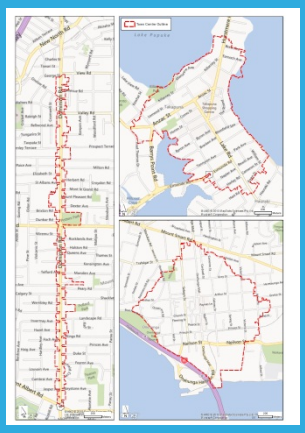

FINAL REPORT

The Economic Impacts of Parking Requirements in Auckland

Auckland Council

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1. Introduction

Auckland Council (AC) commissioned MRCagney to investigate the economic impacts of parking policies in Auckland. AC is currently considering changes to parking policies as part of the draft Unitary Plan, including the removal of minimums from some zones and the imposition of maximums in others.

The following sub-sections:

- Discuss the Need for this Study;
- Provide a historical and economic context; and
- Outline the structure of this report.

1.1 The Need for this Study

This study comes at a unique time in Auckland's history: Following the formation of the Auckland Council, and associated CCOs, the Auckland Plan has established a unified direction for the region.

In the context of this study it is noteworthy that the Auckland Plan establishes a number of targets/goals that are relevant to parking, namely:

- 60-70% of development occurring within the urban limit;
- Up-zoning to allow greater densities, housing affordability; and
- Doubling public transport patronage by 2022.

Parking regulations are discussed in directive 10.6 of the Auckland Plan. This directive instructs the Unitary Plan to consider a wide range of issues when formulating parking policies, such as the latter's implications for development patterns; housing affordability; use of public transportation; investment in public facilities; and neighbourhood amenity.

Public consultation on the draft Unitary Plan (dUP) has been completed and the notified version is currently being developed. It will bring development policies in the Auckland region together within one document for the first time. We understand AC is not seeking to roll over pre-existing district plan parking rules, but instead to re-examine rules to ensure alignment with the new strategic direction identified in the Auckland Plan, especially the aforementioned directive 10.6.

In this report we consider the parking provisions contained in the dUP. Given this strategic context, the purpose of the present study is to quantify the economic impacts of minimum and maximum parking requirements as prescribed in the dUP. As far as we know, this study is the first to empirically estimate the economic impacts of minimum and maximum parking requirements in an Auckland context.

1.2 The Historical Context

Current parking policy in Auckland is the product of a tension and contraflow between more urban and more rural visions dating back to the 1940s and, in particular, the latter part of that decade, just prior to the age of the urban motorway.

Many people today like to imagine that concerns with the availability of car parking and congestion are fairly new, when actually they have been noted for some time. In 1947 the Ministry of Works publication *Design and Living* declared that "*The exciting novelty of the motor car has worn off, and we are becoming*

aware of its problems." Two years later, in 1949, the City Engineer of Auckland City Council, Arthur Dickson, argued that it was essential that downtown traffic was to be kept to an "*absolute minimum*."

Around this time Auckland City Council first began to appreciate that parking had economic impacts and started to implement policies that were designed to manage demand. In 1953, for example, Auckland became the first city in the wider British Commonwealth to install parking meters. In the subsequent seven year period Auckland City Council collected approximately £284,000 from parking meters.

This revenue did not go unnoticed. In the image below the NZ Herald cartoonist, Gordon Minhinnick, implies that lucrative parking revenue has even motivated the Council's to prevent buses stopping on Queen Street, where they would require kerbside space that could otherwise be used for parking. While hapless bus passengers look on, the City Council, with a swag-bag labelled 'Parking Revenue', prevents the bus from using Queen Street by claiming "Keep out: This is our gold mine, not yours!"

Figure 1: "Keep out: This is our Gold Mine, Not Yours!" NZ Herald (circa 1960)

When we fast forward to the present day, we find that Auckland Transport's management of on-street parking in the City Centre is again at the relative forefront of global thinking on parking issues. Their formally adopted on-street parking policy commits to the use of prices, rather than time-limits, as the primary means for managing the demand for public parking. This has in turn seen the removal of time-limits and the gradual expansion of pay parking around the city centre. While drivers must pay to park in the city centre, they can now choose to park for as long as they wish.

Tracing the historical origins of minimum parking requirements as a policy in Auckland is more difficult. Shoup (2005) found that minimums first emerged in Los Angeles in the 1950s in response to rapidly growing vehicle congestion. In Auckland, the first formally-promulgated District Scheme of 1961 required one off-street car parking space per dwelling, a requirement that persisted through to the end of the 1980s. While minimums may have been required earlier than this, it is relatively difficult to tell because a succession of more informal guidelines, draft schemes, and by-laws predated the 1961 scheme.

Over time, Auckland City Council required larger family houses to have more parking (the rule soon became 0.4 car parks per habitable room, with a minimum of one). Even early on there was an awareness that town houses and flats in higher density zones would not be viable if Council insisted on much more than one car park per unit for that type of housing, which the Auckland City Council of the 1960s, 1970s and 1980s did much to promote, at densities of up to 120 habitable rooms per acre (307 per hectare). A requirement that no house-building project be done in such a way as to preclude later construction of a garage was also present in 1961, although this was dropped from later schemes.

In the 1981 District Scheme parking maximums appeared to have made their first appearance in Auckland, along with the first exemptions from minimum parking requirements for retail activities in inner-suburban areas, such as Three Lamps. The oft-cited requirement of two off-street parking spaces per residential dwelling unit outside the central area – including flats and townhouses – did not actually appear in Council planning documents until 1993 when the District Scheme for the now-larger Auckland City took effect. In other words, in 1993 the enlarged Auckland City Council adopted quite high minimum parking requirements, whereas they had previously been relatively modest.

More recently the direction of parking policy in Auckland appears to have turned again. Circa 1996 minimums were removed in the city centre. In the years since minimums have also been removed or reduced in Newmarket, New Lynn, and some of the more intensive residential and mixed use zones. This change in direction is likely to reflect a growing awareness of the negative impact of minimum parking requirements, which will be discussed in more detail in subsequent sections of this report.

1.3 The Economic Context

In this section we set-out the basic economic context for the material that follows, namely:

- First, we establish the default policy setting, i.e. no regulation;
- Second, we introduce a basic economic framework for parking regulations;
- Third, we consider the distributional impacts of parking regulations; and
- Finally, we discuss the relevance of “binding regulations”.

Taken together, this material provides an important qualitative underpinning to much of the quantitative analysis and policy recommendations that follow.

1.3.1 Establishing the default policy setting

First, there is merit in establishing the default policy setting. We suggest the default policy setting is “no parking regulation”, i.e. the absence of parking regulations. While such a scenario does not currently exist in Auckland, there is merit in AC trying to build dUP policies up from first principles, as it were, rather than presuming that the existing parking policies are the default policy setting.

Second, we suggest that minimum parking requirements are viewed as *a regulatory intervention (i.e. public policy) that seeks to increase the supply of parking above what would normally be provided by developments were they able to choose freely.* Maximum parking requirements of course have the opposite effect, i.e. they seek to reduce the supply of parking below what would normally be provided by developments were they able to choose freely.

Economic theory suggests that in, a straightforward market setting, the “optimal” supply of parking will be given by the intersection of people’s willingness-to-pay for parking versus the marginal costs of providing for that demand, i.e. the point at which the private benefits are equal to the private costs. In such a

setting, the level of parking that developments freely chose to supply would be expected to lead to optimal economic outcomes, or more specifically the maximisation of consumer surplus.

On the other hand, under some circumstances the decisions made by individual market participants are unlikely to lead to optimal outcomes. In such circumstances well-designed regulatory interventions may be able to improve economic outcomes by considering factors that are either not considered by direct market participants and/or act as barriers to efficient market functioning, such as externalities and transaction costs. Such costs and barriers are the primary rationale for regulatory intervention.

Taken together, this suggests that the default position policy-makers should adopt with respect to parking regulations can be characterised by:

- *No regulation*, i.e. leaving market participants free to decide how much parking they want and are prepared to pay for. This default position in turn implies that the dUP zones should start from a position of both no parking minimums and no parking maximums; unless
- Evidence exists that regulations on the supply of parking (i.e. minimums and maximums) are 1) able to correct market distortions and thereby lead to more efficient economic outcomes and 2) the most effective policy tool for achieving those outcomes.

The question our work then considers is whether the imposition of parking regulations that is proposed by the dUP, namely minimums and maximums, are likely to have a net positive economic impact, or otherwise. The next sub-section considers (in a qualitative sense) some of the economic arguments for why society may want to deviate from the default policy setting of "no parking regulation".

1.3.2 Developing an economic framework for parking regulations

In this sub-section we consider the factors, or market distortions, which may cause AC to deviate from the default parking policy settings of "no parking regulation".

We are interested in understanding the factors that would cause the private benefit/cost of providing parking to deviate from the social benefit/cost. More specifically, what are the economic impacts of providing parking that may not be considered by marketing participants, which in turn might cause them to provide more or less parking than what is socially optimal?

Before proceeding further we need to differentiate between minima and maxima, as their economic impacts are quite distinct. The table below present the primary economic impacts of minimums and maximums and identifies the primary agent to which the benefits and/or costs are likely to be assigned.

Figure 2: Primary economic impacts of parking provisions

Regulation	Benefits	Costs
Minimums	Reduces parking spill-over *[adjacent residents]* Improves ease of finding car-park *[drivers]* Avoids need for parking management *[AT]*	Reduces value of development *[developers]* Increases traffic congestion *[drivers]* Creates compliance costs *[developers / AC]*
Maximums	Reduces traffic congestion *[drivers]* Improves amenity *[pedestrians]*	Reduces value of development *[developers]* Increases parking management costs *[AT]* Creates compliance costs *[developers/ AC]*

Where benefits exceed costs, then parking regulations are likely to have a net positive economic impact and vice versa. As discussed previously the default or "base" case is defined by the absence of parking provisions. The merits of parking regulations are then able to be defined by their economic benefits and costs relative to this unregulated case.

In the case of parking maxima, for example, if the benefits (i.e. reduced congestion and increased amenity) were found to outweigh the costs (i.e. reduced development value, increased parking management costs, and additional compliance costs), then parking maxima would be considered to have a net positive economic impact, and vice versa.

We note, however, that even in situations where regulation delivers a net positive economic impact, the risk remains that other policy options may be able to achieve the desired benefits in a more effective manner. Hence, merely demonstrating that regulations have a net positive economic benefit compared to the default setting of no regulation is necessary but not sufficient for imposing regulations.

A tougher test is required, namely that the proposed regulations are the most effective way of achieving the desired outcome. In reality such tests are difficult to specify because one rarely knows the full ambit of policy options that may help to address the issue being considered. Nonetheless, there is merit in at least considering whether parking regulations in the dUP are the most appropriate policy tool for addressing the market distortions that are supposedly leading to inefficient economic outcomes.

Finally, theory suggests that a change in the supply of parking, as required by minimums and maximums, would cause the price of parking to be different from its normal level. Hence, parking regulations will tend to operate primarily through their effects on parking prices. Indeed, parking minimums are in many respects designed to increase the supply of parking and hence make it less expensive.

1.3.3 The distributional impacts of parking regulations

Aside from their impacts on economic efficiency, there are valid questions to consider about the distributional impacts of parking regulations, i.e. who wins and who loses, and how these distributional impacts may influence parking policy settings.

In terms of minimums, we suggest the clear winners are existing residents, who benefit from minimums because they reduce their exposure to parking spill-over associated with new developments. Newer retail activities that provide large amounts of parking may also win from retaining minimums, because the regulations introduce barriers to redevelopment and intensification. In this way minimums may actually increase the market power of newer retail areas compared to older areas, where redevelopment and intensification cannot occur without the provision of parking.

In contrast, the clear losers are developers, for whom minimums reduce the potential value of their development and create additional compliance costs. Hence, we have a situation where residents have an incentive to regulate to the detriment of developers. As developers are primarily acting in response to perceived future demand, we suggest that the primary impact of minimums is to reduce the space that is available for accommodating future residents and commercial activities. This is a crucial point: The economic cost of minimum parking requirements is mainly an *opportunity cost*, in that they reduce the land and/or floor space available for other potential uses, rather than a *financial cost* associated with the construction of parking itself.

Indeed, while the direct financial costs of developing surface parking are often relatively low, the opportunity cost of those same physical resources may be quite high. As subsequent sections demonstrate in more detail, opportunity cost is the primary determinant of the economic costs created by parking minimums. We suggest this opportunity cost is primarily borne first by developers and secondly by new residents and businesses, who are prevented from establishing due to minimums.

In terms of maximums, the primary winners are transport users that benefit from reduced congestion. This includes drivers that continue to drive, in spite of there being less parking available; bus users, who benefit from less congested road space; and pedestrians, who must contend with fewer vehicles. On the

other hand, the clear loser is again developers, who are subject to a regulation that will constrain their ability to supply parking at a level that they consider to best meet the market demand.

The key takeaway message of this discussion is that parking regulations generate both economic costs and benefits, and that these impacts are dispersed unequally over a range of actors. This diversity in distributional impacts seems to create incentives for existing residents and retailers to advocate for maintaining parking minimums as a means to protecting their respective positions of privilege. We suggest that the distributional impacts of parking regulations should be considered by AC when evaluating submissions on the dUP.

1.3.4 What if parking regulations are not a binding constraint?

The final question we consider is under what circumstances parking regulations are binding, in the sense that they force a development to provide more or less parking than they would freely choose?

Indeed many new developments could well choose to supply a level of parking that is consistent with what is required by the minimums and maximums specified in the dUP, i.e. the regulations are not binding. For these developers parking regulations are not a burden and hence can be considered to have minimal economic impacts, beyond perhaps creating some minor compliance costs.

Nevertheless, the fact that parking regulations are not binding for *all* developments is not a reasonable argument to support the parking regulations, because the regulations may still be binding on *some* developments. As later sections will show, research on the removal of minimum parking requirements in London found that the supply of parking with new developments reduced by 40% once minimums were removed. Such a response would indeed suggest that minimums are binding constraint on a substantial proportion of developments.

1.4 The Structure of this Report

The following sections of this report are structured as follows:

- Background research;
- Analysis of the economic impacts of minimums and maximums; and
- Conclusions and recommendations

2. Background Research

2.1 Planning and Policy Context

2.1.1 District Plans

In New Zealand minimum parking requirements are applied through local District Plans. The "Objective and Policies" for the parking section of Auckland Council District Plan Isthmus Section (formerly the isthmus section of the Auckland City Council District Plan), for example, are illustrated below.

Figure 3: Parking objectives – District Plan Isthmus Section

12.7.1 OBJECTIVE & POLICIES

Objective

To ensure that the impact of activities on the capacity and safety of the road system is adequately catered for, so as to avoid adverse impacts on the environment.

Policies

- By requiring activities to provide adequate off-street parking and loading facilities.
- By providing opportunities to alleviate parking deficiencies within existing commercial centres.

Here we see that the stated objective is to ensure that "*the impact of activities on the capacity and safety of the road system is adequately catered for, so as to avoid adverse impacts on the environment*." The policy section proposes to achieve this objective primarily by "*requiring activities to provide adequate off-street parking and loading facilities*."

Subsequent sections define adverse impacts as:

- "*Overspill of parking onto the adjacent roadside*", i.e. localised increase in parking demands;
- "*Adversely affecting the "efficient use and capacity of a road*", i.e. localised congestion; and
- "*Adversely affecting the "amenity of an area in terms of aural privacy and visual appearance*."

The District Plan then provides a list of parking requirements for various land use activities.

Figure 4: Examples of minimum parking requirements - District Plan Isthmus Section

ACTIVITY	PARKING SPACES REQUIRED
Boarding house/hostel	One for every non-residential employee plus one for every 3 residents the boarding house/hostel is designed to accommodate; plus 2 for any manager's unit.
Bulk store	One for every 100m² of GFA plus one for every 100m² of outdoor storage.
Buildings used for recreation	One for every 4 people the facility (including grandstands) is designed to accommodate.
Building improvement and hire centres	One for every 20m² of gross floor area of building and one for every 100m² of outside area used for display purposes.

We note that minimum parking requirements for non-residential activities are usually prescribed as a ratio of car-parks to GFA. This relationship is important because it means that within individual sites floor area will "compete" with the requirement to provide parking. In this way, minimum parking requirements are effectively a "tax on floor space", where an increase in floor space triggers an increase in parking.

In medium to higher density environments, where structured parking facilities may be required, minimums can require considerable capital investment that would otherwise be spent elsewhere on the development. Thus the reality is that with constrained sites and limited budgets minimum parking requirements will tend to limit development potential.

