What a Specialised VT Consultant can bring to a Project
Il contributo di un consulente di trasporto verticale nella progettazione

This paper introduces the role of the Vertical Transportation (VT) Consultant in the design of existing buildings and those still on the drawing board, where a large number of people are expected to move around.
The VT systems (lifts, escalators and moving walks) are part of the so-called servants spaces of a building, those auxiliary spaces that serve the utilised-principally ones and create connectivity and continuity of spaces. They play a part in defining the internal vertical and horizontal circulation. They make a functional and comfortable building, promote movement and flows of people and alleviate overcrowding. The VT systems should also ensure accessibility to all users, including people with permanent or temporary limitations (people in wheelchairs, children, elderly, people with buggies and luggage, etc.).
In order to promote the coordinated design of VT within buildings, in the United Kingdom and many other countries there are dedicated engineers that support designers to identify the most suitable VT systems and their requirements. They assist architects and building owners by carrying out this special role within the design process. They design, specify and support the installation of the systems with respect to the building limitations.
VT consultants help clients rethink and improve standard solutions to meet their challenges. Thanks to their worldwide experience and knowledge of specialised systems, they work along with specialists and VT manufacturers to develop advanced and innovative engineering solutions. They manage the provision of bespoke and unique systems with regards to sustainability (energy, cost and space saving goals), code and standards requirements. They ensure accessibility, safety, security and reliability of the VT systems.
VT consultants play a vital role within the architectural design, they recommend the correct systems to ensure the users' well-being. They define routes, atmosphere and experience of the (vertical and horizontal) movement within a building layout, in other words, they contribute to shape the so-called Promenade Architecturale through the spaces.

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Introduction

The design of new and existing buildings, that are extensive and multi-functional, requires an intensive study of the internal circulation. The circulation elements, either horizontal or vertical, contribute to the quality of the building space, allow connectivity and continuity of it. It is important to define these elements at the early design stages, considering the people and goods movement, type of buildings and users (residents, workers, visitors, back of house staff, goods, firefighters).

Vertical circulation elements are to move from one level to another and connect the spaces on each level. They include also the Vertical Transportation systems (VT systems) such as lifts, platforms, stair lifts, escalators and moving walks. All these provide a mechanical vertical movement of people and goods, in a quick and convenient way, however staircases should also always be considered.

VT systems for transporting people are sized on the needs of their users. They have to be functional, ergonomic and safe, and provide a friendly, intuitive and independent use by all categories of people, including people with permanent or temporary limitations (people in wheelchairs, children, elderly, people with buggies and luggage, etc.).

To ensure the VT systems meet the accessibility requirements and offer an efficient and safe service to all the users, in the United Kingdom and many other countries there are dedicated engineers, called Vertical Transportation Consultants (VT Consultants) that support designers and building owners in the design of VT systems, to identify the most suitable system and to review the existing equipment.

When designing small and medium-sized buildings, the VT systems are specified by lift contractors that take part in the tender and then undertake the installation of them. When designing larger buildings, with multiple functions, the assistance of VT consultants is required to specify the VT system provision.

The VT consultants have knowledge of the technological systems and how they work. They usually have an engineering or architecture background and often have experience within VT system manufacturing companies. Thanks to their technical expertise, they provide the most suitable solutions for the projects alongside other specialists and manufacturer design teams to develop advanced and innovative systems. They design the systems in accordance with the design criteria, sustainability requirements (energy, cost and space savings) and standards, in particular those related to accessibility, safety and reliability.

When designing new buildings, the VT consultants work with clients, architects and design teams over the entire design process, from feasibility study to concept design, from schematic to detailed design.

They collect preliminary data such as architectural layout, building occupancy and future population, functions and any specific client needs. They study the vertical flows that are expected to affect the VT systems, they analyse the vertical traffic using specific software to simulate the operation of lifts. Using their experience and knowledge of systems and regulations, they interpret the software outputs and tailor the VT systems for the building. They suggest the most suitable equipment, the number of units, type, sizes, speed, location and layout and they produce technical specifications to be independent from any manufacturer, to allow a competitive tender. They assist with the selection of the successful contractor, review technical layouts, monitor the installation, attend testing in factories and commissioning of the systems on site.

