to the safety of operation. These risks are divided into several levels with regard to the number of dangerous situations occurring and the seriousness of the given safety risk. They can be found in each part of an elevator's construction. It is first necessary to assess objectively and fairly the technical state of an elevator – to make a “diagnosis” and only afterwards begin with the “cure”. With old lifts other problems appear (e.g. unavailability of replacement parts), and therefore removing such risks is only a time-limited solution. The most realistic or most correct choice is to gradually remove safety risks – first those which directly endanger life and health, then less dangerous risks.

We call the activities which serve for the protection of persons and property *certification activities for the operating capability of an lift*.

They are performed:

- in the case of a breakdown or damage to an elevator,
- preventively and
- on the basis of results of checks, inspections, reviews and necessary tests.

Characteristics of the assessed lift and risk analysis of it

It is known that the lifespan of elevators versus the lifespan of other transport systems is significantly higher. **The age of the installed lifts in Slovakia is more than 25 years** and in some cases the age is even estimated at **more than 30 years**, which is

already a very long period for making adequate replacement. These lifts, or more than 98% of them, are from the company Transporta, which anticipated their lifespan to be about 30 years.

2. Analysis of residual risks for the Passenger Lift TOV 250

For the analysis of residual risks according to standards STN EN 81-80 an lift of the type **TOV 250** located in a concrete panel housing block was selected. This is an elevator which is among the most commonly used types of passenger lifts in panel housing blocks, installed during the times of Czechoslovakia. The assessed lift is **located in a walled shaft**. The parameters of the elevator are in the following table.

Table 3: Parameters of the assessed lift

Passenger lift	
Type	TOV
Manufacturer	Transporta-Brno
Year of manufacturer	1976
Loading capacity	250 kg
Max. number of transported persons	3
Speed	0.7 ms ⁻¹
Number of load-bearing resources	2x...diameter 10 mm
Total length of load-bearing resources	2x21.5 m
Voltage	3x400/230 V
Type of driving electric motor	VM 8a/6 2.5 kW
Number of stations/loading points	6/6
Labelling	Ac ₁

**Fig. 3 Elevator machinery, traction wheel and speed-limiter****Fig. 4 Electric installation of the lift**

Fig. no. 4 shows a view into the lift shaft – the suspension devices, the speed-limiter, the counterweights and the terminal switch are depicted.



Fig. 5 View to the shaft [1]

Fig. 5 shows a view of the upper part of the car construction.



Fig. 6 Suspension carrier-beam

The following is the analysis performed of residual risks on an existing lift of the type TOV 250:

Table. 2: A selection from the form of the assessed lift of the type TOV 250 [1]

no.	Examined case	STN EN 81-80 article:	Requirement fulfilled?	Level	Corrective measures/measures (for lowering risks)	Measures which can be used	Note
1 General requirements							
1.1	Equipment without harmful materials, e.g. asbestos	5.1.4	<input type="checkbox"/> yes <input type="checkbox"/> no	high	1. Removal of asbestos which is dispersing (e.g. by replacement with facing), 2. Asbestos is not removed – a warning board is placed there	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no	
2 Accessibility requirements							
2.1	Measures for ensuring accessibility to persons with physical disabilities	5.2.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account		Measures according to STN EN 81-70	<input type="checkbox"/> yes <input type="checkbox"/> no	
2.2	Precision of balancing and stopping	5.2.2	<input type="checkbox"/> yes <input type="checkbox"/> no	high	1. Exchange for regular driving mechanism 2. Arrange for balancing equipment 3. Arrange for regulatory valve	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no	

3 Requirements for anti-vandalism measures							
3.1	Measures against vandalism	5.3	<input type="checkbox"/> yes <input type="checkbox"/> no		Measures according to STN EN 81-71	<input type="checkbox"/> yes <input type="checkbox"/> no	
4 Operation of elevator during a fire							
4.1	Measures for ensuring elevator activities during a fire	5.4	<input type="checkbox"/> yes <input type="checkbox"/> no		Measures according to STN EN 81-73	<input type="checkbox"/> yes <input type="checkbox"/> no	
5 Shaft							
5.1	Perforated lining of the shaft	5.5.1.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	a) Line shaft with non-perforated lining, or b) modify perforated lining of shaft according to 4.2.4.2 STN EN ISO 13857	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no	
5.2	Partial lining of the shaft	5.5.1.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Modify lining of shaft according to: - 5.2.1.2 STN EN 81-1+A3, or - 5.2.1.2 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no	
5.3	Doors (covers) for maintenance to shaft and shaft bottom	5.5.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Doors (covers) resolved according to: - 5.2.2.1 STN EN 81-1+A3, or - 5.2.2.1 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Cars stop when doors (covers) to shaft or shaft bottom are open	5.5.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Arrange safety equipment according to: - 5.2.2.2 EN 81-1+A3, or - 5.2.2.2 EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no	
5.4	Wall of shaft under each threshold of shaft doors	5.5.3	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Arrange thresholds of shaft doors according to: - 5.4.3 STN EN 81-1+A3, or - 5.4.3 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no	
5.5	Protection of access spaces under car with counterweight or balancing weights	5.5.4	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	low	a) Construct solid pillar on solid ground, or b) arrange counterbalance/balancing of weight with safety gear	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no	

