Improving Vertical Transportation Design for a Dense Vertical Urban Environment
提高密集垂直城市环境的垂直运输设计

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卡梅伦最近拿到英国朴茨茅斯大学机械工程学位， 研究主题包括使用 2D 和 3D 软件研究机械系统的模拟 模型。他于 2015 年加入法国 D2E 公司，主要为客 户提供垂直交通和外墙通道方案，并参与过伦敦许 多著名建案，例如芬斯伯里塔、伦敦码头和荷兰公 园公寓等。

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Abstract | 摘要

The development of high-rise residential buildings has grown significantly over the past decade in response to the global increase in population density in urban centers. Urban populations accounted for 54 percent of the global population in 2014 – up from just 34 percent in 1960 – and are predicted to approach 70 percent by 2050. In this world of increasingly dense urbanization and the drive to build ever taller, vertical transportation (VT) has become a vital component to this urban expansion; however, recent experience has highlighted an apparent gap in the expectations and perceptions between key stakeholders (including end users) as to the roles and capabilities of VT in supporting high-rise living. In this paper, D2E explores and compares those expectations and perceptions through surveys, direct interviews, its own VT design experience, gathered industry data, and previous such studies, with the aim of defining and bridging the divisions that currently exist.

Keywords: Development Stakeholders, Elevators, High Rise, Performance Based Design, Residential, Vertical Transportation

过去十年，全球城市人口密度增加，使得高层住宅数量大增。1960 年时，全球城市人口只占总人口的 34%，2014 年已达 54%，预估 2050 年更将高达 70%。城市人口愈来愈密， 楼房愈盖愈高，使得垂直交通成为关键。然而，近来发展显示，对于垂直交通在高楼生 活型态上所扮演的角色与贡献，不同利益相关者（包括使用者）的期望和认知有著明显 落差。在本文中，法国 D2E 公司透过研究、访谈、公司自己的设计经验、业界资料和过 往的研究，探讨了这些期望与认知，希望能厘清目前存在的分歧，并提出沟通之道。

关键词：发展利益相关者、电梯、高层建筑、性能设计、住宅、垂直交通

Introduction

In 2007, D2E first published a paper on the UK high-rise market, entitled High-Rise Luxury Apartments, which explored the relationship between high-rise living and vertical transportation (VT) requirements. In short, the paper highlighted that high-rise living was on the increase, and though VT was key to these developments, it was seen as a cost rather than an investment. Standards and references relevant to VT in residential developments were vague, as elevation only becomes important once a building was inhabited. The paper concluded that the strategy for VT was critical to the success of the building, but there was a knowledge gap as far as professional guidance was concerned.

D2E have built upon this research by continuing to develop the themes around high-rise living while expanding the research to the worldwide market. The new D2E/CTBUH paper Improving Vertical Transportation Design for a Dense Vertical Urban Environment, aims to revisit the knowledge gaps identified in 2007, explore any differences in the priorities and perceptions of VT systems between various key

简介

2007 年，D2E 首度以“高层豪华公寓” 为题，发表一份关于英国高层建筑市场的 论文，文中就高层建筑生活与垂直交通（VT）要求之间的关系进行探讨。概括 而言，该论文指出，高层建筑的数量日益 增加，然而，VT 虽扮演着不可或缺的角 色，但往往被视为成本，而非投资，高楼 住宅的开发建设缺乏明确的 VT 标准和参 考指南，电梯的重要性仅在人们入住后才 获得重视。该论文的结论为 VT 策略为建 筑成功与否的关键，而专业指南方面仍存 在知识缺口。

D2E 持续在此一基础上以高层建筑生活为主题进行各种研究，且将研究范围扩大到全球市场。D2E 与高层建筑与都市人居学会（CTBUH）最新发表的《提高密集垂直 城市环境的垂直运输设计》论文，旨在重 新审视 2007 年发现的知识缺口，探讨各主 要利益相关者间对 VT 系统重要性及看法的 差异，以期增进知识，带领我们深入了解 高层建筑生活这个既令人兴奋又迅速发展 的领域（图 1）。

stakeholders, and go some way to improving our knowledge into this exciting and fast-moving world of high-rise living (Figure 1).

Background/Literature Review

Urbanization is happening globally as people migrate to cities in search of work and economic prosperity. This geographical migration now accounts for over 56 percent of the worldwide population, and is forecast to rise to 68.5 percent by 2050 (United Nations, 2015). However, this is problematic for town planners and local governments alike, because the rate of housing being developed, as well as other vital public services, has to meet the rise in population. This trend has been particularly dramatic in China: over the last three decades, the Chinese urban population has grown by 500 million people (The Economist, 2015). Over 55 percent of the Chinese population now lives in cities (Central Intelligence Agency, 2016).

Figure 2 illustrates the dramatic changes in global urbanization since 1950, and the continued, projected future trend. The rise in urban density is seen in just about every geographical region, not just those with emerging economies. This surge in urban living has in turn given birth to the emergence of the megacity – an urban area with a population in excess of ten million inhabitants. In 1950, there were only two cities capable of claiming this accolade, New York (Newark) and Tokyo. Today, that number has risen to more than 22 million, and continues to grow (United Nations, 2015).

This continued and steady preference for urban living, combined with a generally limited cache of space, has raised the demand for high-rise residential housing as the most efficient solution for mass housing on a limited footprint. Residents flock to this type of accommodation, as it offers inner city living close to their work and places of social leisure. Seeing this trend, real estate developers are focused on meeting this global demand.

The number of residential buildings over 200 meters has experienced large growth in recent

years. There are currently 238 completed developments globally (Figure 3), up from just five in the year 2,000 (CTBUH, 2016).