At this point we also note that the Auckland City Council District Plan (Isthmus Section) does not acknowledge the potential for minimum parking requirements to have adverse impacts, nor does it discuss whether alternative policies might be able to achieve the same outcome. Indeed, the results of our literature review, which are presented in detail in the following section, seem to suggest:

- "Overspill" of parking demands into surrounding streets may be best dealt with by improving the management of on-street parking, rather than requiring off-street parking;
- The provision of large amounts of low-cost off-street parking seems to do more to hamper the efficiency of the road network (through stimulating vehicle travel) than it does to reduce localised congestion that may result from a situation where there is insufficient off-street parking; and
- Off-street parking facilities can have large negative amenity impacts, particularly in terms of the traffic they generate and their visual appearance.

We suggest that the reasons proffered as justification for minimum parking requirements are relatively questionable and/or fail to acknowledge the viability of alternatives to regulation.[1]

The following issues are also relevant to our understanding of the development and application of minimum parking requirements in Auckland:

- Since 1996, developments in the City Centre have not been subject to minimum parking requirements but instead have been subjected to parking maximums;
- Prior to the formation of the Auckland Council, several councils had taken steps to relax and/or remove minimum parking requirements; and
- Developments that were unwilling or unable to provide the required amount of parking were considered under a discretionary resource consent process and either a) declined or b) granted consent with conditions attached.

2.1.2 Draft Unitary Plan

The background to the dUP's car parking provisions suggests that car parking is an essential component of Auckland's transport system that can have major implications for the convenience, economic viability and the design and layout of an area.

The manner in which parking is managed and provided is seen as being important in terms of urban amenity and efficient use of land, and in terms of reducing car use and contributing to a more sustainable transport system.

[1] Note that the justification would typically be considered as part of the s32 analysis rather than in the DP itself. But the issue of potential adverse effects of minimums should be acknowledged in the issues section of the DP, and potentially reflected in the objectives and policies.

The dUP's approach to car parking splits zones into two primary types: 1) Those where maximums apply and minimums do not and 2) Those where minimums apply and maximums do not. The alignment between zones and the parking regulations that apply, along with the percentage of employment and population that is associated with each zone, is summarised in the following table.

Figure 5: Summarising the dUP's approach to parking provisions

Draft Unitary Plan Zones		Minima or Maxima	% of Total Employment	% of Total Population
A	City Centre	Maxima	14%	2%
B	Metropolitan Centre	Maxima	5%	0%
C	Town Centre	Maxima	4%	1%
D	Local Centre	Maxima	1%	0%
E	Mixed Use	Maxima	9%	2%
F	Terrace Housing and Apartment Buildings	Maxima	5%	7%
G	Neighbourhood Centre	Minima	0.2%	0.3%
H	Mixed Housing	Minima	12%	46%
I	Single House	Minima	7%	30%
J	Large Lot	Minima	1%	2%
K	General Business	Minima	1%	0.1%
L	Business Park	Minima	1%	0.0%
M	Light Industry	Minima	24%	1%
N	Heavy Industry	Minima	5%	0%
O	Rural (All Rural Zones & Future Urban)	Minima	3%	7%
P	Other	Minima	9%	2%

This table suggests:

- Zones subject to parking maximums (and no minimums) account for 38% of all employment within the city and 12% of all residents; and
- Zones subject to parking minimums (and no maximums) account for 62% of employment and 88% of all residents.

The dUP proposes no "middle-ground", i.e. no zones are characterised by an absence of parking regulations. This is curious and suggests a rather "polarised" policy direction. Given that most of Auckland is currently subject to minimums and not maximums, we would have anticipated that zones would see a move away from minimums but not necessarily be subject to maximums.

In the city centre, city centre fringe area and in and around metropolitan, town, and local centres there is no requirement for activities or development to provide car parking. Instead, a maximum limit has been set on the amount of car parking that can be provided on a site. This approach aims to support 'intensification and public transport and recognises that for most centres, access to the frequent public transport network (FPTN) will provide an alternative means of travel to private vehicles'.

The maximum levels of accessory parking for activities outside the city centre are generally set at 75% of typical existing minimum parking requirements. The maximum levels for non-residential activities in the city centre are 1/200m^2 GFA. For residential activities in the city centre the rate varies from 0.7/dwelling in the case of dwellings less than 75m^2 in area, to 1.7/dwelling for dwellings larger than 90m^2 in area.

An exception to the above general characteristics is the retail maximums outside the city centre, which have been set at a level with the intent of being 'unrestrictive' maximums.

In all other areas, a minimum level of car parking is required to accompany any activity or development. A maximum limit is set on the amount of car parking provided for offices located in these other areas as well. The minimum levels for car parking are generally set at 75% of typical existing minimum parking requirements.

For any activity that exceeds the amount of parking allowed by the maximum standards, or provides less parking than required by the minimum standards, a resource consent for a restricted discretionary activity is required. The matters over which discretion is restricted relate to 'adequacy for the site and the proposal', 'effects on intensification', and 'effects on the transport network'.

Standalone car parking facilities which are not accessory to activities or development on the same site ("non-accessory parking") are provided for as discretionary activities, which means each facility would be individually assessed under any criteria the Council considered relevant.

Some activities and developments are required to provide cycle parking as well as end-of-trip facilities (e.g. lockers and showers). Activities that do not provide the required cycle parking and end of trip facilities require consent as a restricted discretionary activity. The matters over which discretion is restricted relate to 'adequacy for the site and the proposal'.

The geometric design of car parking and associated manoeuvring is also addressed through minimum standards outlined in the rules of the plan. Activities that do not meet the minimum standards require resource consent as a restricted discretionary activity. The matters over which discretion is restricted relate to 'adequacy for the site and the proposal', 'Design of car parking, loading and access', 'Effects on pedestrian and streetscape amenity', and 'effects on the transport network'

In terms of the spatial definition of the various different areas, and consequently definition of where the minimum / maximum standards apply; with the exception of the city centre fringe parking overlay, the areas are linked to land use zones, which are outlined on the Draft Unitary Plan planning maps.

It is noted that the zoning appears to have been based on a variety of premises; some zones enable the transformation of areas to achieve high densities of development and a compact urban form, while others reflect existing land uses. This results in situations where minimums will apply on one side of the street while maximums apply on the other, or pockets of minimums in areas of maximums and vice versa.

2.2 General Studies

In this section we review general studies of minimum parking requirements. The most original and thorough critique of minimum parking requirements are articulated in Donald Shoup's "The high cost of free parking". This book builds of earlier academic research by Shoup in the 1980s and 1990s. The arguments advanced by Shoup against minimum parking requirements can be summarised as follows:

- ***They assume that parking should always be free, and estimate demand accordingly.*** Minimums match supply to estimated demand for free parking. But as cities grow and intensify there are few reasons to support the presumption that parking would or should remain un-priced. This is true of on-street and off-street parking. Minimums are therefore based on the implicit but unreasonable assumption that parking should always be free.
- ***They create an over-supply of parking that causes congestion.*** As we have seen, one of the key reasons advanced in favour of minimums is that they reduce localised congestion. Shoup, however, points out that the over-supply of under-priced parking that occurs as a result of minimums will have the effect of increasing the supply of parking and lowering its costs, thereby stimulating vehicle travel (and congestion) which would not have otherwise eventuated.
- ***They require more parking to be supplied to meet a given level of demand.*** Requiring individual developments to meet their own parking demands is inefficient because it ignores opportunities to

share parking between nearby activities. In this way, minimum parking requirements actually act as a barrier to "entry" for smaller developers and give market power to large landowners, who are better placed to realise economies of scale from the provision of consolidated parking facilities.

- *They contribute to a fragmented, low density urban form.* This criticism flows logically from the first three: By assuming that large amounts of parking should be provided on individual properties, minimum parking requirements results in a fragmented, low density urban form. This undermines urban amenity and the relative attractiveness of other transport modes, especially walking.

Figure 6: "The High Cost of Free Parking", Donald Shoup (2005)

Criticisms of minimum parking requirements can also be grouped in terms of their economic, social, and environmental impacts, namely:

- *Economic:* Minimums effectively act as an indirect tax on floor space, which in turn lowers land use density and provide a subsidy for vehicle ownership and travel. This contributes to a range of negative externalities, such as congestion.
- *Social:* Minimums bundle what is a transport cost into the costs of development. In the case of residential developments, for example, the costs of providing parking will be reflected in higher prices. And because vehicle ownership and travel tends to be positively correlated with income, a disproportionate share of the cost burden of minimums falls on low income households.
- *Environmental:* Most of the outcomes described above, especially higher rates of vehicle ownership and travel, and larger impermeable surfaces, tend to impact negatively on environmental outcomes. Air and water quality is undermined, especially in situations where parking promotes the outward expansion of urban areas into greenfield areas.

On the other hand, we know of no general texts that defend minimum parking requirements against these criticisms. In fact the only documents that we could find that advance arguments in support of minimum

parking requirements were District Plans themselves (and other similar planning documents from other jurisdictions). Given the large body of research highlighting their pitfalls, the lack of countering evidence in support of minimum parking requirements is, in our opinion, rather notable.

2.3 Academic Literature

Partly inspired by Shoup's work, there is a growing body of academic literature that considers the economic impacts of minimum parking requirements. We summarise some of the most relevant studies in the following sub-sections. We find no academic literature that supports the retention of minimum parking requirements on economic grounds.

2.3.1 Parking requirements and housing affordability: A case study of San Francisco

In this study Jia (1998) investigated the relationship between housing prices and the provision of off-street parking in San Francisco using a hedonic regression model of property prices. Results indicated that an off-street car-park added approximately 10% to the cost of a residential property in San Francisco, where new residential developments are required to provide one car-park per unit.

The researchers conclude:

> *The results are statistically significant, robust, and dramatic. Housing affordability in San Francisco is directly affected by the requirements that parking spaces be provided along with housing units. Why is the requirement for a parking space bundled with housing? Why should each dwelling unit be required to have a fixed number of parking spaces regardless of the numbers of cars in the household? Would the public interest be better served if parking and housing were unbundled, creating separate markets for each?*

One of the more interesting parts of this study is the link drawn between the cost of parking and housing affordability. The authors estimate – using data on incomes and property prices – that 24% more households could afford to purchase their own homes in a situation where parking was not bundled into the costs of the development.

We suspect this estimate is over-stated, because it seems to presume that all households who cannot currently afford to buy would opt for dwellings without parking if they were given the choice, when in reality some would not. Nonetheless the point is instructive for providing something of an upper bound on the degree to which minimum parking requirements may impact on housing affordability.

2.3.2 Cost of Onsite Parking + Impacts on Affordability

The *"Bureau of Planning and Sustainability in Portland"* undertook this sudy into the costs of on-site parking and subsequent impacts on housing affordability. The study considered six different building prototypes, as illustrated in the following figure and associated table.

The costs of these prototypes was analysed from a "ground-up" perspective – whereby the authors calculated the land and construction costs, including parking costs, as well as the number of units and associated rental yields that would be required to deliver an appropriate return on investment.

The key relationship was that as more parking was provided, the construction costs tended to increase, whereas the number of units over which costs were able to be spread decreased. This economic "double whammy" means that even relatively low levels of on-site parking provision had large impacts on the rental yields required for the various prototypes to stack up. For example, even requiring the provision of

0.75 underground car-parks per unit would cause the rental yields required for the development to stack up to increase by USD $500 per month, or 63%.

Figure 7: The six parking prototypes considered in the study

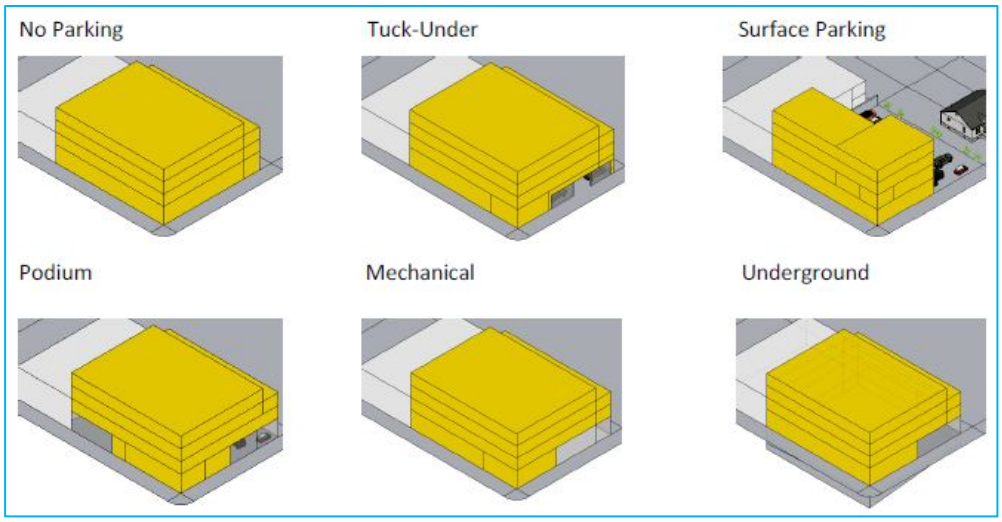


Figure 8: Impacts of on-site parking on housing affordability

Building Development Prototype	# of Units	# of Parking Spaces	Parking Spaces per Unit	7% ROI* Monthly Rent	10 % ROI* Monthly Rent
No Parking	50	0	0	$800	$1150
Tuck-Under	45	9	0.25	$850	$1200
Surface	30	19	0.6	$1200	$1800
Podium	42	22	0.5	$950	$1350
Mechanical	46	23	0.5	$1175	$1660
Underground	44	33	0.75	$1300	$1900

**Note: ROI= Return on Investment*

These results suggest that even relatively "moderate" minimum parking requirements may have significant adverse impacts on housing affordability in medium density settings.

2.3.3 Do parking requirements significantly increase the area dedicated to parking? A test of the effect of parking requirements in Los Angeles

In this study Cutter et al. (2010) test the hypothesis that minimum parking requirements cause an oversupply of parking by examining the value of space used for parking in Los Angeles. They develop a simple theoretical model to show that the implicit marginal value of parking should be equal to the cost of land plus the cost of parking construction.

The authors rely on a large property data set that contains transactions recorded over the period 1997-2005. They use a hedonic regression model to calculate implicit prices for a variety of property attributes, of which the area used for parking is one. Results from this model suggest:

- There is a positive value attached to the availability of parking in the surrounding vicinity; but
- The marginal value of parking is indeed considerably lower than the marginal value of land.

Stated differently, these results provide evidence to suggest that while the availability of parking has a positive impact on property values, this impact is smaller than potential alternative uses of that space. As such, requiring developers to provide parking will tend to reduce the value of their development.

The authors then conduct a direct parking regulation test. This involved comparing the level of parking provided with modern developments to the parking that would be required by the applicable minimums. They found little discernible difference between what was provided and what was required, which in turn suggests that minimum parking requirements were indeed "binding" for their data set.

The authors' conclusions are worth repeating in full:

> *Thus, if the goal of minimum parking requirements is to prevent parking spillover and traffic congestion associated with cruising for on-street parking, our results suggest that MPRs are a blunt and inefficient form of parking management. Other forms of parking pricing that accounts for social externalities can be a superior parking management (Small (1992), Shoup (2004, 2005), Arnott et al. (2005)). For example, Arnott et al. (2005) show that an efficient on-street parking pricing scheme can produce travel time savings from reducing traffic congestion and wasteful cruising-for-parking activity and at the same time raise government revenues, which can be used to reduce distortionary taxation.*
>
> *Minimum parking regulation is a pervasive feature of United States land-use practices. Davidson and Dolnick (2002) state that parking planning questions are among the top five queries for the American planning service each year. Authors such as Shoup (1999) and Davidson and Dolnick (2002) have suggested that parking regulation forces developers to place far more parking spots than necessary on their lot. Arnold and Gibbons (1996) detail the destructive environmental effects of excessive impermeable surfaces. Shoup (1999) also suggest that parking regulations may have a dynamic effect where the design requirements of large parking areas render new development pedestrian unfriendly so that more individuals are forced to travel by car …*
>
> *This research provides further evidence for the arguments of Shoup (1999) and Wilson (1995) that parking minimums significantly distort land-use decisions. In addition, the evidence that, in some cases, parking use value is a small fraction of parcel land value suggests that the efficiency losses from parking minimums may be quite large. However, a full consideration of the optimal level of off-street parking would have to consider the congestion externalities due to lower requirements as well as the environmental benefits of less parking.*

The study by Cutter et al. is the most comprehensive of its kind and has influenced our own analysis.

