1. Introduction and Summary

1.1 The Greater Sydney and Global context.

The Plan for the future development of Greater Sydney requires important decisions to be made about infrastructure priorities, investment, and sequencing. In order to achieve Greater Sydney’s goal of a ‘three city’ metropolitan region, new corridor development will be needed to accommodate both Sydney’s expanding and diversifying economic clusters, and to unlock new housing supply in locations that are accessible to future sources of jobs.

Selection and prioritisation of the next successive cycles of rail corridor and other infrastructure investment will be critical. Initial choices about which nodes should be connected in which order will shape path dependencies that will influence firms, incentivise capital, and produce the spatial pattern and productive potential of the future polycentric Greater Sydney.

In addition, settlement patterns, technology and the pace of growth means that Sydney’s future dimensions can be viewed on two different spatial scales, each with their own infrastructure timeframes:

- The three cities in one metro of Sydney, Parramatta, Western Sydney. (Greater Sydney).
- The wider mega-region with Wollongong and Newcastle. (New Syd Gong).

Two scales of regional development in Sydney: Greater Sydney (1) and New-Syd-Gong (2)

![Map of Greater Sydney](source: greater sydney commission)
Sydney is not the only urban-region to try to build a plan that links multiple cities in one common strategy, combining neighbouring or connected metropolitan areas. Many other metropolitan areas and multi-city regions have sought to do the same, especially where connectivity improvements enable the constituent cities to increase inter-dependence and flows and to develop new forms of complementarity. Examples of large city regions that have done this include:

- **The Greater Pearl River Delta**, (Hong Kong, Macau, Shenzhen, Guangzhou), which has been pursuing a common growth and infrastructure agenda for more than 15 years.
- **The Rhine Ruhr** (Dortmund, Bochum, Essen, Duisburg, Wuppertal, Leverkusen, Cologne, Bonn) where multiple smaller cities work together.
- **The Yangtze River Delta**, where three major cities (Shanghai, Hangzhou and Suzhou) cooperate with more than 20 smaller cities to improve co-ordination of economic development, environmental protection and high-speed rail integration.

There are also many medium-sized regions where cities within a 2-3 hour travel time have pursued a shared regional approach oriented around improved connectivity. These include:

- The Trans Alpine Region (Milan-Turin-Lyon-Genoa)
- Singapore – Kuala Lumpur
- The Northern Powerhouse, UK (Manchester-Liverpool-Leeds-Sheffield-Newcastle)
- The Midlands Engine (Birmingham-Coventry-Warwick-Wolverhampton-Telford-Dudley)
- Great Western Cities (Cardiff-Newport-Bristol-Bath)
- The Seoul Capital Region (Seoul-Incheon-Suwon)
- San Diego-Tijuana
1.2 Why are these multi-city regions engaging in joint planning and shared initiatives?

The idea behind most of these collaborations is that they potentially enhance scale, increase connectivity, improve mobility, and optimise land uses and assets. City, state and national leaders observe the opportunities to fashion a cluster of cities with the potential to compete with larger centres through enhanced co-operation, complementarity, and visibility. More precisely, this approach potentially provides:

- **Scale advantages.** It enables cities and towns to achieve the scale and productivity required to compete with larger places. These cities are joining together to foster ‘borrowed scale’ and become more complementary and functionally integrated.

- **Clarity about specialisation and complementary sector strategies.** By teaming up with other cities, participating cities need to clarify and assess their comparative and complementary advantages.

- **Improved growth management approaches** that enable more planned and connected locations of housing and population growth linked to wider growth planning and infrastructure investment.

- **A strategic case for investing in connectivity,** especially in projects that will reduce the distance or time taken to travel between neighbouring cities.

- **Improved visibility and recognition** through shared communications, and possibly the adoption of a common name or brand.

Usually these strategies are underpinned by a programme of enhanced connectivity, alongside advanced industry supply and value chains, shared labour markets and innovation eco-systems, joint strategic assets, and a common investment market/portfolio. But understanding the leadership, planning and infrastructure required to effectively foster, adopt, and implement the integration of multiple centres within a region is a new task for which lessons are being learned all the time. In this paper we review four international case study examples where multiple neighbouring cities have been linked up by rail infrastructure. We highlight:

i. The cumulative causation of decisions made on subsequent spatial and economic development, and the on the infrastructure imperatives that arise.

ii. The significance of shortening the rail journey times to the development of the more peripheral and more central cities.

iii. The sequential ordering of the rail investment in order to optimise the growth of the respective nodes.

iv. The impact of improving the access of skilled and less skilled markets to major centres of business employment.

v. The expansion of the functioning urban region by reducing long-distance journeys beneath a maximum time threshold.
2. Case Study Analysis, Observations and Lessons

2.1 Introducing the case studies.

The four international examples selected are:

- **San Francisco Bay Area**: The Bay Area Region and the Bay Area Rapid Transport System BART (San Francisco-Oakland-Silicon Valley)
- **Øresund**: The Greater Copenhagen Region and Øresund Bridge (Copenhagen-Malmö-Skane)
- **Randstad**: The Randstad Region and Regional Intercity Rail (Amsterdam- The Hague-Rotterdam-Utrecht and Schiphol airport)
- **Gauteng**: The Gauteng City Region and Gautrain (Joburg -Tambo Airport/Midrand-Pretoria/Tshwane).

The four examples are all city regions of comparable size to Greater Sydney, and span a range of approaches to connecting the major cities and urban centres: from high speed inter-city rail, to multi-line suburban routes, and medium-speed regional rail. In each case these projects have had a very substantial impact on the spatial and economic evolution of the whole region.

<table>
<thead>
<tr>
<th>San Francisco/Bay Area</th>
<th>Initial catalytic infrastructure project</th>
<th>Rationale for regional infrastructure</th>
<th>Impacts</th>
<th>2nd and 3rd phase infrastructure sequencing</th>
<th>Success factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>BART</td>
<td>Maintain CBD role by relieving congestion. Direct development towards sub-centres.</td>
<td>CBD reinforced as major Pacific business hub. Eventually raised demand for multi-family homes along rail corridor. Improved standard of development in key sub-centres.</td>
<td>Link to Airport and Silicon Valley Expansion to San Jose</td>
<td>Role of business leadership. Proactive state government.</td>
<td></td>
</tr>
</tbody>
</table>

| Øresund (Malmö-Copenhagen) | Øresund Bridge | Borrowed scale Solve labour market constraints for Copenhagen. Reduce unemployment and enhance visibility for Malmö. | Cross-border commuting Specialisation and global traded sector leadership (life sciences) Innovation economy | City Centre Tunnel District development (innovation, logistics) Mega-region links to Oslo, Hamburg | Devolution agreement to secure locally responsive investment package Investor, civic sector and academic alliances |

| Randstad (Amsterdam-The Hague-Rotterdam-Utrecht) | Airport link and Intercity rail system | Compact and sustainable development Balanced regional growth among the four cities | Retained and strengthened assets of the smaller cities World-class logistics platform Dynamic regional innovation system | High Speed Rail + 2nd CBD activation Joined-up suburban rail programme | Strong national policy and planning system Incremental, market-responsive development. |

The Sydney region in scale comparison to the four case study regions
In all four cases these regions have invested in one or more cycles of rail infrastructure that have succeeded in cutting down transport times between the key nodes and incentivising more commuters and residents to take up public transport (see Table).

- In San Francisco/Bay Area, the tunnel connection with neighbouring Oakland reduced travel times below 15 minutes, and brought most suburbs within a reliable 30-50 minute commute.
- In the Randstad, high speed rail reduced travel times between Amsterdam and the main airport to below 15 minutes and brought Rotterdam within a 36 minute commute, while other cities all connect within a 45 minute journey.
- In Gauteng, the rapid rail connection reduced an unreliable 70 minute+ car journey between Johannesburg and Pretoria to just 35 minutes, and connected the region’s airport and 6 additional centres within a 40 minute journey.
- In the Øresund region, the cross-border Bridge and Tunnel connection brought Malmö and Copenhagen within 38 minutes, and several districts in between to less than 30 minutes.

<table>
<thead>
<tr>
<th>Impact of rail systems on travel times in the four regions</th>
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<tbody>
<tr>
<td><strong>San Francisco BART</strong></td>
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<tr>
<td>San Francisco-Oakland</td>
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<td>San Francisco-SF Airport</td>
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<td>San Francisco-Richmond</td>
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<td>San Francisco-Fremont</td>
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<tr>
<td>San Francisco-San Jose</td>
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<tr>
<td><strong>Randstad/High Speed and Regional Rail</strong></td>
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<td>Amsterdam-Schiphol Airport</td>
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<td>Rotterdam-The Hague</td>
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<td>Amsterdam-Utrecht</td>
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<td>Rotterdam-Utrecht</td>
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<tr>
<td>Rotterdam-Schiphol</td>
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<tr>
<td>Amsterdam-Rotterdam</td>
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<tr>
<td><strong>Gauteng City Region/Gautrain</strong></td>
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<tr>
<td>Johannesburg-Pretoria</td>
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<tr>
<td>Johannesburg-OR Tambo Airport</td>
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<tr>
<td>Johannesburg-Midrand</td>
</tr>
<tr>
<td>Pretoria- OR Tambo Airport</td>
</tr>
<tr>
<td>Hatfield Station (North Pretoria)</td>
</tr>
<tr>
<td><strong>Oresund Region/Oresund Bridge</strong></td>
</tr>
<tr>
<td>Copenhagen to Malmo</td>
</tr>
<tr>
<td>Malmo to Copenhagen Airport</td>
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<tr>
<td>Malmo to Orestad</td>
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<tr>
<td>Copenhagen to Helsingborg</td>
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<tr>
<td>Copenhagen to Lund</td>
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</tbody>
</table>

Blue indicates car or bus-based journeys as the previous fastest (or only) mode of transport between the two locations.

*San Jose and San Jose are not yet connected via BART – the separate suburban Caltrain line connects them.
This Summary section reviews these four projects in five areas:

i. **Planning** – the extent to which the project was part of a wider plan and the extent to which sequential cycles were anticipated and planned for.

ii. **Outcomes** – the impact of the project on the economic, land-use, and social development of the region.

iii. **Political success** - the perception of politicians, local governments, citizens and media about the project’s impact, and the influence this has had on the appetite and viability of subsequent extensions and upgrades.

iv. **Financial performance** – the return on investment of the project, and the financial arrangements established to address unexpected costs.

v. **The Future outlook** - the prospects for the next cycle of infrastructure development to complement the existing network and expand links to more distant cities and conurbations.

### 2.2 Planning

**How were the big regional rail projects planned and appraised?**

In many cases, transformative rail projects that connect up a region’s main centres have formed the centrepiece of a metropolitan or regional plan. For regions with a limited or stop-start history of planning at the regional scale, rail infrastructure that spans multiple municipalities has galvanised a new model of long-term planning and visioning. Examples include Gauteng 2055 and Randstad 2040.

Economic appraisal, often in the form of cost-benefit analysis, has been an important influence on the decisions made on whether to pursue a regional rail project, and the relative merits of different routes. But the underpinnings of cost-benefit analysis are often questioned in projects that are designed to transform the centre of gravity of economic development in a region and alter the relative attractiveness of different areas, and where many counterfactuals are in play. The uncertainty about future sector and firm preferences adds to the complexity. These four regions (and others) illustrate that there is no blueprint for appraisal of genuinely catalytic regional projects. But there is evidence, including in subsequent phases of these four regions’ infrastructure planning, of more emphasis being placed on:

- scenario planning, based on alternative outcomes and decisionmaking timeframes
- spatial economic modelling of a region’s established and emerging higher value sectors, and consideration of what actions are market driven versus driven by planning policy.
- consideration of other social infrastructure requirements

In the four regions, the planning motives and were different in each case.

In the Bay Area, the genesis of the BART was part of a grand regional vision. Planners intended to create a new region with San Francisco at the core, orbited by the largest ‘secondary’ centres including Oakland and San Jose, in turn surrounded by satellite sub-centres such as Berkeley, and all interconnected by a mass transit skeleton, spearheaded by the BART. So the big project was intended to support the region’s evolution from a 1 CBD to a 3 CBD region, with strong parallels with the Greater Sydney vision. This plan, however, was largely non-binding on local governments.

The Øresund Bridge was distinctive in that it was a joint project initiated by the Danish and Swedish governments. It was not underpinned by a fully-fledged unified cross-regional plan (plans related mainly to economic development), although some efforts were made by the Øresund Committee comprised of local governments to anticipate the subsequent impacts on demand and future infrastructure (see below). Greater Copenhagen and the Malmo Region (Skåne Committee) together develop a Traffic Charter, with a common vision for strengthening transport for economic growth on
both sides of the region, although the many plans produced have not always provided clear priorities on how to sharpen their respective or joint competitiveness. The Bridge itself was not evaluated according to cost-benefit analysis, as is typical in the region, but primarily based on the project’s projected toll revenue and profitability.

In the Randstad, regional projects have been closely aligned to national policy strategies for infrastructure and spatial planning, which identifies a list of project priorities. This is linked to a multi-year investment programme set up to improve the way investments in spatial planning, economic development and mobility are aligned. Since 2000, the big infrastructure projects in the Randstad have been subject to cost-benefit analysis. In general this has tended to result in a stricter approach to the approval of rail projects, more criticism about the relative costs versus the benefits of improved travel times, and a preference for cheaper project alternatives that favour upgrading existing intercity routes. The debate about the route of the high speed regional rail line was very protracted, with national arguments about whether the route should go directly through the environmentally sensitive heart of the region or on a new track next to existing track.

The Gautrain was one of the Gauteng region’s key infrastructure projects that was accelerated because of the deadline of a major event – South Africa’s hosting of the World Cup in 2010. Because of the desire to set up the project as a PPP there was an emphasis on value for money and affordability - National Treasury approvals were granted based on multiple feasibility studies of cost, ridership and revenue forecasts. As South Africa’s first high speed rail project, the project had significant symbolic value and was strongly promoted by the premier of the newly created Gauteng province.

**Was there a clear plan for how to use infrastructure investment to reshape land use?**

Only in a minority of cases were decisive land use actions part of the initial package.

There have commonly been many planning mechanisms at play in the region, which means that the big rail project has a different status in different plans and a joined up approach to land uses was lacking. Most regions did not achieve full alignment of plans and timeframes between national, state and local priorities.

- The Randstad has for 40 years been adding rail links while pursuing development in the urban cores to prevent erosion of the main cities’ commercial, residential and jobs base. Since a 1988 Spatial Planning law, specific zones for densification were identified where supported by local transport interventions and corridor investment. The aim in the last 20 years has been to use intensified land use (especially housing) to allow the cities to operate as a network and to ‘borrow size’ from each other.
- The Øresund region was another strong example of synchronising the infrastructure investment with land use changes. On both sides of the Bridge, the main stops before the city centre, Ørestad and Hyllie, were planned to become new hubs, with public land assembled and brought under new management. A new spatial plan came into force in Copenhagen which specified that large office and cultural buildings had to be located within 600 metres of the station. On the Malmö side, municipal land use planning has become more focused on incorporating sustainability and compact growth around stations, although some strategic locations remained quite car dependent.
- In San Francisco, the original intention of BART was for the stations (situated 3 kilometres apart in the suburbs) to catalyse the development of suburban residential hubs. However land use planning was not actively developed around these stations in most cases during the first two decades. Only in the last 10 years has a much more dedicated approach to transport-oriented development been pursued especially in suburban locations.
Gautrain was designed partly to shape the region’s future urban form, focusing on the core economic area of the Province to bring about a dense polycentric system. Local spatial development frameworks were created for each of the station precincts, such that within 1 kilometre of the stations, increased residential density and land use changes in favour of mixed use were promoted. Retail sites were expected to generate many more trips than office space, including at off peak hours, and were promoted as anchors to encourage ridership to specific destinations. However enforcement of higher residential densities (and quality of housing) has been patchy.

Has planning been multi cycle and were the subsequent phases of infrastructure sequenced in advance?

Large-scale regional infrastructure projects often require envisaging the sequential cycles of infrastructure that will be required to meet new sources and patterns of demand. Regional planners consider carefully which parts of the future system are needed first and when the next parts will be needed to come on line to prevent bottlenecks and keep the region on track to its desired spatial economic future. However even if their preferred sequence of projects is deliverable politically and financially, the informed guesses that planners make are often confounded by unexpected usage patterns and other surprising changes.