Of these 238 completed buildings, China, South Korea, and the UAE account for almost 60 percent; this is a direct correlation to the rapid rise in urbanization that these regions have experienced. However, the developments planned for construction see

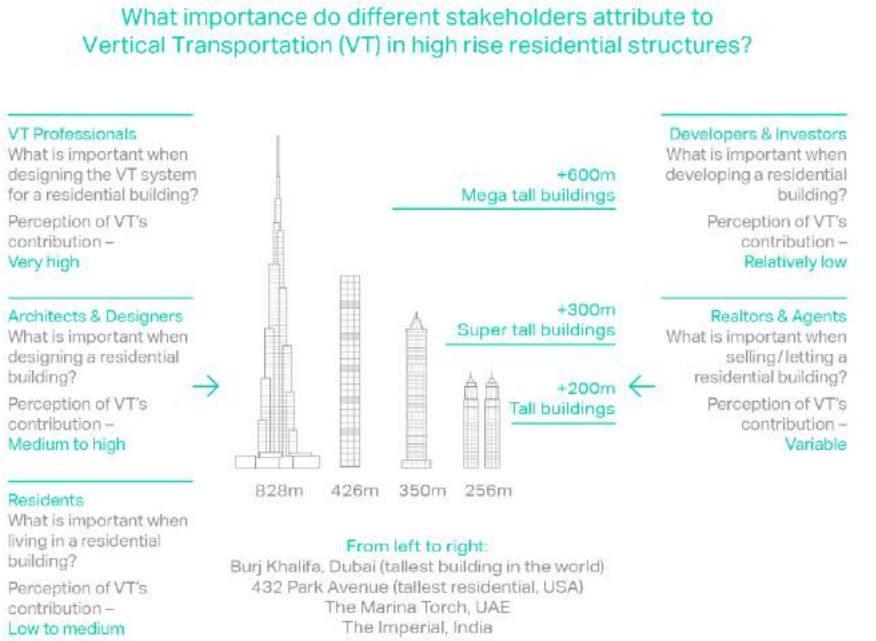

Figure 1. D2E believes there is a disparity in the perception of VT's contribution between key stakeholders in high-rise residential developments. This image aims to illustrate that divergence by ranking the perceived contributions made by VT to the overall development for each of the stakeholders. (Source: D2E International VT Consultants Ltd)
图 1. D2E 相信，不同利益相关者对高层住宅开发项目的垂直运输感知不同。本图旨在显示各利益相关者对 VT 重要性的排序的落差。（来源：D2E 国际垂直交通顾问有限公司）

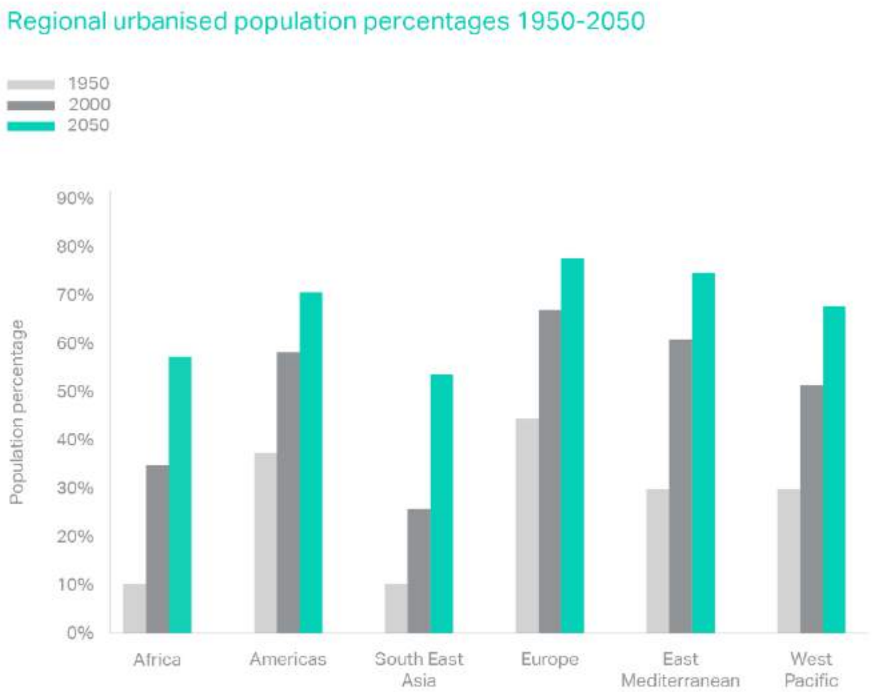

Figure 2. The growth of the urbanized population by region since 1950, and forecast for 2050. (Source: United Nations, 2015)
图 2. 自 1950 年以来城市人口增长情况，预测至 2050 年。（来源：联合国，2015 年）

a shift away from these regions to a more global spread, with India, Australia, and the

US accounting for over half of these planned developments (Figure 4) (CTBUH, 2016).

From the data shown, it is clear that the demand for high-rise residential space is as strong as ever, and will continue to grow. In addition, the development of new and ever more efficient construction technology means that we have the ability to build even taller. Two developments in particular

背景/文献综述

随着人口往城市迁移，寻找工作和经济繁荣，城市化已成全球现象。地域性迁移人口目前占全球人口 56%以上，预计 2050 年将升至 68.5%（联合国，2015 年）。对城市规 划师和地方政府而言，这件随许多问题，因为房屋与其他重要公共建设的脚步，必须 跟上人口增长的速率。此现象在中国尤为显 着，在过去 30 年间，中国城市人口新增了 5 亿人（经济学人，2015）。中国 55%的人 口为城市住民（美国中情局，2015 年）。

Figure 3. The numbers of residential buildings over 200 meters in height, by status from around the world. (CTBUH, 2016)
图 3.　　全球 200 米以上的住宅类高层建筑，以状态划分（来源：CTBUH，2016 年）

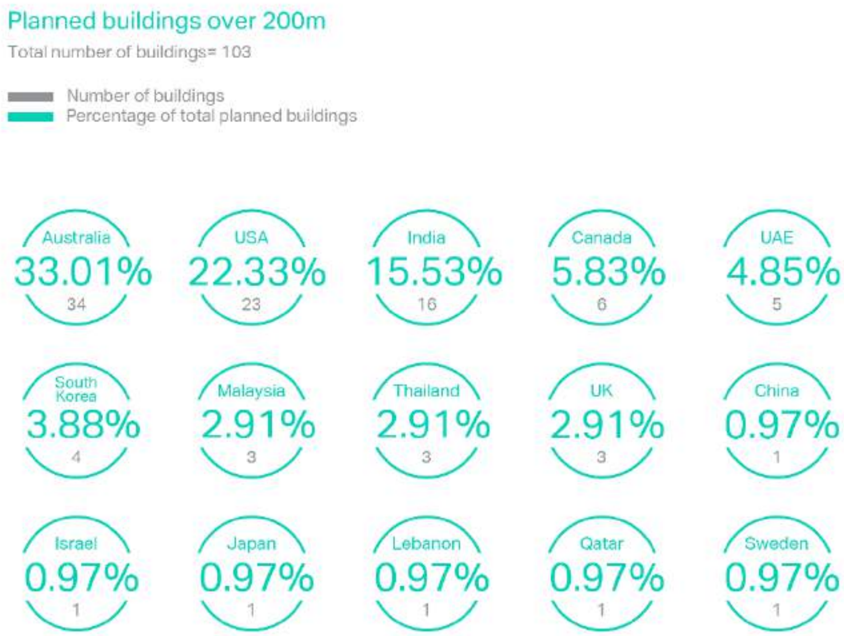

Figure 4. The number of planned structures over 200 meters, by region. (Source: CTBUH, 2016)
图 4.　　已规划的 200 米以上建筑，按区域划分（来源：CTBUH，2016 年）

exemplify this, Lanco Hills Signature Tower in Hyderabad, India and Meydan City in Dubai, UAE, which are proposed to be 604 meters and 711 meters, respectively.

