

More than the last mile

How smarter logistics can help shape tomorrow's cities





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“The supply chains being developed to serve a rapidly urbanising population are becoming increasingly complex. Congestion, pollution and other environmental concerns have influenced public policy, resulting in greater regulation on transport with many cities implementing a complete ban on diesel engines. This will have a systemic impact on the logistics industry and lead to new pressures, not least on the distribution property market which will need to adapt to supply chains which require inventory to be held closer to the urban consumer markets.”

John Manners-Bell

CEO and founder Transport Intelligence

Leadership introduction

Last year we launched our New Industrial (R)evolution research to highlight the big trends driving changes in supply chains and logistics property markets across Europe. One of the trends we considered in our original study was the rising importance of cities and the growth of city logistics. This report builds on that research with a deeper dive into the topic.

Over the past few years there has been increasing interest among logistics property developers and investors in city or urban logistics, a subject that has also risen up city, national and European policy agendas. This interest has been spurred by the growth of e-commerce and online retail and the burgeoning demand for last-mile fulfilment facilities it has generated. In our view, however, this is only a part of the story, as the issues associated with logistics in cities are much wider than servicing e-commerce growth; hence this report has a broader focus.

From a property market perspective, city or urban logistics buildings are often considered a separate market segment, distinct from ‘big box’ logistics properties, that are mainly clustered at Europe’s major gateways (seaports and airports), along its strategic transport corridors and around its major cities. This segmentation may be valid from a property market viewpoint, but these different types of property are often part of the same supply chains. This being the case, to understand the challenges of logistics in cities, and potential opportunities for change, we need to take a wider supply chain perspective that looks beyond cities.

This report presents our views on logistics in cities in Europe. These views have been informed by insights provided from three dedicated stakeholder workshops hosted jointly by JLL and Transport Intelligence (the leading independent logistics consultancy) in Frankfurt, London and Paris. In addition, we have reviewed a range of data sources, existing research, case studies of best practice and our own market intelligence. We have also benefitted from our membership of ALICE – the Alliance for Logistics Innovation through Collaboration in Europe – whose research and innovation road maps include one on urban freight and logistics.

We trust you will find this short study a thought provoking contribution to the city logistics debate. Ultimately our spotlight is on the property opportunities that logistics in cities provide, but, as always we seek to provide insight into logistics property markets by linking them to what is happening more widely in supply chains. We welcome your comments.



Guy Gueirard
Head of EMEA Industrial & Logistics

The Fundamentals of Logistics in Cities

The rise of urbanisation and the growing importance of cities

In line with global urbanisation trends, Europe's population residing in urban areas has increased significantly over a relatively short time-scale. Since 1950 (i.e. in just two generations) Europe's urban population has grown from a little over half its total to close to three-quarters; and by 2050 the urban share is expected to reach 82% - a proportion that the US already has.¹

These urban areas include a wide variety of places – cities, towns and their suburbs – and Europe's cities are themselves characterised by considerable diversity. Within the European Union, for example, only London and Paris rank as 'megacities' by the United Nations definition (having a population over 10 million), although more widely across Europe Moscow and Istanbul also qualify. Within the EU there are a total of 26 cities with a population of over 1 million and 373 with a population over 100,000.² Demographic trends within these cities vary, with some such as London and Brussels expanding strongly while others are shrinking, and every city is unique in terms of how it has evolved historically. Unsurprisingly, therefore, although many cities share similar logistics challenges these may differ widely in terms of their magnitude and significance, which gives rise to specific opportunities and the need for bespoke solutions.

In general, Europe's major cities are important engines of economic growth. Many of Europe's largest cities have grown more strongly in terms of GDP, employment and population than the countries that include them and many are forecast to do so again in the years to 2030 according to Oxford Economics, see Appendix 1.

Beyond this increasing economic power, cities are also becoming more important politically due to the wider devolution of powers in a number of European countries. Even so, despite this, cities still often have insufficient formal authority or power to meet the challenges – logistics and others – that they face.³

Cities are also often the most innovative geographies within a country, the places where in the words of the C40 Cities 'the future happens first'.⁴ So cities are important and interesting not just due to their economic and political significance but also because they provide a window to the future, or a possible future. In the context of this report, cities are likely to form the testing ground for innovations in logistics and property that may subsequently become more widely adopted.

“The need for new homes in cities, like London, is placing huge pressure on industrial land to be released for residential development. This is forcing industrial occupiers and last mile fulfilment operators to relocate further from their customer base, despite the demand for their goods and services increasing. It is essential we provide a robust and flexible urban logistics infrastructure to halt the loss of industrial land and provide the right environment for the sector to thrive.”

Simon Pursey

Head of UK Investment Segro

1. United Nations, *World Urbanization Prospects: the 2014 revision*

2. ALICE, *Urban Freight, Research & Innovation Roadmap*, p.13

3. See JLL, *Governance, Devolution and the Investment Ready City*

4. C40 Cities. *C40 Fact Sheet, Why cities?*



The logistics challenges presented by cities

Despite or because of their success, cities present particular challenges for logistics. As cities grow in population and economic activity the demand for goods and services within them increases leading to growing freight movement and expanding demand for transport infrastructure and for land for logistics activities and warehousing.

At the same time, however, the very same growth in population and economic activity produces competing demand for transport space, giving rise to increasing congestion, reduced road transport speeds and lower journey predictability. Land within cities is also subject to rising demand, with relatively low-value logistics uses often squeezed out by higher-value uses such as residential development. In London, for instance, some 1,300 hectares of former 'industrial' land was lost between 2001 and 2015.⁵ One result of these dynamics is what academics have coined 'logistics sprawl', i.e. the centrifugal spread of warehousing to cities' suburbs and beyond, a trend observable in a number of Europe's major cities, including Paris.⁶ This in turn often increases 'stem distances', i.e. the local delivery distance from warehouse to customers, making logistics

operations less sustainable in terms of road kilometres and emissions. In some cities, policy initiatives may result in the displacement of logistics activities and warehousing from the central areas of cities, as is happening in Istanbul, where the Metropolitan Municipality's regeneration plans aim to shift industrial production and logistics warehouses to the outskirts of the city in order to develop more recreational and residential areas within the city centre.

Emissions are a major and growing concern in cities. In Europe, urban freight - which is often transported by diesel-powered road vehicles - is estimated to be responsible for some 25% of urban transport related CO₂ emissions and between 30% and 50% of other transport related pollutants (particulate matters, nitrogen dioxide, etc).⁷ While concerns about CO₂ are mainly due to its long-term impact on climate change, the focus of many city authorities seems to have shifted over recent years to the adverse health impacts of particulate matter and nitrogen dioxide, which are subject to European Union legal limits. This is unsurprising given the fact that PM_{2.5} concentrations in 2013 were estimated to be responsible for about 467,000 premature deaths across Europe, with another 71,000 premature deaths estimated to be due to NO₂ concentrations.⁸



The need to improve air quality and health in cities has been a key driver behind the proliferation of low emission zones (LEZs) in Europe's cities, with some 200 LEZs currently in operation. In the UK, London, which has had a LEZ since 2008, is now consulting on introducing a new and larger Ultra Low Emissions Zone (ULEZ) in 2019 and five regional cities in England (Birmingham, Leeds, Nottingham, Derby and Southampton) are also introducing LEZs to improve air quality. In addition, to these initiatives there are now a number of European cities that plan to ban outright the use of diesel vehicles with Paris, Madrid and Athens all recently confirming their intentions to remove diesel vehicles from their city centres by 2025.⁹ In other cities, the determination to reduce emissions is leading to radical new plans in city mobility and design, as highlighted by Barcelona's introduction of 'superilles' or 'superblocks'.

