How we measure urban density has a direct effect on how new architectural developments are designed – and how inclusive they are in use. Urban planners most frequently measure density by the number of ‘dwellings per hectare’. But this restrictive metric does not adequately reflect the scale of social and demographic change. The Metricity study led by researcher Paul Clarke proposes alternative measures of urban density that respond to more fluid patterns of living and working – and tests these through design scenarios for Ebbsfleet in Kent. The result is a compelling and provocative look at urban design for future need.

Paul Clarke

Paul Clarke is an architectural designer, researcher and filmmaker with a Master’s degree in Architecture from the Royal College of Art. With an avid interest in the extraordinary and unforeseen implications of future technologies, as well as socioeconomic and demographic change, Paul suggests a way of understanding future worlds, the psychology of society and its inhabitants. Narrative futurology as a critical design approach provides a creative tool to explore alternative and otherwise unknown futures. Paul Clarke has exhibited his work at the Architecture Foundation’s ‘Best in Show’ in 2006.
METRICITY

EXPLORING NEW MEASURES OF URBAN DENSITY

PAUL CLARKE

Research carried out at the Royal College of Art, Helen Hamlyn Centre, October 2006 - September 2008

www.metricity.net
Paul Clarke’s Metricity study is the result of two years of applied research carried out in the Helen Hamlyn Centre at the Royal College of Art, in partnership with the British Council for Offices, the UrbanBuzz initiative and a quartet of leading London architectural practices.

The project addresses the urban design implications of social and demographic change, and therefore touches on one of the core concerns of the Helen Hamlyn Centre – to make cities more livable, inclusive and sustainable places, especially in the context of an ageing population. Metricity also reflects Paul Clarke’s status as a new graduate of the RCA’s Architecture Department, which is renowned internationally for utilizing the cultural diversity of London as a testbed for new ideas.

The focus of Metricity is on how urban density is measured – and on how such measures affect the way new urban developments are designed and occupied. Current metrics favoured by planners, such as the number of ‘dwellings per hectare’, are static and singular and do not reflect the immense upheaval of social and demographic change evident in dynamic cities like London. So right from the start, the research consortium aimed to explore alternative measures that go beyond a conventional and prescriptive approach to density and towards a more animated and realistic description of emerging patterns of living and working.

In conducting the research, it was necessary to unpack a lot of complex issues around density, land use, transport policy and new ways of working. The study homed in on how planners address high-density urban environments around transport nodes, and organised itself around four new measures of density, representing socio-economic, social-demographic, political and technological drivers of change.

These four alternative metrics – Intensity, Amenity, Autonomy and Frequency – were then tested through a series of design scenarios applied to a real development site, Ebbsfleet in Kent, referred to by developer Land Securities as “large enough in scale to define its own way of life”. The scenarios sketch out four alternative and provocative views of the future, based on extensive user research and expert consultation via multidisciplinary and participatory knowledge-transfer events.

The aim of the study has been to stimulate debate, engage the key players and ask how exploration of alternative principles can offer a framework for change. What is clear from the outcomes of the project – and the professional response to it – is that narrow measures of urban density restrict the open-mindedness of the city. We badly need new development to be planned in a more animated and holistic way, especially when dense urban schemes are considered around transport hubs. Only then will the city become more inclusive.

This publication sets out on the long road towards that goal, and I am grateful to Paul Clarke and all the partners who have contributed their time and expertise with such energy and commitment.
**RCA Helen Hamlyn Centre**
The Royal College of Art Helen Hamlyn Centre works to advance a people-centred approach to design and innovation through practical research, projects with industry, events, exhibitions and publications. The Centre has jointly commissioned this research project with the following organisations: British Council for Offices, Arup, Child Graddon Lewis, 3DREID, Fletcher Priest, and UrbanBuzz.
www.hhc.rca.ac.uk

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The mission of the British Council for Offices (BCO) is to research, develop and communicate best practice, and stimulate new thinking, on the design, development, and occupation of offices across the UK. The development of the BCO research programme has been marked by the adoption of a thematic approach which focuses on all aspects of the workplace, sustainability and urban regeneration. It delivers this by providing a forum for debate of relevant issues.
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UrbanBuzz is a knowledge exchange programme designed to address barriers in the delivery of sustainable communities in London and the Greater South East. University College London (UCL) is leading the two year programme (2007-08) with the University of East London. The £5m programme is funding 28 projects, all helping to break down the silo-thinking that can exist amongst and between academic and professional disciplines.
www.urbanbuzz.org

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3DREID Architecture employs a philosophy of knowledge-led architecture in which research provides a fundamental contribution. The practice boasts its own Research and Development Unit that informs all the projects it undertakes to ensure its design is a holistic and a considered response. Previous research has covered the topics of mixed-use within the context of community, real issues that hamper successful urban design, and the design of urban space as inclusive places.
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Fletcher Priest Architects have established a trust, which is a separate registered charity, to support architecture and architectural education in the UK. The work of the trust can take a variety of forms, including the sponsorship of events, exhibitions, publications, research and bursaries. Rather than undertake these activities directly, the trust provides funding to institutions and organisations who are best placed to carry out this work with the greatest expertise. Projects currently supported by the Trust include an international lecture series, financial bursaries for students to undertake their diploma studies, and the part-funding of postgraduate research.
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The Metricity study had four main objectives to meet:

1. Creation of four design scenarios for 2018, that represent new ways of measuring urban density and respond to rising trends. An evidence base of trends and data was taken from horizon scanning material, such as White Papers, newspapers, and reports relevant to strategic urban planning. This process included:
   a. Review of existing data;
   b. Interviews with stakeholders to map assumptions and perspectives on change;
   c. Scenario building, consisting of a participatory workshop and scenario write-up and illustration;
   d. Presentation addressing stakeholders at an horizon scanning conference;

2. User case studies: interviews and first-hand reports of emerging work-life patterns.

3. Involvement of a wide variety of expert consultants and stakeholders in the scenario building and foresight activities.