Elevator manufacturers have responded to this ever increasing drive to build taller, with products that travel faster, use fewer or lighter materials, manage journeys more efficiently, and are proportionally more power efficient than in the past. However, as stakeholders in a supply chain focused on satisfying this growing demand, are we aware of and sympathetic to the preferences and priorities of our colleagues? And most significantly of the tenants and buyers occupying the products of our efforts?

图 2 显示了自 1950 年以来全球城市化的急 剧变化，以及持续发展的未来趋势。不仅 仅是新兴经济体，全球每个地区的城市人 口密度几乎都在上升。激增的城市人口孕 育了巨型城市，即人口超过一千万的城 市。 在 1950 年，全球仅有两个城市纽约
– 纽瓦克和东京获此殊荣。时至今日，巨型城市的数量已攀升至超过 22 个，并继续 增长（联合国，2015 年）。

城市生活方兴未艾，加上空间普遍有限，占地节省的高层住宅成了最有效的大型住宅方案。由于提供离工作和社交休闲场所市内生活圈，人们对这种住宅趋之若骛，而房地产开发商看中这一趋势，聚焦这一全球需求。

近几年来，200 米高的以上的高楼住宅数量大幅增长。目前全球已建成的高层建筑有 238 栋（图 3），而 2000 年，仅有 5 栋
（CTBUH，2016）。

这 238 栋完成的建筑近乎 60%位於中国、韩国和阿联酋，充分显现这些地区迅速发展的城市化进程。然而，以已规划建设的情况来看，高层建筑的分布更趋全球化，印度，澳大利亚和美国占已规划设计之总开发案的一半（图 4）
（CTBUH，2016）。

数据充显示对于高层住宅空间的需求如以往一样强烈，并会继续增长。此外，随着新建筑技术及高性能技术的发展，我们有能力兴建更高的摩天大楼。两个开发项目尤其体现这点，印度海得拉巴的诺科山（Lanco Hills Signature Tower），及阿联酋迪拜的迈丹城（Meydan City），这 两座建筑的高度分别为 604 米和 711 米。

人们不断尝试建设更高的摩天大楼，电梯制造商亦已从善如流，回应此一需求，提供运输速度更快，材料更少或更轻，以及乘坐管理更高效节能的产品。然而，当供应链的各方利益相关者侧重于满足这一不断增长的需求之时，我们是否了解并能够感受同业，以及更重要的——使用我们产品的住户及购买者的喜好和优先要求？

实验方法

为弥补有关高层建筑 VT 策略的知识缺 口，D2E 向市场及行业专业人士收集信息。首先，D2E 确定关键利益相关者，具体而言为：开发商和投资者，建筑师和设计师，制造商和承包商，营销中介和房地产经纪人，以及建筑管理人和住户。

D2E 与一些专业利益相关者（如开发商，建筑师和房地产经纪人）进行直接面谈。访谈对象的筛选条件基于其在该领域的经验和独特专长。D2E 使用在线工具，将从访谈中收集而得的信息编制成定性调查，

Experimental Method

In order to bridge the knowledge gap regarding high-rise VT strategies, D2E set out to gather information from the market and from industry professionals. First, D2E identified the key stakeholders – specifically developers and investors, architects and designers, manufacturers and contractors, marketing agents and realtors, and finally, building managers and residents.

D2E conducted direct interviews with a number of the professional stakeholder groups, such as developers, architects, and realtors. The individuals were chosen based on their experience and unique expertise in the field. From the information gathered during the interviews, D2E prepared a qualitative survey using an online tool in order to add depth to the professional stakeholder groups, and also to reach the resident stakeholder group (Figure 5).

The survey consisted of seven questions regarding expectations for high-rise buildings, issues related to VT, and the respondents experience in high-rise residential buildings. A further three questions identified the provenance of the respondent to allow D2E to effectively analyze the responses. The survey was issued to building managers, residents, architects, and developers from around the world.

All the information gathered through direct interviews and surveys was then analyzed by themes and keywords to build a trend of that stakeholder group's preference or tendency.

Results

Developers/Investors
The position of the developer of high-rise residential structures appears, superficially, to bring the same issues as faced by any other manufacturer. Those being the delivery of a product that will generate a return, whilst keeping the cost base low, and in the shortest possible time; however, the residential market is a complex and multi-tiered one, with sectors ranging from customers who need a home that is affordable and immediately available; through to those aspiring to a different style of living; and then to those making investments, often buying and selling-off plans before construction is complete.

For those developers that expressed a view, both in northern Europe and China, the themes of greatest importance revolved around achieving the best possible value, at the right cost, and in shortest possible time. In terms of VT, the message from the developers again focused on efficient layouts, the number and size of the lifts and the effect that they will have on cost and the net lettable area, and the most efficient installations. When marketing a development directly (as opposed to off-plan), there was a recognition of the importance elevators play in conveying the desired impression of the development, including a concern for the ride quality and waiting times.

Lastly, the common frustration with elevators expressed by developers, irrespective of their region, was the failures and breakdowns post completion. Hidden defects in components that only come to light after handover when the elevator is in operation, were a particular annoyance. This frustration was compounded when combined with an apparent inability by the manufacturer to support the installation in promptly or successfully resolving the faults.

