Title:	Transport and the Megacity: Improving Vitality with Connectivity
Author:	John Prevc, Partner, Make
Subjects:	Sustainability/Green/Energy Urban Infrastructure/Transport
Keywords:	Connectivity Density Social Interaction Sustainability Transportation Urbanization
Publication Date:	2016
Original Publication:	Cities to Megacities: Shaping Dense Vertical Urbanism
Paper Type:	1. Book chapter/Part chapter 2. Journal paper 3. **Conference proceeding** 4. Unpublished conference paper 5. Magazine article 6. Unpublished

Transport and the Megacity: Improving Vitality with Connectivity

超级城市的交通出行：四通八达的交通网络提升城市活力

John Prevc
Partner | 合伙人

Make Architects

London | 伦敦

John Prevc is vice-chair of the Future Spaces Foundation, founded in 2013 to advance research and debate about the design of the spaces people live in. He has more than 28 years of experience as an architect, and has worked for some of Europe's most distinguished architects during his career, including Nicholas Grimshaw, Michael Hopkins and Will Alsop. John is a partner and founding member of Make Architects. Prior to Make, he was a project director at Foster + Partners, where he worked on several tall building designs, including the Al Faisaliah Centre in Riyadh – Saudi Arabia's first skyscraper.

John Prevc 是Future Spaces Foundation 的副总裁。Future Spaces Foundation成立于2013年，旨在推动研究成果，对人们的生活空间设计进行大胆尝试。 作为一名建筑设计师，John Prevc 拥有超过 28 年的专业从业经验，在其职业生涯中曾在诸多欧洲最具代表性的建筑设计公司工作，比如 Nicholas Grimshaw、Michael Hopkins 和 Will Alsop。 John 现在是 Make Architects 的一名合伙人和创始成员。加入这家公司以前，他曾在 Foster + Partners 担任项目总监一职，期

Abstract | 摘要

The world's urban population already accounts for more than half of the total population and is predicted to rise to 66% by 2050. Given that the majority of these urban dwellers still currently reside in cities with populations of fewer than one million people, now is an opportune time to consider the ways small and mid-size cities can ensure they preserve their social and economic vitality as they grow and densify. This paper examines the key role transport infrastructure and associated data exchange networks play in facilitating vitality within growing and densifying cities. Using data collected by the Future Spaces Foundation, it highlights successful transport-related initiatives of three large, rapidly densifying cities – Beijing, Mumbai and São Paulo – and concludes with a call for growing cities to consider these specific accomplishments as well as the broader contribution a well-managed transport strategy can makes towards their socioeconomic prospects.

Keywords: Connectivity, Density, Social Interaction, Sustainability, Transportation, Urbanization

全球城市人口在总人口的占比业已超过一半，这一比例预计到2050年将升至66%。鉴于大部分城市居民目前依然生活在人口总量不到百万的中小型城市，现在开始思考在不断发展扩大、人口不断聚积的过程中这类城市得以确保其社会和经济活力的途径，则恰逢良机。 本报告将对交通基础设施及相关数据交换网络在促进持续发展且人口日益积聚的城市之活力方面所发挥的关键作用进行分析。通过引用 Future Spaces Foundation 收集到的各项数据，报告将突出介绍北京、孟买和圣保罗这三个人口快速积聚的大型城市在交通运输方面的成功举措，并在报告结尾处号召其它日益发展的城市在关注这些具体成就的同时，对管理得当的交通策略对促进城市社会经济远期发展的更广泛贡献做出思考。

关键词：连通性、密度、社交联系、可持续性、交通、都市化

Introduction

Densification and the Need for Well-Managed Transport

The idea of city living often conjures images of bustling city-center neighborhoods with a rich mix of residences and lively clusters of shops and cafes on their doorstep. But the reality for most urban residents is immensely different. Vast, fragmented swathes of urban sprawl afflict cities across North America and Europe, where quality of life and social capital are steadily eroded through job sprawl, poor connectivity and the widespread implementation of single-use developments (Figure 1). Meanwhile, overcrowding is a major problem in cities in developing countries like India and Brazil, resulting in heaving favelas and slums plagued by substandard living conditions. In both cases, residents are isolated from critical amenities, their city's core and, in many ways, each other.

The world's urban population already accounts for more than half of the total population (Demographia World Urban Areas 2016) and is predicted to rise to 66% by 2050 (Cox 2012), at which point there

引言

城市结构致密化对合理布局交通的需求

城市居住概念给人的印象往往是繁忙的市中心街区，及其周边住宅区和众多充满活力的商店和咖啡厅等混合组成的居住生活群纵横交错。然而，多数城市居民的生活现状却与之大相径庭。在北美和欧洲，无序蔓延而又支离破碎的城镇化区域令城市饱受其苦，由于就业机会分散、交通条件差以及广泛采用的单一用途开发，这些城市中生活品质下降，社会资本正逐渐消耗殆尽（图1）。与此同时，像印度和巴西这类发展中国家的城市正面临着人口过于集中这样亟待解决的问题，导致城市贫民窟持续滋生，饱尝标准线以下生活条件的困扰。在以上两种情况中，城市居民都无法获取重要的生活设施，远离城市生活核心，而且在许多方面这些居民彼此间也处于相互隔离的状态。

全球城市人口在总人口的占比业已超过一半（数据来自Demographia的世界城市区域研究），这一比例预计到2050年将升至66%，届时仅城市居民的人口数量就将超过 70亿（2016年人居III结论）。为了确保这一增长态势得到全面管控，我们需要从根本上进行全新探索，以期提升公平平

Figure 1. Urban Sprawl in Los Angeles (Source: senaiaksoy)
图1. 洛杉矶城市扩展（来源：senaiaksoy）

will be more than 7 billion urban residents alone (Habitat III 2016). A radical rethink is in order to ensure this growth is managed sustainably, and in a manner that promotes equality, economic growth, social cohesion, and individuals' health and wellbeing. Of course there is no one-size-fits-all answer to this, but densification of existing urban areas is increasingly perceived as a realistic way to help cities accommodate growing populations and still operate as vibrant spaces where people want to live and work.