2.3.4 The influence of urban transportation and land use policies on the built environment and travel behaviour

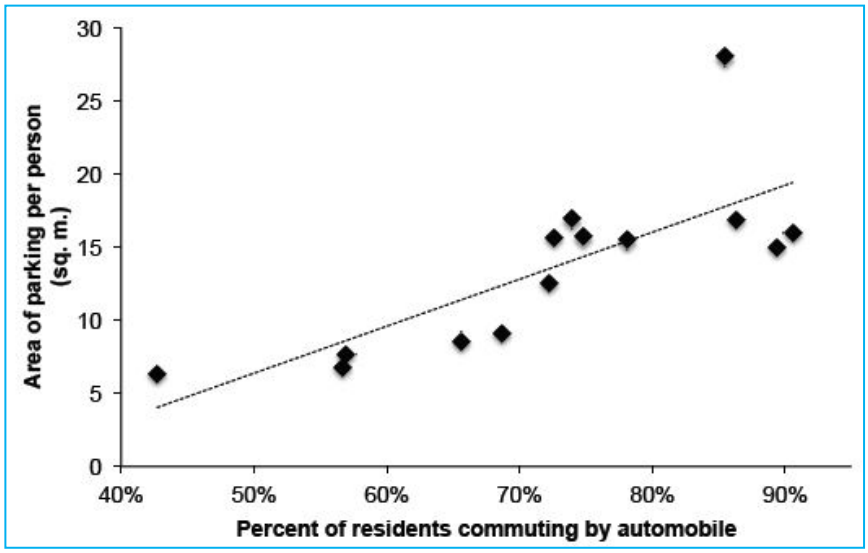
In this dissertation McCahill (2012) considers two topics that are relevant to our discussion, namely:

- **Key policy decisions that influenced transport and land use outcomes.** In 1960 both Hartford (CT) and Cambridge (MA) had similar transport and land use characteristics, but by the year 2000 vehicle mode share in Hartford had increased from 53% to 73%, whereas in Cambridge it declined from 42% to 38%. Parking area per capita in Hartford is more than three times that in Cambridge.
- **Relationships between automobile use and land consumption.** The author examines statistical relationships between vehicle mode share (VMS) and the area of parking per capita in 14 cities in

the U.S., and finds that increased VMS is positively correlated with increased parking area per capita and negatively correlated with human density (residents plus population).

McCahill's research strongly hints (although does not prove) that parking policy affects transport and land use outcomes. More specifically, McCahill finds evidence of a relationship between the area of parking per person and the per cent of residents that commute by private vehicle. The author concludes the provision of parking leads to increased levels of driving and ultimately an increase in the area used for parking, which can be expected to increase congestion and lower land use density.

Figure 9: Relationship between parking per person and per cent of residents commuting by automobile



2.3.5 From Minimum to Maximum: Impact of the London Parking Reform on Residential Parking Supply from 2004 to 2010

The purpose of this study was to (Guo et al, 2012):

> *Examine residential parking supply in London before and after the minimum off-street parking standard was replaced by a maximum one in 2004. Based on 11,428 residential developments after and 216 developments before the reform, it is found that parking supply was reduced by approximately 40 per cent. Ninety-eight per cent was caused by the removal of the minimum standard, while only 2 per cent was due the imposition of the maximum standard. However, the parking supply is actually higher in areas with the highest density and the best transit service than in the areas immediately outside; the adopted maximum standard follows a similar pattern. The market-oriented approach to parking regulation can reduce excessive parking, but it depends on the particular sub-markets. Complementary policies such as strict parking maxima, on-street parking controls and parking taxes are often necessary to form an efficient parking market.*

To paraphrase the most relevant findings from this study:

- Changes in London's parking policy, i.e. the removal of minimums and the imposition of maximums, is associated with a 40% reduction in the parking supplied with new developments;
- 98% of this reduction in parking is attributable to the removal of minimum parking requirements, with only 2% associated with the imposition of maximums; and

- The imposition of maximums will have relatively negligible impacts on the parking market unless they are set at a sufficiently low level that they "bind" for most developments."

The findings of this research from London are consistent with the Los Angeles results, i.e. that minimum parking requirements are a binding constraint on urban development.

2.4 Parking Policy Changes in Auckland City Centre

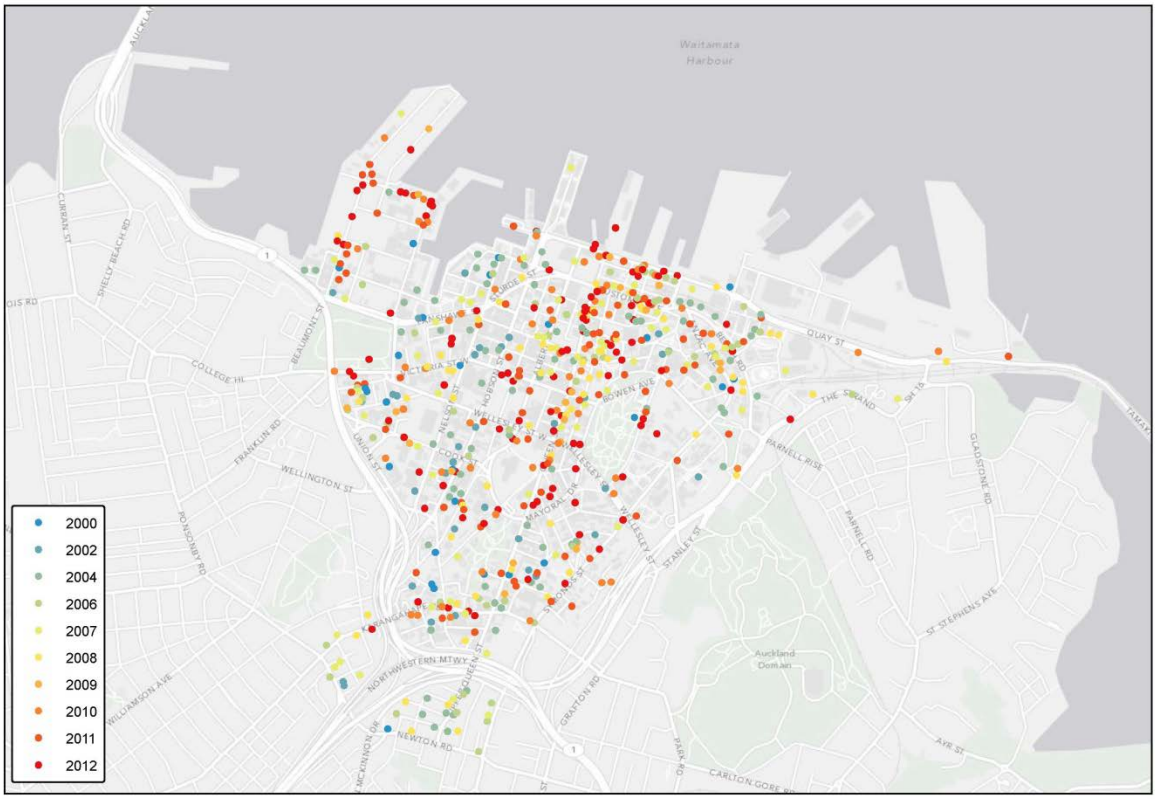
Unlike the rest of Auckland, the City Centre has not been subject to parking minima since the late 1990s and even possibly earlier. Instead, developments in the City Centre have been subject to parking maxima. The City Centre therefore provides a useful test for understanding how the changes to parking provisions proposed in the dUP may affect the parking supply over time.

Of course, the City Centre is unique in many respects, most notably in terms of the density and diversity of its land use; its accessibility to PT; and its demographic make-up. Nonetheless, the economic forces that influence the parking supply – and how these respond to policy settings – are likely to be similar.

The first step in our analysis involved compiling a database of approximately 1,300 resource consent applications lodged in the City Centre from the year 2000 up to the present day. The figure below illustrates the spread of consents across the City Centre and the year in which consent was lodged.

This shows a relatively even spread of consents both in time and space, as such the sample seems like to reflect activity in a range of different precincts within the City Centre.

Figure 10: Map of resource consents included in our sample

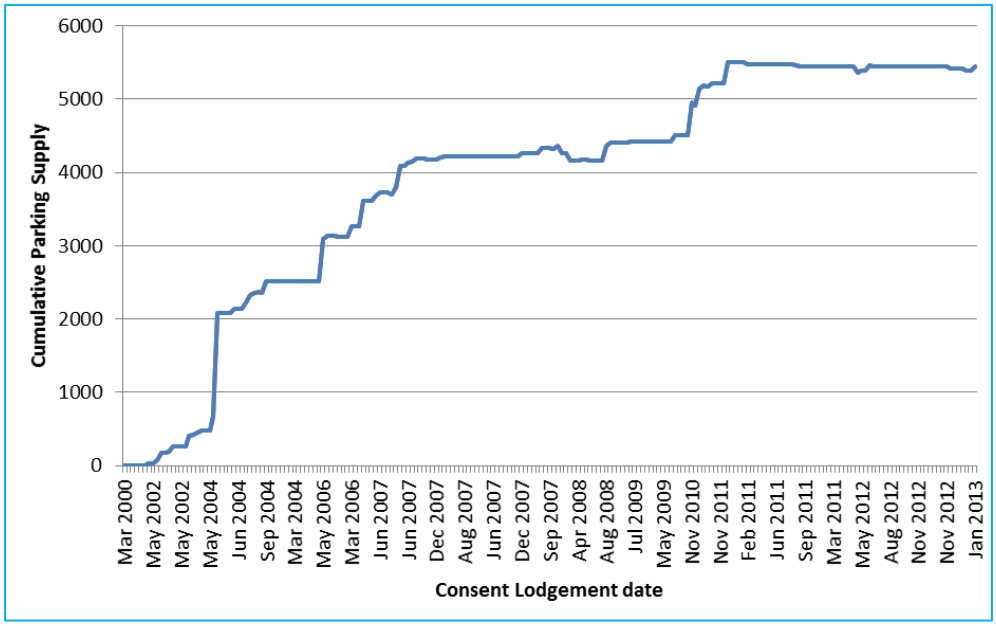


Approximately 266 of the resource consents provided sufficiently detailed information on their associated parking supply (i.e. the change in the parking supply on the site of the proposed development) to be included in our analysis.

The key question we are interested in is how public policies relating to parking provisions have affected the parking supply in the City Centre. More specifically, *how does the level of on-site parking proposed in development applications compare to the existing level of on-site parking and, more importantly, how has this relationship changed over time?*

The following figure illustrates the cumulative change in ancillary parking associated with resource consent applications from 2000 to 2012 based on our sample of resource consents.

Figure 11: Cumulative change in parking supply associated with resource consents 2000 - 2012



We can also plot the change in parking supply as a rolling average change in parking over the period of our data, as shown below.

Figure 12: Rolling average of change in parking supply 2000 – 2012 (n = 100 consents)

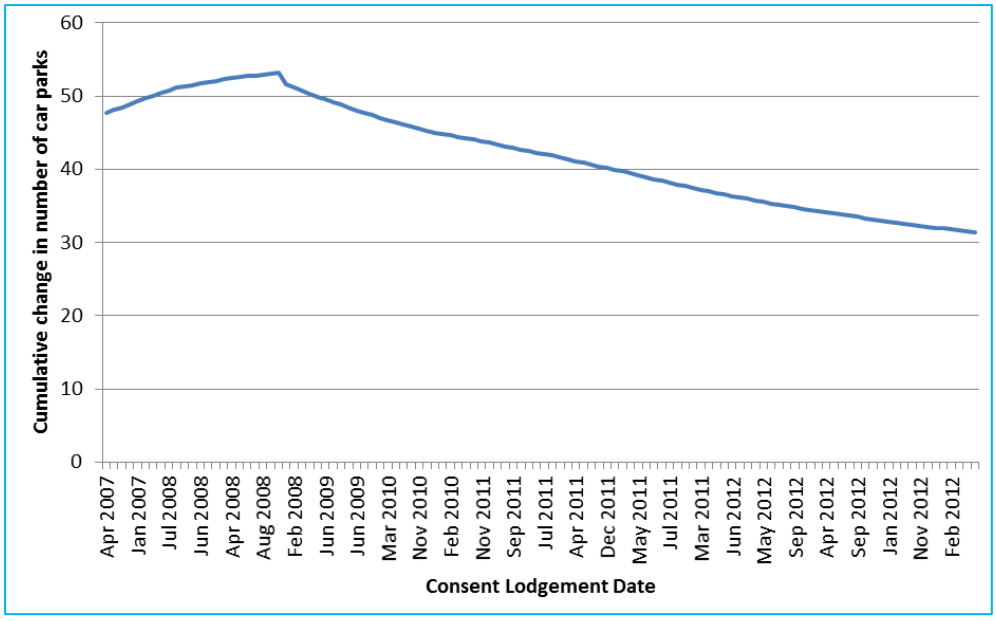
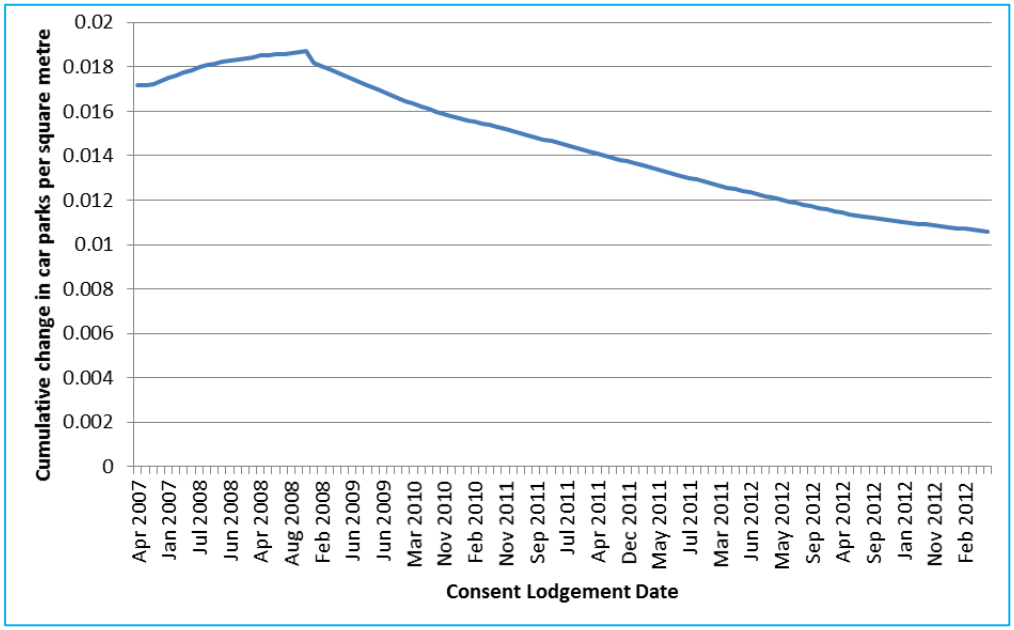


Figure 12 shows the change in on-site parking associated with resource consent applications increased from 2000 to 2008 and then declined in the 4-5 years thereafter (NB: The graph begins in April 2007 because we are using a rolling average of 100 consents so as to smooth variations).

By 2013, the average change in car-parks associated with the last 100 resource consents has declined to 32 additional car-parks per consent, from a peak of approximately 53 additional car-parks per consent in 2008. We note that the rate of decline has been fairly constant over time.

As a check on this trend we standardised the change in car-parks by the land area of the property associated with the consent[2]. This standardisation is useful because it controls for the size of the development and thereby provides a measure of the relative intensity of the parking provided (i.e. change in car-parks per square metre), rather than just the absolute change discussed above (i.e. change in car-parks per development). Results are shown below and confirm the trend found earlier.