The closest example of a foreseen multi-cycle plan to grow its cities in a targeted way with the aid of regular intercity rail is in the Randstad. Here the modern day system has emerged out of a deliberate long-term (60 year) attempt to avoid concentrating too many functions in the city of Amsterdam. The aim instead was to guide urban growth into specific locations served by a new suburban and intercity rail and road structure, with strong links between the four cities to each other and then (soon afterwards) their respective suburbs and hinterlands.

Using new fast regional rail to boost local links in the 2nd cycle: the Randstad

In the Randstad, the Stedenbaan (‘Cities Line’) is an example of how a region can utilise the extra capacity generated by a high speed regional rail line in order to strengthen the local network and stimulate mixed-use development in more locations. It involved a higher-frequency light rail system (from 4 to six trains an hour) combined with a regionally co-ordinated programme of densification around more than 30 local railway stations.

The Stedenbaan was set up as a simplified partnership between the cities and the province, and did not involve new planning instruments but was closely aligned with the planning instruments of existing levels of government. The agreement of local governments committed to delivering 60-80% of new dwellings and office developments within 1200 metres of the train stations. 10 locations were identified as pilots. Despite the setback of demand due to the 2008-9 financial crisis, the Stedenbaan has been viewed as a success. However some argue that too many development locations were identified, resulting in a lack of distinctive profile and identity.⁶

The result, alongside other prior and concurrent investments, is that the 4 main cities in the region all possess light rail systems to connect their key neighbourhoods and surrounding towns. Three also have tram systems and two a metro system. These have ensured that the cities outside Amsterdam have withstood the worst effects of de-industrialisation and the financial crisis, and maintained their appeal for firms and workers alongside Amsterdam’s own agglomeration.

This de-concentration approach ensured that the cities could easily access a talented labour pool at universities and other assets located outside the central city. Although successive national and sub-
regional plans evolved and adapted over time, there has been a 30 year commitment to densify around stations and existing settlements, and to create deliberate inter-dependencies between the 4 large cities in particular. More recently, the planning priority has shifted to emphasise international and long-distance rail connections.

Other regions have forecast future growth in certain nodes and prioritised supplementing an initial rail stimulus with more connections that build choice and flexibility. The Øresund Bridge rail connection initially was initially used by those living and relocating in Malmö to access jobs in Copenhagen. In the 2nd cycle, Malmö has specialised in new sectors and emerged in some respects as the ‘innovation district of Copenhagen’. This trend was broadly anticipated but not entirely planned – instead Malmö and its County of Skane adapted to these new trends and re-invested in key districts, public space and commercial lands accordingly. Gauteng in some respects looked to emulate this process. Notably the development of Ekuheleni as an Aerotropolis has been a centerpiece of the 2nd cycle of planning after the Gautrain, and is now established within a 30 year plan.

Some regions find their plans outrun by economic change. BART was designed for a region moving towards managed polycentrism, but the plan did not predict the boost that BART gave (along with other larger trends) to San Francisco’s relative attractiveness as an urban core. The city’s resurgence ultimately increased commuting distances much further than anticipated. Later on, the second rapid surge in demand for access to San Francisco since 2008 altered the purpose and identity of BART. The system has found that it is serving nearly four times as many people than was initially anticipated, with more commuters taking short-haul trips although the average journey distance remains high at over 22 kilometres. BART decided to remove seats on some trains because of the rising peak-time demand. The demand for express travel to San Francisco has increased, but the single track system intended to serve a more polycentric regional economy cannot accommodate this option.

**Box: The unexpected rise of Silicon Valley**

Despite the development of BART and a clear regional vision for transport-oriented business development, a major part of San Francisco’s regional economy began to concentrate along an industrial corridor almost totally detached from public transport. The emergence of ‘Silicon Valley’ as the global capital of computing was only discovered by local governments after the fact: it involved clustering around a series of unplanned industrial parks and government research facilities, spread out along key junctions along the 101 highway. This exacerbated the decision not to extend BART around the Bay. Between 1980 and 2005, many of the largest corporations chose not to locate their headquarters near transit, relying on commuters to travel by car and shuttle bus. The resulting jobs-housing imbalance in the region was nearly the opposite of the effect intended by the BART system.

**A number of factors appear to determine if regions engage in effective multi-cycle planning**

- A clear locus of planning authority in the region and mechanisms to align plans at different levels and geographic scales, underpinned by higher tier government interest.
- Strong communication between local governments and investment in a shared regional vision and identity.
- The involvement of the private sector in the region’s strategy formulation.
- A pipeline of infrastructure that inspires confidence and appetite among residents, governments and investors.
- The use of economic models which include self-reinforcing cumulative effects.
### Summary

<table>
<thead>
<tr>
<th></th>
<th>Was there a Plan to Accompany the Project?</th>
<th>What kind of Land-Use Accompanied Plans?</th>
<th>Multi Cycle Planning / Anticipation</th>
<th>Key factors influencing effectiveness of the plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco/BART</td>
<td>Yes – a non-binding plan for a new 3 CBD metropolis</td>
<td>Limited zoning at start, but successfully introduced over time.</td>
<td>Unanticipated growth in CBD and away from BART stations.</td>
<td>Lack of connection to all major hubs due to local government project withdrawal. Inadequate rail speed and frequency to compete with cars.</td>
</tr>
<tr>
<td>Gauteng/Gautrain</td>
<td>Yes – new Spatial Development Framework and a 45 year vision for fairer polycentric growth.</td>
<td>Local spatial dev frameworks for station precincts, land use intensification &lt; 1 km from 10 stations, favour to retail sites.</td>
<td>Rail + BRT around stations, followed by 2nd cycle rail corridor extensions to expand use beyond initial user base.</td>
<td>Real estate speculation away from stations near road intersections. Lack of alignment and enforcement of municipal plans.</td>
</tr>
<tr>
<td>Øresund/Bridge</td>
<td>No unified plan – two separate regional planning systems loosely collaborating.</td>
<td>Public land assembly and development agencies set up to develop key station districts between the two big cities.</td>
<td>Yes - 2nd cycle upgrade of both cities’ metro systems and links to suburbs, increasing flexibility.</td>
<td>Strong planning systems and municipal planning capability. High degree of informal collaboration. Declining interest of Danish national government</td>
</tr>
<tr>
<td>Randstad/Regional + HS Rail</td>
<td>Yes – strong nationally influenced plan for a distributed region and compact growth.</td>
<td>Zoning for station area densification in 30+ locations, especially for housing.</td>
<td>3+ cycles to spread functions and pool assets to 4+ cities; start with intercity rail and airport link, then suburban links and then high speed rail and long-distance links when networked flows are higher.</td>
<td>Broadly consistent national planning approach. Consensus-based approach among local municipalities.</td>
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</tbody>
</table>

### 2.3 The Outcomes – economic, spatial, land-use, placemaking

In this section we review the outcomes of rail infrastructure in spatial and economic terms, including for:

- The region’s main CBD and population centres
- The region’s 2nd centres
- The smaller, suburban and out-of-town locations connected by rail
- Airports and airport economies
- More distant and remote cities
We also review their outcomes in terms of regional identity, placemaking and appetite for innovation.

Below is a table with a simplified summary of development outcomes for the different types of location in the region.

<table>
<thead>
<tr>
<th>Positive outcomes/strong activation</th>
<th>Moderate or promising long-term outcomes</th>
<th>Weak outcomes/failure to optimise potential</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main CBDs</strong></td>
<td><strong>2nd centres and airports</strong></td>
<td><strong>Smaller/suburban locations</strong></td>
</tr>
<tr>
<td>San Francisco/Oakland</td>
<td>San Francisco Airport</td>
<td>Walnut Creek</td>
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<td>San Jose</td>
<td>San Francisco Airport</td>
<td>Pleasant Hill</td>
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<td>Copenhagen</td>
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**Supporting the competitiveness of the global functions in the core city**

The immediate benefits for the competitiveness, productivity and global profile of the core city can be identified as an important outcome of improved intercity connectivity within the four regions.

By connecting San Francisco to its suburbs across multiple lines, BART helped protect the core city’s enduring competitiveness as a business and technology hub despite the strong decentralising pull of Silicon Valley (see Box on San Jose for an alternative outcome). The Øresund link has the effect of expanding Copenhagen’s effective labour market, to enable it to accommodate increased demand in business services while also providing more flexibility for new technology and innovation sectors to grow. And a strong intercity system has allowed Amsterdam to emerge as the preferred location for professional services and creative industries - while at the same time Rotterdam has established itself as a port city specialising in food, energy and the circular economy, Utrecht as a magnet for life sciences, higher education and conferences, and The Hague as a political and diplomatic centre.

In each case, rail infrastructure enhanced the commuter platform and acted as an important incentive for companies to relocate to the city or back into the main city. This process of re-urbanisation seems to have occurred more quickly on average than in city-regions where this connective infrastructure was not forthcoming.

**Box: The risks of not linking up a distant primary city – San Jose**
San Jose is an example of a large city in a region whose long-term trajectory has been shaped by the failure to link it adequately during the first cycles of regional rail infrastructure. The city saw its population grow very quickly in the decades since, as it pursued aggressive land annexation and road-dependent growth policies. Subsequent efforts to build local and regional rail connections have been inadequate to compete with the dominance of the car. As the Bay Area region’s economy shifted towards San Francisco and Silicon Valley, the city also lost jobs and its tax base diminished.

45 years after the initial rail infrastructure, San Jose is now experiencing downtown development around its main station, Diridon, which is becoming a hub for BART, high speed rail and other lines. The scale of opportunity that this provides is attracting tech firms to relocate by the station for the first time in more than 50 years. It is resulting in much higher density land uses and a push to overcome fragmented public sector decision-making.

San Jose’s experience shows that large population centres in a region may continue to grow even if they become relatively less well connected, but that this growth risks being unmanaged and unproductive. It illustrates the importance of ensuring larger centres are not ‘left behind’ by new rail infrastructure.

The Outcomes of Connecting 2\textsuperscript{nd} centres

A regular and reliable rail connection to a 2\textsuperscript{nd} centre (city of 400,000+) where times are less than 40 minutes appear to have significant long-term impact in promoting development in that centre and boosting a region’s flexibility.

The 2\textsuperscript{nd} cities of Malmö and Oakland are good examples where the initial experience of improved connectivity was mixed, but over time business, visitors and other customers have become more interested because they offer connectivity, strategic land, attractive costs, improved placemaking, and an environment more conducive to parts of the creative and innovation economy.

In the Randstad, the multi-functional intercity system underpinned the growth of four relatively evenly-sized cities with their own sub-regional economies and labour markets. This positive equilibrium has actually meant that the appetite to build an even more comprehensive regional system (such as the Randstad Loop) has diminished over time. The rate of mass daily commuter inter-city transport between the four cities was relatively modest, and this resulted in priority being given to boosting capacity and speed on existing regional rail networks instead rather than an additional fast rail system to join everything up.

Box: The renaissance of a 2\textsuperscript{nd} centre brought within a 15 minute orbit

For Oakland, traditionally seen as San Francisco’s poorer neighbour, BART’s reduction of travel time to an average of just 13 minutes eventually brought clear benefits. Yet during BART’s first 10 years, virtually no new development took place around downtown Oakland’s three BART stations. It took the construction of Oakland City Center in the 1980s to catalyse the area, with the Oakland Redevelopment Agency providing the necessary land assembly, TIF of public infrastructure, subordination of loans, and equity participation in several assets.\textsuperscript{9}

This has helped spark an Oakland renaissance in the 2\textsuperscript{nd} and 3\textsuperscript{rd} cycles of BART. Empty buildings have been renovated, cultural venues and amenities have multiplied, and more jobs have located
Downtown. In the last decade, corporates such as Uber attracted by comparatively lower rents and good connectivity have moved part or all of their operations to Oakland.

This shows that the rail system:
- Has played a dual role in enabling Oakland residents to commute into the San Francisco CBD, but also created an environment over time in Oakland itself that is attractive to prestigious tenants.\(^{10}\)
- Does not catalyse a critical mass of new commercial and residential development even in a well located 2nd centre without an improved governance vehicle and good timing in the economic cycle.\(^{11}\)

### The Outcomes for Suburban or Out-of-Town Station Locations

The long-term outcomes for built-up suburbs and greenfield locations connected on new regional line or system have been varied.

The Copenhagen-Malmö region has had two striking experiences at using the new fast rail link to deliberately develop strategic out-of-town station locations between the two main cities. On the Malmö side, the development of Hyllie was planned from the outset, and a joint venture to create a signature low-carbon district has been successful. On the Copenhagen side, Ørestad was masterplanned by a Development Corporation as a high density district with four sub-districts to be built out one at a time. Both are extremely favourably located in the new regional transport system. In both cases the districts had a low profile before the project and in both cases the leverage of underused public land has been essential, underpinned by stable cross-party political support.

Despite the big locational advantages and the strong planning arrangements, both Hyllie and Ørestad had initial difficulties realising their ambitions. Both relied on large shopping malls during the initial stages of the project given limited office demand and cost challenges, but within 10 years both have attracted higher-end anchor office tenants. These highlight the ability of rapid rail combined with land-use planning to shift the historic direction of development (eastward in Copenhagen and westward in Malmö). Several factors are viewed to have influenced these districts’ more recent upturn in fortunes:
- the arrival of anchor institutions
- less duplication and competition from other office locations in their sub-region
- better integration with surroundings, more inviting public space, and more human scale of development (especially in Hyllie)
- a focus on delivering high quality family housing to meet the preferences of a wider range of potential residents.

In the Gauteng region, the majority of the suburban stations have not become major locations of regeneration or development. In most cases Gautrain passenger numbers compared with other transport modes are rather modest. Partly this reflects the short time (7 years) since the project was launched. It also is related to the fact that the Gautrain was not designed, in its first phase, to operate as a mass transit system moving very high volumes of people. So far its main consumer base has been higher income passengers. This is being addressed in the next phase.

Midrand Station, located halfway between Johannesburg and Pretoria, was one of the only Gautrain stations in a largely greenfield location and was prioritised as an opportunity for major infill and mixed-use densification. However its growth has been compromised by a large development several kilometres to South and East of the station - Waterfall City - acting as a competitive location. This out-of-town site, at the intersection of major regional roads, has attracted major tenants including Novartis, PwC, Deloitte, Honda and Colgate as well as the largest shopping mall in the...
entire region. The majority of office units in the area are now more feasibly reached by car than by train, and shuttle buses have emerged to serve Waterfall City. Such is the scale of growth around Waterfall that a separate future Gautrain station is being considered.

From the outside the Waterfall City development, in the Gauteng City Region, have been prevented if there had been more explicit attempts to deliver a new urban township.

Across the four cases, a number of common factors emerge as to the outcomes achieved in activating suburban locations and building a more flexible regional economy.

- Fragmentation among land owners and/or inadequate land assembly and land management has seen a number of planned locations fail to host development of the necessary scale or integration to become new anchors of regional growth. The allocation (deliberate or otherwise) of strategic land to parking and low value retail is not an uncommon obstacle. Often it is key for transport authorities and other landowners become more active at leveraging land assets for development.
- Price and affordability shapes uptake of the new rail connectivity across the income spectrum. More suburban locations have seen their hub status and development optimised when a majority of residents view the rail service as accessible and affordable on a daily basis.
- Local opposition of resident and community groups who are unpersuaded by the merits of dense development.
- Real estate fundamentals often govern the success of efforts to achieve transport-oriented development. Activation of suburban locations tends to be more likely where there are (1) existing quality of life and proximity incentives that make the location desirable, (2) prior examples of successful mixed-use development that demonstrate market demand, (3) a high standard of design and placemaking.

The Outcomes for Regional Airports

New connections are not always by themselves a catalyst for business attraction and development around a regional airport. More commonly a better rail link has improved labour market access to and from the airport rather than significant clustering. This indicates the need for a deliberate airport economy or ‘aerotropolis’ strategy.

The Airports that have become major centres of the regional economy typically are early beneficiaries of rail investment. Schiphol first gained a rail connection in 1979, immediately coming within a 60 minute commute of all four Randstad cities. It was also a priority for the high speed line in 2009, which has accelerated growth of a 2nd CBD nearby at Amsterdam-Zuid. This has combined with very deliberate land-use and management approach. Similarly, Copenhagen’s Kastrup Airport was a priority stop for the region’s first rapid rail line and became a hub for residents travelling from multiple directions. In both cases the airports are physically located near the gravitational centre of the region and are attractively located for workers seeking proximity and amenities.

The Regional Airport in Gauteng has some more similarities with Western Sydney Airport, in that it is situated in a part of the region where job creation and placemaking are major challenges. Ekurheleni has been linked in the 1st rail investment cycle, and in the 2nd cycle is one of the priority corridors for aerospace, logistics and housing development.

