

CHAPTER 8

INFRASTRUCTURE PLANNING IN PERTH: PAST, PRESENT AND FUTURE

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INTRODUCTION

Infrastructure planning is essential for any city. Cities throughout history can be observed planning roads, sewerage and water supply (Kostoff, 1991). Without infrastructure the city is only informal, i.e. a series of slums. There are many cities made up of more than 80 per cent informal building and they survive, but with great inequities and huge problems apparent in correcting their infrastructure (UN, 2003). So it's better to plan for infrastructure.

Perth has a long history of planning that goes back to the early colonial surveyor John Septimus Roe, who laid out Perth and Fremantle in the 1830s (Seddon, 1970). But the most significant era began in the 1950s with the planner Professor Gordon Stephenson who was brought from Liverpool University to do the first Metropolitan Plan, which included a full outline and framework for the provision of infrastructure.

This chapter will trace the history of infrastructure planning in Perth from that time and will emphasise transport and land-use planning, along with some consideration of energy, water and waste. The dominant planning paradigm of the time is used to frame the discussion and see how that has influenced the resulting infrastructure outcomes.

PHASE 1: MODERNIST 1950–1983

Modernism is the most dominant planning paradigm of the twentieth century. Much has been written on it and, in terms of the practice of planning and infrastructure, Modernism provided a certainty that was based on a semi-scientific approach to predict land-use requirements. For the first time, planning separated out functions, especially transport and land-use. The Athens Conference of CIAM (Congres International d'Architecture Moderne), which was essentially the work of Le Corbusier in the 1930s, was set up to spread the principles of the Modern Movement. In terms of city planning, the group produced the concept of the Functional City with land-use for living, working and recreation, separated from transport as a different function (Mumford, 1961). This set the scene for comprehensive urban planning of the post-war period that focussed on how to separate out these functions and make each one efficient and sufficient to meet the needs of future urban populations. It is a powerful paradigm that has lasted to this day.

A fundamental tenet of the Modernist City was the commitment to space. No longer did the strictures of the industrial city and its tenements hold it back. They could have a 'healthy supply of clean air', a more natural city. The motto of the UK Town and Country Planning Association was 'nothing gained by overcrowding' (Williams, 1985).

But 'crowding' was what defined old cities that had created centuries of urban fabric based around walking and transit. Every ancient city was defined by walking city fabric that was dense and organic in its form, enabling people to walk across it in around an hour – the universal daily travel time budget (Newman & Kenworthy, 2015). For 100 years from the 1850s onwards, transit fabric was created in medium density, tram-based corridors and railway suburbs clustered closely around stations. This meant that distances of 10 kilometres to 20 kilometres were now feasible within the one-hour travel time budget, as long as the rail infrastructure was provided. By the modernist era, cars began to create

the third kind of urban fabric: automobile city fabric, enabling cities to spread out 40 kilometres to 50 kilometres in every direction – as long as the road infrastructure was provided. The car was now needed to get around the city within the one-hour travel time budget. Planners eagerly embraced the car at this time, driven by modernist ideals of a new and healthier city based on plenty of space, separated land-uses and efficient transport. Thus cars began to be assumed as the basis of access in the new Modernist City.

Infrastructure planning thus had to provide the space for the roads that linked the large residential blocks, large industrial sites, large commercial areas and large open spaces for urban hygiene. The great expansion of our cities outwards began and the need to try and clean up the older parts of the city also began, as they were not nearly spacious enough and had messy mixed uses causing many problems. Most of all these old areas were not designed around the car, so they needed space for roads and parking to enable them to meet their new functional objectives. Car dependence was thus a product of the infrastructure planning for the Modernist City.

The most abiding legacies of this period are the Manuals of Modernism. Modernism in general seeks to find ‘the one best way’ and deliver a manual of how to do this. Thus town planning and infrastructure planning rapidly developed a set of Manuals for delivering the Modernist City. These Manuals of Modernism included:

1. The best way to predict car traffic, based on the Four Step Model,¹ through population and wealth predictions.
2. The best way to separate out land-uses and provide for the car, based on various statutory rule books of a semi-scientific quantitative basis, using plot ratios, floor space ratios, densities, setbacks and road widths.
3. Formulae for creating the best provision of open space as a percentage of any new development, both regional and local open space.

