

Documentation of Assumptions for 2009 LTCCP Business Floorspace Growth Model

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Background

The purpose of this document is to provide a reference to the process and the assumptions behind the business projections and growth model used for the 2009-2016 LTCCP.

It is intended that there is one source of business floorspace projections for the 2009 LTCCP. These are provided from the CCC Growth Model. The main drivers for sub territorial authority projections has been for the development contributions policy and the infrastructure groups forward planning functions and modelling. As such projection information is provided at territorial authority, zone, area unit and meshblock levels to feed into the processes required for future planning. Note, projections at finer spatial scales are likely to have increased levels of uncertainty.

The Growth Model distributes an agreed set of high level projections to finer spatial scales using computer software such as GIS and relational databases. This document covers the business floorspace model. For the LTCCP development contributions models have already been created for household (including holiday home) and population. The impervious surfaces model will be updated based on the latest household and business models.

This is a non technical document is structured along the following topic areas:

- UDS Population and Household Projections
- Population and Household Projections for the Non UDS part of the City
- Labour Force Projections
- Base Floorspace Data
- Zone Group Floorspace Projection methodology
- Description of the projection methodology for each zone, and
- Distribution methodology of business floorspace within each zone

The LTCCP growth model is consistent with the projections in the Greater Christchurch Urban Development Strategy (UDS)¹. However it should be noted that the UDS area only covers part of the City, with the area of Banks Peninsula beyond the Lyttelton Harbour Basin excluded (Figure 1). A separate set of projections was developed for this area.

UDS Projections

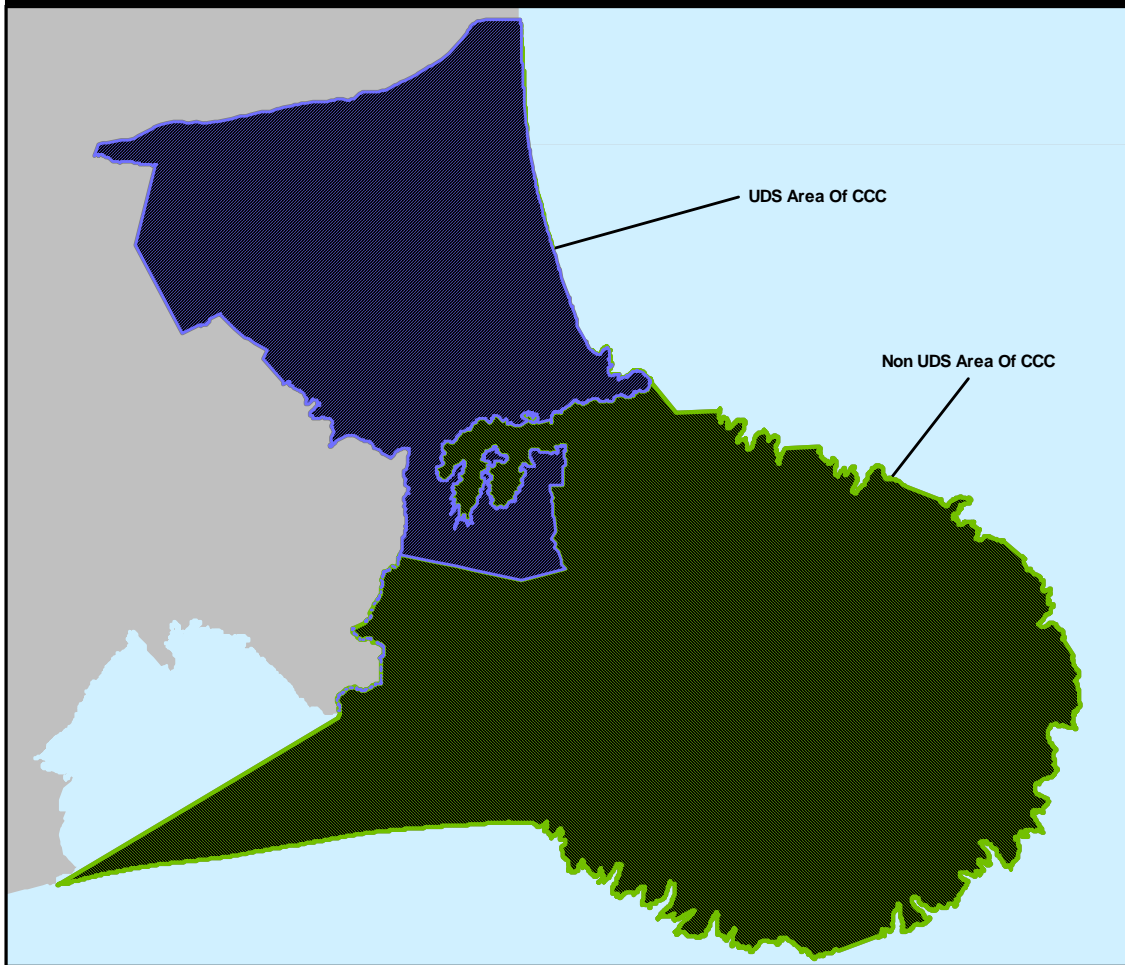
The UDS strategy document was produced in 2007. This used as it's base a set of population and household projections produced by Statistics New Zealand (SNZ) to an agreed set of assumptions in September 2006 for the UDS management team. These projections were based on a unofficial estimated resident population at June 2006(the official estimated population wasn't due to be released until November 2006), and the Statistics New Zealand sub national population and household projections released in February and October 2005 respectively. The UDS projections used the medium assumptions for fertility and mortality and the high assumption for migration for Christchurch, Waimakariri and Selwyn and was subsequently referred to as the "UDS medium high projection". These projections covered the UDS area of the City.

The reason for using the medium high projections was due to a number of factors which included the recent high level of migration driven growth since 2000. This had lead in the short term to growth exceeding the previous high level projections. There was concern that this level of growth would continue and the need to be conservative and have infrastructure and planning anticipating future growth rather than reacting to growth pressures.

	2006	2011	2016	2021	2026	2031	2036	2041
Population	361800	375,018	387,490	402,034	416,725	428,833	440,941	453,049
UDS Labour Force Projection	221,900	235,600	246,000	254,500	260,400	264,000	266,200	269,400

