OUT OF THIN AIR

One Year On
In November 2017, WSP made a simple but radical suggestion. With land in short supply within Greater London, why not alleviate the capital’s housing crisis by building over its rail and tube lines?

Our study, Out of Thin Air, analysed London’s rail infrastructure and concluded that development of the capital’s most viable ‘overbuild’ sites could potentially provide the city with more than 250,000 new homes – or several years’ housing supply.

But where are these sites? Our latest study aims to answer that question. By refining and extending the site identification methodology we put forward in Out of Thin Air, we were able to revise upwards the total set of possible overbuild locations, identifying more land for possible development. We then pinpointed the portions of track and neighbouring land where development is most suitable, based on certain criteria.

By applying this set of ten criteria, our research narrows down the entire set of possible overbuild locations to a core group of opportunity sites. Applying the new methodology to London indicates that more than 280,000 new homes are possible at rail overbuild sites. Almost two-thirds of these are at locations that our analysis shows are either highly or most suitable for development.

There are further considerations – technical, local, planning-related and so on – that might preclude any of these sites from moving further down the development road. However, this latest research takes us a significant step closer to finding valuable space for the new homes London so badly needs.

In doing so, this research also offers a multi-criteria analysis method capable of identifying rail overbuild opportunities - not just in London, but in any dense, space-constrained city, anywhere in the world.

Bill Price,
Director, Strategic Growth
Out of Thin Air was warmly welcomed by construction and property professionals. However, the first question on many of their lips was, where exactly could these new homes be built – which were the overbuild sites most suited to development? We immediately set about the task of developing and refining the methodology behind Out of Thin Air so that we could narrow down, geographically, London’s entire stock of possible overbuild locations to a core set of the most viable sites.

In collaboration with UCL’s Department of Civil, Environmental and Geomatic Engineering, we used geographic information system (GIS) data and multi-criteria decision analysis (MCDA), applied across London’s exposed rail and tube network, to determine those overbuild sites best suited to development.

Housing is London’s biggest crisis. In the autumn of 2017, London’s mayor Sadiq Khan suggested the rate of new residential construction in the capital needed to rise to 66,000 homes a year to eventually meet demand. But the rate of new-build housing is heading in the opposite direction, slowed by rising stamp duty, construction costs and worries such as the prospect of Brexit.

According to the National House-Building Council, builders had just 2,917 new homes planned for construction in the three months to June 2018, the lowest total for that quarter since the depths of the financial crisis in 2009.

The brakes are on, when what London really needs is an injection of imagination and radicalism that can ignite a house building surge.

Out of Thin Air, our 2017 report on the hidden potential of rail overbuild, sought to provide that spark of invention by putting the case forward for a new generation of residential construction over new and existing rail tracks and stations. The report highlighted the societal and environmental benefits that could flow from this shift in perspective.

Out of Thin Air analysed the land occupied by London’s surface-level rail infrastructure for sites that could technically be ‘boxed in’ with a concrete deck, with residential schemes built above.

A conservative estimate put the number of new homes of a typical size (100sqm) that could be developed in this way at around 250,000 – potentially a huge step towards alleviating London’s housing crisis.

The need for new solutions

The benefits of rail overbuilds are many and varied. They

- Require no new land or major demolition
- Offer residents greater mobility, placing them close to rail and/or tube stations
- Promote the ridership of public transport and cut car use, helping to reduce emissions and improve air quality
- Can better ‘knit’ stations and infrastructure into the surrounding urban fabric, improving the public realm and creating safer, more pedestrian-friendly environments
- Offer a sustainable solution to urban development
A new methodology

For Out of Thin Air, the methodology only went as far as identifying those stretches of the rail and tube network in London where overbuild might be technically possible. In essence this meant locations where the track was exposed (not underground, in a tunnel or at a station), and where there was 10m available on both sides of the track.

The analysis identified 1,142km of track across London’s 33 boroughs. To convert the exposed land into areas with overbuild development potential, we made three assumptions: that the average apartment would have a total floor area of 100sqm; that the typical apartment building would have an 12 storeys; and that 90% of our identified land area would be unsuitable or uneconomic to develop, for one reason or another.