The Future Spaces Foundation – a think-tank established to advance research and debate about the demographic, technological and socioeconomic factors that affect the spaces people live in – produced a report in 2015 that names density as one of the cornerstones needed to improve cities' social and commercial vitality (Future Spaces Foundation 2015). As the "Vital Cities Not Garden Cities" report outlines, density has the potential to increase choice and opportunity on a personal level, and economic growth, diversity and social cohesion among the broader population. Importantly, it reduces the risk of producing mono-cultural communities, which arise when there are few public amenities and employment and entertainment options on offer (and therefore reduced opportunities for human contact outside the family unit).

Of course, density must be managed efficiently and intelligently, as the context in which a city grows unquestionably impacts its urban trajectory. And density alone is not sufficient to engender the vitality cities need to be successful, especially fast-growing cities in emerging markets. A complex mix of social, economic, political, environmental and infrastructural conditions need to align to facilitate the kind of development that benefits these cities, not least a considered, well-managed plan for transport infrastructure.

The Future Spaces Foundation's 2016 report "Vital Cities: Transport Systems Scorecard" explores in detail how well-networked, efficient, safe and sustainable transport networks equip densifying cities to meet the needs of their rising and fast-changing populations, limit their environmental impact, and enhance their residents' abilities to interact, exchange and innovate (Future Spaces Foundation 2016). The report's central argument is that a city's chances of economic and social success are vastly improved when its connections – pedestrian, bike, vehicle and public transport networks – are simple, comfortable, safe and affordable.

This paper uses data from the "Vital Cities: Transport Systems Scorecard" report to examine the transport infrastructure and associated data exchange networks of three large, rapidly densifying cities – Beijing, Mumbai and São Paulo – and highlight the successful measures and policies implemented between them. Given that the majority of the world's urban population still currently resides in cities with populations of fewer than one million people (Demographia 2016), now is an opportune time to consider the ways small and mid-size cities can plan for the future, particularly with respect to transport infrastructure, considering its potential to facilitate vitality as a city grows and densifies.

Report and Methodology

Overview
For "Vital Cities: Transport Systems Scorecard," the Future Spaces Foundation investigated how 12 cities around the world fare in terms of transport infrastructure and associated data exchange networks. Using a unique scorecard that quantitatively and qualitatively

等、经济发展、社会凝聚以及个人的健康福祉。当然，解决这个问题不能使用一刀切的方法，但是对现有城市区域进行结构致密化规划开始为人广泛接受，视之为一条切实可行的路径，既能帮助城市接纳更多人口，同时依然能够让工作生活其中的居民感受到城市运转的活力。

作为一家致力推动科研成果，在影响居民生活空间的人口、技术和社会经济因素方面进行大胆尝试的智库公司，Future Spaces Foundation 于2015年发布了一份报告，将城市密度作为基石，倡导以此改善城市的社会和商业活力（详见 Future Spaces Foundation 2015）。正如《生机城市非花园城市》报告所指出，城市密集性在个人层面可增加选择和机遇；从更广义的人口层面则能够促进经济发展、多样性以及社会凝聚力。不仅如此，城市密度还能切实降低城市在公共设施选择单调、渴望就业和娱乐选择情况下可能出现的单一文化社区风险。

当然，城市密度在管理上必须做到高效合理，因为城市发展的背景势必会对其周边市镇产生影响。而单单依靠城市密集性无法有效促进成功城市所需的活力，这在新兴市场的快速发展城市中尤为如此。为促进可以造福城市的此类发展，需要对社会、经济、政治、环境和基础设施状况等方方面面进行统一协调，这其中最重要的就是要对交通基础设施进行缜密规划、合理部署。

Future Spaces Foundation 2016年报告题为《生机城市：交通系统记分卡》（Vital Cities: Transport Systems Scorecard），详细探索如何为日益密集的城市部署网络合理、高效、安全且可持续的交通脉络，从而满足城市人口持续增长和快速变化的需求，限制由此带来的环境影响，提升城市居民交互、交流和创新的能力（Future Spaces Foundation 2016）。报告特别强调，简单、舒适、安全且经济的城市交通体系，包括人行道、自行车、汽车和公共交通网络，将会极大提升城市社会经济取得成功的机会。

本文援引《重点城市：交通系统积分卡》中的数据，对三个快速发展的密集型大都市：北京、孟买和圣保罗的交通基础设施和相关数据交换网络进行分析，重点介绍这些城市实施的成功举措和政策。鉴于大部分城市居民目前依然生活在人口总量不到百万的中小型城市（Demographia 2016），随着这类城市的发展和人口的积聚，现在着眼于思考城市未来规划，特别是交通基础设施方面的远期发展，则恰逢良机。

measures the connectivity of each city's transport network, the report explores how each city has integrated transport and data into its unique manifestation, and provides a framework for determining how each can improve in terms of efficiency, sustainability and accessibility. The body of data collated for the research is presented graphically in an interactive data hub available online. For a snapshot of the results, Figure 2.

Of the dozen cities examined in the study, São Paulo, Beijing and Mumbai comprise the "megacities" category, which refers to cities that have a population of more than 10 million and are located in rapidly urbanising emerging markets. Incorporating effective infrastructure into such cities is, of course, a complex process that requires adequate political will, advanced engineering solutions and deep financial commitments. With the scorecard data, however, it becomes possible to begin a discussion on the connectivity challenges these cities face and how certain strategies are addressing these.

Categories

The 12 cities in the Future Spaces Foundation study are grouped into 4 categories: "megacities" (Beijing, São Paulo and Mumbai); "global cities" (London, New York and Hong Kong); "green cities" (Copenhagen, Vancouver and Singapore); and "car cities" (Houston, Dubai and Kuala Lumpur).

As mentioned, megacities in this context refer to cities located in rapidly urbanising emerging markets, with populations of 10 million or more people. Global cities, meanwhile, are well-established, densely packed metropolises with large day-time populations. Green cities are those that visibly strive for environmental sustainability by promoting cycling and public transport over cars; and car cities are historically automobile-heavy cities that are currently trying to shift to other transport modes.