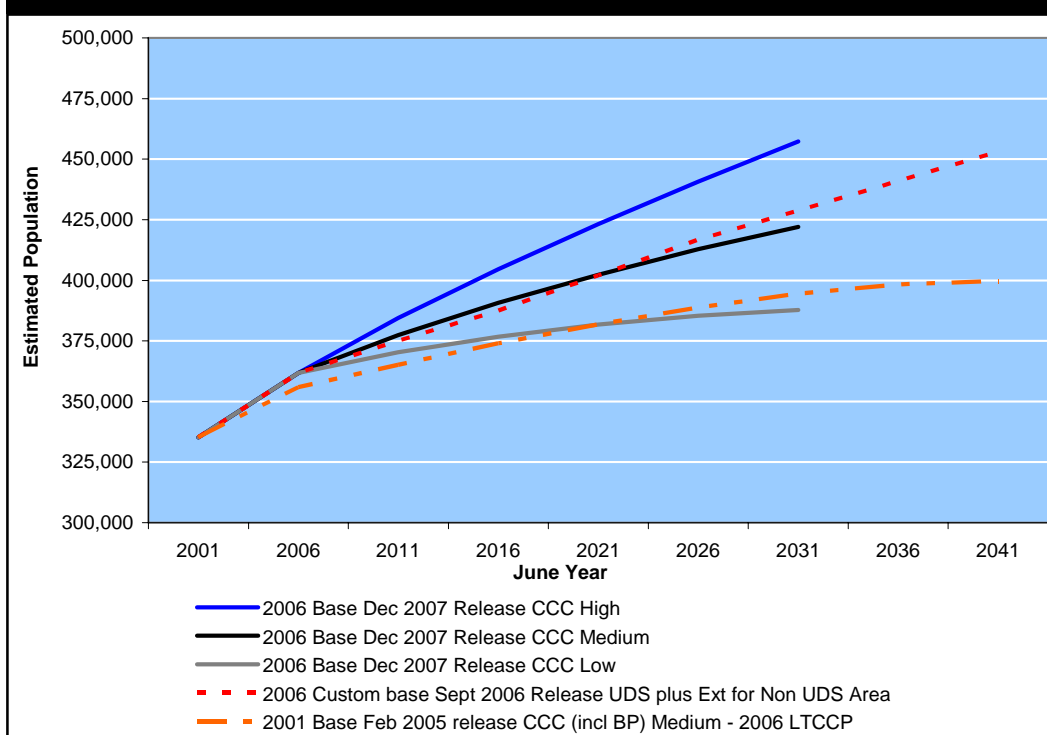
Source: CCC Growth Model March 2007, UDS Population and Labour Force projections, Produced by SNZ September 2006 using the agreed set of assumptions for the UDS Management Team.

Figure 1. Map showing the UDS and Non UDS areas of the Christchurch City Council



Since the UDS strategy document was produced in 2007, SNZ has produced sub national population projections with a 2006 census base. These were released in December 2007. When these were compared with the 2006 UDS medium high projection, the latest SNZ medium projection for Christchurch is very similar to the medium high projections (figure 2). The reason for this has been the increase in the birth rate in the past five years which has raised the natural increase component of the projections. It should be noted that after 2021 the UDS medium

Figure 2. UDS Growth Projections by Area and Type of Development



high projection is higher than the SNZ medium projection and continues to increase at a greater rate. Until the UDS management team decides to adopt a different set of projections, we will be using the September 2006 medium high projection. In addition, SNZ will not be releasing its next updated sub national household projections until the second half of 2008 which is too late for LTCCP planning.

Projections for the Non UDS part of the CCC.

The non UDS part of the City consists of the census area units of Akaroa, Akaroa Harbour, Port Levy, Little River and Banks Peninsula Eastern Bays. Household projections for these areas were based on the area unit household projections produced by Statistics New Zealand in November 2005. These had a 2006 medium projection that very closely matched the 2006 census household count (1250 compared with 1251). These also showed growth was between 50 and 70 households in each five year period between 2006 and 2021. These increments were added to the 2006 census households up to 2021 and from this point 50 households for each five year period were added. Due to the small size of the population in this area, unexpected events may have a significant impact on the nature of the household and population growth especially in the short term. Also growth is likely to behave differently to the rest of the CCC area due to it being influenced by rural and lifestyle trends. Population growth in the non UDS area is calculated based on the projected household growth.

Labour Force Projections

Statistics New Zealand produced a set of labour force projections for the UDS based on the medium high population projection (shown in Table 1) using the following set of assumptions agreed with the UDS management team:

1. These projections have as a base the estimated resident population of Christchurch Urban Development Strategy area in the labour force at 30 June 2001. The projection series have been produced by applying labour force participation rates to the population estimates and projections for the Christchurch Urban Development Strategy area by 5-year age groups and sex.
2. The labour force participation rates for the Christchurch Urban Development Strategy area were based on the 2001 Census. These labour force participation rates were then adjusted in line with the national labour force participation rates used in the National Labour Force Projections 2001(base)–2051 update.
3. The labour force comprises people aged 15 years and over who regularly work for one or more hours per week for financial gain, pay in a family business, or are unemployed and actively seeking part-time or full-time work.

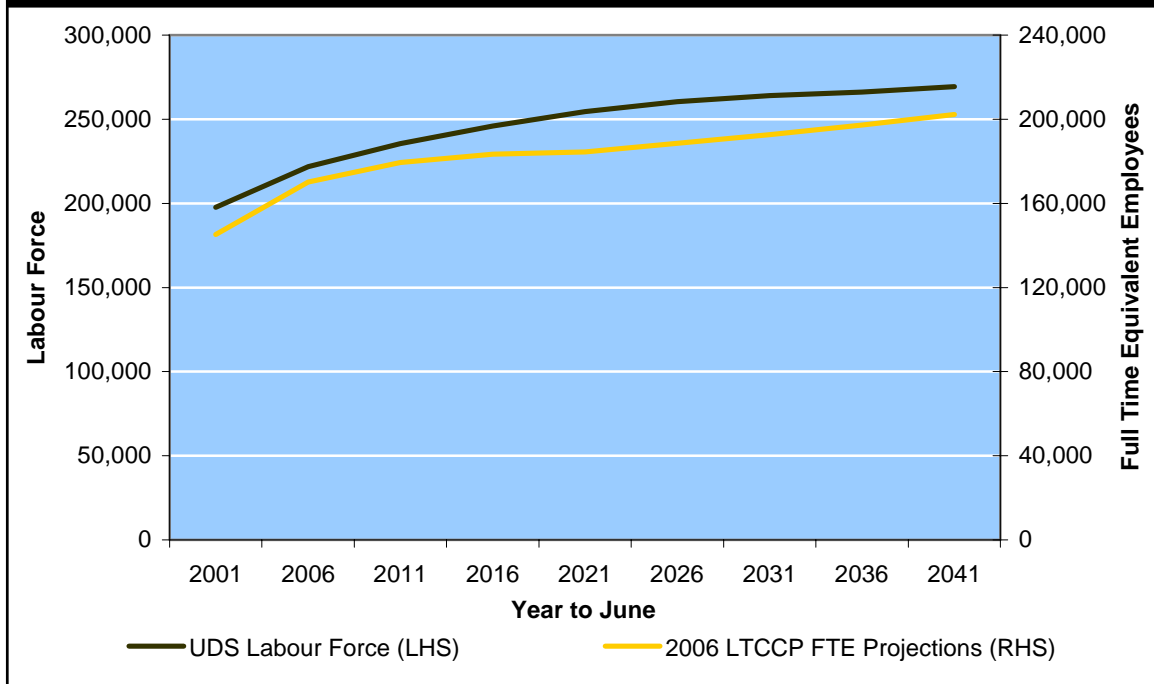
The 2006-9 LTCCP floorspace projections used a set of full time equivalent projections based on NZIER Canterbury projections and calculated for Christchurch level and extended from 2026 to 2041 by Property Economics to project out industrial floor space growth. These projections had a 2002 base and are not directly comparable with the Labour Force projections which measure the total number of people available to work either part time or full time. As such they are numerically higher than the FTE based projections. Proportionally the FTE projections had a higher percentage growth rate, but numerically the growth was in the order of 80 percent of the growth in the Labour force projections between 2006 and 2041(See figure 3 over the page).