7 Machine room and space for pulleys						
7.1	Safe access to machinery and to the space for the pulleys	5.6.1	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Arrange safe access with equipment satisfying: - 6.2 STN EN 81-1+A3, or - 6.2 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
7.2	Anti-slip floor in the machine room and in the spaces for the pulleys	5.6.2	<input type="checkbox"/> yes <input type="checkbox"/> no	low	Prepare anti-slip floor according to: - 6.3.2.2, 6.7.1.1.2 STN EN 81-1+A3 - 6.3.2.2, 6.7.1.1.2 STN EN 81-2+A3 EN 81-2:1998	<input type="checkbox"/> yes <input type="checkbox"/> no
7.3	Horizontal distance in the machine room	5.6.3	<input type="checkbox"/> yes <input type="checkbox"/> no	medium	Cover moving parts with a cover according to table 4 STN EN ISO 13857	<input type="checkbox"/> yes <input type="checkbox"/> no
8 Shaft and car doors						
8.1	Non-perforated shafts and ear doors	5.7.1	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Supplement shaft and car doors according to: - 7.1, 8.6.1 STN EN 81-1+A3, or - 7.1, 8.6.1 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
8.2	Firmness of anchoring of shaft doors	5.7.2	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Replace anchors of shaft doors according to: - 7.2.3.1 a 7.4.2.1 STN EN 81-1+A3, or - 7.2.3.1 a 7.4.2.1 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no

8.3	Shaft and cabin doors with glass	5.7.3	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	a) Replace glass according to: -7.2.3.2, 7.2.3.3, 7.2.3.4, 8.6.7.2, 8.6.7.3 and 8.6.7.4 STN EN 81-1+A3, -7.2.3.2, 7.2.3.3, 7.2.3.4, 8.6.7.2., 8.6.7.3 and 8.6.7.4 STN EN 81-2+A3, or b) replace glass according to: - Annex J STN EN 81-1+A3, or - Annex J STN EN 81-2+A3, or c) reduce size of glass panels according to: - 7.6.2 STN EN 81-1+A3, or - 7.6.2 STN EN 81-2+A3, or d) remove glass panels and replace them with solid panels and supplement "car at station" signalization	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no	
					8.4	Protection against dragging child's hand with horizontal movement of car and shaft doors with glass	5.7.4	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	low
9 Car, counterweights and balancing weights									

9.1	Safe ratio of floor space in car to loading-capacity	5.8.1	<input type="checkbox"/> yes <input type="checkbox"/> no	low	1. To reduce the usable floor space of the car, or 2. to limit use of the elevator only for trained users, or 3. to verify the intended use of the lift	<input type="checkbox"/> yes <input type="checkbox"/> no
						<input type="checkbox"/> yes <input type="checkbox"/> no
9.3	Car doors	5.8.3	<input type="checkbox"/> yes <input type="checkbox"/> no	high	a) Supplement self-acting car doors according to: - 8.6, 8.7, 8.8, 8.9 and 8.10 STN EN 81-1+A3, or - 8.6, 8.7, 8.8, 8.9 a 8.10 STN EN 81-2+A3, or b) supplement manual car doors according to: - 8.6, 8.7, 8.8, 8.9 and 8.10 STN EN 81-1+A3, or - 8.6, 8.7, 8.8, 8.9 and 8.10 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
						<input type="checkbox"/> yes <input type="checkbox"/> no