4. Dissemination online and through print, workshop or conference to enable knowledge transfer to make positive effect on policy.

The concept of a networked society where we will be able to experience a multitude of work and leisure activities suggests a need for new ways of understanding urban density that can adapt to both societal and technological change. This project investigates a qualitative rethink of measuring density that is driven by the increasingly diverse needs of users, and focuses on the emerging concept of work-life ‘blend’ rather than the traditional view of work-life separation. The implications of this become important when we distribute and design workspaces across the urban environment.

In attempting to achieve a more holistic approach to the planning process, the Metricity study worked closely with diverse groups of carefully selected urban dwellers to paint a more descriptive picture of how we live and work today. As suggested in a London School of Economics (LSE) report on density and urban neighbourhoods in London, current standards that use existing numerical measures of density (number of dwellings or people per hectare) as a policy and planning tool should be modified to take into account more complex inter-relationships (e.g. accessibility, internal occupancy levels, car use, parking, open space, distribution of facilities, etc).

This poses a difficult challenge as quantifying the qualities of urban spaces and acknowledging social needs is often a complicated and intangible process. The principles and process developed on the Metricity study aim to offer more descriptive ways of evaluating and governing urban density.
**INTRODUCTION**

**Metric — a general quantity that relates to an entire population, as distinct from an individual statistic that relates to a sample.**

There are a number of parametrics that are more descriptive and offer interesting possibilities as alternative measures of density:

1. **Energy-use:**
   - Looking at the individual carbon footprints or credits per hectare to indicate energy usage and management in the community.

2. **Cultural complexity:**
   - The number of languages per hectare indicates cultural density, an important factor during the bidding process for the 2012 Olympics.

3. **The impact of GDP:**
   - Technology indexes, patent applications per head per hectare, the numbers of gay residents or creatives as a measure of an area’s prosperity.

4. **Technological density:**
   - Assessing the number of wireless hotspots per hectare or infra-red signals per hectare can show technology distribution across the city.

5. **Demographic growth:**
   - Measuring fertility rates or number of births per hectare to gain insight on varying socio-economic circumstances.

6. **Noise complaints:**
   - Antisocial behaviour and noise complaints rose five-fold from 1980 to 2005 according the Office of National Statistics data.

7. **The Metropolitan index:**
   - Starbucks per hectare. Frank Duffy, from DEGW architects, suggests a knowledge economy is measured by ‘ideas per cubic metre per minute’.

8. **Hyperactivity of the city:**
   - Measuring the walking speed of a citizen. The average pace of city dwellers indicates much about the psychology of inhabitants.

9. **Health density:**
   - Health consultants map the geographical impact of diabetes in order to track the populous that is worst affected as a result of poor living conditions.

10. **Happiness as a form of density:**
    - The Number of ASBOs (Anti-Social Behavioural Order) as a measure of social unrest or iPods as measure of affluence per hectare.

11. **Noise complaints:**
    - Measuring fertility rates or number of births per hectare to gain insight on varying socio-economic circumstances.

**The prescriptive planning of London currently adopts the ‘number of dwellings per hectare’ as its principal measure when assessing urban density. It remains a one-dimensional and restrictive means of ‘measuring-up’ the city. Sometimes other units of density that also use a ‘per hectare’ measure are used. The most common include ‘habitable rooms per hectare’ and ‘bed-spaces per hectare’. None have succeeded in adequately representing the characteristics of high-density living or describing the variety of household sizes, building uses or the increasingly varied way in which we live and work.

Habitable rooms and bed-spaces give a better impression of the potential living capacity of a residential development, but cannot describe the type of use per occupancy. For example, pressures on internal space in the home often mean bed-spaces are converted to other uses. Demographic and social change also have a direct effect on density — for example, the increase in second home ownership or a disproportionate dependency on public amenities.

A maximum density limit was initially adopted in order to address the social overcrowding issues of a bygone London and prevent excessive over-development. The reverse is now true as minimum density levels are needed instead to ensure that space is used more efficiently.

Policy now needs to encourage a more sustainable approach to managing density. This could include the enforcing of minimum density levels of housing or the requirement to provide an economically viable public transport node in close proximity to housing.

When we consider how we describe and measure the city, what new metric could adequately define the quantity, quality or type of urban space, and perhaps more importantly, the experience or service it provides to the urban user?

When building at high densities, alternative, more user-centred measures of density could generate a more intense and varied urban environment, one that is visually and socially stimulating, and conceivably better suited to the pursuit of a modern lifestyle. This sort of hyper-density could occur through the application of different policy drivers and different urban measures.

A measurement space for the city. A descriptive scale by which to calculate the capacity, density and scale of urban space.
Horizon scanning uncovers emerging issues of change and anticipates how policy can make more purposeful intervention. This prospect can render some policy and its direction obsolete while creating opportunities for alternative approaches and innovations. The built environment leaves a lasting legacy, the results of which have to be lived with for generations to come. Policy that is prescriptive about acceptable levels of density for development is perhaps at fault, as it leaves little room for change in the future. Planners are beginning to acknowledge this: “...because we all now know that the markets are changing so quickly, and what we all need is changing so rapidly, why set in a plan that will live for five to six years... that will become out of date as soon as it is published.” (Tennant, 2007)

Planning has ultimately looked to preserve land and increase overall control over land development. Could the onus therefore lie with planning policy to develop metrics that control more qualitative aspects of density such as levels of perceived happiness? Metrics most commonly evaluate quantifiable changes such as targets, drivers, numbers and league tables. These have all proved to be instrumental in influencing successful policy implementation. Planning should make use of both a qualitative and quantitative approach and meet its objective of safeguarding the future development of land use with a more holistic vision and social wellbeing in mind. This study aims to provide insight into the changing nature of living and working and its subsequent effect on urban planning and density. The trends that were highlighted through desk research and a literature overview provide a body of evidence to strengthen the design scenarios and provide a global context to the research. The value of the user input to the study, was not necessarily to further identify trends, but to provide a people-centred perspective on this potentially complex and abstract way of looking at the city.