The main reason for using the UDS labour force projections was that the UDS area was selected as the predominate commuter zone for the City, so employment for any part of the City is likely to come from anywhere within the UDS area. The assumption with using labour force is that for particular industries especially those other than the retail and service industries that are primarily population driven (although labour force availability would have some impact as well as spending power of the population) is that the labour component, which is one of the few variables that can be projected out with any degree of robustness, can influence the business growth through restricting expansion/growth if there isn't a reasonable supply of labour. This assumption assumes that any future change in productivity or floor space to employee ratios will be the same as the period that the current relationships were developed and as such are implicit within those relationships although not clearly identified.

To distribute zone level floorspace to the meshblock level, employment projections developed for the UDS were used. These essentially take the additional growth in employment from the UDS Labour force projections and allocate this down to the industrial, commercial or retail centre level (also included out of centre employment - but out of centre floorspace has not been assessed for this project) and subsequently to the meshblock level.

Employment projections are available at the meshblock level for industrial, office, retail and other landuses. Note this is only one potential scenario - but was adopted for the UDS process and as such was used to allocate floorspace growth to the finer spatial scales. Only total employment was used at the meshblock level to allocate

Figure 3. Comparison of UDS Labour Force Projections and FTE Projection used in 2006 LTCCP model.



the business floorspace. The rationale for this was that the relationship between floorspace landuse types and employment using the ANZSIC classification is complex and needs additional work to fully develop.

Base Floorspace data

The base floorspace data at the end of June 2006 comes from the Christchurch City Council's District Valuation Roll. Industrial floorspace comes from the value factors table which contains the mass appraisal data for each property while the commercial and retail floorspace comes from the commercial floor space table which provides for each property the breakdown of retail and office floorspace for each property. Note for the purposes of the analysis the total floorspace was used for each property and zone.

Floorspace for the period since the base date (2007) was produced from the Council's commercial building consent data.

Zone Grouping Floor Space Projection methodology.

This section discusses the methodology for projecting out zone level floor space for each group of zones. Groups of business zones shown in Table 2 were used for the projection process. This was because between 1990 and 2000 the Christchurch City Council collected and aggregated commercial floorspace data to these classes. Since 2000, commercial floorspace data has been collected at the individual zone level. It was considered that a longer trend at a higher level of aggregation was more useful than more detailed data for a shorter time period. Note that the post 2000 data was subsequently used to allocate the growth at the zone group level down to the individual zones.

In the areas that were in Banks Peninsula District (before amalgamation with Christchurch City Council) the decision was to group the commercial floor area projections by geographic areas. This was because the historical consent information was only available from Statistics New Zealand at Area Unit level. The geographic areas identified are Lyttelton Harbour, Akaroa Harbour and Little River. The rest of the Peninsula was left out as there was very little commercial and business development in these areas. Rural activity has been excluded from these projections.

Description of the Projection Methodology for each Zone and Zone Grouping

Central City

Data from building consents from 1966 was used to analyse floorspace growth in the Central City area. The extent of the reporting area has changed several times during this period, but the average annual floorspace growth has been at a reasonably constant rate for much of this period at 16,237 sqm (figure 4). It is assumed that this rate will continue into the future based on the fact that the Central City is intended to have a similar focus in the future, with a mix of commercial office and retail. Although residential is expected to have a greater influence

Table 2. Business Zone Group and Summary of the Projection Components

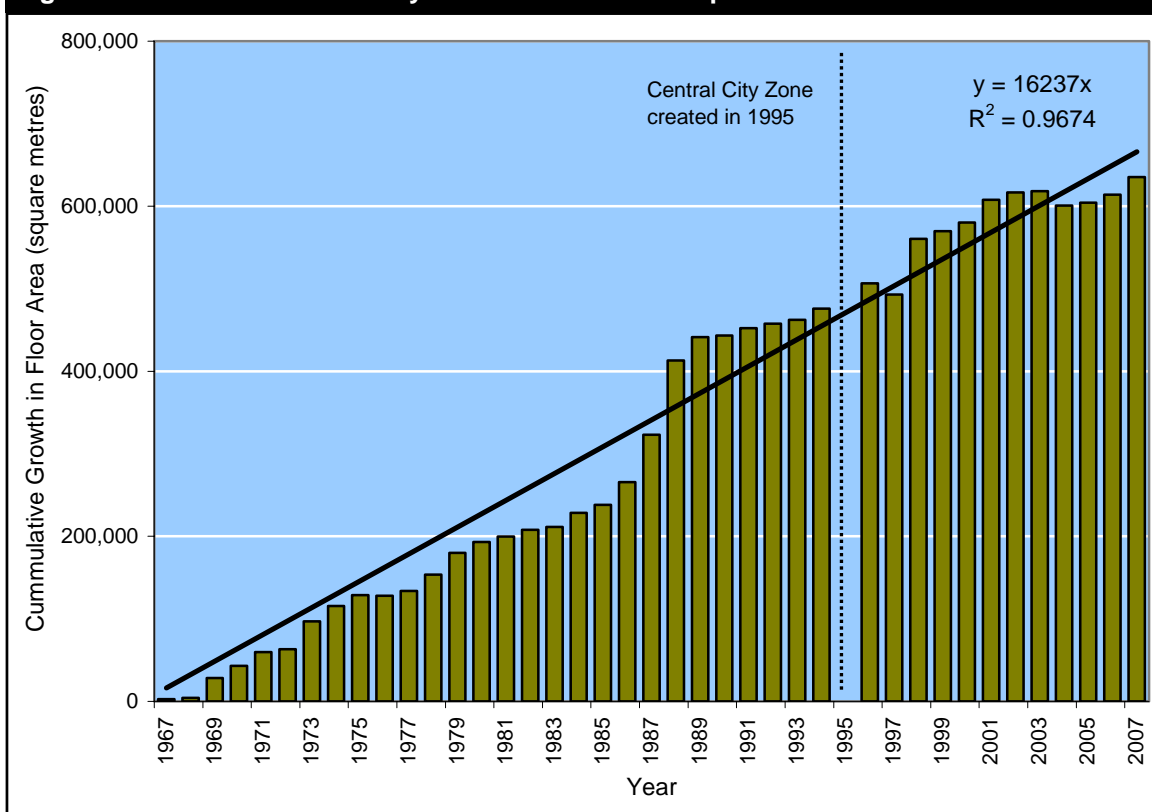
Zone Groups	Zone Codes	Method of Allocation between Zones	Projection variable
Central Commercial	CC, CCE	Net growth in floorspace between July 2000 and June 2007	Based on long term linear trend from 1966
Suburban Commercial	B1, B2, B2P, BRP	Net growth in floorspace between July 2000 and June 2007	Christchurch City Population Projections
Central Industrial	B3, B3B,	Net growth in floorspace between July 2000 and June 2007	Labour Force Projections
Suburban Industrial	B4, B4P, B4T, B5, B6, B7	Average of the proportion of vacant industrial land at 2007 and the net growth in floorspace between 2001 and 2007	Labour Force Projections
Special Purpose Zones	SP(ARPT), SP (HOSP)	These were calculated separately.	Airport - Linear trend, Hospital population based.
Lyttelton Harbour	All zones except rural	SNZ area unit building consent data 1991 - 2007	Linear projections based on historic data from 1991
Akaroa Harbour	All zone except rural		
Little River	All zones except rural		

in the future this is expected to enhance the commercial activity in the central city. Whether this will result in greater growth of commercial activity and floorspace than historically is hard to predict.