9.4	Securing the emergency cover on the car	5.8.4	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	medium	Supplement locking equipment of cover according to: - 8.12.4.2 STN EN 81-1+A3, or - 8.12.4.2 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
10 Load-bearing resources, counterweights and speed-limiters						
10.1	Protection against accidents with friction wheels, pulleys, chain wheels	8.9.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	medium	Supplement covers according to: - 9.7 STN EN 81-1+A3, or - 9.4 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
10.2	Protection against falling of rope/chain from pulleys/chain wheels	5.9.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	medium	Supplement covers according to: - 9.7 STN EN 81-1+A3, or - 9.4 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
10.3	Protection against objects getting between rope/chain from pulleys/chain wheels	5.9.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	low	Supplement covers according to: - 9.7 STN EN 81-1+A3, or - 9.4 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
10.4	Grippers controlled by suitable speed-limiters	5.9.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Supplement grippers controlled by a suitable speed-limiter according to: - 9.8 and 9.9 STN EN 81-1+A3	<input type="checkbox"/> yes <input type="checkbox"/> no

10.5	Correct function of grippers and a suitable speed-limiter	5.9.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	a) Set the system (without interfering in safety components), or b) if setting is not possible, replace the grippers controlled by a suitable speed-limiter according to: - 9.8 and 9.9 STN EN 81-1+A3	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no
11 Guides, buffers and terminal switches						
11.1	Guides of counterweights or balancing weights	5.10.1	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	low	Counterweights or balancing weights: a) equip with firm guides according to: 10.2.1 STN EN 81-1+A3, or b) replace guides with four steel lines	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no
11.2	Suitable buffers or other equipment	5.10.2	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Supplement buffers according to: - 10.3 STN EN 81-1+A3, or - 10.3 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
11.3	Terminal switches	5.10.3	<input type="checkbox"/> yes <input type="checkbox"/> no	medium	Supplement terminal switches according to: - 10.5 STN EN 81-1+A3, or - 10.5 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
12 Distance between cars and shaft doors						
12.1	Horizontal distance between interior surface of wall and threshold, door frame of car or closed edge of car sliding doors	5.11.1	<input type="checkbox"/> yes <input type="checkbox"/> no	high	a) Reduce distance according to: - 11.2.1 STN EN 81-1+A3, or - 11.2.1 STN EN 81-2+A3, or b) equip car with security equipment according to: - 8.9.3 STN EN 81-1+A3, or - 8.9.3 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no

12.2	Horizontal distance between closed car and shaft doors	5.11.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Modify equipment according to: - 11.2.3 or 11.2.4 STN EN 81-1+A3 or -11.2.3 or 11.2.4 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
13 Lifting machinery						
13.1	Emergency driving mechanism of electric elevator	5.12.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Supplement emergency driving mechanism according to: - 12.5 and instructions given in 16.3.1 STN EN 81-1+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
13.2	Emergency driving mechanism of hydraulic elevator	5.12.2	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	high	Supplement emergency driving mechanism according to: - 12.9 and instructions given in 16.3.1 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
13.3	Closing valve (hydraulic elevators)	5.12.3	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> not taken into account	low	Supplement closing valve according to: -12.5.1 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
13.4	Missing controlling of driving mechanism by independent contacts	5.12.4	<input type="checkbox"/> yes <input type="checkbox"/> no	high	Supplement stopping equipment according to: -12.7 STN EN 81-1+A3 or - 12.4 STN EN 81-2+A3	<input type="checkbox"/> yes <input type="checkbox"/> no
14 Electrical equipment						

14.1	Insufficient protection against injury by electric current (IP2X). Protection and marking of electrical equipment.	5.13.1	<input type="checkbox"/> yes <input type="checkbox"/> no	high	<p>1. Equip electrical equipment with covers according to: -13.1.2 STN EN 81-1+A3, or - 13.1.2 STN EN 81-2+A3 with cover at least IP 2X.</p> <p>2. Supplement labelling set by: -13.5.3.3 STN EN 81-1+A3, or -13.5.3.3 STN EN 81-2+A3, if voltage on the clamps is not greater than 50 V.</p> <p>3. Supplement inscription with warning for maintenance workers that voltage remains on the clamps even when power of individual contacts in the group is shut off.</p>	<input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no <input type="checkbox"/> yes <input type="checkbox"/> no	
	14.2	Protection of electric motor of lifting machinery	5.13.2	<input type="checkbox"/> yes <input type="checkbox"/> no	low	<p>Supplement equipment for monitoring temperature according to: - 13.3.1, 13.3.2 and 13.3.3 STN EN 81-1+A3, or - 13.3.1, 13.3.2 and 13.3.3 STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no
	14.3	Lockable main switch in machine room	5.13.3	<input type="checkbox"/> yes <input type="checkbox"/> no	medium	<p>Supplement lockable main switch according to: -13.4.2 STN EN 81-1+A3, or - 13.4.2 STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no
15 Protection against electrical malfunctions, managing, priority							