Addressing emerging futures can be creative, but can also highlight aspects of uncertainty. Although horizon scanning is a useful tool for identifying areas of impending change, making sense of this required a further process. The Metricity study used scenario building to think more strategically about the future of urban density. The aim was to create plausible scenarios for a Transport Development Area (TDA) in the London region that would depict a range of new possibilities for density, transport and the workplace in the year 2018 — a ten-year time horizon. The scenarios are not predictions, or even forecasts. They are stories and descriptions that explore possible future outcomes and thereby inform strategic conversations. This publication presents those scenarios and the research that supports them.

In order to evaluate the design scenarios the metricity study proposes a framework, built around key socioeconomic, social-demographic, political and technological drivers, informed by users’ experiences and narratives regarding their work and lifestyles.

This framework led to the creation of four new principles for measuring urban density that support a greater animation of dense city development: Intensity, Amenity, Autonomy and Frequency.

These principles can be used as a means of assessing the following prescriptive policy issues: use classification, net density metric, zoning, and levels of occupancy. The research investigated these issues, ‘testing’ the framework and assessing the ‘trade-offs’ between the four principles across the four different design scenarios, whilst simultaneously considering the qualitative effects on users and their relationship to density, transport and land use.
**User Metric Principles**

**Intensity** is a descriptive measure of a settlement’s socioeconomic requirements. The focus is on encouraging adaptable spaces that will serve to improve the density of mixed use and the capacity to create economic hubs within more sustainable communities. Thus, it equates to the stacking, layering and the flexibility of programmatic spaces that could promote adjoining and complementary uses, particularly when the result enables more fluid changes of use that can effectively increase levels of occupancy and improve degrees of efficiency. The Intensity principle investigates alternative solutions to the following:

1. Prescriptive planning policy that strictly equates activity to a place, and classifies a building according to activity and does not allow enough freedom for adaptable mixed-use spaces.

2. Prescriptive planning policy that restricts an appropriate mix and provision of different spaces around a transport node that could better suit high-density development and the needs of the end user. For example an inflexible policy of housing density metric, combined with developer-led investment and planning approaches that are entrenched with separating use, is driving out and limiting the development SMES.

3. Flat-planning that can constrain the appropriate volume and mix of density. A balance of living spaces and workplaces are required around a transport development area in order to maximise the economic potential of built transport infrastructure and create accessible, inclusive, and three-dimensionally planned high-density developments.

**Amenity** is a descriptive measure of a settlement’s social-demographic requirements. It examines the typological diversity: the need for access to a range of building types so as to accommodate a continuously shifting household composition. London’s growth requires more housing located in closer proximity to employment options, particularly around dense urban transport development areas where housing demand is encouraged by good transportation links. The Amenity principle investigates alternative solutions to the following:

1. Prescriptive planning policy based on standardised metric of housing currently sets a numeric value to the number of households per hectare viable at a transport development site with insufficient regard to the diversity of household type or demographic needs.

2. The approach of developers to prioritise short-term market trends over the long-term needs of communities. A demographically vibrant mix of housing types that refrains from enforcing the social make-up of communities is required with consideration of the arrangement and numbers in a site.

3. Planning policy guidelines that suggest a hierarchy of open space yet do not actively enforce the appropriate mix of open spaces that are needed in high-density development by the people who will use them. Areas where housing demand is encouraged by good transportation links, in order to establish communities that represent the changing demographic make-up of households.
**Autonomy** is a descriptive measure of a settlement’s democratic needs. It examines the density of inhabitation that could empower stakeholders to influence the shaping of self-sufficient communities. This reflects a need for public consultation and proactive involvement of end-users in the design and delivery stages of creating an autonomous transport development area. The Autonomy principle investigates alternative solutions to the following:

1. Prescriptive planning policy of ‘zoning’. This is a strategic method of separating employment areas and residential areas of planned city growth in such a way that development is restricted by predetermined land use.

2. The provision of different scales of spaces and facilities to foster local community-based entrepreneurship and self-employed businesses/start-ups. This includes the adequate provision and management of services and amenities to aid and support economic activities.

3. The need for more direct user consultation to avoid delays and disputes in planning sizeable transport development areas. Engagement of end-users in planning decisions should not be limited to consultation that is in effect tokenism, but instead should be used by local authorities to have a real impact on design decisions and provision.

**Frequency** is a descriptive measure of a settlement’s dynamic and mobile population. It examines the density of interaction and accessibility requirements of the community connected to transport development areas rather than engendering an inherent reliance on mobility. It looks at how new technologies can provide an alternative means of tracking, regulating and planning for a transient workforce and fluctuations in population density. The Frequency principle investigates alternative solutions to the following:

1. The continued citywide policy of concentrating employment density on a ‘Central Activities Zone’ that encourages an inherently commuting workforce. Although this succeeds in intensifying the centre, it leads to dormitory and satellite development on the outskirts.