Functional Relationships with More Distant Locations

Regional transformation rail projects can promote functional relationships with more distant cities and remote settlements. Usually these long-distance links are not enabled in the 1st phase by an initial
regional line but become a priority as capacity for metropolitan growth is stretched and as other cities develop complementary economic roles and capabilities.

In the Randstad, the introduction of a high speed long distance rail line appears to have had more significant impacts on functional relationships with long-distance locations than with more proximal locations. The links to Paris and now to London are very promising. However the services between Amsterdam, Rotterdam and even nearby Antwerp have seen relatively modest passenger figures, around 50% of the numbers expected.

**Changed Regional Identity**

In the case of BART, and increasingly the case in Randstad rail and the Gautrain, the new infrastructure is building a cohesive regional identity. Increased local government and citizen awareness of interdependence and appetite to co-finance investment inspired other organisations and observatories to emerge to advocate well managed regional growth. Connective rail infrastructure plays a powerful cumulative role in this process.

**Placemaking and Innovation**

In all four cases, the introduction or transformation of a regional rail system has helped to foster increased interest in quality of place around stations. The civic debate about the importance of public space, design and inclusion has grown within 10 years of each system being completed or upgraded, as the trade-offs between different approaches have become clear. More broadly, there are signs that a regional rail system increases the desire of both districts and cities to innovate in terms of sustainability, vitality and future-proofing.

<table>
<thead>
<tr>
<th>What would the regions have done differently in hindsight?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>San Francisco /Bay Area</strong></td>
</tr>
<tr>
<td>Connected San Jose to BART from the start. This would have provided a circular system, connecting all the important locations to each other, and avoided the subsequent fragmentation.</td>
</tr>
<tr>
<td><strong>Gauteng</strong></td>
</tr>
<tr>
<td>Link up the southern corridor, the development corridor that has had greatest need for enhanced regional connectivity, in the 1st phase of the Gautrain. This would have pulled development south west rather than north east, and reduced some of the most urgent spatial imbalances in the region.</td>
</tr>
<tr>
<td><strong>Randstad</strong></td>
</tr>
<tr>
<td>Ensured better connections sooner between the four cities’ suburbs and the wider regional transport system, to improve pan-regional commuting and other flows.</td>
</tr>
<tr>
<td><strong>Øresund</strong></td>
</tr>
<tr>
<td>Created an enduring governance mechanism to sustain pan-regional co-operation and strategy, and reduce economic and political obstacles to integration. A long-delayed second tunnel connecting Helsingborg and Helsingør at the northern end of the region would have also created a larger and more dynamic labour market.</td>
</tr>
</tbody>
</table>

### 2.4 Political success of the Connected City Rail Projects

All four regions have seen their transformative rail projects experience political ups and downs, and changing citizen and media sentiment. Overall there have been three types of experience in these regions.
• Initial political and community opposition followed by a steady increase in confidence. Despite pockets of support for both projects, BART and the Gautrain were both mired in major opposition and controversy for the first 5-10 years of the project. This was due partly to cost overruns, and concerns about pricing, ridership and inclusiveness. However, over time their popularity has risen as more people in the region used and experienced the service, and the rate of public subsidy has decreased.

• Initial optimism followed by a decline in confidence and support. The Øresund project is one that experienced a backlash because the high expectations about levels of daily cross-border commuting came to be seen as unrealistic. This has been exacerbated by increasing competition rather than collaboration among the two sets of national departments and decision-makers. The imbalance of interests and motivations among different political actors across the region has resulted in a decline in momentum and urgency to deliver subsequent cycles of infrastructure in a systematic way. There have also been political challenges about how the rail link is used for border and immigration control. Nevertheless the ongoing effectiveness of the core infrastructure links, and in particular the link to the hub airport, ensure that the enhanced regional connectivity is widely welcomed and appreciated by residents.

• Stable consensus support interrupted by periods of dissatisfaction over poor cost management. The benefits of intercity rail are widely understood and endorsed by local governments and citizens in the Randstad, a product of close co-operation and long-term investment. However the controversies around mistakes made during the 2000s high speed rail project have reduced confidence and enthusiasm for additional high speed links and ambitions for a ‘Randstad loop’.

Among the factors that appear to shape the success of regional rail projects in political terms:
• A quick win that provides visible and routinely accessed benefits (e.g. faster airport access, improved amenities, high quality urban retail) within the agreed costs.
• Importance of business leadership, universities, civic advocacy and other sources of trusted independent evidence to ride out initial disappointments.
• The avoidance of high profile, strictly defined and time limited targets which become publically interpreted as a benchmark for the project’s success or failure.
• Strong branding that is integrated with the wider regional framework and is not seen to over-promise.

2.5 Financial performance

The financial performance of transformative multi-city rail projects varies significantly depending on route choices, project management, technology adoption, ticket prices, and timing in the economic cycle.
In the Øresund, demand was initially below forecasts but reached the forecasted trends within 7 years. Retrospective analysis has indicated that in its first decade the Øresund Bridge generated a consumer surplus of €2 billion, compared with a total construction cost of approximately €4 billion. Viewed over a 50 year period and based on a medium growth scenario the bridge, the internal rate of return has been calculated at around 9%, corresponding to a benefit-cost rate of 2.2, and well above 1 in pessimistic scenarios.\textsuperscript{12}

In the Randstad, the regular intercity rail services have performed well for several decades, with strong buy-in from local governments based on the Dutch consensus-based system. However the delivery of the high speed rail line between 2007 and 2012 was late and expensive. Costing over just €7bn, it was financed by a PPP involving Dutch Railways (NS), a mix of infrastructure and financial firms, and funds from gas exports, with the public sector owning the track and land surrounding it, and paying back the cost over a fixed time frame. Total private sector contributions totaled 14%.\textsuperscript{13} The major challenge has been achieving passenger numbers – the project over-estimated the perceived passenger benefits of an incremental improvement in travel time in an already dense system, and the willingness of passengers to pay a premium for a small time saving.\textsuperscript{14}

The BART project was initially beset by construction delays, operational problems and inflation in the 1970s. Passenger numbers were initially lower than expected and the project required more operating capital than anticipated. The deficit was bridged in 1974 by an emergency state-level sales tax which was made permanent when the fiscal position failed to improve sufficiently by the end of the decade.\textsuperscript{15} Subsequently access to federal support has improved and the system has received $330m received to date in capital grants to upgrade the system. BART has continued to experience occasional budget deficits amid its expansion to new suburbs and high maintenance costs, but with long-term improving ridership, today 83% of operating costs are covered by fare revenue and other revenue sources.

The Gautrain was conceived in a context where there was very little fiscal space within sovereign and sub-sovereign budgets to finance infrastructure. This made a PPP an attractive option, with the private sector to build and operate but not take demand risk. The project was financed by 44% central government transport department, 26% by the provincial government, 18% by provincial borrowing and 11% by private debt and equity. The complexity of the PPP and the lack of a common vision between Concessionaire and the Province have been key challenges. The public resources have been very substantial, with the Gautrain accounting for as much as a third of the entire national transport budget during the late 2000, and continuing to require large ongoing operating subsidies.

2.6 Future Outlook

The next cycle of development looks different in each of the four regions. The regions’ ambitions take at least four different forms:

**Adding to the network to make it more flexible and integrated**
- In Gauteng, the planned Gautrain Phase 2 looks to build upon the core line and develop sub-regional corridor infrastructure around the highest potential Gautrain stations. This 2\textsuperscript{nd} phase is partly in recognition that the single line does not offer enough flexibility or reach to shift the region away from car dependence and towards genuine polycentrism. Such a corridor approach would aim to intensify development within something like a core triangle of the province with the 3 largest cities at the points.

**Building links to more distant cities**
- In a region like Øresund, where the travel time gains to be made between Copenhagen and Malmö have been nearly exhausted, and where intra-metropolitan services are now quite
comprehensive, the next focus is now on building new functional linkages with larger cities within 2-5 hour travel time. The cities of Hamburg, Gothenburg and Oslo in particular form a long corridor (approximately the same length as Canberra to Coffs Harbour) that are making incremental steps to reduce the travel time to within 2.5-3 hours around the axis of Copenhagen-Malmö. With the support of local governments along the corridor, the project is designed ultimately to establish the corridor as a high-knowledge region with the scale (8-10 million people), profile and quality to compete with the best in Europe.

- The Randstad region is also prioritising its direct longer distance links to Brussels, Paris, London and Frankfurt. The region anticipates these links increasingly enable part-week commuters from around Europe. The viability of this commuter demographic depends substantially on the comfort, quality and internet connectivity provided by the rail system. Elsewhere, high speed links in California are also likely to improve linkages between the San Francisco region and the dynamic cities of Southern California (Los Angeles, San Diego).

**Corridor growth between connected cities**
- For the two largest cities in the Randstad region, Amsterdam to Rotterdam, the next cycle is to a large extent about how to build a complementary corridor strategy that sees Rotterdam absorb spillover from Amsterdam as the latter begins to reach its effective capacity (in terms of housing and business growth). In the longer term, there are ambitions to build an all encompassing ‘Randstad loop’ for the region, avoiding some of the delays that occur through intensive use of existing lines at the heart of the region. However this relies on a more joined up governance approach than currently exists.

**Extend the network to the main job centres**
- With the current housing crisis experienced in the Bay Area partly a reflection of the transport deficit in the southern part of the region, the next stage of the region’s system improvements will finally connect BART to the important centres of Silicon Valley and San Jose. This is prompting more joined up approaches between upcoming transport and land use, and greater cooperation among the local governments to locate future business expansion strategically rather than opportunistically.

**2.7 Key Insights for Sydney**

As is to be expected, in none of the four cases did the major projects achieve perfect and predictable outcomes. In most cases the project’s owners and planners have adjusted their expectations, altered their vision, and made different choices later on to reflect new circumstances. These experiences have produced a number of interesting learnings for Sydney.

**What seems to work?**

i. Make railway lines link to **places of work and places where homes are affordable** where either urban regeneration or urban expansion is already happening.

ii. Having a dual function of **inter-city connectivity and frequent in-city stops** whilst retaining increased speed to optimise both productivity benefits and place making impacts.

iii. Improving **connection reliability and quality** to make longer distance commuting by rail attractive. Rail links have greater effects when they are not only fast, but also frequent and all-day round. This creates a ‘guaranteed trip time’ and perception of reliability and convenience that is attractive to users contemplating other modes. On balance, the evidence from the four regions studied would suggest that maximum speed may be of less importance than frequency, efficiency, reliability, and journey quality of the system.

iv. A governance structure to implement a vision around **new stations and surrounding districts** over a minimum 10-15 year period is required. Development agencies or corporations
endowed with decision-making and project delivery responsibilities around land use, financing, transport planning, and maintenance are often key to activating development, and maintaining focus and commitment during uncertain periods.

v. Active public-sector intervention to lead transport-oriented development (TOD) and wider area based intensification around transport nodes. Therefore, actively seeking to create particular districts, including the Aerotropolis in Western Sydney, rather than leaving it to chance, is a good idea.

vi. Incremental cyclical expansion through multiple cycles. The system and development benefits of cyclical expansion over time seem to accumulate. Consideration of the sequencing of different phases and cycles to optimise uptake and benefits.

vii. Integration of new infrastructure with existing systems is key for flexibility and to optimise benefits.

What seems to not work?

i. Creating the railway line alone without other infrastructure and incentives to reduce car usage. This is especially the case if the new line is owned and managed separately to many other lines and operations in the region.

ii. Where a new railway line is not integrated from the point of view of interchanges, ticketing, and links the development benefits are reduced.

iii. Hoping development will take place around transport nodes simply because ‘it should’, is unlikely to result in optimisation of development potential. Sometimes the public sector and other might have to lead the process with concrete land-use actions.

What ways can Sydney optimise the outcomes and returns?

i. Note the overall positive experience of other regions that have developed regional rail as a means to manage growth and foster expanded spatial development capacity to overcome the limitations of historic land use patterns and geographic constraints. They have been able to adopt a new spatial development character.

ii. Take a 50 year view, underpinned by anticipated population growth, economic transition and social/environmental goals. Consider cycles/phases of rail expansion across the greater Sydney region to produce an integrated regional rail network. Prioritise schemes and elements of the system that have immediate benefits for growth management, housing supply and affordability, congestion reduction and labour productivity.

iii. Actively ‘brand’ the new infrastructure and places/locations in terms of lifestyle choice and sustainability, in order to overcome perceptions among traditional car users.

iv. Foster partnership and leadership with leaders in established and emerging sectors, and with anchor institutions, so that they play a responsible role vis-à-vis the region’s development, set up in locations conducive to public transport growth, and also help planners anticipate new preferences.

v. Introduce some elements of demand management for car usage such as road pricing, congestion charging, or tolls as feasible when the new rail capacity comes on stream.

vi. Target specific populations such as students, airport users, commuters, two job families, and demonstrate how the new services can help them, using incentives if necessary, and spread ridership throughout the time of the day.

How might Sydney anticipate the infrastructure, local and regional development outcomes?

i. It is very possible that the 1st cycle effects will be to contribute to increased agglomeration in core Sydney unless the routes chosen emphasise connections between locations elsewhere in the region. So, there is a need for phases that better serve the centre and connect the regions to be closely aligned.
ii. 2nd centres seem to be activated more successfully when they are located within a 30 minute journey time. Locations that are at a disadvantage in terms of current amenities, attractiveness and organisation are on many occasions catapulted above more established but more distant districts if travel times reliably fall beneath the 30 minute timeframe. In Greater Sydney achieving 30 minute connectivity between key locations would be a priority.

iii. When aspiring 2nd centres are 30-60 minutes distance, and train numbers are fewer than 6 per hour, it is more common for them play a commuting function for a long period of time, before developing their own economic agglomeration.

iv. Within Greater Sydney, the ‘Three City’ strategic vision should be developed in ways that enable foresight about future housing and labour market dynamics, as well as aviation, leisure and education related travel demand. This Three City strategy will then also offer important insights about demand phasing and the development of existing smaller towns and cities and their connectivity requirements.

v. Anticipating future enhanced connectivity between Newcastle, Sydney, Gosford, Wollongong and Canberra should be part of the current cycle of planning so that new increments of rail connectivity within Greater Sydney can help mitigate future costs or barriers for the larger rail projects that may come.
Case Studies

3.1 San Francisco Bay Area and the Bay Area Rapid Transit (BART) (San Francisco-Oakland-Silicon Valley-San Jose)

Sources: Michael Macor, The Chronicle; Wikimedia commons
Summary

The San Francisco Bay Area is the world’s leading technology region, and also a multi-city 7.5 million person metropolis that consists of at least three major centres of gravity (San Francisco, Oakland and San Jose), as well as the corridor of Silicon Valley and more than 80 small cities. Conceived when the region was home to just 4 million people, the San Francisco Bay Area Rapid Transit District (BART) was the first metropolitan rail infrastructure project in California.

BART was planned 50 years ago as a direct response to the region’s geographical constraints and rising car dependence. The project succeeded in connecting downtown San Francisco with commuting suburbs to the south and in the East Bay. But in the process, the region encountered challenges delivering high density transport oriented development around the outer BART stations. The planned activation of second and 3rd tier regional centres in the 1970s and 1980s did not generally materialise and in some cases constricted growth in those areas.

This case study highlights the long-term evolution of a regional scale infrastructure project and incremental adaptation of the system to create more capacity and provide more access to opportunity. BART has been successful at helping to activate the growth of San Francisco’s neighbouring city Oakland (15 kilometres away), which has become much more attractive to business, commuters and other residents. With the Bay Area’s population booming and its prominence in the internet age driving prices up, the early 2000s saw people and business seeking affordable homes outside of the traditional centres. 30 years on, transport oriented development has now taken off around many of the BART stations. The latest extensions to BART now see the route finally head south to connect Silicon Valley and San Jose with the rest of the Bay, creating a fully integrated network that will now also link into high speed long-distance rail.

