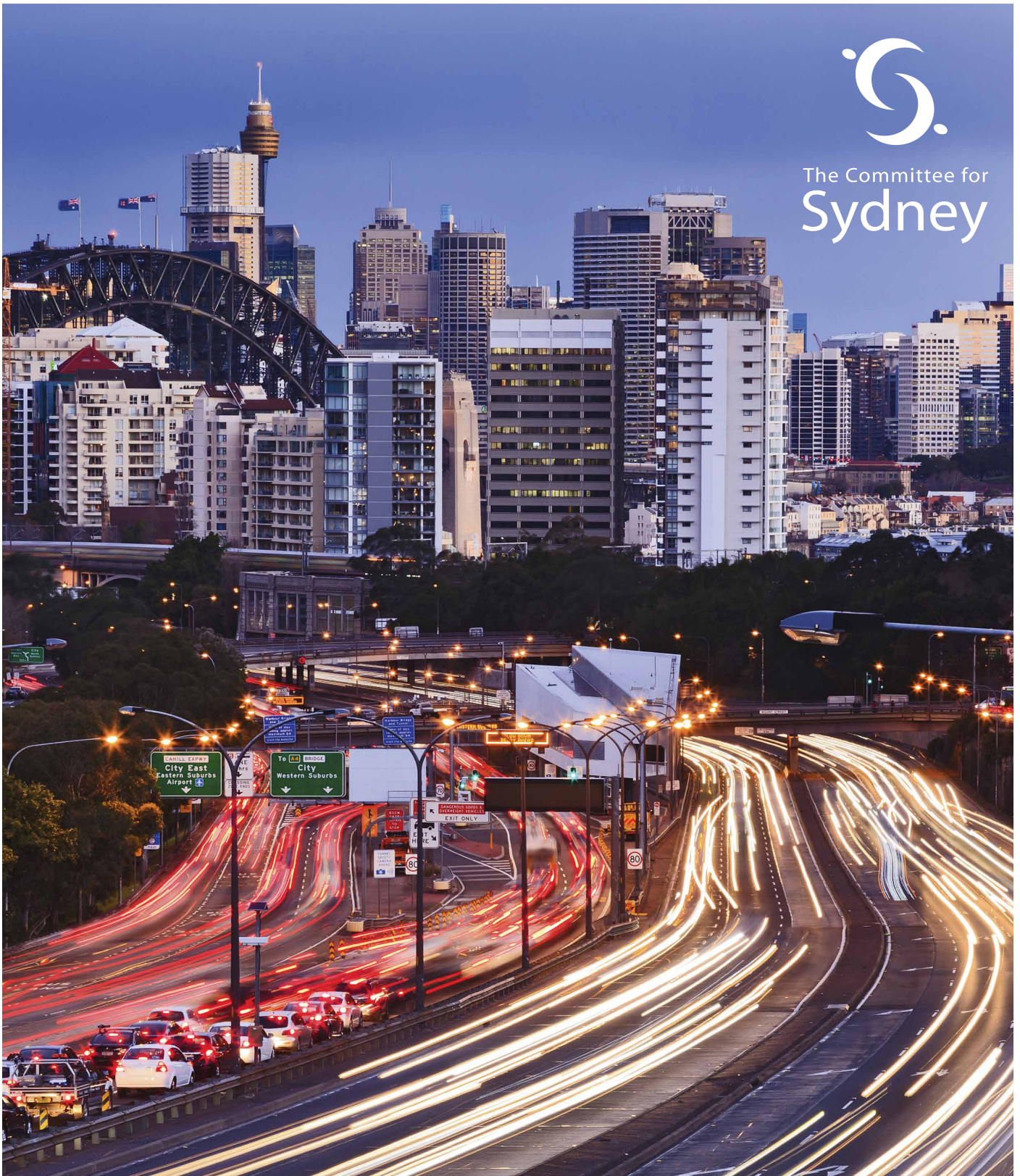The Committee for
Sydney

THE GEOGRAPHY
OF TIME
MAPPING SYDNEY'S EFFECTIVE
JOB AND SERVICE DENSITY

WHY CITIES?

Cities can be noisy, crowded and expensive. So why are so many of us seeking to live in them? Why are more and more people seeking the urban life? Just a few years ago, for the first time in history, more people lived in cities than outside, and by 2050 two in every three people will live in cities. In Australia, major cities are home to two thirds of our people and economy.

For all their challenges, cities offer us better access to things we like or need. They can make us more productive and innovative. In cities, our access to markets and labour is bigger and thicker. We can grow our businesses faster and larger. Get more interesting and better paying jobs. New ideas spread faster in cities. Education and learning is easier, as is access to a diversity of cultural and artistic experiences.

Cities offer us greater opportunities. They give us more options. More choice on where to work, people to see, things to do. We humans are essentially very social animals. We like to see people and be seen. Even the introverts among us find comfort in the crowd.

Cities offer us access to activities and places we like. The services we need are more likely to be available. There is more entertainment and a greater variety of things to do. For these reasons, cities – for all of their problems – are increasingly popular and growing.

pwc

THE ETERNAL CITY OR THE ETERNAL COMMUTE: THE 30-MINUTE CITY OR 60-MINUTE CITY

Cities don't always live up to our aspirations. Too often the promise of greater connectivity and access is thwarted by the city itself. People can be kept from each other by congestion, distance or sprawl. Services we want may be available, but are inaccessible from where we live. Jobs too are usually available, but they are not evenly spread across the metropolis, often meaning a long and slow commute. In too many cases the very reasons we sought a life in the city are being denied us. If it takes us more than an hour to get to hospital, to work, or to pick up the kids then the city is betraying its promise. There is a limit to our tolerance, because there is a limit to our time.

We instinctively, if sometimes unconsciously, know when the city is letting us down. We know when we turn down an interesting job offer because the commute to the new workplace is just too long to be worth taking. We know when one parent has to drop out of the workforce because getting from work makes it impossible to pick up the kids on time. We know when we lose contact with friends and families because they are separated from us by the insurmountable time barriers of the city.

Consciously or not, our tolerance has limits. There is a limit to how much time we will waste commuting. This is known as our "travel time budget". That is how much time we are prepared to spend on accessing the things we want: jobs, services, entertainment, and friends. If any of these things take more than 60 minutes to access then we will think twice about whether they are worth it.

Curiously our "budget" hasn't changed over the centuries. We know that early cities were structured around a maximum walking distance of one hour. When transit like trams and trolley cars were introduced cities expanded further, but never much beyond a one hour maximum. With the advent of the private car our commute sped up and we spread further again. We might be able to travel further and faster now than in medieval times but the maximum amount of time we spend traveling has remained pretty constant – about an hour.

Much beyond an hour and we start to change our habits, our locations and our destinations. We might move closer to a job we like, but only if we can afford to. If we can't, we might quit and take a job closer to home. Sometimes, when the commute becomes too much, we might even leave the city, seeking a better life elsewhere. When this happens, cities start to become less productive. Rather than bringing people together they are driving people away. Rather than living up to the promise of a better life they betray us with too long a commute and frustrated, we leave. A 70 minute city doesn't last too long.

"The 30-Minute City has more social cohesion, stronger social capital and a happier, healthier population."

The converse is also true. When we move toward the "30-minute city" we start seeing the reverse. People, freed from the commute, start spending their time budget on other things. They see more friends and spend more time with family. They invest more time on education, leisure or keeping fit. They take the job that makes them feel more satisfied and stimulated. They become more productive. This city, the 30-Minute City, has more social cohesion, stronger social capital and a happier, healthier population.

THE GEOGRAPHY OF TIME

Of course, not all parts of the city can be characterised as having 60-minute or 30-minute commutes. Most have each of these typologies, and everything in between, in the one city. Some areas simply have better access then others. Some parts of the city have a higher density of jobs and services than others. Some parts of the city offer better transport choices, so you can choose to drive, or take a bus or train. Some places have so much access that you can usually get to where you want to go by bike or walking. Our "time budget" has a geography and with access to data from across our public transport network, our roads network and accurate population mapping, we can now quantify this.

