European Lift Association

WHITE PAPER

SAFETY, ACCESSIBILITY AND ENERGY EFFICIENCY (SAEL) WORKING GROUP

Synergy achievements in combined measures for improving Safety, Accessibility and Energy efficiency in modernizing Existing Lifts

ELA
European
Lift Association

CONTENTS

White Paper

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Introduction

The **Recovery and Resilience Facility (RRF)** aims to help the EU to emerge stronger and more resilient from the current crisis due to the dramatic situation of coronavirus. Investments and reforms – along the directions suggested by the EU: **green, digital and social resilience** – are needed to ensure economic recovery. The Recovery and Resilience Facility consists of large-scale financial support to both public investments and reforms. The instrument is part of the **'Next Generation EU'** (EUR 750 billion in loans and grants over the period 2021-2026). EU support will be in response to national (recovery and resilience) plans, submitted to the Commission (by the end of April 2021) following the Commission's evaluation criteria.

An important focus on "social resilience" aims at improving the quality of life for EU citizens and helping vulnerable groups, such as the elderly and people with disabilities.

We believe that **the Lift industry can materially contribute to this important target**.

For example modernizing old lifts as well as installing new lifts to existing buildings without these appliances, has benefits well aligned with the RRF targets, including:

- **Safety –** Modernized lifts offer a much higher level of safety compared to older equipment.
- **Accessibility –** Improving accessibility – e.g. ensuring better stopping accuracy and improving user interface thanks to wider cars equipped with automatic doors – increases quality of life, especially for the elderly and people with disabilities.
- **Energy efficiency –** Modernized lifts are more environmentally sustainable and support a Circular Economy thanks to higher energy efficiency components and also leveraging digital enablers
- **Circularity** - Modernized lifts are more environmentally sustainable and support the transition to a Circular Economy thanks to extended product lifetime and enabling the re-use of existing components preventing waste generation.
- **Economic benefits –** Allowing elderly and people with disabilities to live longer at home will not only improve their quality of life, but also provide significant savings for local authorities.
- **Digitalization –** Modern connected lifts bring remote digital services to buildings, improving their usability, availability and security. Digital solutions increase the attractiveness of buildings and can help cities to reduce risks such as the increasing disparity between living areas.
- **Health and well-being –** Latest sanitization solutions available for new and existing lifts – such as air purifiers and touchless operation of lifts through mobile devices – contribute to improve health and safety of our society.

Lifts, escalators and moving walks are used more than 1 billion times a day in the European Union. It is the most used vehicle for travelling, and the safest by far. The community of the travelling public appreciates the **mobility** and **accessibility services** that lifts, escalators and moving walks provide to all groups in the community. They also expect that their journeys are made as safe as possible, and nowadays the ride comfort is so high, and the levelling accuracy so precise, that the user does not even realize or perceive that he is entering or leaving a lift (conversations continue, documents or business cards are exchanged, introductions made and lots of laughter heard on travelling lifts, etc.).

Lifts are essential for providing movement around any building, especially residential developments and medical facilities. They also play a vital role in making sure people can carry out essential activities such as shopping for essential items or when receiving deliveries.

Lifts are particularly important for the elderly and disabled. This can be crucial, especially during the coronavirus pandemic, in areas where residents have their movement restricted, or if hospitals become over crowded.

Medical and emergency services personnel also need fully-functioning lifts, in order to reach tenants and carry out their work safely and efficiently. A lift is critical in any of these situations, and becomes paramount during a widespread virus outbreak, such as we see today.

In addition, **lifts are crucial for business continuity** in places like distribution centers, or areas of mass-transit and public infrastructure. These are complex areas where essential goods need to be moved, food and supplies need to be delivered and critical healthcare providers need to commute to work.

More than six million lifts are in use today in Europe, to the satisfaction of the immense majority of users. But not everything is perfect. **In many countries, more than half the existing lifts are 25 years old or even older.** Only a few of them have been modernized to meet the latest state of the art actual requirements in safety and performance.

Ageing lifts can be made safer, more energy-effective, more reliable, and comfortable through regular maintenance & repair and through improvements, e.g. modernizations and technical updates, increasing lift performance and restoring the “state of the art”.

Primary focus should be given to lifts which do not carry the CE marking, in other words lifts that were not installed in the era of the European Lifts Directive, but date from before the turn of the century, from 1997. The fact that some lifts installed in the late 1800’s are still functioning is a reminder of the incredible sturdiness and safety of lifts. Even though the average lifetime of a lift is longer than any other common transportation means, the definition of user safety has changed and evolved significantly during the same period of time.

The **European Green Deal** is the plan to **make the EU's economy sustainable** by turning climate and environmental challenges into opportunities and making the transition just and inclusive for all. The EU aims to be climate neutral in 2050 and decided to focus in ensuring **transformation of the EU building stock** into a highly energy efficient and decarbonised building stock by 2050.

As announced in the European Green Deal, the Commission adopted on 14 October 2020 a strategic Communication **"Renovation Wave for Europe – greening our buildings, creating jobs, improving lives".** It contains an action plan with specific regulatory, financing and enabling measures for the years to come and pursues the aim to **at least double the annual energy renovation rate of buildings by 2030** and to foster deep renovations. It is expected that mobilising forces at all levels towards these goals will result in **35 million building units renovated by 2030.**

Following the starting process to revise the **Energy Performance of Buildings Directive (EPBD)**, ELA has developed a position paper related to the contribution of lifts to the building energy performance that will be published in due time.

Lifts also contribute to the adoption of digital technologies in line with the ambitious EU policy goals, and the **Smart Readiness Indicator (SRI)** is one enabler in ensuring transformation towards smart buildings and cities. ELA is an active member of topical group C of Smart Readiness Indicator (SRI) for buildings, a voluntary scheme introduced in 2018 by the Directive amending the Energy Performance of Buildings Directive (2018/844/EU). This indicator will allow for rating the smart readiness of buildings, i.e. the capability of buildings (or building units) to adapt their operation to the needs of the occupant, also optimizing energy efficiency and overall performance, and to adapt their operation in reaction to signals from the grid (energy flexibility). In this respect ELA is working on a specific assessment to consider the role of building transportation systems to increase safety and security in buildings through digitalization.

SECTION 1

Purpose of this White Paper

There is a need for technical and social solutions to facilitate every day's life and to comply with the requirements of an **inclusive society**. These solutions will impact on all residents of urban societies and people in their work environments, be they young or old, healthy or with restricted mobility. These solutions shall constantly evolve and change according to the "state of the art" in the community.

Building owners are in a key position to provide the necessary infrastructure.

Vertical passenger lifting means and related services are an integral part of the accessibility chain of buildings and of society as a whole.

This paper provides useful input to improve the "Mobility Chain" in existing buildings, with particular attention given to the vertical passenger transportation means which are present everywhere in the built environment.

This document is a **compendium of information materials** produced recently by European Lift Association (ELA). It is a milestone in the long process that, through **best practices** and **case studies** exemplified further in this document, will strengthen the approach called SAEL, a focus on **synergy achievements in combined measures for improving safety, accessibility, and energy efficiency in modernizing existing lifts.**

ELA introduces the SAEL approach to modernization of existing lifts by providing expertise and information on the synergy achievements in combined measures for improving safety, accessibility, and energy efficiency on existing lifts. The information is consolidated and published as a "White Paper", giving guidance to all stakeholders.

This **White Paper can be used as a guideline** for:

- **National lift association** in promoting synergy achievements in modernizing existing lifts and through this increase their safety level, accessibility, and energy efficiency, sharing best practices and information to be used at national level.
- **National authorities** to determine their own programme of implementation in a process via a filtering method in a reasonable and practicable way based on the level of risk (e.g. extreme, high, medium, low) and social and economic considerations.
- **Building owners** to follow their responsibilities according to existing regulations (e.g. Use of Work Equipment Directive – UWED).
- **Building owners** to upgrade the safety level of existing lifts on a voluntary basis even if no particular national regulations exist and simultaneously improving accessibility and energy efficiency.
- **Maintenance companies and/or inspection bodies** to verify and inform the owners on the safety, accessibility and energy efficiency level of their installations.

- **National authorities, owners and maintenance companies and/or inspection bodies** to be inspired by initiatives and best practices already undertaken by other member-states, e.g., countries that have already adapted SNEL (Safety Norm for Existing Lifts) in national regulations or legislations.
- **Members of the European or national Parliaments or other public officers** to consider the opportunity of creating funds and subsidies – at country, region, or city level - supporting the modernization of existing lifts in the EU (fiscal measures, reduced VAT, etc.)
- **The European Commission and other European bodies** e.g. the European Economic and Social Committee.
- Associations or other stakeholders.

This Guide gives the building owner the basic information on "where to look first" in order to enhance safety, improve accessibility and reduce the energy consumption of existing lifts. There are "low hanging fruit" that obviously need to be picked first. Some intervention should clearly be done first, and this Guide gives the reader a "ranking" for each measure that should be taken, in order to enhance safety, improve accessibility and reduce the energy consumption of existing lifts.

SECTION 2

Background

Currently available codes of good practice and national laws, based on the transposition of existing European Directives and Recommendations, can help achieve this higher implementation level of safety, accessibility, and energy efficiency of lifts. Amongst these, the most important ones are:

- EN 81-80:2019 "Rules for the improvement of safety of existing passenger and goods passenger lifts" or so called **"SNEL" (Safety Norm for Existing Lifts)**. SNEL is the known abbreviation for the specialists of the lift industry in Europe when they refer to EN 81-80.
- Use of work equipment Directive (UWED, 89/655/EC amended by 95/63/EEG and 2001/45/EC);
- Product liability Directive (85/374/EC of 25th of July 1985);
- Product safety Directive for the consumers (2001/95/EC of 3rd of December 2001);
- Directive 89/391/EC of 12th of June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work.
- Derived Recommendations from the SNEL, defined by the stakeholders of the European Lift Industry, based on robust data analytics, e.g. "Incidents & Accidents Statistics" over years.

In 2003, the European Committee of Standardization (CEN) added to its well-known European Standards for new lifts the key standard for the safety of existing lifts, EN 81-80:2003 – the so-called "SNEL". This standard was the result of several years of work by committed safety experts from the lift industry, government authorities, third party inspection bodies, consumers' organizations and insurance companies. Since then, the main new lift standards EN 81-1/2, have been replaced with EN 81-20/50, which created the need to upgrade the EN 81-80:2003 standard as well. The EN 81-80:2019 version reduces the safety gaps of existing lifts and nearer the safety level, which EN 81-20/50 defines for new lifts placed on the market.

EN 81-80:2019, *Safety rules for the construction and installation of lifts – Existing lifts – Part 80: Rules for the improvement of safety of existing passenger and goods passenger lifts*, categorizes various hazards and hazardous situations, each of which has been analysed by a **risk assessment**. It then provides a list of corrective actions to improve safety progressively.

According to EN 81-80:2003 the **lift should be audited against a checklist of 74 risks**, the revised standard – EN 81-80:2019, **has 85 risks**, some even covering lifts which were placed on the market according to the Lifts Directive 95/16/EC having CE-marking.

The identification of a risk or hazardous situation can be carried out in the course of any periodical survey or special examination on a given installation, but only technically competent and sufficiently trained persons should be allowed to carry out these

examinations. This can be subject to national legislations or regulations. Once the risks of the installation have been identified through this proactive assessment or safety audit, improvements can be made (if necessary) by a "step by step" upgrading which can naturally be combined with any modernization being carried out. In addition, preventive maintenance and repairs are necessary on an ongoing basis.

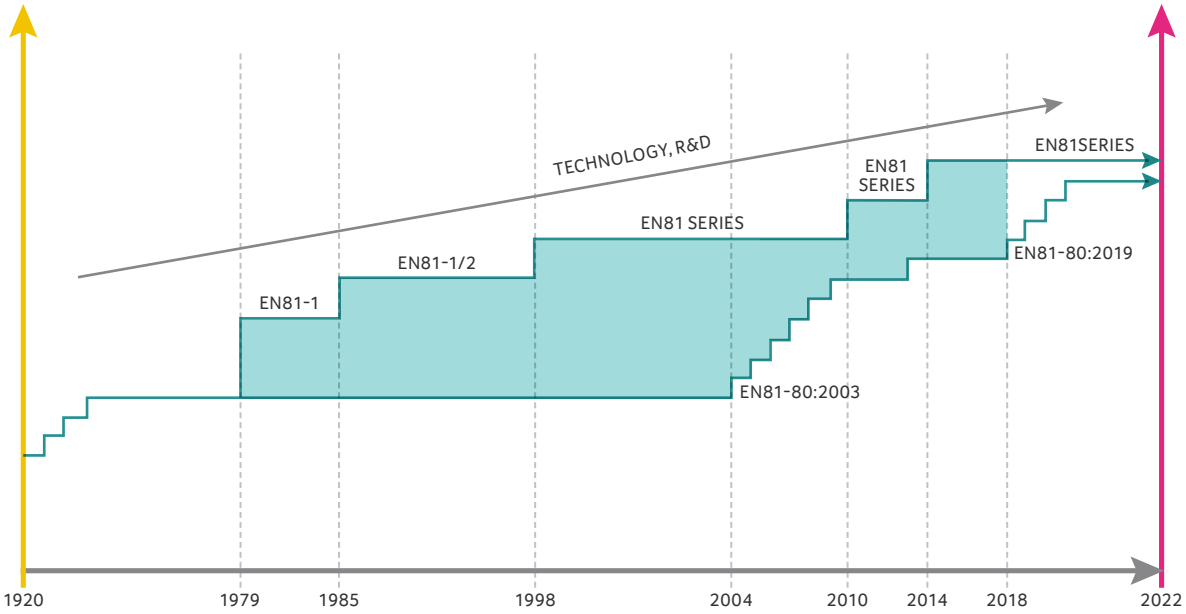


FIG. 1 – STEP BY STEP APPROACH OF SAFETY FOR EXISTING LIFTS IN EUROPE

SNEL is an important safety instrument that shows its long-term impact in many countries in Europe. SNEL and its various applications throughout the continent and abroad (Hong Kong, Australia and others) also serve as a benchmark and an example to other countries inside and outside of Europe.