Each city in the report has been appraised on 31 measures – a mix of quantitative data (for example, carbon emissions from transport per capita or the number of electric vehicle charging stations per square kilometer) and qualitative assessments (such as quality of cycle lanes or network reliability).

These 31 measures are spread across 10 categories: 4 "network inputs" (infrastructure and policies a city has in place to promote connectivity) and 6 "network impacts" (spheres a city's transport system can influence). See Figure 3 for a full list of categories and measures. The scorecard awards each city an overall letter grade between A and F based
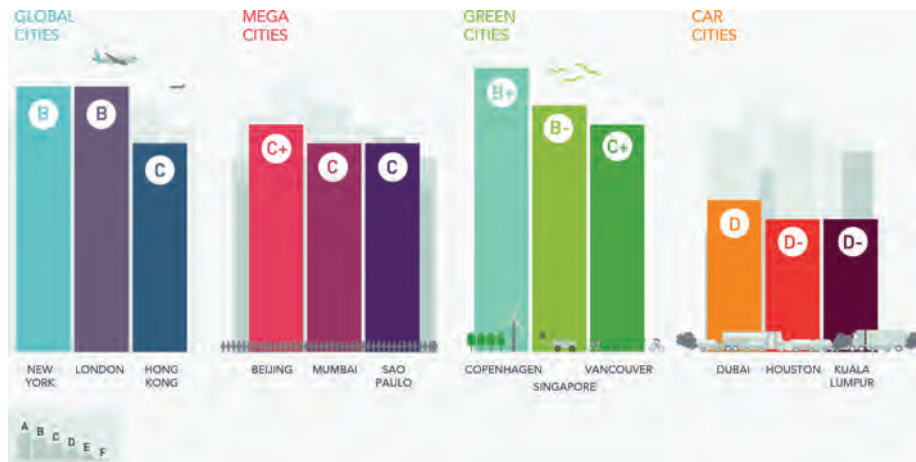

Figure 2. Overall "Vital Cities: Transport System Scorecard" scores (Source: Make Architects)
图2. "重点城市：交通系统评分卡"总体评分（来源：Make Architects）

on these measures, an exercise that offers a standalone assessment of how each one's overall approach to transport fares, and provides a basis for comparison between cities.

Scoring

To create the overall score for each city, each of the 31 individual measures is "normalized" on a scale of 1 to 5. Quantitative measures are benchmarked against "ideal" targets cities should strive to achieve – for example, a rapid transit network length of 1km per 1km2 (considered ideal as below this, few people can walk to such transit exchanges). Qualitative measures are scored using a tightly defined criteria based on policy information, local insights and expert judgments about city infrastructure and policies – the measure examining the quality of cycling infrastructure, for example, assesses network connectivity, the extent to which cycle lanes are separated from road and pedestrian traffic, and the availability of safety features like dedicated lighting and crossings.

These scores are then aggregated within their relevant category, which is awarded a score, converted onto a scale of A to F (Figure 4). From here, an overall score is calculated, also converted on a scale of A to F (Figure 2). Each of the 10 categories has an equal weighting, and the maximum number of points in the overall scorecard is 50, converted as follows:

*"Plus" and "minus" scores are derived at points equidistant from the main scores.

A city that achieves an A grade is considered to have excelled across the board, achieving reliable and well-connected public transport systems, safe and attractive environments for walking and cycling, smart road policies that promote green initiatives like car-sharing and low-carbon vehicles, and effective usage of open data and apps.

报告和分析方法

概览

对于《生机城市：交通系统评分卡》，Future Spaces Foundation 对全球12个城市的交通基础设施及相关数据交换网络的运作方式进行了分析研究。报告采用独特的评分卡形式，对各个城市交通网络的连通程度进行定量定性评价，探索各城市如何将交通运输及数据与自身特有的城市形式进行集成，并为确定各城市改善交通效率、可持续性以及交通运输便利性的方式提供一套参考框架。针对研究整理得出的数据以图表形式储存在可在线读取的交互式数据库中。研究结果的截图图2。

此次研究分析的数十个城市中，圣保罗、北京和孟买构成研究的"超级城市"类别，用以作为快速城镇化的新兴市场中人口规模超过千万体量的城市的参照。显然，将高效的基础设施整合入这类城市，操作流程无疑纷繁复杂，需要充分的政治决心、领先的工程设计解决方案以及坚实的财务保证。然而，利用评分卡数据，我们可以就这类城市面临的交通互联性挑战以及具体策略如何解决这些挑战展开讨论。

分类

Future Spaces Foundation 对12座城市进行了分析研究，并将这些城市划分为4类："超级城市"（北京、圣保罗和孟买）、"全球城市"（伦敦、纽约和香港）、"绿色城市"（哥本哈根、温哥华和新加坡），以及"汽车城市"（休斯顿、迪拜和吉隆坡）。

如上所述，按以上分类定义的"超级城市"即指快速城镇化的新兴市场中人口规模超过千万体量的城市。"全球城市"则是建设良好、紧密集且日间人口流量巨大的大型都市。"绿色城市"指致力于发展可持续环境，积极倡导自行车和公共交通为主、自驾出行为辅的城市。"汽车城市"指历来依靠汽车为主要出行方式，但目前正努力向其它交通出行模式转型的城市。

Public transport network	Bike and foot network	Private vehicles	Data & apps	Affordability	Accessibility	Sustainability	Breathability	Mobility	Safety
Length of the rapid transit network, km per km²	Length of the cycle network, km per km²	Traffic reduction policy	Open transit data policy	Monthly ticket cost, share of average net monthly wage	Trips taken by public transport, share of motorized transport	Transport emissions, tonnes per capita	NO2, annual average	Trips taken by foot and bike, share of total	Pedestrian fatalities, per 10,000 people walking to work and school
Network capacity	Quality of the cycle network	Car share clubs, locations per km²	Electronic payment facility	Cost-difference multiplier, outer vs inner zone	Accessibility of the public transport system		SO2, annual average		Cyclist fatalities, per 10,000 people cycling to work and school
Network connectivity	Bike-sharing scheme, locations per km²	Car-sharing promotion	Availability of wifi in the public transport system				PM2.5, annual average		
Frequency and reliability	Bike-sharing promotion	Electric vehicle charging infrastructure	Quality of web- and mobile-based transport information						
Network maintenance and development	Walkability score	Electric vehicle promotion	Provision of real-time transport information						

