SiteSolve.
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A case study:

Leveraging technology to inform development decisions and deliver walkable neighbourhoods

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Executive Summary

Local authorities, developers and local communities are facing a range of challenges in our towns, cities and rural neighbourhoods. Improving public health, creating quality housing for all, leveraging disused land, and reducing the inequality gap, all whilst delivering on our climate objectives. The walkable neighbourhood concept (also known as the 15 minute city or 20 minute neighbourhood) can support all these priorities by taking a holistic view of the way we plan our places. This concept sees places designed so that residents can meet their day-to-day needs within a reasonable walk from their home. Although the concept is simple, knowing what actions to take to deliver it can be challenging and complex.

In this study we brought together mapping data with emerging generative design, optimisation and visualisation technology in order to identify the actions a local authority can take to deliver a walkable neighbourhood. This study considered 514 sites identified through the Strategic Housing Land Availability Assessment in North East London, and concluded:

- 24 of the sites had no access to any of the amenities defined in this study as forming a walkable neighbourhood. Where these sites were clustered, this identified as most in need for significant area investment to improve facilities for the existing and future communities.
- Through our automated site viability appraisal, based on real engineering and architectural rulesets, 8 sites were identified as impractical for residential development, and 287 were not considered to be currently cost viable. This automated approach saves wasted time and effort around considering these sites individually, and where these unviable sites were clustered, it identifies the need for area wide investment to improve facilities and desirability of these areas.
- Of the currently viable sites, 78 were already located in a walkable neighbourhood, highlighting these sites as quick wins to build much needed houses. However 86 sites were missing only one amenity, often clustered in a particular areas, identifying the areas were investment in amenities could unlock significant surrounding development to maximise return on investment for the community.
- This automated approach allows for multiple scenarios to be evaluated to support the decision making around longer term strategies or policy decisions. In this study we explore how the projected build cost and housing value increase in 3 years would affect these numbers. In this scenario the number of cost viable sites increased from 227 to 274, increasing the potential number of new housing units that could be built by approximately 5000. Further sensitivity studies could be undertaken in the future to understand the impact of market variance, surrounding investment and policy decisions.

With these conclusions, specific actions can be identified in order to maximise the number of people living in a walkable neighbourhood, with real data to justify those actions to stakeholders, development partners and the community. By leveraging emerging technology, this pioneering approach gives evidence-based decisions in rapid time, giving local authorities and public bodies confidence to take the necessary steps to deliver for their communities.

Introduction

Local authorities, developers and local communities are facing a range of challenges in our towns, cities and rural neighbourhoods: how do we create more housing to meet the needs of our communities? How can we meet our climate change objectives? How can we improve the public health of our communities? How can we leverage our disused land stock for the good of the community?

Each of these focus areas are difficult on their own - when considering all these together it can be incredibly challenging to know if you are making the right decisions. These priorities can compete: the sites which are most desirable for development are in well established areas, so how do I attract developers to the areas most in need of improvement? How do I know which areas to focus on? If I invest in facilities to improve public health in one area, how do I know we can get a return on investment for our community? How do I ensure my decisions don't just improve the affluent areas at the detriment of the more deprived?

The walkable neighbourhood concept (also known as the 15 minute city or 20 minute neighbourhood) can help address all these challenges, by promoting local neighbourhoods to improve access to facilities, including amenities and green space, reduce road traffic by creating easy access to public transport and improve desirability and investment.

But implementing this principle needs a methodical data led approach, so there can be confidence in the decisions being made, and stakeholders and communities can be sure their needs are being met. Technology can help with this.

Existing technologies can be brought together to support the decision making process for local authorities to balance these opportunities and prioritise the biggest wins. In this case study we demonstrate how this can be done.