SNEL has to be applied as a technical guide package, to promote the progressive (when?) and selective (what?) maintaining and/or improvement of the safety of existing lifts. This can be seen in decreased accident trend in countries which actively promote SNEL, e.g. by making defined SNEL measures mandatory, even by law or regulation. Thanks to these actions a very clear increase in the European lift safety and accessibility for lift users, lift workers and third-party inspectors shall be reached.

Member States, building owners, lift industry and third-party inspection bodies have a vital interest in understanding the implications of SNEL. They must link up with closely related EU and national existing regulations.

The core message here is that SNEL needs to be applied in a proactive way. This allows the application of the well-known prevention principle, of taking the necessary and sufficient measures to ensure a safe situation.

This "SNEL" approach, once integrated and well applied, makes the lifts safer for all of us.

The creation, at Member State level, of a specific national law or decree, referring to or based upon this EN 81-80 standard, can give a more mandatory character to it.

Regarding the **energy performance of lifts**, the most important standards are:

- EN ISO 25745-1:2012 - Energy measurements and verification
- EN ISO 25745-2: 2015 - Energy calculation and classification for lifts

Regarding the **accessibility of lifts**, the most important standards are:

- EN 81-70: 2021 *Accessibility to lifts for persons including persons with disability*
- EN 81-80:2019 *Safety rules for the construction and installation of lifts – Existing lifts – Part 80: Rules for the improvement of safety of existing passenger and goods passenger lifts*
- EN 81-82:2013 *Safety rules for the construction and installation of lifts. Existing lifts. Rules for the improvement of the accessibility of existing lifts for persons including persons with disability.*

SECTION 3

The opportunity in modernizing existing lifts

Europe is the leading continent by far for the number of lifts installed. The installed basis (more than 6 million lifts) represents some 50% of the number of lifts installed in the world. This is changing rapidly due to the urbanization of Asia, particularly China, where more than 600,000 lifts were installed in 2018, while Europe only installed some 150,000 units in the same period and America some 50,000 units.

	2021	
	Employees	Existing Lifts
Austria	2,234	131,954
Belgium	2,550	120,488
Bulgaria	2,500	84,000
Croatia	288	612
Cyprus	300	19,106
Czech Republic	1,920	136,470
Denmark	839	44,001
Estonia	150	5,170
Finland	1,500	66,500
France	17,000	629,000
Germany	17,000	815,000
Greece	6,300	430,000
Hungary	645	41,573
Ireland	500	26,000
Italy	25,200	992,000

	2021	
	Employees	Existing Lifts
Latvia	350	6,210
Lithuania	390	8,640
Luxemburg	358	15,048
North Macedonia	310	11,050
The Netherlands	2,836	104.102
Norway	1,401	43,040
Poland	4,000	135,895
Portugal	2,144	158,563
Romania	685	52,463
Slovakia	1,100	48,840
Slovenia	450	10,948
Spain	15,912	1,075,405
Sweden	3,660	129,500
Switzerland	4,249	275,209
Turkey	22,000	531,500
United Kingdom	9,161	318,252
TOTAL	**148,122**	**6,466,263**

FIG. 2 – STATISTICS OF EUROPEAN EXISTING LIFTS *(SOURCE ELA)*

The European lift industry (including Turkey) maintains some **6,250,000 lifts** with a total number of personnel of round about **152,000 employees**.

SAFETY

The average age of existing lifts is above 25 years.

Europe also has a large share of the new generation of MRL lifts (Machine Room Less) compared to other continents, North America remaining very traditional for the types of lifts installed, except for the high-rise applications in city centres.

The fact that the lift stock is on average much bigger in Europe than in North America and much older than in Asia, statistically implies a higher risk of accidents for the European lift users and workers. Fatal accidents of users and workers unfortunately happen every year, though in a limited number (between 10 and 20). Serious accidents are numerous, and the number of incidents is very high, but impossible to define precisely, since most of these incidents and "near misses" in the use of lifts are not reported by the victims. The statistics for workers are more reliable, since these must be reported for Health & Safety reasons, in order to improve equipment and practices.

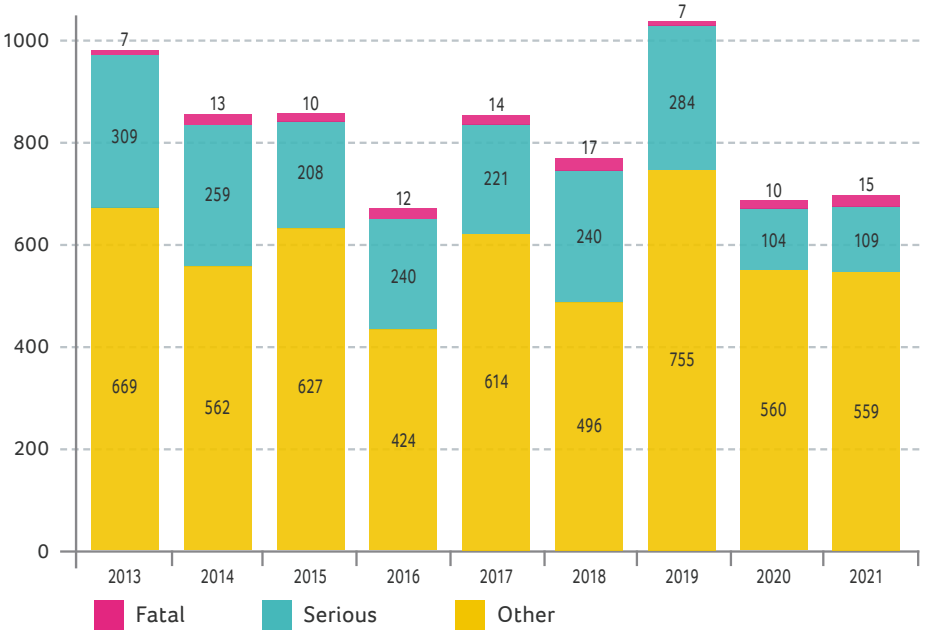
The Statistical Committee of ELA, which works closely with the national lift associations, maintains a table of accidents & incidents for Lift Users and Lift Workers.

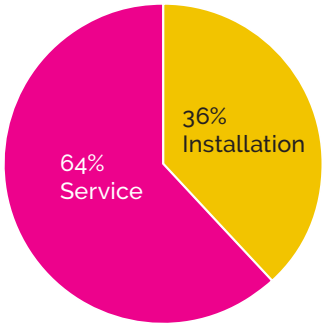
The main causes of accidents are linked each year to the SNEL risks and communicated to all member associations, in order to identify the main causes and eradicate them in the future.

The total number of accidents registered by ELA Statistical Committee in 2019 were 2.239, whereof 13 were fatal.

The analysis of the reported accidents shows again for 2019 a clear link to the SNEL risks.

The charts following point out the main risks for lift users as well as for lift workers.





24 reporting countries
683 reported cases in 2021

FIG. 3 – LIFT WORKER ACCIDENTS 2013-2021 *(SOURCE ELA)*

LIFT WORKER ACCIDENTS 2021 – INSTALLATION 24 reporting countries 243 reported cases

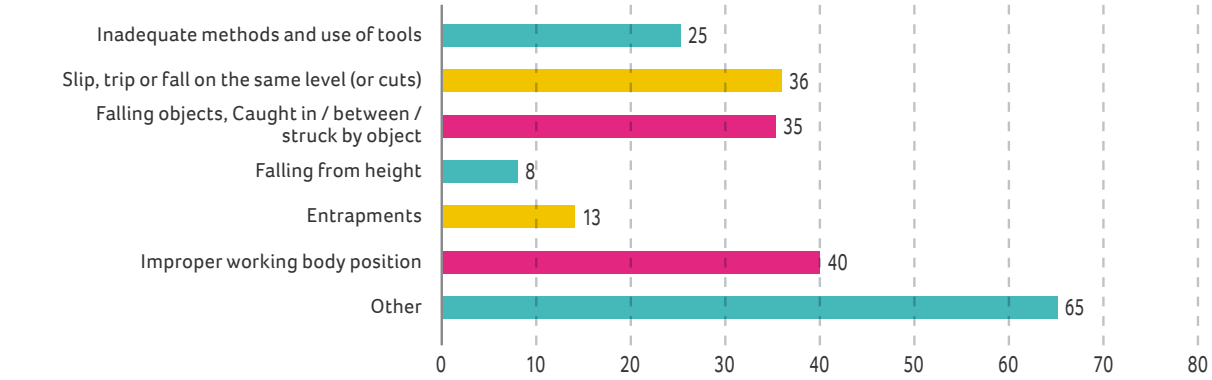


FIG. 4 – MAIN CAUSES OF LIFT WORKER ACCIDENTS 2021 – INSTALLATION *(SOURCE ELA)*

LIFT WORKER ACCIDENTS 2021 – SERVICE 24 reporting countries 440 reported cases

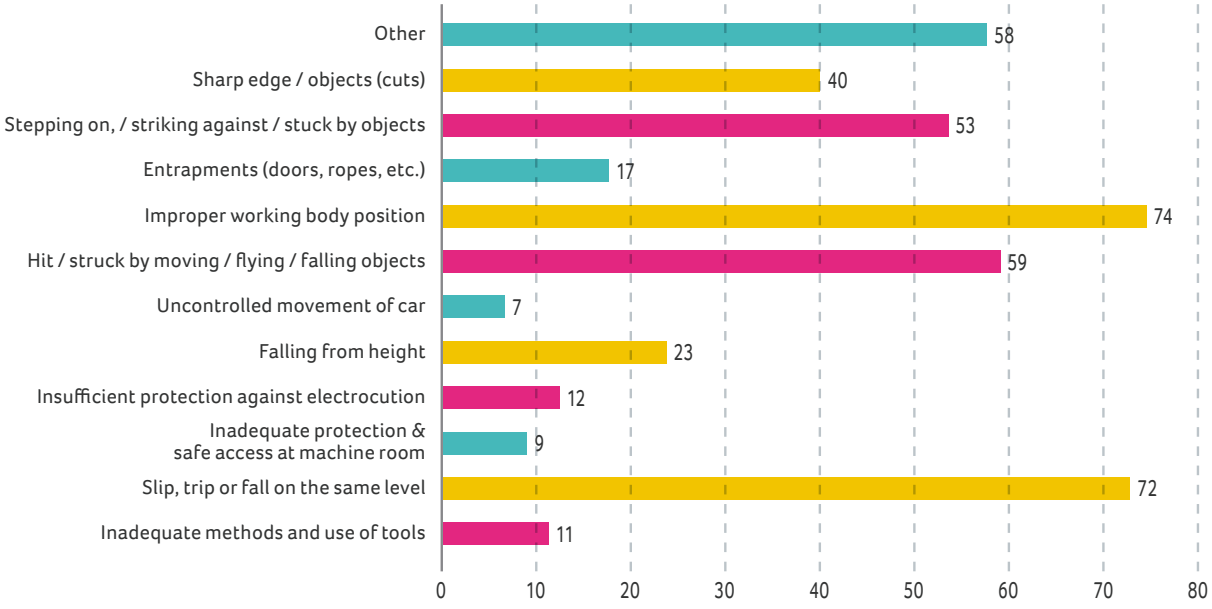


FIG. 5 – MAIN CAUSES OF LIFT WORKER ACCIDENTS 2021 – SERVICE *(SOURCE ELA)*

For lift workers, SNEL measures cover almost 50% of the risks that resulted in a fatal accident.

In EN 81-80:2019, clause 5 describes methodology for improving the safety of existing lifts using risk profile and priority levels for successfully defining the "when" and "what" status of each predefined SNEL risk.

The definition of priority levels, categorized as extreme, high, medium or low, will depend on national history of lift regulations and applied standards, accident statistics, specific product knowledge and social expectations. Thus, implementation of EN 81-80 per country, based on the defined risks, will vary in content and scheduling, to allow for any local differences in the assessment of those risks.

Today, this process, which has been applied successfully in several European countries is an on-going process in most EU Member States. Using the national filtering as recommended by the experts who wrote the standard, will bring a de facto safety harmonization of the existing lifts. It will be a great step towards European integration.

Our aim is to make the European Commission and national decision makers be convinced by the fact that the **upgrade of the lift stock, based on EN 81-80:2019, can mean several additional benefits at the same time such as energy efficiency and improved accessibility** to persons with disabilities and with impaired mobility, who can remain at private home longer and therefore reducing costs for the society.