Our latest study aimed to replace this final assumption with real data. First, we applied a set of constraints: appropriate sites should be within a 20-minute walk of a station and over areas of exposed track at least 50m in length.

We were able to hone our analysis of the land adjacent to rail tracks, and in doing so uncovered 14% more land with potential for overbuild than we had reckoned in our first study – indicating a significantly greater area of land available for new homes than previously thought.

Constraints*

Exposed railway

Minimum track length

Proximity to station

Minimum area of ‘home’

Criteria*

Environmental

Economic

SSSI

Population density

Listed buildings

Opportunity areas

Protected vistas

PTAL

Building height

House price

Car ownership

Sports facilities

Using GIS, we then analysed this new, more accurate picture of available rail land to identify those locations best suited for development. We devised a set of socio-economic and socio-environmental criteria to mirror the factors that play a part in real-life decision-making on urban development projects. They included factors such as: the proximity of sites to listed buildings, protected vistas of London landmarks, Sites of Special Scientific Interest (SSSIs), local Opportunity Areas and sports and fitness facilities; local property prices and car ownership; as well as population density and accessibility to public transport.

Data for all of the criteria was mapped across Greater London to produce ten separate “suitability map layers”, which were each given a weighting according to their importance. We then combined the individual weighted layers into a single combined layer, which categorised the entire Greater London area by its suitability for development, from least suitable and low suitability to high suitability and most suitable. When we placed this over the map of the capital’s surface railways, we had a complete, colour-coded picture of London’s developable rail land, from least suitable to most suitable.

Finally, we examined these developable areas to generate totals, by London borough, for the area of land available in the four suitability categories. With this data, and our assumptions regarding home sizes (100sqm), building heights (12 storeys) and levels of public space and mixed-use accommodation, we were able to reach estimates of the number of homes in each category.

*See page 19 for glossary of terms
Our analysis revealed that, across Greater London, there are a total of 2,470 hectares (ha) of land where overbuilding is possible. Almost two-thirds of this land (1,617 ha) has the capacity to create close to 180,000 homes in highly suitable or most suitable areas for development.

Brent (187 ha), Ealing (166 ha) and Croydon (142 ha) are the boroughs with the greatest area of suitable rail land across all four categories, some way ahead of Bromley, Lewisham and Barnet. Although large outer London boroughs dominate the breakdown of developable rail land, Wandsworth, Newham and Hammersmith & Fulham also rank highly.

Translating the developable areas into numbers of homes, our study estimated that a total of 282,000 new homes could be possible if all rail overbuild opportunities across Greater London were developed.

In Brent, there are opportunities to create almost 22,500 new homes by building over railways, in Ealing almost 20,000, and in Croydon 17,000. Other boroughs contain a higher level of rail land that is highly suitable and most suitable for development. In Lewisham, almost 11,000 homes are possible on highly suitable and most suitable land; in Newham the figure is almost 10,500; in Barnet it is almost 10,000; and in Hammersmith & Fulham there are almost 9,000 new homes possible on highly suitable rail land. Enfield and Barking & Dagenham also possess high percentages.

The opportunities that rail overbuild offers for development, and for solving the supply of new homes for Londoners, are remarkable. But what do these opportunities look like in reality, on the ground?

### Estimated rail land by borough

<table>
<thead>
<tr>
<th>Borough</th>
<th>Hectares</th>
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<tr>
<td>Brent</td>
<td>187</td>
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<tr>
<td>Ealing</td>
<td>166</td>
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<tr>
<td>Croydon</td>
<td>142</td>
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<td>Bromley</td>
<td>116</td>
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<td>Lewisham</td>
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<tr>
<td>Barnet</td>
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<tr>
<td>Barking &amp; Dagenham</td>
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<tr>
<td>Hillingdon</td>
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<tr>
<td>Wandsworth</td>
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<tr>
<td>Newham</td>
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<tr>
<td>Enfield</td>
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<td>Haringey</td>
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<td>Hammersmith &amp; Fulham</td>
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<td>Havering</td>
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<td>Merton</td>
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<td>Waltham Forest</td>
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<td>Camden</td>
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<td>Lambeth</td>
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<td>Harrow</td>
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<td>Redbridge</td>
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<td>Southwark</td>
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<td>Hounslow</td>
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<td>Richmond upon Thames</td>
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<td>Bexley</td>
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<td>Tower Hamlets</td>
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<td>Kingston upon Thames</td>
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<td>Sutton</td>
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<td>Islington</td>
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<td>Hackney</td>
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<td>Kensington &amp; Chelsea</td>
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<tr>
<td>Westminster</td>
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<tr>
<td>City of London</td>
<td>1</td>
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</tbody>
</table>