4. Similar engineering models that could predict energy, water, sewerage and solid waste requirements based on population predictions.

Perth adopted the Modernist City Plan in spades. The WA Government hired the best academic planner in the world (the best English one anyway), Professor Gordon Stephenson, to create the full comprehensive plan. When completed, it was published in 1955 as the Stephenson-Hepburn Plan and has been the dominant influence on planning and infrastructure ever since. The Plan was converted into a bi-partisan Town Planning Act and a Metropolitan Regional Planning Authority was set up to enact the Plan for the whole metropolitan region (a step just taken by both Melbourne and Sydney).

In terms of infrastructure and open space, the Plan had a special twist; it created a Metropolitan Region Improvement Fund based on a land tax. The fund was to set aside space for infrastructure and for regional open space (further elaborated on in chapters 10 and 11). The planners immediately started using the Four Step Model to predict road capacity increases along most major roads and plan provision of high-capacity freeways. As a result, Perth has the highest provision of road space per capita in the world, a crown lost later in our surveys to Atlanta (Newman & Kenworthy, 1989, 1999, 2015).

If a global data comparison was made, Perth would also probably be the winner of the open space crown as the purchase of regional open space has proceeded rapidly over the past fifty years. A positive aspect of this has been the acquisition of all river and beach frontage land, a great success story in Perth's Modernist phase of planning. However, not all regional open space has been the most ecologically sensitive land, more like the 'land-left-over' open space. That was not seen as an issue in the Modernist City model where lots of space is needed to ensure people are healthy. There was no idea then that spacious car-dependent urban sprawl would be seen today as a major public health problem connected

to obesity, diabetes and depression, all related to the lack of human walking activity (Giles-Corti, Ryan & Foster, 2012).

PHASE 2: POST MODERNIST 1983–2001

The Post Modernist period was a time of uncertainty about the kind of Modernist planning that had been previously unleashed. Proponents weren't sure of what lay ahead, but they didn't much like what had been let loose on the world's cities. Many European cities in this period set aside the predictions of the Four Step Model and decided instead to build up their original urban fabric rather than demolish what they had by constructing freeways, road reserves and car parks.

People in Perth were also becoming a bit nervous about the famous Plan. This was the time that the Metropolitan Plan and its departmental processes had taken all the rail reserves out of the Stephenson Plan and had begun to set aside massive road reserves for the future². All of this was based on the predictions of the Four Step Model that showed massive road-capacity increases would be needed. In particular, planners frequently claimed 'Perth will never need a rail system' (Director General of Transport, 1979).

In 1979 the state government closed the Fremantle Railway using the rationale that it would not be needed in the future. Perth was going to be a car city and it would only need a few buses for those who could not drive or afford a car. Moreover, it needed a freeway down through the western suburbs, as predicted by the model, and the best place to put it was along the railway line.³

To those not trained to see the beauty in the Plan or to see the science in the road-capacity predictions, it just seemed wrong.⁴ In particular, it appeared problematic when the price of oil quadrupled in the second global oil crisis and the world entered a global geopolitical future where oil and car dependence were suddenly not so certain.

The uncertainty was widespread. The public reacted to the Plan as there was a perception that it had been progressed

alongside huge concern that this was the wrong path. When the state government lost the election in 1983, a new era began that tried to patch together a new plan. A study at the time revealed it was not economics that closed the rail line and a plan to electrify the system was put in place. Soon after another plan was also produced to take the rail line deep into the car-based suburbs to the north.⁵ These suburbs were the products of Stephenson's Plan and the Manuals of Modernism. But they were failing. Employment was not going into the dispersed suburbs, so people funnelled into the Mitchell Freeway each morning and home again in the late afternoon. It reached capacity very quickly.

The politics of the car-based suburbs drove the state government to build the 'railway to nowhere' as critics called it. How could a railway to the northern suburbs ever work when all the models showed that people with wealth would only use a car? Plus, there was nothing out there to go to, except suburbs. But it did work. People moved onto the railway in much larger numbers than any expert or model had predicted (Newman, 2012).