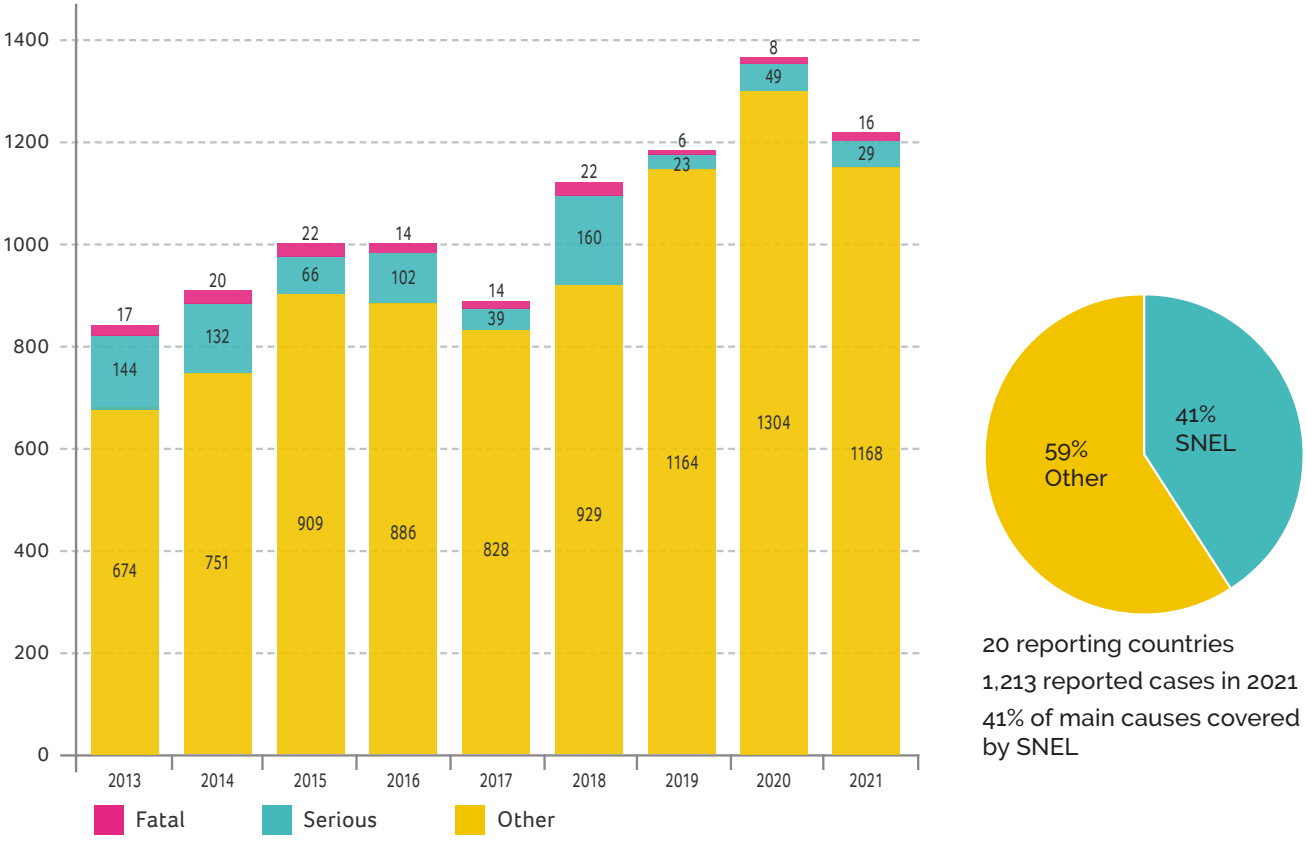


FIG. 6 – LIFT USER ACCIDENTS 2013-2021 *(SOURCE ELA)*

LIFT USER ACCIDENTS – MAIN REASONS 2021

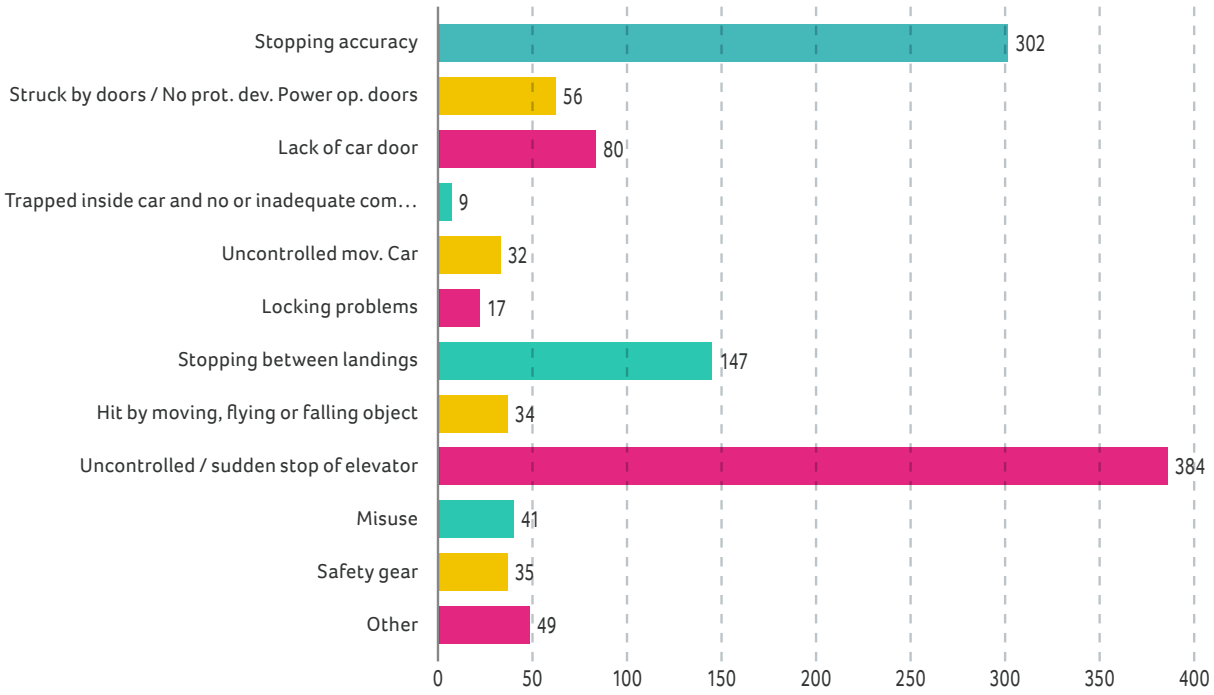
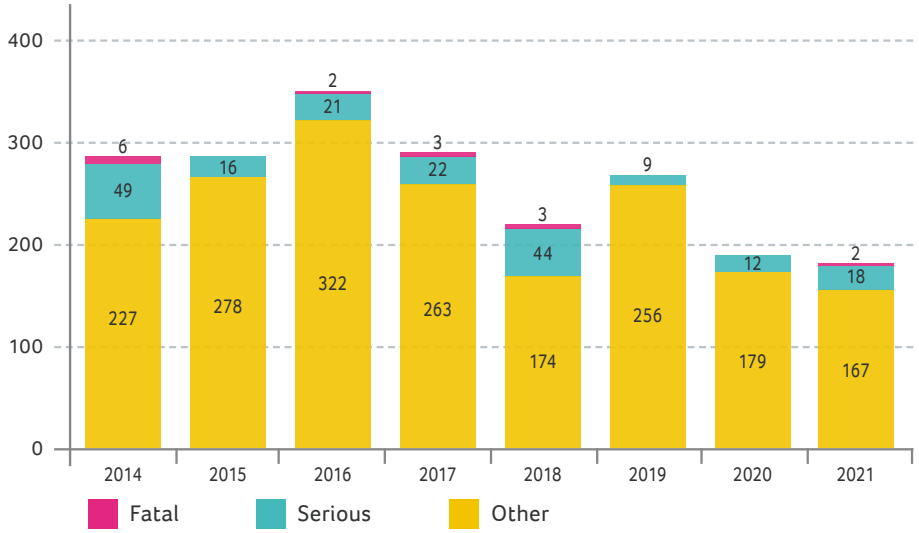


FIG. 7 – MAIN CAUSES OF LIFT USER ACCIDENTS 2021 – SERVICE *(SOURCE ELA)*

Nearly 50% of all registered causes can be directly related to measures covered by the SNEL. More frankly said, those accidents – even fatal accidents – and/or the pain caused, could have been avoided if modernization efforts had been fulfilled timely.

ESCALATOR USER ACCIDENTS 2021



18 reporting countries
187 reported cases in 2021

FIG. 8 – ESCALATOR USER ACCIDENTS 2014-2021 *(SOURCE ELA)*

ESCALATOR USER ACCIDENTS – MAIN REASONS 2021

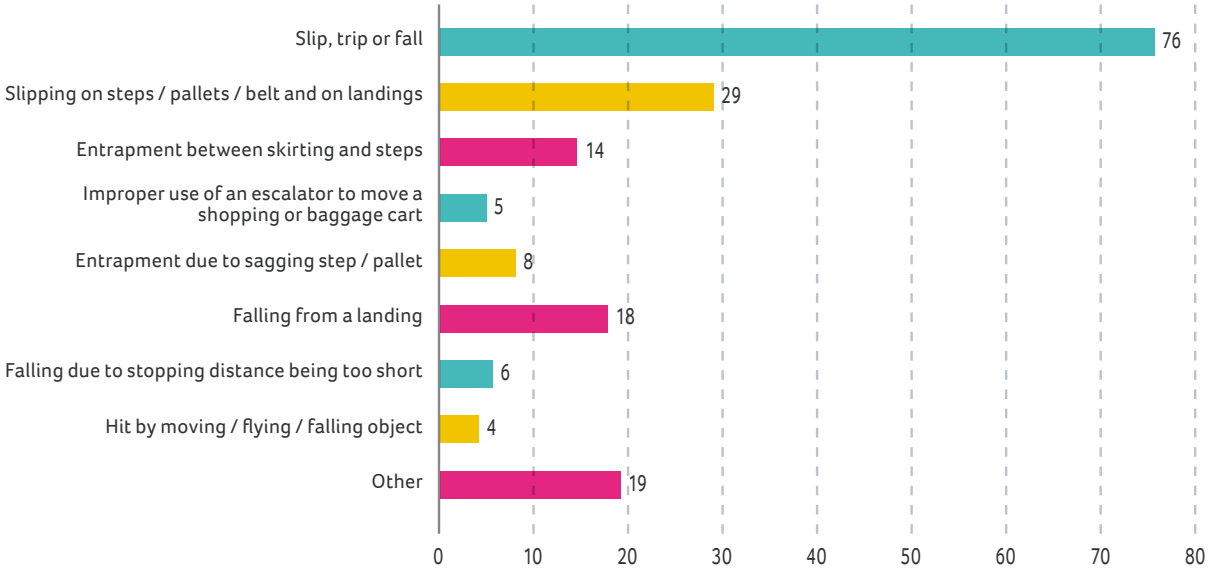
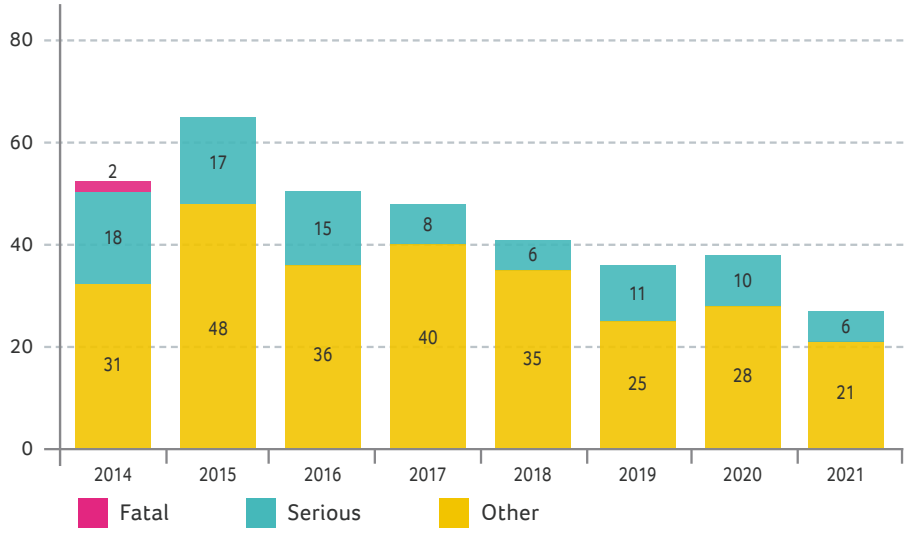


FIG. 9 – MAIN REASONS FOR ESCALATOR USER ACCIDENTS 2021 *(SOURCE ELA)*

ESCALATOR WORKER ACCIDENTS 2021



11 reporting countries
27 reported cases in 2021

FIG. 10 – ESCALATOR WORKER ACCIDENTS 2014-2021 *(SOURCE ELA)*

ESCALATOR WORKER ACCIDENTS – MAIN REASONS 2021

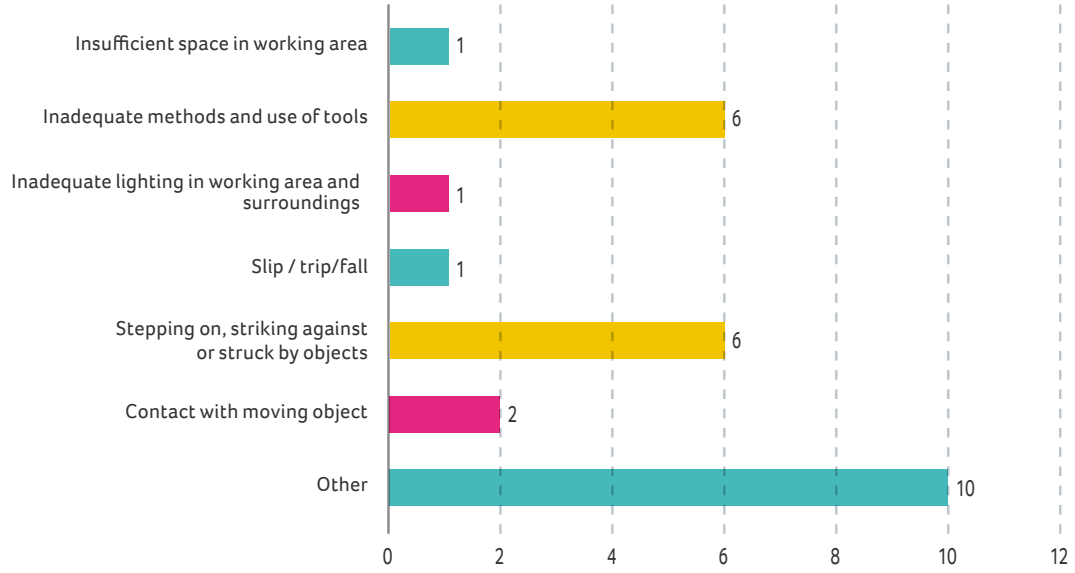


FIG. 11 – MAIN REASONS FOR ESCALATOR WORKER ACCIDENTS 2021 *(SOURCE ELA)*

ACCESSIBILITY

In the world we have more than one billion of people with a disability, experiencing high risk of poverty and social exclusion. So about 15% of the world's population lives with some form of disability: sight, hearing, mobility, verbal, and cognitive problems.

FIG. 12 – THE FIGURES OF DISABLED PEOPLE *SOURCE: WORLD HEALTH ORGANIZATION*

This global trend for disability is on the rise due to world population ageing (see fig. 13) and the rapid spread of chronic diseases.