Methodology

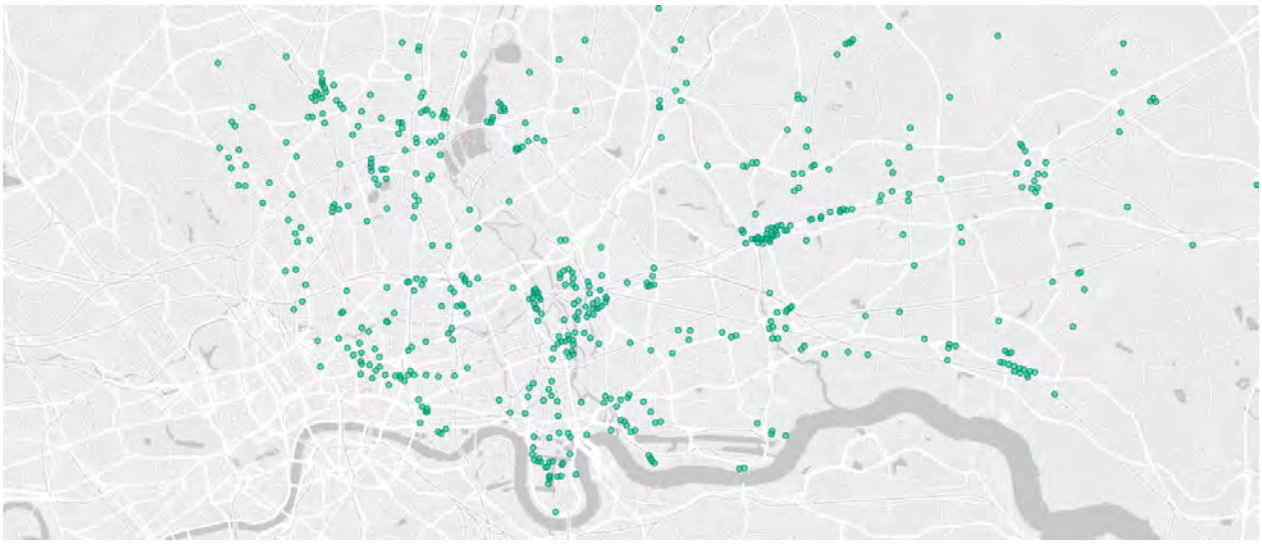


Figure 1: 514 sites in North London identified as having housing development potential

This case study focusses on an area in North East London, where 514 sites have been identified as having potential for housing through the Strategic Housing Land Availability Assessment (SHLAA). This study aims to rapidly answer the following questions:

- **Which parcels of land are currently financially viable for housing development?**
- **Which parcels of land are already connected into the priority amenities that make up a walkable neighbourhood identified for this study, and hence provide the most immediate opportunity to build housing which supports the concept?**
- **Which parcels of land have access to outdoor green space, and therefore provide the local community the opportunity to enjoy fresh air and outdoor spaces.**
- **Which areas require investment in development of particular facilities or infrastructure, and how many new homes could be brought forward off the back of that investment?**
- **Which areas require the largest investment to improve the local facilities for the community, and desirability of the area for private investors?**

Three pieces of technology were brought together for this study, in the following way:

Step 1:

Leverage available mapping data to understand available facilities.

GIS mapping data was leveraged in order to identify facilities across the region being considered, and the proximity of facilities to potential opportunity sites was extracted. This case study is based on data available from OpenStreetMap.

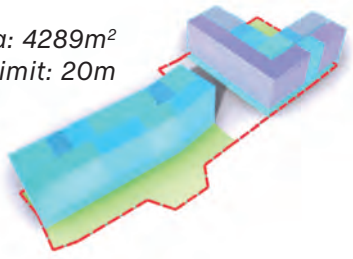
Figure 2: GIS map of amenities

Step 2:

Leverage generative design tools to understand true development potential.

Our algorithmic design optimisation tool, SiteSolve, was used to optimise the layout of buildings on each opportunity site to find the layout with the largest return on investment. This tool leverages real architectural and engineering principles, giving confidence that the solutions created are both efficient and buildable, considering the true geometry of the site.

Site area: 4289m²
Height Limit: 20m
110 units



Site area: 4416m²
Height Limit: 20m
50 units

Figure 3: unit difference due to geometry

The tool was run across all 514 sites simultaneously through an automated process taking a number of hours. The tool iterates through 1000s of options every second, with every option generated meeting key architectural and engineering rulesets, and identifies the best solutions to maximise return. This gives a true and realistic picture of development potential, and the best chance of unlocking land for viable development.