By the end of the 1990s it was the southern suburbs' turn to request their piece of this pie. It was good politics so a commitment was made to go ahead, but it didn't fit the models, the theories or the manuals and, hence, the transport professionals struggled to believe it would work. This rail service now carries the equivalent of eight to ten lanes of traffic at peak times.

As part of the Post Modernist era, the question was raised as to whether we were overdoing it with our roads. Jeff Kenworthy, a Perth transport and urban planner, was asked to conduct the Road Reserves Review for the state government. He found that road reserve spaces set aside across the metropolitan region were equal to the area from Scarborough to the CBD and down to Fremantle, i.e. around 90 square kilometres of road reserve had been set aside for asphaltting (Department of Planning and Urban Development, 1991). A vigorous case was made to keep these spaces, just in case. But the party was largely over and very few new big roads were

planned until the recent phase of federal government-funded projects with the Western Gateway and the Perth Freight Link.

There was indeed a halt to several of the major road projects – a freeway up the river to Guildford and the Fremantle Eastern By-Pass, which was the road that was supposed to replace the railway and continue on through the middle of the Fremantle suburbs all the way to Rockingham. The loss of urban fabric and natural environment in these road projects seemed to have been overlooked in the rush to provide scientifically based solutions to growing car-driving populations. They were excised from the plan despite the cries of the purists who believed in the inherent truth of the Four Step Model.

Publications at the time attempted to make sense of what was going on by gathering numbers and analysis on how different cities were handling this phenomenon of car-based planning. In particular, two books addressed the concept of ‘automobile dependence’ to try and comprehend the nature of this problem (Newman & Kenworthy, 1989, 1999). The concept was based on quantitative data comparing thirty to forty cities around the world in their transport and land-use patterns and used examples of cities that were standing up to this Modernist force. The concept is now used by nearly every city in the world (including Perth) as they try to address the multiple issues surrounding too much car use. But it did not mean that Perth stopped the momentum of the Modernist City program; it just did not have a good handle on what kind of city it wanted to be and certainly did not replace the Manuals of Modernism, though they tended to go a bit more underground.

How could cities find a way through the conflict between Modernism and Post Modernism in their infrastructure planning?

PHASE 3: EMERGING SUSTAINABILITY 2001–2015

The next phase of planning led to a greater definition of what kind of city Perth wanted to be: a more sustainable city. The Post Modern era had left a vacuum and the Brundtland Commission

filled it. After years of trying to resolve the conflict between the forces of progress (often labelled as ‘the economists’ but mostly consisting of those pushing the Modernist view of the world) and the forces trying to stop progress (often labelled ‘the environmentalists’ but really covered the Post Modernists), the United Nations Commission on Environment and Development (1987) endorsed the need for development but specified it must be sustainable development.

The sustainability movement was, however, not really clear in concept or in what planners were meant to do and there were certainly no manuals. Across the globe, strategies were developed to determine how the environmental and social aspects of development, which had been neglected by the Manuals of Modernism, could now be re-invented or rehabilitated (Hargroves & Smith, 2006). Globally, academics were developing solutions that integrated economic, social and environmental factors into city planning and infrastructure (e.g. Banister et al., 2000; Newman & Kenworthy, 1999).

What did it actually mean for cities? What did it mean for planning and infrastructure? Cities, states and nations began trying to find new ways of approaching development and it was not easy.⁶ The topic has been addressed in many books, but translating it into mainstream planning had to wait until the twenty-first century when, in most cases, cities began assessing their futures differently. In Perth this was focussed in the State Sustainability Strategy (Newman & Rowe, 2003) and subsequent planning documents including the recent strategic assessment of Perth and Peel called the Green Growth Plan (Government of Western Australia, 2015). Clearly sustainability demanded a much greater recognition of:

- the local community and the urban fabric that had grown around it;
- the value of the natural environment; and
- the importance of reducing our reliance on fossil fuels and other resources like water.

However, it did not mean that these elements of our footprint needed to reduce our capacity to grow economically, indeed, as the UN has outlined, we need to decouple growth in footprint from growth in the economy (UNEP, 2014).