In addition to air pollutants, another emission from freight vehicles is noise – which stems not only from the running of the vehicles themselves but also from the loading and unloading of the goods being transported. The adverse impact of noise on residents is the major reason why cities and local planning authorities impose restrictions on 'out of hours' and night-time deliveries. As a result, most urban freight movement in cities is heavily concentrated in certain peak periods during the day, which causes congestion and capacity issues.

The drive to reduce or eliminate diesel vehicles and to cut down noise is likely to support the growth of alternative low emission vehicles. In particular, electric vehicles look set for growth as these are low in emissions and much quieter than standard trucks. For example, Mercedes-Benz is reportedly in discussion with some 20 potential customers to trial a new 25 tonne Urban e-Truck which has a range of 320 kilometres.¹⁰ If electric vehicles are to become more important in logistics operations in cities they will need to be supported by a large investment in an appropriate charging infrastructure.

Another challenge for logistics in cities is the imbalance in transport flows with cities generally 'importing' significantly more freight than they 'export'. According to ALICE, incoming freight represents 40% to 50% of truck kilometres in urban areas, outgoing freight represents 20% to 25% and the remainder originates from and is delivered within the city.¹¹ This imbalance makes it very difficult to integrate inbound and outbound flows and helps to explain the relatively high level of 'empty running' in cities, which in London has been estimated to be around 31% of vehicles kilometres.¹²

On top of these pressures the growth of e-commerce has added a further layer of complexity to logistics in cities because it has hugely fragmented the last mile, by increasing the number of delivery points. Moreover, the lead time on offer to customers continues to fall. As e-commerce is still relatively immature, forecasts suggest that it will continue to develop strongly across Europe bringing with it expanding demand for last-mile fulfilment solutions.

The result of all these factors is that logistics operations in cities are being increasingly challenged in terms of their efficiency and their impact on the environment. The issue is to find ways of improving the overall efficiency of logistics in cities while minimising adverse environmental impacts.

Barcelona's superilles

Faced with excessive pollution and noise levels, the City of Barcelona is implementing a new mobility plan to cut traffic through the creation of a number of 'superilles' or 'superblocks'. These blocks will be formed by bringing together existing blocks in many of the city's main grid of streets to create enlarged blocks (or islands) with drivers of private and commercial vehicles restricted to the roads of the superblocks' perimeter and only allowed to enter the streets in the block if they are residents, or are servicing residents or local businesses. The area within the superblocks will be redesigned with speed restrictions for vehicles (10 km per hour), pedestrianisation and cycle lanes. At present, only one superblock has been set up in the Sant Martí neighbourhood, but there are plans for up to 10 in total. If widely implemented, local deliveries will become more difficult; however, the local environment and safety should be enhanced. One thing that is now apparent in Sant Martí is the lack of noise inside the block.

5. AECOM for Greater London Authority, GLA, London Industrial Land Supply & Economy Study 2015, March 2016

6. Laetitia Dablanc and Adeline Heitz, Logistics Spatial Patterns in Paris: the rise of the Paris Basin as a Logistics Megaregion, Final Report, May 2015

7. ALICE, Urban Freight, Research & Innovation Roadmap, p 14.

8. EEA, Air quality in Europe - 2016 report, p. 9.

9. The Guardian, 2 December 2016. 'Four of the world's biggest cities to ban diesels cars from their centres'

10. Logistics Manager, 'Mercedes-Benz starts customer trials of electric truck', 15 February 2017

11. ALICE, Urban Freight, Research & Innovation Roadmap, p.13.

12. University of Westminster, London Freight Data Report: 2014 update, estimate for 2010.



“Due to the enormous growth of e-commerce, city logistics is increasingly becoming a crucial part of the supply chain, creating a new asset class of which investors should be aware.”

Susann Birkert-Müller
Head of Logistics Deka Immobilien GmbH

Logistics property demand in cities

Although e-commerce has been growing robustly across many European countries (with further escalation predicted) and has attracted substantial interest as a driver of demand for logistics facilities in cities, the need for logistics land and buildings in cities is clearly much more broadly-based. Existing research suggests that the key sectors that drive demand for urban freight transport in Europe's cities – and therefore, by extension, warehousing and land for logistics – include:

- Retailers, including e-commerce
- Express, courier and post
- Hotels, restaurants and catering
- Construction
- Waste and recycling.¹³

Retailers have traditionally required logistics space to replenish their city shops, which over time have seen their stock room capacity diminish in order to maximise selling space. Although the growth of 'centralisation' has resulted in more store replenishment being fulfilled from retailer distribution centres, many stores in cities are also supplied direct from suppliers. At the same time the shift to 'just in time' replenishment has led to an increase in the number and frequency of deliveries to shops. Often retailers, or their suppliers, will supply city stores from national or regional distribution centres based outside the city, where land is more readily available, costs are cheaper and access to strategic infrastructure is better. Road is the dominant transport mode for distribution.

The growth of e-commerce has created huge complexity for retailers because of the fragmentation of delivery options (e.g. home delivery, delivery to workplace, click and collect, etc) the competition between them to deliver purchases more quickly to customers and the high level of returns. Add in the fact that customers are not prepared to pay for the true costs of delivery, and it is unsurprising that e-commerce is causing profitability problems for retailers and financial difficulties for some major parcel carriers providing last-mile deliveries on their behalf.¹⁴ Both retailers and parcel carriers have been demanding more space in cities to satisfy escalating online demand, with same day delivery especially requiring the retailer to hold local stock close to customers. Amazon is probably the best example of this with its Prime Now service offering one to two-hour delivery, supported by local warehouses in and on the edge of major cities.

Warehouse demand from express and parcel carriers is being largely propelled by the growth in e-commerce, which is generating a huge increase in parcel volumes. As noted above, many parcel operators are under intense pressure from their clients and, in general, there is over capacity in the carrier market. This industry ideally requires high volumes coupled with limited delivery points to maximise the number of items per drop off. However, while e-commerce has increased volumes, it has also expanded the number of potential delivery points. This provides a strong rationale for retailers to try to centralise their delivery destinations, e.g. by offering 'click and collect' destinations.

The hotel, restaurant and catering sector is a major source of freight traffic in cities traditionally supplied direct by food and drink producers or wholesalers. In London, food and drink is the second largest source of heavy goods vehicle (HGV) traffic, after construction materials.¹⁵

Construction activity in cities generates significant logistics activity with knock-on demand for land and buildings. In London construction dominates HGV freight. It also accounts for the largest number of freight-related deaths of vulnerable road users - notably cyclists - in the UK's capital. As a result, the Mayor of London is now seeking to ban HGVs which have significant blindspots and a 'zero rating' for visibility.