### BART – Key Figures

- The 5th most extensive rapid rail network in the US with nearly 120 million journeys p.a.
- Carries 440,000 passengers each weekday.
- Average journey length: 22 kilometres.
- Connected the regional core of San Francisco with:
  - Oakland (15 kilometres) - 13 minutes travel time
  - Fremont (54 kilometres) – 47 minutes travel time
  - San Francisco International Airport (20 kilometres) – 27 minutes travel time
- Connections with San Jose (80 kilometres) and Silicon Valley (50-70 kilometres) eventually developed in the project’s 3rd phase

### Background and evolution

The BART system is the fifth largest rapid transit system in the United States. Opened in 1972 after decades of planning and a lengthy approval process, BART provided the San Francisco metropolitan region with over 120 kilometres of track, 33 stations, connecting 17 distinct communities. With track extensions and add-ons, BART now consists of 45 stations, over $15bn in transport infrastructure and handles well over 100 million journeys each year.
BART’s genesis can be traced to the economic boom after 1945. Rapid population growth (1.7 million in 1940 to nearly 2.7 million in 1950) and the car boom threatened San Francisco’s connectivity and viability as a business centre for the future. The business community wanted to maintain San Francisco’s hub status in an expanding regional economy. In the words of the commission charged with devising a transport solution at the time, “[i]f the Bay Area is to be preserved as a fine place to live and work, a regional rapid transit system is essential to prevent total dependence on automobiles and freeways.” In addition public antipathy to freeways, including the so-called freeway revolts of 1955, meant rapid rail was the city’s best hope of a transit system able to cope with the city’s growing fortunes.

BART was a scheme originally promoted by San Francisco’s business community, which saw the project as central to the vision of the city as the ‘Manhattan of the Pacific’. The economic case was pushed by the Bay Area Council comprised of some of the region’s leading financiers and industrialists. They helped move the original idea through each stage of authorisation by state and local governments. It suggested and implemented BART financing, publicised the concept as a campaign prior to the referendum, and upon BART’s completion, advertised San Francisco’s improved liveability to the rest of the business community.

The Bay Area Council, along with the San Francisco Chamber of Commerce and advocacy group SPUR were key supporters from the idea’s inception right the way through the more difficult periods of BART’s development. The business community collaborated effectively based on a shared commitment to develop Downtown San Francisco into a thriving destination without causing chronic congestion.

**Timeline of BART’s growth in ridership**

Of the local counties in the region, the central city was the most active promoter of BART. Of the three counties that eventually voted, San Francisco was the most in favour. However two of the five
interested counties, those lying to the North and South of San Francisco did not ultimately buy into the scheme: San Mateo County, on the grounds that BART would not benefit its residents sufficiently; and Marin County, because the financial burden of a four county BART (once San Mateo had exited the plan) was too great for its modest tax base to support. The plan eventually proposed, was, though still based on the original principles, a scaled back version, with routes within the borders of the three remaining councils. The upshot was that BART did not connect in an integrated loop around the Bay, and instead became the largest part of a fragmented regional transport system.

Given the entrenched culture of car dependency in the Bay Area, BART (as one of 28 transport agencies/operations in the region) was unable to play a significant short or medium-term role in shifting modal share in the region. But over the decades it has become more influential in shaping the pattern of urban development. BART is able to boast a record of consistent, albeit occasionally interrupted, ridership growth. Most of this traffic consists of commuting in and out of the CBD. In 2012 BART experienced its busiest ever day, carrying a record 568,061 riders, many of whom were celebrating Halloween and attending the San Francisco Giant’s baseball World Series victory parade.

In the early stages the regional media turned against the project when costs began to mount and initial ridership fell below expectations. Over time, however, opinion of BART shifted more positively:

“In San Francisco a wide range of citizens voted for the issue of BART and since then have benefited, from jobs at least.”
Frederick Yurt, Institute of Government Studies, 1974

“For many tourists, the [BART] system is the archetype of everything a modern urban rapid transit system should be, and a model for the great majority of large cities...BART seems a modern technological miracle...but the system has almost completely failed to end the typical Californian’s love affair with the car”
Peter Hall, 1981

“Thank God for BART; it does take the strain off. And now we know precisely how grateful we should be to the urban planners who pushed BART despite severe community opposition in many places.”
Jon Carroll, San Francisco Chronicle, 2013

**What was the spatial, land-use, development and economic rationale for the project?**

BART provides two core functions to the Bay Area:
1) a short-distance urban rail option within the large Bay Area cities thanks to its frequent stops;
2) intercity connectivity for commuters at the fringes of the Bay Area such as Dublin and Pittsburg, to provide capacity to transport people from more affordable neighbourhoods to the vibrant jobs markets in San Francisco and latterly Oakland.

San Francisco’s topography made the city reliant on bridges to connect with the north (Golden Gate Bridge) and eastern (Bay Bridge) centres. The Bay Bridge and Golden Gate Bridge both opened in the 1930s, but within a decade the region was experiencing a post-1945 housing boom which resulted in a growing demand for new ways to travel and had used up much of the bridges’ capacity. By the late 1940s it was already considered vital to better connect San Francisco’s CBD with its surrounds. The principal aim of the BART project was therefore to relieve traffic congestion, in particular on the Bay Bridge, the sole direct link between San Francisco, Oakland and other East Bay communities.
The city of San Francisco was amenable to public transport, because much of its initial population growth had occurred before mass car usage. The city operated the USA’s first municipal railway (opened in 1911) and an extensive trolleybus network. Initially the Key Route streetcar also connected San Francisco to the East Bay via the Bay Bridge. However the streetcar was then pulled up to make room for buses and cars, as happened throughout the United States, leaving the East Bay with no passenger rail system at the time BART was conceived.

Policy makers in the 1950s and 1960s also acknowledged the inevitability that suburbanisation would accelerate in future decades. Rather than allowing this process to expand haphazardly, it was intended that a hierarchical metropolis could be fashioned with San Francisco at the Bay Area’s core, orbited by the largest ‘secondary’ centres including Oakland and San Jose, in turn surrounded by satellite sub-centres such as Berkeley, and all interconnected by a mass transit skeleton, spearheaded by the BART. In effect BART was intended to support the region’s evolution from a 1 CBD to a 3 CBD region, with strong parallels with the Greater Sydney vision.

The intention was for BART’s stations (situated 3 kilometres apart in the suburbs) to catalyse the development of suburban residential hubs and the larger urban centres – each with their own specialisations - and in doing so the Bay Area would avoid Los Angeles-style sprawl (Los Angeles had its own vision of “suburban hubs” which relied on the freeway network to connect them). Part of the case was that BART would catalyse redevelopment in the more established industrial parts of the metropolitan area – like Oakland – by improving those areas’ connectivity with the rest of the Bay Area.27

How was the project managed, assembled, delivered and financed?

The BART involved an innovative financial mechanism - the issue of a bond secured against future taxes from the three local Counties comprising the BART District. Federal funding for transport projects, though available for freeways, was not (yet) available for rail. Being long before PPP, local public funding was the only way to finance BART. State law prescribed that 60% voter approval (specially reduced from 66% when BART’s approval looked uncertain) was needed before the authorities could issue a BART bond.

Under the financial package narrowly passed by the electorate, the BART District was granted a taxing power of 5 cents per $100 of local taxation that supported the issue of a $792m bond to finance the initial build and operation costs. The package also included authority to levy property taxes to support a general obligation bond issue, if approved by District voters.
The additional cost of the Transbay Tube - estimated at $133m - was to come from bonds issued by the California Toll Bridge Authority and secured by future Bay Area Bridge revenues.

The extra cost of rolling stock was to be funded primarily from bonds issued against future operating revenues. The total cost of the system was at the time the largest single public works project ever undertaken in the U.S. and paid for by the local taxpayer.²⁸

Construction delays, operational problems and inflation in the 1970s meant passenger numbers were initially lower than expected and the project required more operating capital than anticipated. The deficit was bridged in 1974 by an emergency state-level sales tax which was made permanent when the fiscal position failed to improve sufficiently by the end of the decade.²⁹

Although at the time of the bond issue no federal support was available for rapid rail, Washington’s stance on this changed during the lifetime of the project. The $330m received to date in federal capital grants have made an important contribution to upgrading the system from original plans. (If BART had been built in the 1990s and 2000s, it is likely that at least 50-60% of its capital costs could have been federally funded under the U.S. Urban Mass Transportation Assistance Act of 1974.)³⁰

What have been the key phases of the BART project’s evolution and additional regional infrastructure?

BART’s regional rail infrastructure has evolved through three phases in San Francisco, each of which has influenced but also responded to the wider economic geography of the region, which has experienced several unexpected shifts.

1st phase: a long-distance commuter line serving CBD growth

As BART enabled more workers to travel to the region’s core, San Francisco CBD, which had long been the region’s Downtown, became an even more dominant central commercial hub than initially forecast in the 1970s and 1980s. The uniform pattern of sub-centres that was anticipated did not exactly materialise as imagined, and only a small number of sub-centres experienced significant growth.
This model had advantages in terms of providing concentrated access to a wide range of high-skill and mid-skill jobs. The increased densities in Downtown made it more walkable, more people commuted by public transport, and the high concentration increased business interaction. However the fairly single-use CBD lacked vibrancy in the evenings, and was vulnerable to downturns in the real estate market. The monocentric regional model also fostered inefficient one-way use of infrastructure and increased commuting distances.

BART’s 3 phases of evolution

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2nd phase (1990-2008): The emergence of a new suburban economic corridor unconnected to main rail system

In the late 1980s and into the 1990s, a corridor 50 kilometres south west of San Francisco known as Silicon Valley began to attract IT jobs and investment on a much larger scale. A 30 kilometre corridor of suburban high tech campuses rapidly emerged, stretching from San Jose in the east to Palo Alto in the west. The Silicon Valley cluster did not concentrate within a traditional CBD or near transit, but instead spread out in a chain along key junctions along the highway corridor.

The ability of the Bay Area to shift towards TOD was hampered by the decision of several of the largest corporations in the Valley not to locate their headquarters near transit. Among them include Apple, which has built a new campus with 11,000 parking spaces serving 14,000 employees, in Cupertino, more than 5 kilometres from the nearest rail station.

With the rise of suburban office parks across Silicon Valley, San Francisco witnessed the phenomenon of ‘reverse commuting’ to Silicon Valley’s these campuses via shuttle buses and personal vehicles since the early 2000s.31 Shuttles have proven highly popular among tech employees - just one company, biotech firm Genentech, had 38 shuttle buses serving 27 commuter routes by 2015.32 However, shuttles have exacerbated the jobs-housing imbalance in the region by enabling individuals to live further from work.33

Comparison of transit and shuttle times to four major Bay Area firms from popular regional locations34
The phenomenon of reverse commuting contributed to Downtown San Francisco’s share of metropolitan jobs falling to below 10% by 2008. This dispersion of office development has also been caused by the City of San Francisco’s ‘Proposition M’, which has limited the rate of office construction authorised since the mid-1980s to ensure more housing is built. More recently, with house prices rising exponentially, plans have aimed to respond to the renewed desire for downtown living, increase the supply of housing and focus new office growth south into the Downtown ‘South of Market’ district, called SOMA. Gradually the tensions have grown about whether to retain Downtown as primarily office development or permit more mixed-use residential and entertainment uses to increase vibrancy and partly combat urban sprawl. This choice has been framed as one between a ‘Central Business District’ or a larger ‘Central Social District.’

To some degree Caltrain, a separate diesel powered rail system connecting San Francisco to San Jose via San Mateo County, has helped to serve some of Silicon Valley’s growth. But Caltrain has served a narrow market and has a limited off-peak service. But the rapid growth in jobs, uncoordinated land uses, and the underinvestment in transit has stretched the corridor’s transportation network beyond capacity. BART is still by far the region’s largest rail system, both in kilometres and riders. But its linkages with the Caltrain are not synchronised in terms of departure times, and they are also physically inconvenient and require passengers to pay a separate fare.
Other externalities emerged in the new model. Car dependence grew and the metropolitan area saw the highest amount of long-distance commuting in the United States.\textsuperscript{39} It also ranked 2\textsuperscript{nd} in the U.S. for yearly hours of delay per car commuter due to congestion. Meanwhile the city of San Jose, one of the three main cities in the region and not connected to the BART, experienced rapid car-based expansion and lost its status as a walkable centre of commerce.

3\textsuperscript{rd} phase (2008–2020): BART expansion, the re-urbanisation of business and the revival of San Jose

In the last decade, technology firms have started to migrate to Downtown San Francisco and surrounding districts, trading office parks for converted industrial warehouses and Class A office buildings near existing mixed-use areas. Employee preferences have increasingly turned against the unattractive sprawling Silicon Valley built environment, and towards the more vibrant main urban centres of San Francisco, Oakland and San Jose. Google, Twitter, Yelp, Uber, Airbnb, Dropbox, and others are either located or have signed agreements to occupy space in SOMA. Around 80% of recent office demand has been driven by technology companies.\textsuperscript{40}

The rapid surge in demand for San Francisco has in some ways altered the purpose and identity of BART. The system has found that it is serving as much as four times as many people than anticipated, with more commuters taking short-haul trips although the average journey distance remains high at over 22 kilometres. BART decided to remove seats on some trains because of the rising peak-time demand. The demand for express travel to San Francisco has increased, but the single track system intended to serve a more polycentric regional economy cannot accommodate this option. At the same time, BART’s major bottle neck is at the Transbay Tunnel which connects San Francisco with Oakland.\textsuperscript{41} Planning for a second bay crossing is underway with several options mooted.
In this phase, San Francisco’s economy has become more specialised and many financial, manufacturing and distribution firms have moved out of the core city.\(^4\) To some degree East Bay locations have benefited from this relocation, as non-tech firms have moved in significant numbers to Oakland but also Pleasant Hill, Dublin, Fremont, and other secondary locations.

Other centres are also beginning to benefit from the overspill from tenants looking to avoid high rentals. Downtown San Jose in particular is beginning to re-establish its credentials for mixed-use and quality placemaking.\(^4\) Google announced in 2017 that it is looking to build a 1 million sq ft campus next to the Diridon station in San Jose, which is where BART, VTA Light Rail, Caltrain, and ultimately High Speed Rail will connect. This suggests that major businesses are now recognising their own impact on the region and the importance of allying with public transport, placemaking and connectivity.

Population growth in the Bay Area’s three largest cities\(^4\)

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Box: The risks of not linking up a distant primary city – San Jose

San Jose was not linked to BART because the project was opposed by the two local governments through which the line passed. Its population has grown faster than other cities since BART was built, and its pro-growth and land annexation policies have seen it accommodate a lot of the region’s recent immigration, especially from Asia.

The city was located at the fringes of Silicon Valley and for the last 40 years most residents have commuted out to jobs in the Valley ‘suburbs’. Without any substantive planning intervention, this led to serious congestion, spatial imbalances, and a diminished tax base. The County tried to grow its light rail system and multi-modal transport in the 1970s and 1980s, but major motorway investments at the same time allowed travellers to bypass the city, and local train speeds were too slow to be competitive.

Efforts to redevelop downtown and establish a centre of gravity in San Jose for the South of the Bay Area have been hampered by low densities, height restrictions, and competition from outlying local governments for investment. It was not until the 1990s that the city began to develop its own identity, attract its first major corporate HQ downtown (Adobe in 1995), and rebuild its reputation for quality of life and diversity.
45 years after BART’s arrival in the region, San Jose is finally being connected to the system and using it as a platform for mixed-use and quality placemaking. Its Diridon Station is emerging as one of the key transport hubs in the region, where BART, plus VTA Light Rail, Caltrain, and ultimately High Speed Rail will connect. More than $10 billion of investment is remaking the Station. It is anticipated that the line will provide opportunities for workers throughout the Central Valley to access jobs in Silicon Valley and San Jose, while it will also make it easier to electrify the Caltrain line from San Jose to San Francisco because it will run on the same tracks. The infrastructure is catalysing much higher density land uses, and is re-establishing San Jose as a key gateway to the region. Google announced in 2017 that it is looking to build a 1 million sq ft campus next to the station.

San Jose’s experience shows that large population centres in a region may continue to grow even if they become relatively less well connected, if their land use policies are not co-ordinated with the needs of the region. However their growth may contribute to additional sprawl, car dependence, and the share of higher value economic activity they host may decline. In hindsight, San Jose illustrates the importance of ensuring larger cities are not ‘left behind’ by new rail infrastructure.

What have been the project’s main impacts on spatial and economic development in the Bay Area?

BART was designed in the 1960s, when the Bay Area population was under 4 million people. As of 2016, the Bay Area population is over 7.5 million and will be 9.3 million by 2040. Since 2010, Bay Area employment has grown at double the rate of other US metros - 3.2% annually. This growth has created congestion that BART alone has been unable to withstand, but the project has had important impacts on regional development.

- **Supporting the growth of the main regional business district - San Francisco.** BART helped preserve the pre-eminence of downtown San Francisco as a regional economic centre during the 1980s when downtowns of major cities in similar metropolises experienced significant losses in employment. Between 1980 and 1990 alone, San Francisco recorded a rise from 50 workers per acre to 65. One of BART’s central achievements is, despite the continued rise in car use, that the network’s commuter capacity has contributed to San Francisco maintaining functional levels of road traffic.