When designing systems in existing buildings, VT consultants undertake an assessment of the existing equipment and verify condition and performance. They carry out site inspections,

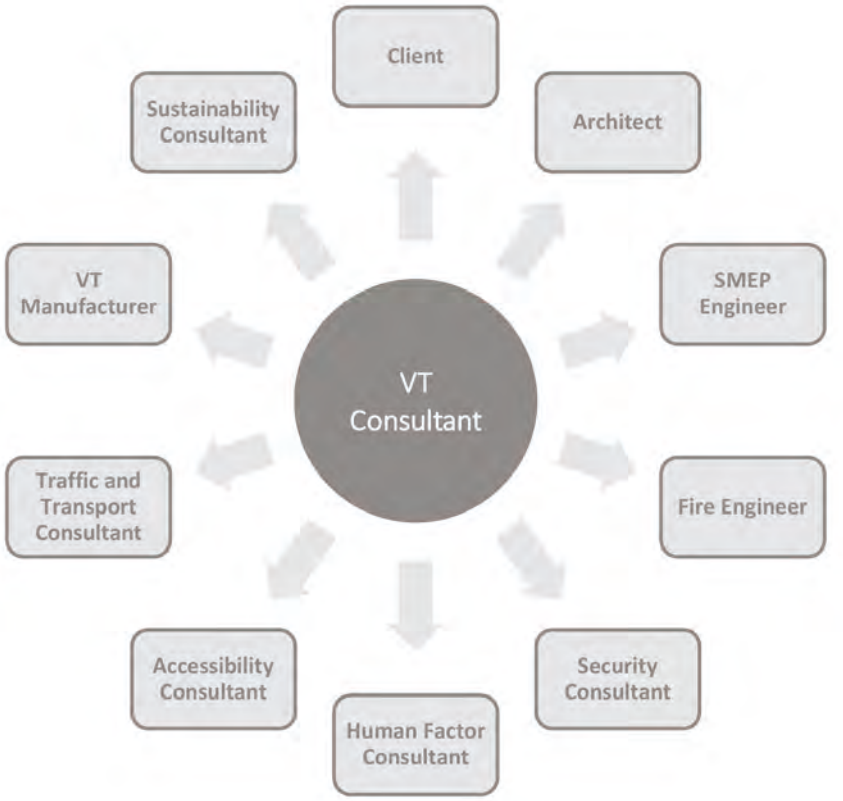

Fig.01 VT Consultant role and collaborations.

collect and review documents (O&M, certificates, etc.), interview manufacturers that supplied and are maintaining the systems, they ensure the compliance with the VT system latest codes, estimate the life expectancy and provide recommendations for maintaining, modernising or replacing the equipment. Their recommendations are to ensure the VT systems provide a good quality of service and achieve compliance with standards, in terms of safety and reliability, performance, energy efficiency and provide guidance on the costs.

Accessibility of VT Systems

VT systems are essential for the transport of people with disabilities. Disabilities can be physical, sensorial, intellectual and phycological. They may be visible or not visible, temporary or permanent. Some people may have more than one disability, they may need assistance and be assisted by one or more companions; some people may carry orthopaedic appliances or be responsible for transporting other people.

The design of VT systems should be based on the ergonomics of all these categories of people, on their needs and the space they require to be accommodated comfortably.

The role of the VT consultants as regards to the accessibility of people with disabilities consists of designing and specifying for safe, comfortable, and effective human use VT systems.

The accessibility requirements for VT systems are specified by international and national regulations based on the *Universal Design* principles of Equity, Flexibility, Simplicity, Perception, Tolerance for Error, Low Physical Effort, Size and Space for Approach Use.

To achieve these goals, to ensure the systems take into account human capabilities, limitations and characteristics, the VT consultants must have a good knowledge of national and international regulations.

Although all the current standards have common principles and provide a similar level of functionality and safety, the documents have quite significant differences.

At present, all around the world, there are three main standards that provide prescriptive rules on the VT systems: the EN 81 series of the European standards, the ASME code A17.1 / CSA B44, the Building Standard Law of Japan (BSLJ) combined with the Japanese industrial standards of Elevator Association (JIS / JEA).

In order to improve the performance, safety and energy efficiency of the VT systems, other than to ensure the compatibility of the various components, products and services worldwide, it has been introduced an international statutory code, the ISO code.

ISO (International Organization for Standardization) is an international body, based in Geneva, which is in charge of harmonising the regulations issued by various and different countries and establishing common requirements, specifications, guidelines and features of the systems. The ISO standards are applied uniformly by all the countries that are member of the body. Once applied, they are aligned to local legislation, environment, history and local cultures and if deemed necessary, some of the rules can be modified to be more stringent.

By way of example, in the United Kingdom there is an additional requirement for firefighters lifts which forbids the use of these lifts for the transport of goods. Basically, goods lifts can be used to transport passengers and goods and for emergency evacuation but not in event of fire. This is to prevent the risk of the lifts being occupied or its entrance being obstructed when the lifts are required for fire evacuation.

In Hungary there are several national decrees that impose strict requirements on lift sizes, capacity and speed, performance (handling capacity, average waiting time, time to destination), firefighters lift provision, accessibility, ventilation, vibration and noise.