All cities are major producers of waste and hence waste management and recycling are significant activities in Europe's cities and a major user of industrial land. Given the slow-moving nature of this product, waste is more likely than average to be moved by non-road modes - rail or inland waterways.

Overall, the picture in many of Europe's major cities is one of growing demand for freight transport and warehousing, generating rising congestion and emissions as well as a squeeze on land. As a result, city authorities across Europe are under pressure to improve the local environment by reducing congestion, pollutants and noise and improving safety; and companies are under pressure to find new models to make their logistics operations more efficient. These twin objectives are often pursued separately but new technologies and business models offer the potential opportunity to secure both environmental and overall efficiency gains with greater collaboration between all the stakeholders.

13. DG Move European Commission: Study on Urban Freight Transport by MDS Transmodal in association with Centro di ricerca per il Trasporto e la Logistica (CTL), April 2012.

14. Julian Allen, Maja Piecyk and Marzena Piotrowska, University of Westminster; An analysis of online shopping and home delivery in the UK, February 2017.

15. Presentation by Paul Strang, Transport for London at ITS, FTC2050, University of Westminster; Preventing an urban delivery crisis seminar, 2 February 2017

21st Century Logistics in 20th Century Cities



Technological change

The increasing pace of technological development is widely recognised as one of the megatrends driving change across all geographies and in every industry, and this potential clearly exists in the case of logistics in cities. Some of the technologies considered in this respect involve substantial changes in systems and ways of working, and are likely to be realisable only in the longer-term, if at all, while others involve more incremental change and are already in play, or could be adopted more quickly.

The physical internet

The 'physical internet' is an idea that seeks to create a universal and open interconnected global logistics network to optimise the distribution of goods worldwide – comparable to the way the electronic internet has created a universal and open network to transmit electronic messages. Within Europe, this vision is being researched and promoted by ALICE. To be achieved it requires, at the very least: an open and shared interconnected network of physical distribution hubs (warehouses); standardised and 'smart' units for carrying and moving freight; secure information systems; and huge changes in business models, with companies prepared to collaborate in logistics while still competing in other areas, such as product quality and customer service. This vision is not a looming reality. Even ALICE refers to 2050 as the potential date in which the physical internet might become a reality, but we think the complexities and changes

required could prove insurmountable. But it is something that major companies and institutions are researching and, therefore, a concept that all stakeholders in city logistics need at least to be aware of. If realised, it would be a genuine transformational 'game changer'.

Smart cities

Much has been written over recent years about 'smart cities' that use digital technologies to better manage their space and infrastructure to enhance mobility, sustainability and liveability, but few such cities currently exist in Europe or indeed anywhere else. The reason is that the enabling technologies - especially the Internet of Things (IoT) and big data analytics - are still in their infancy. For instance, the IoT requires reliable and ubiquitous connectivity which does not exist in most cities. As a result, many types of Cooperative Intelligent Transport Systems (C-ITS) that are widely discussed, such as any form of vehicle-to-vehicle (V2V) and/or vehicle-to-infrastructure (V2I) communication that would enable autonomous vehicles, appear to be some way off in terms of being implementable in cities.

For example, when ranking the world's countries on both their 4G speed and network availability, OpenSignal found that only the Netherlands among European countries ranked in the global top 10. Table 1 ranks the top five European countries in terms of 4G speed and availability¹⁶.

Table 1: Highest ranking European countries for 4G availability and speeds

4G Availability		4G Speed	
Lithuania	84.7% (3rd globally)	Hungary	40.6 Mbps (3rd globally)
Netherlands	84.1% (5th)	Romania	35.6 Mbps (4th)
Norway	82.4% (7th)	Bulgaria	34.3 Mbps (6th)
Sweden	81.4% (9th)	Netherlands	33.8 Mbps (7th)
Hungary	79.8% (12th)	Luxembourg	31.7 Mbps (9th)

16. <https://opensignal.com/reports/2016/11/state-of-lte>

“The internet of things is a key enabler of the next generation of city logistics. Leveraging its potential requires smart combinations of intelligent devices, vehicles, streets and logistics buildings.”

Wolfgang Lehmacher
Director Supply Chain and Transport Industries
at the World Economic Forum

Besides the Netherlands having one of the better infrastructures established for 4G, OpenSignal also reports that Dutch mobile users are connected to WiFi over 70% of the time, the highest level in the world.¹⁷ The Netherlands appears, from a connectivity standpoint, to be the European country where currently the greatest opportunity exists for development implementation of smarter technologies. This is perhaps why we see such initiatives as Amsterdam Smart City (ASC) – the innovation platform of the Amsterdam Metropolitan Area. A number of cities and authorities across Europe are seeking to push forward similar initiatives, but Amsterdam is perhaps among the most proactive in this respect.

ASC aims to drive innovation by challenging businesses, residents, the municipality of Amsterdam and academic institutions to deal with modern urban issues. Within this initiative, the city has set out an action programme for Smart Mobility which aims to solve mobility issues while promoting sustainability, safety and accessibility. This programme includes projects on traffic management, route optimisation for refuse removal including just-in-time collection, crowd management, real-time urban accessibility and also smart, connected public lighting, which has seen a collaborative effort from the likes of Cisco, Philips and Alliander. This collaboration among corporates has led to a project called Smart Lights, involving the planned installation of LED lighting connected to a system that allows for better energy use and also additional WiFi coverage.¹⁸

Case study: the Port of Hamburg – a ‘smart port’

Starting in 2011, the Hamburg Port Authority (HPA) installed road sensors to create a traffic management system to allow it to monitor traffic across its major roadways. Subsequently, this system was expanded to directly link up with drivers’ smart-phones and/or on-board computers. This was made possible by some 300 sensors coupled with automatic radar identification and radio-frequency identification (RFID) technology. Further augmentation and improvements were made when Wi-Fi hotspots were introduced in strategic locations.

One of the biggest challenges and risks associated with this initiative is the increased transparency that the ‘smart port’ allows and the HPA has had to invest heavily in secure data management systems to encourage firms to participate and share data. However, in general, the smart port is widely seen as an innovative success which is inspiring other ports to follow suit. For example, the Port of Antwerp is now investing in the Internet of Things to kick off their venture, called NxtPort.

MaaS and WaaS

While truly smart cities appear some time away, there are many other, less holistic, ways in which new technologies could improve the utilisation of infrastructure and assets to reduce the pressure in cities, including through the promotion of ‘Mobility as a Service’ (MaaS), or its warehouse equivalent, ‘Warehouse as a Service’ (WaaS). These ideas are based on matching real-time demand for transport or warehousing with supply, in much the same way that Uber links the demand for car transport with drivers.

Uber already provides such a freight service in certain US cities, through its UberRUSH business, and it has been reported for some time to be looking at entering Europe with a similar service. Other examples include Stuart, a French app backed by GeoPost, with services offered in Paris and Barcelona. Stuart allows retail stores to connect with local couriers to rapidly move goods within city centres. MaaS technology can also take on the last-mile solution of providing a safe and trusted point for consumers to receive goods. For instance, Volvo’s recent in-car delivery service enables its car owners to have goods delivered to the trunk of their vehicles. Through its application, Volvo allows partnered delivery providers in select Swedish cities to set a time and place for the customer’s vehicle to act as the final destination.