Figure 13: Rolling average change in parking supply per square metre 2000 – 2012 (n = 100 consents)



These results seem to suggest that the provision of car-parking in the City Centre has undergone two distinct phases:

- *Phase 1 – End of the status quo (2000 – 2008):* The removal of minima and the imposition (and subsequent lowering of maxima) from the late 1990s onwards seems likely to have enabled redevelopment of small sites and/or land uses for which minima had previously been a binding constraint. This saw a slow-down in the degree to which resource consent applications proposed additional on-site parking, with a peak reached in 2008.
- *Phase 2 – New parking paradigm (2008 – present):* Following several years of high fuel prices and declining private vehicle mode share (possibly in response to major public transport improvements, such as Britomart and the Northern Busway), it appears that new developments

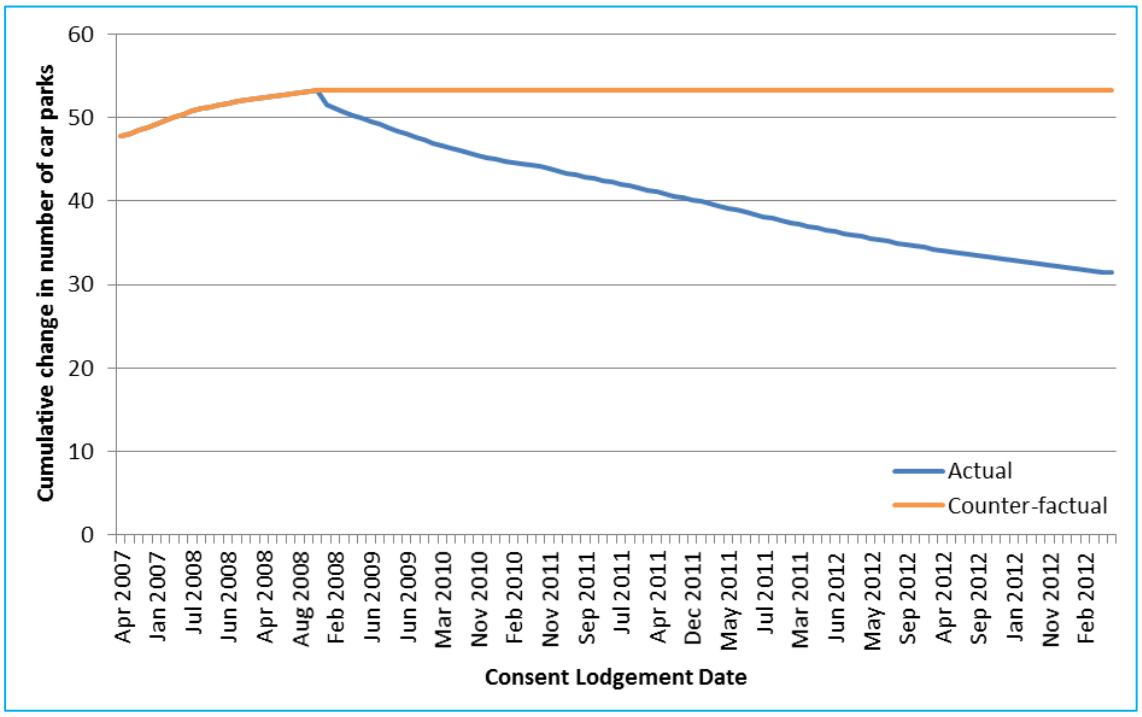
[2] Insufficient data was available on the GFA of individual consents, so we used land area as an alternative means of standardisation.

in the City Centre have begun to provide less (in a relative sense[3]) on-site parking than they did previously. City centre development appears to be increasingly de-coupled from parking supply.

These results are somewhat intuitive. The reduction in the intensity with which new developments have provided on-site parking has coincided with a pronounced reduction in private vehicle mode share to the City Centre.[4] These trends may reflect higher fuel prices, general public transport improvements, congestion, and changing attitudes to public transport. The cumulative effect of these changes is that the relative importance of car-parking to new developments will have declined over time.

The resource cost savings associated with the reduction in parking intensity observed since 2008 can be estimated in comparison to a (hypothetical) counter-factual scenario where the provision of parking continued at the rate observed in 2008, as illustrated below. If the counter-factual scenario outlined below had eventuated, then the City Centre would now be home to approximately 1,200 more car-parks than currently. Assuming resource costs of $50,000 per car-park, this equates to a potential resource cost saving of $60 million since 2008.

Figure 14: Possible counter-factual for provision of parking in the City Centre



Avoiding the need to provide 1,200 car-parks means the City Centre will in turn have meant that the latter was able to accommodate approximately 1,000 more employees and/or residents[5] more than would have been possible in the counter-factual scenario. The higher density that results is likely to have generated agglomeration economies and reduced congestion compared to the counter-factual scenario where those same people would have had to work and/or live outside of the City Centre.

The final question we must consider, however, is the degree to which the apparent change in trends in the provision of parking in the City Centre reflected 1) public policy, specifically the removal of minimums

[3] Noting that most consent applications are associated with an increase in the levels of activity accommodated on-site. So while we observe a net increase in parking, the amount of parking per square meter of GFA (which is unavailable) may have reduced.
[4] http://transportblog.co.nz/wp-content/uploads/2012/11/pt-screenlin-report.pdf
[5] Given that 1,000 employees/residents is equivalent to approximately 1% of the City Centre, the reduction in parking provision may have contributed to significant agglomeration benefits (either in production or consumption). We have assumed 30 sqm per car-park, 20 sqm per employee, and a conversion rate of 50%. The conversion rate measures the proportion with which space used for car-parking might be converted to gross floor area, i.e. employment purposes.

and imposition of maximums and/or 2) normal market forces, specifically reduced demand for car-parking. While we cannot conclusively answer this question, we can draw the following inferences:

- *Public policy impacts seem to be dominated by the removal of minimums* – Data indicates that only 2% of developments in our sample failed to comply with maximums. This in turn suggests the dominant public policy impact will be associated with the removal of minimums, rather than the imposition of maximums. This finding aligns with earlier research in London, where the removal of minimums (as opposed to the imposition of maximums) was found to be accountable for 98% of the reduction in parking observed in the wake of the policy change.
- *Impacts of imposing parking maximums are likely to reduce over time* – It seems likely that the direct impacts (and hence any benefits) of imposing parking maximums will reduce over time, because the long-term strategic factors that they anticipate (e.g. improved public transport) will eventually influence parking provision via normal market forces. The congestion reduction benefits that they deliver, however, may persist longer (discussed in subsequent sections).

The following sections build on these findings by outlining a more general economic framework for assessing parking provisions in the dUP.

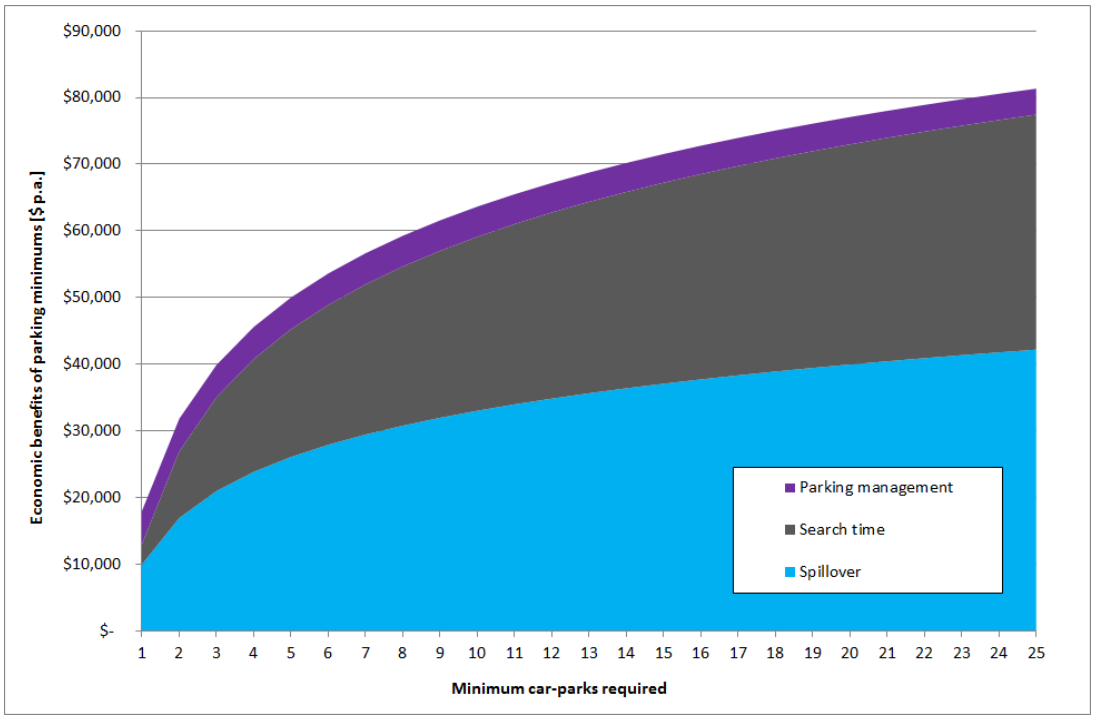
3. The Economic Impacts of Minimums

3.1 Micro-economic Foundations

Previous sections suggested parking minimums could be justified in areas where the social benefit of providing parking was higher than the private benefit. Such a situation might arise when developers do not consider to: 1) Parking spill over; 2) Search time; and 3) Costs of parking management.

The figure below illustrates these benefits for a hypothetical development that could provide anywhere between 0–25 car-parks, but which wishes to provide zero car-parks. Here the social benefits have been calculated as a function of the number of on-site car-parks, where the social benefits increase with increasing availability of on-site parking – albeit at a diminishing rate.[6]

Figure 15: Hypothetical economic benefits of parking minimums



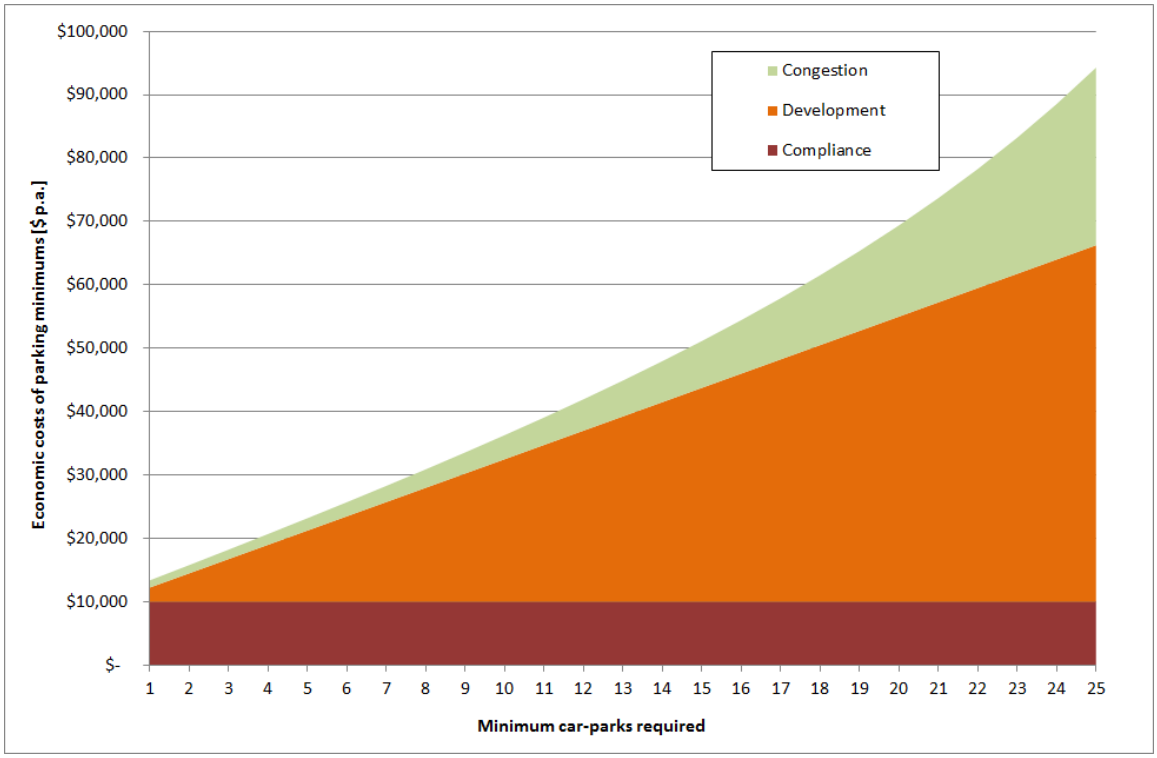
These social benefits are arguably external to the development and as such are unlikely to influence the micro-economic decisions of the developer about the number of on-site car-parks they should provide.

On the other hand, the imposition of minimums will also create economic costs, specifically they: 1) Lower the value of a development; 2) Increase traffic congestion; and 3) Create compliance costs. These economic costs are illustrated in the following figure for the same hypothetical development.

In this case the total economic costs of parking minimums also increases with the level of on-site car-parking required. Here we have assumed compliance costs are constant, i.e. independent of parking requirements, while impacts on development and congestion costs tend to increase non-linearly with the number of on-site car-parks required.

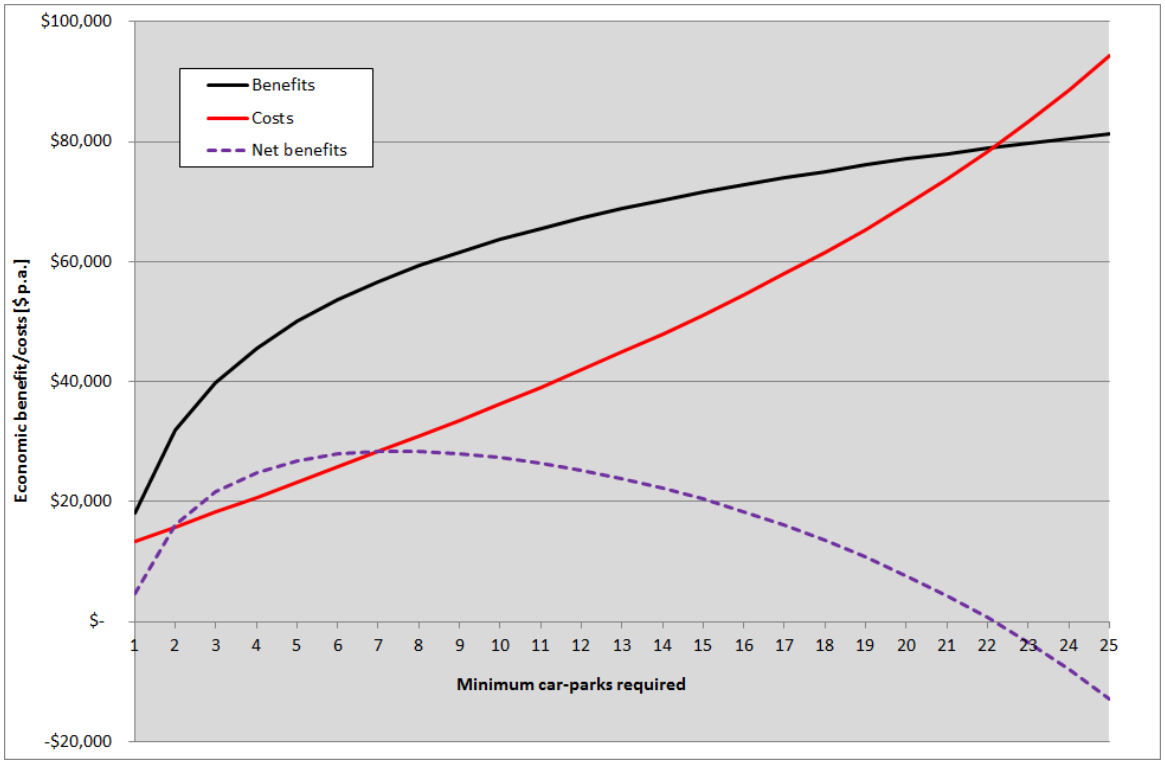
[6] Here we have assumed 1) that the micro-economic benefits of parking minimums are additive and 2) that the benefits observe a logarithmic functional form. Later sections will revisit the first assumption.

Figure 16: Hypothetical economic costs of parking minimums



Subtracting Figure 17 from Figure 16 provides us with an indication of the "net social benefit" of parking minimums, as illustrated by the purple dashed line in the figure below. Here we can see that the net social benefits attributable to parking minimums case is maximised at approximately 7 on-site car-parks.

Figure 17: Hypothetical net economic benefit of parking minimums as a function of on-site parking



While this example is hypothetical, it is useful to highlight some of the underlying microeconomic forces that characterise the economic impacts of parking minimums.

First, the economic benefits and costs of parking minimums will vary considerably depending on the location and nature of the proposed development. The location will influence the vacancy levels in the surrounding streets, and hence potential impacts on spill-over and search times. The nature of the proposed development will determine the level to which requiring more parking increases congestion and/or reduces the value of the development. For this reason it seems apparent that it will not be possible to specify optimal levels for parking minimums ex ante. Instead, parking minimums will always be at best an approximation of what is considered to be the socially optimal level of parking provision.