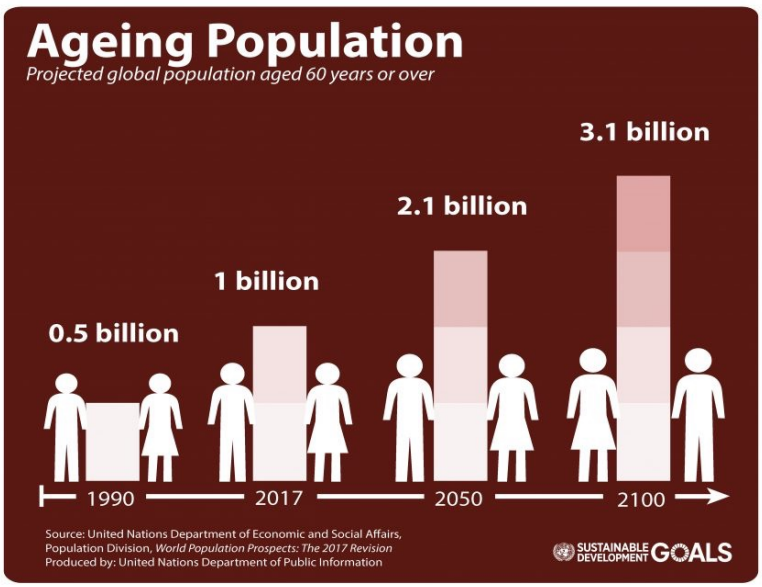


FIG. 13 – THE TREND OF AGEING POPULATION *SOURCE: UNITED NATION*

There is a growing trend in our population with people living longer. More senior citizens require easier accessibility and people with disabilities and impaired mobility, expect safety without the need of assistance.

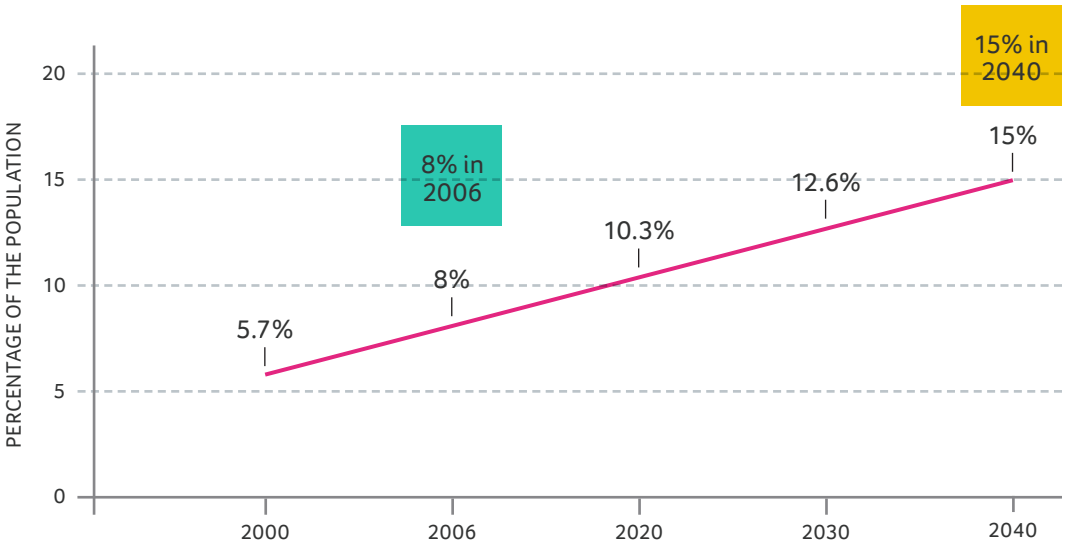


FIG. 14 – INCREASING PROPORTION OF SENIORS 75+

People, despite age and mobility problems, wish to stay in their homes where they have been living for many years. Accessible lifts are fundamental to keep accessibility from the dwelling to the public road, it is necessary to keep good social relationships that is a major concern to increase the lifetime of senior citizens. In addition, costs to maintain them at home by improving accessibility and ergonomics of their environment are really less than costs of specialized establishments.

Taking an example, **the cost to house a senior citizen in a specialised building catering for their basic accessibility needs can start in the region of EUR 30 thousand per annum, whereas this single year cost, may make an existing lift accessible and usable, together within improving the safety and energy efficiency of the unit. Even in situations where daily care is required, it can still be considerably more cost effective to make the lift accessible and usable.**

As to moving to a specialist building, there is also the hidden costs of having to re-locate, together with the distress and anxiety this may cause.

With the integration of accessibility requirements (from EN 81-70), EN 81-80 "SNEL" combined with EN 81-82 "Rules for the improvement of the accessibility of existing lifts for persons including persons with disability" are key documents to achieve this goal.

ENERGY EFFICIENCY

Energy efficiency is a requirement for all building equipment in today's society. Energy has become paramount in the fight against global warming and the reduction of CO_2 emissions. The building stock is responsible for roughly half the emissions of CO_2 in Europe, via heating and direct emissions. It also has indirect emissions, when producing electricity used by the building equipment, from heating and cooling, to running lifts and escalators.

Over the past years many new technologies have been developed in order to improve the **energy performance** of existing lifts both in terms of absolute energy consumption as well as in usage optimization. Here is a list of some design options that contributes to the overall efficiency of the lift system:

Traction lift	Design options	Hydraulic lift
Higher efficiency motor	Standby of the lift controls	Higher efficiency motor
High efficiency gear	Lift controls	High efficiency pump
Gearless motor (avoid gear losses)	Traffic handling management	Control valve
Low Loss Inverter/VVF drive	Usage optimization minimizing number of travels	Regeneration
Regeneration	Reduce friction losses in pulleys, guide rails and guide rollers	Hydraulic recooling
	Rope weight (aramid/kevlar)	
	Belts	
	Car door motor	
	Standby/Lighting ventilation	
	Standby of emergency equipment	

FIG. 15 – LIST OF DESIGN OPTIONS THAT CONTRIBUTES TO THE OVERALL EFFICIENCY OF THE LIFT SYSTEM

For reference and additional details, please refer to the **EcoDesign Preparatory Study for Lifts** final report. With these technologies, lifts have contributed to **reduce energy consumption of buildings** over the past years and have the potential to contribute even further to the renewed EU Commission targets for Climate and Digital transformation.

A recent study from ELA shows that, **upgrading the energy class from D to B** according to **EN ISO 25745-2:2015** of 124 951 lifts per year, which represents an assumption of a 2% yearly renovation rate, would grant a saving of **136 229 tons of CO_2 eq per year**. The 2% assumption has been taken as mid-point from the current renovation rate of about 1% and the EU target of 3% renovation/year of the existing buildings stock. Comparing the saving potential described above it would equal to approximately 135 000 cars with average CO_2 emission of 100g/km running 10 000 km/year. **When upgrading a lift with the measures taken through SNEL-initiatives, it is also seen that new components with new technology – state of the art technology, also have a positive effect in terms of energy savings and the level of lift safety.**

As an example, dealing with stopping accuracies, one measure can be to replace the drive system, e.g. "two speed drive" to a "frequency-controlled drive system (ACVF)". This raises the safety level of the lift, and also gives energy savings.

For further reading https://ela-aisbl.eu/index.php/infodesk/library/latest-news/515-achieving-net-zero-for-the-lift-industry-is-it-possible.

SECTION 4

Synergy achievements on improving safety, accessibility and energy efficiency when modernizing existing lifts

SAEL APPROACH AND FOCUS AREAS

ELA introduces the **SAEL approach to modernization of existing lifts by providing expertise and information on the synergy achievements in combined measures for improving safety, accessibility, and energy efficiency on existing lifts.**

The following **focus areas** for the **modernization interventions** have been considered in this White Paper:

- Electrification system (E)
- Machinery (M)
- Doors (D)
- Car (C)
- Signalization (S)
- Information and Communication Technologies (I)
- Hoistway (H)

4.1 CATALOGUE OF MODERNIZATION INTERVENTIONS FOR EACH FOCUS

In the next chapters are presented the synergy achievements in combined measures for improving safety, accessibility, and energy efficiency in modernizing existing lifts **for each focus area**. The interventions are described in a tabular and reader-friendly format, including their impact on safety, accessibility, and energy efficiency.

Modernization opportunity D.4: Change from lift manual doors to lift automatic doors	
Lift manual door	Lift automatic door
	
Description	Modernize the existing lift doors moving from manual operation to automatic operation
Impact on safety	**INCREMENTAL (+)** : Reduced risks to get injuries for end users during manual opening and closing
Impact on accessibility	**SIGNIFICANT (++)** : Improved accessibility for users avoiding to manually open the landing door and the car door. The benefits are even more significant for people with disability.
Impact on energy efficiency	**SAME (=)** : Typically, modern door operators are more energy efficient than old type of door operators but moving 2 doors instead of 1 could need more power for the motor.

In the re-cap table included in **ANNEX I** all the synergy achievements in combined measures for improving Safety, Accessibility and Energy efficiency in modernizing Existing Lifts are reported.

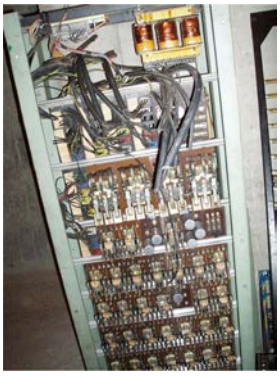
ANNEX II provides a table of elements of existing lifts that may not be aligned with the current state of the art in terms of Safety, Accessibility and Energy efficiency. It provides the benefits for modernising these components individually based on the requirements of EN 81-80 / 82 and may be used as a checklist prior to carrying out a Modernization.

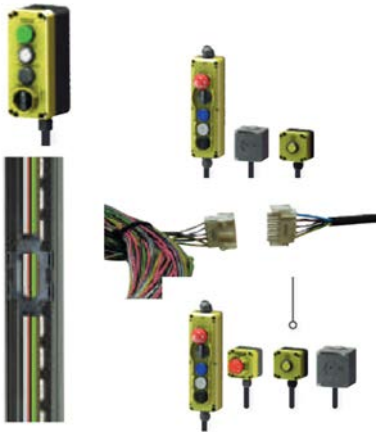
In **ANNEX III** several study cases with real examples of modernization interventions are presented to deliver a strong message to building owners about the feasibility and suitability of modernizing existing lifts bringing synergy achievements in improving safety, accessibility, and energy efficiency.

4.2 COMBINED MEASURES ON ELECTRIFICATION SYSTEM

In this section the synergy achievements in combined measures on electrification system for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity E.1: Upgrade of drive system with frequency converter / inverter	
	
Description	Upgrade of drive system with frequency inverter
Impact on safety	**SIGNIFICANT (++)** : Accurate levelling on landing floors, high reliability
Impact on accessibility	**SIGNIFICANT (++)** : Better stop accuracy
Impact on energy efficiency	**INCREMENTAL (+)** : Low energy consumption

Modernization opportunity E.2: Change the lift controller	
	
Description	Modernize the existing controller by a new one
Impact on safety	**SIGNIFICANT (++)** : Reduced risks to get electrical shock with IP2x protection, indication on the circuits supplied when the main switch is off. Accurate levelling on landing floors, high reliability
Impact on accessibility	**SAME (=)** : No change
Impact on energy efficiency	**SIGNIFICANT (++)** : Low energy consumption in stand-by mode due to new management of the energy

Modernization opportunity E.3: Changes to the wiring and the control boxes in the shaft	
	
Description	Modernize the existing shaft wiring + controlled boxes by a new one
Impact on safety	**SIGNIFICANT (++)** : Boxes IP2X to avoid any contact. Stop boxes in the hoisting (roof of the car and pit) and pulley room Identification of the terminal block with current when the power supply is down Separation between the power supply and the control supply Consignation system per lift
Impact on accessibility	**SAME (=)** : No change
Impact on energy efficiency	**SAME (=)** : No change

4.3 COMBINED MEASURES ON MACHINERY

In this section the synergy achievements in combined measures on machinery for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity M.1: Upgrade of the machine	
	
Description	Modernize the existing machine which is usually noisy for a new one which is less noisy and energy efficient
Impact on safety	**SAME (=)** : Less risk of broken-down machine and less noisy machine
Impact on accessibility	**SAME (=)** : No change for the people access in the car
Impact on energy efficiency	**INCREMENTAL (+)** : Less energy consumption due to new technology more efficient

Modernization opportunity M.2: Upgrade geared machine with brake on the low speed shaft (traction sheave shaft)	
	
Description	Modernize the existing machine moving from one break on the high speed shaft (worm) to one break on the high speed shaft (worm) and one the low speed shaft (traction sheave shaft) manage by a new selection system able to detect overspeed in up direction.
Impact on safety	**SIGNIFICANT (++) :** Being able to manage the uncontrolled movement of the car and the overspeed in upward.
Impact on accessibility	**SAME (=)** : No change for the people on the car.
Impact on energy efficiency	**LESS (-)** : The second shaft needs a bit more energy to manage it..

Modernization opportunity M.3: Change from geared to gearless machine	
	
Description	Modernize the existing machine moving from a geared machine without brake on the traction sheave shaft to a gearless machine with brake on the traction sheave shaft.
Impact on safety	**SIGNIFICANT (++)** : Being able to manage the uncontrolled movement of the car and the overspeed in upward.
Impact on accessibility	**SAME (=)** : No change for the people on the car.
Impact on energy efficiency	**INCREMENTAL (+)** : Better efficiency due to the velimination of the gearbox.

Modernization opportunity M.4: Implement an automatic rescue device to avoid people being blocked inside the car	
Description	Install a rescue device that moves the car to the nearest landing to allow people get out in case of problem or shutdown
Impact on safety	**SIGNIFICANT (++)** : Being able to get out of the car in the normal way when the lift is out of service without any risk.
Impact on accessibility	**SIGNIFICANT (++)** : Being able to get out of the car in the normal way when the lift is out of service which is very important for people with reduced mobility.
Impact on energy efficiency	**SAME (=)** : No impact

4.4 COMBINED MEASURES ON DOORS

In this section the synergy achievements in combined measures on doors for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

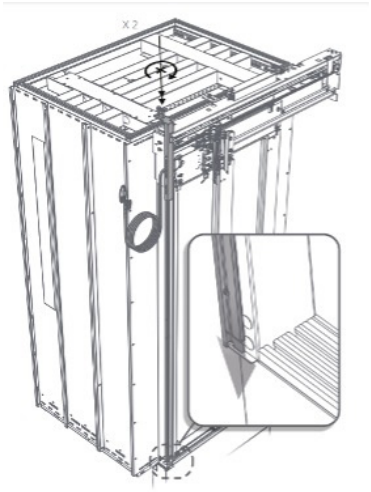
Modernization opportunity D.1: Installation of car door with existing landing hinge door (instead of safety light beams)	
	
Description	Installation of a folding door at the car and remove safety light beams.
Impact on safety	**SIGNIFICANT (++)** : Persons cannot contact the shaft wall and get injured.
Impact on accessibility	**INCREMENTAL (+)** : No longer high risk of hard running stops in case of safety light beam activation. Higher travel speed than 0,63m/s .
Impact on energy efficiency	**LESS (-)** : Car door needs more energy for opening and closing process than safety light beams.