One area that has seen significant MaaS adoption is food delivery for restaurants. Over the last few years, several start-ups have sprung up in various European cities such as Deliveroo in the UK, Delivery Hero in Germany and Resto-in in France, all of which have expanded beyond their original markets.

A number of providers already seek to promote ‘Warehouse as a Service’ in which warehousing is offered on a short-term, shared basis to meet demand. TimoCom, which operates both a freight and warehouse exchange, is the largest provider across Europe with warehouse options in some 44 countries across Europe. Stowga, which operates exclusively in the UK with a focus on seaport and airport locations, is another example. We expect to see the WaaS model grow as an option for servicing logistics in cities, including for last-mile fulfilment of e-commerce. A recent study by ABI Research forecasts global ‘Mobility as a Service’ revenues will exceed \$1trillion by 2030.¹⁹

Automated last-mile

Another potential technology solution involves self-driving delivery robots, which, for instance, Starship Technologies is seeking to roll out in cities around the world to provide a faster, smarter and more cost-efficient way of distributing last-mile deliveries.²⁰ Launched by the co-founder of Skype, Starship Technologies has already teamed up with the likes of Just Eat in the UK and the Swiss Post Office in Switzerland with its robots capable of travelling at a speed of around six-and-a-half kilometres per hour (a good walking pace) with a typical delivery radius of around three kilometres. These robots are currently being trialled in various European cities, including London and Hamburg. They are considered a low-cost option compared with the existing high-cost last-mile delivery models, plus they are much cleaner than road transport having minimal emissions.

Drone delivery is another possible autonomous solution, but while it has niche applications – such as for delivery to islands or remote inland areas – we are more doubtful about its potential in dense urban areas for mass e-commerce deliveries due to regulatory and operational issues, including economic viability when compared with existing models (van delivery). In the UK, Amazon agreed a partnership with the Civil Aviation Authority to trial drones and recently accomplished its first drone delivery in the UK – but this was in a rural part of Cambridgeshire rather than a dense city. The examples we are aware of across Europe – involving DHL in Germany and DPD Group in France – reinforce our view that in Europe drones are more likely to remain a niche application outside of cities rather than a mass delivery means within them.

3D printing

Additive manufacturing, or 3D printing, is another technology which has the potential to alter freight traffic dynamics in cities. With 3D printing, businesses and consumers could in the future produce many of the goods that are currently supplied to them by producers and retailers. If 3D printing does achieve widespread adoption in this way then potentially this could reduce freight traffic in cities. However, at present, the total value of all 3D printing products and services remains relatively small at just over \$5 billion worldwide.²¹ As a result, we do not expect 3D printing to impact logistics in cities in a major way in the foreseeable future.

17. <https://opensignal.com/reports/2016/08/global-state-of-the-mobile-network/>

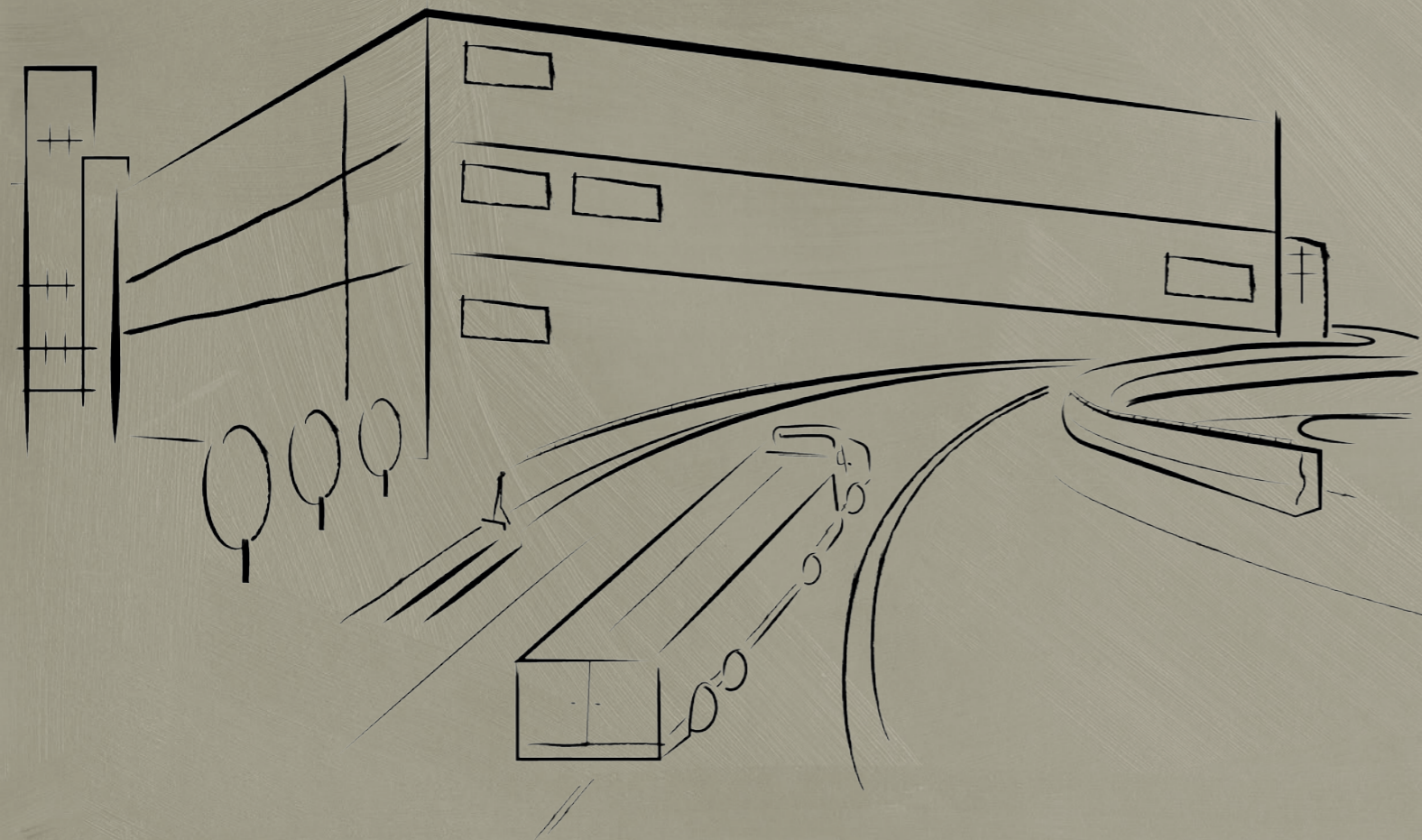
18. <http://www.ledsmagazine.com/articles/2016/02/philips-teams-with-cisco-and-dutch-energy-utility-alliander-on-smart-lighting-project.html>

19. <http://www.prnewswire.com/news-releases/abi-research-forecasts-global-mobility-as-a-service-revenues-to-exceed-1-trillion-by-2030-300326140.html>

20. ‘A glimpse of the future: self-driving delivery robots’ in *Logistics & Transport Focus*, February 2017

21. *Wohlers Report 2016*

Implications and opportunities for real estate



We believe that concerns over the local environment in cities and the drive to improve the efficiency of logistics will bring significant changes in logistics operations in many of Europe's major cities where environmental and efficiency issues are often most acute. As a consequence, we expect to see rising demand for different types of logistics properties, which, while not necessarily new, will become more common. We anticipate this growing demand and need to include:

- Transshipment facilities
- Shared-user consolidation centres
- Local facilities for last-mile fulfilment including centralised facilities for 'click and collect'
- Multi-modal logistics platforms and alternative modes of transport
- Multi-storey buildings
- Underground facilities that make use of existing car parks, many of which, we believe, will become surplus to requirements as car travel to central and inner city areas declines.