2. London’s future growth that requires better information and technology management to accurately describe the movements of workers and facilitate a model of development that encourages a more intelligent distribution of employment and services. These communication technologies could facilitate new means for supporting more workplaces at remote hubs a distance from city centres.

3. The integration of planning policy guidelines with Transport Development Management (TDM) and the use of intelligent infrastructure to plan for the frequency of population flows around transport nodes.
Understanding and improving the socio-economic sustainability of place, and providing policy with the right metrics, allow some wider issues to be tackled: “The vision is actually about how we plan our places and develop places going forward. It is a real challenge for planners, policy makers, investors and developers to think differently about places. Living and working in a place actually helps create a successful and an economically vibrant community.” (McCarthy, 2008)

One of the key challenges in trying to achieve sustainable communities is that today’s labour market has far greater mobility and freedom to travel and communicate using new technologies. It is therefore unrealistic to expect any local populous to remain attached to its particular area and its local economy. A spread of population travelling from a wider catchment area to a centralised agglomeration of businesses is far more likely, as this follows the recent historical model of development. The risk here is the emergence of dormitory towns for commuting employees, resulting in dormitories that are not sustainable in their own right.

Furthermore, shifts towards service-based, financial and creative industries are giving rise to alternative styles of collaborative working with an emphasis on the exchange of knowledge. Altogether different types of offices are emerging out of the growth of this knowledge-driven economy. Temporal and fixed workspaces have successfully adopted and exploited new communication technologies and provide the capability to reinvent means of interaction. The need for people to be in the same place at the same time is becoming challenged.

Arguably stimulated by the digital and more increasingly urban age, the knowledge workers of today are setting a precedent for a more integrated way of living and working that does not entirely conform to the past conventions of the industrial era and an outdated planning system that prescriptively separates home from work. Being connected through improved accessibility to both virtual and physical geographies will be increasingly important.

There are a number of drivers and trends that reflect a changing workforce demographic with no ‘one-size-fits-all’ solution. However, a simplified rationale might help categorise the dominant interrelationships between living and working as typified in the four categories above.

There is a distinction between those users who actively encourage their work and life to blend or integrate and those who maintain a steady work and life separation, either through strict boundaries imposed on time or a virtual or geographical disconnect. There are also those who are driven by work and attain less of a work-life balance and those who organise work around life.

The planning and design of the urban environment will need to respond to these changing patterns of work in order to support vibrant and animated cities that have more relevance to the way in which we live and work.
To fully examine the changing work-life patterns emerging in large cities, users were selected from London and Tokyo to show cultural variance. People were interviewed, observed and photographed in their workplace, whilst travelling and going about their daily routine. The users were also provided with a means of self-documenting behaviour using a photographic diary.

Chris, 31
Learning and teaching coordinator. Lives in Cambridge and commutes two hours to work in South Kensington, London. “The daily commute is a time for catching up on ‘me’ time. As is so common for the everyday commuter, people rarely talk to one another, it is not the done thing”.

Mase san, 23
Property market trader, living and working from hotels in Tokyo city. “A city centre hotel means no set time to return home.”

Tanabe san, 35
Self-employed architect. Living and working in rented Small Office Home Office Apartment with partner, in Shinonome, Tokyo. “I cannot distinguish work life from private life. To improve work life is to improve private life.”

Sakamoto san, 28
Sales representative for airline, lives in a domicile and works in a central office. “It is difficult to find my own private space in the city, I typically rent a Manga-kisa cubicle in order to relax.”

Briony, 27
Self-employed social entrepreneur. Living in shared accommodation and works in a shared Hub workspace, London. “I had a hub and spoke pattern with my friends. I knew lots of people who didn’t know each other. Since the Hub, it’s become networked, I feel part of a community.”
A case study from BT shows that the move to incorporate new ways of working has proved positive for workers as they enjoy a better work-life balance. "BT home workers are taking 63 per cent less sick leave than their office-based colleagues. The retention rate following maternity leave stands at 99 per cent compared with a UK average of 47 per cent, saving BT an additional 7.4 million a year." (British Telecommunications plc, 2006). On the whole this responds to the needs of BT employees but it also reflects emerging trends amongst users across a broad range of sectors. These include the following drivers:

**1. Carbon Offsetting**
Flexible working patterns and new means of management for a more efficient workforce and building stock will combat the growing pressures on individuals, organisations and government to reduce the carbon footprint. These workforce behaviours will be strictly monitored for their carbon cost.

**2. Commuting Culture**
A growing preference of lifestyle choices to avoid commuting may encourage a local-based economy and workforce. Figures show a steady increase in numbers enduring the cost and stress of the daily commute.

**3. Workforce Wellbeing**
Greater flexibility will aid social care and welfare, particularly those with dependants or on maternity leave. This also has particular relevance to an ageing population, as the care of elderly people has become a central issue to the cost of social care. Flexible working has notably improved staff retention, saving skills and recruitment costs.

**4. Ageing Workforce**
An increase in the demographic of those living and working for longer may affect the number of people who are unable to travel long distances to work or, for example, are highly-skilled knowledge based workers who wish to supplement their income beyond retirement through internet based services.

**5. Travelling Time**
"Journey times to work have ‘rocketed’ over the past decade, according to research by the TUC, although the pattern of commuting varies in different UK regions. London, as you would expect, has the highest number of workers now travelling for more than an hour to work per day: 1.3million." (Greenwood, 2008)

**6. Live-Work Integration**
Integration of workspaces and home in one building is a major factor for small and medium enterprise (SMEs: up to 250 employees). According to the DTI Annual Small Business Survey 2005, 41% of these businesses are home-based. This has a significant relationship to urban density with the restriction of land availability in the UK encouraging high market values of homes and workspace.