Today, more than 65% of all BART trips begin and end on Market Street, the main thoroughfare of San Francisco. San Francisco CBD remains the pre-eminent business hub of the Bay area, and, within a number of sectors, the Pacific seaboard. Its development success as the centre of the rail system is attributed to its confined space, a strong real estate office market, and high floor area ratios. By expanding employers’ labour pool access by 10-15%, BART’s commuter platform continues to drive economic activity to the core city. Square, Airbnb, and Dropbox are all now headquartered in the city partly because of BART. Conversely nearby Mission Bay lost out on Salesforce’s tenancy due to its relative distance from commuter transit.

- **Facilitating densification in the larger urban centres.** BART’s impact has been important in serving the area’s main urban nodes. Although some of its impact was not especially visible during the car-centric era of the 1970s and 1980s, as commuter distances grew inexorably, BART’s effect in slowing the rate of sprawl and of densifying employment in key sub-centres
have become clearer since. The larger city of Oakland doubled its office space between 1979 and 1993 thanks to the regional access provided by BART.\(^{52}\)

A recent study by the Bay Area Council explored the rate of development and argues that even more large-scale densification around key centres has only been curtailed by institutional constraints on construction.\(^ {53}\)

| \textbf{For Oakland,} traditionally seen as San Francisco’s poorer neighbour, BART’s reduction of travel time to an average of just 13 minutes has brought clear benefits, although they did not come quickly. \hfill |
|\hline
| During BART’s first 10 years, virtually no new development took place around downtown Oakland’s three BART stations. It took until the construction of Oakland City Center in the 1980s to catalyse the area. The development, spearheaded by the Oakland Redevelopment Agency is linked to the 12th Street BART station. The ORA provided significant support to the development including land assembly, tax increment financing of public infrastructure, securing federal urban renewal grants, subordination of loans, and equity participation in some of the development’s assets.\(^ {54}\) |
| In the 2\(^{nd}\) and 3\(^{rd}\) cycles of BART, public and private investment sparked a renaissance in Oakland, backed by city leadership. A deliberate attempt was made in 1999 to add 10,000 residents to Downtown Oakland to bring the city centre to life. Empty buildings have been renovated, cultural venues and amenities have multiplied, and more jobs have located Downtown. In the last decade, corporates attracted by comparatively lower rents and Bay Area connectivity have moved part or all of their operations to Oakland: they include Uber, the Sierra Club, CoreLogic, and Lennar Multifamily. Attracting Uber’s 400,000 sq ft ‘2\(^{nd}\) headquarters’ to a location near to 19th Street BART Station is an important indication of the confidence in Oakland. This trend demonstrates BART’s effect of not only enabling people in Oakland to commute into the San Francisco CBD, but also creating an environment in Oakland that is attractive to prestigious tenants.\(^ {55}\) The challenge for Oakland has been to achieve a critical mass of new commercial and residential development to accommodate growth affordably, as the city’s boom periods have tended to occur just before recessions which have set its progress back.\(^ {56}\) |

- \textbf{Eventually supporting business growth in the smaller suburban centres.} In the 2\(^{nd}\) and 3\(^{rd}\) cycles BART has been particularly successful in spurring the development of suburban areas, notably in the East - particularly the suburbs of Contra Costa County – which are now acknowledged as among the biggest beneficiaries of BART.\(^ {57}\) During the 1980s and 1990s BART helped serve the growth of office space around suburban stations where land use policies were conducive, especially Concord, Pleasant Hill, and Walnut Creek. The rising costs of traffic and housing have seen more demand for multi-family housing around suburban stations, especially for young professionals. Policies of incremental infrastructure investment, in tandem with local communities, have been successful, reducing the need for costly up-front public investments.
By increasing access to San Francisco International Airport in Phase Two, and to West Dublin/Pleasanton and Oakland International Airport in Phase Three, BART has successfully increased the amount of employment as well as the number of households located within close proximity to a BART station.\textsuperscript{58}

### The delayed catalytic impact of BART on suburban development

In the first two decades of BART, the project’s influence on land use change in the Alameda and Contra Costa Counties to the east of the core city was limited and sporadic.

- In Alameda County, proximity to a BART station had an inverse effect on the chances of that a vacant site being developed into residential or commercial site, while industrial development rates remained unchanged. Areas near a BART station increased the likelihood that a site would be redeveloped to commercial or industrial use, but not residential use.
- In Contra Costa County, the closer a vacant site was to a BART station, the less likely it was to be developed for any use. Proximity to a BART station also had very limited effect on redevelopment.

By the end of the 2\textsuperscript{nd} cycle, the effects on development in the Eastern Counties had become more visible, with property values rising 15\% around BART stations compared to less connected homes.\textsuperscript{59}

The main reasons attributed to the fact that many suburban station locations failed to experience high levels of commercial and/or residential development have been:

1. the stations were surrounded by parking lots for commuters
2. local resident associations repeatedly objected to dense development
3. a lack of commercial demand in the immediate station surrounds.\textsuperscript{60}

### BART’s leadership role in shaping sub-centre development

BART has come to play an important role in expanding capacity in second and third regional centres and in informing local policymakers’ ‘smart-growth’ strategies. These include Housing Incentive Production and Transportation for Liveable Communities, around BART stations to counter the inertia of the ‘build-it-and-they-will-come’ approach of the previous decades.\textsuperscript{61} Increased levels of development are now taking place around suburban stations that previously saw limited development activity.\textsuperscript{62} As a result 67\% of Class A office inventory in Alameda County and 32\% in Contra Costa County – is located within a half mile of BART station.\textsuperscript{63} Demographic changes (more childless households) and rising car ownership costs are expected to increase BART use in the medium term, notwithstanding the new alternatives to car ownership in the form of Uber and Lyft.

“We are trying to create a transit-based lifestyle,” he said, “and promote a new sense of life and community around our stations. That, in turn, generates a greater sense of security for riders and residents alike. Stations become active and vibrant around the clock.”\textsuperscript{64}

John Rennels, Principal Property Development Officer, BART

In the last decade, BART has become much more active at leveraging its land assets for development. The agency has successfully made the case that housing values benefit from proximity to BART in the range of 10-15\%. Between 2006 and 2017 BART and its developer partners have completed eleven TOD projects with well over 2,000 housing units and significant office and retail space built at a cost
of $460 million. These projects include Fruitvale Village in Oakland, and projects at Hayward, Castro Valley, Union City, Dublin and Pleasant Hill stations.\textsuperscript{55} The projects contribute to an increased non-park and ride modal share of access to BART, rising from 66\% to 73\% since 2008.\textsuperscript{66}

### Examples of polycentric commercial development enabled by BART

Many nodes in the Bay Area have successfully leveraged their improved connectivity in the region to achieve economic development.

Walnut Creek transformed into a commercial centre once connected with the rest of the region. The city, on the north-eastern spur of BART, is continuing to expand with a transit village adjacent to the station with a project for 596 residential units and 22,000 square feet of commercial space.

The Contra Costa Centre Transit Village is another prime example of the benefits of the link between BART and business. The Transit Village has 85 corporate tenants companies totalling 6,000 employees immediately adjacent to the BART station.

Among the more central locations to have thrived because of proximity to the BART network include Mid-Market, a formerly deprived neighbourhood in the City of San Francisco. BART has been a catalyst for Twitter, Uber, payments company Square, dating service Zoosk, customer support company Zendesk, and tech co-working spaces to establish themselves in this district.\textsuperscript{67}

A further 16 projects have been approved or in negotiations, leveraging private investment of well over $1 billion, highlighting the pace and scale of BART’s TOD projects. Development is planned at stations in Millbrae, Daly City and San Francisco on the west to the East Bay cities of Richmond, El Cerrito, Walnut Creek, Oakland and the new Warm Springs station in south Fremont, scheduled to open later this year. Cumulatively, these projects will add 4,000 new housing units and over 1 million square feet of office space.\textsuperscript{68}

Although BART has had much more success with TOD, a number of obstacles persist, including:
- the high cost of parking replacement.
- the loss of the ability of cities to fund projects through redevelopment since 2012.
- high construction costs which makes projects much less profitable outside San Francisco.

Nevertheless demand for TOD – by both the market and cities – is stronger than ever, as evidenced by approval of a 24 story residential tower at the MacArthur BART station in Oakland in 2017.

### Lessons for Sydney

- BART was the catalytic project designed to support the Bay Area region’s evolution from a 1 CBD to a 3 CBD (1+2) region. Its legacies are infrastructural but it has also helped build the identity of the Bay Area as one region, increasing local government and citizen awareness of interdependence and appetite to co-finance investment. It has strong parallels with the vision for Greater Sydney.

- Linking Parramatta via a 15 minute journey to Sydney may not yield instant results in terms of activating it as a genuine 2\(^{nd}\) CBD (see Oakland), but it will provide the long-term basis for its dynamic growth, if placemaking conducive to the growth of knowledge-based, creative and innovative firms and workers is prioritised.
• The initial rail transport may boost carrying capacity to and from jobs in Sydney, unless other actions are simultaneously taken to boost connectivity between the other key nodes in the region. Where the railway line links to places of work and places where homes are affordable and urban regeneration is in train, this does help build opportunities to grow more adaptably in future.

• Creating the railway line alone does not reduce car usage in a car dependent region. However it does expand the number of options for reaching the CBD, the Airport and other 2nd centres. In a region like Sydney which also inherits a dispersed geography, a line may be more likely to have transformative effects where it can outcompete car travel times and by providing greater choice and flexibility.

• Local land use policy and public investments need to be supportive if suburban stations >30 minutes away from core Sydney are to achieve their development potential. Public sector and public landowner leadership may be necessary to achieve the critical mass of commercial and residential development required.

• An airport extension is no guarantee to act as a major catalyst for business attraction and growth without deliberate approach to land-use, development and business engagement.

• The system and development benefits of cyclical expansion of the system over time seem to accumulate.
3.2 Greater Copenhagen /Øresund (Copenhagen-Malmö)
Summary

The Øresund region is an example of a dual-city region that has pursued an infrastructure-led approach to integration over the past 20 years, and is now entering its third cycle of evolution and adjustment in response to the first catalyst.

In the years after the opening of the Øresund Bridge that connected the larger city of Copenhagen with the smaller city of Malmö by road and rail, there was concern that the connection was operating to the exclusive benefit of Copenhagen. The early evidence suggested that Malmö residents were using the link to commute and access jobs in Copenhagen, while many Copenhagen residents relocated to access the cheap housing of their smaller neighbour.

However in the 2nd cycle, activated by a rail connection to Malmö’s city centre, Malmö’s increased profile, urban quality and land availability saw its offer gain recognition from around the region and beyond for its good quality housing, public services and grow-on space for innovation firms. Over the last decade, Malmö has specialised and emerged in many respects as the ‘innovation district of Copenhagen’.

At the same time the rail infrastructure has seen Malmö’s wider side of the region (Skane) come together with greater ambition and purposefulness and work properly as its own region as well. As it enters a 3rd cycle, when direct policy support for the region has waned, the Øresund has functionally emerged into a dual metropolitan system with strong interdependencies and an increased presence on the global stage.

This case study offers an important lesson for Sydney about the effects of improved links to smaller cities. Investment to connect with Newcastle or Wollongong, for example, is unlikely over the long term to result only in agglomeration in Sydney, but will see a more complementary system. Malmö’s experience suggests that over time business, visitors and other customers become interested in a smaller city in a big region because their improved connectivity and profile reveal under-recognised assets such as access to strategic land, attractive costs, improved placemaking, and a vibrant consumption economy. Often small cities rely on higher tiers of government to ride out an initially disappointing cycle and sequence the next item of infrastructure.

This case study also suggests lessons about the impact a major transport link can have on fostering:

- Better managed polycentric growth in the individual metropolitan areas
- Governance and organisational dividend within the metropolitan areas even when higher tier government support dwindles.
- More of an outward looking and open mindset among the constituent cities, and a desire to lead on issues of global importance.

Background and evolution

The Øresund Region has a population of nearly 4 million, comprised largely of Copenhagen (the largest city in Denmark) and Malmö (the third largest city in Sweden). It is probably Europe’s foremost example of two cities building a cross-border collaboration based on connective infrastructure. The region is among the 20 largest in Europe, and has long possessed distinct science, technology advantages, with global specialisms in life sciences, IT and the green economy.

The idea for a bridge over the Øresund to link Copenhagen and Malmö was first put forward as early as 1936 by a consortium of engineering firms proposing a national motorway network for Denmark.
Picked up again post-war in the 1950s and 60s, disagreement existed over whether the link should be at the narrowest point of Øresund at Helsingør-Helsingborg, further north of Copenhagen, or form a more direct link between the two largest cities. There was further deliberation over the form of the bridge, with a 1973 agreement projecting it as a motorway bridge. The concept faded once more due to the energy and economy crisis, Denmark’s decision to join the EC, and increasing environmental awareness.

A shared imperative for regional integration

Momentum to build the Bridge grew again in the 1980s, when Malmö was one of the European cities most heavily affected by de-industrialisation. By 1994 the city had a budget deficit of one billion SEK (approx. AUD 160 million), and its entire base of heavy industry (shipyards, textiles) had disappeared. 30% of the city’s workforce had lost their jobs, and population fell to a century low, compelling its city leaders to find a new set of economic roles and spatial approach. Meanwhile Copenhagen had established itself as a centre for professional services, but was also struggling with a tight labour force and high business costs. It was also seen as economically cut off from the rest of the country.

In these challenging circumstances, a stronger link between the two cities was seen to allow for a complementary alignment of the goals of both cities. Ultimately, leaders in both Copenhagen and Malmö saw an infrastructure link between them as a means achieving borrowed scale and international competitiveness to put the region on the map among the largest most advanced regions of Northern Europe and North America. Connecting the two cities also offered the prospect of a clearer shared economic identity and greater specialisation and complementarity.

These imperatives contributed to the bridge being reconsidered in the early 1980s, with the formation of an Øresund delegation (OD), which investigated a variety of options for the fixed link connection. The OD decided the project should be assessed principally on commercial viability, which played a significant role in the final product. The Øresund Link did not have a full socio-economic cost-benefit project appraisal, as is usual for infrastructure investments in Sweden. The assessment focused solely on economic profitability, toll fees and therefore traffic volume became the ultimate criteria. It was this same commercial viability appraisal that favoured the link having both road traffic and a railway system (Falkemark 1999).

National policy was a key enabler of the Øresund project. In Denmark, planning policy in the 1990s, placing a strong emphasis on spatial restructuring through urban competitiveness with a European orientation. This saw a shift away from the notion of a ‘fixed link to the continent’ toward the ideas of regional development. Meanwhile planning for Malmö had since the 1960s promoted decentralisation of the city. They aimed to create a multi-centred city by dispersing service functions and retail to different parts.

The Øresund Bridge was finally inaugurated in 2000. It comprised a two-track rail and four-lane road bridge-tunnel, the longest of its kind in Europe. It also incorporates a data cable, meaning that the bridge is the main facilitator of Internet data transmission between central Europe and Sweden/Finland.

The impacts of this link were significant. While in the aftermath of industrial change, the region had the challenge of an ageing workforce and intensifying international competition in its key industries, through the combined resources of its two main urban centres, it has achieved the scale, specialisation and flexibility to become one of Europe’s leading 20 regions.
What was the spatial, land-use, development and economic rationale for the project?

There were primary motivations highlighted for initiating this catalytic regional project:

- **To improve northern European transport links:** Sweden’s lack of physical connectivity to the European market, and limited links across wider region stretching from Hamburg to Oslo were concerns at the time. The Bridge would connect the road and rail networks of the Scandinavian Peninsula with those in Central and Western Europe. It would allow the international European route E20 to cross via road, and the Øresund Line via railway. And it would offer an alternative to the unreliable ferry-based service in place at the time. By unlocking the link to core Europe the project offered a once-in-a-generation opportunity for business growth.

- **To generate development to address the region’s position within a rapidly globalising economy and assist Sweden’s application for membership of the European Community:** Sweden’s focus on European integration meant a growing interest in the Link to facilitate the movement of goods and labour. The Link was one prioritised as an infrastructure project under the EC Trans European Network programme. Denmark, being part of continental Europe, could act as a gateway to Sweden and Finland in the north. This would also allow the Øresund region to play a part in increasing trade with the new northeastern European markets.