Transshipment facilities

As more cities regulate or ban diesel vehicles, we believe there will be a need for more transshipment points where freight can be transferred from diesel vehicles to vehicles powered by alternative fuels, particularly electric vehicles. These facilities could range from shared transfer points on road sides to more developed facilities with buildings for consolidation. In France, for example, a number of cities such as Bordeaux have implemented espace de livraison de proximité (ELP) initiatives which allow for transshipment of freight to more environmentally friendly vehicles. ELPs function as areas of road space dedicated to the loading and unloading of goods for delivery to nearby destinations and are typically very small scale operations often only employing one or two people.

Consolidation centres

Mandatory consolidation centres, such as that operated on behalf of London's Heathrow Airport, have been proven to reduce vehicle trips significantly. However, voluntary consolidation centres have often struggled to attract participants, who in many instances prefer to manage their own delivery arrangements, particularly because of the additional handling costs involved in consolidating goods prior to onward delivery. There is also a view that the consolidation centre concept could become less relevant in cities if C-ITS enable cities to better manage their traffic and/or businesses to collaborate more easily without the necessity of a specific physical consolidation centre.

However, partly because we think that such a future is unlikely to be realised soon, we believe that there is a bigger role for shared-user consolidation centres in cities if city planning authorities can persuade all stakeholders of their merits and promote them through appropriate regulations and incentives.

One niche example of consolidation involving parcel deliveries is provided by Gnewt Cargo, a UK small business founded in 2009 to provide last-mile solutions through a purely electric vehicle fleet by consolidating parcel deliveries for its carrier clients. Operating from four sites in London (including two client sites) Gnewt Cargo takes delivery from clients overnight and consolidates for onward delivery by electric vehicle. Last year it delivered 2.6 million parcels in London all at zero emissions.

"Urban Consolidation Centre models boast clear environmental benefits, but the financial and business model has yet to prove its worth. This type of approach can only generally succeed if local authorities at the city in question implement and apply very strict regulation, making the system something of a freight transport public utility."

Jérôme Libeskind

Founder, expert in urban freight and e-commerce Logicités

Localised delivery hubs for last mile fulfilment including centralised facilities for 'click and collect'

The growth in last-mile fulfilment and same-day delivery is already driving more demand for localised hubs, and this will continue as e-commerce grows further. In future, some of these hubs are likely to need to be suitable for automated delivery by robots, such as highlighted by the example of Starship Technologies previously mentioned. Given that these robots only operate over a limited area, this could lead to a significant number of such hubs (e.g. the Starship robots only service an area within three kilometres of their hub).

In addition to local delivery hubs, we consider there is more potential to provide centralised facilities for 'click and collect', including lockers and pick-up points, at a range of different urban locations, such as railway and underground stations. There is a strong rationale for these types of facilities because they are a way of countering the fragmentation of delivery that e-commerce gives rise to and they ensure successful first-time delivery.

Multi-modal logistics

We believe that there are greater possibilities for multi-modal logistics platforms in cities as multi-modal transport, involving rail and water especially, can help to relieve road congestion and reduce emissions.

With respect to rail, existing research highlights potential for three different types of rail freight operations relevant to city logistics. Firstly, rail can provide dedicated freight services into cities using rail freight terminals with subsequent delivery by road. Secondly, railway stations within cities could be used as potential logistics hubs; for example with goods delivered into the station prior to consolidation and /or onward delivery. Finally, use could be made of passenger rail services and infrastructure to deliver freight into cities.²²

Examples of rail freight services using dedicated terminals in European cities are relatively common:

- In Paris the French supermarket chain Monoprix ran a multi-modal logistics operation to supply its stores in Paris between 2007 and 2016 with a shuttle train delivering goods to the Bercy rail terminal near Gare de Lyon from where they are transported to their final destination by liquefied natural gas (LNG) powered vehicles. This operation ceased in December 2016.
- Also in Paris, XPO Logistics, Sogaris (the real estate developer) and Eurorail reached agreement in 2016 to route products into the heart of Paris via a rail shuttle. The service, which is planned to start in September 2017, will transport goods by rail from a terminal located in the

northern region of Ile-de-France to a new multi-modal logistics hub at Chappelle International being developed by Sogaris. The products will then be distributed on XPO Logistics' trucks using alternative fuels such as gas (NGV) instead of diesel.

- In Berlin, BEHALA operates a tri-modal logistics centre at Westhafen just to the north-west of the city centre which is serviced by rail (as well as inland waterway and road).
- In London, DB Cargo runs a rail freight terminal at Dagenham, which attracted much media interest recently when it received its first train from China.

Blue Gate, Antwerp

In Belgium, Blue Gate Antwerp will seek to alleviate traffic congestion and pollution in the city from a decontaminated industrial heritage site offering multi-modal access (rail, water and road) and focusing on 'smart' logistics and city-regional distribution initiatives around green and return logistics.

Cases of city railway stations used as logistics hubs are much rarer, although in recent years some trials have taken place at Euston station in London, involving respectively a leading supermarket chain and an express operator. Euston station was considered particularly suitable for these tests because it had been rebuilt in the 1960s to cater for urban distribution.

Examples involving the movement of freight on passenger services are relatively limited with existing research highlighting that these are typically very specific in their geographical coverage and/or in the commodities carried. Nonetheless, our workshops highlighted potential interest in this idea as a way of making good use of existing transport infrastructure.

Freight transport by water is widely considered to be underused in major cities built around rivers, such as London and Paris. In the former, the Greater London Authority has sought to protect a number of riverside wharves in order to safeguard the potential for freight movement along the River Thames. In Paris, the French grocery retailer Franprix is using the River Seine to deliver products by barge from the harbour of Bonneuil-sur-Marne to Port de la Bourdennais in central Paris to supply around one-third of its 350 Paris stores.²³

There is also growing interest in the possibilities to increase the use of bicycles in freight, particularly in last-mile deliveries. In the past most cycle logistics businesses were operated by small firms and were rarely linked to larger

22. University of Westminster, Urban Railway Hub Freight Expansion Feasibility Study, Final Report, March 2015

23. The Guardian.com, Tuesday 1 March 2016, Paris's river revolution: the supermarket that delivers groceries via the Seine.



logistics companies, hence their overall impact was very limited. This is changing to some extent with cycle logistics businesses partnering with major logistics service providers, or the latter operating their own services. For example, DHL Express has deployed bicycle couriers in cities in a number of European countries– including the Netherlands, France, UK and Italy.