**7. Ubiquitous ICT**
(Information Communication Technology) Abundant use and reduced cost of broadband and other ICT allows business to be conducted with fewer overheads, for example a virtual site as opposed to the cost of physical premises. This will include everyone from eBay operators to internet-based services.

**8. Productivity & Work-Life Blend**
Measures to monitor the enhancement of performance and productivity of the workforce require flexibility in both workspace and management in order to redirect previously wasted time towards smarter working styles. This often incorporates an overlap or blend between living and working that improves the ability to do more with available resources.
The **Metricity** study focuses on the role of the workplace in influencing urban form, and in particular considers the drivers of change that affect economic sustainability and influence city development.

Modern cities around the world have traditionally bought into the notion of agglomeration economies: the idea of similar and even disparate industries coming together and sharing resources and mutual benefits. The result of this is a spatial cluster of built urban form that conveys layered interactions of cultural, commercial and social habitation. The key attribute and justification for this agglomeration is the increase in the economic ability of the city and the positive impact on businesses to reduce overheads by clustering together.

The effective agglomeration of industries is typically dependent on the successful integration of transport within the city so that people and businesses can be placed within relative proximity to one another. This will generate wider economic benefits as outlined in the Eddington Transport Study.

The ‘super-sized’ office development of London’s Canary Wharf is a prominent example of urban density that focuses a workforce around a transport node. It demonstrates the significance of scale in transportation and urban enlargement required to match the economic expansion needed to compete on the global stage. Upon the completion of CrossRail, the major transport infrastructure that will serve as a link between Heathrow and Canary Wharf, the effective capacity of employment for the area will increase almost three-fold. (Currently a net employment of 80,000 is expected to increase to 220,000 job opportunities, according to Transport For London). A mass transit system to support the transport needs of this prospective workforce will further encourage hundreds of thousands of commuters daily.

However, there is a huge inefficiency in this arrangement — the cost of having workplace-related amenities and services lying dormant through the weekend. Consider, for example, Westminster City Council — it has “230,000 residents but the population grows by around 1.1 million people on a typical weekday. It provides a workplace to more people than any other borough in the UK.” (Deign, 2004)

Furthermore, as illustrated by this study’s user research, today’s work-life patterns are complex and demand alternative designs in the architecture of a city. It is not just the scale of urban density that is important, but also the type and mix of office, as this is what will facilitate the ‘trade’ of knowledge and allow greater permeability. The many drivers that are reflected in the changing world of work need to be reflected in changes to the workplace. The question is: how will the scale and mono-functional, mono-cultural nature of developments such as Canary Wharf respond to changing user behaviour, accommodate sustainable growth and adapt to the test of time? The evidence suggests that current models of workplace and their corresponding urban form are built upon archaic ideas of work, following a strict separation between work and living spaces.

**Accessibility**

London’s transport expansion indicates a clear attempt to meet the demands of a city driven by greater agglomeration, supporting the growing centralisation of both employment and services. This is reflected in the policy mapped to improve ‘accessibility’ to the central activities zone. However this type of transport planning promotes further centralisation of employment and, with that, the associated services and amenities. The result of this is that London’s future growth will continue to create isolated satellites of dormitory development with residents being required to travel outside the local area in order to reach their nearest services and amenities.

The role of transport should meet user needs for accessibility without creating an inherent need for mobility. This requires land use to be mixed in order to reduce additional need for the use of transport: “Access not movement is the true aim of transport. One may have access to facilities without moving much at all… the true goal of planning, the real meaning of mobility, is therefore, access” (Adams, 1981).
The objectives of the study were synthesised into a ‘scenario cross’ (see page opposite) that defines the four scenarios and imagines how the existing test site would be affected in the four alternative futures. Through this process, the study identified a cluster of related issues, resulting in the following key questions:

- Should future urban growth and density levels be fostered exclusively around transport nodes?
- If intensified land development could be achieved through density and mix of use, should it be focused around transport infrastructure?
- How will this policy affect the test site — will the site emerge as a satellite or hub, or a node or spoke?
- Can a balance be struck between centralised and decentralised growth?
- Can planning create smart economic growth, providing local economic activity and vibrancy without negative environmental impact?
- Centralisation of employment tends to create a monocentric efficiency model for city growth in respect of journey times and planning for transport. How can city planning create a more balanced economic development?

**Test Site**

The aim of the Metricity study was to test possible alternative measures for urban density within hypothetical scenarios that consider four alternative plans for an elected transport development area. The site had to have significant national and international transport links and be adequate enough in scale to encourage capacity and growth in density. The study nominated an under-developed site that fell outside the geographical boundaries of Greater London. The Ebbsfleet development site in Kent, which is currently being developed as a new settlement in the area, was chosen (see inside front cover). It is a site that will facilitate both transport and density to establish its future regional and national importance and provides a good opportunity to test the new principles. The scenarios offer an opportunity to assess the relevance of alternative measures for density and to analyse the effect of current approaches in policy on the success of Transport Orientated Development (TOD).

The developer of Ebbsfleet Valley, Land Securities, refers to the site as “large enough in scale to define its own way of life”. Its location makes it an ideal site for exploring dependency on London through rail links, or independence through its own urban form. Served by both express, domestic and international commuter train lines, it is hoped that the transport-orientated development will create ‘high-speed’ regeneration for the area. A journey time of 17 minutes to London’s St. Pancras, and a relatively remote location from established central city services, means that the Ebbsfleet site is an effective test-bed for creating new architectural scenarios that explore how we might live and work in the future.