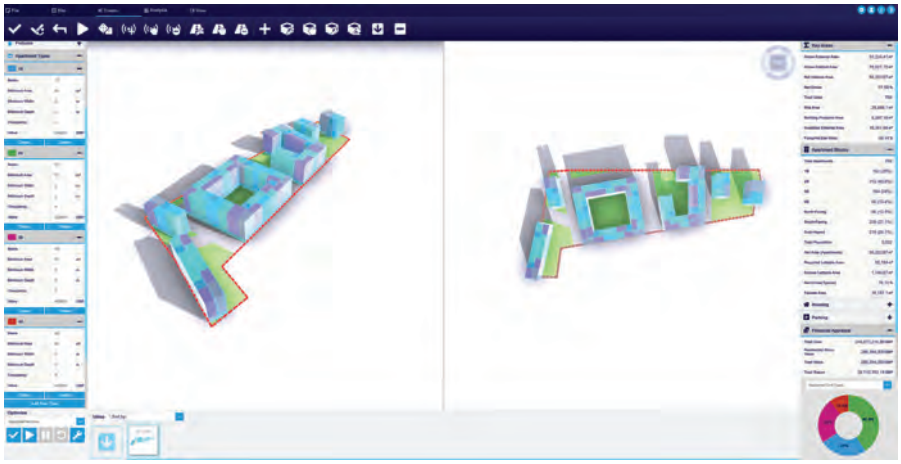


Figure 4: SiteSolve interface

Step 3:

Use computational power to run multiple scenarios.

Once this workflow is established, we can rerun in minimal time to consider a variety of different scenarios. These scenarios could consider the impact of different policy decisions, economic growth, or a particular investment. For every scenario considered, SiteSolve will run 1000s of iterations to find you the optimum solution in every scenario.

Three scenarios have been considered in this study:

Scenario 1: Viability of sites at current build costs and sales values.

Scenario 2: Viability of sites in 3 years' time, assuming increases in build costs and sales values.

Control Case: Maximising the number of apartments on a site.

Step 4:

Interrogate the combined datasets in an interactive dashboard.

Interactive dashboards are then created outlining the resulting data, allowing interrogation into the results to inform decisions being made.

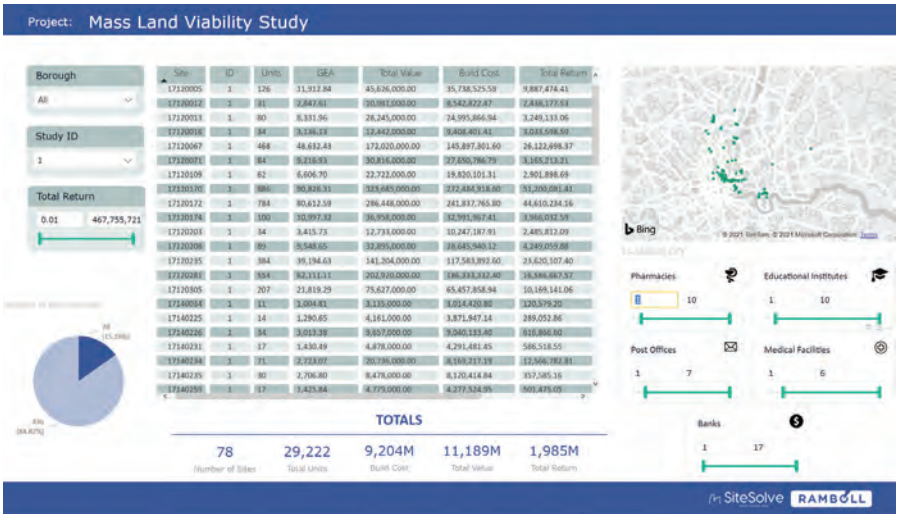


Figure 5: dashboard used to interrogate the data

The following table outlines key assumptions made in this study:

Allowable building height	Height not to exceed the 95th percentile of all building heights within 500m radius of the site, based on building height data available from Emu Analytics [5].
Definition of a walkable neighbourhood	A radius of 800m from the site boundary is considered to be a walkable distance for all. This distance was used in Ramboll's 20-minute neighbourhood study for the Scottish Government [1], from the Scottish Government definition and widely accepted worldwide. 
Local amenities considered	Based on data available on OpenStreetMap [3], the following key amenities are considered to make up a walkable neighbourhood for the purposes of this study; Education (including nursery, school or college) Medical facilities (including health centre, hospital, doctors, or healthcare and health definitions) Pharmacy Post office Bank *A more comprehensive assessment could consider many more factors, for a full definition please see Ramboll's research report* [1].
Apartment definition	Based on GLA minimum apartment sizes from the London Plan (50m², 70m², 86m², 90m²). Target mix of 25% ,40% ,25% ,10% assumed in all locations.
Apartment values	Local authority housing statistics used for 2019-2020 sales, broken down by borough [8].
Apartment values growth	15% increase assumed over 3 years, based on land registry data [9].
Build cost	Current build cost assumed at £3000/sqm from Riders Digest 2019 [6].
Build cost growth	8% increase base off CostModelling construction building cost indices over 3 years [7].

Results

This section outlines the conclusions which have been drawn from the assessments made.

24 (5%)

of the development sites have access to none of the listed amenities

Of these 24 sites, 22 were not considered commercially viable in the scenarios run in this study. These sites highlight the lack of facilities in these areas. Could these sites be reconsidered from SHLAA sites, and instead be used to build a set of local facilities for the benefit of the existing community?

Where these sites are clustered, this indicates an area where broader investment could have significant benefit. There is the potential that using one of these sites for new facilities, or including delivery of local facilities as part of any planning decision, could benefit viability of the adjacent sites, unlocking new housing and improving the community as a whole.

8 (1.5%)

sites were considered impractical for residential development

When attempting to maximise the number of units on a site, it became clear that 8 sites were not suitable for development into apartment blocks. In this case study, this was predominantly because the prevailing height limit in the areas adjacent to these sites was very low, meaning there was no precedent to build a viable height. These were therefore excluded from the study.

There are a number of other reasons why the technology could eliminate impractical sites, including sites of complex or unusual geometry, sites with limited or no access, or sites with a ‘red flag’ constraint.

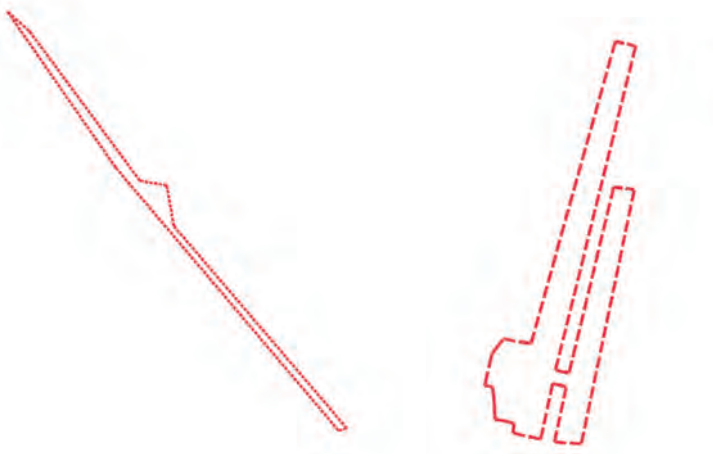


Figure 6: examples of sites with unusual geometry

227 (44%)