Architects and Designers
Having canvased the opinions and experiences of a number of architectural practices based in London, but with international experience, the picture that develops is as much about environment as it is about practical, commercial interests. The key words that dominate in the architectural interviews tend to express a desire for high-rise residential developments that cultivate a positive experience. Importance is placed on making the development a socially enjoyable experience: neighborly, and including "liveability," communal spaces, and moving away from concrete towers. In addition to these aspirations, confirmation of the development footprint is seen as crucial to the future of the project, to maximize efficiency

以增加专业利益相关团体的深度，并接触到居民利益相关者群体（图 5）。

该调查由七个问题组成，包括关于对高层建筑的期待，VT 相关问题和高层住宅的使用经验。另有三个问题追溯受访者背景，进而让 D2E 有效地分析回应。这项调查发送给世界各地的建筑物管理人员、住民、建筑师和开发商。

直接访谈和调查收集到的所有信息均由主题和关键字进行分析，建立起利益相关者群体的偏好或倾向的趋势。

结果

开发商/投资者 表面看来，高层住宅开发商与其他制造商 持相似立场，面临的课题均为交付一项产 品，以产生回报，并同时要保持低成本， 且在最快的时间内交付。然而，住宅市场 结构复杂、涉及层面众多，顾客涵盖了需 要价格适中，立即入住的自用户，追求不 同的风格生活的顾客，以及往往在完工前 即完成购买及抛售的期房投资客等不同 客层。

不论是欧洲北部或是中国的开发商，皆认为最重要的课题为以适当的成本，在最短的时间内，实现最高价值。在 VT 方面，开发商认为重点在于高效布局、电梯的数量和大小，成本和净可出租面积效益，以及最有效的安装方案。若销售的是现房而非期房，一般同意电梯在对开发项目的印象方面扮演重要角色，包括乘坐质量和等待时间。

最后，所有地区的开发商皆表示，最常见且最令人不满意的问题在于竣工后电梯异常或故障。电梯在开始运行后，组件出现

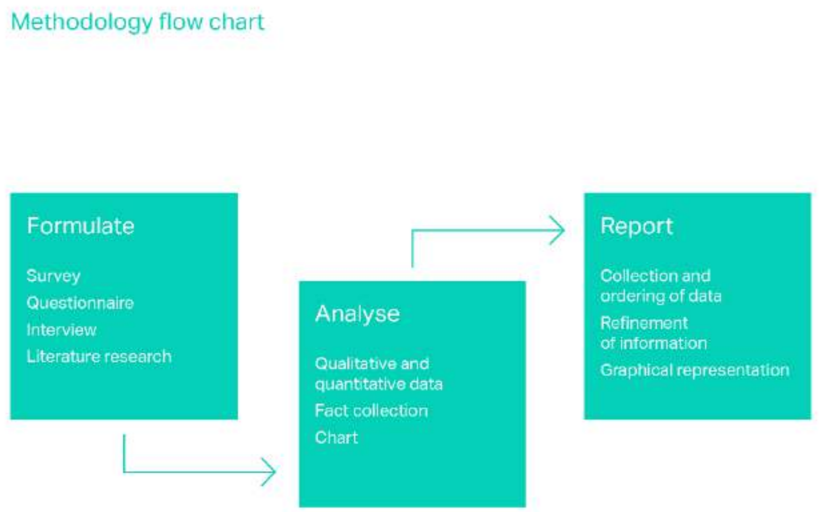

Figure 5. Flow chart describing the methodology employed in surveying high-rise residential stakeholders. (Source: D2E International VT Consultants Ltd)
图 5. 流程图描述调查高层住宅利益相关者采用的研究方法（来源：D2E 国际垂直交通顾问有限公司）

by getting the right balance between unit size and numbers, and the core space.

For the architectural community that was surveyed, the role played by VT is as much about supporting that experience as anything. The VT is seen as the transition from the lobby to the apartments and, as such, needs to maintain the same standard of finish, or standard of experience, or continue the theme developed in other parts of the building. This is manifested in, not only the type of finishes employed, but also the physical size/capacity of the elevators, as over-sizing the elevators creates an impression of quality and luxury. This last point is interesting and appears to be in conflict with the desire to achieve efficiency in the footprint. The recognition that elevators are the biggest influence on core arrangement, and that they take up a lot of floor space contradicts the conviction that "bigger is better."

The elevator related problems experienced by those architects and designers who responded tend to follow the same themes. Specifically, they tend to center on the special requirements of elevators. Particular frustrations are felt with designing in the flexibility of the core, so that the shaft dimensions meet a range of manufacturers' requirements as this doesn't feel cost effective. Also, small changes in shaft design and dimensions at later stages in the process have a dramatic impact on the footprint configuration. Further, the fact that the elevators tend to be procured as an M&E package (a machine), and not an architectural feature, appears to be frustrating because commercial considerations then dominate. The cheapest product to demonstrate technical compliance is procured rather than the product that achieves the aesthetic aspiration.

What is interesting from a VT consultant's perspective is that the architectural and designers bias avoids those technical considerations that the VT consultant sees as important, such as performance, redundancy, ride quality, and so on.

Agents/Realtors
The position of the agent, with respect to high-rise residential developments and the VT systems that support them, is a complicated one driven as much by the market sector that the development is targeting than anything else. At the entry end of the market, more commonly referred to as Affordable or Private Rented Sector (PRS) in the UK, the "churn rate" is a driving factor. This is the rate at which tenants move in and out of their apartments over a fixed period. With tenancy agreements of typically 18 months to two years, any reasonable-sized PRS development is going to have a high churn rate – possible daily moves, but certainly weekly. Under these circumstances the priority for a VT system is two-fold: firstly, to be sufficiently robust to withstand the punishment of such regular movements of large items such as furniture and white goods; and secondly, there needs to be sufficient numbers of elevators to ensure the that the regular loss of one elevator to support tenants moving does not reduce the available lifting capacity to the point where regular passenger conveyance is compromised. The PRS market is already well established in China, with a state source indicating that less than 25 percent of graduates in their early 30's own homes (Michelle, 2015); this is equally well established in Asia and mainland Europe. The sector has grown substantially in recent years in the UK, now accounting for 16.5 percent of all UK households (Veldkamp, 2015), and is an area that may come into conflict with other stakeholders' desires to minimize core space in order to maximize revenue.

For the mid-range market, (typically £750 - £1,500 per ft2 in London) where there are a higher proportion of owner occupiers, the priority for the selling agent is the service charge. The concern for agents who were surveyed was that the inclusion of more elevators to obtain a superior service would result in a larger maintenance and repair burden. This would necessitate a higher service charge and effectively put the development beyond the budget of the target market. In the opinion of these agents canvassed, the service charge is an obvious additional cost that is readily comparable by potential buyers and can be an important input into the buying decision. For those markets and regions where long-term tenancies are the cultural norm in the mid-range market, the service charge is less obvious as it is absorbed into the rent. None-the-less, the tendency to measure the value of residential space by cost-per-unit-area is an important influencer.