**Scenario building: Hypothesis Matrix**

The objectives of the study were synthesised into a ‘scenario cross’ that defines the four scenarios and imagines how the existing test site would be affected in the four alternative futures. Through this process, the study identified a cluster of related issues, resulting in the following key questions:

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![Transport Hub](transport_hub.png)

**Controlled policy of high-density at transport nodes**

- **Scenario A**: Dis-connected suburb
- **Scenario B**: Timeshare Towers
- **Scenario C**: Incorporated Cluster
- **Scenario D**: Open Source City
SCENARIO A
DIS-CONNECTED
SURBURB
**Disconnected Suburb**

**Density Metric**

Dwellings per Hectare

**User Workstyle**

Work-life separation — A disconnect through geographies, commute, and virtual barriers.

**Common User Profiles**

1. Suburban commuter — Separates work and life by road and transport connections.
2. Homeworkers — Teleworkers remote working from home offices in isolation, connected through virtual telecoms.

**Urbanscape & Building Typology**

A predominantly low density suburban extension built at a national average of 25 dwellings per hectare. Built to meet short-term housing requirements, this is a settlement numbering less than 5,000 homes and reflects the suburban spread that has historically happened over the last century. With a dominant residential emphasis and minimal employment, this scenario depicts a typical Commuter Satellite Town. This separation of uses is entrenched in the current planning system and is encouraged by an explicit work-life divide. Often described as ‘bed towns’, they provide a resting place for a commuting workforce that leaves the suburb deserted in the morning and returns to fill it in the evening. The low density of taxpayers in the area does not attract local facilities or businesses, leaving it potentially disconnected. Instead, a bypass and roadside development encourage wider catchment through superstores, business parks and shopping malls. Delivery vans and taxis sustain the connections needed to access essential services.

**Intensity Value**

A lack of efficient use of residential space and the remote placement of amenities and employment has resulted in low intensity of land use. A strong distinction between work and life allows for a psychological detachment from work which can have a positive effect on the wellbeing of the residents. However, this clashes with the need to travel over increasingly longer distances to essential services, leading to a reduction in personal leisure time and a qualitative imbalance.

**Frequency Value**

Transport expansion has enabled people to continue living in low-density suburban housing, although journey times to work have increased exponentially. Mass-transit corridors such as high speed trains operate high frequencies of services that link suburb to city, transferring residents from home to job. The suburb itself is road dependant and population density fluctuates excessively — being highly active in mornings and evenings creates localised rush hours and transport logjams.

**Amenity Value**

This suburb houses some of the overspill population from London. It represents an idealised picture of living that is endorsed by developers and has provided people with personal home ownership and abundant private space. However, this housing typology has led to a sparse and car-dependant populous. The lack of residents in the daytime means that there are few economically viable local amenities. Individualism has thwarted, permeability through to neighbouring suburbs and shared public space is left to the fringes.

**Autonomy Value**

The suburb represents today’s strictly applied planning zones and limited mixed use spaces. This results in isolated residential populations rather than providing opportunities for sustained growth. Whilst these areas are subject to planning laws and local authority jurisdiction, residents exert their power through residential committees that have been known to have a ‘Not In My Back Yard’ attitude, fiercely opposing change and thereby stunting long-term development.
SCENARIO B
TIMESHARE TOWERS
Density Metric
Floor Area Ratio (FAR)

User Work Style
A dominant work focus developer-led and market intensive, with systematic compartmentalisation of units as fixed mono-functional spaces.

Common User Profiles
1. Dorm-worker — Contractual worker with domicile accommodation linked to their job position.
2. Nomadic worker — Long-haul traveller using hotel offices as a workspace and the rooms for temporary accommodation to match the changing working day. Assimilates live-space remotely through virtual connections.

Urban Landscape & Building Typology
The scenario illustrates a focused high-density urban development with high-rise buildings. Green belt restrictions preserve land for self-sufficient power and food provision, protecting the productivity of the settlement. This has resulted in intensive land use and a subsequent negative impact on housing standards. Accommodation for living becomes more tightly packed together. The outcome is a transport node that is economically self-contained with a heavy premium on space. The soaring cost of floor space creates rapidly growing markets and trade. A global trend for company relocation in search of competitive business rates has created the Knowledge Shipping Port with a rapid turnaround of businesses and services.

Intensity Value
The building supports the regular trading of workspace and live-space and conforms to a rigid model of development. Businesses and people move in and out of the building every year and units are designed around shipping container geometry to support efficiency. Homogeneous in typology, these developments prohibit external changes and limit personalisation. Instead this type is heavily branded and with vertically connected spaces stacking businesses and housing on top of each other. Public areas include a shopping and leisure district limited to the ground floor level.

Amenity Value
The architecture has been designed to support rapid turnaround and the apartments only meet short-term market needs. Developer profits have driven the creation of small self-contained flats that are more like hotel timeshare accommodation. The lack of adaptability and inadequacies of the living spaces encourage more transient living and working patterns. The prevailing property ownership of banks, corporations and businesses on the site means that housing is typically bought or rented by the company workforce.

Autonomy Value
The site provides administration support, meeting spaces and a hotel complex for cross-channel businesses. As the site boasts national transport links, companies can locate satellite offices at reduced cost. This results in greater demand for temporary office space for the nomadic, short-term workforce. Facilities such as shops, medical centres, leisure facilities are administered under private contract within large business centres. The developer parcels all rent agreements under one roof and single tenancy, meaning that any future redevelopment would avoid complicated negotiations with a mix of ownership.

Frequency Value
Short walking distances and services ‘on the doorstep’ put facilities within easy reach. However shared public space is costly due to service charges. The atmosphere is secluded and private with company facilities aimed at workers only. Nomadic and transient workers are limited to social exchange with each other. The result is a transient, ‘on the move’ community that does not see the site as a permanent home and tends to relocate as new work contracts arise. Despite national transport links the site is rarely visited by outsiders.
Density Metric
Productivity or a value-added measure of connectivity such as ‘ideas per cubic metre, per minute’.