of the sites identified are considered to be currently cost viable

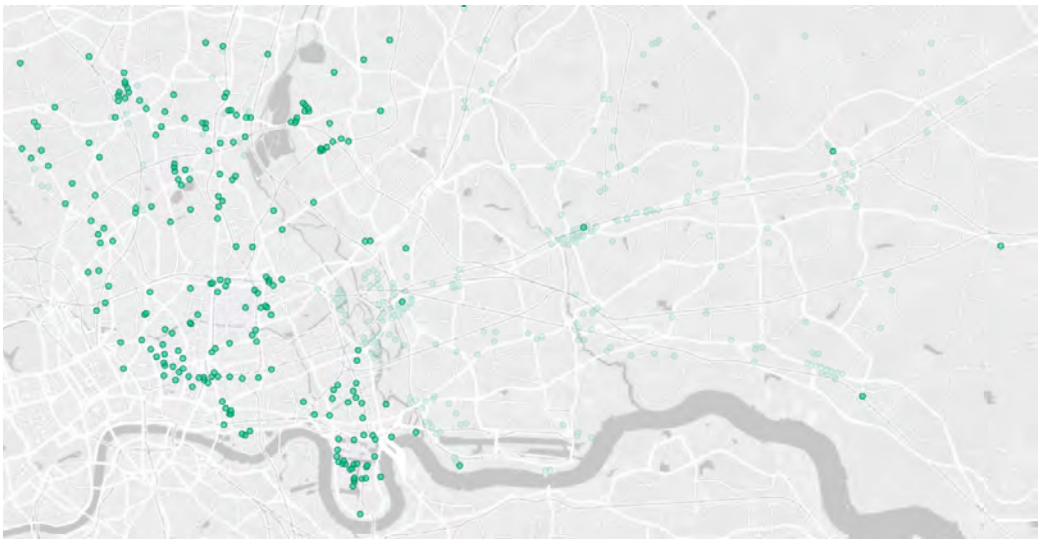


Figure 7: sites identified as currently cost viable

When optimising to maximise return on investment, the current day scenario (scenario 1) indicated that only 227(44%) of the sites were currently cost viable. These sites had the potential to deliver a combined total of around 60,800 homes. This assessment allows for the identification of the most viable sites now to be prioritised in order to deliver on the immediate housing need.

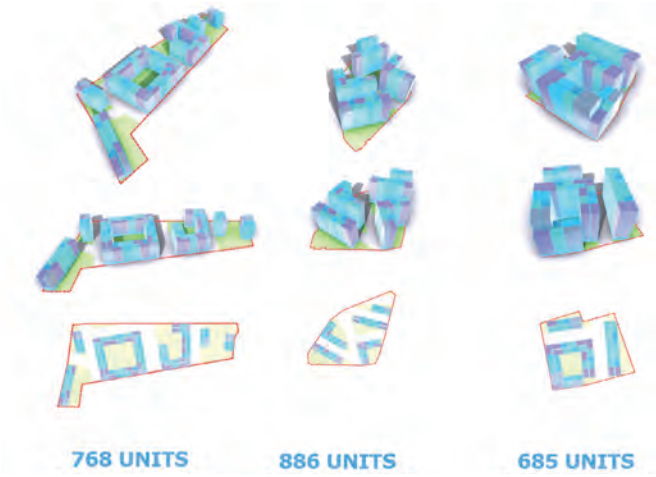


Figure 8: example of viable site ideas created by SiteSolve

This also allows interrogation into the areas where sites are not currently anticipated to be cost viable, indicating that investment in these areas to improve infrastructure or local facilities could drive an increase in values, allowing new houses to be unlocked whilst improving the surroundings for all local residents.

Notably, in some cases this optimisation indicated that building less than the maximum number of potential homes could lead to a cost viable solution. For this study the reason was typically that a 'tipping point' in design was identified i.e. after a particular height, a step-change in floor area allocation is required for fire and servicing requirements, and hence it can be more cost effective to build just below this height limit. The SiteSolve tool allows you to find the sweet spot where the additional apartments created by adding an extra floor would not warrant the less efficient floorplate created over the height of the building.