Nuremberg micro-depots²⁴

In Nuremberg, Germany, courier and express providers DPD and GLS launched a pilot project in April 2016 to test the use of micro-depots and bikes in the city centre and a residential district of the city. In this trial, parcels destined for retailers and consumers were deposited in centrally-located containers, vehicles or buildings, from which the parcel couriers subsequently used emissions-free delivery alternatives such as bikes or hand trucks. The pilot project was led by the Nuremberg Institute of Technology and supported by Bavaria's Interior Ministry, the Nuremberg Chamber of Commerce for Central Franconia and the City of Nuremberg – highlighting engagement with a wide range of stakeholders.

Another modal solution which is being considered in certain cities is the use of underground freight pipelines. In the UK engineering company Mole Solutions has been awarded a

feasibility study grant from the government to consider the potential of underground freight pipelines. The company has developed a system that it claims could reduce road freight in urban areas by using freight pipelines that link edge-of-town consolidation centres with inner town nodal points. Mole Solutions is looking at piloting in Northampton, which is considered particularly suitable as a project site as there is a disused underground rail line between one of the town's main logistics estates and the town centre. The technology employs driverless, electric-powered capsules running along dedicated underground lines under automatic control and has the potential to run 24 hours a day. This concept links with two other approaches to reduce city congestion, namely edge of city consolidation centres and inner city last-mile lower impact deliveries, e.g. by electric vehicles or bikes. Other examples of pipeline trials include the CargoCap system in Germany, the PipeNet concept in Italy and the Tube Cargo Express (TCX) in Belgium.

Multi-storey ramped warehouses

In many cities office, retail and residential developments have become more intensive over time, whereas plot densities for logistics space have moved in the opposite direction because of the greater yard space in new and modern buildings compared with older ones. The latter trend is due to the changing function of many warehouse buildings – from facilities for storage to facilities for rapid distribution.

Due to the pressure of demand on land in some of Europe's major cities and rising land values, there is now emerging interest in certain cities in multi-storey (and multi-user) ramped warehouses, which are commonplace in large Asian cities including in Japan, Singapore, Hong Kong and China but currently very rare in Europe. European examples include a couple of 1970s built developments in Paris and the X2 building next to London's Heathrow Airport, completed in 2008. Multi-storey ramped warehouses are, however, relatively common in Istanbul due to the hilly topography of the city and high land values.

Entrepôt Ney

Entrepôt Ney in Paris' 18th arrondissement, is a 120,000 sq m, three-storey ramped warehouse. Located just off a major junction with the Paris Périphérique, the site provides good access to the greater Paris area. There is also direct rail access, although the rail is not in use. The facility is owned and occupied by Geodis. In total there are about 40 different companies operating at this facility with fashion and smaller local transport/logistic companies making up the majority of occupiers. Amazon is also located here operating a Prime Now facility. At present, the building is fully occupied.

Each floor has about 10 units at about 3,000 sq m each. The highest rents are on the ground floor with rents reducing on the two upper levels which are both accessible by a separate ramp for in and out traffic. These ramps are also the only way to access the large volume of rooftop parking.

Pantin Logistique

Located outside of, but in close proximity to the Périphérique, this facility totals around 150,000 sq m. Louis Vuitton and Hermès both rely on the site to fulfil their locations in Paris. La Poste is another notable tenant, and the building is also used for additional storage for the Halle de Pantin – located directly across the road. Currently there is about 5% vacancy in the building, but this is primarily office space. Prior to the refurbishment in 2012 by Pantin Logistique there was about 30%-40% vacancy.

The largest negative and criticism from occupiers is the inefficiency of operating on the top floor. There is only one ramp in and one ramp out. Lower clear heights also exist on the top floor. The trade-off however is in the rental price; while the range varies from about €80-€100 per sq m on the ground floor, occupants on the top floor only pay between €50-€60 per sq m.

X2, Heathrow

Built in 2008, the X2 development next to Heathrow Airport provides around 21,775 sq m on ground and one upper level divided into four units per floor. It was designed to be multi-occupied with a focus on airport cargo and airport-related occupiers with high throughput requirements, rather than storage. Each unit has a clear height of 6 metres and two level access doors. The ground floor units have a floor loading of 30 kN/sq m with the first floor units having a floor loading of 15kN/sq m. The upper floor is serviced by two one-way ramps for commercial vehicles. All the units have dedicated yard areas with a minimum depth of 33 metres. The building was relatively slow to let but is now fully occupied by air freight forwarders: Airworld Services Ltd occupy the whole of the ground floor and the upper level is occupied by Freightnet Handling, Westgate Handling Services and Crane Worldwide.

24. https://www.dpd.com/home/news/latest_news/pilot_project_in_nuremberg_can_micro_depots_revolutionise_the_last_mile

There is now some interest in certain European cities in the development of multi-storey ramped warehouses although this interest is limited to date. We are aware of some developer interest in this concept in London but no new developments of this sort are actually under construction in the city. However, some multi-storey developments are underway or well advanced in France and Germany:

- Sogaris is currently developing a three-storey logistics facility at its Chappelle International site in Paris;
- SEGRO is currently developing a 15,000 sq m two-storey ramped warehouse on ground and one upper level in Munich;
- Vailog, a SEGRO-owned company, is also planning a 64,000 sq m two-storey ramped building at Gennevilliers in northern Paris called Paris Air 2. This building will offer 10 metres clear height on the ground floor and 7 metres clear height on the first floor. It also has 5 ton/sq m floor loading on the ground and 3 ton/sq m on the top floor with 35-metre deep yards on both levels.

A range of challenges and opportunities exist with respect to multi-storey ramped warehouses. As a largely untested market the nature and extent of demand from occupiers is uncertain, although the case studies above highlight high occupancy rates in existing developments from a range of occupier types. Building design issues include the number and positioning of ramps, column layout and yard areas, and the inclusion of cargo lifts which may obviate the need for ramp access to every floor.

Going underground

An alternative to building up is building down or, more likely, utilising existing underground space such as city car parks. We believe that many car parks in cities are likely to become surplus to requirements for parking if car trips reduce due to a combination of rising congestion, wider congestion charging or road pricing in cities, and a modal switch to public transport. As a result, these car parks could offer significant potential for logistics hubs right in the heart of cities. In Paris, for example, Chronopost operates two underground facilities within central Paris. The first opened in 2005 and is located in a former city-administered parking garage below the Place de la Concorde. The second, which opened in 2013, is located in Beaugrenelle along the quay on the Seine, below an existing building. These facilities enable Chronopost to reduce mileage and emissions for last-mile deliveries in Paris.