Alongside the statutory rules, there also are "technical standards" (of good practice and guidance), which, although not legally binding, they considerably affect the market value of buildings, in particular of commercial buildings.

In the United Kingdom, the VT consultants use national guides and manuals that set the performance criteria of VT systems. The best known and used guides are the BCO guide (British Council for Office, the Britain's leading forum for the discussion and debate of best practice in all aspects of the office sector) and the Guide D of CIBSE (Chartered Institution of Building Services Engineers). These guides have also become quite relevant all-around Europe over the past years.

Furthermore, some clients (e.g. hotel operators) may specify additional requirements for the design and construction of buildings and for the installation of systems, to ensure uniformity of their performance, operation and management.

When working in a not-known environment, the VT consultants ask for assistance to local professionals, such as engineers and architects, and to local branches of the main VT system suppliers. They collect information on local VT and engineering regulations, available technologies, market and traditions.

The VT consultants have to keep themselves aware on the current standards and design guidelines. They undertake research, reading, they attend conferences and seminars, and they refer to VT professional associations such as LEIA (Lift and Escalator Industry Association)

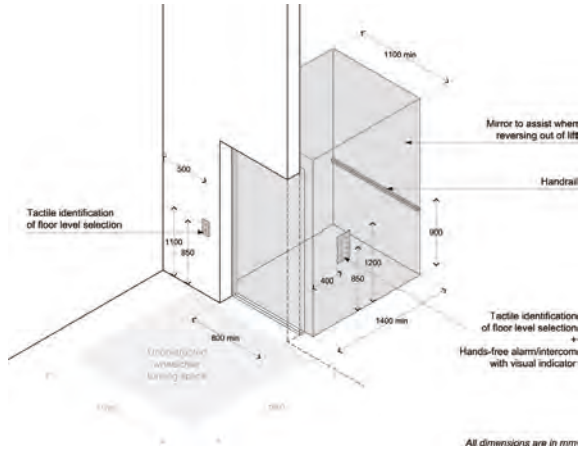

Fig.02 Key dimensions associated with passenger lifts.

at European level, ANACAM (National Association of Construction and Maintenance Companies Elevators) in Italy, both representing industrial companies operating in the sector of VT systems (lifts, escalators and moving walks) and CIBSE in the United Kingdom, which comprise a dedicated VT group (CIBSE Lift Group).

The VT consultants play an important role in architectural design, especially in the definition of accessible VT systems and environments. The VT consultants specify the features of the systems so that they allow an accessible and safe use of them and an equal experience of the spaces for all the users.

In the case of lifts, they indicate the dimensions of cars and doors, the entrances and landings, the architectural elements and details, the materials and surfaces, the characteristics and the position of the accessories, the protection and safety devices, ride comfort, vibration and noise levels. As regards to escalators and moving walks, they specify inclination and speed, the width of steps and the landing areas, the characteristics of the accessory and protection elements, their materials and finishes.

VT consultants also suggest bespoke solutions for systems, especially when working on existing buildings that are limited by structural, plant and space constraints. Existing systems may not be modified or replaced and therefore it is necessary to work on their sub-systems and components applying clever and unusual features as concerns to all the equipment.

In some occasion, as regards to lifts, as a VT consultant, I personally worked on the following unusual requirements and features:

- When I designed lifts in an existing building, where lifts were working as a group and located very far from each other, I required the lift doors to close at limited velocity to allow more time to those who need longer to get in or out of the lift;
- When I designed lift for a private residential building, for a person with very rare physical disabilities, I specified a platform lift with bespoke "joy stick" control instead of the typical push buttons for floor level selection;
- When I designed lifts in existing buildings, with structural and architectural constraints, I specified the goods lifts to be accessible lifts and to comply with EN 81-70:2018 requirements. Since landing controls are to be placed at minimum distance of 500 mm from any adjacent corner or wall at landing and since I had to space limitations, I suggested stand-alone pedestals instead of wall-mounted landing panels;

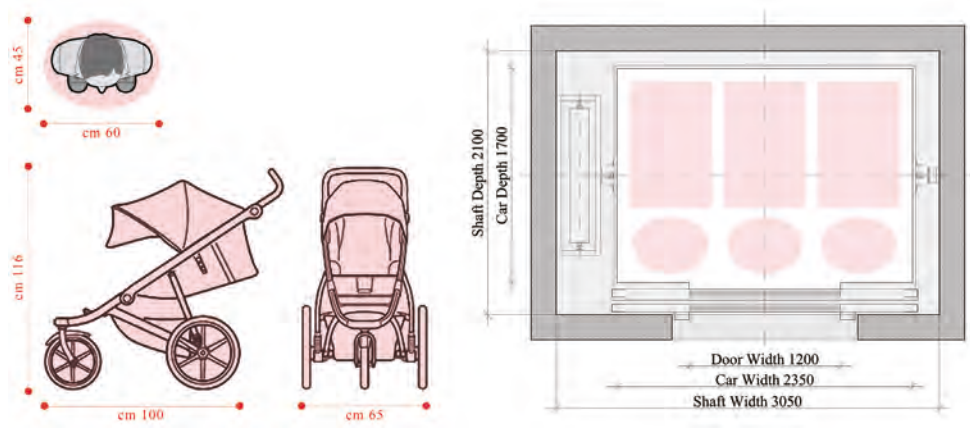

Fig.03 Typical human body occupancy ellipse and buggy occupancy, and their accommodation within the lift car.