With new technologies like mobile phones and digital timetables we can now measure how long it actually takes to get from one part of the city to another and at different times of the day. We can also map where most of the jobs are located and where people live. We can pinpoint the main services we want, like schools and hospitals, and determine how long it will take get to them. We can do the same with entertainment and retail precincts. Combining them all we can now develop accurate maps of this geography of time (see Appendix for methology).

This is not simply to discover interesting maps of Sydney. If our city is to deliver on the promise of a global city, it must be a data-driven, and crucially, a responsive city. It is our hope that this data can not only describe how our city is developing, but help make more informed decisions about land use, employment and infrastructure planning.

EFFECTIVE JOB DENSITY

Effective Job Density is a measure of how many jobs are accessible to a person within a set time (typically 30 minutes). It is a commonly used proxy measure of the agglomeration economy and how 'connected' a person is to the benefits of the city, as people who live in areas of higher effective job density can access more jobs and the consequent benefits of agglomeration.

To examine Effective Job Density, we have researched the number of jobs accessible to a worker relative to the time taken to get to these jobs, adjusted by the current mode split of those workers in their travel to employment. In short – how many jobs can a worker access from their home by public transport or private vehicle?

Similarly, Effective Service Density measures relative access to services – using education, health and retail as the key services citizens need to access in order to enjoy the benefits of the city.
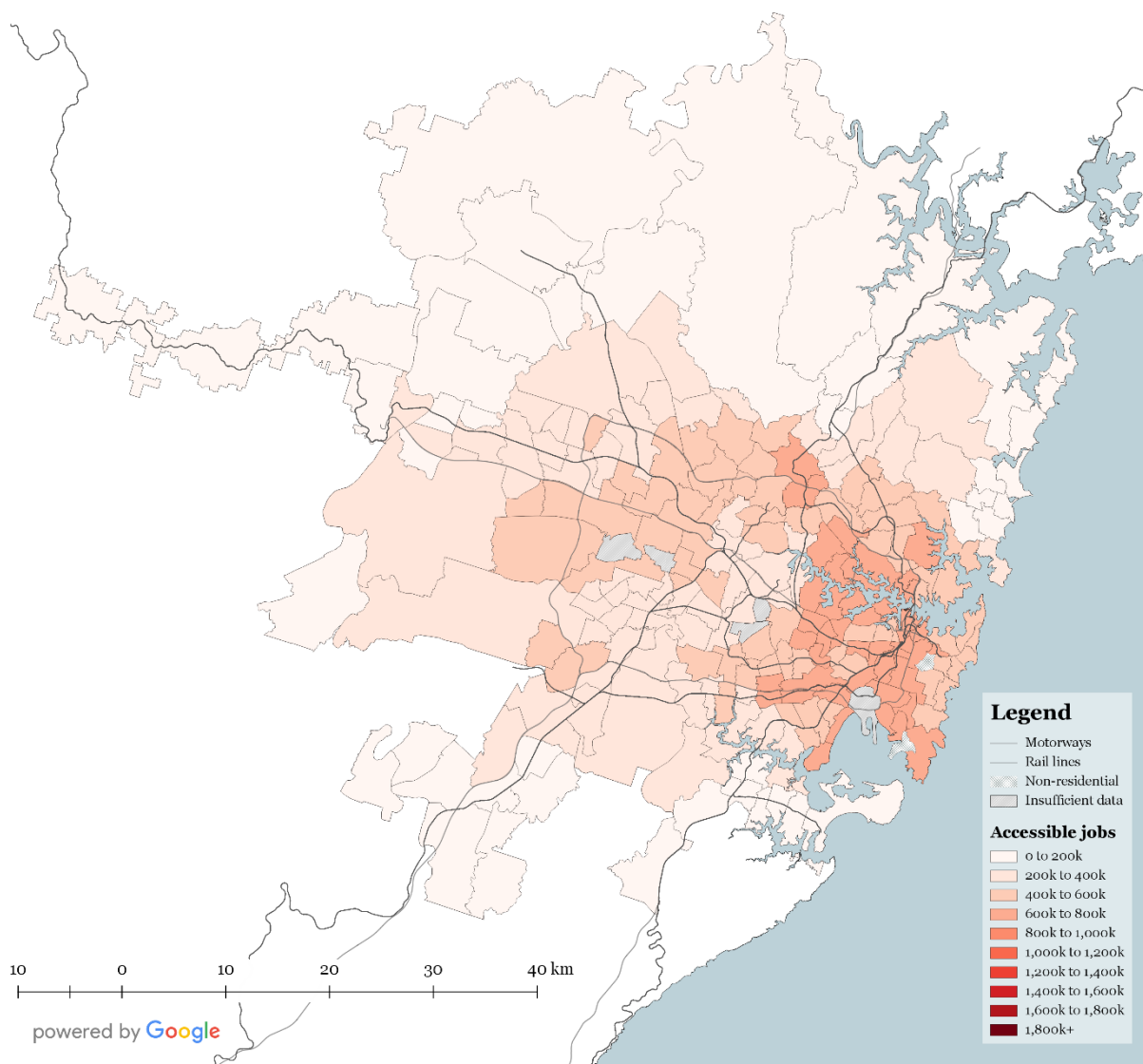
This analysis undertaken using PwC's Geospatial Economic Model (GEM) helps illustrate the reality of the 30 Minute City in current day Sydney. We can now see which parts of Sydney have access to the most jobs in the shortest time and through different transport modes.

Sydney is home to over 2 million jobs, containing approximately one fifth of all of Australia's employment, however, the 30-Minute City is not yet a reality for all Sydneysiders. Approximately 30% of Sydney can access large numbers of jobs within 30 minutes, with 70% lacking access to significant numbers of jobs without travelling further than 30 minutes. Figure 1 shows how many jobs are accessible within 30 minutes by public transport and/ or private vehicle, weighted by mode preference, on a weekday morning.

Table 1 shows a list of the Sydney suburbs with the highest Effective Job Density. A number of these locations are expecting low levels of new development and density planned - it may be worth considering whether higher densities would be appropriate in these locations, given their high Effective Job Density.

Sydney is home to over 2 million jobs, containing approximately one fifth of all of Australia's employment, however, the 30-Minute City is not yet a reality for all Sydneysiders.

Figure 1: Number of jobs accessible within 30 minutes in Sydney on a weekday morning