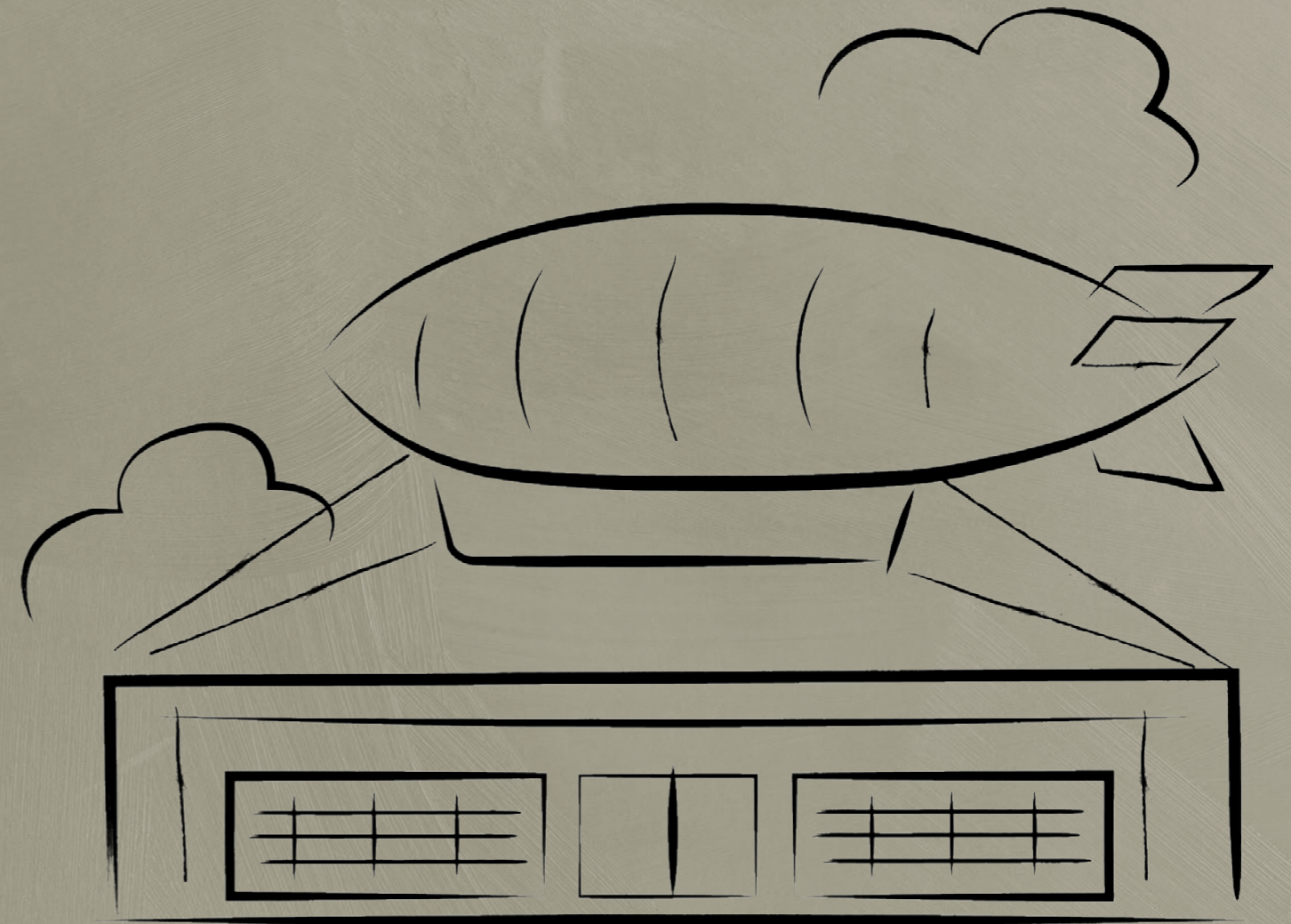
Before the development of the Concorde centre, deliveries were sent directly to customers relying on vans and diesel trucks from a major hub south of Paris. The Concorde and Beaugrenelle centres now act as mini-distribution/cross-dock facilities in the heart of the city. Packages are sent in from the hub and sorted within the two Urban Delivery Centres (UDCs) and subsequently shipped out on electric vehicles.

Warehouses in the sky

The view that property markets are all about 'location, location, location' assumes that a property's location is fixed. However, Amazon has recently attracted considerable attention for a patented idea involving 'airborne fulfilment centres' that could be used as moveable aerial bases for deliveries by unmanned aerial vehicles (drones). This type of invention would represent a complete departure from warehouses as we know them, being fixed in location to a point on the ground, but this is not something we see happening any time soon. There are, we believe, easier and quicker wins – including potentially mobile 'warehouses' on the ground. These may be nothing more than a trailer which can service as a local delivery point, e.g. for final delivery by walking or bike, as already happens in many cities.

Night-time and out-of-hours deliveries

In addition, to the different land and property opportunities considered above, many European cities are investigating the potential for more evening or night-time deliveries when there is generally spare capacity on road networks. This would involve lifting current restrictions on transport and warehouse operations that often apply, which are usually designed to limit noise disturbances for local residents. This approach certainly has potential with plenty of evidence that noise and inconvenience can generally be limited by relatively simple changes to working practices and the use of quieter vehicles. There is a link here with the growing interest in the use of electric vehicles for urban deliveries. We believe there is a strong case for lifting night-time restrictions in order to make better use of transport and warehouse capacity, provided issues around noise can be properly addressed. The so-called 'PIEK' standards, first set out in the Netherlands, have been adopted in several European countries such as the UK, France, Germany and Belgium as the key standards for limiting noise during out of hour deliveries.



Conclusions

Cities present many logistics and other challenges but also significant opportunities. This short paper has highlighted some of the key issues as we see them. Our conclusions focus on some potential opportunities to improve overall logistics efficiency within cities and to reduce environmental impacts.

- 1 There is a need to find new models of city logistics which are more sustainable and which maximise efficiency while minimising adverse environmental and social impacts.**
Many of Europe's largest cities are under pressure as growing populations and economic activity, coupled with changes in consumer behaviour and expectations linked to the growth of e-commerce, generate increasing demand for freight transport and more complex logistics solutions. These changes, in turn, are leading to rising levels of emissions, including CO₂, particulate matter (such as PM₁₀ and PM_{2.5}), nitrogen dioxide and noise, with adverse impacts on the local environment of cities and public health.
- 2 New or developing technologies and concepts have the potential to address both efficiency and environmental objectives but there are no easy or quick wins.**
'Smart cities', based on the Internet of Things and big data, have this potential but require much better connectivity than most cities currently provide. Other less holistic concepts, such as 'Mobility as a Service', 'Warehouse as a Service' or autonomous vehicles, may also improve efficiency and reduce environmental impacts. Some concepts - such as the physical internet - would be transformational game changers, if ever realised.
- 3 Old technologies should not be ignored as partial solutions may be found by looking 'back to the future'.**
Old technologies, such as a greater use of rail for bringing goods in or out of cities and the use of bikes for last-mile delivery can cut emissions, while not compromising efficiency.
- 4 More night-time deliveries in cities would make more effective use of the transport network at times when it has capacity and would cut down peak traffic impacts.**
This could be an opportunity to improve efficiency and cut emissions when combined with safer, cleaner and quieter vehicles.
- 5 Logistical considerations need to be at the forefront of city land use planning and building design.**
The zoning of cities and the design of buildings needs to be rethought to improve logistics efficiency and reduce congestion and disruptions. Buildings (offices, shops, hotels, hospitals etc.) are the start or end destination of most freight trips but often need to be better designed to handle freight. This is especially the case in large buildings or buildings occupied by multiple businesses - such as big office blocks or shopping centres.