Growth in the Central City can be described as short periods of quite intense growth followed by periods where this growth in floorspace is taken up before another period where the market reaches a point where all the conditions are favourable for another significant burst of floorspace. Note this data is also based on floorspace consented rather than built and there is often a delay between a consent being issued and development being completed. This could also explain this lag between periods of high growth.

The central city area is divided into the central city zone and the central city edge zone. Proportions of development in each zone are based on recent building consent activity since July 2000, and show that 99% of

Figure 4. Growth in Central City Zone Business Floorspace since 1966



the development has occurred in the central city zone. It is anticipated that there will be considerable growth in the CCE area in the next five year period with development such as on the old "Turners and Growers" site, while the vast majority of growth will occur in the central city zone.

Suburban Commercial

The suburban commercial areas are those areas zoned B1, B2 (B2P) and BRP. These are the local corner shops, supermarket based centres, sub regional centres such as Riccarton and Northlands Malls and the BRP areas such as Tower Junction. These are primarily retail and service orientated, but there is also a significant proportion of small to medium sized office activity in some of these areas.

Analysis has shown that development in these areas since 1991 has been strongly related to population growth in the City ($r^2 = 98\%$, figure 5). This means that almost all the growth in floorspace can be accounted for by population growth. In summary suburban commercial floorspace grows on average 5.5 sqm for each additional person (usual resident population) added to the City. It should be noted that the reason for using cumulative data for this analysis rather than year on year data is that floorspace growth will often lag behind population growth or in some cases, for example in the larger malls may occur in anticipation of growth so it is unlikely that growth in floorspace will occur in the same year as growth in population.

Floorspace growth is distributed between the different zones based on recent consent information. The B1 receiving 10%, B2 82%, Retail Parks (BRP), such as Tower Junction, 7% and the remaining 1 percent of growth in the B2P areas. The actual location of this growth is determined by the UDS employment projections.

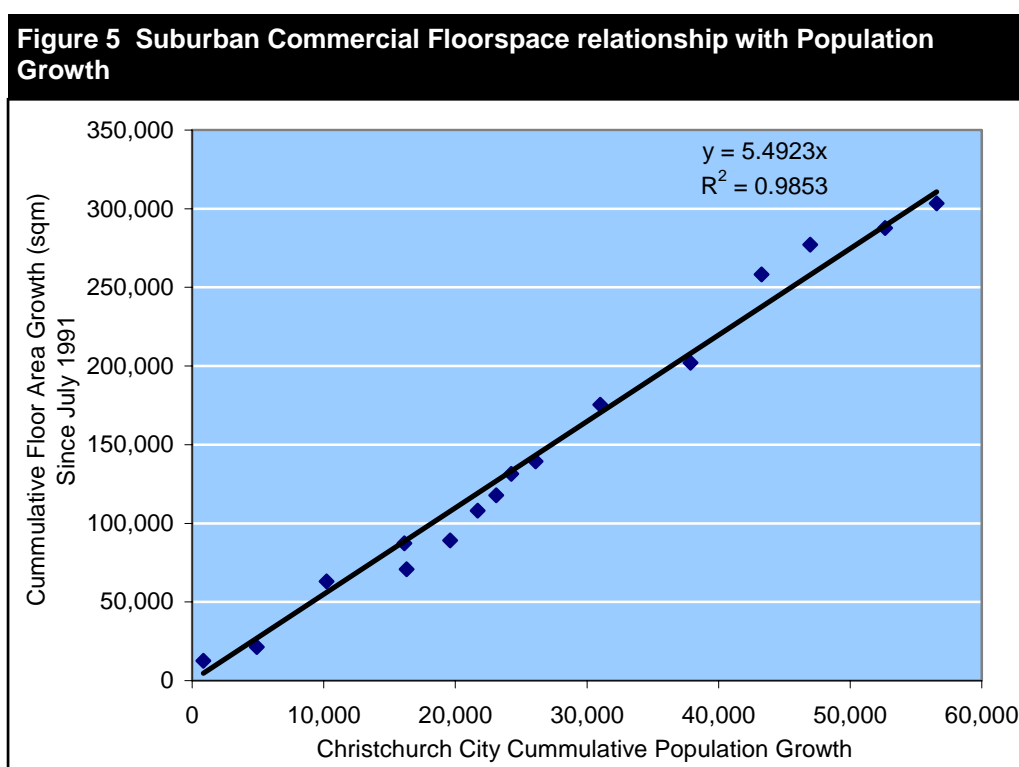
Note the relationship between population growth and floorspace for these areas is the same as used for the 2006 LTCCP however due to the changes in the projected population and the more recent historic data the actual projected floorspace is different by 250,000 sqm or twice as much due to the growth in population from 2006 to 2041 increasing from 42,900 to 117,809 usual residents.

This analysis has not been taken to the next level of catchments for each centre. This would require some market segmentation which has been done in some ways for the commercial strategy and then used to feed into the UDS employment projections used to distribute the growth. As such is implicit in the employment projections.

Central Industrial

The central industrial areas includes the Business 3 and Business 3B zoned areas, these are located in the four avenues, Sydenham and Addington parts of the City. They contain typically light industrial and service based businesses that meet the needs of the City's residents and businesses. There is very little vacant land in these areas due to the established nature of the area.

The growth in business floorspace in the area best fitted a relationship with the UDS Labour Force projections



(Figure 6). The relationship between floorspace growth and the labour force in the period 1998 to 2007 was stronger than over the period 1996 to 2007 however the latter period was dominated by lower levels of growth especially since 2001. However it should be noted that the UDS labour force projections are only 5 yearly and the intervening years have been interpolated using a linear trend.

Figure 7 shows the projected growth rates for this area based on a series of relationships. The lowest level of growth is from the 2006 LTCCP projection. This is based on the much lower employment projections used at the time and appears to be too low considering the growth since 1991. The next 2 series are based on the relationship with the UDS Labour force projections, and are different based on the start date of the relationships created. The 1998 base date produced a lower projection than the 1996 base. It was decided to use the relationship based on the 1996 base date as this showed that the floorspace growth over the next 5 year period would continue at the same rate as over the past five years (which was already a decreased on the previous 5 year period) before declining due to the impact of a the slowing of the labour force growth .

The distribution of growth between zones is based on historic building consent trends since July 2000. Under this scenario, growth will be 6% in the B3B zoned areas and 15% in the B3 areas. These are not high amounts of growth, but considering the current density of businesses in these areas already it is unlikely they will experience high levels of net growth in floorspace. Note, net floorspace growth excludes the replacement of existing floorspace and the conversion between business types, unless there is additional floorspace growth as a result of these activities.