Effective job density, as measured by number of jobs accessible within 30 minutes by public transport or private vehicle, weighted by mode preference, on a weekday morning.
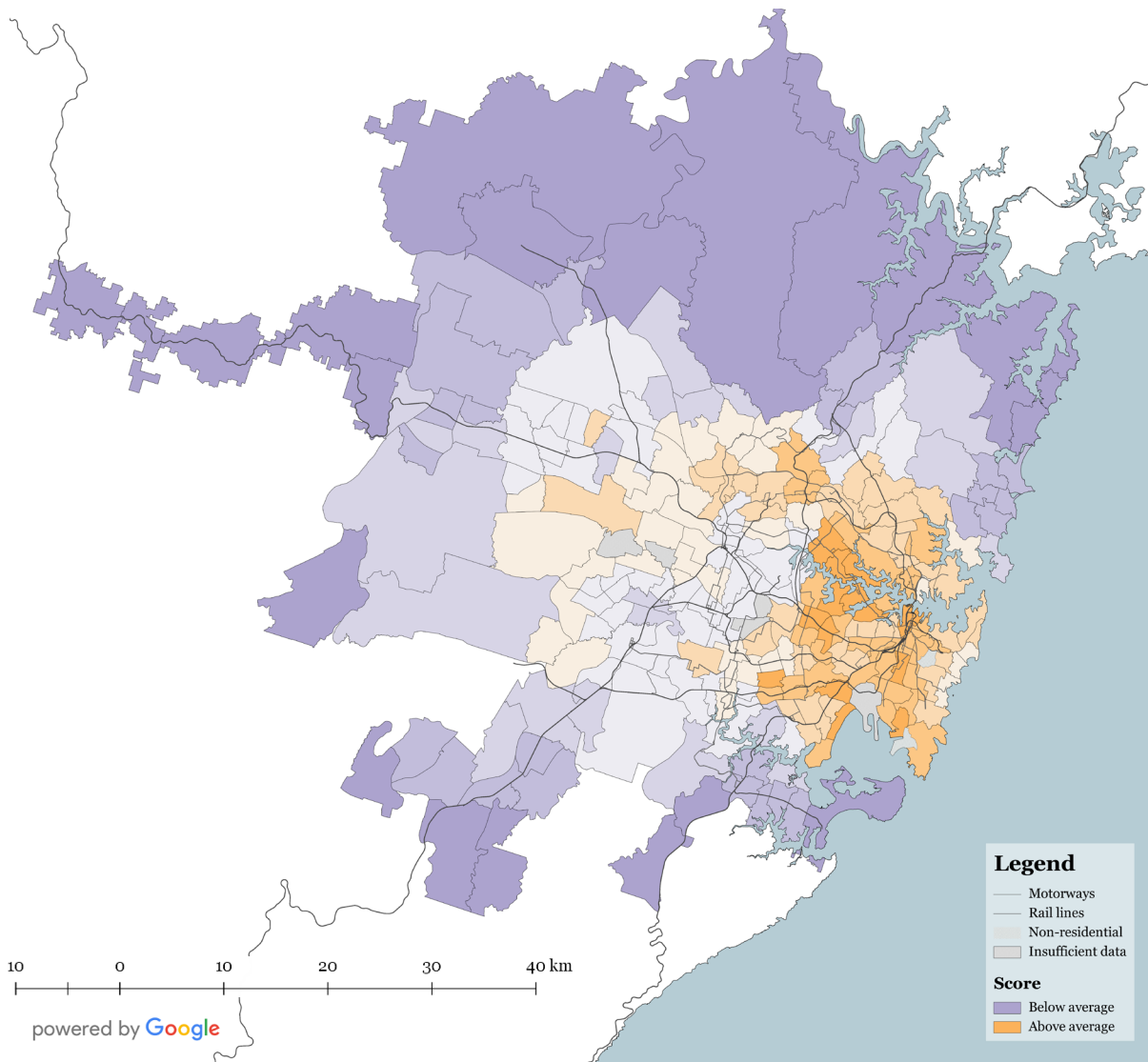
Table 1: What suburbs offer the greatest access to jobs in Sydney?

Suburb	Number of jobs accessible
Drummoyne – Rodd Point	786,929
Roselands	778,762
Gladesville – Huntleys Point	768,828
Banksmeadow	742,584
Hunters Hill – Woolwich	736,565
Monterey – Brighton-le-Sands - Kyeemagh	724,083
Burwood – Croydon	723,758
Five Dock – Abbotsford	720,439
Waterloo – Beaconsfield	709,894
Ryde – Putney	709,046

ACCESS TO THE 30 MINUTE CITY IS GEOGRAPHICALLY UNBALANCED

We can see from Figure 2 that access to employment in Sydney is uneven, varying depending on where you live. For instance, people living on the outer edges of the city have the poorest access to jobs, with access to less than 10% of jobs within a 30 minute commute on a weekday morning. At the other end of the scale are people in central Sydney, who enjoy access to 46% of Sydney's jobs within a 30 minute car commute on a weekday morning.

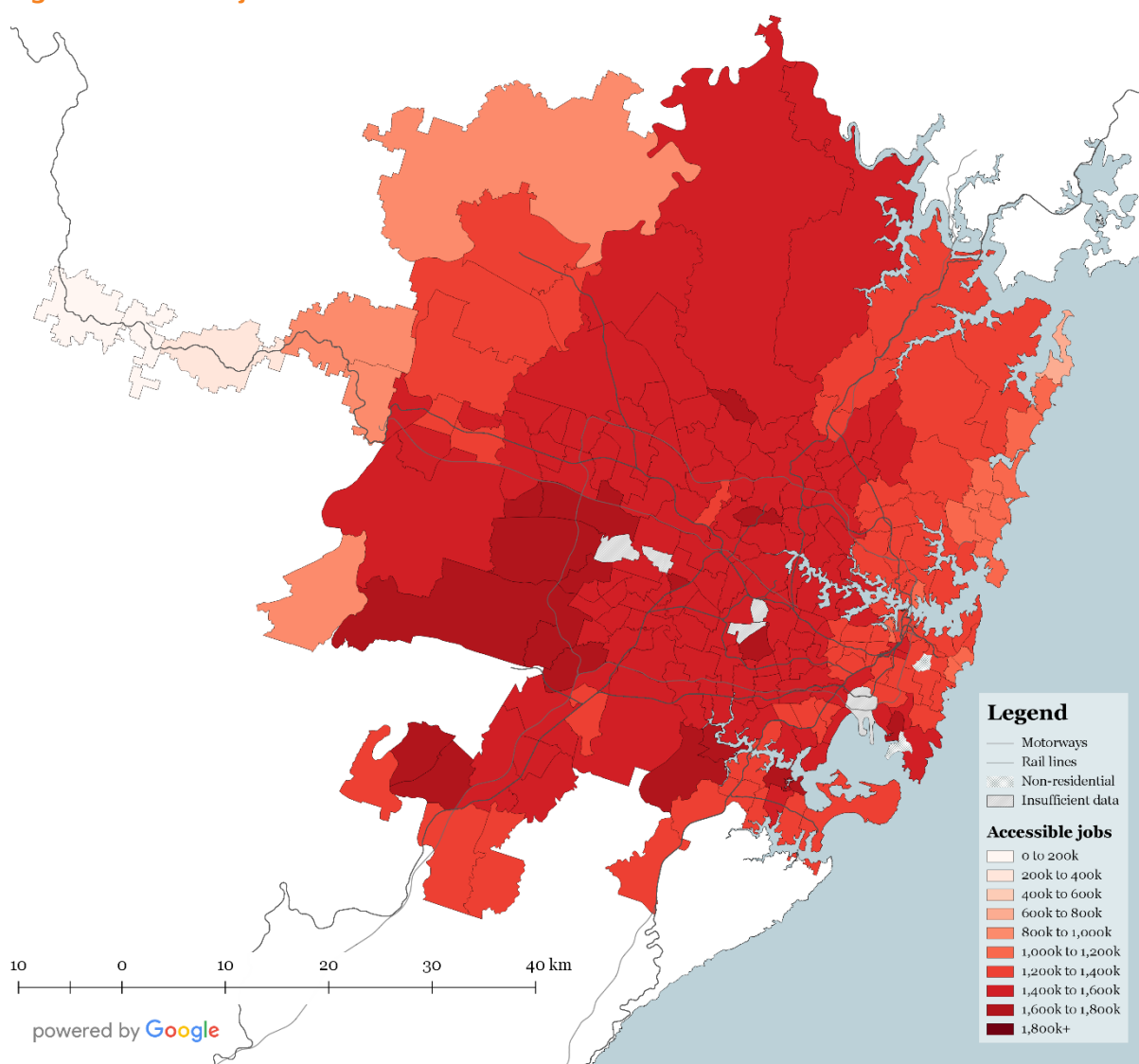**Figure 2: Effective job density – above and below average access**

For many areas of the 'inner-ring' of Sydney, effective job density is high. Areas around Parramatta, Macquarie Park and North Sydney are also above average.