### Overbuild potential per HexCell

- **Up to 300 homes**
- **300 to 600 homes**
- **600 to 1,200 homes**
- **1,200 to 2,000 homes**
- **Greater than 2,000 homes**
- **0 homes**
This site lies south of Clapham Junction in south-west London, between John Archer Way and the A214 (Trinity Road). Trains using the line form commuter links into Surrey as well as longer distance services to Basingstoke, Portsmouth, Southampton and beyond.

The rail corridor here comprises a group of four Network Rail lines in a cutting around 6m deep, 220m long and with an overall width of about 60m. The cutting slopes are vegetated with no significant rail infrastructure other than the usual signals, communications, drainage and power supplies to the third rail.

There's a strong potential for development here. The cutting depth means that a new ‘ground level’ can be provided roughly in line with surrounding roads and bridges. There is also an existing block of apartments to the east, roughly 11 storeys high, thereby potentially inviting modest height on the adjacent rail site. Finally, the site is in travel Zone 3 and well within a 15-minute walk of three stations.

The decking solution here would comprise pre-cast concrete beams spanning around 18m supported on concrete walls. The cutting is wide enough for the heavy residential part of the overbuild to sit over the cutting slopes, with the span over the railway carrying more modest loads from landscaping and public realm spaces.

In terms of homes, **development of half of the site area to 15 storeys would generate 540 homes.** Using modular, prefabricated homes would help in terms of logistics and construction, and also reduce loading on the beams and foundations. These homes would be isolated from vibration and noise.

It’s worth noting that there are additional lengths of rail corridor available both to the north and south of this location.
Gipsy Hill, Opportunity 2:

Gipsy Hill is a station on the Southern Rail network, north of Crystal Palace and south of West Norwood. The station serves trains to Victoria and London Bridge and does not presently offer step-free access.

To the south-east of the station is a gently curving cutting approximately 4m deep, 30m wide and 260m long, without any significant rail infrastructure. Two blocks of seven-storey apartments and a petrol station lie immediately to the west.

The decking solution here would involve concrete walls with in-situ or precast concrete beams spanning around 11m over the twin track. To accommodate the curvature of the cutting, the deck could be constructed in a series of facets with triangular ‘fillets’ at 20m intervals. As the cutting is relatively narrow, new buildings would be built over the track to respect adjacent views and rights to light.

Building to eight storeys over half the total area would generate 310 new homes. Again, a modular approach to construction would help in reducing loads on both the foundations and the deck slabs.

There’s a further opportunity here, which would involve integrating the development with the road and bridge at Gipsy Hill, allowing retail and other uses.

North Acton, Opportunity 3:

North Acton Station is in Zone 2/3 on the Central Line. The station currently lacks step-free access. This area is seeing significant densification and development, as it forms the edge of the Old Oak Common Depot with its associated future HS2, Overground, Crossrail, and West London Orbital stations.

Two separate areas in this vicinity are of interest. The first area is immediately to the north-east of North Acton Station, across the adjacent additional single track for the Great Western-Great Central Joint Railway. It is a substantial cutting slope, approximately 30m wide by 230m long, of undeveloped land.

Moving southeast along the Central Line, across the Victoria Road bridge, the second area of interest encompasses both the twin tracks of the Central Line and the single track for the Great Western-Great Central Joint Railway, both of which are flanked by substantial open cutting slopes and a generous median between the lines. This area is approximately 60m wide on average, by 200m long. These sites could be accessed from adjacent industrial parks on either side of the railway lines.

The North Acton Station area already has substantial height precedent, with adjacent development of upwards of 20 storeys under way in the area, likely due to its proximity to a future major transport hub at Old Oak Common. Substantially-sized business and industrial centres also surround the area.