User Workstyle
Live Work Integration — A combination of working and living in the same district, corporately franchised to provide a mixed-use development.

Common User Profiles
1. Expander — An opportunist who develops business interests through their social connections and has a work-oriented approach to life.
2. Overlapper — Integrates living and working within the same space and often teams up with a cohabiting partner or colleague.

UrbanScape & Building Typology
This scenario constitutes a mixed-use and medium density settlement that alternates between low and high-rise development, with business and commercial centres working alongside amenities for local residents. As the town has attracted a number of companies and enterprises, this scenario depicts a Knowledge Campus Town. Unlike previous company towns that were vulnerable to abrupt changes in the market, this town and its related facilities focus on versatility of business interests and uses ICT to broker new contractual partnerships between different companies and employees. A cellular organisation of services and employment has been encouraged by decentralisation and more pervasive company distribution. Homeworking and flexi-working are prevalent styles of employment.

Intensity Value
High intensity of uses layered around a regional transport hub results in a town that acts as an economic satellite to the city. Mixed, interdependent and complementary uses of activity are dispersed across the site and the companies encourage a work-integrated ethos. Small-scale, distributed workplaces mingle with residential amenities in high-density clusters. These provide rentable facilities and shared meeting spaces whilst providing for the local community.

Amenity Value
‘Horizontal towers’ allow for a mix of residential use and office space. This is a franchised suburb that uses contractual partnerships with companies and organisations such as colleges and universities to provide facilities for both the workforce and the residents. Money is redirected from formerly centralised high-density areas to this suburb and supplements the provision of necessary amenities that public or government services might otherwise fail to finance.

Autonomy Value
A development process that actively works over time to create new ‘clusters’ allows the town to expand and evolve as dictated by residential or business needs. Increased autonomy is achieved by the private-public partnerships of services, including local leisure and health services, public space and city academies. These partnerships are encouraged by company taxes, subsidies and franchises. Company investment into public services is promoted as good corporate social responsibility and attracts some of the best workers to this location.

Frequency Value
Knowledge-based enterprises are often found in ‘clusters’ where companies within the same industry or evolving industries are located close together. This has generated competition and co-operation that is mutually beneficial through the sharing of knowledge and other interdependencies. This dynamic has provided added value to public spaces such as knowledge trading squares and information high streets for facilitating localised exchange and the movement of information.
SCENARIO D
OPEN-SOURCE CITY
Density Metric
Internet enabled user consultation

User Workstyle
Has a dominant life focus — user-led and estate-managed development with a focus on long-term needs.

Common User Profiles
Reclaimer — Gives more focus to their life than their work and actively tries to reclaim social space.
Networker — A portfolio worker with a virtual and transient existence that provides them freedom of movement to create variety and continuous shifts of life and work patterns.

Urbanscape & Building Typology
An organically developed site under estate management that is highly networked. A high density site with a mixture of high and low-rise development and good local access to transport. This internet enabled networking structure has been secured by enticing early adopters of technology to the area, offering them financial incentives to move to Ebbsfleet. Their technological expertise has helped the site develop. Social networking software is used to identify prospective community needs facilitating organic growth of the development around users’ requirements. Open source products and new features of a knowledge economy, such as ‘Wikinomics’ and ‘crowdsourcing’ have demonstrated the benefits of mass cooperative enterprise. Ebbsfleet has taken full advantage of the newfound independence of the employee and highly pervasive employment contracts to exploit a cooperative workforce and a diversity of opportunities.

Intensity Value
Tenants are able to adapt the architecture to their needs. A multitude of activities take place and flexible boundaries blur the lines between the private and the public spaces. Estate management initially provides low rates of rent to encourage small and creative businesses to grow. This follows the example of some managed estates in central London where any losses are easily returned by the higher residential rents that can be demanded due to the improved vibrancy of the area.

Amenity Value
The area develops naturally upon the opening of the transport infrastructure. The estate management arranges the community amenities on a time-share basis with spaces changing hands according to needs and when they are surplus to requirement. This adaptive estate allows for a cooperative evolution that slowly alters the make-up of the services, typologies and sizes of households. With such a mix, conventional boundaries are hard to define and the system is organised by management software.

Autonomy Value
Virtual procurement allows this community to consider a long-term development strategy. All long-term plans for the site are open for discussion. Pixel maps based on Virtual Earth Maps provide the development data. The online community conducts a user survey of prospective tenants thereby approximating and reflecting the market and needs of the community prior to construction. This eliminates some of the risk for developers related to high-density development and enables active user participation and investment in the space around them.

Frequency Value
A network of branching streets and arcades are interconnected, filtering human traffic and flow from multiple access points across the transport node. Lanes have been reduced in size to slow the movement of people and encourage a high level of interaction and social cohesion. Raised walkways provide swift movement when needed. Waves of inhabitants flow through the depths of the site whilst passers-by pick up on networking opportunities through short-term visits. A transient yet instantly familiar community takes no time to become well acquainted with each other.
Entangled with the issues of density and workplace is that of sustainable communities. Developers commonly create new settlements at around 5,000 dwellings or less. This is in part due to the fear that higher densities might become unmanageable or difficult to market. They are perceived to be a greater economic risk. However, such low densities are regarded as insufficient to create a viable local economy. Sustainable communities require a relatively higher density than the national average of 25-30 dwellings per hectare. More long-term vision and managed development can enable organic slow growth that can adapt to economic forces.