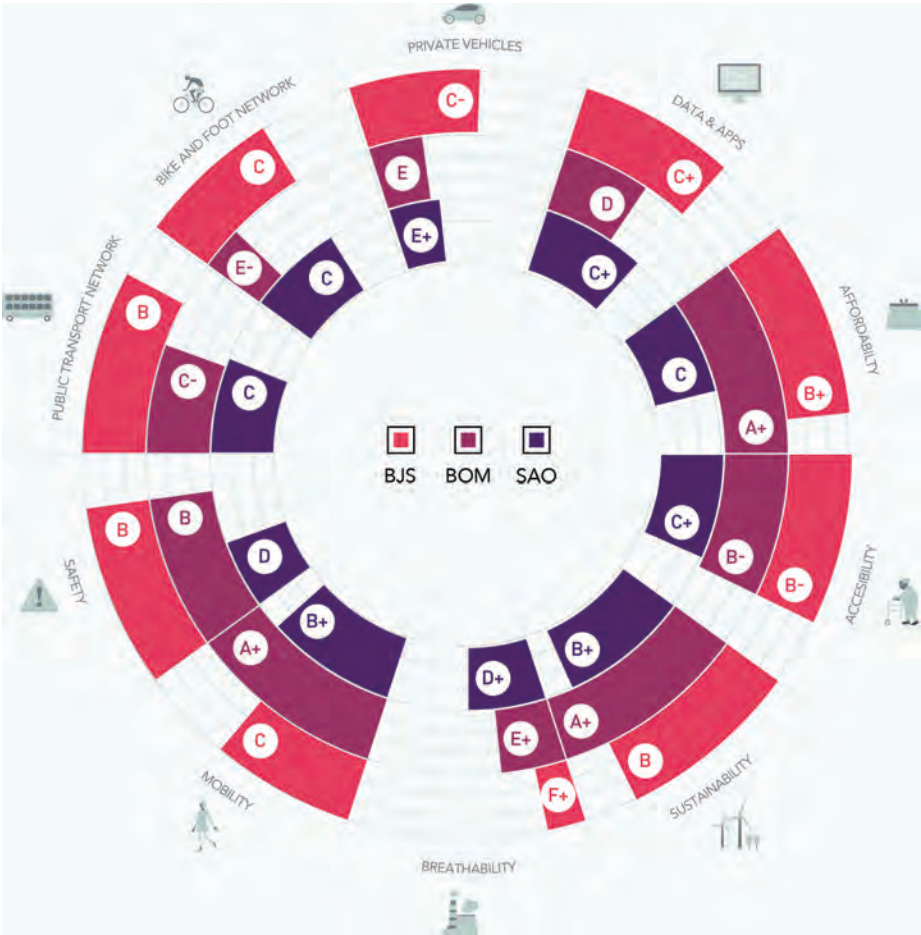Figure 3. Individual measures and categories (Source: Make Architects)
图3. 分项指标与类别（来源：Make Architects）

Figure 4. Megacities' individual scores across the 10 categories (Source: Make Architects)
图4. 超级城市在10个类别的独立评分（来源：Make Architects）

报告中介绍的每座城市均按31项衡量标准，即一系列定量数据（比如人均交通运输的碳排放量或每平米电动车充电站的数量），和多种定性分析（比如自行车道的质量或交通网的稳定性），进行评估。

这31项措施涉及10个类别：4项"网络投入要素"（促进城市互联互通所需建设的基础设施和需要落实的政策）和6项"网络影响因素"（城市交通体系能够产生影响的范围）。参见图3类别和衡量标准的完整列表。评分卡将根据这些衡量标准给定每座城市 A 至 F 区间的总体字母评级，这一做法为每座城市交通运输的运行方式提供了一套独立的评价策略，并对各城市间的比较设定了基础。

评分

为了给每座城市制定总体评分，31项独立措施均按 1 至 5 分进行"标准规范"。应努力实现某些以"完美"目标城市作为基准的定量措施——比如，每1千平米设有1公里长的快速交通网络（这一标准以下视为"理想"，因为经过该交通换乘的人流会较少）。定性措施则依据有关城市基础设施的政策信息、当地愿景和专家判断制定的严格标准进行评分——比如，检验自行车配套基础设施的措施可以用于评价网络联通性、自行车道与公路和行人交通的独立设置程度，以及诸如专用照明和过街专用道等安全配置的分配比例。

这些评分随后按各自类别进行加权，得出一个评分，然后转化成 A 至 F 间的一个评级予以表示（图4）。据此将计算出一个总体评分，同时使用 A 至 F 间的一个评级予以转化表示（图2）。10 项分类中，每一分类均占相等的权重，总评分卡的最大分数值为 50，按以下细分：

取得 A 等级评分的城市即视为各个类别均表现优异，实现了连接畅通的可靠公共

Data Sources

The above methodology was designed by Longitude Research in consultation with the Future Spaces Foundation and is based on a wide program of desk research and interviews.

Longitude Research spoke with several industry experts to gather feedback on the scorecard design, including Greg Lindsay,

Urbanist and Senior Research Fellow at the New Cities Foundation; Carl Hughes, National Policy Director at the Institute for Transportation and Development Studies (ITDP); and Karl-Heinz Posch, Coordinator of the European Platform on Mobility Management.

Longitude also used local researchers in each city to collate primary information

and source opinions and insights from stakeholders, all of which was used to inform the qualitative scores. Other data sources for the various scorecard measures include city administrations, policy documentation, transport companies, local and national statistical offices, traffic police reports, environmental agencies, local and international NGOs, and a variety of news sources.

Further information on the data and methodology used can be found on the Future Spaces Foundation's website.