At the upper end of the market, the super-prime client has a surprisingly sophisticated knowledge of materials, equipment, and technology. The comment that such clients "know what they want" was noted a number of times from agents. Whether seeking to procure a private home for personal use or to develop luxury homes for others, it appears that the super-prime client values service excellence and discretion, and is not averse to sacrificing footprint for an enhanced core to achieve this. Such super-prime developments

交付前隐藏的瑕疵，则是最令人感到不满意的问题。若制造商无法及时支援安装，或无法成功解决故障，问题更雪上加霜。

建筑师和设计师
根据一些总部设在伦敦，具备国际经验的建筑师事务所的意见和经验，环境与现实考量及商业利益同等重要。建筑师的访谈中出现的关键词往往包含营造高层住宅正面体验，着重愉快的社交经验、友善睦邻环境，“宜居性”，公共空间及舍弃钢筋水泥大楼。除这些理想，开发项目的足迹确认被视为未来项目的关键，通过在单位的大小、数量，和核心空间之间取得平 衡，使效率最大化。

对接受调查的建筑师而言，VT 的作用在于支持此等体验。VT 被视为从大厅到公寓的过渡空间，因此需要维持与建筑物一贯的表面视觉或经验标准，或者延续建筑物其它部分的主题。这不仅显现于使用的表面材质，还包括电梯大小及载容量，因为大型电梯能创造高质量和豪华的印象。最后一点很有意思，因为它与面积的有效设计似乎有所抵触。对电梯是核心布局最大的影响要素，及其占用大量的空间的体认与越大越好的信念相互抵触。

这些建筑师和设计师受访者所经历的电梯问题往往具有同样主题。具体而言，他们往往集中于电梯的特殊要求。为配合制造商对井道尺寸的要求而弹性设计核心布局特别令他们感到挫折，因为这并不符合成本效益。此外，在后期阶段，井道设计及尺寸的微小变动对面积布局有着产生巨大影响。而且，事实上，电梯的采购被视为一个机电组合（一台机器）而非建筑功能的一部分，这点也令人感到挫折，因为如此一来商业考量占据主导地位。采购的选择条件往往在于符合技术规格且最便宜，而非达到美学要求的产品。

对 VT 顾问而言，有意思的是，建筑师和设计师的主观选择往往回避了 VT 顾问认为 重要的技术考量，例如性能、冗余、乘坐 质量等。

中介/房地产经纪人 中介在高层住宅项目的发展及 VT 系统中扮 演的角色较为复杂，主导因素通常为所针 对的目标市场。在初级市场——在英国通 常称为可负担或私人租房部门（PRS）——“翻转率”是一个考量因素。翻转率是指住户在一固定期限间搬入及搬出公寓的速率。由于租约通常为 18 月到 2 年，PRS 大楼一般有着高翻转率，每日可能有人搬出或搬出，肯定至少每周一次。在这种情况下，VT 系统需具备两个重要性能。首先，要够坚固，能承受如家具和白色家电等较大型物品经常移动。第二，需有足够的电梯数量，以确保一座电梯在租户搬动物品无法载客时，有其他电梯可供使用，不影响一般运送乘客服务。PRS 市场在中国已趋稳定成熟，根据国家数

will often include back-of-house, staff, and goods elevators in support of the home or the development – something that the mid-range and PRS markets could not tolerate.

The frustrations with VT expressed by agents, centers primarily on developments that target a particular market sector where the VT design had failed to recognize the priorities described above. In addition, and interestingly, a reoccurring area of irritation, was the belief that the VT industry tended to over-complicate products and systems, with references to destination control, touchscreen technology, and so on. This was interesting as the super-prime sector is demonstrating a growing interest in home-automation and the "internet of things" as a unique selling point or differentiator. VT systems are being included in this, with a desire for home automation to including the facility to call an elevator from an apartment.

Finally, the real estate agent community has a preference to describe and measure developments in terms of "units" – a unit being an apartment. This is important from a VT perspective because those involved with the design of VT systems regard the population as a more valuable metric for their work, and whilst population can be derived from the apartment-mix-per-level; this difference in "vocabulary" illustrates the delta between stakeholders.

VT Professionals

As might be expected, those professionals and designers involved in the VT industry regard VT as the most significant element of the high-rise residential development. Whilst we must be gracious and forgive our colleagues for promoting our area of interest, the focus of VT professionals' attention is not in the obvious areas. It might be expected that this group would emphasize highly technical areas and matters of code and statute compliance and, whilst these subjects are acknowledged, the emphasis tends toward understanding and satisfying the client vision and requirements. Themes such as a robust goods, firefighting, waste, and maintenance strategies; a high-quality finish; suitably sized elevators; knowing the demographic of the residents; and focusing the life cycle of the VT design, are well represented by VT professionals.

Again, as might be expected for a community who spend their professional lives immersed in all aspects of VT, the range of problems and issues experienced is as wide as it is varied, with no one theme dominating. That said, there are two areas that recur. The first is a desire to provide users with more information about their elevators and the technology employed. There is a feeling that ever more involved and connected technology is being lost on the end users, who desire simplicity. Secondly, there is a collective eye on the future, from the perspective of trying to ensure the longevity, or the whole life cycle of the elevators, that energy use is as efficient as can be, and that replacement at the end of life is as straight forward and as undisruptive as possible.

Residents

The opinions and priorities of the residents who ultimately fund the developments we work on and who experience first-hand the results of our collective efforts, should carry the most significance for all for us. With that in mind, it is interesting that the themes that dominate when discussing what's important to residents about their buildings are motivated by lifestyle and convenience: proximity to amenities, like shops, restaurants, entertainment, parks, schools, and transport links; and a desire for a peaceful, quiet, and pleasant place to live. The only other significantly influencing factors expressed by those who responded were security (14.8 percent) and elevators a very lowly 3.7 percent (Figure 6). These views tend to reflect the aspirations of the architectural community to provide a socially enjoyable experience, the "liveability" of the development, and an emphasis on communal spaces.