- **To connect the region’s two largest cities, whose economic issues were complementary:** Policymakers and scholars had long identified a lack of integration between the Swedish and Danish economies. However, it was clear that Copenhagen’s labour shortages in certain sectors could complement Malmö’s unemployment issues. Bringing together Copenhagen and Malmö markets would facilitate a common housing and labour market, while increasing commercial and educational opportunities.

- **To Improve access to Kastrup international airport** and enable it to play a hub role for Scandinavia, attracting users from Sweden more used to travelling via other airports.

How was the project managed, assembled, delivered and financed?

The Link is owned by the Swedish and Danish states through a public enterprise, the Øresund Bridge Consortium (Øresundbro Konsortiet). This is a 50-50 venture between the two governments to design, build, finance and operate it. The Consortium raised construction capital by borrowing on the national and international credit markets, with the two governments acting as guarantors. The Consortium is responsible for the coast-to-coast section of the link while the two states act as guarantors through two subsidiary companies: Svedab, and A/S Øresundsforbindelsen.

The connective infrastructure on both sides of the region was also financed by the subsidiaries. As the Swedish and Danish states act as guarantors for the loans, the credit ranking of the Consortium is effectively the same as that of the two states, ensuring advantageous deals for the loans.75

The primary financing mechanism has been revenue gained through user fees on the coast-to-coast section, with two-thirds of total revenue generated by road traffic users. The national railway agencies of each country pay the remaining third as fixed fees to use the tracks. When the loan for the coast-to-coast section is repaid (around SEK 20 billion), the revenue will go towards repaying the debt for the connecting infrastructure. In 2017, profits before value adjustment rose by more than 10% to DKK 1 billion (AUD 200 million) due to increased revenue from road traffic and lower interest expenses. Railway usage has been stable at around 11 million passengers per year since 2012, and revenue from rail is only about 40% as much as from road. All loans for the project are expected to be repaid in full by 2034, sooner than previously expected.76
How has the infrastructure to support regional integration been phased?

1. **1st Phase 1995-2008**
   - Main infrastructure development: Oresund Bridge and Rail Link between Copenhagen and Malmö plus 4 stations
   - Effects on spatial and economic development: Big rise in commuting from Sweden to the larger city of Copenhagen
   - Unexpected or adverse changes: Challenges activating the key station areas between the two cities despite planning

2. **2nd Phase 2009-2015**
   - Main infrastructure development: Malmo City Tunnel to speed link further
   - Effects on spatial and economic development: Metro and sub-regional rail development in both cities
   - Unexpected or adverse changes: Malmö rises as popular business location, employment growth
   - Alignment of planning becomes more challenging
   - National support (esp Denmark) declines for integration.

3. **3rd Phase 2016-2025**
   - Main infrastructure development: Fehmarn belt fixed link to connect Hamburg
   - Effects on spatial and economic development: Expansion and modernisation of the railway and motorway networks
   - Unexpected or adverse changes: More long distance links with wider region.
   - Growth of wider number of districts on both sides

The sequencing of infrastructure in the Øresund has facilitated the ongoing growth, expansion and competitiveness of the region on both sides. The first phase consisted of the rail and road link, and resulted in an immediate rise in commuting from the Swedish side, where jobs were scarce and less well paid, to the larger city of Copenhagen. Malmö’s cheap property prices also attracted Swedish employees to relocate.

Around 2007, just before the City Tunnel came online that provided faster access from the bridge to the city centre of Malmö, the city began to experience increased demand from companies, investors, talent and visitors. This was partly as a result of increased recognition of Malmö’s distinct offer within a high performing European region, and its own urban fabric that had benefited from significant investment since 2000 as part of a devolved package for the Skane region.

In the most recent phase, major metropolitan infrastructure has been completed in both Copenhagen and Malmö that allows both cities to accommodate population growth, relocate assets and optimise land use. In this phase the international macro-dimensions of the region are being developed by fast rail and further tunnels, that will soon bring Hamburg and Gothenburg into the region’s functional orbit.
Project Impacts

How have decisions made affected subsequent spatial and economic development? Have new sources of infrastructure demand arisen? And new projects gained momentum?

The immediate practical effect of the Oresund Link was huge: travel times across the strait went from an hour-long ferry journey to 10 minutes via train or car. During rush hour in the mornings and evenings, six trains now run per hour between the two cities. The number of travellers crossing over the bridge doubled over 15 years to about 70,000 per day. Malmö residents that previously relied on regional services to fly out of Stockholm can now reach Copenhagen Airport in a 35-minute drive. This airport provides a faster, more direct service to a greater variety of destinations.

The Bridge link had an immediate impact in reducing unemployment on the Swedish side and boosting Copenhagen’s labour market. The net effects have been very positive in pure aggregate growth terms, with the region outperforming many of its peers in the 15 years since the link came online.

Economic performance in Malmö-Copenhagen since the Øresund bridge opened in 2000 (Source: LSE Cities)

Impact on relationship between Copenhagen and Malmo

The rise in cross-border flows in the mid-2000s was due to Danes buying homes in Malmö to take advantages of lower house prices and commuting into Copenhagen. Large house price differences between Malmö and Copenhagen remained a major driver in the bridge’s first 5-10 years.

The first cycle also saw Swedish workers drawn to Copenhagen, with many unemployed young people in Malmö gaining their first job in Copenhagen in various service industries. This was particularly pronounced around 2005 due to the great shortage of labour in Copenhagen and high unemployment in Scania. Danish jobs were also more attractive because the wage levels in Denmark were significantly higher than in Sweden.

Industry capitalised on Malmö’s cheaper land, often locating offices in Copenhagen but having storage and distribution facilities in the former. Shifting operations to the other side benefited those that
previously had little capacity to expand in Copenhagen. At this stage, many international tourists stayed in Malmö when, for example, visiting for conferences in Copenhagen due to the convenience and price difference (e.g. COP15).

Second cycle changes

Over the second cycle, Malmö was ‘discovered’ by Copenhagen residents for its natural scenery and its retail opportunities. This has resulted in more trips from Copenhagen to Malmö. Predictably, Malmö’s property values have subsequently increased, outpacing those in the rest of Sweden by nearly 20% between 1999 and 2006.77 By 2013, the price per square metre for a single-family home in the Malmö area was almost at the same level as in the Copenhagen Capital Region.

Most significantly, Malmö has become a popular business location as a result of the bridge, with growing numbers of regional and functional headquarters, development agencies and international venues. The establishment of new offices in Malmö formed a critical mass in the labour market, with the majority of talent now living and working within the city rather than commuting to Copenhagen. Between 2000 and 2009, employment in Malmö for basic services grew at a 7% higher rate than Stockholm, and 14% higher for advanced services. The rate of growth of new jobs in the region between 2000 and 2009, in fact, exceeded both the Stockholm and Gothenburg regions and Sweden as a whole.

Malmö’s appeal has stemmed from:

- Its access to Copenhagen Airport in Kastrup, which is far larger than would normally be associated with a city of its size
- The larger, more fluid labour market makes it easier to recruit qualified staff
- Its general proximity to Denmark and Copenhagen

As a result of the bridge, around 70 companies have established headquarters, regional headquarters, specialist offices and meeting places in Malmö, adding over 5200 jobs. Whereas originally Malmö was greatly used for operations and storage, the industries have become increasingly advanced. The Øresund Bridge is seen to have strengthened Malmö’s industry in three main areas: home furnishings and building products (e.g. IKEA), cars products (e.g. Mercedes-Benz and Peugeot), and in the food/restaurant industry (e.g. Findus). IKEA Group has been of particular influence in the area. The success of Malmö is represented by the increase in leisure travel over Øresund Bridge alongside fall in commuting.
Such a major influence on the development of the southern part of the city shows how the Øresund Link has helped fulfil planning objectives for Malmö relating to decentralisation. Meanwhile, Copenhagen, rather than losing out to Malmö’s growth, has acquired an increasingly specialised and higher value economy, in addition to experiencing a re-urbanisation of its core.

By the end of 2017, the Øresund region is expected to reach a relatively youthful population of 4.0 million. Rapid population growth over the last few years is greatly due immigration from other countries, with Scania and Sweden absorbing particularly high numbers of refugees. In 2015, the population of Malmö increased by 1.4 percent (4467 people). Copenhagen grew by 1.9 percent (11,297 people).

In summary, over time it is clear that the improved road and rail connections have had various effects for the smaller city of Malmö:

i. Increasing the effective asset base, market size, and ‘borrowed scale’ for both cities.
ii. Unlocking gains in productivity on the routes with congestion.
iii. Increasing access to opportunity and reduce job/skills mismatches.
iv. Enabling specialisation between locations
v. Creating scope for land re-use and intensification around stations and corridor development
vi. Increasing its ability to attract higher skilled workers

Other spatial impacts

The link has had significant spatial impacts too. One is the stimulation of several new sources of demand at the stations between Copenhagen and Malmo, shifting the historic growth pattern of the two cities away from each other and towards each other.

In Southern Malmö, the tunnel delivered a new train station in Hyllie. This key development area is due to have 9,000 homes and a matching number of jobs, running entirely on renewable energy. Hyllie was merged with Vaster in 2013 to form a larger strategic region. On the Copenhagen side, Ørestad to the south east of the core city now provides an important additional source of growth capacity for Copenhagen (see Boxes on Hyllie and Ørestad below).

One of the main beneficiaries of the Øresund Bridge/Rail Link on the Malmö side has been the southern district of Hyllie, 7 kilometres south of the city centre. It was the site of the first station after the tunnel, and the stop before Malmö Central, 6 minutes away and 30 minutes to Copenhagen.

Malmö’s initial concern was that the initial road access provided by the bridge would funnel into a motorway around the city, with the risk that the railway would take the same route and not pass through central Malmö. Its 1990 comprehensive plan committed to compact urban renewal enabled by a rail stop in the city centre. It eventually agreed a route via the part-residential part-vacant area of Hyllie because of the large amount of municipally owned land.78

Hyllie station and development in the foreground, Bridge to Copenhagen behind
Hyllie was planned to accommodate business, commercial premises, 9,000 homes and a new 15,000 seat indoor Malmö Arena. 40% of the area was City-owned land. Work started in 2007 to anticipate the completion of the Citylink tunnel in 2010. As Malmö’s largest development opportunity, the City has been keen to use it to demonstrate the city’s sustainability credentials – in 2011 it entered into a joint venture with VA SYD and E.ON to build in smart city capabilities to the district and become carbon-neutral. This is seen to have been successful at achieving a shared vision with a high degree of trust between the partners.\(^1\) The district also benefited from an international-class shopping mall (Emporia) that attracted shoppers from both Malmö and Copenhagen sides of the region, and encouraged people to treat Hyllie as a place to stay rather than pass through.

The City has focused a lot of its effort in removing physical barriers and improving the quality of place in Hyllie. The area attracted major new tenants such as IKEA, IKANO Bank, and Maxomorra. By 2016, Hyllie was achieving the highest office rents in the Malmö region.\(^2\) However the ‘new’ Hyllie is not yet perceived to be well integrated with its immediate surroundings, and reliance on motorised traffic is still high.

Located 8 kilometres south of Central Copenhagen, \(\text{Ørestad}\) was a target for development as the nearest stop to Copenhagen Airport and the penultimate stop before the link to Malmö. 4 years before the Bridge was built, a masterplan was developed for a high density mixed-use district, which had around 3 million square metres of development potential, much of which was reclaimed publically owned heathland with low value and low profile.

\(\text{Ørestad} \) with the centre of Copenhagen in the background

The district was divided into four sub-districts, to be developed sequentially in tandem with the development of the new M1 driverless metro line which arrived at the same time as the \(\text{Øresund Bridge}\). \(\text{Ørestad North}\) was developed first, followed by \(\text{Ørestad City}\) and \(\text{Ørestad South}\), at approximately 5-year intervals. The creation of a new public transport system was directed by the \(\text{Ørestad Development Corporation}\), co-owned by the City of Copenhagen (55%) and the national Ministry of Finance (45%). A National Act gave the
Development Corporation the power to plan the area and to provide the necessary land improvements and infrastructure.

The aim was to achieve land sales along strategically located sites to finance the metro. However for many years the project only accommodated one office building, next to the station, partly because of oversupply in other locations in Copenhagen. The development of the metro also did not go as planned due to large cost overruns and debts, poor ticket sales, and a failure to generate interest in building plots around the metro line. The financial challenges resulted in an agreement to build a large shopping mall at the most prominent location in Ørestad, against previous regulations to favour urban retail. They also weakened the negotiation capacity of the Development Corporation with private developers.

The district eventually began to succeed in the 2nd cycle. National government helped to persuade and part-subsidise some public institutions to locate in the Ørestad Nord area, which became home to national TV and radio HQs, an expanded university and a new IT University. By 2007, 53% of the planned building area in the district had been sold. At the same time, the planning focus switched towards more housing in order to be attractive to both international businesses and young families.

By 2008, 5,000 people had moved in, and by 2016 10,000 had arrived, nearly half of the total anticipated population. The district has seen culture, media and IT firms move in, although it is a long way off achieving the 60-80,000 jobs and the critical mass of activity it has anticipated. Despite the high standard of architecture, improving and activating public space is an ongoing challenge.

Various key transport infrastructure projects have been developed to support the growth in demand triggered in part by the Oresund Link. These include:

- **Pågatågen** commuter train lines: as demand has grown on the Skane County’s local train system, other types of train have had to be added to the roster. Additionally, new stops for “Pågatåg” commuter trains and new passing sidings to improve accessibility and increase capacity for passenger traffic are being created. Entirely new “Pågatåg” commuter train lines are on their way, including a new line to Trelleborg (32 kilometres from Malmo, 34 minutes) which opened in 2016.

- Metro Cityring: a new metro line comprised of a 15.5 km underground railway under downtown Copenhagen, the “bridge quarters” and Frederiksberg. This will open in 2019, dramatically reducing travel times.

- Copenhagen’s first light rail project, the 27km Ring 3 line is also moving ahead. And a new railway from Malmö to Lund is being built.83

A number of road projects are also meeting increased traffic demand in a context of rapid regional population growth. There are new ring roads in Copenhagen and Malmö to accommodate the increase in local traffic. Regional super-buses: plans for nine regional super-bus routes around Skane County to improve accessibility for passenger traffic are currently underway. And a bridge is being built south of Copenhagen to Fehmarn in Germany (where there is currently a ferry route). This bridge will provide faster connections from the Øresund Region to mainland Europe and increase traffic on the Øresund Bridge. With Øresund Link and the link between Copenhagen and its airport already at capacity, the city is seeking ways of separating local passenger traffic from freight traffic, providing more opportunities for freight and mainline trains to travel to the south of Denmark.85

Expanding the functional urban region
There has been incremental growth of the functional region of Øresund achieved by improved access to more peripheral cities such Helsingborg and Zealand. The Hallandsas tunnel involves double tracks on the West Coast Line north of Malmo between Båstad and Förslöv in order to increase capacity, reduce travel times and improve accessibility for heavier cargo trains.

The 8 Million-City plan for the Oslo-Copenhagen corridor, the most densely populated stretch of Scandanavia, aims to link up cities across three countries to form a single megalopolis. The backbone of this will a high-speed train, intended to reduce rail travel times between Oslo and Copenhagen by 5 hours by 2025. There are ambitions to make the mega region much more integrated, and a number of projects have recently concluded that will make a difference to the region’s international links, and, in time, borrowed scale.

These include:

- Copenhagen-Hamburg link has reduced journey times down from 4.45 to 3.15.
- Copenhagen-Gothenburg link has reduced times down from nearly 5 hours to 3h48 minutes
- Copenhagen-Oslo will be reduced by the ‘8 million city’ project to just 5 hours

The region in general has switched focus on double tracks to boost capacity and hours of operation, with high speed rail improvements that radically reduce travel time less of an immediate priority.

Lessons for Sydney

- By strategically combining the urban assets of a geographically divided region, the Øresund has shown how a multi-city region can achieve the scale, specialisation and flexibility to improve its global profile despite relative remoteness from the major centres of economic activity.

- An improved connection between a region’s largest centre and a smaller centre often elicits concern that the benefits accrue solely to the big city. The experience of Copenhagen and Malmö suggests that over the longer term (10-15 years), the second city becomes more specialised and attractive for certain types of business and residents.

- Investment to connect with Newcastle or Wollongong is likely to reveal under-recogised strengths to domestic and international audiences - such as access to strategic land, attractive costs, improved placemaking, and a vibrant consumption economy.

- Rail infrastructure can help to catalyse more ambitious government, joint working and purposeful metropolitan development in a second city. Plans to connect up a region should also focus on the governance and organisational dividend (within and beyond the region’s core) that can become somewhat self sustaining even if higher tier government support wanes.