Scorecard Results

How Megacities Fared
As Figure 2 shows, the megacities came just behind the global cities and green cities in terms of overall scorecard results, and ahead of the car cities. Beijing scored a C+, while Mumbai and São Paulo each received a C. No city scored an A overall, though Copenhagen, showing an impressive record for sustainability, safety and mobility, topped the scorecard with a laudable B+.

Delving deeper (Figure 4, which shows the 10 category scores that together comprise each megacity's overall score), it is clear that, broadly speaking, Beijing, Mumbai and São Paulo have some way to go to compete with global and green cities. At the same time, the research shows there is much these cities can be proud of, revealing many successfully implemented strategies and initiatives between them that other cities can learn from.

Below is a selection of highlights of their performance across the study.

Beijing leads the pack in providing a well-networked public transport system
The public transport network category considers the extent to which a city has implemented a dense, reliable, well-networked mass transit system that acts as a green, space-saving alternative to private vehicle use.

Beijing is the clear forerunner of the three megacities in this category, outperforming

São Paulo and Mumbai (as well as five other cities in the study). A primary reason for this is its substantive network connectivity and network capacity. Beijing comes first among the megacities (and tied for second within the whole study) by both measures. (Figure 5 for megacities' comparative score in this category.)

The following contributed to these high scores:

- The city has an extensive subway system – the second-largest in the world, after New York's – that serves both inner city areas as well as suburbs up to 30km from central Beijing.

- Plans are in place that could add an additional 500km of lines (including light rail and monorail) over the next 25 years.

- Plans are in place to expand the suburban rail system into a 1,000km network for commuters travelling up to 70km from central Beijing.

- Bus networks are extensive, reaching far-flung suburbs

- Intercity and suburban railways connect into the subway.

- The airport express train connects to three subway lines in the city.

- The city operates a number of airport shuttle buses.

- The majority of railway stations are well served with nearby bus stops.

- Bike-sharing schemes that target commuters, some central and some suburban, are integrated into the rail network (Figure 6).

- A universal ticketing system is in place in which a single card can be used on all subway lines, city buses, expressway tollbooths and the airport express train, as well as some taxis and long-distance bus lines.

交通体系、安全而美观的人行和骑行环境、倡导绿色交通举措（如拼车服务和低碳汽车等）的智能公路政策，以及开放数据和应用程序的有效应用。

数据来源
上述方法由 Longitude Research 听取 Future Spaces Foundation 专业意见，依据广泛的桌面研究和调研后设计推出。

为了收集有关评分卡设计的反馈，Longitude Research 请教了多位行业专家，包括Greg Lindsay、Urbanist 和 New Cities Foundation 的资深研究员；交通运输与发展研究所（ITDP）的国家政策总设计师 Carl Hughes；以及负责交通流管理的欧洲平台（European Platform）协调员 Karl-Heinz Posch。

Longitude 还在每座城市聘请了当地研究人员进行信息核实，并从各有关方获取专业见解和观点，用于提供定性评分。用于不同评分卡措施的其他数据来源包括城市管理、政策文档、交通运输公司、当地及国家数据办公室、交通政策报告、环境保护机构、当地及国际非营利组织，以及多家新闻来源机构。

有关采用数据和方法理论的更多信息，详阅 Future Spaces Foundation 的官方网站 （http://www.futurespacesfoundation.org）。

评分卡最终得分

超级城市如何运转
如表1所示，在评分卡总体结论方面，超级城市仅位列全球城市和绿色城市之后，排在汽车城市之上。北京评分为 C+，孟买和圣保罗评分为 C。尽管根本哈本在可持续性、安全和流动性方面的记录十分出色，以B+的好成绩名列评分卡榜首，但没有一座城市的总体评分达到 A 级。

进一步深入分析（见表4，显示的是10项分类评分，10项分类加权即构成每座超级城市的总体评分），从广义上看，北京、孟买和圣保罗显然具备实现与全球城市和绿色城市相互竞争的途径。与此同时，研究还发现了这些城市足以引以为豪的诸多方面，揭示出其中很多政策和举措的成功
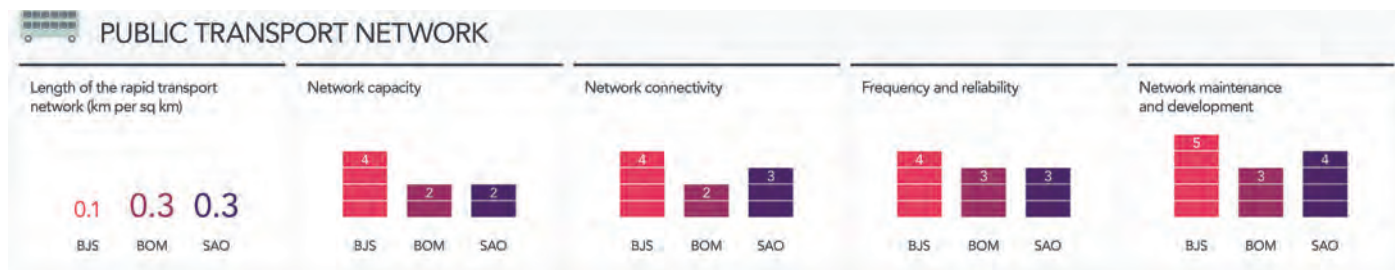

Figure 5. Public transport network scores: megacities. (Source: Make Architects)
图5. 公共交通网络评分：超级城市。（来源：Make Architects）

Figure 6. Bicycles available for public rental at Dongsishitiao station in Chaoyang District in 2011. (Source: Tanuki Photography)
图6. 2011年朝阳区东四十条站提供的自行车公共租赁使用情况。（来源：Tanuki Photography）

- Central government funding is used to support public transport development.