THE 60-MINUTE CITY

For Sydneysiders in many parts of the city, the 60-Minute city is closer to their lived experience than the 30-Minute city. Programs and investments that grow the 30-Minute city, including the Greater Sydney Commission's 3 City approach, will help deliver the 30-Minute city to more people.

Figure 3 shows that almost all people in Sydney can access most jobs across the city within 60 minutes. This tracks with historical experience of the outer-limit of people's travel preferences, with anything more than a 60 minute commute causing people to either move closer to work or find alternative employment closer to home.

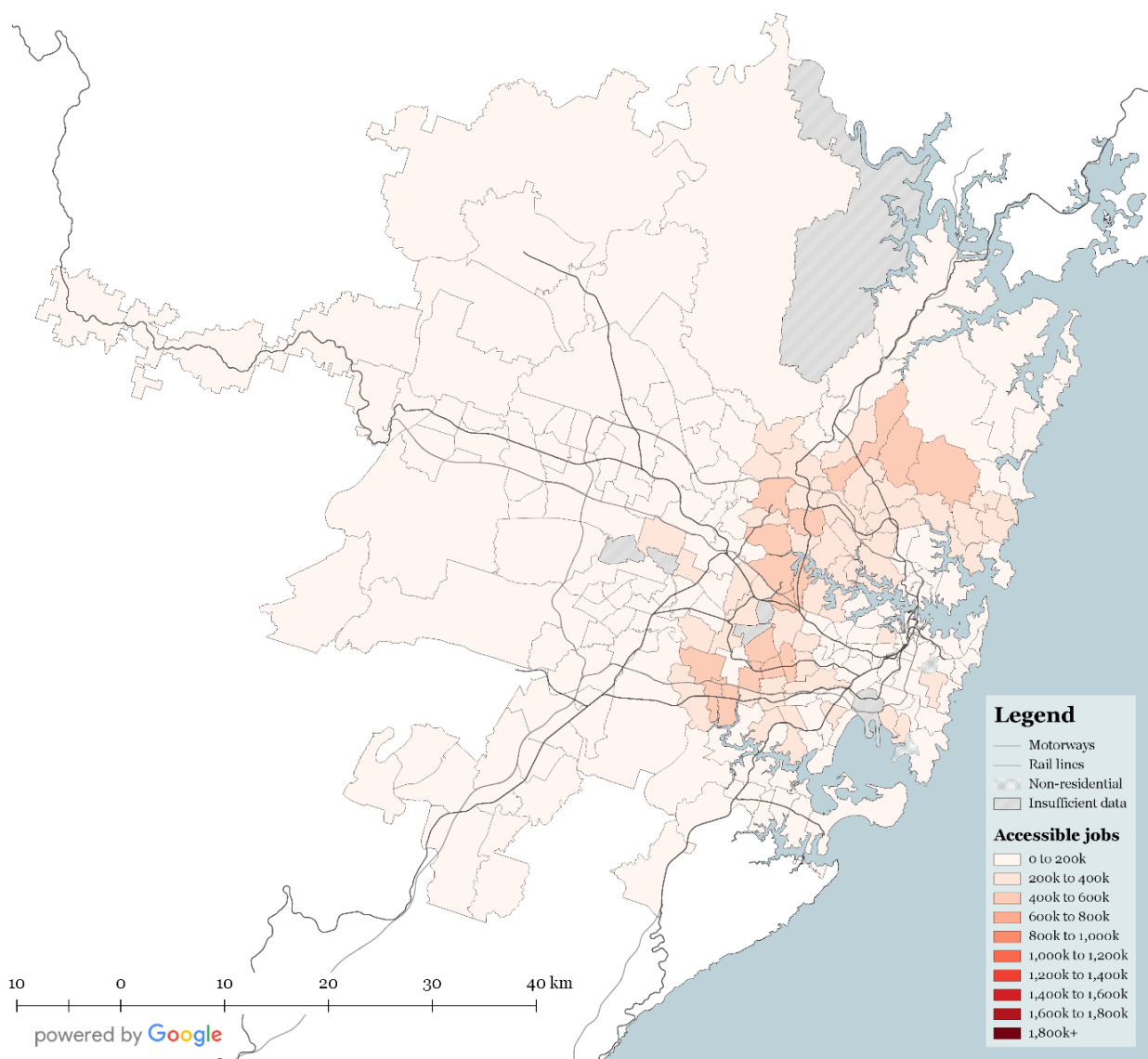**Figure 3: Number of jobs accessible within 60 minutes**

Effective job density, as measured by number of jobs accessible within 60 minutes by public transport and/or private vehicle

WHAT IMPACT DOES CONGESTION HAVE ON EFFECTIVE JOB DENSITY?

One of the challenges of our road network is that while it is congested in peak hour, most roads are relatively free-flowing at other times. By comparing the relative access to jobs at 8:00am and 12:00pm on weekdays, Figure 4 shows what a dramatic impact congestion has on accessibility.

Figure 4: Increase in jobs accessible within 30 minutes between the morning peak and midday

The increase in numbers of jobs accessible within 30 minutes when comparing morning peak and midday.

Table 2 examines which suburbs are most impacted by congestion in terms of access to jobs. This shows that middle-ring suburbs are the areas where people stand to gain the most from reducing congestion – and that they stand to gain a significant increase in the number of jobs they can access within 30 minutes by public transport or private vehicle. Achieving an increase in access to jobs would also support the NSW Department of Planning and Environment's project to fill in 'the Missing Middle', increasing densities across this area with appropriate medium density housing.

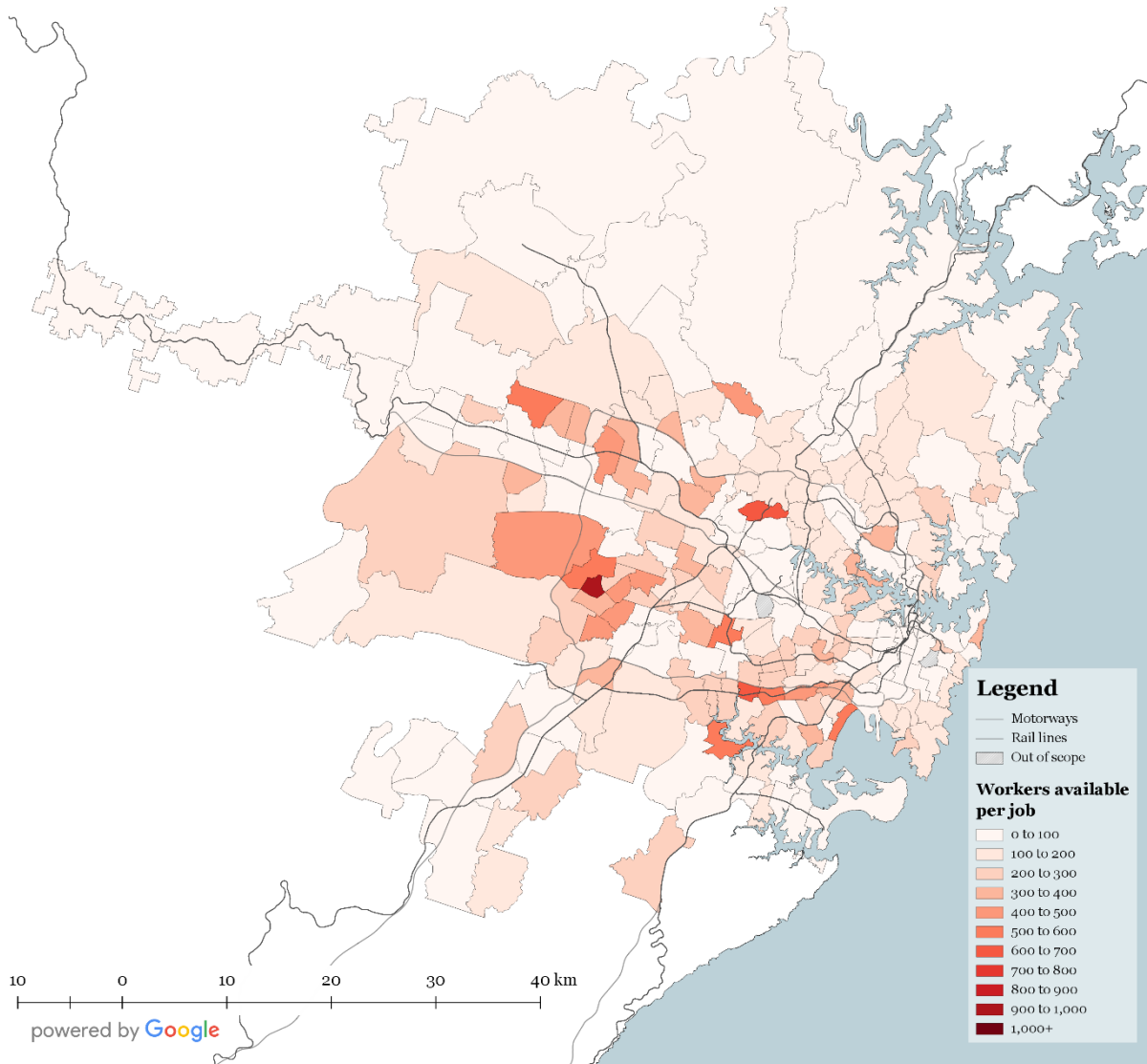**Table 2: Middle-ring suburbs are those most affected by congestion**