The track alignments in question are mostly straight, though the railway land which encompasses the cutting slopes varies in width at the site boundaries. There appears to be no significant rail infrastructure or obstruction in the vicinity, save for the Victoria Road bridge which divides the two sites; this bridge could form a useful connection and road frontage for future businesses in the over-site developments.

The solution in North Acton would comprise precast concrete beams spanning over the track with concrete walls. Again, due to a relatively narrow cutting, the aim would be to respect adjacent views with new buildings over the track. On both sites a modular approach to construction would help reduce foundation loads and loads on the deck slabs. Adopting an average of 12 storey buildings over 50% of the total area would generate 1,100 homes.
The methodology developed by WSP to gauge overbuild development potential has revealed in stark reality the opportunities within London’s grasp to provide much-needed new homes in prime locations close to rail and tube stations.

But our methodology doesn’t just apply to London or to UK cities - it can be applied to any major city with significant surface rail infrastructure, anywhere in the world.

Just a cursory analysis of available rail land in major cities reveals the opportunities in sample cities across the globe.

Applying an informed estimate of 1,200 homes per hectare of rail land indicates that Melbourne could create around 77,000 new overbuild homes within 10km of its centre; Vancouver could build 46,000 new homes; and in Copenhagen the potential is almost 42,000.

### International opportunities

<table>
<thead>
<tr>
<th>10km radius</th>
<th>Brisbane</th>
<th>Copenhagen</th>
<th>Melbourne</th>
<th>Sydney</th>
<th>Toronto</th>
<th>Wellington</th>
<th>Vancouver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail land (ha)</td>
<td>28.8</td>
<td>35</td>
<td>64.5</td>
<td>24</td>
<td>23</td>
<td>8.8</td>
<td>38</td>
</tr>
<tr>
<td>Number of homes</td>
<td>34,560</td>
<td>41,760</td>
<td>77,400</td>
<td>29,160</td>
<td>27,506</td>
<td>10,560</td>
<td>46,033</td>
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</tbody>
</table>
With rail overbuild, we’re on a journey. Many assumptions, caveats, ifs and buts apply to the analysis contained within our latest methodology. In looking at the potential across such a large, dense and varied urban landscape as London, it’s impossible to factor in many of the local constraints that have a bearing on development.

What our latest research shows beyond doubt is that tremendous potential does exist. By putting numbers of new homes in places with specific locations on the rail network, it makes extensive large-scale overbuild development more tangible.

At present, London is failing to make the most of the opportunities waiting in the spaces above its railways – not simply to put roofs over Londoners’ heads but to provide homes in well-connected locations, close to existing stations, shops and amenities, not in far-flung suburbs where cars are a must.

London’s housing problem isn’t going away – without radical solutions, it is only going to worsen. Working together, as construction and planning professionals, developers and local politicians, we can make London a world-leader in rail overbuild.

This research brings us a step closer to realising that extraordinary potential.
Thank you to those who contributed to the thinking in this report:

Philippa Wood – WSP
Jack Philpott – UCL

*Socio-environmental and socio-economic criteria*

**Listed Buildings**
Listed Buildings refers to an object or structure that contains architectural and/or historic interest

**Population Density**
The spatial distribution of the population indicates how many people may be affected by overbuild development

**LVMF Protected Vistas**
London View Management Framework - the preservation of views from specific places of interest

**Sports and Fitness Facilities**
A measure of the local community. Greater proximity to a facility is deemed more desirable for potential occupants due to social inclusion

**Sites of Special Scientific Interest**
It is preferable that proposed developments are further away from an SSSI

**Ordnance Survey Building Heights**
A measure of the height to which overground infrastructure may be developed

**House Price**
A measure of the local cost of homes in the area

**PTAL**
Public transport accessibility levels – indicates the accessibility of an area to transport, social inclusion

**Car Ownership**
A percentage measure of how many households possess 2+ cars. A greater percentage is preferable as the overground project aims to positively influence the environmental issues by reducing car emissions

*Constraints*

**Exposed Railway**
The track cannot be in a tunnel, under a bridge or inside a station

**Proximity to station**
An appropriate site must be within 1.6km of a station adhering to Transport for London’s 20-minute walk

**Minimum track length**
Minimum of 50m in length considered appropriate by WSP

**Minimum area of a ‘home’**
Minimum of 100sqm per ‘home’ has been adopted by WSP
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