Along with reducing the number of cars on the road and cutting down associated levels of pollution, fuel consumption, congestion and traffic fatalities (all notably high in Beijing), this move towards a well-connected public transport network is integral to enabling people from all over the city to interact and exchange ideas – a crucial development, given Beijing's drastic suburbanization in recent decades. Addressing Beijing's horizontal expansion with a bigger and better-connected network will go a long way in ensuring factions of people spread across the city do not become isolated from one another, from the rising number of young people choosing to live alone to the city's skyrocketing over-60 population (many of whom can no longer drive). With effective connections, Beijing's residents are better equipped to access education, medical care and employment, and establish and uphold social and professional ties – all of which, among many other benefits, preserves individuals' sense of agency and furthers the city's economic prospects.

São Paulo demonstrates a strong effort on the bike and foot network front
This category considers the policies and infrastructure a city has implemented to encourage walking and cycling, from the length and quality of its cycle network to its efforts to promote bike-sharing.

São Paulo receives a C for its bike and foot network, far outstripping Mumbai's E- and coming tied for third in this category (alongside Beijing) in the overall study. The city scores particularly highly for its bike-sharing cycling scheme (both in terms of promotion and locations per square kilometer) as well as the quality of its cycle network, outperformed only by Copenhagen in this latter measure. (See Figure 7 for megacities' comparative score in this category.)

The following efforts contributed to this:

- A portion of São Paulo 2014 Transport Master Plan is dedicated to developing a safe and attractive cycling network.

- The city is on track to provide 400km of dedicated – that is, physically separated from cars and pedestrians – cycle lanes by the end of 2016.

- More cycle lanes are currently being built outside the city center to improve connectivity.

- The city operates two bike hire schemes. These span 227 stations, are fairly cheap,

实践范例，可供其他城市学习效仿。

以下分享一些此次研究发现的各城市表现亮点。

在提供良好网络布局的公共交通系统方面，北京位居同类城市榜首
公共交通网络类别针对城市中密集、可靠、网络布局良好的公众交通体系（作为节省空间的绿色出行方式替代私家车）的到位程度进行评价。

北京无疑是此次研究的三座超级城市中的佼佼者，表现优异于圣保罗和孟买（以及此次研究的其他五座城市）。主要原因在于北京拥有广泛的网络联通性和网络运营能力。在两项指标中，北京在调查的所有超级城市中均位列榜首（并在整体研究中并列第二位）（图5，了解超级城市在该类别的竞争性评分）。

取得如此高评分得益于以下贡献因素：

- 北京建有广泛的地铁系统——拥有仅次于纽约的全球第二大地铁网络布局，服务中心城区及辐射30公里的城郊地区交通出行。

- 北京已规划将在未来25年内另外增建总长500公里的路线（包括轻轨和单轨列车）。

- 针对距离北京中心城区70公里的居民的交通出行需要，业已规划的远郊铁路系统将会拓展至1千公里。

- 公共交通网络布局广泛，深入偏远郊县。

- 城际铁路和城郊铁路并入城市地铁网络。

- 机场快运铁路与市内三条地铁线路相连。

- 全市开通多条机场巴士线路。

- 大多数火车站周边均有公交车站提供良好的转乘交通服务。

- 针对目标人群需要，在中心城区和一些城郊地区提供自行车租车方案，一并并入铁路网络（图6）。

Figure 7. Bike and foot network scores: megacities (Source: Make Architects)
图7. 自行车和步行网络评分：超级城市（来源：Make Architects）

and can be paid for by bank card, mobile phone app or a single ticket. The CicloSampa scheme is particularly popular with commuters, as it is well connected to transport hubs within central districts. The Bike Sampa system is also widespread.

- Officials are investing in cycling education and safety initiatives to encourage more and safer cycling.

- An SOS bike service is in place, which sees 40 bike mechanics regularly cycle around the city to help carry out bike repairs, with another 10 located in dedicated tents. While waiting for repairs, cyclists can use one of 120 free bikes for up to one hour.

Investing in a bigger, safer, more accessible bike and foot network is a significant bolster for health and safety in São Paulo. An incentive to walk or cycle where possible promotes exercise and an active lifestyle (vital in a country currently facing a growing obesity epidemic); has the capacity to significantly reduce the high carbon emissions of this heavily populated, car-focused city; brings life to the streets, not least via the introduction of "parklets," mini recreational spaces in now-disused parking spaces (Figure 8); and promotes inclusivity, giving people of all economic means a safe, affordable option for transport. While São Paulo's size, sprawl and patchy rail coverage are such that cars are simply unavoidable for certain journeys, the city's improving bike and foot network is nevertheless helping the city move away from its car-centric culture by making multi-modal commutes that include cycling an increasingly viable option, particularly for those commuting to and between the city's polycentric cores.

Mumbai comes out on top in terms of affordability, sustainability and mobility

Mumbai leads the way in terms of affordability, sustainability and mobility, scoring an A+ in all three categories – the only city in the whole study to do so. (See Figures 9, 10 and 11 for megacities' comparative score in these categories.)

Between these categories are four individual measures: proportion of typical income spent on public transport, cost-difference multiplier, transport emissions per capita, and percentage of trips taken by foot or bike.

The following are among the factors that earned Mumbai its top marks:

- A second-class monthly rail ticket for

· 实施统一的计票系统——一张卡即可用于所有地铁线路、城市公交、快速路收费站、机场快线铁路以及部分出租车和长途公交线路。

· 中央政府提供资金，为公共交通发展提供支持。

在减少公路车辆行驶、降低相关污染水平和能源消耗、减缓城市拥堵和交通致命事故（目前北京居高不下的显著问题）背景下，该项瞄准连接便利的公共交通网络发展战略将作为一个整体让来自全市不同地方的人都能够互动交流。考虑到北京近几十年来大规模的城乡一体化进程，这无疑是一项至关重要的城市发展战略。为了确保城市各个角落的居民不至于面临孤立隔离，不至于割裂越来越多选择独居的城市青年和持续增长的60岁以上的老年群体（其中多数人不再符合驾驶资格），在北京这样区域跨度巨大的城市落实覆盖范围更广、联通性更好的交通网络将需要付出更多努力。凭借高效的交通连接网络，北京居民得以更加轻松地获取教育、医疗和就业机会，能够发展并维持社会和职业关系——这一切，连同其他多项优势，将带给个人稳定的归属感，从而进一步推动城市的经济发展。