Suburban Industrial

This is the largest geographic area and the area with the greatest growth in floorspace in the City. It includes existing industrial areas and new greenfield areas. It includes the light industrial and servicing zoned areas of B4, the B5 areas which are more characterised by heavy industry, to rural industrial(B6) and the new B7 zone which is a combination of rural industrial and space intensive, high effects, "dry" industries which often would be constrained in a normal suburban industrial settings and which would be incompatible with residential activities. Because the B7 zone is relatively new and hasn't received any growth the distribution of new floorspace to each zone is based on the average proportion of growth since 2000 and the proportion of vacant residential land available at June 2006. This assumes that the distribution of growth at a zone level is related to the capacity for future growth as well as the historic trend in actual growth.

Figure 8 shows the relationship between growth in the UDS labour force and suburban industrial floorspace growth. Note with the labour force growth the data is only five yearly so the intermediary steps are interpolated linearly. So in reality the relationship is only based on 3 points. Although having noted this the floorspace data is

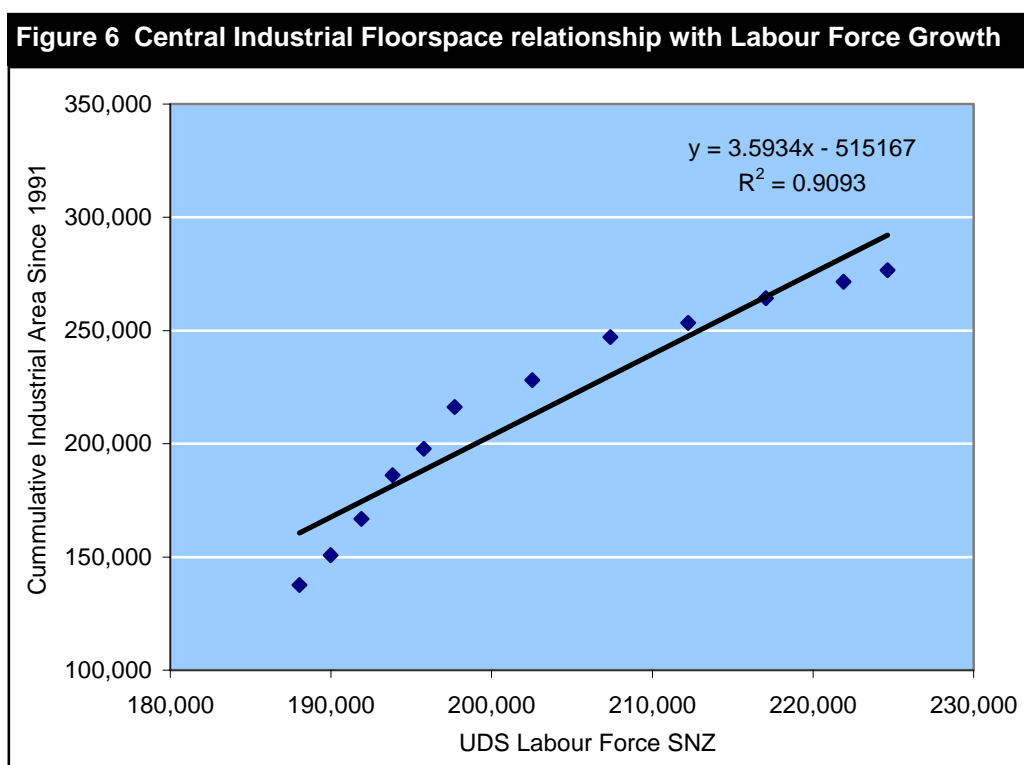
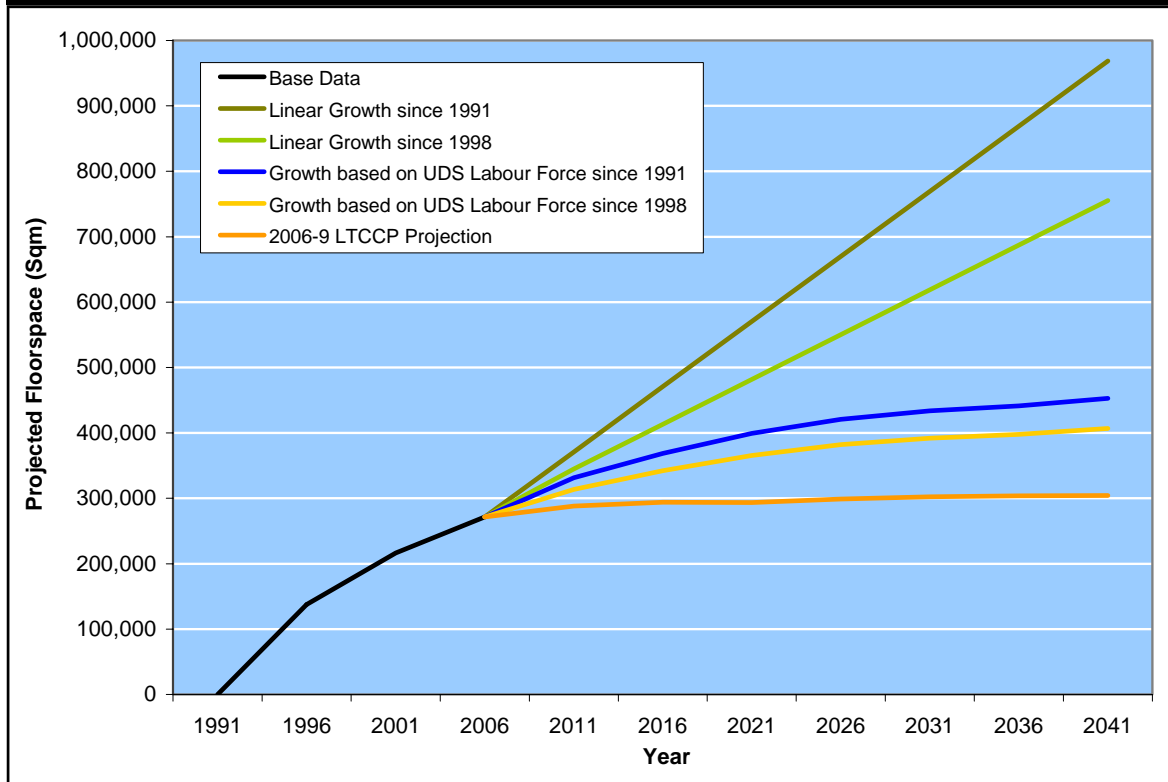


Figure 7 Central Industrial Floorspace Projections based on different Assumptions



annual so it is surprising how well these are distributed along the linear trend between the labour force projection points.

Figure 9 shows the labour force based projection into the future compared with the 2006 LTCCP trend, which shows very little growth from 2006 due to a slowing of the employment projections they were based on. The trend based on the UDS Labour Force projections shows a continuation of the current trends over the next five year period followed by a gradual decline in growth as labour force is constrained.