Planners for WA government grappled with these concepts for three years (2001 to 2003) and a new consensus emerged that the city could still grow, indeed it must, but it had to get much better at reducing car dependence and the urban sprawl that was intertwined with this. It needed to redevelop in inner urban areas and create better quality public transport, walking and cycling. It had to do something about place-making in special places, preserve important environmental features and it had to try and control urban sprawl. The ideas were there but could they be delivered?

The new Department of Planning and Infrastructure experimented with integrating transport and infrastructure, with the minister also committed to the concept. The experiment failed as the top-down policy of integration was always agreed to, but the bottom up did not know how to do it; they knew what they should do but the Manuals of Modernism remained firmly in place on both statutory planning and transport planning. And so the juggernaut of car-dependent sprawl continued.

Water was a different story. In 2001 it didn't rain at all. The state government went into crisis mode and set up a cross-government approach to saving water and looking at better alternatives. The Water Manuals did not have much to offer as constraints on resources were not part of the Modernist view of the world. But all kinds of conservation measures (and then desalination technology) worked (Newman, 2015a). Since then the Water Manuals have included large sections on reducing, reusing and recycling as raised in chapter 9. All levels of government and planning agree that water consumption should not continue to grow if we are to continue to increase our wealth, yet this remains a fundamental of the Manuals of Modernism when it comes to resource consumption.

Solid waste has had a similar work-over from its Modernist Manuals, though it's perhaps not as spectacular as the water success story. Waste is now seen to have the potential to decrease to zero without causing a reduction in our wealth. Every now and then a crisis due to land constraints for landfill undermines progress, based on previous assumptions of reducing waste, but we mostly understand waste now from a sustainability perspective.

Energy for power has also begun to be seen as something that could involve much less consumption, less waste and much more local and renewable sources. However, most of the planning in the twenty-first century continued to plan for electricity growth as its link to wealth seemed to be very strong. As outlined later, the predictions were incorrect and decoupling did in fact set in.

Infrastructure planning in some areas was not quite so certain anymore and was beginning to emerge within a sustainability paradigm. However, the Modernist Manuals for transport and land-use have largely remained in place throughout this period (though the first signs of change have begun to be observed). Throughout the world's developed cities three things began to happen simultaneously: car use peaked and declined (see chapter 26); public transport, cycling and walking began growing dramatically; and cities began to come back in (redevelopment) faster than they were going out (greenfields development; Newman, Glazebrook & Kenworthy, 2013; Newman & Kenworthy, 2015). The causes of these changes were multiple and include:

- economic factors relating to the value of dense centres for the new knowledge economy jobs that need people to meet face to face;
- the new smart phones and tablets that enabled people to keep in contact with friends and work colleagues at any time and place and which cannot be used while driving; and
- the culture of urbanism found to be so desired by the young and wealthy.

The Manuals of Modernism do not understand such trends or their causes. Wealth has always been coupled with car ownership and use, larger houses and suburban bliss. The demand for a more urban and less suburban city is now being embraced by people in ways that Modernism could never have done. But how mainstream is it becoming?

PHASE 4: DISRUPTIVE INNOVATION 2015–

The notion of Disruptive Innovation was first espoused by Clayton Christensen at Harvard Business School in 1995 (Bower & Christensen, 1995; Christensen, Baumann, Ruggles & Sadtler, 2006; Christensen & Overdorf, 2000). He suggested that innovation did not have to be seen as a top down process of technologies that were invented to cleverly and rationally replace those of the previous era. He suggested that instead it was driven by demand, when people saw an innovation which met their needs better than the mainstream market was able to offer. Then they began to purchase the alternative innovation, despite it being seen as more expensive by those in control. Soon the innovation flips the whole system into a new way of providing services and the economy is mainstreamed with a new way of doing things.

Examples are given by Christensen of the 3.5-inch disc, which was preferred over the 5.5-inch disc for memory storage despite it being more expensive per unit of memory. However, the 3.5-inch disc was cheap and more convenient and eventually gave rise to the notebook computer, a major system change. The mainstream provider of the 5.5-inch discs went under – this is called the Kodak Effect.

The application of Disruptive Innovation to cities is only just being attempted (e.g. Seba, 2014) but it may provide us with a much better insight into how our cities are likely to unfold and how the Manuals of Modernism will finally be rewritten. The first signs can be seen in application to energy and to transport/land-use.