在自行车和步行网络方面，圣保罗作出了坚实的努力

以鼓励步行和自行车出行为视角，从部署自行车网络的长度和质量到加大投入发展自行车租车业务，本类别着重考虑城市在这一方面推行的政策及建设的基础设施。

圣保罗在发展自行车加步行出行网络方面获得 C 级评分，远超孟买的 E 级评分，在总体研究中此项类别的评分中与北京并列第三。圣保罗凭借其自行车租车出行计划（以每平方公里的推广和布局设置为评价点）以及自行车网络质量而获得极高评分，在同等评价措施方面仅位于哥本哈根之后（图7，了解超级城市在该类别的竞争性评分）。

圣保罗取得的成绩得益于以下贡献因素：

· 圣保罗2014年的交通总体规划中有一部分专门针对安全便捷的自行车出行网络开发。

· 这座城市正在积极建设400公里专用自行车车道，即与汽车和行人分离的专用道，即将于2016年年底建成。

· 目前在市中心外圈正在开发更多的自行车道，以改善市内交通通达性。

· 市内实施两套自行车租用计划。两项计划覆盖227个自行车租赁站点，价格较为低廉，支持银行卡、手机应用程序和单次票计费。CicloSampa计划方案因其布局与市中心城区交通枢纽的良好衔接，尤其受到出行者的青睐。另一项计划，即Bike Sampa系统的覆盖范围也同样广泛。

· 城市官员正在普及自行车交通知识，并对安全举措方面进行投入，以鼓励更多、更安全的自行车出行。

· 城市中设有自行车急救支援服务，安排40名自行车技工巡逻全市，此外还有定点在专门帐篷内的10名技工，帮助执行自行车维修工作。在等待维修期间，骑行人可以启用120台免费自行车中的一台，满足自己一个小内的交通出行需求。

投资发展更加广泛、更为安全且更加便捷的自行车和步行网络是对圣保罗城市健康与安全事业的巨大支持。 对尽可能步行或自行车出行提供奖励将推动健身及动感生活方式（对于正面临着肥胖人群日益扩大的国家而言至关重要）；大福减少人口聚集且主要依赖汽车出行的城市的碳排放；为街道注入更多活力，包括通过建立"parklets"——建在废弃停车场上的迷你休闲空间（图8）；提升城市包容性，为各阶层的人们提供安全、经济的交通出行选择。鉴于圣保罗的体

Figure 8. A "parklet" in Sao Paolo (Source: SDOT Photos)
图8. 圣保罗的"小公园"（来源：SDOT Photos）

Figure 9. Affordability scores: megacities (Source: Make Architects)
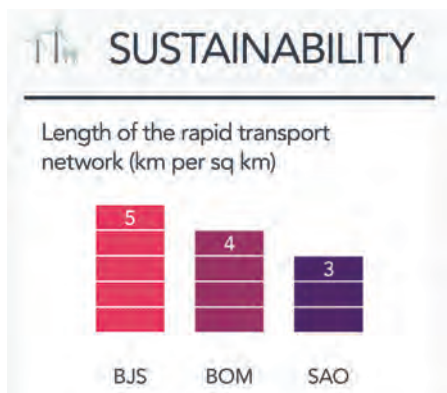经济性评分：超级城市。（来源：Make Architects）

Figure 10. Sustainability scores: megacities (Source: Make Architects)
图10. 可持续性评分：超级城市（来源：Make Architects）

Figure 11. Mobility scores: megacities (Source: Make Architects)
图11. 流动性评分：超级城市（来源：Make Architects）

the Greater Mumbai area costs just 1% of the average net wage (according to the latest state-level labor force survey) – the lowest relative price across all 12 cities studied.

- Mumbai's transport emissions amount to 0.3 tonnes per capita – the lowest across all cities studied.

- More than 50% of all trips in the city are taken by foot or bike (Figure 12) – again, the best score across all 12 cities.

Mumbai's high levels of affordability, sustainability and mobility make a strong case for the benefits of densification and the fight against urban sprawl. With some 67,000 people per square mile, the city is the fifth-densest in the world and by far the densest in the FSF study(Demographia World Urban Areas 2016), and still it manages to produce excellent ratings on three important transport-related outputs – not in spite of its population density but because of it. Take Mumbai's high figures for bike and foot trips – these are possible because of the close proximity of amenities across the city, and in turn have the potential for important knock-on effects, like addressing obesity in a city where it's rising dramatically. Suburban growth has been significant in recent years

to be sure, with architecture schemes like Make Architects' high-profile residential development Aranya emblematic of the rising middle class in Mumbai's broader metropolitan region; and there's much that can still be done to ensure this outward growth doesn't prevent either metropolitan or central residents from being able to move easily around the city, not least a focus on upgrading the city's rail network (the forthcoming Mumbai Metro offers some hope on this front). Still, Mumbai's low ticket prices and carbon emissions are evidence of a transport network coping well in the face of rapid and continuing population growth.

Conclusion

The Need for People-Focused Design
A great deal of the architecture and urban design that emerged after the Second World War addressed growing populations by embracing manufactured global urbanism over local personality and placemaking – a notion best illustrated by the monolithic high-rises of modernist architect Le Corbusier. However, since the 1961 publication of Jane Jacobs' widely influential The Death and Life of Great American Cities, which pieces together criticisms of and antidotes to this ideology

量大、蔓延范围广且铁路服务极不健全，人们不可避免地要使用汽车来解决某些出行需要。城市日趋完善的自行车加步行网络通过打造多模式交通出行选择，包括针对那些在城市多中心间频繁往来穿梭而提供的自行车出行替代选择方式，势必将帮助城市逐渐摆脱以汽车为主的出行文化。

孟买在生活成本可承受性、可持续性和流动性方面高居榜首
孟买在生活成本可承担性、可持续性和流动性类别方面的评分均达到 A+，遥遥领先其他城市。而孟买也是整项调查中唯一取得这一成绩的城市（图9–11，了解超级城市在这三个类别的竞争性评分）。