This graph also shows the growth projection if the past 15 year trend was forecast out at the same rate (linear growth since 1991). This would lead to significantly more growth (approximately 50% more growth) which is

Figure 8 Suburban Industrial Floorspace relationship with Labour Force Growth

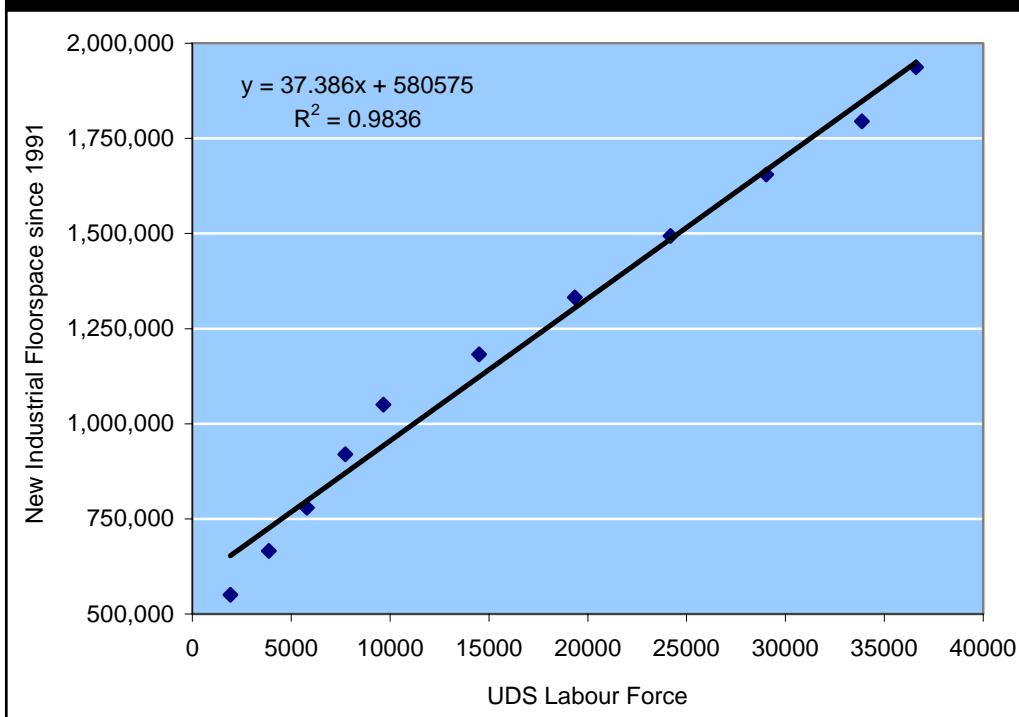
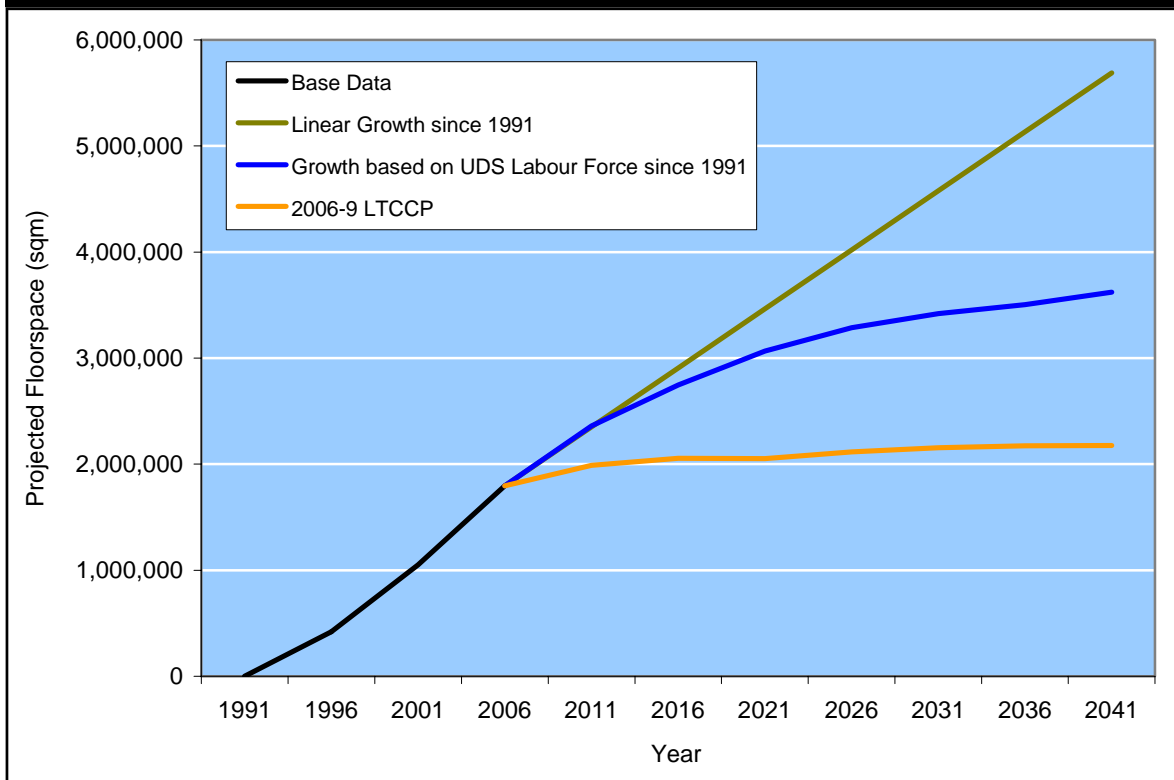


Figure 9 Suburban Industrial Floorspace Projections based on different Assumptions



possible, but would possibly require additional land due to the additional 2 million sqm of additional floorspace and increases in productivity greater than recent rates to offset the future employment constraints. However the assumptions used to base the current set of projections on is that floorspace growth relates to the size of the available pool of labour. While the linear growth trend is strong ($r^2 = 97\%$) the relationship with the Labour force is slightly stronger at $r^2 = 98\%$. In addition contemporary commentary of business activity have noted that the lack of available workforce due to low levels of unemployment is restricting business growth, there is no reason why this wouldn't be the case in the future.

Special Purpose (airport)

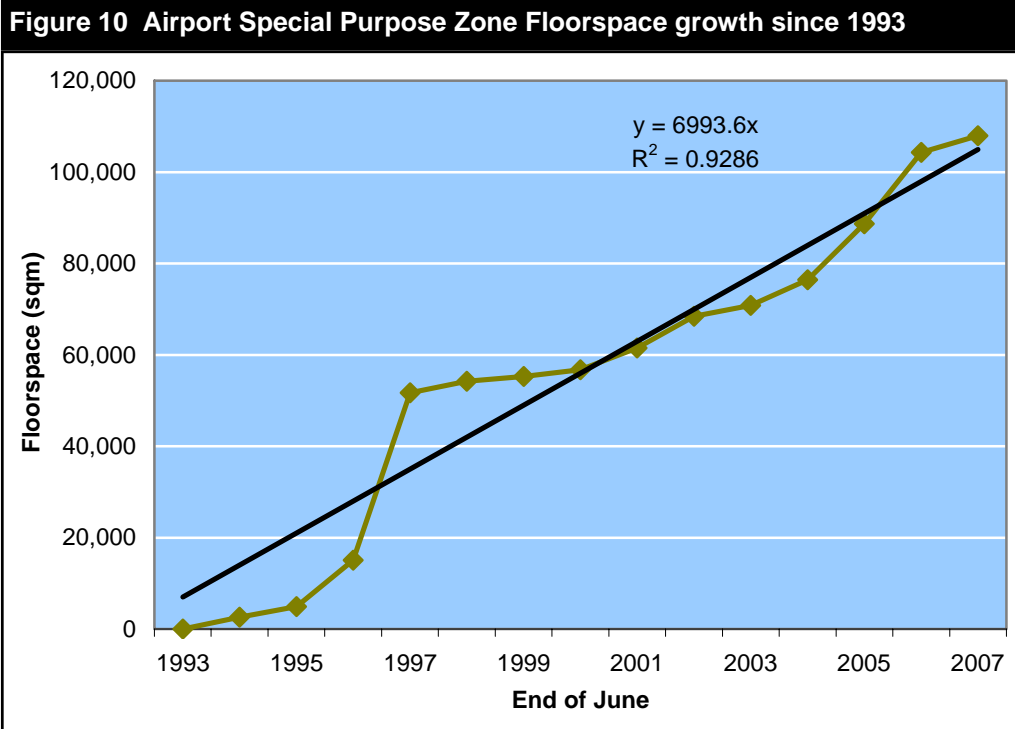
The airport special purpose zone includes the area of the Christchurch International Airport, including the runways, airport buildings and surrounding land for airport services. It is intended that development within this zone be clearly associated with the operation of the airport and aviation. It should be noted that there is a diverse range of industries in this zone. Under the UDS and the aspirations of the airport company there is a desire for considerable business development within this zone.