15.1	With change of phase no danger of bad functioning of the elevator threatens	5.14.1	<input type="checkbox"/> yes <input type="checkbox"/> no	low	<p>Supplement protection against a change of phase for ensuring that the phase change cannot cause dangerous function of the elevator according to: - 14.1.1.1 j) STN EN 81-1+A3, or - 14.1.1.1 j) STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Equipment for inspection ride	5.14.2a	<input type="checkbox"/> yes <input type="checkbox"/> no	high	<p>Supplement equipment for inspection ride according to: - 14.2.1.3 STN EN 81-1+A3, or - 14.2.1.3 STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no	
	Stopping equipment on car roof	5.14.2b	<input type="checkbox"/> yes <input type="checkbox"/> no	high	<p>Supplement stopping equipment according to: - 14.2.2 STN EN 81-1+A3, or - 14.2.2 STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no	
16 Plates, labelling and operator instructions							
16.1	Information about safe use and maintenance of lift	5.15	<input type="checkbox"/> yes <input type="checkbox"/> no	medium	<p>Provide correct contacts, labelling and instructions for operator and use stated in: - 15.2.1, 15.3, 15.4, 15.5.1, 15.5.3, 15.7, 15.11 and 15.15 STN EN 81-1+A3, or - 15.2.1, 15.2.5, 15.3, 15.4, 15.5.1, 15.5.3, 15.7, 15.11, 15.15, 15.17 and 15.18 STN EN 81-2+A3</p>	<input type="checkbox"/> yes <input type="checkbox"/> no	

Notes:

1. The examined case is crossed out – at present this risk is impossible to assess (the elevator is not equipped with these components).
2. A requirement “not taken into account” – this examined case does not apply in the elevator and probably will not be, or for other reasons will not be.

High level: the risk must be removed soon, medium level: the risk must be removed in a period together with greater modernization, low level: the risk may be removed in the long run together with modernization.

CONCLUSION

From the presented form for assessing the safety of an existing elevator it follows that the assessed elevator has risks which fall into the category of "high" – which need to be resolved as soon as possible – but there are also risks which, unfortunately, are not taken into account, so that it is not possible to resolve them. Namely because the elevator is not subject to current legislative provisions, and it is not possible to remove these risks. It is not possible to remove them because the elevator would need complete replacement or reconstruction, for which there is not financing, unfortunately. Such a complete replacement of an elevator costs approximately 30,000 – 40,000 €. It is necessary to note that given the fact that regular reviews, inspections, tests, controls, maintenance and all activities necessary for its safe operation, are conducted on this elevator, and that its age is relatively high, and it perhaps represents from its visual side a danger, it still ranks among the group considered to be "less dangerous".

It is recommended that the performed analysis of residual risks be given to building owners who are responsible for elevators. It then becomes their choice about how to deal with the results of the analysis. They may decide for gradual removal of defects, or for a radical solution – namely a complete replacement which, unfortunately, is financially demanding. It is necessary to keep in mind, however, that no small amount of money is spent annually on maintenance of this equipment. Therefore, it is suitable to consider reconstruction of the elevator, after which only essential service (review) would be performed.

Literature

- [1] BOGAČIKOVÁ, M.: Bezpečnosť pri práci v prevádzke vyhradených technických zariadení – výťahov, Thesis, TU in Košice, SjF, KBaKP, 2015
- [2] Charakteristika elektrického trakčného výťahu a jeho konštrukčné prvky. [online]. [cit. 2015-02-07]. Accessible the Internet at: <<http://vytahy.tzb-info.cz/8072-perspektivy-prevadzky-obeznych-vytahov-v-clenskych-krajinach-europskej-unie-v-cr-a-sr>>
- [3] Revízie a súvisiace normy. [online]. [cit. 2015-02-19]. Accessible the Internet at: <http://www.elvys.eu/html/vytahy3.html> >
- [4] Bezpečnosť starších výťahov v bytových domoch. [online]. [cit. 2015-02-14]. Accessible the Internet at: <<http://www.tisr.sk/sk/overovanie-bezpecnosti-technickyh-zariadeni/odborne-informacie/zdvihacie-zariadenia/bezpecnost-starsich-vytahov.html>>
- [5] Overovacia činnosť prevádzkovej spôsobilosti výťahu. [online]. [cit. 2015-02-21]. Accessible the Internet at: <http://www.osbndr.sk/dokumenty/smernica_na_vytahy.pdf>

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