In addition to the various drivers of change already outlined (i.e. the nature of the economy, technological advancements, the environment and the promotion of work-life balance or integration), another factor that needs to be taken into account is the significant increases in the population, such as those projected by the Office for National Statistics. These indicate a growing need for dense urban development across London settings.

With the knowledge economy of the 21st century and the demands and complexity of today’s work-life patterns, the architecture of the city needs to act differently. Fundamentally the world of work is changing and the workplace needs to reflect these changes, detecting the drivers of change and responding to trends.

Lifestyles that encourage the separation of work from living are dependent on an adequate transport infrastructure. This driver has given rise to the sprawling growth of suburbs and low residential densities. On the other hand, there are drivers encouraging greater work-life integration, responding to the needs of an ageing workforce and the welfare and care needs of employees with dependants. These will be equally important in the future.
CONCLUSIONS

QUALIFYING AND QUANTIFYING

A complex dynamic exists between a population’s critical mass, its density and the transport accessibility of proposed new developments. This results from the fact that predicting the transport requirements of a new development can be difficult as it relies on fully understanding user behaviour.

The relationship between density and transport is a ‘chicken and egg’ scenario. On the one hand, attempts to encourage dense housing are reliant on transport links that can accommodate growth and supply local people with access to employment opportunities. On the other hand, planners tend only to implement transport improvements once a development has already been established and improvement warranted by existing demand.

The Metricity study set out to view the city as an integrated system and offer a way of thinking about urban density that inspects the product life cycle of this multifaceted output and allows for growth and change. Policy and the delivery frameworks for creating urban density need to go through many levels of interrogation using a variety of measuring tools. The four principles of urban density developed through the research process offer a new metric space for urban density and a way of enabling this – the Metricity Formula. Within this approach there are four quadrants of data, together reflecting a more holistic and rational approach to urban planning.

The Metricity Formula incorporates existing measures so as to determine the value of key characteristics in the appraisal of new development sites. It stresses that these measurements are to be considered in conjunction with input arising from the active user consultation. Furthermore, assigning each factor a weighting system allows for the site-specific conditions of place, permitting trade-offs to be assessed and local user involvement to be balanced against wider city-development needs. This enables the existing one-dimensional metric to be applied within a more realistic and integrated context.

All these features of the Metricity Formula have been brought together to aid the inclusive development of the city around the provision of good transport links and the work-life needs of its citizens. It promotes a dialogue between stakeholders and offers urban planners, developers and architects a rationale and process for acting this.

In light of pressing land use, changing user needs and employment attitudes, the study aims for a visionary approach that is socially sustainable and brings greater freedom and choice to the urban planning process: “...We are concerned that the need for short-term ‘numbers’ is overtaking the need for long-term vision. Many large-scale projects, often in sensitive town and city sites, are being developed in a piecemeal fashion without appropriate investment in the quality of the public realm, appropriate access and the design of individual buildings.” (Rogers, 2005)

METRICITY FORMULA

Application of the Metricity Formula to evaluate the diverse merits of a particular planning process should follow the following four steps:

1. CLARIFY EVALUATION CRITERIA
   Provides a tool for planners to evaluate the suitability of transport development areas according to the four principles, and recognises the individual perspectives that would arise from an application for development (User / Developer / Architect / Planner)

2. APPLY WEIGHTING TO CRITERIA
   The matrix encourages the evaluation of key quantifiable metrics for a specific project. These include dwellings per hectare, plot ratios, floor area ratios, population density, habitable rooms per hectare, transport accessibility, etc. Cross referencing these with the four principles allows one to agree and establish what weighting to apply to each of the metric.

3. CONDUCT ANALYSES CRITERIA
   Enforces the need for adequate public consultation within the planning process and more implementation of design ideas that relate to user input. The analysis of the development would include speculative scenarios to provide a measure of consideration for contingency plans. This overall approach relates to an adaptive set of strategies for development as opposed to definite or optimised plans.

4. SCORE EACH CRITERIA
   On the basis of this criteria a scoring or weighting of each factor would allow a comparative assessment for a particular site. The weighting of criteria may relate to the aspirations of specific users and local concerns as well as looking at a national agenda.


We would like to thank the following people for their help and support during the project: Tessa de Reuck, assistant psychologist of UCL; Jeremy Myerson, Rama Gheerawo, and Margaret Durkan at the Helen Hamlyn Centre. Paul Warner of 3DReid; Michael Lewis of Child Graddon Lewis; Dr Jeremy Watson, Neil Kirkpatrick of Arup; Keith Priest of Fletcher Priest Architects; Dr Ian Selby of British Council for Offices and all at the BCO Urban Affairs Committee; David Cobb, Gemma Moore and Julian Hart of UrbanBuzz; Nick Tennant, Policy officer, planning for housing team Dep. Communities and Local Government; Dr John Smith of JSA; Atsue Takeoka, User Science Institute at Kyushu University in Japan. Martin Sagar, Director, and Charles Scott of Sheppard Robson Architects; Prof. Nigel Coates of the RCA; James King and Alex Jarvis (for a creative communication and illustration workshop); Cian Plumbe of Studiohead (for endless discussions); Gerrard O’Carrol and Fiona Raby.

The following people kindly lent their expertise and experience to the project: In Tokyo: Tanabe-san, Sakamoto-san, Mase-san, Pechu Kucha and KDA Architecture. In London: Chris Mitchell at the RCA; Briony Greenhill and members at the Hub, Angel; Sandra King of BT; Dr Alister Wilson of Waverley Consultants; Brian Brader of Foresight; Mike Althorpe of RIBA Building Futures; Steve Kennard at Land Securities; Adam Marshall at Centre for Cities, Institute for Public Policy Research.