Energy is rapidly moving towards the use of renewables, especially solar PVs on roof tops. In Perth, the city now has 490 MW of PV on household rooftops, equivalent to the size of a large coal-fired power station. These PVs are mostly on the larger but poorer houses in the outer suburbs (Newton & Newman, 2013). For most utilities facing this transition, the temptation is to first deny it is happening as solar is more expensive, but people continue to buy it because they receive lower bills and so it seems cheaper, starting a niche market that rapidly grows. Already the signs of an emerging system flip are showing, for which there is yet still little preparation (Green, Byrne & Newman, 2015).

Utility engineers and the politicians they advise are still using the Modernist Manual, which explains how a centralised power system works in an attempt to try to make solar fit. And it won't. They need to construct a new manual that enables a more distributed and participatory energy system to emerge (Rauland & Newman, 2015). This system will continue to have a grid but it will have many more localised systems run by communities, industries and local governments; it will be based on smart control systems and battery storage; and will eventually be 100 per cent free of fossil fuels. This will be in place by 2030 and will be unstoppable unless the Energy Manuals of Modernism are applied as a fundamentalist set of rules.

The same will happen in our cities as they phase out oil and large-scale car dependence, including the asphalt-oriented Transport Manuals. The Disruptive Innovations of urban rail, especially light rail, and their associations with local walking and cycling within a dense urban centre in a series of linked centres is the city of the future being imagined in most cities (Newman & Kenworthy, 2015). The light rail phenomenon continues unabated in US cities, where in ten years' patronage increased 190 per cent, heavy rail patronage increased 53 per cent and bus use decreased 3 per cent during the era of peak car use.

The Transport Manuals suggest that as wealth grows the use of cars will increase, however, the data are now showing that

car use is decoupling from wealth and that urban rail is growing much faster than ever expected. Across all the world's cities, the emergence of urban rail as a faster option than cars stuck in traffic has now been quantified: urban rail in the past decade is now on average more than 20 per cent faster than traffic and in some cities 50 per cent faster (Newman & Kenworthy, 2015). In Perth this is very clear with the new rail systems to the north and south, which average over 90 kilometres per hour and have top speeds of 130 kilometres per hour, going straight past the freeway 'car parks' at peak time (McIntosh, Newman & Glazebrook, 2013). Nothing in the Modernist Manuals and the Four Step Model would have predicted this.

Urban rail is disruptive because it is generally more capital intensive than buses and most transport planners who use the Manuals think that buses should be just as effective. But buses are not competitive with urban rail quality – rail capacity is significantly better and, when provided, urban rail immediately attracts the kind of land-use intensities that cities are trying to attract. This is the system change that urban rail induces: it brings people back in to more crowded and less spacious locations because that is where they want to be. This new system keeps young talent in the city and the urban economy thrives without the need for cars (and oil). Regenerating cities rather than urban sprawl is clearly economically better (Trubka, Newman & Bilsborough, 2010a, 2010b, 2010c). Exponential declines in car use happen when transit-oriented developments (TODs) are built around a corridor of rail (Newman, Kenworthy & Glazebrook, 2008). Urban rail is now growing dramatically across developed cities and emerging cities, such as in the eighty-two Chinese cities and fifty-one Indian cities that are building urban rail (Newman & Kenworthy, 2015).

Perth is beginning to show these trends. The city centre has redeveloped with 30,000 residents moving into high-density housing over the past decade compared with the 700 that were there before. Such a market was not part of the Modernist Manuals, which assigned the CBD a single commercial function. Demand for

such urban lifestyles in other dense, walkable centres across Perth is growing rapidly. The next thirty years of urban development can indeed be fitted into about twenty urban centres across the city (Hendrigan & Newman, 2012).

The polycentric, smart city of the future, with its focussed land-use and integrated transit-oriented development, is nothing like the Modernist Functional City with its commitment to endless space and car dependence. It will be

- high density and mixed in its rediscovered and rehabilitated walking city fabric (not just in the CBD);
- medium density in its transit-city fabric along corridors dominated by fast urban rail and accessible to all in the surrounding areas; and
- low density in the adjacent car-based suburbs (but with electric vehicles run by solar homes) where intensive use of renewables and other community-based technologies will be creating small local economies.