Second, when parking minimums are set at very high levels they are likely to have negative economic impacts, i.e. their costs will outweigh their benefits. In this context, historical engineering standards, which required individual developments meet the 90th percentile peak demand for on-site parking, have the potential to be quite damaging. As such, the dUP's approach to setting parking minimums 25% lower than the previous rates may be a step in the right direction, albeit a necessarily approximate one.

The following section will abstract ourselves from the level of an individual development and instead attempt to assess the potential benefits and costs of parking minimums across a broader area.

3.2 Modelling Economic Impacts

The previous section concluded the economic impacts of parking minimums represent a clear tension between benefits and costs. Moreover, we are unable to predict the optimal level of parking minimums ex ante, certainly on a universal basis (i.e. for all potential properties and all potential developments).

We now seek to gain some insight into the economic impacts of parking minimums more generally. We choose to focus our analysis on three specific areas, namely Onehunga, Dominion Rd, and Takapuna. The extent of our study areas, and our reasons for choosing them, are discussed in detail in Appendix A.

3.2.1 Economic Benefits

The economic benefits of minimum parking requirements arise primarily in response to how they help enable society to avoid costs. Put simply, regulating for increasing provision of on-site parking could potentially benefit society in the following three key ways:

- *Parking spillover* – because there will be more parking provided with new developments; and/or
- *Search costs* – because people will be able to find a car-park more quickly; and/or
- *Parking management costs* – because supply will always increase to match demand.

We argue that the benefits of parking minimums are not independent of each other and hence should not be considered separately and subsequently added together.

Instead, the benefits of parking spillover and search costs are likely to be positively related, because they both relate to on-street vacancy rates[7]. Lower levels of on-site parking provision would tend to increase on vacancy levels and in turn increase instances of parking spillover for existing residents, as well as the time people spend searching for a car-park. Parking spillover and search times are arguably the same thing: Whereas the former relates to existing residents the latter is a more comprehensive indicator.

Now, if parking minimums did not exist and there was no offsetting policy action in response to low parking vacancy, then these search costs would surely rise. However, low vacancy for on-street parking

[7] By "vacancy" we mean the number of car-parks that are available but not occupied by vehicles, as distinct from supply.

is precisely the situation in which Auckland Transport (AT) would be likely to intervene in order to manage the demand for parking, by way of implementing pay parking and/or time-limits. Both pay parking and time-limits are intended to reduce demand and increase turnover, such that people are able to find a car-park when and where needed, i.e. the parking management response mitigates search costs.

For this reason we suggest parking spillover and search costs are "dominated" by parking management costs. That is, if we were to remove parking minimums then AT is likely to respond with increased parking management, which would then mitigate the negative effects of parking spillover and search costs. For this reason, it seems reasonable to assume that the removal of parking minimums precipitates an increase in *parking management costs*, but not an increase in parking spillover and search costs – the latter two impacts are mitigated by the former. Counting all three impacts would therefore place us at risk of double-counting.

More specifically, we assume the removal of parking minimums would result in the following parking management costs being incurred by AT (NB: Cost rates sourced from AT Parking Operations):

- *Comprehensive parking management plans (CPMP)* – surveys and analysis of supply/demand, which we have assumed cost $100,000 per year from the first year that minimum parking requirements are not applied.
- *Monitoring and enforcement* – to ensure compliance with parking restrictions; we have assumed additional monitoring and enforcement costs $90,000 per year per town centre, i.e. $270,000 (this is sufficient to cover the costs of three full time enforcement officers).
- *Purchasing and servicing parking meters* – we have assumed that parking meters cost $12,000 each. The need for parking meters is assumed to emerge from year 5 onwards, when 300 meters are purchased for a total cost of $3.6 million. After that, an additional 300 meters are purchased every 5 years. We have also assumed that the metres need to be replaced every ten years and incur additional maintenance/servicing costs of $150 per machine per year.

We incorporated these parking management costs into a discounted cash flow model to estimate their total net present value, where we assumed a discount rate of 8% over 30 time period. The discounted cash flow model is summarised in the following table:

Figure 18: Inputs into the discounted cash flow model of parking management costs

Year	Discount factor	CPMP	Enforce	Meters	
				Servicing	Capital
1	100%	$100,000	$270,000	$0	$0
2	93%	$100,000	$270,000	$0	$0
3	86%	$100,000	$270,000	$0	$0
4	79%	$100,000	$270,000	$0	$0
5	74%	$100,000	$270,000	$45,000	$3,600,000
6	68%	$100,000	$270,000	$45,000	$0
7	63%	$100,000	$270,000	$45,000	$0
8	58%	$100,000	$270,000	$45,000	$0
9	54%	$100,000	$270,000	$45,000	$0

10	50%	$100,000	$270,000	$90,000	$3,600,000
11	46%	$100,000	$270,000	$90,000	$0
12	43%	$100,000	$270,000	$90,000	$0
13	40%	$100,000	$270,000	$90,000	$0
14	37%	$100,000	$270,000	$90,000	$0
15	34%	$100,000	$270,000	$135,000	$7,200,000
16	32%	$100,000	$270,000	$135,000	$0
17	29%	$100,000	$270,000	$135,000	$0
18	27%	$100,000	$270,000	$135,000	$0
19	25%	$100,000	$270,000	$135,000	$0
20	23%	$100,000	$270,000	$135,000	$3,600,000
21	21%	$100,000	$270,000	$135,000	$0
22	20%	$100,000	$270,000	$135,000	$0
23	18%	$100,000	$270,000	$135,000	$0
24	17%	$100,000	$270,000	$135,000	$0
25	16%	$100,000	$270,000	$135,000	$7,200,000
26	15%	$100,000	$270,000	$135,000	$0
27	14%	$100,000	$270,000	$135,000	$0
28	13%	$100,000	$270,000	$135,000	$0
29	12%	$100,000	$270,000	$135,000	$0
30	11%	$100,000	$270,000	$135,000	$3,600,000
Totals		**$1,215,841**	**$3,282,770**	**$776,147**	**$9,254,301**

This suggests that minimum parking requirements help to avoid costs of parking management to the value of $14.5 million over 30 years. While these costs are likely to be fiscally neutral for AT, they are economic costs nonetheless and need to be considered as benefits of parking minimums.

3.2.2 Economic Costs

As previous sections have noted, the primary economic costs of parking minimums are their effects on:

- *Compliance costs*, which arise because the presence of parking minimums increases costs of lodging and processing consents;
- *Lower development values*, which arise because parking minimums require new developments to provide more on-site parking and subsequently lowers the value of the development;
- *Congestion costs*, which arise because parking minimums increase the availability of parking and hence reduce the price of driving.

While the first cost is real, we suggest it is relatively difficult to estimate and also comparably small. For this reason we focus on the impacts of parking minimums on the value of development and congestion.

To quantify the impacts of parking minimums on development values, we first we used a hedonic regression model to analyse developments in Takapuna, Dominion Road, and Onehunga. The model and associated calculations are summarised in more detail in Appendix B. This analysis found that 1) floor space had a high value in these locations and 2) an increase in the supply of on-site parking was associated with a reduction in floor space, i.e. parking substituted for floor space.

We then simulated the value of floor space that was displaced by the area required to provide one additional car-park. This analysis indicated that each car-park cost approximately $19,000 in foregone floor space. But this raises the question of how much additional parking do parking minimums require of new developments compared to what they would freely choose otherwise?

The aforementioned research in London by Guo et al. (2012) found that the removal of minimums was associated with a 40% reduction in the level of on-site parking that was provided with new developments. For this reason, we specified low, medium, and high scenarios in which parking minimums caused a 20%, 35%, and 50% oversupply of parking respectively. Under these scenarios the foregone value of floor space was subsequently estimated to total $57 – $119m across our three study areas.

We then sought to quantify the economic costs they create by way of increased congestion. By increasing the availability of parking, minimum parking requirements tend to lower the actual and perceived costs of parking. In the long run this means that minimum parking requirements are likely to stimulate more driving, and hence more congestion. To quantify these costs, we used AC's strategic regional transport model (ART3) to simulate higher parking costs in our three study areas.

We assumed that – in the absence of parking minimums – the price of short stay parking in Onehunga, Takapuna, and Dominion Rd would increase by 50% from $1.87 to $2.80 per trip in 2041. In terms of long stay parking, we assumed the price would rise by 25% in Takapuna and Onehunga to $18.51 and $10.58 respectively. On Dominion Rd we set the price of long stay parking equal to the price at the northern end, which is closest to the city centre.

The ART3 model was then run with these adjusted parking input prices, while all other input assumptions remained the same. Results suggested a total reduction in vehicle trips of 1,700 in the AM and PM peak periods, with 3,800 fewer vehicle-kilometres travelled per day. These results were annualised by multiplying it by 240 (5 days per week times 48 work weeks per year) and subsequently converted into dollar terms by assuming a congestion benefit rate of $1.70 per km.[8] On this basis, the additional congestion caused by parking minimums in these areas was estimated at $1.5 million per year in 2041.

Of course, the dis-benefit associated with increased congestion will not occur instantaneously but will instead eventuate gradually over time. For this reason we analysed congestion benefits within a discounted cash flow model, where we assumed benefits ramped up from $0.75 million in year 0 (presuming some developments respond in anticipation of the policy change) to $1.5 million in 2041. Using a standard discount rate of 8% this suggests that removing parking minimums would yield $12.3 million in congestion reduction benefits over the 30 year evaluation period.

To finish, we note that the ART strategic transport model predicted that approximately 80% of the vehicle trips that were discouraged by higher parking costs would instead shift to using public transport. Put another way, removing parking minimums and charging market rates for parking would be likely to greatly increase the demand for PT, and hence reduce the latter's need for operating subsidies. This is a good example of how removing a distortion in one market (i.e. parking) enables another market to operate

[8] NZTA's EEM Vol. 2 specifies a rate of $1.56 per km in 2008 dollar terms. We inflated this rate to 2012 values using the Reserve Bank of New Zealand inflation calculator, which came to $1.70 per km.

more efficiently (i.e. public transport). Hence, it is fairly clear that the market inefficiencies introduced by parking minimums extend well beyond land use development and into the transport sector.

3.2.3 Cost-benefit Ratio

In this section we condense findings from previous sections into a single cost-benefit cost ratio (CBR). The purpose of the CBR is to compare the costs of minimum parking requirements to their benefits; a CBR greater than one thus indicates that minimum parking requirements have net economic costs, and vice versa for a CBR less than one. Our estimated economic impacts are summarised below.

Figure 19: Estimated economic costs of excess parking supply in our study areas

Estimates		High (50%)	Med (35%)	Low (20%)
Costs of minimums	Property values	$157.5m	$120.1m	$75.7m
	Congestion	$12.3 million		
Benefits of minimums		$14.5m		
Cost-benefit ratio		11.7	9.1	6.1

These results suggest the economic costs of minimum parking requirements exceed their benefits in all scenarios. This in turn suggests parking minimums, on balance, have negative economic impacts, even in those situations where they cause only a small (20%) parking over-supply. We emphasise again that earlier studies in London found that the removal of parking minimums resulted in 46% less on-site parking being provided with new developments, which suggests that our simulated scenarios are reasonable.

We note that this cost-benefit analysis is considered to be "conservative" insofar as it is likely to underestimate the economic costs of minimum parking requirements for the following reasons:

- ***We consider only economic costs for commercial properties.*** In reality, the application of parking minimums would also costs for residential properties, especially in medium to high density areas where the need to provide more parking could require parking structures and reduce the space available for other more valuable uses.
- ***We consider impacts only on low density properties.*** Because we rely on aerial photos and GIS to calculate the parking area on each property we could not include multi-storey properties where parking is not visible from the air. It is precisely these properties where the value of floor space is likely to be higher and minimum parking requirements are more likely to be a binding constraint.
- ***There are a number of unquantified costs.*** We have not quantified the impacts of minimums on compliance costs. The same is true of agglomeration economies, which are likely to follow from increased density. By not including them in our analysis, the resulting cost-benefit ratios are likely to be relatively "low", in that they underestimate the potential benefits of removing minimums.

On the basis of these results, and the caveats noted above, we would suggest that parking minimums have, on balance, relatively large negative economic impacts in our study areas. We also suggest that these economic impacts are directly proportional to two key variables: 1) the value of floor space and 2) the degree to which parking substitutes for floor space.

As both these variables are likely to be positively correlated with the density and value of development, we infer that the negative economic impacts of minimum parking requirements are likely to increase with

density and property values. We suggest the direction of these negative economic impacts is relevant given the intensification of urban areas espoused in the Auckland Plan.

The following section generalises our findings to the rest of Auckland.

3.3 Generalising our Findings

3.3.1 Methodology

In our previous work on the economic impact of minimum parking requirements we found:

- *Benefits* - The resource cost savings associated with reduced parking management neutralised the other benefits, namely reduced parking spill-over and ease of finding car-parks, largely because the latter are alleviated by parking management.
- *Costs* – These were dominated by their impacts of minima on the value of development, or more specifically the floor area, which accounted for approximately 90% of total costs (with the remaining 10% associated with increased traffic congestion).
- *Balance of impacts* – in the case of Takapuna, Onehunga, and Dominion Rd we found that the costs of minima exceeded their benefits by approximately 5:1.

On this basis we propose the following economic rule-of-thumb for assessing areas where removing parking minimums would have net economic benefits:

- Calculate the value per square metre for properties in Takapuna, Dominion Rd, and Onehunga. The result is then divided by 6.1 [A = (Total value)/(6.1 x sqm)][9]
- Calculate the value per square metre for each parcel in Auckland City [M = value/sqm]
- Where M > A then the economic costs of parking minimums in that parcel are likely to exceed the benefits, i.e. the economic benefits of removing minimums will exceed their costs. We specify the following ranges:
  - Where M > 1.25A, then we have a strong case for removing minimums
  - Where 1.25A > M > 0.75A then we have a moderate case for removing minimums; and
  - Where A > 0.75M, then we have a weak case for removing minimums.

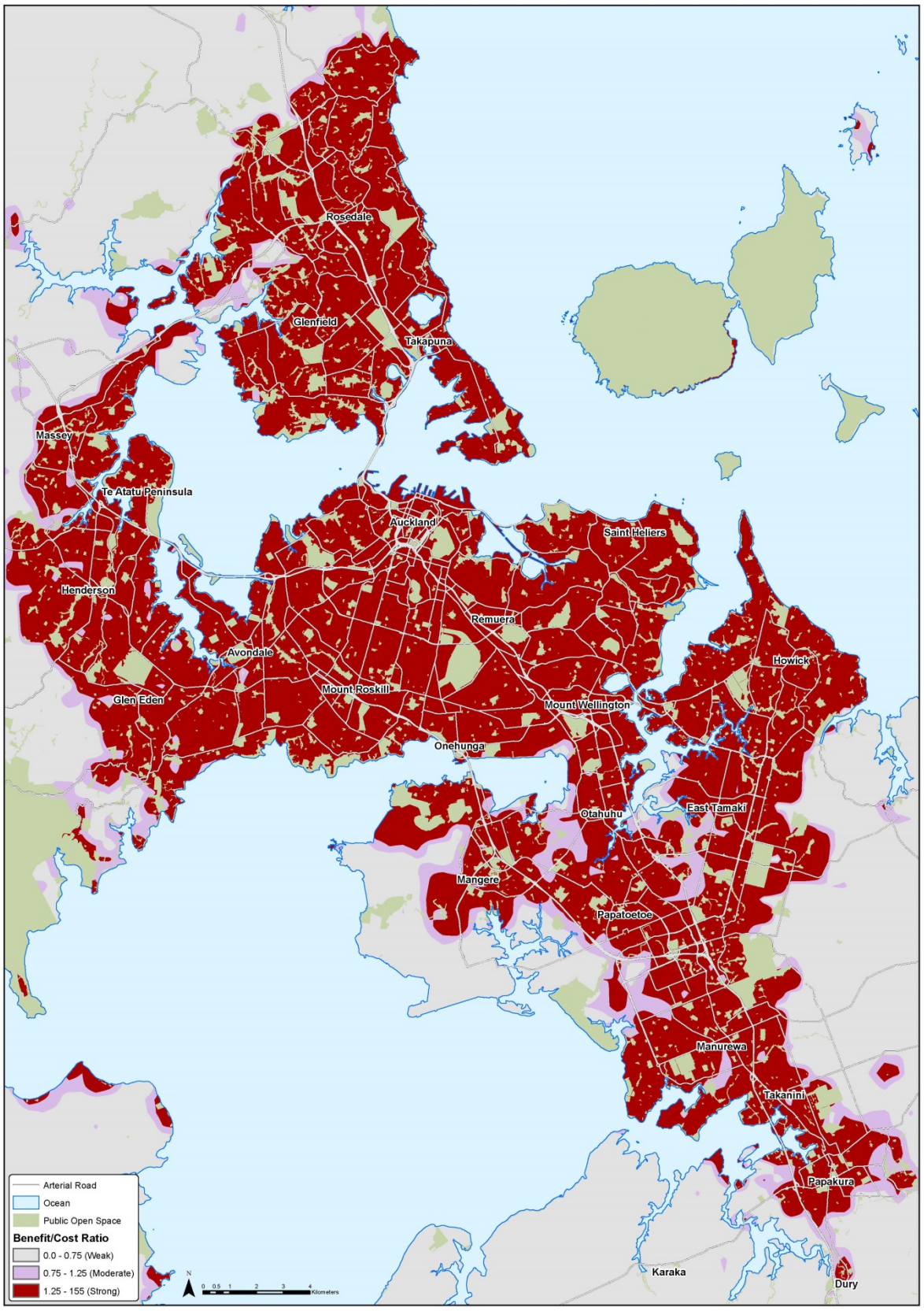
Given that individual property parcels are relatively "fine" and do not necessarily align with dUP zones, we applied two post-processing steps whereby 1) results by parcels were "smoothed" in GIS and 2) results were subsequently aggregated to the dUP zones.