- When I designed scenic glass lifts, with large areas of plain glass, I required lift car and shaft finishes with surface decorated glass to prevent confusion to visual impaired people. I also included stone car flooring to prevent dizziness to those suffering from vertigo;
- When I worked on railway and public transport lifts, I specified car and landing finishes to be vandal resistant, to be easy to clean and maintain, to be resistant to liquids (including urine), and lift car flooring to be slip-resistant;
- When I designed lifts for healthcare buildings, I specified lift speed appropriately in order to minimise any adverse effects to patients and elderly;
- When I worked in public and touristic buildings, I specified audio signals and announcements to be clear both in the lift car and at landing, and to be provide both in the local national language and English for foreigner visitors.

When designing accessible VT systems for infrastructure projects such as railway stations and airports the VT consultants work together with Transport and Traffic Consulting teams for developing vertical transportation models and carry out traffic analysis.

Transport and Traffic consultants are engineers and researchers specialised in traffic planning who undertake detailed studies of public and private, vehicular, railway, pedestrian and cycle transport and provide strategies for its management and development. They develop models for providing efficient, safe and sustainable movement of people and goods.

They also study and plan accessible and connected environments and spaces, to make transport systems inclusive and to meet the needs of all the categories of users, including people with disabilities, to make it safe, friendly use with no additional costs. Transport and Traffic consultants provide requirements for modelling passenger traffic patterns, the use of lifts, escalators and moving walks; they identify the categories of passengers based on the capabilities and characteristics of the people; they provide assessments of the impact of people in wheelchair, with buggies and luggage on the building sizing and specify the use and choice of the VT systems.

Understanding the dynamics of pedestrian movement helps VT consultants to develop more realistic vertical traffic models, to create sustainable environments and meet current and future needs.

VT consultants also work together with Fire team to design for emergency escape routes for a building. They assist to define the evacuation of people via lifts. They specify lift size, speed

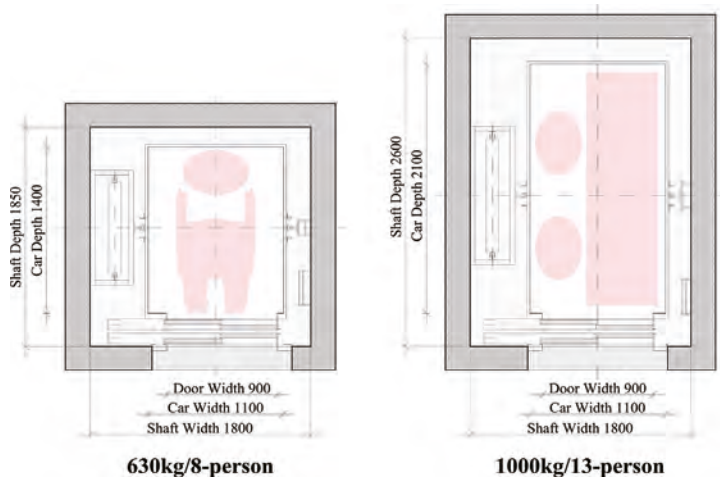

Fig.04 Minimum evacuation lift size (630kg/8-person) and minimum lift size to evacuate ambulance stretcher (1000kg/13-person).

and equipment to meet the fire legislations and to provide a safe, independent and respectable evacuation for all building users, including people with disabilities and those who may be injured during an emergency. Although evacuation lifts are not required by building regulations yet, they are increasingly requested by developers and tenants.

A new code of European standards is being published and is specific for the evacuation of people with disabilities through lifts (prEN 81-76).

The control, requirements and operation of escape lifts are determined by the fire strategy and the minimum requirements (lift capacity, dimensions, power supply, control system, etc.) are the same as per fire-fighters lifts, in accordance with EN 81-72:2015.

The minimum sizes of evacuation lift can accommodate a wheelchair user plus a standing passenger. However, in some buildings there may be a requirement to evacuate people with injuries. In this case, the lift car sizes of evacuation lifts should be able to accommodate a standard ambulance stretcher.

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