Suburb	Jobs accessible within 30 minutes: weekday morning	Jobs accessible within 30 minutes: weekday noon	Net increase in jobs accessible within 30 minutes	% change
Homebush Bay – Silverwater	366,591	937,537	570,946	256%
Greenacre – Mount Lewis	551,197	1,115,998	564,800	202%
Punchbowl	435,739	963,302	527,563	221%
Concord West – North Strathfield	320,835	809,080	488,245	252%
Homebush	346,929	834,720	487,791	241%
Condell Park	523,297	992,775	469,478	190%
Ermington – Rydalmere	485,768	948,023	462,255	195%
Belmore – Belfield	479,683	940,520	460,837	196%
Revesby	385,687	824,641	438,954	214%
St Ives	318,528	753,645	435,118	237%

"Middle-ring suburbs are the areas where people stand to gain the most from reducing congestion."

CAN WE EXPAND THE 30-MINUTE CITY WITHOUT ADDITIONAL TRANSPORT INFRASTRUCTURE?

One of the key challenges facing Sydney is the current infrastructure deficit, most noticeable in the need for increased public transport. While it is true that we are currently experiencing an infrastructure boom unlike any seen in recent years, the degree of 'catch-up' required to achieve a 30-minute city means that we must also think of alternative ways of utilising existing infrastructure more efficiently when considering population and employment growth across Sydney. Some solutions to this challenge have been addressed in previous Committee publications, including demand management for our roads system[1], and value capture to help fund the public transport we need[2].

Figure 5: Workers available per job within 30 minutes on a weekday morning.

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1   Committee for Sydney, *Issues Paper 12: A Fork in the Road - A new direction for congestion management in Sydney*, April 2016, http://www.sydney.org.au/wp-content/uploads/2015/10/CfS-Issues-Paper-12-A-Fork-in-the-Road-1.pdf

2   Committee for Sydney, *Issues Paper 11: Are We There Yet? Value Capture and the Future of Public Transport in Sydney*, December 2015, http://www.sydney.org.au/issues-paper-11-are-we-there-yet-value-capture-and-the-future-of-public-transport-in-sydney/

There may also be a simpler solution to a portion of this challenge. Where are the locations in our city that are already accessible to large numbers of workers, but lack jobs for these workers to fill? Or – put another way – where are the locations where we could encourage additional employment, confident in the knowledge that there is a ready and willing workforce to fill these jobs, without the need for a single new piece of transport infrastructure?

Figure 5 compares the number of jobs available by location to the number of workers who can access that location within 30 minutes, identifying a number of areas with significant opportunity for increases in employment.

Promisingly, Table 3 shows that many of these locations are situated close to the north-west and south-west growth centres, suggesting that active encouragement to move jobs to these locations would increase the number and breadth of Sydney residents able to access jobs within 30 minutes. Several are also in the Canterbury/St George region, probably because of their position within 30 minutes of large populations to the north, south, east, west and south-west.

Table 3: Top 10 locations for workers available for each current job

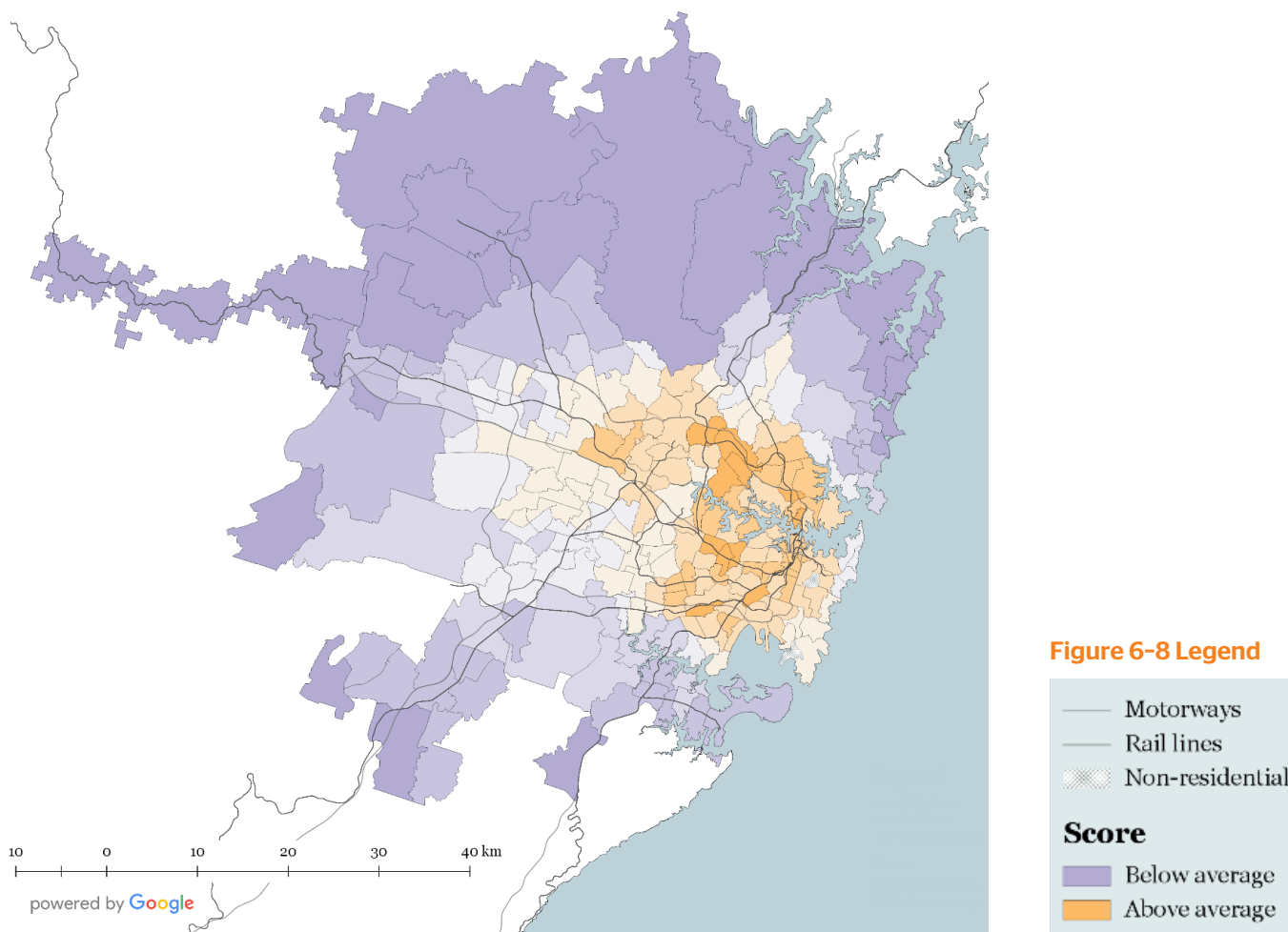| Rank	Region	Number of workers who can access each job
1	Edensor Park	907
2	Oatlands – Dundas Valley	683
3	Riverwood	657
4	Lethbridge Park – Tregear	594
5	Narwee – Beverly Hills	549
6	Bossley Park – Abbotsbury	538
7	Yagoona – Birrong	530
8	Illawong – Alfords Point	526
9	Monterey – Brighton-le-Sands – Kyeemagh	511
10	Doonside – Woodcroft	469