- Rapid access to an international airport from several directions can help it to play a hub role for a much wider region. There may be benefits if an airport is more than a terminus and a ‘dead end’ of a linear growth corridor, but if it has several orientations and opportunities for growth and connectivity around it.

- Out-of-town stations established during a major rail project can offer important opportunities for high quality mixed use district development that act as demonstrators for the region (in terms of housing, design, mixed use, diversity).
• The reduction of travel time to cities in the 300-600 kilometre range does have some spillover effects but more spillover impacts have occurred in cities brought within a 80 minute travel time.
3.3 Randstad (Amsterdam-The Hague-Rotterdam-Utrecht)
Summary

The Randstad is an example of a successful and competitive multi-city region where, despite the absence of a pan-regional governance mechanism, investment in the rail and road infrastructure network has fostered strong inter-dependencies between several evenly sized cities over the past 30 years.

Amsterdam possesses the region’s strongest global profile, and is home to the largest financial and business services clusters, including law and advertising, and cultural industries. But the other cities provide very important complementary functions – educational, engineering, Port, logistics, conferences, political and diplomatic. Crucially the ability of Rotterdam, Utrecht and The Hague to retain their core specialisations and attractiveness to both firms and talent has not been undermined by improved connectivity to the global city of Amsterdam. If anything strengthened links, including to the region’s airport Schiphol, have enhanced their ability to play complementary functions.

- Population: 7.5 million, growing 10% a decade.
- Strong system of intercity rail and compact planning, with accelerated regional rail investment since early 1990s.
- Faster travel times
  - Amsterdam to Rotterdam Central: reduced from 53 minutes to 30 minutes
  - Amsterdam to Brussels travel time reduced to <2 hours.
- Cross-regional commuting and diverse housing provision
- Unlocked capacity for mixed-use densification and expanded the cross-fertilising innovation eco-system

Background and evolution

The Randstad is the region that comprises Amsterdam, Rotterdam, Utrecht and the Hague, four cities located all within 75 kilometres of each other. It is a polycentric city region that has grown from 5 million to 7.5 million people over the past 30 years, at a pace and scale not dissimilar to that of Greater Sydney’s planned growth up to 2050.

All four cities have developed a co-dependence and complementarity with the others, thanks in part to a high capacity and high speed regional rail network which has maximised the relative proximity of each city (75km or less between each). In effect the special degree of connectivity allows the Randstad to function as one unified multi-city region, even though it has no formal governing body to represent the agglomeration. Indeed, the overlap of its labour markets, and the specific role played by each hub with:

- Amsterdam as a business city with a major hub airport
- Rotterdam as a port city specialising in food, energy and the circular economy.
- Utrecht and a life sciences and higher education magnet
- The Hague as a political and diplomatic centre

This allows the individual parts to comprise a diversified and competitive global city in its function, that is one of the leading junction boxes for trade, investment and knowledge in the world.

The journey to an integrated multi-polar region

The Randstad’s evolution as a high infrastructure metropolis has relied to some extent on a purposeful national policy framework that has avoided concentrating too many functions in one city.
The platform for this high infrastructure platform has been 80 years in the making. The rapid growth of railways in the 1930s connected key industrial and port infrastructure to each other, and to the four cities, laying the foundation for what would later become a unified spatial agglomeration. Much of the current network rests on this inherited structure. This was followed by a period in the 1950s and 1960s characterised by policy and planning to contain sprawl. Urbanisation was guided into specific locations designated by the state, and served by a new suburban rail and road structure which connected the suburbs of each city in the Randstad to their nearest core city (but not to the wider region).

It is in response to this model that a new era of planning began in order to build a coherent regional development pattern. In a certain sense there are parallels between where the Randstad was in 1990 and where Greater Sydney is today.

Guided by the national government, what the Randstad region chose to do was initiate a multi-cycle programme of urban and transport development. Cross-regional links were enhanced and this was accompanied by prescriptions for local governments to densify around existing settlements.

In 2009 a new North-South High Speed line connecting Amsterdam to Schiphol airport, Rotterdam and the wider Benelux was opened. At the same time a regional Stedenbaan network was developed to improve connections in the southern part of the region, especially between Rotterdam and The Hague, unlocking land for densification. The Stedenbaan has used the freed-up capacity of the existing railway between Schiphol Airport and Rotterdam that was created by establishing the High Speed line on its own track.

These upgrades have been sequenced with other high quality local rail improvements that continue to support rail connectivity around the cities to the wider regional network:

- Regionet in Amsterdam.
- Utrecht is developing the Randstadspoor - a regional train network connecting its suburbs to its core.  

What was the spatial, land-use, development and economic rationale for the recent regional infrastructure projects?

For 10 years the Randstad had experimented with a policy of ‘concentrated deconcentration’ to control urban sprawl by focusing population growth in designated suburban towns or new-towns surrounding the key four cities. However by the mid-1970s, this policy was changed for good, with development redirected to the urban cores to prevent any further erosion of their commercial, residential and jobs base.

The big shift came with the 4th Memorandum on Spatial Planning (1988) which ushered in a phase of public transport-oriented compact urbanism. During the 1990s, specific zones for densification were identified and allowed to thrive within core urban areas, and these were supported by local transport interventions.

The 5th Memorandum on Spatial Planning (2001) shifted policy emphasis to treat the Randstad region as a whole (rather than treating each city and its suburbs individually). Upgrading each city’s connectivity to each other became a priority. This was supported by decentralising strategic infrastructure decisions to more regional bodies, while insisting that development should be concentrated along transport corridors. The Randstad Vision 2040 further specified the need to improve internal mobility to sustain the networked nature of the four cities, and their compact character.
In the most recent phase, spatial policy has devolved planning powers and strategic decision making to local and metropolitan authorities, producing more regional incentives to cooperate and improve local connections. The long programme of regionalisation and densification has created the drive to think as a connected region and saw major investments in cross-regional projects to upgrade connections to and between the major ports (Schiphol and Rotterdam), and between functional urban areas. This has led to the High Speed train project, as well as RandstadRail, and to a lesser extent Amsterdam Regionet. For all these major projects, the explicit stated aim has been to allow the four cities in the Randstad to ‘borrow size’ from each other, while retaining their compactness. Indeed, transport improvements have been accompanied by explicit densification projects in each of the core cities, specifically around the redevelopment of all the major central stations following the arrival of High Speed Rail, but also along transport-oriented development corridors such as the Stedenbaan and Regionet, - even though commercial property continued to be more spread out, and closely linked to the highway network.

How are regional rail projects managed, assembled, delivered and financed?

Most rail infrastructure projects in the region evolve from a highly consensus-based system, with national government playing a guiding role. Dutch Railways and ProRail own most of the infrastructure, they are part responsible for financing any new development (through central government subsidies). In the last cycles of infrastructure development, starting in the 1990s, both the state and local authorities have taken a more regional view, and indeed local authorities have also become much more involved in the big rail projects.

The Zuid High Speed line linking Amsterdam to Schiphol, Rotterdam and the wider Benelux was completed in 2009. Costing over just €7bn, it was financed by a private-public partnership involving Dutch Railways (NS), a mix of infrastructure and financial firms, and funds from gas exports, with the public sector owning the track and land surrounding it, and paying back the cost over a fixed time frame. Total private sector contributions totaled 14%.

The metro-style service called Stedenbaan is widely considered to be the first step in more integrated cross-regional light rail network which not only connects city centres to the wider region but also links in the suburbs. As with other projects in the region in practice it is a collaboration of local public actors including all three tiers of government, local service providers, as well as business. The Metropolitan Region serves as the coordinating body and forum for the ad-hoc arrangements.

What are the key phases of the region’s rail development? What is the cumulative causation?
The 1st phase initial project in catalyzing the region’s development was the rail connection to the Schiphol airport in 1979, which linked it up to the wider regional network (several decades after its opening). This was a major spur to the subsequent new regional thinking and planning. Previously connected only by road and shuttle bus, Schiphol began to grow rapidly and developed into an airport city with well over 50,000 employees by the late 1980s.

The 2nd phase continued the airport infrastructure so that by the 1990s Schiphol was accessible by rail directly from all of the Randstad’s major cities in less than an hour.92 The largest project in this phase was the Zuid High Speed 1997 high speed rail line connecting North to South via the airport (completed in 2009). This both met the pan-regional rail network capacity requirements, and freed up capacity on the intercity network to increase frequencies, unlocking further growth at Schiphol airport’s already considerable aerotropolis (100,000 jobs today). It also released land around central stations for new rounds of densification.

The 3rd phase in effect made it possible to Amsterdam to add capacity at the city fringe and establish a second CBD. ZuidasDok is a major example of a station and line regeneration project that has unlocked extra mixed-used development capacity and created a new CBD connected not just to the city, but the wider Randstad.

The 3rd phase has seen a variety of projects emerge beyond the core city of Amsterdam. Stedenbaan (South Randstad) and Randstadspoor (Utrecht) have accompanied Regionet (Amsterdam) to enable densification projects to follow transport upgrades. Meanwhile at Schiphol, further rail capacity upgrades are in the pipeline as the high-speed connection and growing cross-regional accessibility have triggered further demand for growth.93

As to Stedenbaan, transport infrastructure is being sequenced to arrive with new housing and commercial capacity in the South Randstad, and the cities it connects there (between Rotterdam and The Hague). It is playing a central role in in plugging the “city to city” gaps left by previous phases of development in the Randstad, especially in relation to connections between suburbs and the wider

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**Main infrastructure development**
- 1st Phase (1979-1995): Airport connection and regional inter-city rail
- 2nd Phase (1996-2009): High Speed Line to Brussels via airport and Rotterdam
- 3rd Phase (2010-2017): Stedenbaan to improve suburban links around the bigger cities

**Effects on spatial and economic development**
- De-concentration from Amsterdam – retained strengths in Utrecht and The Hague
- Rise of an early aerotropolis model around Schiphol
- Emergence of 2nd CBD in South Amsterdam, Zuidas
- Reduced road congestion in airport
- Re-urbanisation in Rotterdam
- More cross-regional commuting
- Densification around a larger number of stations
- Increased housing demand in Amsterdam

**Unexpected or adverse changes**
- Rejection of proposed reforms to city and regional governance models
- Major technical and cost challenges to delivering high speed line
- Sub-regional planning rather than regionwide approach
- Lack of Amsterdam appetite to accommodate much greater density
- Momentum to position region in integrated way to achieve global profile for investment
region. Development of both light-rail for the Stedenbaan, and housing, is scheduled to continue until at least 2023 - with housing following transport improvements. 80% of new housing is being built next to railway stations.94

Project Impacts

Growth management

The Randstad’s early efforts at, and subsequent improvements to, city to city connections have not undermined the strengths and competitiveness of each individual urban area. This is because the regional transport network has allowed Amsterdam to ‘borrow scale’ and the other cities to specialise and benefit from Amsterdam’s financial expertise, gateway attributes and cosmopolitan appeal.95 Although the City of Amsterdam has seen the largest increase in population since 2000, at 100,000 new people, they are followed closely by Utrecht, The Hague and nearby Almere, a town 25km east of Amsterdam.

The current phase of transport-oriented development with Stedenbaan, and other smaller projects, is helping the region’s cities avoid sprawl achieve its ‘compact’ and ‘networked’ vision. New mixed-use developments are sequenced in parallel to, or after, transport projects – avoiding the ad-hoc way some suburbs had been connected to the transport network in the 1960s and 1970s.

As the most recent phases of network upgrades have got underway, the cities of the Randstad are now all within a 30 to 50 minute journey from each other, as are the key infrastructure including Schiphol airport (among the busiest in Europe) and the Port of Rotterdam (the largest European port).

Transport patterns

Cross-regional commuting is slowly increasing, as confirmed by the latest central government mobility studies. Between 2005 and 2015, for instance, cross-regional trips to and from Rotterdam and Utrecht increased by nearly 8% and 19% respectively, and by nearly 3% in the case of Amsterdam. The Stedenbaan network is seeing year on year growth in passenger numbers, with different segments of the network having seen passenger growth jump by up to 25% between 2007 and 2014. Housing demand has also surged along the line.

Change in number of commuter trips to and from the five urban areas, as % of national baseline96
Regional rail commuting is strongly dominated by higher skilled workers, and has only slowly picked up as most rail commuting continues to be between immediately neighbouring cities. For cross-regional commuting to increase further, gaps in suburb to suburb and north to south connections will need to be filled. As such, the region is slowly moving from several connected functional urban areas, to merging into one larger integrated transport network - although this will take further time and investment to complete.97

Economic development

The transport infrastructure of the Netherlands, and specifically the Randstad, is considered among the best in the world by the World Economic Forum and has made not only commuting a smoother experience, but allows the region to be the main logistics and trade hub in Europe.

Improved regional connectivity has not resulted in a major shift in business relocation to favour Amsterdam, but has also fostered flexibility and diversification: Stedenbaan is enabling new mixed-used real estate development to be accommodated in the southern Randstad, as have major station upgrades in Amsterdam (e.g. Zuidas) and Utrecht, and around the Schiphol airport zone. In addition, the greater ease of commuting, and greater cross-regional connectivity, are part of the reasons that Rotterdam and Utrecht are now able to contemplate hosting innovation locations (e.g. the Rotterdam Innovation District, the Utrecht Life Sciences cluster).98

Because of its strong and continuous co-ordination and monitoring, Stedenbaan has evolved into a more comprehensive project, not rigidly focused on densification but observing the economic differentiation and complemenarities that emerge between the different cities. It has shown the benefit of agreeing common planning goals across the region and involving all parts of the region in the process.

Appetite for rail solutions

The modern Randstad region inherited one of the most densely used rail networks in Europe but until the 1980s that had not prevented the growth of the car. The last 30 years has seen a new level of regional investment and integration, and the success of early projects have created demand for new light rail solutions to link-up the entire region.
### Table of impacts in terms of economic and spatial development

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### Lessons for Sydney

- A regional rail system requires full consideration of long-term economic change, the relative assets and future competitiveness of the main locations, and a clear set of social and environmental objectives.

- Inter-city connections appear to have very strong benefits when they almost have metro-style frequencies and when there are links built with each main city’s suburban labour market.\(^9\)

- Active and deliberate public-sector intervention to optimise land use around stations has been effective.

- Picking the right number of locations where the market can optimise development potential is an important component of a regional transport plan.
3.4 Gauteng City Region and the Gautrain (Johannesburg-Pretoria-Ekurheleni)

Route map of Gautrain and course through Midrand
Summary

The Gauteng City Region comprises the three cities of Johannesburg, Pretoria (Tshwane) and Ekurhuleini. Often described as Africa’s ‘Global City Region’ the global ambitions of the region took a big step forwards through the provision of fast-rail passenger connection, the Gautrain, timed to coincide with the hosting of the 2010 FIFA soccer World Cup.

The Gautrain Rapid Rail Link is an 80km, 10 station rail mega-project linking Johannesburg, Pretoria and the region’s international airport. Structured as a pioneering PPP and acting as a demonstration project for high speed rail in South Africa, the 1st phase of the Gautrain was completed in time for the 2010 World Cup. Trains travel between the two main cities in 35 minutes, and from the major employment centre of Sandton to downtown Johannesburg (akin to the Parramatta – Sydney link) in 15 minutes.

The Gautrain has significantly reduced the travel time and travel reliability between the two largest cities in the region, Pretoria and Johannesburg, from over two hours in peak traffic to 35 minutes. It has also connected the two cities to the 3rd metropolitan municipality, Ekurhuleni, an airport zone centred on the region’s main International Airport.

The rail project only accounts for a small share of cross-regional commuters, but in a context of deep regional asymmetries it has begun to establish some complementary roles of the three main cities in the region: Pretoria as the political and educational capital, Johannesburg as business centre, and revitalised Ekurhuleni as the Aerotropolis.

The big improvement in travel times has given meaning and momentum to the Gauteng region as it pursues a 40 year plan for polycentric growth. The Gautrain gave shape to a first phase of more strategic regional planning, and in some cases has produced significant densification and precinct development around smaller stations that have a critical mass and quality of place. A bus rapid transit system has made it possible to link the stations in the linear corridor to the sprawling suburbs.

The project is entering a 2nd phase where the region has developed the confidence to pursue 5 sub-regional strategies around the highest potential Gautrain stations, while also expanding the Gautrain project itself. The rail infrastructure in train is hoped to serve a wider set of development corridors that are seen as a necessary addition to the first line if the region is to shift away from car dependence and build a sustainable polycentric growth model.