New and creative ways of tackling the myths of urban density will be needed to assist in fostering greater acceptance of urban density to help make this city (Newman, 2014).

At the same time, private-sector-led proposals for new rail lines will be based on how effective and easy it is to create redevelopment opportunities along corridors. Government transport planners will need to see they take second place behind land development in order to enable this process.⁷ New Public Private Partnership (PPP) guidelines that enable this will ensure that public good outcomes are achieved (Newman, 2015b), which would include a dramatic increase in the urban regeneration of new centres as well as a lot more urban rail (see chapter 28).

Driving these changes in transport planning will be the mainstreaming process that replaces the Manuals of Modernism.

1. The Four Step Model will be replaced by a model that shows how the three urban fabrics of the walking

- city, the transit city and the automobile city will have their own regulations and performance criteria; with significantly less car use in the first two fabrics and modified requirements for space in the auto city fabric.
2. The Statutory Planning models will all be changed to reflect these three urban fabrics and their different requirements for density, mix and car dependence. As automobile city fabric begins to be redeveloped (already happening in the 1950s and 1960s suburbs), there will be a new set of regulations that can enable more walking city fabric in centres and more transit city fabric in corridors to enable the polycentric city.
 3. The open space plans will both respect the important natural features of an urban area and enable the kind of amenity that is necessary for each community and the density of their activity. In walking city areas, the need for intimate urban parks and bigger footpaths will be more important than the need for some regulated percentage of open space.
 4. The water, energy and waste plans will have predictive power based on reducing, reusing and recycling as well as new smart, renewable technologies that fit into each area of the city differently.
 5. The consultants and models that are able to create fit-for-purpose solutions, as suggested above, will be responding to the Disruptive Innovations of the twenty-first century and enabling our cities to adjust to these big changes.

CONCLUSIONS

The Manuals of Modernism have been the guide for infrastructure planning in Perth, and most modern cities, since the 1950s. These Manuals have survived the era of Post Modernism and the era of Emerging Sustainability. They are unlikely to survive the

era of Disruptive Innovation as the trends against their models are running heavily against them. Professionals who use them may find they are not providing acceptable solutions for politicians and even result in legal action, as has been the case for several recent toll road projects where traffic predictions were disastrously wrong (Goldberg, 2012).

The new Manual for Transport is likely to be called Fit for Purpose Transport Planning and the Manual for Statutory Planning is likely to be called Fit for Purpose Planning. The first will be much bigger than the second as an agile planning system will need to be able to cope with disruption better than it does now.

NOTES

1. The Four Step Model was first developed in Detroit in the 1950s and is now used around the world to predict traffic levels. Its four steps are: trip generation (from land-use and demography), trip distribution, mode choice and route assignment.
2. I had a conversation with the head of transport planning in the Department of Planning at that time who told me he had personally removed all the rail reserves and had implemented road widenings on every highway to six lanes as well as massive freeways and interchanges he designed using a 50c piece or a 20c piece to draw the space required on the map.
3. The same public servant I interviewed over the road reserves process in the late 1970s explained to me why the closing of the Fremantle Railway was an essential step. They needed to be able to get tanks from the Swanbourne SAS Base to the Rockingham Naval Base when the Russians invaded and this required a freeway down the north-south corridor. The railway was the only space available.
4. To me as an academic in Environmental Science studying oil vulnerability in cities and as a Fremantle City Councillor trying to look after the old walking city fabric of Fremantle and the old rail corridor that had created the western suburbs, it didn't seem right.
5. Transport planners in the WA government originally proposed a busway as they could not imagine a train line being necessary in these car-based suburbs. However, it was rejected mostly on political grounds (see Committee for Perth, 2011; Newman, 2012;)
6. I wrote my first paper on this topic at a Royal Australian Planning Institute conference in 1993 and published *Sustainability and Cities* in 1999, but translating these concepts into mainstream planning had to wait until the twenty-first century when I was asked to produce the State Sustainability Strategy.
7. This concept is developed in The Entrepreneur Rail Model, available from www.sustainability.curtin.edu.au/publications and summarised by Newman (2015b).

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