据，中国年龄 30 出头的毕业生不到 25% 拥有房产（Michelle，2015 年），其他亚 洲和欧陆国家也相同。此区块近年来在英 国大幅增长，现占所有英国家庭的 16.5%
（Veldkamp，2015 年）。这与其他利益相关者希望降低核心空间，以最大限度地提高收入的做法可能有所抵触。

至于自住业主比例较高的中端市场，（在伦敦通常为每平方英尺 750 至 1,500 英镑），服务费是销售中介的优先考虑事项。受访的中介关注的是，更多的电梯数量意味着更好的服务，保养和维修的支出随着提高，因此需要更高的服务费，实际而言，这将超出目标市场预算。受访的中介认为，服务费对购屋者而言显然是笔额外支出，他们会进行比较，把它当做是否决定购屋的一个重要条件。对中级市场长期租约较为盛行的市场和地区而言，由于服务费包括在租金内，它并非一个明显的考量。然而，以每单位面积成本来衡量住宅空间价值是一个重要的影响因素。

在高端市场，顶级头等客户对材料、设备和技术通常有着令人感到意外的细腻了解。许多中介表示，这样的客户“知道自己想要什么......”。无论购买自用住宅，或者开发豪宅，顶级头等客户重视卓越的服务及自主权，不反对牺牲面积以达成更优异的核心布局。这类顶级开发项目往往会包括中端市场和 PRS 市场无法纳入的内场服务、人员及货物电梯。

中介指出，VT 令人感到不满意的地方，主要集中在 VT 设计未能认识到上述特定市场领域的优先考量。另外，有趣的一点是，VT 行业一再为人诟病的地方在于他们

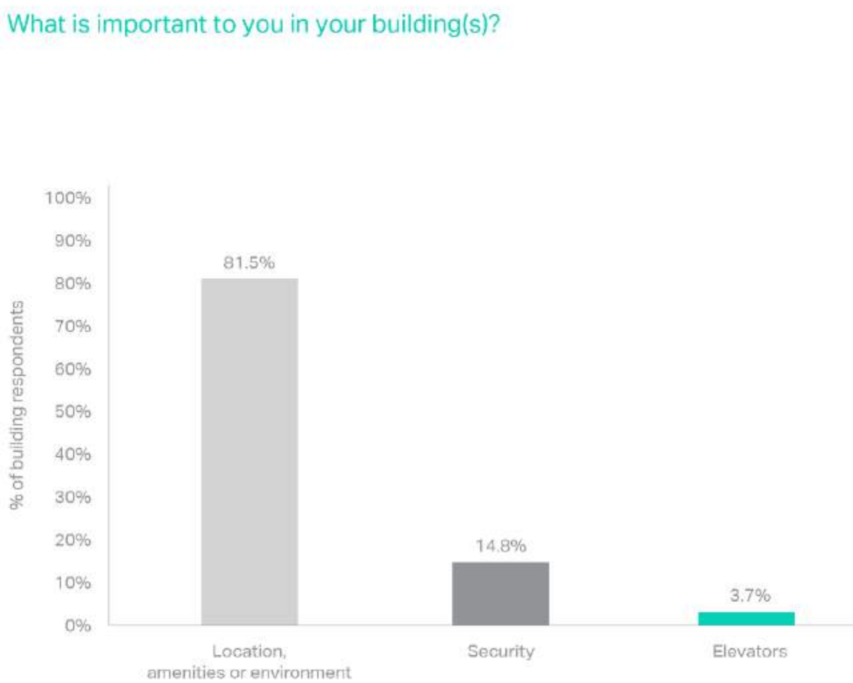

Figure 6. The views of surveyed residents, stating what is most important to them in their building. (Source: D2E International VT Consultants Ltd)
图 6. 受访的住户陈述建筑的哪些方面对他们最重要（来源：D2E 国际垂直交通顾问有限公司）

Lift related issues

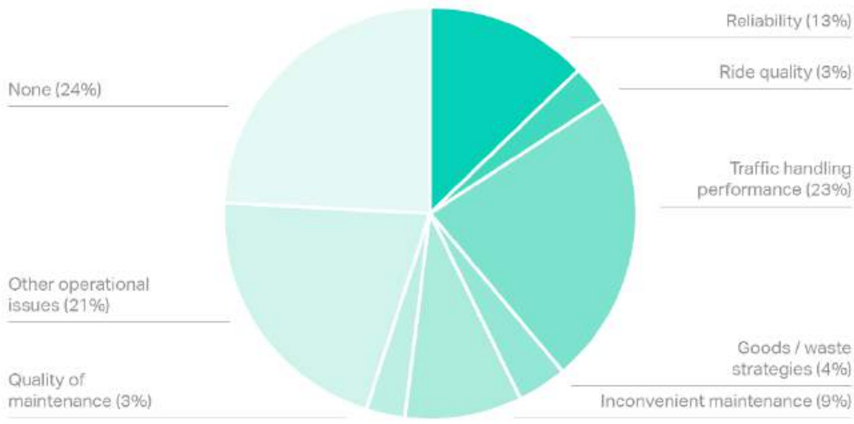

Figure 7. The views of residents by category, responding to survey questions specifically focused on their experiences of VT. (Source: D2E International VT Consultants Ltd)
图 7. 住户回答专门针对他们的 VT 经验的调查问卷，以住户意见分类（来源：D2E 国际垂直交通顾问有限公司）

When residents were invited for their opinions specifically concerning the importance of VT to them, the responses were emphatic. The adjectives being returned by the vast majority of the survey included “crucial, extremely important, essential, and imperative.” Only eight percent rated elevators of little or no importance.

The frustrations felt by residents towards their VT service is, as might be expected, dominated by poor service or a complete lack of service. With reference to Figure 7, 22 percent of the complaints were related to elevators not being available through breakdowns (Reliability), or due to preventative maintenance planned at inconvenient times (Inconvenient Maintenance). Around 10 percent of grievances related to residents’ experiences of waiting times being more than expected (included in Traffic Handling Performance). The remaining areas reported as of concern were divided between unsatisfactory operation of the elevator itself, such as slow elevator speed; unexpected door operation and user errors (Other Operational Issues); and dissatisfaction with certain building strategies, such as the movements of goods or the movement of domestic waste in passenger elevators (Goods / Waste Strategies). Almost a quarter of those responding had no issues with their elevators at all.

When asked to compare their issues with elevators to issues with other services in their building, only two percent placed other services ahead of elevators. The remainder repeated their elevator experiences.

The geographical distribution of respondents was dominated by Hong Kong and Dubai, with Kuwait and the UK also well represented (Figure 8).

Conclusions

It is clear that the acceptance of, and even preference for high-rise living continues to grow globally. Building up is not simply an efficient response to increasing urbanization, but is often a sought after product feeding an aspirational market. Indeed, even less mature high-rise residential markets such as London, where house ownership was traditionally seen as the norm, are witnessing an increase in the private residential sector.

It is also apparent that VT is no longer just a cost, but is increasingly being recognised as bringing value to high-rise developments. Whilst the majority of stakeholders appear to recognise the importance of VT to the operation of a high-rise development, its potential to contribute to a social pleasing experience is perhaps still a new concept. The message from the end users appears to be that the importance of VT is still really only recognised once apartments are occupied. Crudely, it would appear that whilst elevators don’t sell apartments, they certainly dominate when it comes to stress free living, irrespective of region or the floor lived on.