EFFECTIVE SERVICE DENSITY

Of course, cities provide us with more than just jobs. We can also map the geography of services such as health and education as well as retail opportunities, like shopping centres and supermarkets.

Figure 6 examines the density of hospitals, based on access to hospital beds. Figure 7 examines the density of education, based on access to school places and Figure 8 shows retail density, using access to retails centres. Each of these is measured on the number accessible within 30 minutes travel by private vehicle or public transport.
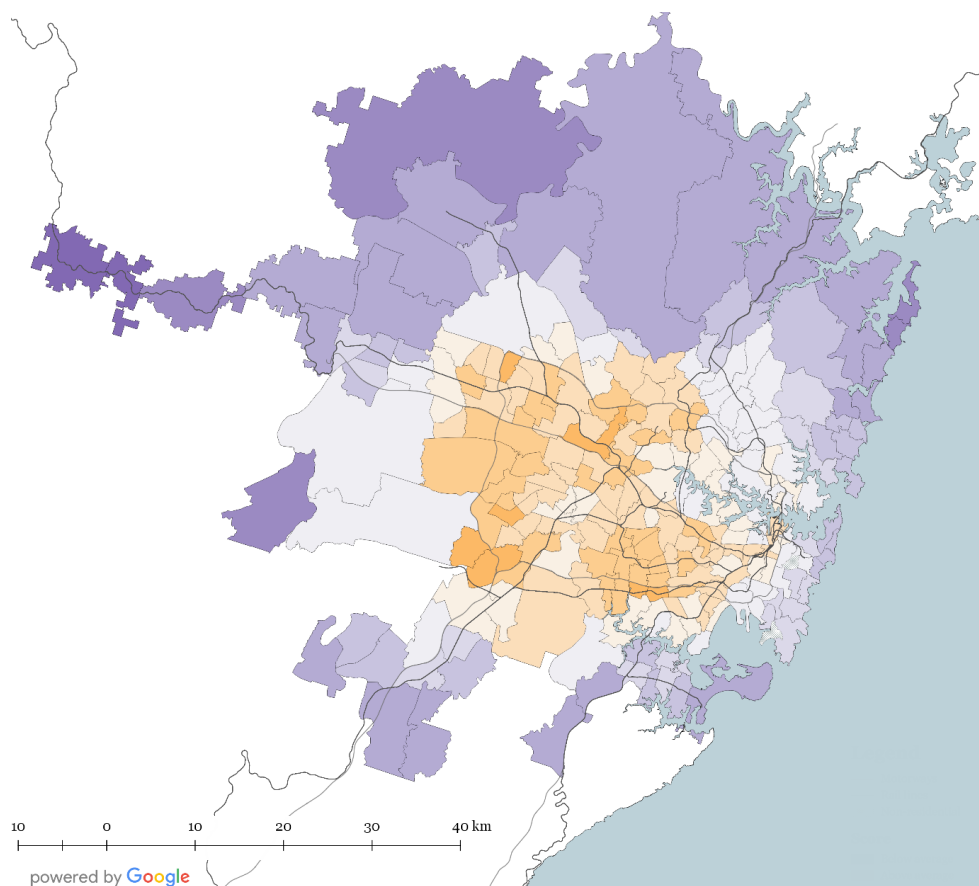
Overall accessibility to health, education and retail opportunities in Sydney is more widely spread than job accessibility. This is an important point for planners and policy makers to consider. While job accessibility is incredibly important, less than half of the Australian population are in work or looking for work. For the majority, access to health and other services may therefore a more meaningful metric.

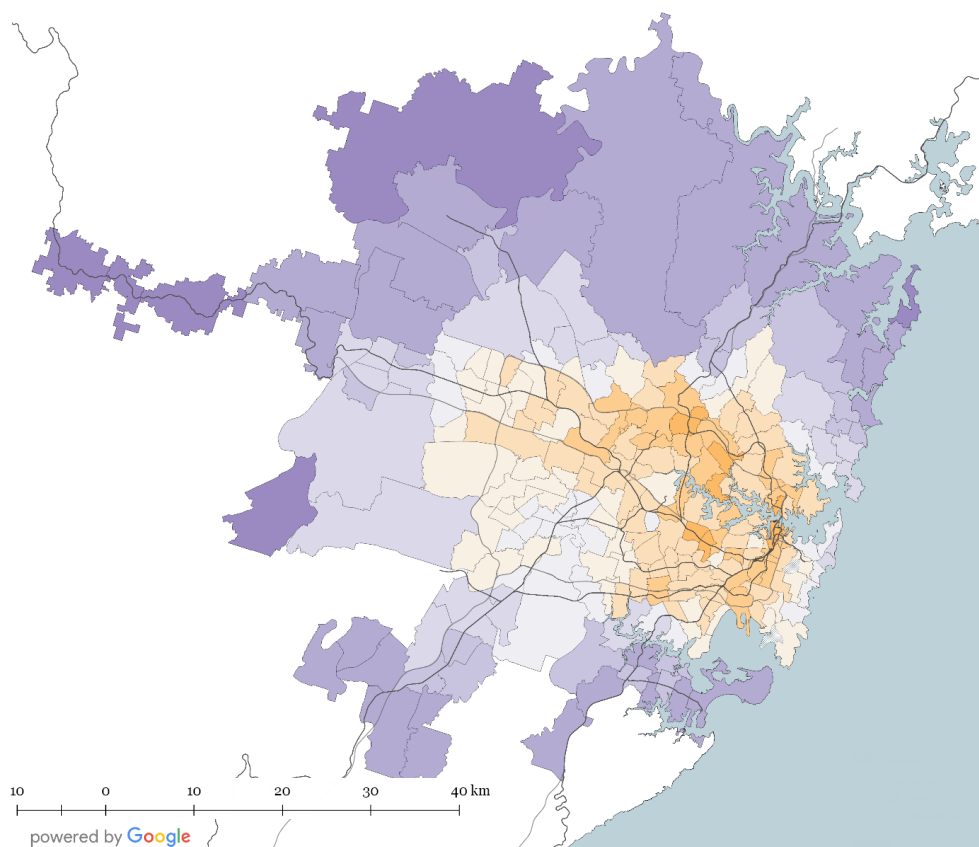**Figure 6: Access to hospitals within 30 minutes**

Figure 6–8 Legend

— Motorways
— Rail lines
▒ Non-residential

Score
▨ Below average
▨ Above average

This map illustrates a measure of the number of hospital beds available within 30 minutes.

Figure 7: Access to schools within 30 minutes

This map illustrates a measure of the number of school places available within 30 minutes.