Modernization opportunity D.2: Installation of automatic landing hinge doors (instead of manual opening hinge doors)	
	
Description	Installation of a door drive at each hinge landing door.
Impact on safety	**INCREMENTAL (+)** : Persons don't have to open the hinge door manually. Handicapped people don't have the problem to fall down when they open the door by hand.
Impact on accessibility	**SIGNIFICANT (++)** : In case of automatic opening landing hinge doors in combination with automatic opening folding car doors. Also people in a wheel .chair can use the lift.
Impact on energy efficiency	**LESS (-)** : Automatic opening hinge doors need more energy than manual hinge doors.

Modernization opportunity D.3: Installation of automatic power operating sliding car door (instead of automatic car folding door)	
	
Description	Installation of an automatic power operating horizontal car sliding door and remove the automatic car folding door
Impact on safety	**INCREMENTAL (+)** : During the car door opening process persons cannot trapped between the door panel and the car wall
Impact on accessibility	**INCREMENTAL (+)** : Clear opening width is bigger because of the missing guiding shoes of the fast folding door panels. Also the full car size can be used for a wheel chair.
Impact on energy efficiency	**SAME (=)** : Energy consumption of automatic sliding car doors and folding car doors are similar.

Modernization opportunity D.4: Installation of horizontal sliding landing doors (instead of automatic opening hinge landing doors)	
	
Description	Automatic landing hinge doors are replaced by horizontal sliding landing doors.
Impact on safety	**INCREMENTAL (+)** : Less risk to be injured by the automatic opening hinge door.
Impact on accessibility	**SIGNIFICANT (+)** : People are standing in front of the landing door and don´t have to take care about the movement of the landing door panels. Door opening. and closing process is faster
Impact on energy efficiency	**SIGNIFICANT (+)** : Less energy consumption because the horizontal sliding landing doors will be locked, unlocked and moved by the horizontal sliding car door.

Modernization opportunity D.5: Installation of light beam at the car entrance (instead of no light beam)	
Description	Installation of a light beam at the car entrance to detect a person during the closing process and reopen the door.
Impact on safety	**SIGNIFICANT (++)** : Detections of the people will help to avoid trapping between the panels.
Impact on accessibility	**INCREMENTAL (+)** : Higher accessibility because of the reopening process.
Impact on energy efficiency	**SAME (=)** : A light beam system needs less energy therefore nearly no influence on the energy consumption.

Modernization opportunity D.6: Installation of a light curtain between the car and landing door (instead of a light beam at the car entrance)	
	
Description	Installation of a light curtain at the car between the car and landing door and remove the light beam at the car entrance
Impact on safety	**SIGNIFICANT (++)** : Person can much better detected by a light curtain than by a single light beam.
Impact on accessibility	**SAME (=)** : Because of better detection, reopening process will start earlier.
Impact on energy efficiency	**LESS (-)** : Light curtain will need more energy than a single light beam.

Modernization opportunity D.7: Installation of new automatic power operating sliding car door (instead of old automatic power car sliding door)	
Description	Installation of a new automatic power operating sliding car door with new door controller.
Impact on safety	**SIGNIFICANT (++)** : New door controller can detect an obstacle faster than the old one. In addition, force limitation in opening direction for glass doors is implemented.
Impact on accessibility	**SIGNIFICANT (++)** : Fewer malfunctions due to failure of the door drive, door control, switches, and wear parts such as rollers and guides. Better riding comfort and higher reliability.
Impact on energy efficiency	**SIGNIFICANT (++)** : New door drives and door controllers are much more energy efficient and can be switched on in Stand-by mode with very short restart time < 3 sec (VDI 4707-2).

Modernization opportunity D.8: Installation of new sliding landing doors (instead of landing sliding door)	
Description	Installation of new landing sliding doors according to EN81-20/50.
Impact on safety	**SIGNIFICANT (++)** : Higher strength of door panels and door frame.
Impact on accessibility	**INCREMENTAL (+)** : Fewer malfunctions due to failure of switches and wear parts such as rollers and guides. Better riding comfort and higher reliability.
Impact on energy efficiency	**SAME (=)** : Landing doors don't have detection devices, light curtains, controller or drives.

Modernization opportunity D.9: Installation of 3D light curtain with green-red light signal function on the closing edge (instead of light curtain between car and landing door).	
Description	Installation of 3D light curtain with green-red light signal function.
Impact on safety	**SIGNIFICANT (++)** : Earlier detection of passengers. No more trapping between the door panels.
Impact on accessibility	**SIGNIFICANT (++)** : Visual green – red light function curtain helps handicapped people and children to know when the doors are beginning to close or closing. Fewer accidents.
Impact on energy efficiency	**LESS (-)** : More energy consumption compared to standard light curtain because of additional green – red function.

4.5 COMBINED MEASURES ON LIFT CAR

Neither the change of the complete car nor intervention on the structural frame are considered in this section. Assumption is that overall structural conditions of the car, do not represent a safety risk. Nevertheless, such actions may open the possibility to optimize the car size considering the existing lift hoistway dimensions, something that could be covered in another section of this white paper.

On the other hand, although this section doesn´t intend to cover the so called "slow" lifts, those whose nominal speed is up to 0.15 m/s and were installed under the machinery directive, some of the measures could also be applied to them.

Therefore, and in summary, potential interventions described in this section are focused on the non-structural parts of cars with nominal speed greater than 0.15 m/s: roof, ceiling, decorative panels, mirror/s, car control panel/s, car door/s, floor and apron.

EN standards screened for consideration in this review belong to the family EN 81, Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods:

- Part 20, Passenger, and goods passenger lifts
- Part 28, Remote alarm on passenger and goods passenger lifts
- Part 70, Accessibility to lifts for persons including persons with disability
- Part 80, Rules for the improvement of safety of existing lifts
- Part 82, Rules for the improvement of the accessibility of existing lifts

EN 81 standards not screened:

- Part 72, Firefighters lifts
- Part 73, Behaviour of lifts in the event of fire
- Part 76, Evacuation of disabled persons using lifts
- Part 77, Lifts subject to seismic conditions

In this section the synergy achievements in combined measures on lift car for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity C.1: Equipment on top of the car	
Description	Install on top of the car an inspection control station, a stopping device, and a socket outlet, according to EN 81-20:2020, 5.4.8.
Impact on safety	**INCREMENTAL (+)** : Reduced risks to get injuries for maintenance personnel while performing their job.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.2: Car roof balustrade and/or toe guard	
Description	Introduce a car roof balustrade and/or toe guard according to EN 81-20:2020, 5.4.7.2 and 5.4.7.4.
Impact on safety	**INCREMENTAL (+)** : Reduced risks for people to fall from top of the car and/or produce injuries by falling objects.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.3: Non-slip car roof	
Description	Introduce means to avoid/reduce possibility to slip while working on the car roof, in accordance to EN 81-20:2020, 5.4.7.1 b).
Impact on safety	**INCREMENTAL (+)** : Reduced risks to slip/fall at the top of the car while performing maintenance or inspection.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.4: Car ceiling	
Description	Substitute existing decorative ceiling by one complying EN 81-20:2020, 5.4.4, in terms of non-flammability.
Impact on safety	**INCREMENTAL (+)** : Reduced risks to users and equipment in the case of fire.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.5: Car panels	
Description	Substitute existing decorative car panels by ones complying EN 81-20:2020, 5.4.4, in terms of non-flammability.
Impact on safety	**INCREMENTAL (+)** : Reduced risks to users and equipment in the case of fire.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.6: Car mirrors	
Description	Substitute existing mirrors *or other glass finishes (by one/s complying EN 81-20:2020, 5.4.4, in terms of non-flammability.
Impact on safety	**INCREMENTAL (+)** : Reduced risks to users and equipment in the case of fire.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.7: Car lighting (normal and emergency)	
Description	Whenever possible, introduce a car lighting configuration according to EN 81-20:2020, 5.4.10. Light sources should be of the LED type
Impact on safety	**SAME (=)** : Typically improves visibility and availability of lighting (redundancy).
Impact on accessibility	**SIGNIFICANT (++)** : Improved accessibility for users with low vision level.
Impact on energy efficiency	**INCREMENTAL (+)** : Typically, depending on the light source removed, there is an impact in energy consumption. Improvement is increased if old had a permanent lighting.

Modernization opportunity C.8: Car ventilation	
Description	Whenever possible, if car panels and/or car door are replaced increase natural ventilation by adding more holes, etc. or forced ventilation using means as fans.
Impact on safety	**INCREMENTAL (+)** : Typically improves air refresh and quality, which it is important in these times (virus).
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**LES (-)** : Fans will increase energy consumption

Modernization opportunity C.9: Load control	
Description	Whenever possible, use a load weighting device according to EN 81-20.
Impact on safety	**INCREMENTAL (+)** : Avoids use of lift over nominal load, eliminating damages to some lift components involved in passenger safety.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.10: Doors dwell time	
Description	To include an adjustable device to set a door dwell time between 2 and 20 seconds, in accordance to EN 81-70.
Impact on safety	**INCREMENTAL (+)** : Reduce risks to get injuries for end users during entering and leaving the car.
Impact on accessibility	**INCREMENTAL (+)** : Improved accessibility for users by allowing for more time to enter and leave the car.
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.11: Handrails	
Description	Install handrail/s in accordance to EN 81-70.
Impact on safety	**INCREMENTAL (+)** : Improved safety for users with mobility limitations.
Impact on accessibility	**INCREMENTAL (+)** : Improved accessibility for users with mobility limitations.
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.12: Car floor	
Description	Substitute existing decorative floor by one complying EN 81-20, in terms of non-flammability and EN 81-70 in terms of non-slippery.
Impact on safety	**INCREMENTAL (+)** : Improved safety for users with mobility limitations.
Impact on accessibility	**INCREMENTAL (+)** : Improved accessibility for users with mobility limitations.
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity C.13: Car apron	
Description	Include or improve existing car apron in accordance to EN 81-20.
Impact on safety	**INCREMENTAL (+)** : Reduced risks to fall into the hoistway.
Impact on accessibility	**SAME (=) : No impact**
Impact on energy efficiency	**SAME (=) : No impact**

4.6 COMBINED MEASURES ON SIGNALIZATION

In this section the synergy achievements in combined measures on signalization for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity S.1: Car & Landing buttons	
Description	Substitute existing buttons by ones complying EN 81-70, to enhance accessibility and safety.
Impact on safety	**SIGNIFICANT (++)** : Improved safety for users thanks to innovative technologies especially on health aspects Health products dealing with sanitary context Latest generation of printed circuit boards are more environmentally friendly (REACH & RoHS considerations)
Impact on accessibility	**SIGNIFICANT (++)** : Improved accessibility for users especially for disabled persons (contrast, colours, interface with buildings)
Impact on energy efficiency	**SAME (=) : No impact**

Modernization opportunity S.2: Car Operating Panel (COP)	
	
Description	Include or improve existing COP in accordance to EN 81-20, 28 & 70.
Impact on safety	**SIGNIFICANT (++)** : Increased thanks to digitalization aspects (connectivity, remote alarm…) Latest generation of printed circuit boards are more environmentally friendly (REACH & RoHS considerations)
Impact on accessibility	**INCREMENTAL (+)** : COP position well adapted to the users, also includes buttons disposition
Impact on energy efficiency	**INCREMENTAL (+)** : Stand-by mode considered

Modernization opportunity S.3: Hall Position Indicator (HPI)	
	
Description	Include or improve existing HPI in accordance to EN 81-70
Impact on safety	**SIGNIFICANT (++)** : Safety increased thanks to technologies limiting contrast but also viewing angle. Also, reliable information display is made available for end users, on-time information. Latest generation of printed circuit boards are more environmentally friendly (REACH & RoHS considerations)
Impact on accessibility	**SIGNIFICANT (++)** : Use of recent technologies increase contrast but also viewing angle. Also, reliable information display is made available for end users, on-time information
Impact on energy efficiency	**INCREMENTAL (+)** : Stand-by mode considered, optimized power consumption of boards

4.7 COMBINED MEASURES ON INFORMATION AND COMMUNICATION TECHNOLOGIES (I)

In this section the synergy achievements in combined measures on technology solutions for improving safety, accessibility and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity I.1: Installation of Two-way intercom system (if not existing at all before)	
Description	Installation of a two-way intercom system, connected to a central emergency/call-center.
Impact on safety	**SIGNIFICANT (++)** : Persons cannot get trapped in a lift car.
Impact on accessibility	**SIGNIFICANT (++)** : Automatic submitting of lift number, even if trapped person doesn't speak the required language interface with buildings)
Impact on energy efficiency	**SAME (=)** : Probably similar consumption as old module

Modernization opportunity I.2: Installation of up-to-date Two-way intercom system (instead of old intercom)	
Description	Installation of a new two-way intercom system, connected to a central emergency/call-center; on top of the existing controller system (replacing the old intercom) or as part of a new electrical controller system.
Impact on safety	**INCREMENTAL (+)** : Information about levelling/open doors/light is included
Impact on accessibility	**SIGNIFICANT (++)** : Automatic submitting of lift number, even if trapped person doesn't speak the required language and Information about levelling/ open doors/light is included.
Impact on energy efficiency	**SAME (=)** : Probably similar consumption as old module

Modernization opportunity I.3: Installation of an intercom system with sensor for automatic lift status information	
Description	Installation of a new two-way intercom system on top of the existing intercom system or as part of a new electrical controller system with sensor for automatic lift status information, connected to a central emergency/call-center. Lift status is transmitted automatically, before alarm button is pushed. Detection e.g. of car light, levelling, etc.
Impact on safety	**SIGNIFICANT (++)** : Detection of technical problems before persons get trapped .
Impact on accessibility	**INCREMENTAL (+)** : Higher availability due to early detection of errors.
Impact on energy efficiency	**SAME (=)** : Probably similar consumption as old module

Modernization opportunity I.4: Installation of Predictive maintenance module based on digitalization	
Description	Installation of Predictive maintenance module on top of the existing intercom system or as part of a new electrical controller system.
Impact on safety	**SIGNIFICANT (++)** : Detection of technical problems and wear before persons get trapped.
Impact on accessibility	**SIGNIFICANT (++)** : Very high availability due to early detection of certain effects (wear,...) that are not even errors yet.
Impact on energy efficiency	**LESS (-)** : LESS (-) Additional device and additional sensors might lead to slightly higher consumption.