<table>
<thead>
<tr>
<th>Gautrain in summary</th>
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<tbody>
<tr>
<td><strong>Length, stations:</strong> 80km, 10 stations</td>
</tr>
<tr>
<td><strong>Cities linked:</strong> Johannesburg, Pretoria and Ekurheleni (including OR Tambo International Airport)</td>
</tr>
<tr>
<td><strong>Cost:</strong> Estimated R25.4 billion (AUD 2.5 billion)</td>
</tr>
<tr>
<td><strong>Aim:</strong> to support hosting the 2010 World Cup, alleviate chronic inter-city congestion in South Africa’s most important economic agglomeration, and to anchor transport-orientated development.</td>
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</table>
Background and evolution

Despite being South Africa’s smallest province – at 18,000 km², one and a half times the size of Greater Sydney - Gauteng is by far the country’s most populous, at over 13 million people. The region dominates the country’s industrial, financial and services sectors and accounts for over a third of South Africa’s GDP and 10% of the entire GDP of Africa. It is comprised of 15 municipalities, with the neighbouring cities of Johannesburg and Pretoria at its core.

Map of the Gautrain within Gauteng province

Despite the dynamism and potential of the region, Gauteng has also suffered from severe infrastructure deficits and self-confessed set of ‘critical transportation [and] socio-economic challenges.’ Since the 1970s, the urban landscape of the region evolved into a connected cluster of cities, towns and urban nodes, within a landscape of urban sprawl, low density housing programmes and spatial imbalances between jobs and homes. Large segments of the population are physically detached from key services, including transport. Roads have provided the main arterial links between the major urban and economic centres of the province. Congestion, and all of the economic, environmental and social costs that come with it, has long been viewed as a major inhibitor to Gauteng’s ambition.
While successive governments attempted to address the severe spatial exclusion though the formation of the National Transport Policy Forum and the Reconstruction and Development Programme, the effects of these strategies made only incremental progress. Meanwhile the Gauteng Spatial Planning Framework has not been fully aligned with the municipal plans, especially the larger metropolitan municipalities of Johannesburg and Pretoria.107

The Gautrain (and its proposed connections to bus and rail networks) was therefore designed to provide welcome modernisation to the technologically and socially out-dated modes of transport.108 With a total cost of around R25bn (AUD $2.5 billion), the Gautrain was a big and symbolic first step in response to the region’s infrastructure deficit, and the congestion affecting 150,000 (previously growing at a rate of 7% per annum) daily drivers of the N1 motorway between Johannesburg and Pretoria.109

**What was the spatial, land-use, development and economic rationale for the project?**

The project’s architects in Gauteng identified that the Gautrain would add 1% to the province’s GDP and create a total of 141,000 jobs.110 In terms of economic and spatial development, the planners identified three main rationales for the Gautrain to become the 1st phase catalytic project for a more integrated polycentric region.

i. **Re-engineer the unsustainable development pattern.** Leaders argued that the Gautrain was the key trigger to overhaul a development path that was unsustainable. For the region’s biggest cities, their continental and global competitiveness depends on infrastructural improvement and reduction of the worst costs of sprawl. At the same time the region’s smaller cities have lacked the connectivity and concentration of investment to establish themselves.111 Gautrain was viewed as a vehicle to ensure South Africa does not miss out on its best hope of a successful global city region to power the country’s future growth.112

![Population density in Gauteng and the 1st phase route of the Gautrain](image)

ii. **Reduce congestion and join up the transport system.** Gautrain was a pillar in the vision for a new urban form for Gauteng. Unmanaged population growth and reliance on a grid system of roads as the primary transit medium has led to sprawl radiating outwards from the region’s
two largest cities. The first intention was to reduce the 90 minute driving time between the two cities along the N1 motorway, which was a cause of major travel delays, air pollution and high numbers of road traffic accidents. A road-based solution such as bus lanes (as used in Cape Town), was considered for the cost advantage, but rejected because it lacked a long-term pathway towards reduced congestion. It was estimated that 20% of Pretoria-Johannesburg commuters would switch from road to rail travel with more than 120,000 passengers per day using the service and with more commuters making the switch to rail during the project’s lifetime with fares priced to undercut the cost of car travel. The project was also intended to start to bring together the province’s fragmented transport system, via a complementary bus network with a strong peak time service.

iii. **Deliver public policy commitments for inclusion and job creation.** Gautrain was viewed as an important vehicle through which the South African national government could improve the economic empowerment of underprivileged black populations in townships at the peripheries of Johannesburg and Pretoria. Employment and training opportunities for target demographics were secured in the concession agreement.

iv. **Achieve corridor development.** Gautrain’s capacity to stimulate corridors of development became a cornerstone of the 2040 Johannesburg Growth and Development Strategy. Gautrain and the supporting bus networks were a vehicle for “integrating a divided city...[and] laying the foundation for a new era of mass public transport.” The Gautrain was expected to have a catalytic effect around the new stations in terms of land use and redevelopment opportunity.

As such the Gautrain was viewed as an important building block of a more strategic, denser and people-oriented planning approach, in alignment with the long term provincial strategy Gauteng 2055.

**How was the project managed, assembled, delivered and financed?**

The delivery framework for the Gautrain project was one of the first in South Africa to be orchestrated through a ‘turnkey PPP’ structure. The design, construction and operation of the project was undertaken by the multi-national Bombela Consortium. The total cost was estimated at US$3bn with about 18% coming from private sector investment via a combination of debt and equity.

Public involvement in the PPP is notably almost entirely though the Gauteng Provincial Government with municipal bodies (such as the City Governments) largely absent from the decision making process on the main project, although more active in the district development associated with it.

While the operation and maintenance of the Gautrain is provided under the PPP by the concessionaire, it is the Gautrain Management Agency, a Gauteng Province body with representation from national government, that has overall responsibility for the project.

Despite the strong ridership performance, Gauteng province has had to provide significant subsidies (c. R900 million per year) to Bombela to guarantee the project company’s income at a floor price, regardless of levels of ridership. The province’s commitment represented a firm conviction in the future imperative to build the region through rail connectivity.

**How has infrastructure for regional spatial development been phased?**
The project’s pre-feasibility study was completed in 1999 with phase 1 Gautrain completed in time for the football World Cup in 2010. The full first development was completed in June 2012 when Gautrain’s second phase of construction was opened to passengers.

2nd and 3rd phase: Expansion of Gautrain combined with macro-regional links

Gautrain is now entering the next phase of development involving extensions to reach out to poorer neighbourhoods. These include Extension 1: New line from Mamelodi in Tshwane to Naledi in the south of Johannesburg; Extension 2: Extensions from ORTIA to Boksburg; Extension 3: New connection between Randburg and Sandton.
There are also ambitions for **high-speed links to the large cities** 500-700 kilometres away, although these are a long way from securing the finance or political support.\(^{123}\)

- The Johannesburg and Durban High Speed Line – bringing travel time between the terminals down to two hours with services to major nodes along the route will also act as a major freight route, and the long-term need has been identified for a third line in the existing corridor.
- The Johannesburg - Musina High Speed Line connects the region to the corridor or urbanisation in northern South Africa

**Project Impacts**

*Project impact in numbers*

In linking the established Johannesburg and Pretoria economic hubs, KPMG estimate that a full length Gautrain commuter journey from south of central Johannesburg to Hatfield, north of Pretoria, beats a car journey time even in a no-traffic scenario – and is three times quicker in heavy traffic. Improvements to national and international air connectivity, a trip from downtown Johannesburg to OR Tambo International Airport on Gautrain is twice as fast as the same journey by road in a no-traffic situation and eight times as efficient in heavy traffic.

<table>
<thead>
<tr>
<th></th>
<th>Gautrain</th>
<th>Car – No traffic</th>
<th>Car – Heavy traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hatfield stations and Park station</td>
<td>42mins</td>
<td>49mins</td>
<td>2hrs 35min</td>
</tr>
<tr>
<td>Average travel time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR Tambo and Sandton station</td>
<td>15mins</td>
<td>32mins</td>
<td>2hrs 5mins</td>
</tr>
<tr>
<td>Average travel time</td>
<td></td>
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</table>

**Time saving**

- Sandton: 32mins faster than a car
- 15mins

*Source: KPMG\(^{124}\)*

Several analyses have been carried out to assess the impact on the 1st phase of the Gautrain in the 7 years since it opened. Calculations suggest that each R1 of investment has been calculated to have created R1.73 in economic output, and an additional R0.18 of tax revenue for national government. By 2013, the project was directly sustaining 6,000 jobs and created a wider impact on low-income households of around R200m per year. As a result planners have identified
substantial future economic gains to be derived from the next phase of expansion of the Gautrain system.

<table>
<thead>
<tr>
<th>No. of train passengers per day</th>
<th>45,000(^{125})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue per year</td>
<td>US$65m</td>
</tr>
<tr>
<td>Customer Satisfaction Score, 2012</td>
<td>93(^{126})</td>
</tr>
</tbody>
</table>

Retail development around the region has seen significant boost from the Gautrain. More than R10 billion was invested in new developments and upgrades to retail centres between 2009 and 2014, with the additional investment adding more than 3% to the region’s GDP. The provision of office space at or near stations had led to additional investment of R986 million (AUD 100 million) in office space by 2015.\(^{127}\)

The first 7 years of the Gautrain suggest that the main benefits of the first phase of BRT in tandem with Gautrain lie in its improved access to amenities, rather than its direct expansion of access to work opportunities. Benefits so far primarily accrue to medium-income households rather than to the poorest commuters in the area, but have been shown to contribute to community satisfaction with transport and living conditions as a whole.\(^{128}\) One unexpected outcome has been a sharp rise in the use of minibus taxis due to the increased speed and reliability of road travel that Gautrain and BRT have contributed to.\(^{129}\)

**Spatial development**

Gautrain forms the axis of a vision for a new urban form for Gauteng. This vision is predicated on the basis of the continued autonomy of Gauteng’s 15 local governments, but recognising their close interconnectedness, the need for close cooperation in matters of common interest.\(^{130}\) The vision for Gauteng is to re-direct urban growth along a broadly north-east to south-west axis between Johannesburg and Pretoria, and building a third major centre in Ekurhuleni to the East of Johannesburg which includes the International Airport.

In terms of stimulating development activity around stations, the Gautrain has produced mixed results so far across the stations designed to anchor new urban activity. On the one hand, the established centre of Rosebank just 3km north of Johannesburg CBD has witnessed dramatic growth in mixed-use development, pedestrianisation and modal integration. Commitment to TOD has been a major incentive to property developers to engage.

The activation of Midrand Station, at roughly the mid-point between Johannesburg and Pretoria, has been more mixed. In this part-residential, part-industrial and part-greenfield location, significant development has occurred several kilometres to South and East of the station - Waterfall City in particular, but acting as a competitive location to Midrand. Property development around the Gautrain station has been more sluggish. Grand Central Airport to the North and East of the station prevents development in that direction while elsewhere land remains undeveloped and held by two major landowners who have elected not to develop the land in the early years of the station’s opening. Overall the Gautrain hub has not yet seen this centre shift away from its historic car dependence.\(^{131}\)

At another medium-sized station node in the region, Centurian, initial commercial development has slowed compared to development in Pretoria, Hatfield and Sandton. In 2016 un-occupied office space was estimated at 18% down from 5% in 2009. Centurian, like Midrand, has suffered
from a lack of density in the vicinity of the new train station, putting many office units unattractively out of reach commuters wanting to walk the final step of their journeys.\textsuperscript{132}

The contrast between Rosebank and Midrand and Centurian illustrates that the rapid rail infrastructure has had varied activation effects, linked to:

- The existing critical mass of mixed-use development
- Quality of placemaking
- The land value incentives to pursue immediate development rather than banking the land until prices rise sufficiently.

This is an example of a more established area closer to downtown Johannesburg that has been viewed by people, developers and investors as a better bet than the more remote semi-greenfield hub at Midrand.\textsuperscript{133} Many other established suburbs have also witnessed a downturn since the

The unexpected new node of development

In the heart of the Gauteng region, possibly the biggest development success story since the Gautrain is Waterfall City, a 1.4m sq. metre site located between Midrand and Sandton stations. Having attracted a raft of multinational businesses including Novartis, PwC, Deloitte, Honda and Colgate to the development among many corporate tenants. As well as offices the site is also home to the Mall of Africa- the region’s largest retail site.\textsuperscript{134}

While Midrand Station is immediately bordered by a small airport and pre-existing light industrial development, the Waterfall City area borders affluent suburban residential development.\textsuperscript{135} The relative development trajectories indicate that commuting convenience alone will not overcome other challenges with the local built environment.

The Gautrain has been intended to promote a ‘string of beads’ spatial approach (see map) that allows the two big cities to grow but also facilitates the development of new nodes which, by leveraging the new-found connectivity and status as a sub-regional hub, can better attract people and investment to carve-out their own economic identity within the wider region.\textsuperscript{136} However concerns have been raised as to whether land-use planning is sufficiently robust to optimise the potential around the stations in all these locations.
A new ‘corridor’ approach for the City Region

In terms of the next cycle of Gauteng’s spatial and economic development, attention is now being trained on 5 Corridors. These ‘corridors’, which in practice resemble sub-regions than linear connections, are designed to stitch together sprawling development, using the Gautrain stations as gateway hubs.

Central Development Corridor

The Central Development Corridor seeks to enhance Johannesburg’s global functions in finance, ICT and pharmaceuticals, focusing on investment in the CBD and urban core to the north. Among a number of very large development projects in the Central Corridor, the largest is Waterfall City near Midrand. This is home to the new Mall of Africa but is located several kilometres from the nearest Gautrain stop.

Township revitalisation projects and extensive home building programmes will seek to improve the quality of housing while extensions to the Reya Vaya Bus Rapid transport system aim to bring large numbers of currently marginalised residents into reach of the transport network.

The Eastern Development Corridor

The Airport Development zone of Ekurhuleni is the centre of a second corridor. To support a variety of industrial initiatives and free trade zones in aerospace, transport and logistics, the Eastern Corridor, involves a major house building plan and extension of the bus system will seek to facilitate local access to the nearby growth.

Northern Development Corridor
The Pretoria Corridor aims to leverage the city’s universities, technology capability and emerging innovation economy. Much of the corridor’s focus is just to the south of Pretoria in Centurian, where the Africa Gateway development will contain Africa’s largest convention centre, as well as significant leisure and commercial developments. With these economic anchors and catalysts, this development is seen as a watershed moment for Centurian to gain critical mass. 160,000 new homes are planned to be built in this area.

**Southern Development Corridor**

The only corridor that does not benefit from access to the Gautrain, the Southern corridor focuses on waterfront development and post-industrial revival.

The success of this Corridor approach remains to be seen. One risk is that the spatial implications of this strategy are in tension with the growing share of economic activity that is concentrated in the triangle between Johannesburg, Pretoria and the airport. How Gauteng implements its aspirations for more balanced and fairer polycentric development will be key over the next 5-10 years.

**Gautrain’s impacts in terms of economic and spatial development**

<table>
<thead>
<tr>
<th>Successful outcomes</th>
<th>Challenges</th>
<th>Unexpected effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving productivity through reduced congestion.</td>
<td>Some spatial and economic development has entrenched imbalances in the region – Gautrain currently serves none of Gauteng’s townships.</td>
<td>Growth of the Waterfall City project away from the Gautrain network.</td>
</tr>
<tr>
<td>Benefits of connectivity fairly evenly shared between Pretoria and Johannesburg.</td>
<td>Maintaining consistency in polycentric approach given divergent performance and opportunities in the centres.</td>
<td></td>
</tr>
<tr>
<td>Reinvigorating established second centres in the region - especially Rosebank and Sandton.</td>
<td>Medium sized growth centres along the rail line have yet to be activated to poor quality of place and lack of critical mass.</td>
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**Lessons for Sydney**

- A 40-50 year regional plan and vision can inform a regionwide debate on infrastructure and communicate the risks and the costs of not taking decisions or of taking alternative courses of action.

- A single regional rail line that mainly connects the already higher performing urban centres to support higher income commuters and residents will achieve important but limited benefits in terms of shifting overall regional dynamics and disparities.

- Regional rail can serve a polycentric growth model but require links connecting key points in the region outside the main CBD to be sequenced simultaneously.
• Customer experience, brand, quality and comfort are very important priorities if the project is to overcome negative perceptions and incentivise a new demographic of rail users.

• Land ownership, market interest, the potential quality of urban realm, and relative attractiveness of future competitor locations, are important factors when considering out-of-town station development locations.
Between Johannesburg, Pretoria and Johannesburg.


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