The choice of elevator of the supplier needs now to be drive as much by the local presence of that organisation, and their ability to support their products through its lifetime, as it does by the traditional measure equipment cost.

倾向将产品和系统复杂化，过分强调目的地控制或触摸屏技术等事项。这点很有意思，因为自动化家居在顶级头等市场获得越来越高的关注，“物联网”为独特卖点或差异化因素。 VT 系统为此其一部分，住户希望自动化家居加入可以从公寓中直接呼叫电梯的设计。

最后，房地产经纪人偏好以“单位”来描述和衡量开发项目，一个单位即是一个公寓。从 VT 的角度来看，这点很重要，因为 VT 系统的设计人员把人口视为高价值的工作指标，人口可从每一层公寓组合来计算，用语差异说明了各利益相关者之间的不同。

VT专业人员 正如预期，VT 行业的专业人士和设计师认 为 VT 为高楼和住宅开发项目最重要的元 素。虽然我们对于同事促进本行利益的努 力加以体谅，但 VT 专业人士聚焦的地方并 非明显的重点。外界期待这些专业人员聚 焦高技术领域、规范和法规遵从等问题。

尽管 VT 专业人员认知到这些课题，他们的工作重心依然摆在了解和满足客户的理想和需求。VT 专业人士代表的课题包括强大产品战略、消防策略、废弃物策略和维修策略、高质量表面、合宜的电梯大小、住户人口分布的理解以及聚焦 VT 设计的生命周期。

VT 专业人员穷尽其职业生涯，沉浸研究各式各样的 VT 课题，但他们遇到的问题种类和范围不尽相同，不限于任一个主导课题。尽管如此，有两个课题一再重复。第一是想为用户提供关于电梯和其所使用的技术的详细信息，最终用户希望简单化，但感觉参与度和连接技术尚未到位。第 二，集体目光集中于未来，从确保延长使 用寿命，或电梯的整个生命周期的角度着 手，致力于能源使用效率最大化，使用寿 命结束后的更换作业尽量保持简单，且维 持无中断服务。

住户 住户是我们的工作资金的来源，也是我 们工作成果的第一手体验者，因此他们的意见和优先要求是我们的首要考量。 考虑到这点，在讨论建筑哪些方面对住 户的重要性较高时，生活方式和便利性 占主导因素。住户希望邻近商店、餐厅 和娱乐场所、公园、学校和交通连结等 设施，也渴望和平、幽静宜人的居住环 境。受访者们回答的其他影响因素是 安全性（14.8%），电梯的比重仅占 3.7%（图 6）。这些意见往往反映了建筑界对提供愉快社交经验，“宜居性”及重视公共空间的理想。

当住户被邀请回答 VT 对他们的重要 性的看法时，回应显示受到重视。回 收的绝大多数形容词包括“关键”，“极其重要”，“重要的”和“不可或

Can the supplier demonstrate the reliability of their equipment, both during those early 'teething' stages when the building is first occupied that are so vital to establishing a positive perception of the development, and through the lifts' lifetime? Is the service provider's supply chain sufficiently robust and responsive to give the owner and residents alike confidence in their vertical transportation?

From the Architectural stakeholder group, is there a means by which the VT equipment can be procured outside of the M&E package? Can the elevators be procured directly as an architectural package, in order that the design intent, the aspiration that the lifts support the experience of the building is retained and fulfilled.

From the Realtor stakeholders, the early involvement of the VT design team to understand the target market for the development and design the VT system to address the specific requirements of that market (churn rate, service charge and so on). And from a number of quarters, an apparent growing desire to avoid over complication in the lift interfaces, or excessive use of technology. Ultimately experience is showing that users value simplicity when interacting with lift systems.

And what of the residents, who ultimately are the consumers of what we, the professionals strive to develop and deliver. The high rise residential market has thus developed without too much direct input from the consumers, but as the market continues to grow, D2E envisage that the residents will, and are become more knowledgeable, and through their purchasing choices, more influential of VT systems and equipment. And what residents are telling us today is they want availability and reliability. What they want to know is that there will be an elevator available when they need it, and it will come when called.

Perhaps this is the single message to take away from this study, that if we are to effectively improve and enhance vertical transportation design to effectively support the needs of vertical urban environments, then we must not lose sight of the fundamental reason we are designing these vertical urban environments. Specifically, the need we are designing to meet is to provide residents, our consumers, with places to live, with homes.

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D2E has received valuable information through interviews and surveys. We would therefore like to take this opportunity to thank the following companies for their advice, opinion, and sharing of their knowledge:

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Foster + Partners Ltd
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Guiyang Hongyi Real Estate Developments Co. Ltd
GVA Ltd
Henning Larson Architects Jestico + Whiles + Associates Ltd KONE Lifts Ltd
Kone Pederson Fox (KPF) Ltd
Lotte World Tower and Mall
Lynch Architects Ltd
MACE Real Estate Ltd
MAKE Architects Ltd
OTIS Ltd
PLP Architecture Ltd Savills PLC
Schindler Ltd
Second London Wall Ltd
Shenye East China Real Estate Co. Ltd
Sun Hung Kai Properties Ltd
TH Real Estate Ltd ThyssenKrupp UK PLC Wilkinson Eyre Architects Ltd

缺”。只有 8%的人认为电梯不太重要或 完全不重要。

如同预期一样，在 VT 方面，最让住户感到挫折的是服务质量低，或者完全缺乏服务。图 7 显示，22%的电梯问题是电梯故障无法使用（可靠性），或安排在不便利的时间进行维修保养（维护不便）。约 10 %的怨言和等待时间超过预期有关（包括运输性能）。其他报告的关注事项分别为电梯本身的运转不令人满意，例如电梯速度缓慢，意外的电梯门操作和用户错误（其它操作问题），以及对建筑策略的不满，例如货物动向，或客梯运载生活垃圾（货物/废弃物策略）。受访者几乎有四分之一的人答复电梯方面没有任何问题。

当被要求比较电梯和建物其他方面的问题时，只有 2%人认为其他事项的重要性高过电梯。其他人重复他们的电梯经历。

受访者的地理分布是由香港和迪拜为主，科威特和英国也占相当比例（图 8）。

绪论

明显地，高层生活在全球越来越被接受，甚至已成为人们的偏好。建设向高空发展，已不单只是对不断日益发展的都市化作出的一种有效响应，而也是在这个赋予灵感的市场里，能满足人心，叫他们追求的一种产品。事实上，甚至在如伦敦这些高层住宅市场仍未完全发展成熟，传统上人们仍然以拥有房舍为常的城市里，现时人们也看到了私人住宅市场的需求增加。