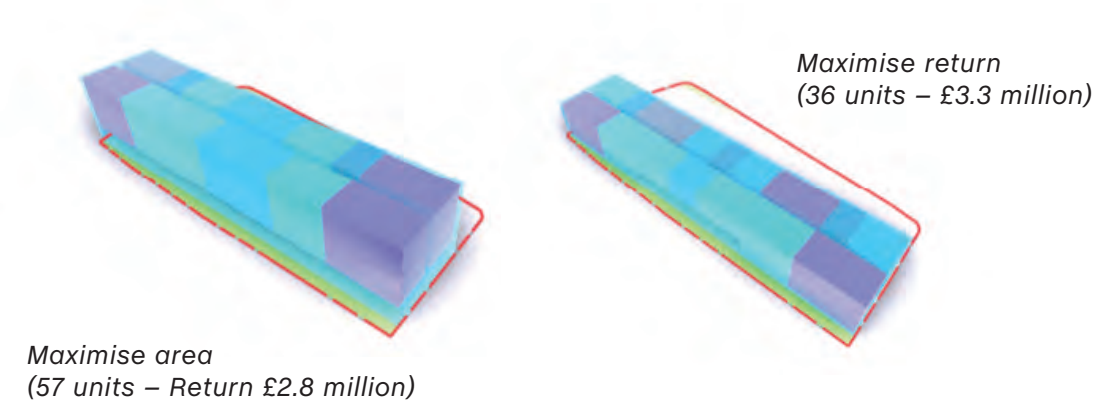


Figure 9: two sites showing building less sometimes results in greater return

Case Study Example

In a study for Transport for London (TfL), SiteSolve was used to look at over 2,000 sites to build a case for land associated with transport infrastructure that could be released for development. In this study, the team had developed a methodology around the abnormalities and their associated costs. This resulted in many sites where, due to the abnormalities (e.g steep topology requiring landscaping, or uplift on façade cost due to proximity to railway), building more led to a negative return, while building less led to a positive one.

Two sites showing building less sometimes results in more return

Of the currently viable sites,

78 (34%)

are already located in a walkable neighbourhood

Bringing forward development on these sites will maximise the benefit from the existing local facilities, whilst bringing forward much needed housing which would currently be considered viable. Hence these development sites could be identified as 'quick win' sites to create much needed housing.

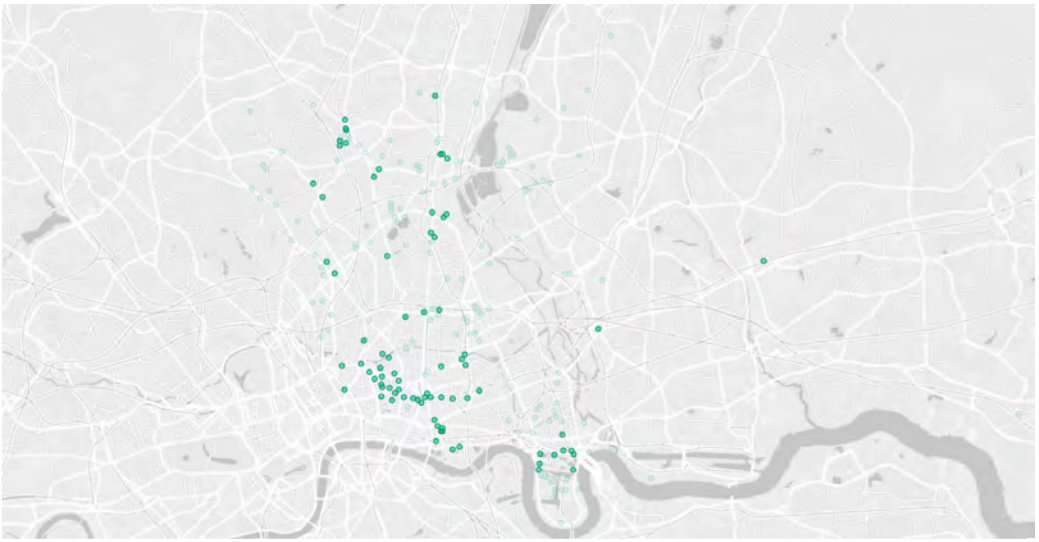


Figure 10: map of sites identified as 'quick wins'.

83 (36%)

of the currently viable development sites are only missing one facility to be located in a walkable neighbourhood

Through the dashboard, it is very easy to drill into the results of this analysis to identify potentially hidden opportunities. For instance, when considering which sites do not have easy access to educational facilities, 4 clusters of sites could be clearly identified. Hence utilising the development sites in these areas to include educational facilities would improve the existing and potential future community access to education. For instance, as shown in the image below, 44 sites do not have easy access to an educational facility within walking distance, but focusing investment in just 4 areas would address this access issue in 29 of these sites;

44
identified sites...
do not have access to an educational institute within 800m.

39
more sites...
could have easy access to all identified amenities if a school could be build in each of the 4 identified clusters.

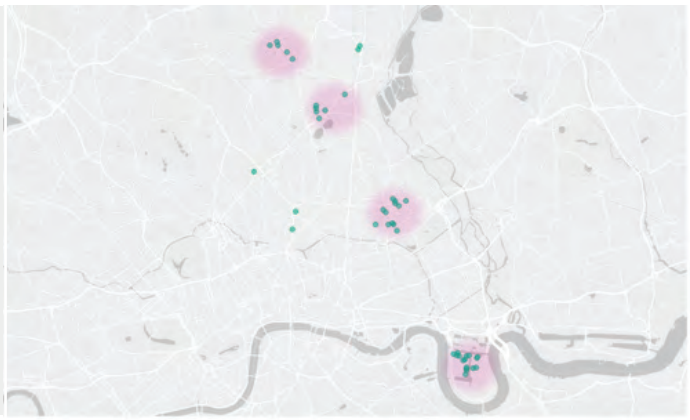


Figure 11: indentified clusters without easy access to educational facilities

Again, 21 sites don't have easy access to medical facilities, but 12 of these sites are located in just 2 clusters.