4.8 COMBINED MEASURES ON HOISTWAY

In this section the synergy achievements in combined measures on hoistway for improving safety, accessibility, and energy efficiency in modernizing existing lifts are presented.

Modernization opportunity H.1: Renewal of well lighting	
	
Description	Replacement of old well light (typically bulbs) by new LED technology.
Impact on safety	**SIGNIFICANT (++)** : Better lighting leads to safer work conditions for service technicians.
Impact on accessibility	**SAME (=)** : No impact on accessibility for users.
Impact on energy efficiency	**INCREMENTAL (+)** : Energy consumption of LEDs is smaller, but overall energy saving is limited

Modernization opportunity H.2: Create shaft ventilation in totally closed shaft without control	
	
Description	Some shafts are completely closed, an opening to the outside (lateral or in ceiling) leads to better ventilation and as a smoke outlet in case of fire. This opening is permanently open.
Impact on safety	**SIGNIFICANT (++)** : Reduced CO_2 concentration in the shaft and less risk that the lift shaft is a smoke distributor inside a building.
Impact on accessibility	**SAME (=)** : Hardly any impact on accessibility for users.
Impact on energy efficiency	**SIGNIFICANTLY LESS (--)** : Can lead to massive energy losses inside a building, especially if the shaft is part of a heated area and the building is in cold climate.

Modernization opportunity H.3: Create shaft ventilation in totally closed shaft with control	
Description	Some shafts are completely closed, an opening to the outside (lateral or in ceiling) leads to better ventilation and as a smoke outlet in case of fire. This opening is controlled by a controller which is typically connected to the fire system and CO_2 sensors etc.
Impact on safety	**SIGNIFICANT (++)** : Reduced CO_2 concentration in the shaft and less risk that the lift shaft is a smoke distributor inside a building.
Impact on accessibility	**SAME (=)** : Hardly any impact on accessibility for users.
Impact on energy efficiency	**SAME (=)** : No heating losses and only minor consumption of the system.

Modernization opportunity H.4: Close open ventilation openings with a controlled ventilation system	
Description	If a shaft is already equipped with a permanent opening, this can lead to thermal losses of the building, especially if the shaft is part of a heated area and the building is in cold climate.
Impact on safety	**Incremental (+)** : Temperature in the shaft can be kept at a more constant level.
Impact on accessibility	**SAME (=)** : Hardly any impact on accessibility for users.
Impact on energy efficiency	**SIGNIFICANT (++)** : Elimination of high thermal losses of the building.

SECTION 5

Synergy achievements on improving safety, accessibility and energy efficiency when fully replacing existing lifts

When the status of the existing lift is not suitable for further upgrading, the full replacement might be a choice to be considered. The benefits resulting from fully replacing existing lifts are listed here:

- **Safety** – Fully replaced lifts offer a completely different level of safety compared to older equipment as they must meet latest and tougher safety requirements.
- **Accessibility** – Fully replaced lifts are improving accessibility of the building and increase quality of life, especially for the elderly and people with disabilities.
- **Environment** – Fully replaced lifts typically have a smaller carbon footprint, are more sustainable and support a circular economy thanks also to the digital enablers.
- **Economic benefits** – Fully replaced lifts, delivering enhanced mobility in the building and with their improved accessibility, allow elderly and people with disabilities to live longer at home, not only improving their quality of life, but also providing significant economic benefits for local authorities.
- **Digitalization** – Fully replaced lifts, equipped with advanced connectivity, allow bringing remote digital services to buildings, improving their usability, availability and security. Digital solutions increase the attractiveness of buildings and can help cities to reduce risks such as the increasing disparity between living areas.
- **Health and well-being** – Fully replaced lifts, equipped with latest sanitization solutions – such as air purifiers and touchless operations of lifts through mobile devices – contribute to improve health and safety of our society.
- **Availability** – Fully replaced lifts might solve the issue of spare parts availability

These benefits are achieved also in case of installation of a new lift in an existing building not equipped with a lift, especially ensuring the accessibility and mobility of residents of the building.

5.1 ADVANTAGES OF PARTIAL MODERNIZATION AND FULL REPLACEMENT

Both partial modernization and full replacement play an important role in the upgrading of a building, and no general advice can be given, which way should be chosen. The optimum solution should be discussed with the maintenance partner or an independent lift consultant.

The advantage of a full replacement is that all components are changed at the same time and that the lift is at the latest state of technology at the time of the replacement. Full replacements further typically provide a slightly better energy performance, but result in a longer downtime of the lift inside the building.

Modernizations of components or functional groups lead to less cost at the point of replacement and result in a shorter downtime for the users. They are typically more sustainable in the use of raw materials as many components stay in the shaft, but will typically not bring all components/functions to the latest state.

SECTION 6

Conclusions and recommendations

With this document, ELA intends to support the national lift associations in promoting synergy achievements in modernizing existing lifts and through this increase their safety level, accessibility, and energy efficiency.

In this paper many interventions to modernize existing lifts have been presented, including the description and the evaluation about their impact on safety, accessibility, and energy efficiency.

Clearly there is a huge potential and solutions available on the market to upgrade the stock of existing lifts contributing to enhance their safety, ensure the accessibility for all the users, and improving the energy efficiency of the buildings.

Each building has certain and specific features and its own history, so the building owner, supported by lift professionals, can identify the most urgent and suitable interventions to be conducted depending on the current status and conditions of the existing lift.

As example, the building owners can find in **ANNEX III** many interesting **case studies** of modernization initiatives already taken in many countries and for many building types.

Modernizing an existing lift will increase the value of the building ensuring reduced operating costs due to better energy efficiency.

People despite age and mobility problems wish to stay in their homes where they have been living for many years. Accessible lifts are fundamental to keep accessibility from the dwelling to the public road, it is necessary to keep good social relationships that is a major concern to increase the lifetime of senior citizens. In addition, costs to maintain them at home by improving accessibility and ergonomics of their environment are really less than costs of specialized structures.

To recap, **here are the main advantages in modernizing existing lifts, including full replacement cases:**

- **Safety enhancements**
  - Significant safety level improvement
  - All SNEL points solved and covered
  - All safety requirements according to the latest state of art
  - Door protection by curtain of light or other sophisticated solutions and not only one photocell if any
  - Building management responsibilities of safety in good order
  - Digital enablers can bring additional safety features

- **Improved accessibility**
  - Better stopping accuracy
  - Signalization with improved user interface
  - Enhanced accessibility due to automatic doors
  - Digital user interfaces may be made available like mobile phone etc.
  - Elderly persons can live and stay home longer with accessible lifts than without
- **Energy saving**
  - One point to improve building energy efficiency and save up to 40% of operating energy costs
  - Digital enablers can bring contribution in the reduction of lift energy consumption
- **Enhanced performances**
  - Latest state of the art solution
  - Typically provide bigger capacity as size and speed
  - Better service capacity
  - New visual outlook and parts or new surfaces
  - Can be adapted to the building interior
  - Modern connected lifts allow bringing remote digital services to buildings, improving their usability, comfort, availability, and security
  - Latest sanitization solutions available also for existing lifts - such as air purifiers and touchless operations of lifts through mobile devices – can contribute to improve health and safety of our society
- **Availability**
  - Modernizing existing lifts or fully replaced lifts might solve the pain issue of spare parts availability
- **Building value**
  - Increase the image and reputation of the building
  - Increase of the market value of the building

These advantages generate value – in social, environmental, and economic dimensions of sustainability – for people, the society, and our planet.

We highly recommend the spread of this White Paper (or an extract) to all the stakeholders – policy maker, authorities, building owners, national lift associations – involved in enabling the accessibility and mobility of people in buildings, districts, and cities.

ANNEX I

SUMMARY TABLE OF COMBINED INTERVENTIONS IN EACH FOCUS AREA

				IMPACT		
ID	MODERNIZATION INTERVENTION	FROM	TO	S	A	E
FOCUS AREA: ELECTRIFICATION SYSTEM (E)						
E.1	Upgrade of drive system with frequency converter / inverter	Poor levelling accuracy on landing floors, low reliability and high energy consumption	Accurate levelling on landing floors, high reliability and low energy consumption	++	++	+
E.2	Change the controller	Old controller with few protection against electric shocks and no management of energy saving during the standby phase and no control of the phasis	Controller with all protection in conformity with new norms and energy saving during the standby phase and control of the phases	++	=	++
E.3	Electric changes of the wiring and the control boxes in the shaft	Old electrical shaft wiring	Boxes IP2X to avoid any contact. Stop boxes in the hoisting (roof of the car and pit) and pulley room. Identification of the terminal block with current when the power supply is down. Separation between the power supply and the control supply. Consignation system per lift.	++	=	=
FOCUS AREA: MACHINERY (M)						
M.1	Upgrade of the machine	Noisy and poor efficient motors	Silent and highly efficient motors	=	=	+
M.2	Upgrade geared machine with brake on the low speed shaft	Geared machine with only brake on the high speed shaft	Geared machine with brake on the high speed and on the low speed shaft	++	=	–
M.3	Upgrade geared machine to gearless machine	Geared machine without low speed shaft brake	Gearless machine	++	=	+
M.4	Installation of an automatic rescue device	Lift without rescue device or manual rescue device	Lift with automatic rescue device	++	++	=
FOCUS AREA: DOORS (D)						
D.1	Installation of car door with existing landing D2 hinge door (instead of safety light beams)	Car with safety light beam	Installation of a folding door at the car	++	+	–
D.2	Installation of automatic landing hinge doors	Manual opening hinge doors	Installation of a door drive at each hinge landing door	+	++	–
D.3	Installation of automatic power operating sliding car door	Old automatic car folding door	Installation of an automatic power operating horizontal car sliding door	+	+	=

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ANNEX I

SUMMARY TABLE OF COMBINED INTERVENTIONS IN EACH FOCUS AREA

				IMPACT		
ID	MODERNIZATION INTERVENTION	FROM	TO	S	A	E
FOCUS AREA: DOORS (D)						
D.4	Installation of horizontal sliding landing doors	Automatic opening hinge landing doors	Horizontal sliding landing doors	+	++	++
D.5	Installation of light beam at the car entrance	No light beam	Installation of a light beam at the car entrance to detect a person during the closing process and reopen the door	++	+	=
D.6	Installation of a light curtain between the car and landing door	A light beam at the car entrance	Installation of a light curtain at the car between and remove the light beam at the car entrance	++	+	–
D.7	Installation of new automatic power operating sliding car door	Old automatic power car sliding door	Installation of a new automatic power operating sliding car door with new door controller	++	++	++
D.8	Installation of new sliding landing doors	Old landing sliding door	Installation of new landing sliding doors according to EN81-20/50	++	+	=
D.9	Installation of 3D light curtain with green-red light signal function on the closing edge	Light curtain between the car and the landing door	Installation of 3D light curtain with green-red light signal function	++	+	–
FOCUS AREA: CAR (C)						
C.1	Install on top of the car an inspection control station, a stopping device, and a socket outlet, according to EN 81-20:2020, 5.4.8.	Inspection device according 81-1 ?	Install on top of the car an inspection control station, a stopping device, and a socket outlet, according to EN 81-20:2020, 5.4.8	+	=	=
C.2	Introduce a car roof balustrade and/or toe guard according to EN 81-20:2020, 5.4.7.2 and 5.4.7.4.	No balustrade and/or toe guard	Introduce a car roof balustrade and/or toe guard according to EN 81-20:2020, 5.4.7.2 and 5.4.7.4.	+	=	=
C.3	Non-slip car roof	Slip car roof	Introduce means to avoid/reduce possibility to slip while working on the car roof, in accordance to EN 81-20:2020, 5.4.7.1 b).	+	=	=
C.4	Car celling	Decorative ceiling not complying to non-flammability	Substitute existing decorative ceiling by one complying EN 81-20:2020, 5.4.4, in terms of non-flammability.	+	=	=
C.5	Car panels	Decorative car panel not complying to non-flammability	Substitute existing decorative car panels by ones complying EN 81-20:2020, 5.4.4, in terms of non-flammability.	+	=	=
C.6	Car mirror/s	Mirrors or glasses non-compliance in term of non-flammability	Mirrors or other glass finishes complying EN 81-20:2020, 5.4.4, in terms of non-flammability.	+	=	=

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SUMMARY TABLE OF COMBINED INTERVENTIONS IN EACH FOCUS AREA

				IMPACT		
ID	MODERNIZATION INTERVENTION	FROM	TO	S	A	E
FOCUS AREA: CAR (C)						
C.7	Car lighting (normal and emergency)	Classis tungsten car lighting	A car lighting configuration according to EN 81-20:2020, 5.4.10. Light sources should be of the LED type	=	++	+
C.8	Car ventilation	Car panels and/or car door without ventilation	Increase natural ventilation by adding more holes, etc. or forced ventilation using means as fans.	+	=	–
C.9	Load control	No load	Load weighting device according to EN 81-20.	+	=	=
C.10	Automatic power operated doors	Old power operated car door or no power operated car door	Include a power operated car door, at least 800 mm width (EN 81-70), in accordance to EN 81-20.	+	++	=
C.11	Door operation protection	No light curtain	Include a protective device "e.g. light curtain" in accordance to EN 81-20:2020, 5.3.6.2.2.1, b).	++	++	=
C.12	Doors dwell time	No door dwell time adjustable	Adjustable device to set a door dwell time between 2 and 20 seconds, in accordance to EN 81-70	+	+	=
C.13	Emergency alarm and intercom system	No emergency alarm system with rescue device	Install in the car an emergency alarm device and intercom system with a rescue service in accordance to EN 81-28 and EN 81-70	+	+	=
C.14	Control of normal operation in the car	Car operating panel	Install car operating panel/s including control devices for normal operation of the lift according to EN 81-20 and EN 81-70	=	++	=
C.15	Signals in the car	No position signal or position signal not complying with EN 81-70	Install position signals, visible and audible, according to EN 81-70	=	++	=
C.16	Handrails	No handrails or handrails not complying with EN 81-70	Install handrail/s in accordance to EN 81-70	+	+	–
C.17	Car floor	Car floor not complying to EN 81-20 and EN 81 70	Substitute existing decorative floor by one complying EN 81-20, in terms of non-flammability and EN 81-70 in terms of non-slippery.	+	+	=
C.18	Car apron	No apron	Include or improve existing car apron in accordance to EN 81-20 or EN 81-21	+	=	=