3.3.2 Results

The following map illustrates areas where we find a strong (red), moderate (purple), and weak case (grey) for removing parking minimums respectively. This analysis finds a strong case for removing parking minimums from most of the metropolitan urban area. A weak case for removing minimums is found on some parts of the urban fringe and in low density industrial areas.

[9] Dividing by 6.1 is equivalent to saying that minima should be removed wherever the cost-benefit ratio is less than 1. The 6.1 figure is derived from the lowest CBR found in the previous section.

Figure 20: Mapping the economic case for removing parking minimums



This analysis is summarised in the table below in relation to dUP zones. We also show the parking provisions and the percentage of the regional population and employment for each zone.

Figure 21: Relationship between dUP zones, parking provisions, population statistics, and minima[10]

Draft Unitary Plan Zones		Minima or Maxima	% of Total Employment	% of Total Population	Case for removing minimums		
					Strong	Moderate	Weak
A	City Centre	Maxima	14%	2%	67%	1%	32%
B	Metropolitan Centre	Maxima	5%	0%	81%	4%	15%
C	Town Centre	Maxima	4%	1%	82%	7%	11%
D	Local Centre	Maxima	1%	0%	75%	7%	18%
E	Mixed Use	Maxima	9%	2%	75%	14%	11%
F	Terrace Housing and Apartment Buildings	Maxima	5%	7%	85%	7%	8%
G	Neighbourhood Centre	Minima	0.2%	0.3%	73%	10%	17%
H	Mixed Housing	Minima	12%	46%	77%	10%	13%
I	Single House	Minima	7%	30%	69%	11%	21%
J	Large Lot	Minima	1%	2%	13%	10%	77%
K	General Business	Minima	1%	0.1%	37%	13%	50%
L	Business Park	Minima	1%	0.0%	42%	48%	10%
M	Light Industry	Minima	24%	1%	54%	18%	29%
N	Heavy Industry	Minima	5%	0%	34%	20%	47%
O	Rural (All Rural Zones & Future Urban)	Minima	3%	7%	0%	0%	100%
P	Other	Minima	9%	2%	1%	1%	98%

We suggest where more than 50% of a zone falls into the "strong" category then a very strong case exists for removing parking minimums on the grounds of their economic impacts.

3.4 Implications for the dUP

Based on this analysis we draw the following inferences for the dUP:

- We find strong support for dUP proposals to remove minimums in zones A – F
- We find moderate support for dUP proposals to retain minimums in zones J, K, and N
- We find weak support for the dUP proposals to retain minimums in zones G – I and L – M

The final bullet point is most important. It suggests removing minimums from zones G – I would be likely to have positive economic impacts for 77% of the zone. The mixed housing zone (H) currently covers 46% and 12% of regional population and employment respectively. Hence, removing minimums from this zone would be likely to have significant positive economic impacts.

The case for removing minimums from the neighbourhood centre zone is also relatively strong, where at least 73% of the zone would similarly benefit. However, we note that the neighbourhood centre zone (G) is relatively small, accounting for less than 1% of total regional employment and population respectively. As such, the significance of removing parking minimums from this zone is much lower than in the mixed housing zone (H) discussed above.

Interestingly, removing minimums from the single house zone (I) is also likely to deliver economic benefits, even if the case is not as clear cut as the zones discussed above, i.e. the mixed housing and neighbourhood centre zones. We also note that the single house zone is relatively large and accounts for approximately 30% and 7% of total regional population and employment respectively.

The final point is relatively important, especially if AC is considering changes to zones and/or boundaries, which may present opportunities to align zones and/or their boundaries with these results. If this is the case then we suggest that where possible zone boundaries are re-drawn such that the denser parts of the mixed housing and single housing zones are not subject to parking minimums.

[10] Percentages for some small zones are rounded to zero.

Finally, we note that our analysis is based on a number of conservative assumptions, specifically:

- *High threshold* – Our previous research for AC suggested the economic benefits of removing minima ranged from 6.1 – 11.7. In our analysis we have used the low estimate, i.e. 6.1. In contrast, using the higher estimate, i.e. 11.7, would lower our threshold for removing parking minimums almost by a factor of two compared to what has been used in this analysis; and
- *High parking management costs* – The CBRs are based on relatively high about the parking management costs. In practice, we suspect that economies of scale in parking management, as well as ongoing technological innovations, such as phone and pay systems, will greatly reduce the parking management costs that are incurred by AT compared to that assumed in our previous analysis. These economies of scale, if achieved, would also lower the threshold for removing minimums.

In short, our primary finding is that there is strong economic support for expanding the areas that are not subject to parking minimums compared to what has been proposed in the dUP. Indeed, we would suggest that the removal of minimums in the mixed housing zone is particularly important, because it represents a relatively large swathe of relatively dense urban development.

Failing rolling back minimums entirely, lowering the rate at which they apply will still deliver economic benefits compared to the alternative, i.e. higher minimums. We caution, however, that lowering – rather than removing – parking minimums is somewhat inferior and not justified by this analysis. As it stands, we find little to no evidence – either in the literature or in this analysis – to support the retention of parking minimums in most parts of metropolitan Auckland where densities and land values are relatively high.

In general, while the dUP does seek to reduce the economic impost of parking minimums compared to previous District Plans, we consider there to be considerable economic justification for expanding the areas that are not subject to minimum parking requirements.

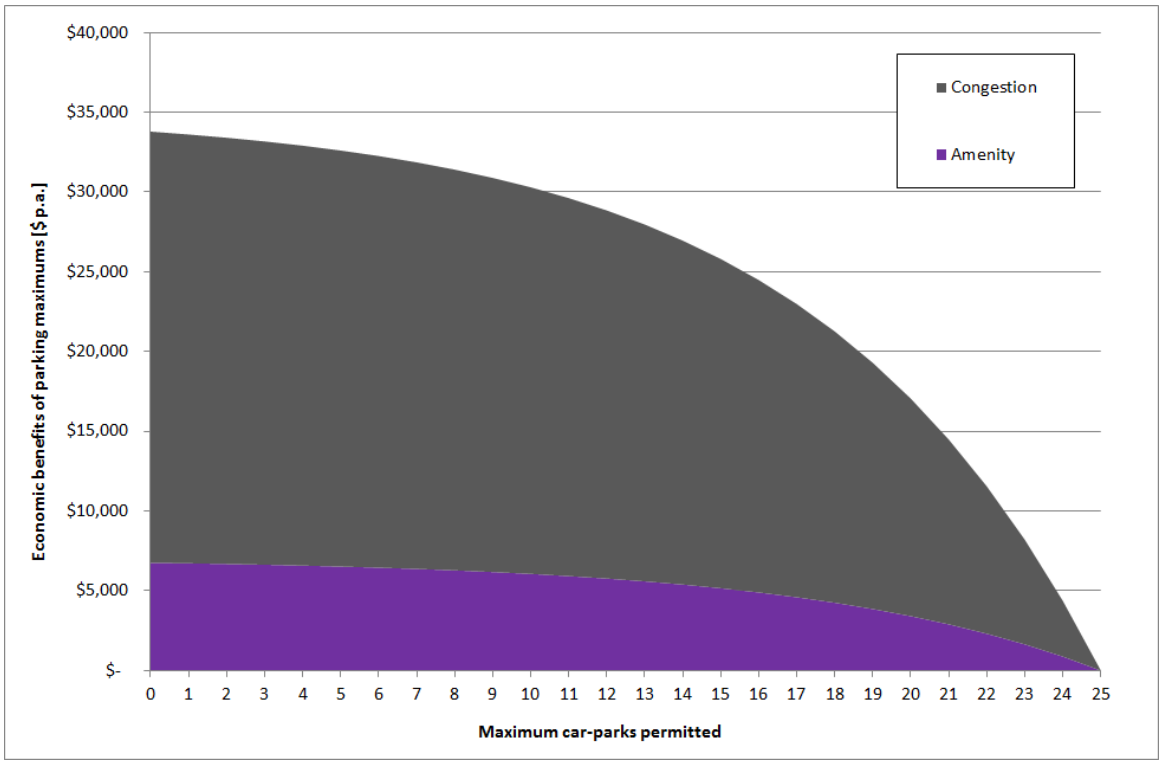
4. The Economic Impacts of Maximums

4.1 Micro-economic Foundations

In terms of maximums, the primary economic benefits are reduced traffic congestion and increased amenity for pedestrians in busy urban environments that are afflicted by high traffic volumes. The figure below illustrates the benefits of parking maximums for a hypothetical development that could provide anywhere between 0–25 car-parks, but which wishes to provide 25 car-parks.

Hence the benefits of maximums will reduce as the parking maximum approaches 25, i.e. are non-binding. The figure below illustrates how the congestion and amenity benefits of maximums would decline as they approach a non-binding level, i.e. as the maximum permitted car-parks increases.

Figure 22: Hypothetical economic benefits of parking maximums

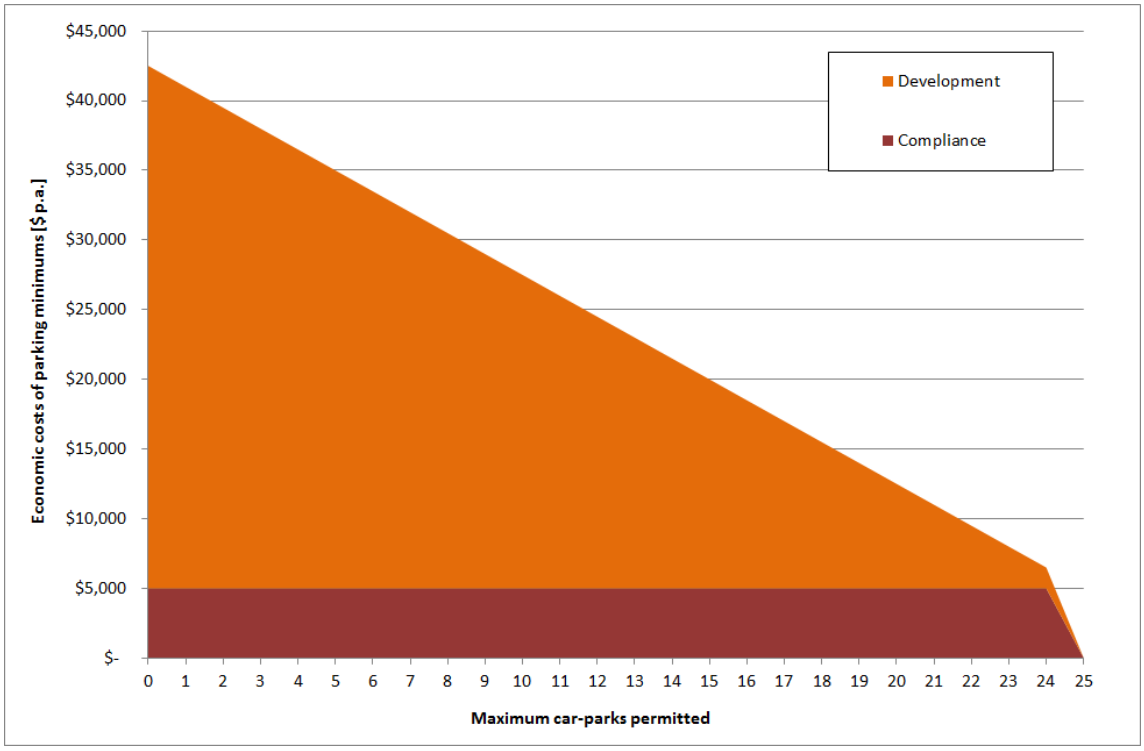


These benefits are arguably external to the development and as such are unlikely to influence the micro-economic decisions made by the developer about the number of on-site car-parks to provide.

On the other hand, imposing maximums will also create economic costs, specifically they: 1) Lower the value of a development by reducing the ability for them to provide the level of parking demanded by the market and 2) Create compliance costs by raising the regulatory burden for a complying activity.

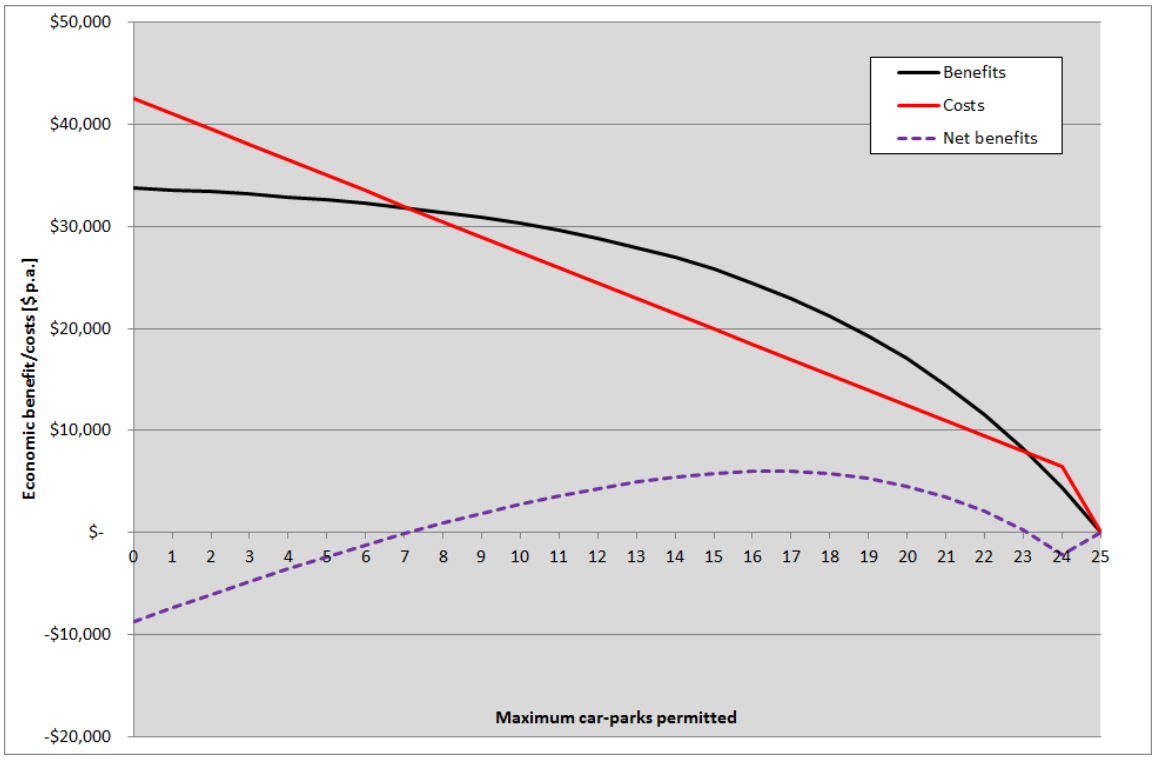
These economic costs are illustrated in the following figure for the same hypothetical development discussed above. In this case the total economic costs of parking maximums also decrease as the allowable number of on-site car-parks increases. Here we have assumed compliance costs are constant, i.e. independent of parking requirements. Compliance costs are set to zero at the point where the parking maximums become non-binding, i.e. when 25 on-site car-parks are permitted.