20
identified sites...
do not have access to an medical facility within 800m.

12
more sites...
could have easy access to all identified amenities if a medical facility could be build in each of the 2 identified clusters.

Figure 12: indentified clusters without easy access to medical facilities

The number of sites considered to be cost viable increase to

274(53%)

in 3 years.

Assuming that not all the sites can be built at the same time, a future scenario (3years) was also run. The same sites were run with increased apartment values and build costs, as outlined in the methodology. It showed that the number of cost viable sites increased from 227 (44%) to 274 (53%), with approximately 5,000 additional units.

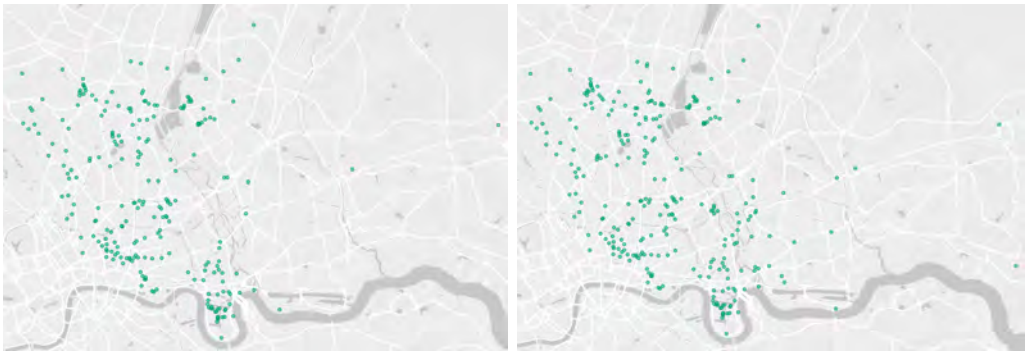


Figure 13: cost viable sites increased from 227 (44%) to 274 (53%) over 3 years

This automated approach, and the speed at which a scenario can be considered, allows multiple scenarios to be considered to understand the risks and opportunities. This can also be undertaken to look at the impact of a particular improvement or investment which could alter house values in an area, such as improved transportation, or introduction of new facilities, to ability of a particular investment to unlock viable housing for the community.