明显地垂直运输不再只是一种成本，它越来越被认为是一种向高层发展会带来价值的途径。虽然大多数利益相关者似乎已认识到垂直运输在高层发展运作方面的重要性，但对他们而言，它能对于社会作出贡献，使人生活畅意的潜力，也许仍然是一个新概念。从最终用户的信息来看，似乎只有当公寓入伙后，才可看到垂直运输的重要性。坦白地说，虽然升降机的情况不会影响公寓的销售，但不论您住在哪一区域或那一层公寓内，在人们强调自由生活之际，升降机都肯定占着主导地位。

现今对升降机供货商的选择，跟传统的测量设备成本一样，供货商需要尽可能在当地有他们的接触点，以及在他们产品的寿命期内，提供支持服务。这供货商是否可以证明他们设备的可靠性，无论是当建筑物初入伙时，这个对建立发展正面印象十分重要的“长牙”阶段，以致生产品的整个寿命期内亦然。这个服务供货商的供应链又是否够强大和反应灵敏，以致可以给业主和居民对他们要使用垂直运输同样有信心?

Location of respondents

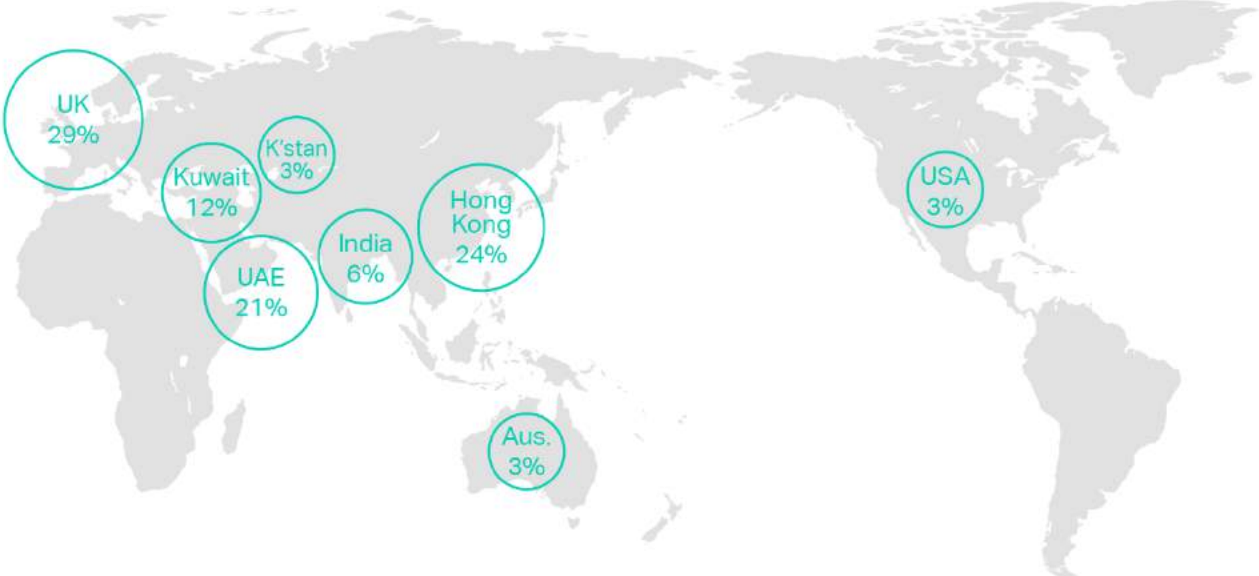

Figure 8. A representation of the global distribution of respondents to D2E's online survey of VT experiences. (Source: D2E International VT Consultants Ltd)
图 8.　D2E VT 经验网络调查的全球受访者分布（来源：D2E 国际垂直交通顾问有限公司）

Recommendations for Further Work

Following the research and conclusions reached in this paper, further work is required to bridge the gap between pre-build and post-build requirements (from the various interested parties) which will facilitate the development of a VT Design Guide for High-Rise Residential Dwellings. Further, whilst this paper did not intend to focus on any one country, the explosive growth of high-rise residential towers in China should be recognized, and the effects would be worthy of further research.

从建筑的利益相关者组织中，有没有途径可以在“机电一体化包件”之外采购垂直运输设备?可否直接采购升降机作为一个“建筑包件”，以便保留和达到原来要配合使用这建筑物经验的设计意图和灵感构思?

从 Realtor 房地产的利益相关者，这些垂直运输设计团队在早期已参与了解目标市场的发展和设计垂直运输系统，以满足这市场的特别要求具体要求(客户流失率、服务费等等)。从一些住宅可以看到，明显地，住客越来越渴望避免太复杂的升降机接口，或过度使用的技术。最终经验显示在与升降机互动的关系上，用户十分重视其简便性。

那些住客是甚么?他们就是我们这些专业人事竭力去发展出来和交付的产品的最终消费者，然而，高层住宅市场在没有取得消费者的直接意见之下便作出发展。但随着市场的不断增长，D2E 预期住客将会知悉更多，并且在他们对选购作出攒择时，他们对垂直运输系统和设备更具影响力。今天住客告诉我们，他们想升降机是可以易于取用和可靠的。　他们想要经验的是，当他们需要时使用升降机时，便可以轻易取得；当他们指示它来时，它便会来。

也许这项研究告诉我们的，就是这个单一的信息，如果我们要有效地改善和提高垂直运输的设计，以致能有效地满足到垂直都市环境的需要，我们一定不能忽视我们最先设计这些垂直都市环境的最基本的原因，特别是要满足的是那些住客，就是我们消费者的需要，为他们提供一处家居生活的地方。

致谢

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建议后续研究

建议就本论文进行的研究和达成的结论， 进一步补强建设前和建设后要求的知识缺 口，从而促生《高层住宅 VT 设计指南》。

此外，虽然本文重点不限任何单一国家， 高层住宅在中国的爆发性增长应该得到承 认，其影响值得进一步研究。建议就本论文进行的研究和达成的结论， 进一步补强建设前和建设后要求的知识缺口，从而促生《高层住宅 VT 设计指南》。

此外，虽然本文重点不限任何单一国家， 高层住宅在中国的爆发性增长应该得到承 认，其影响值得进一步研究。

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