Figure 23: Hypothetical economic costs of parking maximums



Subtracting Figure 24 from Figure 23 indicates the "net social benefit" of parking maximums, as illustrated by the purple dashed line in the figure below. Here we can see that the net social benefits attributable to parking maximums would be maximised for this hypothetical development at approximately 17 car-parks.

Figure 24: Hypothetical net economic benefit of parking minimums as a function of on-site parking



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While this example is hypothetical, it is useful for highlighting the underlying microeconomic foundations that characterise the potential economic impacts of parking maximums for an individual development.

First, the shape of the benefit and cost curves imply that maximums are most likely to have net negative economic impacts if they are set too tightly (i.e. close to zero) or too loosely (i.e. close to what the developer would provide anyway if they could choose freely). This suggests that if maximums to be are applied at all, then they should be applied at a level where they are moderately binding.

Second, in a similar way to minimums the economic benefits and costs of parking maximums will vary considerably depending on the location and nature of the proposed development. The location will influence the degree to which an increase in parking contributes to congestion, while amenity impacts will be mostly dependent on pedestrian volumes. The nature of the proposed development will determine how much parking the developer wishes to provide, the degree to which these trips create additional congestion, as well as the relative costs to the development of not being able to provide parking.

For these reasons, and as with minimums, we cannot specify optimal levels for parking maximums ex ante. Instead, parking maximums will always be (at best) an approximation of the socially optimal level of parking provision. The following section will abstract ourselves somewhat from the micro-economic level of an individual development and instead attempt to assess the potential benefits and costs of parking maximums across a broader area.

4.2 Modelling Economic Impacts

4.2.1 Economic Benefits

The primary external economic benefits of maxima relate to its effects on congestion. However, these cannot be estimated in a general sense because we do not know to exactly to what degree the maximums will reduce the level of on-site parking that is provided by individual future developments, nor how this will flow through into higher parking prices and eventually reduced levels of vehicle travel.

Instead, we sought to simulate the effects of parking maximums using AC's strategic regional transport model, ART3. This simulation proceeded using the following methodology:

- We estimated the potential maximum impacts of parking maxima on prices. In particular we assumed that parking maximums would reduce the level of parking supplied by 5%, which in turn was anticipated to cause prices to be 5% higher than they would be otherwise. This effect was expected to be realised by 2041.
- We then inflated short and long stay parking prices in ART zones that are affected by maximums. Where zones were partly affected by maximums, the impact was weighted based on the proportion of residents in each zone that were affected by maximums as a proportion of total residents. E.g. if the population of a particular zone was 500, of which 200 resided in areas affected by parking maximums, then the price inflator for that zone = (200/500)*5% = 2%.
- We used ART3 to model the changes in travel demands (specifically vehicle kilometres travelled) predicted by the ART model. The reduction travel attributed to parking maximums was then:
  - Converted from a daily to an annual figure using a factor of 240 (i.e. 48*5 = 240 normal weekdays per year); and
  - Monetised using a factor of $1.70 per vehicle kilometre (i.e. value of each vehicle-kilometre removed from the road network generates $1.70 in congestion reduction benefits).
- We incorporated the annual congestion reduction benefits within a discounted cash flow model which assumed a 30 year time-horizon and 8% discount rate. We also assumed that the benefits ramped-up linearly from zero (2014) to each their maximum effect in 2041.

Using this methodology, the congestion reduction benefits of parking maximums was estimated to be $33.1 million p.a. by 2041, which equates to $140 million over a 30 year period.

We also undertook a range of sensitivity tests on these calculations, as summarised in the following table. The purpose of these tests was to provide an indication of the degree to which the estimated benefits of parking maximums were sensitive to our underlying assumptions.

Figure 25: Sensitivity testing of the de-congestion benefits of parking maximums

Scenario	Parameters changed	NPV benefits	
		Total	Change
Base	N/A	$140.0 million	N/A
Discount rate	6% p.a.	$190.3 million	+$50.3 million
	10% p.a.	$105.7 million	-$34.3 million
Time horizon	20-year	$91.6 million	-$48.4 million
	40-year	$160.6 million	+$20.6 million
De-congestion benefits	$2.00 per veh-km	$164.7 million	+$24.7 million
	$1.40 per veh-km	$115.3 million	-$24.7 million

Finally, individual sensitivity tests were combined to define a range of potential benefits as follows:

- *Low* – In this scenario we applied a 10% p.a. discount rate; 20-year evaluation period; and $1.40 per veh-km, which was associated with forecast benefits of $61.6 million.
- *High* – In this scenario we applied a 6% p.a. discount rate; 40-year evaluation period, and $2.00 per veh-km, which was associated with forecast benefits of $270 million.

Based on these results, parking maximums are expected to generate decongestion benefits of $61.6 – $270 million, with a mid-point estimate of $140 million.

4.2.2 Economic Costs

The economic costs of parking maximums are primarily related to their impacts on development values. Put simply, parking maximums will constrain the ability for a developer to provide the level of car-parking that they consider is optimal for their development. The economic costs arise due to the difference between the level of parking desired by the developer and what parking maximums permit.

We do not consider it possible to forecast what these costs are ex ante, without prior knowledge of the types of developments that are affected. Even ex post calculations would be difficult and require knowledge of what the developer would have otherwise done, and in turn what the prices yielded by the development had the development proceeded exactly as desired by the developer.

For these reasons we do not attempt to estimate the economic costs of parking maximums. In reality, if they are set at a level that are only moderately binding for the majority of developments then they would seem likely to have only moderate economic costs.

4.3 Results and Discussion

Our analysis suggests that parking maximums may be expected to generate $61.6 – $ 270 million in decongestion benefits. We are unable to quantify costs associated with this proposal and so cannot calculate a cost-benefit ratio for parking maximums.

We can, however, consider their merits in a more qualitative sense. To some degree parking maximums are a response to the so-called "prisoners' dilemma", whereby:

- Congestion is a significant economic burden on society whose costs are largely external to the decisions of individual developments; and
- As individual developments have no incentive to reduce the level of car-parking that they provide, even if it might be in society's best interests to do so, they provide a level of car-parking that maximises the value of their individual development; but
- If all new developments were subject to the same rules around the maximum level of parking that they can provide then the negative effects on any individual development would be relatively small, because all new developments would be placed at the same relative competitive disadvantage.

In this context, well-considered regulation that reduces the level of parking supply for every development in a relatively transparent and comprehensive way may be an effective policy for reducing congestion while avoiding adversely impacting on the competitiveness of individual developments.

We should also consider whether parking policy is the most appropriate way to manage congestion costs. Indeed, time-of-use road pricing would seem to be a more direct policy for addressing the impacts of congestion. While time-of-use road pricing has some definite theoretical advantages, we note that it also suffers from the following issues and/or barriers to implementation:

- Previous work on road pricing initiated by AC has not been endorsed by Central Government at the present time. Without Central Government support it seems unlikely that time-of-use road pricing will be implemented in Auckland within the next 5-10 years; and
- Some uncertainty remains over whether road pricing is more effective at managing congestion compared to parking policy. While road pricing is more targeted insofar as it charges vehicles that are being driven rather than vehicles that are parked, road pricing also incurs relatively high costs for infrastructure and revenue collection.

In light of these political and financial issues with time-of-use road pricing, it may be reasonable for AC to assert that – at the present time – parking maximums are the "first best" policy available to them for managing congestion in Auckland.

We note one final relevant consideration about the merits of applying parking maximums. That is, what is the likelihood that the policy might have unintended consequences? One of the unintended consequences of parking minimums, for example, is that they subsidise vehicle travel, which undermines use of transport modes and contributes to increased congestion.

In terms of parking maximums, we note the risk of the following unintended consequences:

- *Reinforce market power* – By restricting the supply of parking supplied with new developments, parking maximums may enable pre-existing developments to exert market power with regards to the supply of parking. This is especially true of the existing commercial parking operators, whose market power is likely to be enhanced by the application of parking maximums, primarily because parking maximums will constrain supply and hinder the entry of new commercial parking providers.

- *Lock-in or stimulate parking supply* – Parking maximums may signal to landowners that parking will become increasingly scarce in the future. Existing properties that have a level of on-site parking in excess of the parking maximums may be discouraged from re-developing in order to maintain their current levels of parking, i.e. the existing level of parking risks being "locked-in". For new developments, maximums may be seen as a "target", or optimal parking level, and hence encourage developers to build as much parking as they are allowed.
- *Sense of entitlement* – in areas where parking maximums are applied people may have increased expectations that Council will provide alternatives to driving, such as public transport. However, the perceived viability of alternatives is subjective rather than objective, hence the risk exists that parking maximums will place further responsibility on Council for meeting the travel needs of individuals that are looking to travel to these areas.

While the unintended consequences listed above may not eventuate, it is important to first acknowledge that the risk exists and subsequently monitor the situation accordingly.

4.4 Implications for the draft dUP

In terms of the implications for the dUP, we would suggest that parking maximums may generate benefits in terms of reduced congestion and increased amenity.

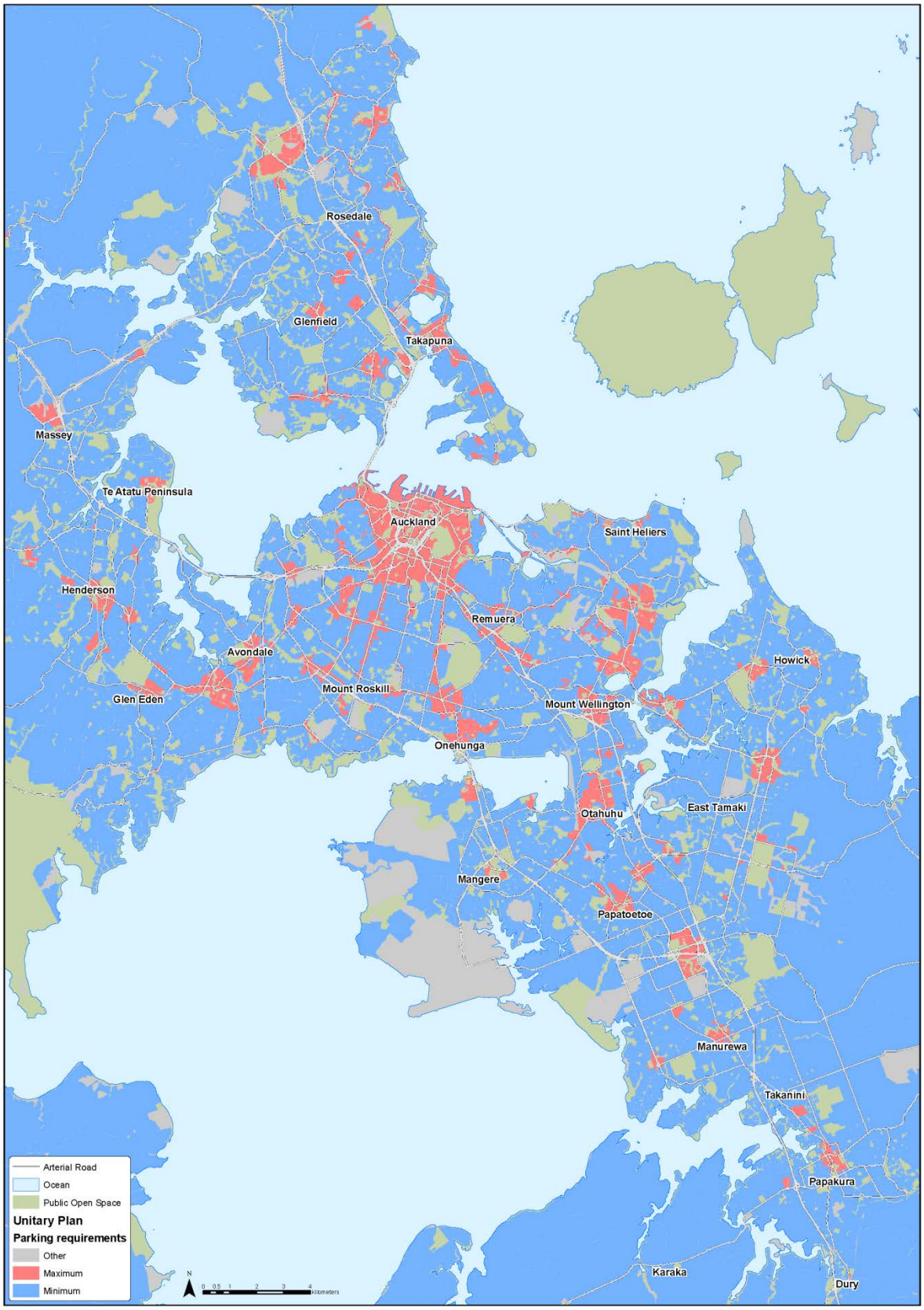
While we have estimated the decongestion benefits of parking maximums, we were unable to quantify their costs, such as lower development value and compliance costs, and as such are unable to draw a conclusion as to their relative merit, at least insofar as a benefit-cost ratio is concerned.

Nonetheless, in the event that AC retains seeks to retain parking maximums in future iterations of the Unitary Plan, then we would recommend a focus on:

- *Maximising the decongestion and amenity benefits* – by applying parking maximums in areas where additional vehicle trips are expected to increase congestion, whether locally or sub-regionally, and/or high levels of pedestrian activity is expected.
- *Minimising compliance costs* – by setting parking maximums in a relatively transparent and universal way that does not incentivise "gaming behaviour" by individual developments.
- *Minimising negative impacts on new developments* – by ensuring that, as much as possible, parking maximums are 1) applied equally to similar types of development and set at 2) moderate levels that do not place them at a significant disadvantage compared to existing developments.
- *Mitigating unintended consequences* – in particular
  - *Market power*, i.e. parking maximums could create barriers of entry into the commercial parking market and enable existing operators, including Council, to extract higher profits.
  - *Lock-in effects*, i.e. parking maximums may discourage redevelopment of existing parking facilities. Other policy settings could seek to offset this incentive, for example enabling existing developments to roll–over existing parking supplies.
  - *Sense of entitlement,* i.e. parking maximums create a public perception that Council will provide for their travel needs whenever they are unable to find/afford car-parking.

Finally, we reiterate a point made earlier: In terms of economic impacts there is considerably more evidence of the *negative* impact of parking minimums than there is of the *positive* impacts of parking maximums. The areas in which the dUP applies maximums and minimums are shown below.

Figure 26: Areas in which the dUP applies maximums or minimums



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5. Conclusions and Recommendations

5.1 Conclusions

Based on the results of this study we have drawn the following conclusions:

- The Auckland Plan establishes a number of targets/goals that interact with parking policy, such as:
  - Up to 70% of development occurring within the 2010 urban limit through intensification;
  - Improving housing affordability; and
  - Doubling PT patronage by 2022.
- In response to these targets/goals, directive 10.6 of the Auckland Plan suggests the Unitary Plan consider a wider range of issues than has traditionally influenced parking policy.
- Minimum parking requirements can be understood as a regulatory intervention (i.e. public policy) that seeks to increase the supply of parking above what would normally be provided by new developments if they were free to choose themselves. Economic theory suggests that an increase in the supply of parking will cause parking prices to be lower than what they would be otherwise. Hence, minimums tend to result in *more parking* at a *lower price*. Parking maximums have a similar effect, albeit in the opposite direction, i.e. they result in *less parking* at a *higher price*.
- Well-designed regulatory interventions can reduce economic costs incurred elsewhere, such as externalities and transaction/search costs, which are either not considered by direct market participants and/or act as barriers to efficient market functioning. One of the proffered advantages of minimum parking requirements is that they 1) make it easier for people to find a park and thereby alleviate localised congestion and 2) reduce the need for local government to monitor/manage public parking. In this light, the key question we seek to answer is: *What are the overall economic impacts (costs and benefits) of minimum parking requirements?*
- Our review of the literature suggests:
  - Minimums act like a tax on floor space that squeeze out alternative activities and thereby contribute to higher costs of living (for residents) and lower commercial property values.
  - Minimums will tend to constrain the development potential of individual sites and ultimately the wider urban area, while stimulating higher levels of vehicle use.
  - In London, the removal of minimums and the application of maximums were found to cause a 46% reduction in the level of parking providing with new developments. Less than 2% of the reduction in parking was attributed to maximums, with 98% attributable to minimums.
- We evaluated the economic impacts of parking minimums in Takapuna, Onehunga, and Dominion Rd. These areas are considered to be typical of the medium density, mixed use urban areas in Auckland that the dUP expects will intensify in the future. In these locations the costs of parking minimums was found to exceed their benefits by a ratio of approximately 6:1 respectively. Put another way, the benefits of removing minimum parking requirements in these locations are more than six times greater than the costs incurred in doing so. These results do not include impacts on residential property, compliance costs, or agglomeration economies and nor do they consider opportunities for economies of scale in parking management. Hence, we suggest that our estimates of the benefits of removing parking minimums are relatively conservative.
- Parking maximums were found to have moderate congestion reduction benefits. These benefits are likely to be partly offset by additional compliance costs and impacts on development value.