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SUMMARY TABLE OF COMBINED INTERVENTIONS IN EACH FOCUS AREA

				IMPACT		
ID	MODERNIZATION INTERVENTION	FROM	TO	S	A	E
FOCUS AREA: SIGNALIZATION (S)						
S.1	Car & Landing buttons	Old devices	Substitute existing buttons by ones complying EN 81-70, to enhance accessibility and safety	++	++	=
S.2	Car Operating Panel (COP)	Old devices	Include or improve existing COP in accordance to EN 81-20, 28 & 70	++	+	+
S.3	Hall Position Indicator (HPI)		Include or improve existing HPI in accordance to EN 81-70	++	+	+
FOCUS AREA: INFORMATION AND COMMUNICATION TECHNOLOGIES (I)						
I.1	Installation of Two-way intercom system (if not existing at all before)	No intercom device	Installation of a two-way intercom system, connected to a central emergency/call-center	++	++	–
I.2	Installation of up to date Two-way intercom system	Old intercom device	Installation of a new two-way intercom system, connected to a central emergency/call-center; on top of the existing controller system (replacing the old intercom) or as part of a new electrical controller system	+	++	=
I.3	Installation of an intercom system with sensor for automatic lift status information	Old intercom device	Installation of a new two-way intercom system on top of the existing intercom system or as part of a new electrical controller system with sensor for automatic lift status information, connected to a central emergency/call-center. Lift status is transmitted automatically, before alarm button is pushed. Detection e.g. of car light, levelling, etc.	++	+	=
I.4	Installation of Predictive maintenance module based on digitalization	No predictive maintenance	Installation of Predictive maintenance module on top of the existing intercom system or as part of a new electrical controller system	++	++	–

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SUMMARY TABLE OF COMBINED INTERVENTIONS IN EACH FOCUS AREA

ID	MODERNIZATION INTERVENTION	FROM	TO	IMPACT		
				S	A	E
FOCUS AREA: HOISTWAY (H)						
H.1	Renewal of well lighting	Old light in the well or machinery (tungsten light)	Light with new LED technology	++	=	+
H.2	Create shaft ventilation in totally closed shaft without control	Shaft completely closed	Opening to the outside (lateral or in ceiling) leads to better ventilation and as a smoke outlet in case of fire. This opening is permanently open.	++	=	−−
H.3	Create shaft ventilation in totally closed shaft with control	Shaft completely closed	Opening to the outside (lateral or in ceiling) leads to better ventilation and as a smoke outlet in case of fire. This opening is controlled by a controller which is typically connected to the fire system and CO_2 sensors	++	=	=
H.4	Close open ventilation openings with a controlled ventilation system	Shaft equipped with a permanent opening without controlled ventilation system	Installation of controlled ventilation system	+	=	++

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ANNEX II

SUMMARY TABLE ON BENEFITS FOR MODERNIZING COMPONENTS INDIVIDUALLY

			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
GENERAL					
Removal of Asbestos: Lift Car, Door Panels, Controller Components. Brake Linings, Lift Well &/or Machine Room construction.	Asbestos containing materials	Non-asbestos containing materials	++	=	=
Handling of Heavy Equipment EN 81-20: 5.2.1.7	None, or unmarked devices	Suspension points marked with safe working load	+	=	=
Lighting of the landings in the vicinity of the landing doors EN 81-20: 5.3.7.1	Natural or artificial lighting of the landings does not achieve 50lux	Provide new efficient lighting	+	++	+
Information on safe use and maintenance of lift EN 81-20: 5.2.4, 5.4.2.3.2, 5.4.2.3.3, 5.12.1.5.2.4, 5.12.1.11.1, 7.2	Correct notices, markings, and operating instructions not provided	Correct notices, markings, and operating instructions provided	++	+	=
Improved maintenance regime	Reactive maintenance programme	Preventative pro-active maintenance programme, reducing the number of call-outs and lift down time.	+	+	=
LIFT CAR DIMENSIONS					
Car size sufficient for one wheelchair user without accompanying person EN 81-70: 5.3.1 Table 3	Lift Car with smaller dimensions	1000mm width x 1300mm depth (450Kg) Type 1		+	
Car size sufficient for one wheelchair user with accompanying person EN 81-70: 5.3.1 Table 3	Lift Car with smaller dimensions	1100mm width x 1400mm depth (630Kg) Type 2		++	
Car size sufficient for one larger wheelchair user with some other persons, or stretchers EN 81-70: 5.3.1 Table 3	Lift Car with smaller dimensions	1100mm width x 2100mm depth (1000Kg) Type 3		++	
Car size sufficient for one larger wheelchair user with a few extra passengers, and allows a wheelchair to rotate within the car. EN 81-70: 5.3.1 Table 3	Non-compliant (also minimum dimensions for adjacent entry lifts subject to entrance location)	1400mm width x 1600mm depth and 1600mm width x 1400mm depth (1000Kg) Type 4		++	
Car size sufficient for one larger wheelchair user with several extra passengers, and allows a wheelchair to rotate within the car. EN 81-70: 5.3.1 Table 3	Non-compliant	2000mm width x 1400mm depth and 1400mm width x 2000mm depth (1275Kg) Type 5		++	
Ratio between the rated load of the lift to the car floor area EN 81-20: 5.4.2	Car floor area gives the potential of the rated load being exceeded.	Reduce available floor area to ensure compliance, or restrict the use of the lift to instructed users only	+	=	=

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SUMMARY TABLE ON BENEFITS FOR MODERNIZING COMPONENTS INDIVIDUALLY

			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
INSIDE THE LIFT CAR					
Car wall finishes EN 81-70: Annex D	Non-matt finishes may give optical confusion and glare cause by reflection of light.	Install matt finishes to minimise reflection of light sources.	=	+	=
Slip resistant car flooring EN 81-70: 5.3.2.4	Car flooring without slip resistance	Install slip resistant flooring	+	+	=
Ventilation in the car EN 81-20: 5.4.9	Car with no ventilation	Compliant ventilation provided	++	+	=
Normal lighting in the car EN 81-20: 5.4.10.1, 5.4.10.2, 5.4.10.3	Inadequate lighting within the lift car	Compliant energy efficient lighting	+	+	++
Normal lighting in the car EN 81-20: 5.4.10.1, 5.4.10.2, 5.4.10.3	Compliant Incandescent or fluorescent lighting within the lift car	Replace with compliant energy efficient lighting	=	=	++
Emergency Lighting within the lift car EN 81-20: 5.4.10.4	No or inadequate emergency lighting within the lift car	Compliant energy efficient emergency lighting	+	+	++
Handrail in the car EN 81-70: 5.3.2.1	No or non-compliant handrail location	Positioned on the side wall where the Car Operating Panel is fitted	=	++	=
Device to allow wheelchair users to see behind in Lift Cars where wheelchairs cannot turn around. EN 81-70: 5.3.2.3	No device on Type 1, Type 2 or Type 3 cars	Safety Mirror (or similar device) to allow wheelchair users to see behind.	+	++	=
Mirrors in the lift car EN 81-20: 5.4.4	Non-safety glass mirror fitted	Safety mirror fitted	=	++	=
Mirrored Car wall finishes EN 81-70: Annex D	Substantially mirrored walls causing confusion to partially sighted persons	Decorate bottom edge of the mirror, or position the bottom edge of mirrors, 300mm above the floor.	=	+	=
Install a tip-up seat EN 81-70: 5.3.2.2	No or non-compliant tip-up seat (optional fitment)	Tip-up seat to aid disabled persons during uses, and/or in the event of entrapment	=	+	=
OUTSIDE THE LIFT CAR					
Protection against falling from car roof If choosing balustrades and EN 81-20: 5.4.7.4 is not achievable, provide to EN 81-21: 5.6	Gaps between the car & the well wall presenting a fall hazard	Reduce gaps to less than 0.3m. Where not possible to reduce gaps, install balustrades to EN 81-20: 5.4.7.4	++	=	=
Strength of car roof and emergency trap door and non-slip surface. EN 81-20: 5.4.7.1	Car roof with insufficient strength and / or no non-slip properties.	Strengthen the car roof, and provide non-slip surface.	++		=
Locking emergency trap door not opening towards the inside of the car. EN 81-20: 5.4.6.3	Trap door with no, or non-compliant lock giving access to the car roof.	Provide compliant emergency trap door and locking mechanism	++	=	=

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SUMMARY TABLE ON BENEFITS FOR MODERNIZING COMPONENTS INDIVIDUALLY

			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
OUTSIDE THE LIFT CAR					
Car apron below the lift car to avoid people falling into the well EN 81-20: 5.4.5	Lift Car with no, or non-compliant car apron	Provide compliant car apron or where this is not possible, provide car apron compliant with EN 81-21: 5.8	++	=	=
Inspection control station on the car roof EN 81-20: 5.4.8 a)	Compliant inspection station not present	Compliant inspection station installed	+	=	=
Stopping device on the car roof EN 81-20: 5.4.8 b)	No or non-compliant stopping device fitted	Compliant stopping device fitted	++	=	=
Emergency lighting on the car roof EN 81-20: 5.4.10.4	No or inadequate emergency lighting on the lift car roof	Compliant energy efficient emergency lighting	+	=	+
Distance from the Car Sill to the facing internal well wall EN 81-20: 5.2.5.3.1	Excessive distance giving an accessible space.	Install provision to reduce the gap (preferred), or Car door mechanical locking to EN 81-20: 5.3.9.2	++	=	=
Distance between the closed car door and the closed landing door. EN 81-20: 5.3.4.3	Excessive distance giving an accessible space.	Car and/or landing door devices installed to reduce distance	++	=	=
Distance between leading edges of car and landing door EN 81-20: 5.3.4.3	Excessive distance giving an accessible space.	Car and/or landing door devices installed to reduce distance	++	=	=
CONTROL & INDICATIONS					
Landing control devices EN 81-70: 5.4.2.2, Table 4 and Table 5	Non-compliant Control devices	Install complaint Landing Controls	=	++	=
Illuminating arrows and audible signal on collective systems EN 81-20: 5.12.4.3 EN 81-70: 5.4.2.4.1, 5.4.2.4.2	No or non-compliant illuminating arrows and audible signal	Compliant illuminating arrows and audible signals	=	++	=
Car control devices EN 81-70: 5.4.2.3.1, Table 4 and Table 5	Non-compliant Control devices	Install complaint Car Controls	=	++	=
Car control device positions EN 81-70: 5.4.2.3.1 a) and b)	Non-compliant control device positions	Floor buttons position above the alarm and door buttons	=	++	=
Door open button EN 81-70: 5.4.2.3.2	No door open button in the car	Provide door open button to re-open the doors if closing, and to hold the doors open whilst the button is pressed.	+	++	=
Visual indication of the floor level EN 81-70: 5.4.2.5.1	No or non-compliant floor position indicator	Provide visual position indication between 1.6m and 1.8m above the floor level, with floor numbers between 30mm and 60mm high.	=	++	=
Voice announcement of floor position EN 81-70: 5.4.2.5.2	No or non-compliant floor position announcement	Compliant voice announcement of flor position	=	++	=

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			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
LIFT ALARM SYSTEM					
Intercom system between the lift car & emergency operation location. EN 81-20: 5.12.3.2	No or non-compliant intercom where the lift travel exceeds 30m or direct communication is not possible.	Provide compliant intercom powered by the emergency supply	++	=	=
Alarm System allowing two-way communication to the rescue service. EN 81-28	No alarm communication system	Compliant alarm & communication system	++	++	=
Visible and audible alarm signals integrated in or above the control panel EN 81-70: 5.4.2.5.3	No or non-compliant features installed	Complaint features installed	+	++	=
Induction Loop EN 81-70: 5.4.2.5.4	No or non-compliant Induction loop	Compliant Induction loop installed	=	++	=
Alarm device in pit EN 81-20: 5.2.1.6	No device installed	Compliant device(s) installed.	++	=	=
Alarm device on the car roof EN 81-20: 5.2.1.6	No device installed	Compliant device(s) installed.	++	=	=
LIFT DOORS					
Automatic Car & Landing Doors	Manual Car and Landing doors	Install power operated horizontal sliding doors	+	++	–
Automatic Car & Landing Doors	Manual swing landing door	Install automatic openers to swing doors	+	++	–
Automatic Car & Landing Doors	Simple mechanical automatic operation	Install regulated operation with power saving mode	+	=	+
Presence of car door(s) EN 81-20: 5.3.6.2.2.1 or EN 81-20: 5.3.6.2.2.2	Lift Car without any car door protection	Provide automatic power operated, or manually operated car doors	++	=	=
Door opening EN 81-70: 5.2.1	Door opening less than 800 mm for Type 1, 900 mm for types 2, 3 & 4, and 1100mm for type 5 lift cars	Increase door opening to comply, or in line with national regulations (if higher)	=	++	=
Imperforate car and/or landing doors EN 81-20: 5.3.1.2	Perforate doors	Imperforate doors provided	++	=	=
Strength of the car and/or landing doors EN 81-20: 5.3.5.3	Inadequate strength of the car and/or landing doors	Modify or replace doors to ensure strength requirements are achieved	++	=	=
Sliding car or landing doors with multiple panels EN 81-20: 5.3.14 EN 81-20: 5.3.11	No mechanical linkage or electrical contact(s) on non-driven panel(s), allowing the door panel to remain in the open position	Modify or replace to ensure compliance	++	=	=