针对这些类别，我们采取了4项独立的评价标准：基本收入中用于公共交通的比例、成本差异乘数、人均交通污染排放值，以及步行或自行车出行的百分比。

以下是孟买能稳居榜首的贡献因素：

- 在大孟买地区选择铁路的二等座位出行，每月月票支出仅占个人平均净收入的1%（数据依据来自于最新的全国性劳工调查），价格在研究涉及的全部12座城市中最低。

- 孟买的交通出行产生的污染排放量为人均0.3吨，在所有研究对象城市中该人均排放量最低。

- 市内超过一半的出行由步行或自行车完成（图12），在分析涉及的所有12座城市中依然排名最优。

孟买市高度的生活成本可承受性、可持续性和流动性是对城市密集化发展优势的有力印证，也是反对城市向外扩张的佐证。孟买市每平方英里上容纳的人口数为 67,000，位列全球最密集城市第5位（数据来自Demographia的2016年世界城市区域研究），也是目前为止FSF分析的城市中人口密度最大的城市，但该市仍在这三项重要的交通评价因素方面获得了出色的评分，而在这之中，孟买的人口并未成为阻碍，而是成为了动因。在孟买出行，大多数人都会选择自行车或者步行。这在孟买非常现实，因为市内分布的生活设施彼此相对集中，这也会在一定程度上释放更多的潜在影响，比如帮助解决城市与日俱增的肥胖人口问题。需要确定的是，郊区发展过去几年一直摆在重要位置，比如Make Architects开发的高端居住建筑方案，Aranya emblematic，可谓孟买更广泛的城市区域内正在发展壮大的中产阶级居住选择的代表性项目。为确保城市的向外扩展趋势不会限制城市或城区居民在市内的自由流动，孟买依然还有很多工作要做，首当其冲的就是要专注升级城市铁路网络（孟买未来的地铁发展规划将在这方面大有作为）。另外，孟买低廉的票价和

Figure 12. Commuters walking to work in Mumbai (Source: anandoart)
图12. 孟买步行前往工作的通勤人员（来源：anandoart）

碳排放水平都可以证明城市交通网络能够很好的应对城市持续快速激增的人口。

结论

设计需要以人为本

二战后，建筑与城市设计层出不穷，通过积极发展超越本地人口特色和地方特点的模式化全球城市风尚（专注大体量高层设计的现代主义建筑师Le Corbusier对该理念进行了最佳演绎），用以解决城市不断增长的人口问题。然而，1961年，Jane Jacobs发表了题为《美国大城市的生与死》专著，随即引起业界轰动。Jane Jacobs 通过该部专著将人们对理想城市主义及相关城市发展政策的批评声音和解决方案予以整合，由此影响了更多的建筑师和规划师开始将注意力转移到以人为本的设计上。

这种设计强调安全性、城市活力和个体的健康福祉，是北京、孟买和圣保罗这样快速发展扩张的城市保持城市活力的关键要素。城市扩张如果忽视人的生活品质，必会产生社会的区块割裂——较好的结果就是形成了无生机的住房构成的单调、低密度远郊居住区，依赖汽车满足城市出行；糟糕的结局就是城市滋生成片的贫民窟，饱受贫穷与犯罪困扰，缺乏基础服务支持。可靠、便捷、规范的交通基础设施是解决并避免城市化发展因缺乏管理而产生多种割裂情况的关键保障。实现更为紧密的互联互通实为关键，这将利于打造更为紧密的社区结构，为其提供更优质的社会联系和经济前景——简言之，这样的城市将更加充满活力。

随着人口不断增长和城市日益密集，北京、孟买和圣保罗这样的超级城市代表着城市发展的未来。尽管三座城市在交通领域仍有很多需要改善的空间，但它们所取得的成就依然值得称道。谨记这些成就，发展中的城市会做得更好，将有利于打造更大、更好且更活跃的城市环境。

and its associated policy, many architects and planners have shifted their attention to more people-focused design.

This kind of design – which values safety, urban vibrancy and individual wellbeing over corporate efficiency – is integral to achieving vitality in rapidly expanding cities like Beijing, Mumbai and São Paulo. Expansion that ignores people's quality of life inevitably produces segregated sections of society – at best, these take the form of bland, low-density suburbs with lifeless housing blocks and a high dependency on cars; at worst, they are teeming slums that suffer from poverty, crime and a lack of basic services. Reliable, accessible, well-managed transport infrastructure is crucial to addressing and preventing the many forms of isolations that result from poorly managed urbanization. Achieving greater connectivity is a key component in producing more cohesive communities with better social ties and economic prospects – in short, more vital cities.

With population growth and urban density on the rise, megacities like Beijing, Mumbai and São Paulo are the cities of the future. While all three have significant room for improvement on the transport front, they also boast noteworthy successes between them. Growing cities would do well to consider these accomplishments, which are paving the way for bigger, better, more vibrant urban environments.

References:

Cox, W. (2012) **What is a Half-urban World?** New Geography [Online] Available at: http://www.newgeography.com/content/003249-what-a-half-urban-world [Accessed: 12th May 2016].

Demographia World Urban Areas. (2016) 12th Ed. [Online] Available at: http://www.demographia.com/db-worldua.pdf [Accessed 12th May 2016].

United Kingdom. Future Spaces Foundation. (2015) Vital Cities Not Garden Cities. [Online] Available at: http://www.futurespacesfoundation.org/wp-content/uploads/2016/04/Vital-Cities-not-Garden-Cities-FSF-dps.pdf [Accessed: 12th May 2016].

United Kingdom. Future Spaces Foundation. (2016) Vital Cities: Transport Systems Scorecard [Online] Available at: http://www.futurespacesfoundation.org/vitalcitiestransport/ [Accessed 12th May 2016].

United Nations. Habitat III. (2016) Zero Draft of the New Urban Agenda [Online] Available at: https://www.habitat3.org/bitcache/3d1efc3b20a4f563ce673671f83ea0f767b26c10?vid=578792&disposition=inline&op=view [Accessed: 12th May 2016].