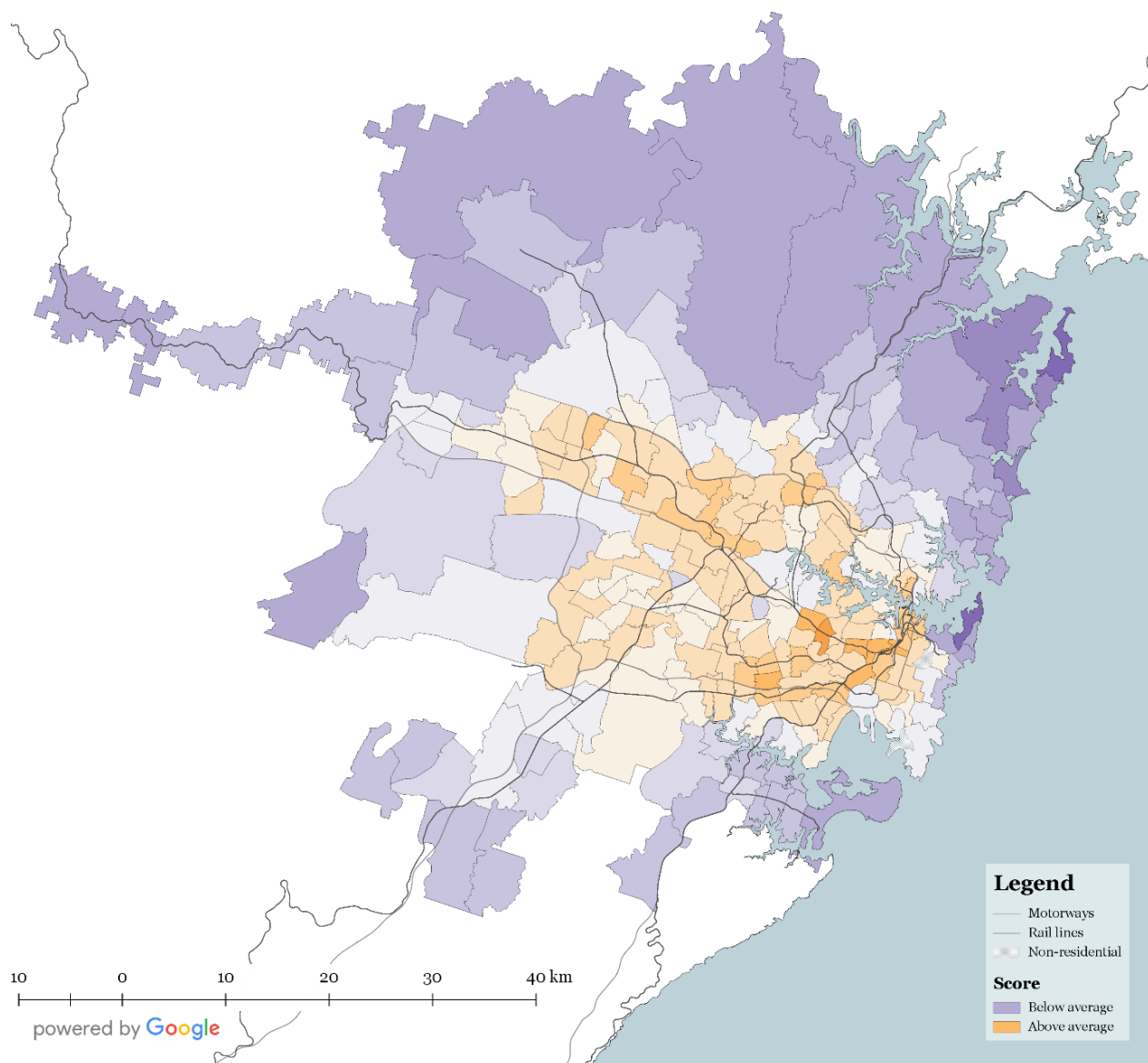**Figure 8: Access to shopping within 30 minutes**

This map illustrates a measure of number of retail centres available within 30 minutes.

OVERALL ACCESSIBILITY

When we combine access within 30 minutes to services (health, education and retail) with access within 30 minutes to jobs, we see the 'overall accessibility' of Sydney, as can be seen in Figure 9.

What is apparent from the overall accessibility map is that public transport remains the most effective method of travel to key locations, with the inner city, and key inner-city transport interchanges like Strathfield and Ashfield remaining the suburbs best connected to services.

Figure 9: Overall accessibility within 30 minutes

Overall access to services and employment within 30 minutes across Sydney – using a combined measure of Jobs, Health, Education and Retail.
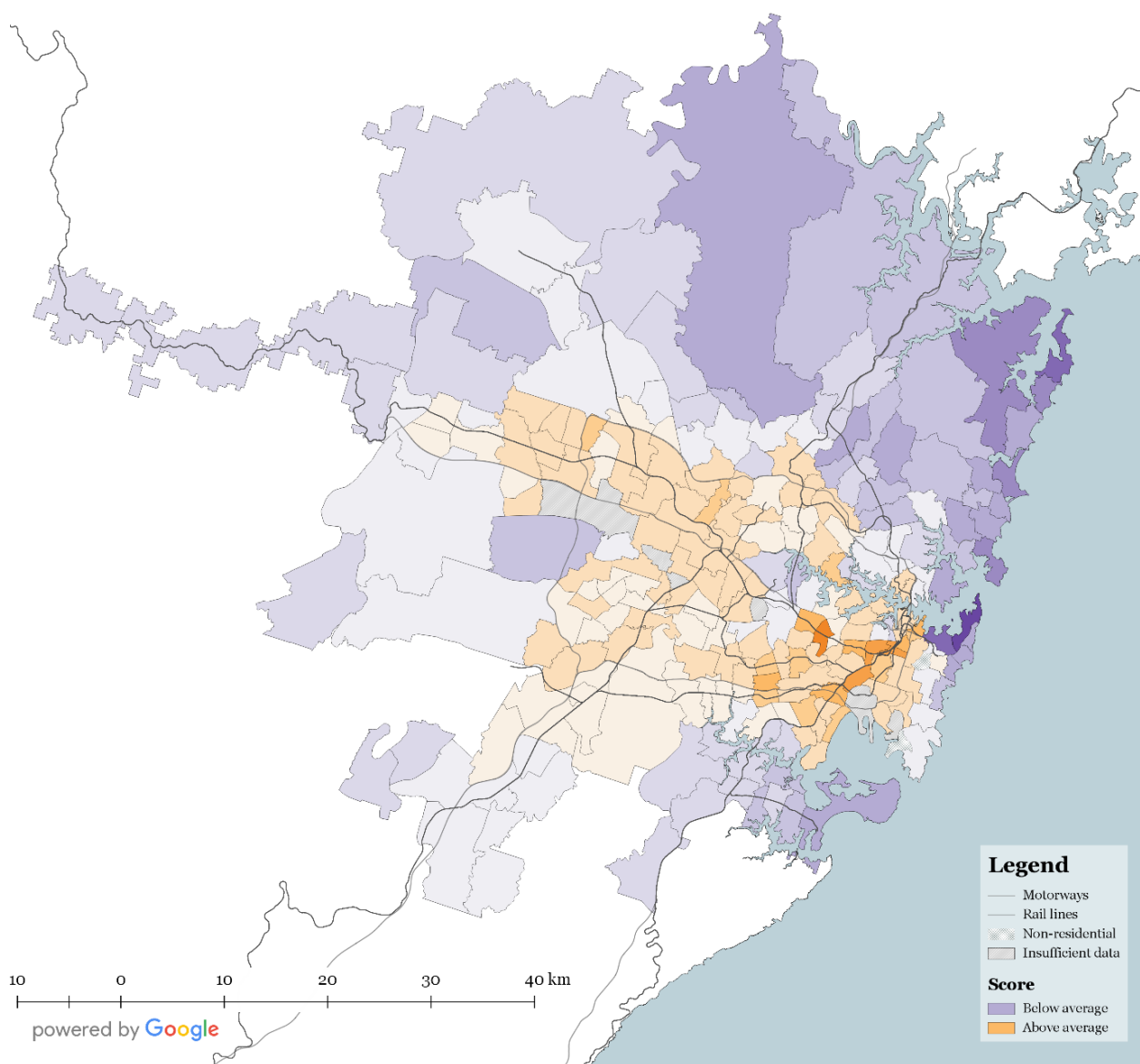
BEST VALUE LOCATIONS FOR ACCESSIBILITY

If you are currently looking to buy property, which areas of Sydney are the best value if you want good access to employment and services? By overlaying our accessibility map with a measure of property prices, Figure 10 shows which areas of Sydney are above average and below average 'value' in terms of their relative access to jobs and services against the cost of housing. Table 4 shows the top 10 'best value' suburbs in Sydney. This includes a number of surprising locations that are better 'value' than average, despite being some of the most expensive areas of the city, due to their extremely good access to jobs and services. A number of the best 'value' locations run along major transport corridors, particularly public transport corridors – suggesting that their value hasn't been fully captured by the property market.