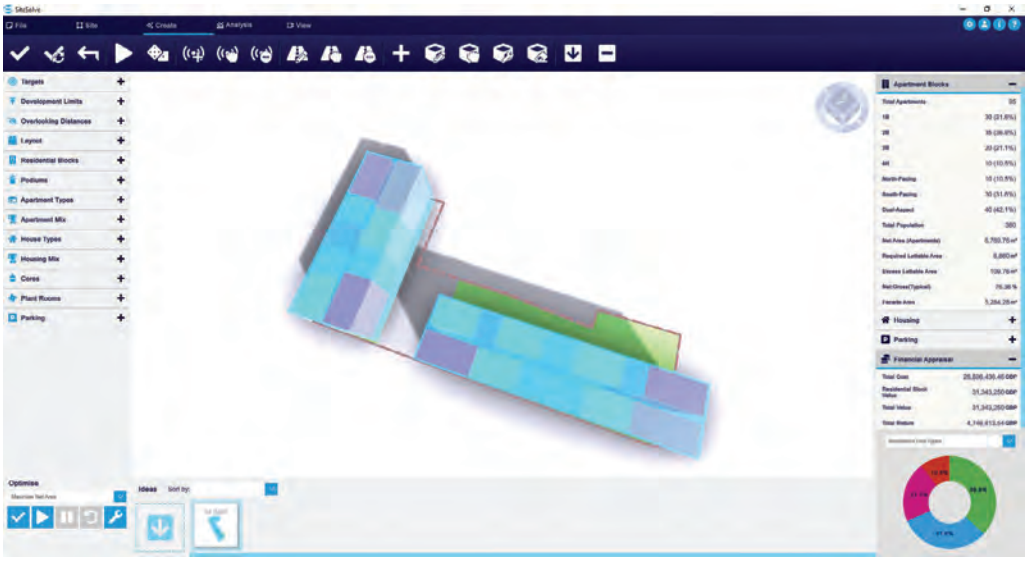


Figure 14: SiteSolve results for site considered cost viable in future case

Green space
identification

This kind of study could also be used to show the proximity of sites to green space. The figure below showcases how parks and public gardens [4] overlay with the 800m radius of each site. The overlay looks promising for the sites, however, further studies could be undertaken to verify the quality and accessibility of each of these.

Figure 15: London's green spaces overlayed on the 800m proximity radius for each site

Conclusion

The data created in this study can be used to help prioritise the sites with the most potential alongside the areas which can benefit most from various investments. It allowed for multiple scenarios to be tested to understand how the portfolio may change over time.

The study identified the sites which have, or are close to having, the priority amenities defined in this study within walking distance, whilst also showing the actions needed to create more walkable neighbourhoods to benefit local communities. The results of the study identify 'quick win' actions to deliver local policy, alongside the areas needing long term investment in order to level up the community across this portfolio. The approach used here can be used to provide the evidence necessary to justify investment decisions in many priority areas including housing, amenities, infrastructure or green space, to name just a few.

This study was based on a set of assumptions and open source data, however, the methodology and scenarios to be tested can be modified for future studies. This can include more information about other amenities, such as quality food shops or markets, connectivity to public transport and leisure facilities as well as greater detail around the abnormalities, and their associated costs, for each site.

All of these conclusions were made through a data led approach, in a matter of days. By bringing together emerging technologies in generative design, optimisation, data processing and visualisation, the actions needed to realise maximum value for the community and deliver on local policy can easily be quickly identified and justified through this innovative data led approach.

Data Sources:

Ramboll's 20 minute neighbourhood study for the Scottish Government
[1] https://uk.ramboll.com/news/ruk/20-minute-neighbourhoods-research-launch

Site Data:
[2] https://data.gov.uk/dataset/d508d0d9-6ebf-4aed-93a0-da173feaf24a/strategic-housing-land-availability-assessment-shlaa-2017-approvals-allocations

Amenity Data – OpenStreetMap
[3] https://www.arcgis.com/home/item.html?id=615a7c56ced84194a4a4c5b7385fa960

Green Space Data – OpenStreetMap
[4] https://www.arcgis.com/home/item.html?id=96df0c14fc984776a965a272f83bba59

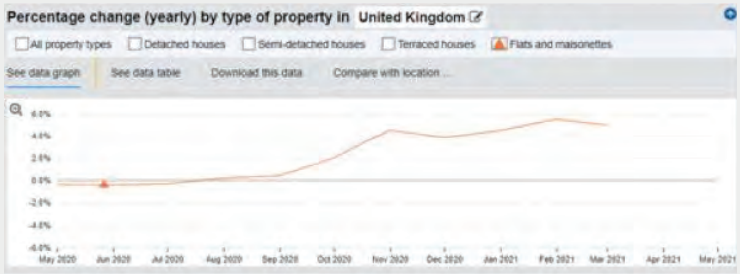
Building Height data
[5] https://www.emu-analytics.com/products/datapacks.php

Build cost:
[6] Riders Digest 2019 – UK Edition
Riders-Digest-2019-UK-Digital-3.pdf

Build cost increase over 3 years
[7] https://costmodelling.com/construction-indices

Apartment Values per Borough
[8] https://www.gov.uk/government/statistical-data-sets/local-authority-housing-statistics-data-returns-for-2019-to-2020

Apartment Value Yearly price increase
[9] https://landregistry.data.gov.uk/app/ukhpi/browse?from=2020-0501&location=http%3A%2F%2Flandregistry.data.gov.uk%2Fid%2Fregion%2Funited-kingdom&to=2021-05-01&lang=en



Apartment Sizes

[10] https://www.london.gov.uk/what-we-do/planning/london-plan/past-versions-and-alterations-london-plan/london-plan-2016/london-plan-chapter-3/policy-35-quality-and

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