As the business environment in this area is quite complex and due to it's relationship with the airport the rate and how it will develop is likely to be dependant on factors external to the City such as passenger numbers and freight volumes rather than labour force or population which has been used to project out floorspace in other areas. In addition there is a large quantity of land available for development in this zone. Subsequently, it has been decided until we get a better understanding of the relationships driving the growth in floorspace to use a linear projection of historic growth trends for the future time periods (figure 10).

Special Purpose (Hospital)

Growth in the hospital special purpose zones excludes any growth that has occurred as a result of expansion of the public hospital system. This is because the Canterbury District Health Board is exempt from paying development contributions. Other government departments such as the Ministry of Education are also exempt for paying development contributions, so public schools are also not included in the floorspace growth calculations.

Information on development in these zoned areas was only available from July 2000. Since 2000 the range of annual net floorspace growth has been quite variable (-113 to 15,500 sqm per annum). This meant is was very



difficult to determine a credible trend and relationship with a variable that could be projected out. As such it was decided to relate the growth over this period to population growth and forecast this ratio. The assumption being that private hospitals are a service based industry that are population driven. It could be argued that growth in the older age groups might provide a stronger relationship than the total usual resident population. This could be tested in the future when more trend data is available.

Banks Peninsula Geographic areas - Lyttelton, Akaroa, Little River

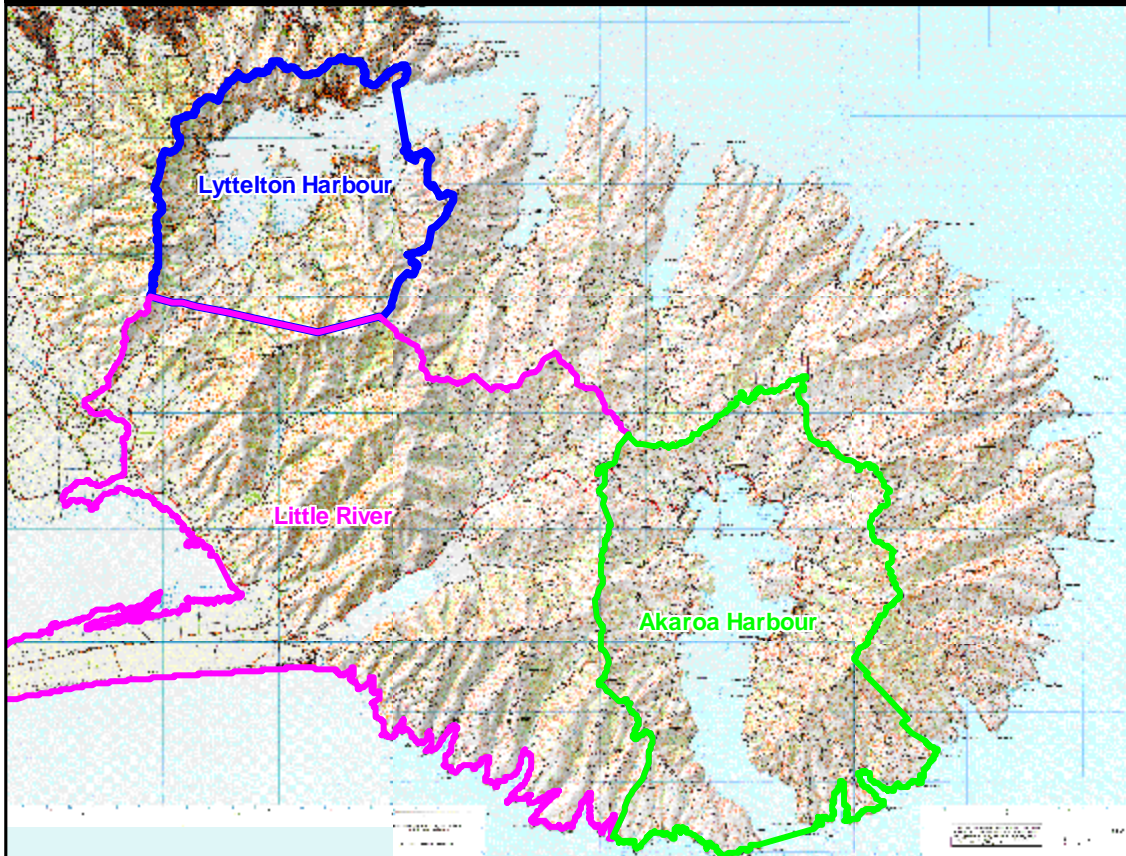
Growth in the Banks Peninsula area of Christchurch has been projected out for the geographically defined areas of Lyttelton Harbour, Little River and Akaroa Harbour (Figure 11). Banks Peninsula projections were calculated in a different methodology than the other parts of the City. This was due to having to source the building consent data from Statistics New Zealand rather the old Banks Peninsula District didn't collect this data. Secondly growth in commercial and industrial areas is quite variable both temporally and spatially from a relatively low base.

As a result growth was projected out at the whole area based on an average annual growth rate. The reason for this is that in all three areas, commercial and industrial growth is dominated by external factors such as tourism, port functions in addition to the traditional functions of servicing the rural and town communities. As a result considerable work needs to be done to determine any more sophisticated relationships especially as both tourism and export activities are influenced by both domestic and international variables.

Figure 12 shows growth in this area is on average 1964sqm per annum. This was then split between the three sub areas based on the proportion of growth in each sub area based on analysis of the Statistics New Zealand building consent records aggregated to the 2006 area unit boundaries. As such the projections at the sub area level are based on the assumption that development in these areas will follow historic trends. The result is that the 1964sqm per year has been divided between the sub areas by the following amounts: Lyttelton Harbour - 47%; Akaroa Harbour 46%; and Little River 7%. Note it is assumed that there will not be any commercial growth in areas outside these areas. Since 1990 the amount of growth outside these areas has only amounted to 4% of the total growth, but it is difficult to determine which area this is likely to happen in as there is no business zoned areas in the areas outside the three sub areas. The Little River area has been included even though it has historically had little growth because it has areas zoned for business activity that have the capacity for additional development.