5.2 Recommendations

Based on the conclusions outlined above, we recommend:

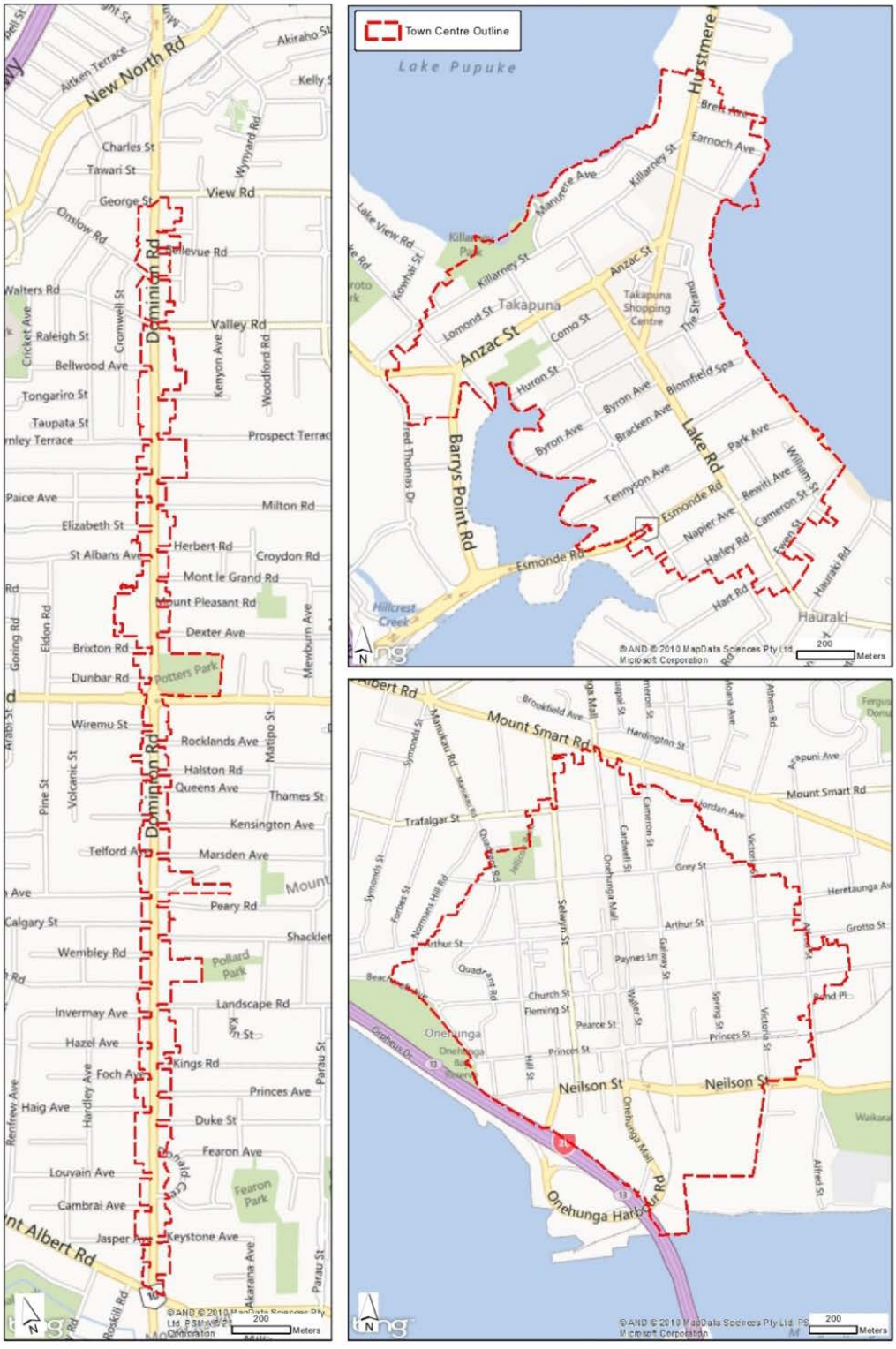
- Auckland Council considers adopting a "default position" whereby the Unitary Plan does not regulate the supply of on-site parking unless there is clear evidence that the economic benefits outweigh the costs in those areas. We note that none of the zones proposed in the dUP assumes such a position – instead all zones are currently subject to either parking maximums or minimums.
- In particular, we recommend the following zones are not subject to either maximums or minimums (the dUP currently applies minimums to these areas):
  - G. Neighbourhood Centres; and
  - H. Mixed Housing
- When re-drawing zone boundaries and/or re-defining zones, we recommend AC consider removing or lowering minimum parking requirements in areas where:
  - Floor space is highly valued, or it will be so in the future; and/or
  - More affordable housing and/or higher value commercial development is desired; and/or
  - Congestion exists on the road network and/or higher public transport use is anticipated.
- If our recommendation to move to remove minimums is not accepted by AC, then reducing them to as low a level as possible is a "second-best" alternative. This is especially important for smaller dwellings (1-2 bedrooms), such as townhouses and apartments, for which minimums will tend to significantly increase the costs of construction. We note that such dwellings are predominantly occupied by low-income households, for which housing affordability is currently a major issue.
- In areas where maximums are applied, then we would recommend that AC consider how to:
  - *Maximise benefits* – by targeting their application to areas where increased vehicle travel is expected to increase congestion, whether locally or sub-regionally.
  - *Minimise compliance costs* – by setting parking maximums in a way that makes it clear when/where they apply.
  - *Minimise distortionary impacts on new development* – by ensuring that, as much as possible, parking maximums are applied equally to similar types of development.
  - *Negate their unintended negative consequences* – in particular
    - Market power, i.e. ensure that parking maximums do not create barriers of entry into the commercial parking market and enable existing operators to extract higher profits.
    - Lock-in effects, i.e. ensure parking maximums do not discourage redevelopment of existing parking facilities, possibly by using other policy settings to encourage redevelopment of these sites.
    - Sense of entitlement, i.e. ensure that parking maximums do note result in a public perception that Council will provide for their travel needs whenever people feel that they are unable to find and/or afford car-parking.

Appendices

Appendix A – Study Areas for Analysing Parking Minimums

We chose to focus our analysis on the following three study areas, namely Onehunga, Dominion Rd, and Takapuna, as illustrated below.

Figure 27: Outline of the study areas – Dominion Rd, Takapuna, and Onehunga



These areas were selected because they are typical of the medium density and diverse urban areas that characterise much of Auckland's central isthmus, where the dUP anticipates considerable intensification.

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We deliberately included one corridor in our study areas, as the economic impacts of minimums in these locations may be different from a normal town centre, especially in terms of their congestion impacts.

The extent of the two town centres, namely Onehunga and Takapuna, was defined to include properties within 2km walking distance of their geographic centre, as defined by Google. In terms of Dominion Road, we also included all properties that fronted onto Dominion Rd between View Road and Mt Albert Road. The extent of these study areas is illustrated in the following figure.

Appendix B – Modelling the Impacts of Parking Minimums on Property Values

Model Formulation

Minimum parking requirements result in more parking than what the market would deliver on its own. This in turn incurs an "opportunity cost", insofar as the area used to provide parking is unable to be used for more valuable uses, such as floor area.

Where the provision of parking comes at the expense of more valuable uses then we would expect property values to be lower, ceteris paribus. It is the gap between the value of floor space and the value of parking that we use to estimate the economic cost to property owners of providing more parking.

To investigate whether such a gap exists between the value of floor space and the value of parking in our study areas we applied the following hedonic regression model:[11]

$$\ln(S_i) = \beta_1.ln(L_i) + \beta_2.ln(F_i) + \beta_3.\ln(P_i) + \beta_4.\ln(D_i) + \beta_5.Year_i + \beta_6.Sale_i + \beta_7.T_i + \beta_8.O_i + \beta_9.Com_i + c$$

Variables are defined as follow (sourced from property transaction database unless otherwise stated):

- S_i is the sales price for property transaction *i*
- L_i is the land area (m^2) for property transaction *i*
- F_i is the floor area (m^2) for property transaction *i*
- P_i is the parking area (m^2) for property transaction *i,* which was calculated using GIS.
- D_i is the distance from the town centre for property *i,* which was calculated using GIS.
- $Year_i$ is the year in which the building associated with property transaction *i* was built.
- $Sale_i$ is the date of sale for property transaction *i*.
- O_i and T are dummy variables for Onehunga and Takapuna respectively
- $Comm_i$ is a dummy variable for commercial property transactions
- $\beta_1, \beta_2, \beta_3, \ldots \beta_9$ are the coefficients to be estimated
- c is the constant of the regression model

We also formulated the following two hypotheses about our model:

- *An increase in land and floor areas has a positive impact on property values*, i.e. $\beta_1, \beta_2 > 0$.
- *An additional square metre of floor area is worth more than an additional square metre of parking.*[12]

$$\left.\frac{\partial S}{\partial F}\right|_i = \left(\frac{S_i}{F_i}\right).\beta_2 \; and \; \left.\frac{\partial S}{\partial P}\right|_i = \left(\frac{S_i}{F_i}\right).\beta_2 \rightarrow \frac{\beta_2}{F_i} > \frac{\beta_3}{P_i}$$

[11] Hedonic regression models have been extensively used in the economic literature to estimate people's willingness to pay for property attributes, which in this case is revealed by how much they pay for a particular property.
[12] This relationship is established by taking the partial conditional derivative of the model with respect to F and P.

Data and Results

The following table provides a statistical summary of the data used in our model. The highest average sales price for commercial transactions was recorded in Takapuna, with the lowest in Onehunga.

Figure 28: Summary of data for property price regression (n = 219)

Variable		Type	Mean	Std dev	Min	Max
Sales price [$]	S	Linear	$1,150,431	$1,123,732	$96,750	$10,800,000
		Log	13.6	0.831	11.48	16.20
Land area [m^2]	L	Linear	933	1034	100	7,714
		Log	6.47	0.820	4.61	8.95
Floor area [m^2]	F	Linear	641	761	60	4,847
		Log	6.06	0.842	4.09	8.49
Parking area [m^2]	P	Linear	279	384	15.3	3,281
		Log	5.05	1.06	2.73	8.10
Dist. to centre [m]	D	Linear	1,697	2,073	149	7,061
		Log	6.83	1.04	5.00	8.86
Build year [year]	$Year$	Linear	1957	21	1900	2000
Sale date [year]	$Sale$	Linear	2005	3.2	2000	2012
Onehunga	O	Dummy	53%	*Not applicable*		
Takapuna	T	Dummy	24%			
Commercial	Com	Dummy	33%			

We then applied the regression model specified in the previous section (in spatial error form) to this data; results are summarised in the table below.

Figure 29: Summary of results for property price regression

Variable		Coefficient	t-stat	P-value	95% confidence interval	
					Low	High
$ln(L)$	β_1	0.452	4.16	0.000	0.239	0.664
$ln(F)$	β_2	0.403	4.98	0.000	0.245	0.562
$ln(P)$	β_3	-0.068	-1.44	0.149	-0.165	0.025
$ln(D)$	β_4	-0.285	-4.18	0.000	-0.419	-0.151
$Year$	β_5	0.004	2.61	0.009	0.001	0.007
$Sale$	β_6	0.066	7.48	0.000	0.049	0.084
T	β_7	-0.547	-2.55	0.011	-0.968	-0.127
O	β_8	-1.183	-6.81	0.000	-1.522	-0.842
Com	β_9	-0.260	-3.74	0.000	-0.397	-0.124
c		-129.8	-6.81	0.000	-166.8	-92.8

The model has an overall R-squared of 82% and an F-statistic of 116.15, which suggests that it fits the underlying data reasonably well. Turning now to our hypotheses, we see $\beta_1, \beta_2 > 0$, i.e. an increase in land or floor area has a positive impact on property values, as expected.

With regard to our second (and more interesting) hypothesis, the first thing to note is that the coefficient on floor area is positive, whereas the coefficient on parking area is negative (although not statistically different from zero). This implies floor area will be worth more than parking area and in turn means that properties would be worth more if they provided relatively more floor area and proportionally less parking.

The following section will outline a process for generalising these findings across our wider study areas.

Generalising our Findings

To generalise our findings we first need to establish the degree to which parking "squeezes out", or substitutes for, floor area. To answer this question we developed a simple regression model of the ratio of floor area to parking area, where both variables were standardised by the land area. In this form, the variables represent the percentage of land area that is used to provide floor space and parking area:

$$fratio_i = \beta_1 . pratio_i + \beta_2 . D_i + c$$

Where for each property transaction *i*:

- $fratio_i$ is the ratio of floor area to land area;
- $pratio_i$ is the ratio of parking area to land area;
- D_i is the distance to the nearest town centre;
- β_1 *and* β_2 are coefficients to be estimated; and
- c is the constant of regression.

The following tables summarises the data and results for this regression (NB: We we relaxed our high-density filters in this regression, which increased the sample size. These filters were applied in the previous regression because some of our data was sourced from aerials and hence the could not be calculated for high-density properties).

Figure 30: Summary of data for floor area substation regression (n = 294)

Variable		Type	Mean	Std dev	Min	Max
Floor to land ratio	$fratio$	Percentage	77.8%	36.3%	26.0%	246%
Parking to land ratio	$pratio$	Percentage	28.5%	14.9%	2.14%	89.2%

Figure 31: Summary of results for floor area substitution regression (n = 294)

Variable		Coefficient	t-stat	P-value	95% confidence interval	
					Low	High
$pratio$	β_1	-0.5084	-3.70	0.000	-0.778	-0.239
D	β_2	0.007	2.04	0.041	0.000	0.014
Cons	c	0.427	4.07	0.000	0.222	0.633

We again used the spatial lag model to control for autocorrelation. Results suggest that every additional 100m^2 of parking results in 50.84m^2 reduction in floor area, ceteris paribus, i.e. a 51% substitution effect.

Our data suggests that the average area required for a car-park is 30m^2. The following table shows how all these results can be used to estimate the economic costs associated with an increase in parking and the consequent reduction in floor area, which has been calculated for the mean property in our sample.

Figure 32: Impacts of an additional car-park on property values

Attribute	Before	After	Change
Floor area	641m^2	622m^2	-18.5m^2
Parking Area	279m^2	309m^2	30m^2
Value	$1,150,431	$1,132,573	-$18,995

This suggests that in situations where minimum parking requirements are binding, then their marginal economic impact is approximately -$19,000 per car-park.

To generalise our results further we must consider to what degree minimum parking requirements causes more parking to be provided than would occur otherwise. While we do not have direct information on the level of "over-supply", and such information would be relatively hard to come by, we can lean on other studies to guide our assumptions.

The aforementioned study of minimum parking requirements in London, for example, found that developments provided 40% less parking once minimum parking requirements were removed. While London is relatively dense compared to Auckland, the latter is likely to have higher parking requirements than the former.

For this reason we chose to simulate three parking "over-supply" scenarios, ranging from 20%-50% with a mid-point scenario of 35%. We analysed the impacts of these parking over-supply scenarios in terms of their impacts on the capital value of properties, as summarised below.

Figure 33: Estimated economic costs of excess parking supply in our study areas

Scenario	Excess	Impact	Improvements	Cost
Current			$988,870,000	-
Low	20%	5.8%	$931,515,540	-$57,354,460
Medium	35%	9.2%	$897,893,960	-$90,976,040
High	50%	12.1%	$869,612,278	-$119,257,722

This suggests minimums cause a loss in value of between 5.8-12.1%, with the mid-point of our range (i.e. a parking oversupply of 35%) associated with a 9.2% reduction in the value of capital improvements. Based on this analysis, we estimate that the cost of minimum parking requirements for commercial properties in these town centres varies from $57-$119 million, with a mid-point estimate of $91 million.

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