Table 4: Top 10 'best value' suburbs in Sydney based on accessibility metrics and property prices

Rank	Suburb
1	Ashfield
2	Sydenham – Tempe – St Peters
3	Burwood – Croydon
4	Roselands
5	Redfern – Chippendale
6	Petersham – Stanmore
7	Newtown – Camperdown – Darlington
8	Surry Hills
9	Northmead
10	Arncliffe – Bardwell Valley

Figure 10: Best value locations for accessibility

Property prices were derived from rental and purchase prices for houses and units.

A TOOL FOR A BETTER SYDNEY

We can now see which parts of Sydney remain happily within the "time budget" of the 30-Minute City and which areas are not. As the city grows and changes, its 'geography of time' will also change. Jobs might relocate, to be closer to the Western Sydney Airport for example. As congestion worsens, some neighbourhoods will move out of the 30-minute area. Similarly, as we expand our transport we can bring more communities into closer contact with jobs and services and improve their 'time budget'.

Most importantly we can use this geography of time to help inform our priorities for where population growth should be encouraged and where we will get the best social and economic return for our urban investments. For example it may prove prudent to better link the people of Liverpool and Penrith (currently at least 60 minutes from a large portion of Sydney's jobs) with the burgeoning jobs growth planned for Western Sydney Airport. With a rapid and frequent train service we could move both (and their hundreds of thousands of residents) from a 60-Minute City to a 30-Minute City. Alternatively we might want to support the planned jobs growth at Parramatta by linking the growing population around the Central West District with an integrated light rail network. Accessing jobs and services at the end of a light rail line could save thousands from the need to commute to the CBD. Saving thousands of people millions of hours is absolutely a good investment.

We may also need to rethink some of our infrastructure investment decisions. If accessibility and access are the foundation of cities, then investment that improves accessibility to jobs and services should be prioritised. All new investments should be able to clearly state for whom and by how much accessibility improves. This key metric is absent from the current debate but, with a renewed understanding of the importance of a 30-Minute City, it should be top of the agenda.

CONCLUSION

The Committee has for some time stressed the importance of Sydney becoming a more data-driven city. We have published a series of reports titled *#wethecity* and will continue to focus on this key theme. Private and public sector members of the Committee are at the forefront of the shift towards Smart Cities in Australia. This report reflects our drive towards showing what benefits can accrue to the community, business, government and Sydney itself out of the use of the data that new technologies and research tools are making available to city-builders and planners as never before.

The Committee and its members are seeking to show how useful this approach can be also for community engagement and indeed for involving Sydneysiders in a fuller understanding of the key trends in their own city so that they can also play a more formative and creative role in shaping it. The future of city planning involves co-designing on the basis of open data and the imaginative use of digital tools. This report is a contribution to this objective.

This also comes at a time when it is becoming clearer that smart cities really require smart governance. Australia is beginning to equip itself with smart cross-government collaboration in the form of the new Federal Cities and Digital Transformation policy and the emerging City

Deals – taking the form of an innovative compact between tiers of government. At the heart of this discussion will be that smart piece of urban governance which Sydney has embarked on in the form of the Greater Sydney Commission – Australia's first metropolitan-scale cross-government city planning structure.

And it's already clear that the GSC, with its digital dashboard for elements of the city's performance and its strong commitment to evidence-based policy making in the emerging District Plans, is embracing the data-driven city. It also, and most relevantly for this report, has a vision of an inclusive Sydney that provides more opportunities for more Sydneysiders across the metropolitan area in what might be called 'the city of short journeys'. Its emerging 'Three Cities' model of Sydney is embedded in the kind of thinking outlined in this report about understanding how Sydney currently works.

We conclude with a reminder for ourselves of the key challenge for Sydney as it grows to a city of more than 8 million people – using smart policy levers to ensure as much of our city is a '30-Minutes City' and limiting the extent to which we create or maintain the '60-Minute City'.

PWC AND CITIES

Australian cities are the heart of our economy and our future prosperity relies on their success. That can only happen when people feel included in a community full of opportunity.

Right now, our cities face challenges to achieve a city for all. PwC are committed to helping solve the problems facing Australian cities. We are determined to drive change, and ensure our cities become places of vibrancy, diversity, connectivity and inclusion. Places that attract talent and investment – where people want to live, work and play.

Great places are the result of collaboration – they don't just happen by chance. PwC is driving collaboration, bringing people together to create social change – and great cities.

APPENDIX – METHODOLOGY

Our analysis has been completed in partnership with PwC, utilising their unique Geospatial Economic Model (GEM).

GEM calculates the economic output, employment and industry characteristics for 2,214 'locations' across Australia where business and government operate. Economic output is calculated in a way that is consistent and reconcilable with the ABS National and State accounts. The time series runs from 2001 to 2015, with forecasts out to 2036

We compliment this economic view of Australia with other data 'layers' including and demographic factors, government spend, access to transport and infrastructure, access to essential services, climatic conditions, customer preference, intention to purchase, crime statistics and more.

For this analysis we expanded the transport and accessibility layer. This ensures we better understand the important role transport plays in supporting the economic and social opportunities cities provide their residents.

More information can be found at pwc.com.au/analytics/gem.html

The Analysis has brought together a variety of data sources to evaluate the number of jobs accessible by car and public transport. Our weekday morning output is based on leaving at 8am. Weekday noon is based on weekday travel leaving at 12pm and Saturday morning is based on Saturday 8am.

To calculate our figures, we first generated population-weighted centroids for each SA2, based on mesh block counts.

We then calculated travel times by car and public transport in both directions between each centroid, with travel times sourced from Google. Car travel-times are weighted for traffic.

For each SA2 the total accessible jobs is the count of jobs in SA2s that could be reached within the relevant time threshold by public or private transport on the day and time in question, with the count used being the average weighted by the SA2's mode share.

A similar method was used for available worker metrics, with the number of workers in each SA2 derived from population demographics and worker participation rates by SA2s, and finding the total count of workers in SA2s who could reach the SA2 in question within the time threshold.

Other accessibility metrics were derived by calculating the travel time to all points in the location class and summing the total reachable from each SA2 within the time threshold. For hospitals, retail and schools underlying metrics were totalled to give scores, being beds for hospitals, number of retail centres and places in schools.

Our house price index is derived from rental and purchase prices for houses and units by SA2.

Data has then been standardised and weighted to produce indices. The 'overall services accessibility' score combines schools, hospitals and shopping scores. The 'overall accessibility' score combines jobs accessibility with the schools, hospitals and shopping scores, and the 'overall' score considers all the components of the 'overall accessibility' score, as well as property value.

The Committee for
Sydney

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"The Committee for Sydney provides critical thought leadership for a city we all love; they are pushing the boundaries."

THE HON. GLADYS BEREJIKLIAN MP
PREMIER OF NSW

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