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			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
LIFT DOORS					
Power operated horizontal sliding car door, with hinged landing door	Landing door unlocks before the car doors are fully open, or the car doors start to close before the landing doors is closed.	Install new control system to ensure the correct operation	+	+	+
Car door restrictor or locking device EN 81-20: 5.3.15.2 or EN 81-20: 5.3.9.2	Car door can be opening during travel and may give access to open of the landing door.	Replace Car door operator with efficient regulated operator providing compliance	++	=	+
Landing Door Locking Devices EN 81-20: 5.3.9.1	Non-compliant door locking device	Provide conformity assess locking device that has been verified in compliance with EN 81-50	++	=	=
Self-closing and locking of the landing door when the car is outside the unlocking zone EN 81-20: 5.3.9.3.4	Landing door may remain open and/or unlocked when the lift car is away from the landing.	Modify or replace to ensure compliance	++	=	=
Landing door Emergency Unlocking EN 81-20: 5.3.9.3.1	Non-compliant Emergency Unlocking device	Provide compliant Emergency Unlocking device	++	=	=
Landing door fire resistance	Landing entrance not suitably fire tested	Install fire tested door to EN 81-58	++	=	=
Vertical surface below each landing door EN 81-20: 5.2.5.3.2	No vertical surface with crushing hazard.	Vertical surface to prevent crushing hazard.	++	=	=
Protection device to reverse automatic doors if a person crosses the door opening of a closing door EN 81-20: 5.3.6.2.2.1 b)	Lift fitted with no, or non-compliant protection device.	Provide compliant non-contact protection device covering 25mm to 1600mm of the opening height	++	++	=
Protection device to limit the force required to prevent the closing of an automatic door. EN 81-20: 5.3.6.2.2.1 c) and d)	Force to prevent the doors closing and initiate the re-opening of the doors exceeds 150N	Replace Car door operator with efficient regulated operator providing compliance	++	++	=
Door open dwell timer	No or insufficient door open dwell timer	Provide adjustable door open dwell timer to ensure passengers have time to enter/exit the lift.	+	++	=
GLAZED LIFT DOORS					
Glazed car and/or landing doors (not vision panels) EN 81-20: 5.3.5.3.4, 5.3.5.3.5, 5.3.5.3.6, 5.3.5.3.7	Non-compliant car and / or landing door vision panel	Modify or replace doors to ensure requirements are achieved	++	=	=
Prevention measures to avoid dragging children hands in horizontally sliding landing or car doors with glass EN 81-20: 5.3.6.2.2.1 h) and i)	Doors without protection features to avoid the dragging of children hands, or limit the opening for to 150N	Replace Car door operator with efficient regulated operator providing compliance	++	++	=
Glass vision panels in Manually operated car and/or landing doors EN 81-20: 5.3.7.2.1	Non-compliant car and / or landing door vision panel	++	=	=	=

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			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
LIFT MACHINERY SPACES AND LIFT WELL ENCLOSURES					
Access to machinery spaces and pulley rooms. EN 81-20: 5.2.2.5	Insufficient means of access	Provide access means to EN 81-20: 5.2.2.5	++	=	=
Locking devices to Machine / Pulley room, Emergency / Pit Access Doors	Easy access to dangerous Lift Machinery Areas, or fall from height hazards.	Secure Lift Machinery Areas	++	=	=
Lighting in the Machinery Spaces & Pulley Rooms EN 81-20: 5.2.1.4.2	None or insufficient lighting	Improved or replacement energy efficient lighting installed	++	=	+
Lighting in the Machinery Spaces & Pulley Rooms	Incandescent or fluorescent lights installed	Lighting replaced with energy efficient lighting	=	=	+
Pulley room stopping devices close to access point(s)	No or poorly positioned stopping device	Correctly positioned stopping device(s)	++	=	=
Non-slip floor of machinery spaces and pulley rooms EN 81-20: 5.2.1.9	Non-compliant floor	Provide coating or other material to make non-slip	++	=	=
LIFT WELL EQUIPMENT					
Lighting in the lift well EN 81-20: 5.2.1.4.1	None or insufficient lighting	Improved or replacement energy efficient lighting installed	++	=	+
Lighting in the lift well	Incandescent or fluorescent lights installed	Lighting replaced with energy efficient lighting	=	=	+
Guiding of counterweight or balancing weight EN 81-20: 5.7	Inadequate rigid guiding	Provide rigid guiding, or where not possible, comply with EN 81-21: 5.4.3	++	=	=
Final limit switches EN81-20: 5.12.2	None or non-compliant final limit switches	Compliant final limit switches that operate before the car or counterweight contacts the buffer, or before the ram enters its collar.	++	=	=
Stopping device in the lift pit EN 81-20: 5.2.1.4.1	Not installed, or non-compliant	Compliant Lift Pit stopping device installed	++	=	=
Inspection control station in the pit EN 81-20: 5.2.1.5.1 b) Note: Complete compliance is likely to require an entire new lift control system.	Compliant inspection station not present	Compliant control system and inspection station installed	++	=	=
Car and counterweight buffers EN 81-20: 5.8	Inadequate or non-compliant buffers	Compliant buffers	++	=	=

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			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
LIFT MACHINERY					
Protection against injury from traction sheaves, pulleys or sprockets EN 81-20: 5.5.7	Insufficient guarding giving entrapment or crushing hazards	Provide compliant protection / guarding	++	=	=
Protection against ropes/chains leaving the sheaves, pulleys or sprockets EN 81-20: 5.5.7	Insufficient provisions giving breakdown / trap-in, and /or prolonged trap-in hazards	Provide compliant provisions	+	=	=
Protection against the introduction of objects between ropes/chains and sheaves, pulleys or sprockets EN 81-20: 5.5.7	Insufficient guarding giving entrapment or crushing hazards	Provide compliant protection / guarding	+	=	=
Minimum of two independent brake sets on traction or positive drive lifts EN81-20: 5.9.2.2.2	Braking system that could be ineffective with a single component failure.	Compliant breaking system	++	=	=
Emergency operation system Traction or Positive drive EN 81-20: 5.9.2.3 Hydraulic Lifts EN 81-20: 5.9.3.9	No or insufficient means of emergency operation to move the lift car in an emergency (i.e. during passenger release).	Compliant emergency operation system to move the lift car	++	++	=
Means of removing the power which can cause rotation of the motor EN 81-20: 5.9.2.5 or 5.9.3.4	Non-compliant means which may allow uncontrolled movement of the lift car	Update the control system to provide compliant features and energy efficiency	++	=	+
Motor run time limiter EN 81-20: 5.9.2.7 or 5.9.3.10	Timer to detect if lift car is stuck in the guides, etc	Provide compliant run timer	++	=	=
Shut-off valve (hydraulic lifts) EN 81-20: 5.9.3.5.1	No means of isolating the hydraulic fluid between the cylinder and the down valves	Shut-off valve installed to give means of fluid isolation	+	=	=
Low cylinder pressure device EN 81-20: 5.9.3.9.1.5	No means to prevent the ram descending when the system pressure is low	Install compliant system to ensure the ram does not descent.	++	=	=
Slack rope switch for overspeed governor rope EN 81-20: 5.6.2.2.1.6 c)	Lift with no electrical switch to detect a slack rope condition	Provide switch to detect a slack rope condition	++	=	=
Slack rope/chain detection device EN 81-20: 5.5.5.3	No protection against abnormal extension, slack rope or slack chain	Provide switch to detect a slack rope condition	++	=	=
Protection against Lift Car free fall and de-scent with excessive speed EN 81-20: Table 11 or Table 12	No or insufficient means to prevent free-fall or descent at excessive speed	Provide compliant provisions	++	=	=
Protection means against ascending Lift Car overspeed on traction drive lifts with counterweight EN 81-20: 5.6.6	No or insufficient means to prevent ascending car overspeed	Provide compliant provisions	++	=	=
Protection means against unintended Lift Car movement with open doors EN 81-20: 5.6.7	No or insufficient means to prevent unintended car movement	Provide compliant provisions	++	=	=

S = SAFETY A = ACCESSIBILITY E = ENERGY

ANNEX II

SUMMARY TABLE ON BENEFITS FOR MODERNIZING COMPONENTS INDIVIDUALLY

			IMPACT		
INTERVENTION	BEFORE	AFTER	S	A	E
LIFT MACHINERY					
Protection against Lift Car creeping on hydraulic lifts (or presence of clamping device) EN 81-20: Table 12	No or insufficient means to prevent creeping	Provide compliant provisions	++	=	=
Device to prevent the lift from starting if overloaded EN 81-20: 5.12.1.2	No device fitted, giving uncontrolled movement risk	Install compliant overload detector	++	=	=
Protection against electric shock (direct contact) EN 81-20: 5.10.1.2.2	Inadequate protection	Install compliant components to protect against electric shock	++	=	=
Marking of terminals that remain live after power disconnection EN 81-20: 5.10.6.3.5	Non marked terminals giving an electrocution risk	Correctly identified terminals	++	=	=
Protection for an overheating lift machine motor EN 81-20: 5.10.4	No means provided giving a failure / fire hazard	Correct means installed, allowing the car to travel to floor level and allow passengers to leave the car	++	=	=
Earth fault protection EN 81-20: 5.11.1.4	No protection against an earth fault in an electric safety circuit or brake circuit, or a down valve circuit (hydraulic Lifts)	Earth fault protection installed	++	=	=
Power phase reversal EN 81-20: 5.11.1.2 j)	No phase reversal detection provided	Phase reversal protection against a dangerous condition provided	++	=	=
Levelling and stopping accuracy of the car EN 81-20: 5.12.1.1.4	Unable to stop and maintain the car within +/- 10mm of floor level.	Accurate drive system fitted and associated controls	++	+	+
Inspection control station in the pit EN 81-20: 5.2.1.5.1 b) Note: Complete compliance is likely to require an entire new lift control system.	Compliant inspection station not present	Compliant control system and inspection station installed	++	=	=
Car and counterweight buffers EN 81-20: 5.8	Inadequate or non-compliant buffers	Compliant buffers	++	=	=

S = SAFETY A = ACCESSIBILITY E = ENERGY

ANNEX III

CASE STUDIES

Case Study #1

Location: Spain

Segment: Residential

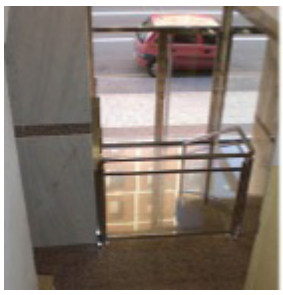
Highlights: Accessibility improvements with construction works

BEFORE MODERNIZATION

- Lift installed in 1981
- National regulation dated 1966
- No harmonized standards
- 2 speed, 1 m/s
- **Machine room**
- **Lower landing: street level + 143 cm**
- Normal pit depth

AFTER MODERNIZATION

- Lift installed in 2016
- Lifts Directive 2014/33/UE
- EN 81-20/50:2014 & EN 81-70:2003
- VF, 1 m/s
- **Machine room-less**
- **Lower landing: street level**
- Low pit



Case Study #2

Location: Madrid, Spain

Segment: Residential

Highlights: Controller replacement, improving safety, reliability, and comfort

BEFORE MODERNIZATION

AFTER MODERNIZATION

ANNEX III

CASE STUDIES

Case Study #3

Location: Aranjuez, Spain

Segment: Residential

Highlights: Machine replacement, improving safety, energy consumption, reliability, and comfort

BEFORE MODERNIZATION


AFTER MODERNIZATION


Case Study #4

Location: Madrid, Spain

Segment: Residential

Highlights: Car doors replacement, improving safety and reliability

BEFORE MODERNIZATION



AFTER MODERNIZATION


ANNEX III

CASE STUDIES

Case Study #5

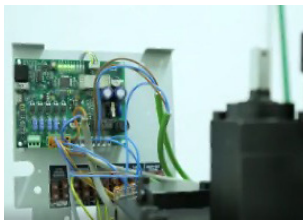
Location: Madrid, Spain

Segment: Residential

Highlights: Hydraulic unit replacement, improving safety, energy consumption and environmental impact

BEFORE MODERNIZATION

AFTER MODERNIZATION



Case Study #6

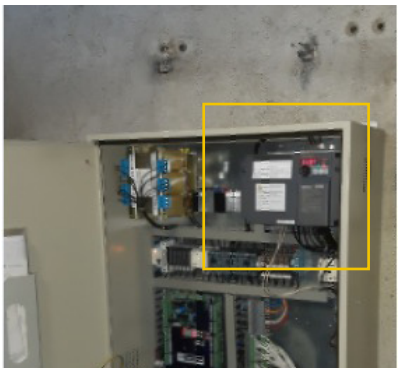
Location: Lecco, Italy

Segment: Residential

Highlights: Inverter installation, improving safety, energy consumption and comfort

BEFORE MODERNIZATION

AFTER MODERNIZATION



ANNEX III

CASE STUDIES

Case Study #7

Location: Madrid, Spain

Segment: Residential

Highlights: Replacing manual door with automatic door, improving safety and accessibility

BEFORE MODERNIZATION

AFTER MODERNIZATION

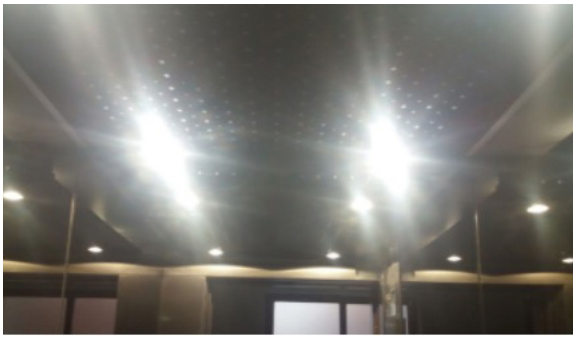
Case Study #8

Location: Madrid, Spain

Segment: Residential

Highlights: Installation of LED lights in lift car, improving power consumption

BEFORE MODERNIZATION



AFTER MODERNIZATION

European
Lift Association

European Lift Association, AISBL
44 Avenue Herrmann-Debroux
Box 1
B-1160 Brussels, Belgium

Tel: +32 (0) 2 779 50 82 Email: info@ela-aisbl.org Web: **www.ela-aisbl.org**

March 2023