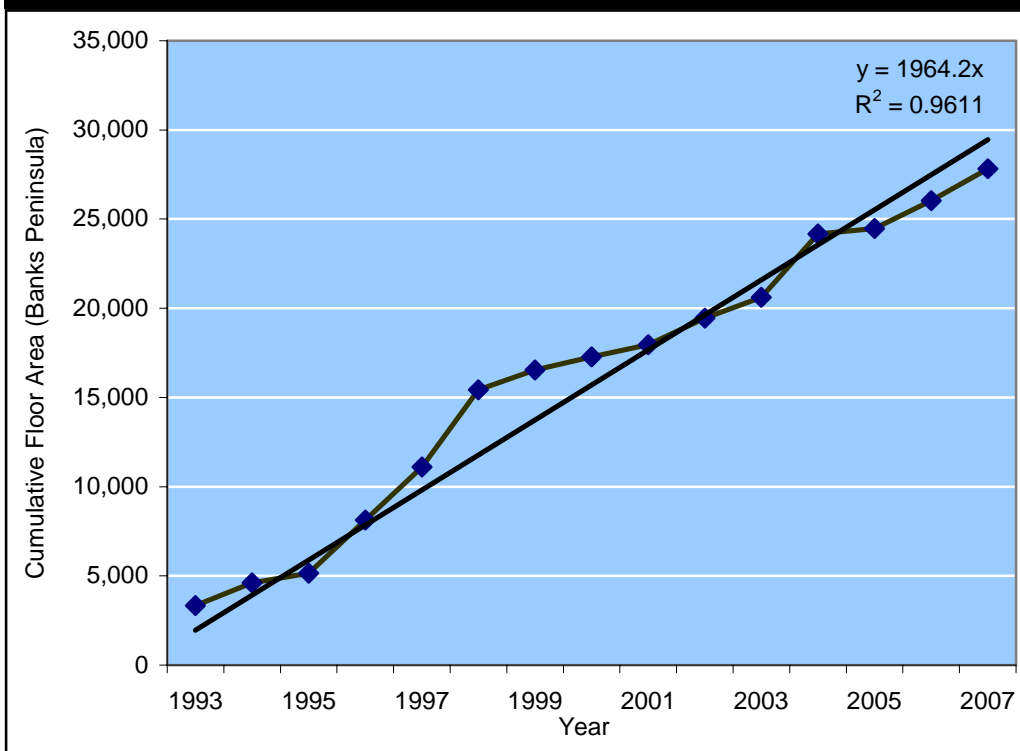
Akaroa and Little River were outside the UDS study area and as such didn't have employment projections at the meshblock level to distribute the floorspace growth at this level. The process that was used in these areas was simply to assume growth was related to the current distribution of employment in these areas. That is areas with

Figure 11 Business areas in Previous Banks Peninsula District



high employment now would end up with greater growth in floorspace. This doesn't take into account the ability to fit more growth into an area, however it was considered that because the meshblock data would be aggregated up to area unit level any error at the meshblock level would be removed when the data was aggregated to the area unit level to be used for the development contributions funding model.

Figure 11 Banks Peninsula Floorspace Growth since 1991



Distribution of business floor space within each zone.

The future amount of floorspace for each zone identified in the model was then distributed throughout the City to a meshblock level based on the UDS projected employment distribution in the City between 2006 and 2041. This provided an employment growth scenario for each meshblock in the City, and was used to allocate the growth in each zone group to a specific meshblock based on the following formula.

$$FS_{mb_i z_j p_t} = FS_{z_j p_t} \times P_{Empl_{mb_i z_j p_t}} + FS_{mb_i z_j p_{t-1}}$$

Where

$$P_{Empl_{mb_i z_j p_t}} = \frac{Empl_{mb_i z_j p_t} - Empl_{mb_i z_j p_{t-1}}}{Empl_{z_j p_t} - Empl_{z_j p_{t-1}}}$$

And

$FS_{mb_i z_j p_t}$ is the floor space for each meshblock (i), zone (j) and period (t)

$FS_{z_j p_t}$ is the floor space projections for each zone and time period

$P_{Empl_{mb_i z_j p_t}}$ is the proportion of employment in each meshblock, zone for a particular period to the total zone employment for the same period.

$Empl_{mb_i z_j p_t}$ is the amount of employment in each meshblock, zone for each period

$Empl_{z_j p_t}$ is the totals amount of employment for each zone and projection period

Description of adjustment for actual growth since 2006 base date.

Once the floorspace was allocated to individual zones and then to the meshblock level based at 2006. The meshblock data was then adjusted for the actual growth in the year to June 2007. This often resulted in growth at different levels to what was projected. As such the difference in growth was redistributed both spatially and temporally in response to the actual growth.

Appendix 1: Summary of Projected Growth for each Zone from 2006 to 2041

ZoneCode	2006	2007	2011	2016	2021	2026	2031	2036	2041
Central Commercial									
CC	1,478,346	1,498,045	1,558,833	1,639,320	1,719,807	1,800,294	1,880,782	1,961,269	2,041,756
CCE	48,017	48,008	48,715	49,413	50,111	50,809	51,506	52,204	52,902
Central Industrial									
B3	987,964	992,054	1,024,080	1,058,351	1,086,360	1,105,802	1,117,665	1,124,915	1,135,460
B3B	223,714	222,185	226,982	230,082	232,616	234,376	235,449	236,105	237,059
Suburban Commercial									
B1	181,796	186,115	188,977	195,752	203,653	211,634	218,212	224,790	231,368
B2	438,618	445,219	497,990	554,011	619,339	685,327	739,713	794,099	848,485
B2P	7,261	7,501	8,134	8,957	9,917	10,887	11,687	12,486	13,285
BRP	93,455	93,650	98,627	103,507	109,198	114,946	119,683	124,421	129,158
Suburban Industrial									
B4	1,298,190	1,342,466	1,423,398	1,542,208	1,639,312	1,706,714	1,747,841	1,772,974	1,809,531
B4P	61,721	75,501	83,464	104,096	120,958	132,663	139,804	144,169	150,517
B4T	25,282	29,685	29,685	33,847	37,255	39,620	41,064	41,946	43,229
B5	1,832,794	1,881,238	2,022,557	2,202,625	2,349,795	2,451,949	2,514,280	2,552,371	2,607,777
B6	64,342	67,890	110,525	154,348	190,166	215,027	230,197	239,467	252,951
B7	-	-	22,459	43,771	61,189	73,279	80,656	85,164	91,722
Special Purpose Zones									
SP(ARPT)	111,427	115,045	146,402	181,377	216,352	251,327	286,302	321,277	356,252
SP(HOSP)	45,225	60,700	60,700	61,379	70,525	79,763	87,377	94,990	102,604
Banks Peninsula Areas									
Aka	20,638	21,269	23,685	26,751	29,899	32,691	33,754	34,490	34,898
LRiver	2,989	3,835	3,835	3,908	4,382	4,801	4,961	5,072	5,133
Lyt	56,132	56,065	59,271	62,431	65,675	68,552	69,648	70,406	70,826

Appendix 2: Maps showing distribution of current and future floorspace (2006 and 2041) by Meshblock