- 6 Warehouses and suitable land for logistics activities will remain critical for efficient city logistics but if these activities are pushed too far out of the cities they service, this will drive up 'stem distances' and, subject to the type of vehicles involved, emissions.**
We think there will be greater demand in and around cities for transshipment points, shared-user consolidation centres, local facilities for last-mile fulfilment including centralised facilities for 'click and collect', multi-modal logistics platforms and alternative modes to road transport; and multi-storey buildings. In addition we believe existing underground car parks in city centres could be converted into central logistics hubs, as many become surplus to requirements due to declining car travel to central and inner city areas. Electric vehicles will become much more important in city logistics, which will require significant investment in an appropriate charging infrastructure.
- 7 The varying interests of the different stakeholders in city logistics need to be addressed in order to identify new approaches that satisfy all of them.**
Logistics in cities involves many different 'stakeholders' (including city and local authorities, shippers, retailers, logistics service providers and consumers) often with different objectives and priorities. This makes it more difficult to identify and implement solutions to its challenges as each make decisions based on their own objectives. Greater collaboration between all stakeholders is likely to maximise logistics efficiency overall and minimise environmental and social impacts, but this requires a significant change in behaviour.
- 8 Logistics in cities present big opportunities for real estate developers and investors due to strong demand and supply dynamics.**
We predict rising demand for facilities from corporate occupiers coupled with limited land in many major cities. This will support values and overall investment performance.

"We have yet to fully comprehend the implications of the loss of huge swathes of industrial land to alternative uses in UK cities, particularly London. Coupled with ever increasing congestion and the need to improve air quality, the way the logistics industry serves the city of the future is going to drive new property solutions along with innovate delivery strategies. It will take public and private sectors working in partnership to make this happen."

Paul Weston

Senior Vice President – Head of London &
South East Markets Prologis

Appendix 1: GDP, employment and population growth in selective cities and countries

	GDP, % p.a.			Employment, % p.a.			Population, % p.a.		
	2000-2015	2015-2030	2000-2030	2000-2015	2015-2030	2000-2030	2000-2015	2015-2030	2000-2030
Brussels	0.90%	1.50%	1.20%	0.60%	0.50%	0.60%	1.50%	1.00%	1.30%
Belgium	1.40%	1.50%	1.40%	0.80%	0.40%	0.60%	0.60%	0.40%	0.50%
Prague	2.90%	2.20%	2.60%	1.00%	0.40%	0.70%	0.50%	0.40%	0.50%
Czech Republic	2.60%	1.90%	2.30%	0.40%	-0.10%	0.20%	0.20%	0.00%	0.10%
Munich	1.50%	1.10%	1.30%	1.00%	0.50%	0.70%	1.40%	1.30%	1.30%
Berlin	1.10%	1.30%	1.20%	0.90%	0.50%	0.70%	0.40%	0.60%	0.50%
Hamburg	1.00%	1.00%	1.00%	0.90%	0.40%	0.60%	0.40%	0.70%	0.50%
Frankfurt	0.50%	0.90%	0.70%	0.70%	0.00%	0.40%	0.90%	0.90%	0.90%
Germany	1.10%	0.90%	1.00%	0.50%	-0.20%	0.20%	0.10%	0.00%	0.00%
Madrid	2.00%	1.80%	1.90%	1.20%	0.80%	1.00%	1.20%	-0.10%	0.60%
Barcelona	1.10%	1.30%	1.20%	0.60%	0.50%	0.50%	0.90%	-0.30%	0.30%
Spain	1.40%	1.50%	1.40%	0.70%	0.50%	0.60%	1.00%	-0.20%	0.40%
Paris	1.40%	1.30%	1.30%	0.40%	0.50%	0.50%	0.60%	0.50%	0.50%
Lyon	1.50%	1.60%	1.60%	0.90%	0.60%	0.80%	0.90%	0.50%	0.70%
France	1.10%	1.20%	1.20%	0.50%	0.40%	0.40%	0.60%	0.40%	0.50%
Budapest	2.30%	1.60%	2.00%	0.80%	0.70%	0.80%	0.00%	0.30%	0.10%
Hungary	2.00%	1.50%	1.70%	0.10%	0.20%	0.20%	-0.20%	-0.20%	-0.20%
Dublin	6.00%	2.60%	4.30%	1.30%	1.30%	1.30%	1.10%	0.70%	0.90%
Ireland	4.10%	2.50%	3.30%	1.10%	1.40%	1.30%	1.30%	0.90%	1.10%
Milan	1.10%	1.40%	1.30%	1.20%	0.80%	1.00%	0.60%	0.20%	0.40%
Italy	0.00%	0.80%	0.40%	0.40%	0.30%	0.40%	0.40%	0.10%	0.30%
Amsterdam	2.30%	1.60%	2.00%	0.90%	0.80%	0.80%	0.90%	0.70%	0.80%
Netherlands	1.10%	1.20%	1.20%	0.50%	0.50%	0.50%	0.40%	0.30%	0.30%
Oslo	2.80%	2.40%	2.60%	1.30%	0.80%	1.10%	1.60%	1.20%	1.40%
Norway	1.60%	1.50%	1.50%	1.10%	0.50%	0.80%	1.00%	0.80%	0.90%
Warsaw	4.10%	3.00%	3.60%	1.20%	0.40%	0.80%	0.20%	0.20%	0.20%
Poland	3.50%	2.50%	3.00%	0.80%	0.00%	0.40%	0.00%	-0.10%	-0.10%
Bucharest	5.00%	2.40%	3.70%	1.90%	0.40%	1.20%	0.30%	0.20%	0.30%
Romania	3.70%	1.90%	2.80%	-0.50%	-0.10%	-0.30%	-0.70%	-0.20%	-0.40%
Moscow	3.30%	1.10%	2.20%	2.10%	-0.20%	1.00%	1.10%	0.40%	0.80%
Russia	3.60%	1.10%	2.30%	0.70%	-0.80%	-0.10%	-0.10%	-0.20%	-0.20%
Stockholm	3.10%	2.00%	2.50%	1.10%	0.80%	1.00%	1.30%	1.10%	1.20%
Sweden	2.10%	1.30%	1.70%	0.70%	0.40%	0.60%	0.70%	0.50%	0.60%
Istanbul		3.40%			1.80%			1.00%	
Turkey	4.00%	3.20%	3.60%	2.20%	1.30%	1.80%	1.50%	0.70%	1.10%
Birmingham	0.90%	1.50%	1.20%	0.10%	0.30%	0.20%	0.60%	0.50%	0.60%
London	2.70%	2.30%	2.50%	1.50%	0.90%	1.20%	1.20%	1.20%	1.20%
United Kingdom	1.70%	1.70%	1.70%	0.80%	0.40%	0.60%	0.70%	0.50%	0.60%
Aggregated 22 Cities	2.50%	1.80%	2.10%	1.90%	0.70%	1.30%	2.10%	0.60%	1.30%
Aggregated 16 Countries	1.60%	1.40%	1.50%	0.70%	0.10%	0.40%	0.40%	0.10%	0.30%

Underlying data sourced from Oxford Economics



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