CONCEPT PLAN REVIEW
FOCUS GROUP CONSULTATION

FINAL REPORT ON

LAND ALLOCATION

Submitted to the Ministry of National Development
December 2000
22 Dec 00
Mr Mah Bow Tan
Minister for National Development

CONCEPT PLAN REVIEW
FINAL REPORT OF FOCUS GROUP ON LAND ALLOCATION

In August this year, you appointed us to co-chair the focus group on Land Allocation to study and brainstorm for ideas to resolve the dilemma of competing land needs.

Our focus group has completed the study and we submit our final report for your consideration. This report builds on the planning scenario of accommodating a population of 5.5 million in the medium term based on projections of demand and supply figures given by the relevant government agencies.

Our focus group formed four Resource Groups to examine the different land uses. The four resource groups are:

a. Resource Group on Housing Space
   Led by Mr Goh Chong Chia (Feedback Group on Housing)

b. Resource Group on Work Space
   Led by Dr Malone-Lee Lai Choo (Dept of Real Estate, NUS)

c. Resource Group on Green & ‘Blue’ Space
   Led by Dr Geh Min (Singapore Environment Council) & Mr Tan Shee Tiong (Singapore Institute of Planners)

d. Resource Group on Roads & Infrastructure
   Led by Dr K Raguraman (Feedback Group on Transport)

The resource groups questioned assumptions & projection figures, gathered data, brainstormed ideas and studied feedback from more than 200 members of the public and invited individuals, who participated in the resource group discussions. The recommendations were presented at the Public Forum held on the 8th December 2000 where broad public discussion and feedback were obtained before the focus group finalised its recommendations.

We are grateful for the assistance of many government agencies, the participation of individuals from various walks of life and the many contribution of ideas and feedback from the public which contributed significantly to this Report.

Finally, we together with our members, would like to thank you for this opportunity to contribute in the planning of Singapore to make this place a global city and a better home.

Assoc Prof Vivian Balakrishnan & Mr Tham Tuck Cheong
Co-chairmen of Focus Group on Land Allocation
19 January 2001

Assoc Prof Vivian Balakrishnan and Mr Tham Tuck Cheong
Co-chairmen, Focus Group on Land Allocation

Dear Vivian and Tuck Cheong,

CONCEPT PLAN REVIEW
FINAL REPORT OF FOCUS GROUP ON LAND ALLOCATION

Thank you for your letter of 22 December 2000 and the final report of your focus group.

2 In the current Concept Plan review, we wanted to consult as many Singaporeans as possible and to open up feedback channels for everyone to contribute ideas. Forming the focus group is key to the consultative process through which we hope to draw fresh perspectives, new ideas and better insights on how we can balance competing land needs.

3 The effort of your focus group in harnessing and studying the feedback from more than 200 members of the public and invited individuals in the resource group discussions is commendable. The focus group has certainly achieved the objective of generating and debating many ideas that could resolve the dilemma on land allocation.

4 I will ask URA and the relevant government agencies to study your recommendations. Where they can be implemented in a practical and sustainable manner, they will be adopted, with overall national interests foremost in our mind.

5 I thank all the members of your focus group and also all the individuals who have actively contributed ideas and feedback to the focus group.

Yours,

[Signature]

MAH BOW TAN

Ministry of National Development, No.5 Maxwell Road, #22-00, Tower Block MND Complex, Singapore 069110
FOCUS GROUP

Co-Chairpersons

Assoc Prof Vivian Balakrishnan  
CEO, Singapore General Hospital

Mr Tham Tuck Cheong  
Partner, Consultants Incorporated Architects & Partners

Members & Nominating Organisations

Mr George Abraham  
Feedback Unit

Mr Sunny Chan  
Economic Development Board

Mr Chia Ngiang Hong  
Real Estate Developers’ Association of Singapore

Mr Fazlur Rahman bin Kamsani  
Feedback Unit

Dr Geh Min  
Singapore Environment Council

Mr Goh Chong Chia  
Feedback Unit

Mr Goh Peck San  
People’s Association

Mr Heng Chee How  
National Trades Union Congress

Assoc Prof Ho Kong Chong  
Dept of Sociology, National University of Singapore  
(alternate, Prof Chua Beng Huat)

Dr K Raguraman  
Feedback Unit

Dr Amy Khor  
Singapore Institute of Surveyors & Valuers

Mr Khor Thong Meng  
Real Estate Developers’ Association of Singapore

Ms Lyn Lee  
Feedback Unit

Mr Lawrence Leow  
Association of Small & Medium Enterprises

Mr Victor Liew  
The Monetary Authority of Singapore

Mr Quek Suan Kiat  
The Monetary Authority of Singapore

Ms Saw Phaik Hwa  
Singapore Retailers Association

Mr Daren Shiau  
National Youth Council

Mr Sim Wong Hoo  
National Science & Technology Board  
(alternate, Dr Kwok Kian Woon)

Mr Mason Tan  
Singapore Institute of Landscape Architects

Mr Tan Shee Tiong  
Singapore Institute of Planners

Mrs Wong Siow Hong  
Singapore Retailers Association

Ms Yang Geok Foong  
Feedback Unit
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6 **SUMMARY OF PROPOSED LANDTAKE FOR 5.5 MILLION** ........ 39
This report represents the combined efforts of the 31 members of the group, the more than 200 members of the public who sent their ideas to us, and the 400 people who attended the public forum held on 8th December 2000.

The Focus Group was presented with a planning scenario of accommodating 5.5 million persons who needed to live, work and play on our tiny island in the medium-term. There was a theoretical land shortfall of 4,000 hectares. The Group was tasked to study the implications of this shortfall and the potential trade-offs that it would entail.

As this was the first time that URA had convened a Focus Group prior to the development of a Concept Plan, it was a learning experience for all concerned.

The process by which these recommendations were made was perhaps just as important as the findings themselves. The Focus Group could not possibly claim to be fully “representative” of the Singapore population at large. Nevertheless, we were to act as a focal point for ideas and feedback from as wide a cross section of the population as possible. The public responded with numerous useful and realistic ideas that we adopted gratefully.

The other noteworthy aspect of this process was the extreme openness of the statutory authorities like the Urban Redevelopment Authority (URA), Jurong Town Corporation (JTC), Economic Development Board (EDB), Housing and Development Board (HDB), National Parks Board (NParks), Land Transport Authority (LTA) and Civil Aviation Authority of Singapore (CAAS) to the innumerable questions that the Focus Group posed. There was never a hint of reluctance to share information, and definitely a sense of common purpose to solve future challenges. This represents a further significant improvement in the process of public consultation and accountability in Singapore.

At the end of the day, this report represents our collective views of the options facing Singapore in the future as far as land allocation is concerned. We hope the planners and authorities will find it useful, and implement a significant number of the proposals.

The Co-Chairmen of the Focus Group would like to record their deepest appreciation to everyone who participated in this effort in one way or the other.
AKNOWLEDGEMENTS

1. We would like to thank the following organisations for providing us with the information we requested to complete this report:

- Civil Aviation Authority of Singapore
- Economic Development Board
- Housing and Development Board
- Jurong Town Corporation
- Land Transport Authority
- National Parks Board
- Urban Redevelopment Authority

2. We would also like to thank the following individuals for participating in our meetings and for their useful feedback:

- Mr Chu Wee Kian
- Mr Darwis M. Said
- Mr David Wong
- Ms Esther Yap Teck Fern
- Mr Jonathan Lee Swee Kok
- Ms Liang Wern Ling
- Mr Lee Han Shih
- Ms S. E. Seow
- Ms Sharifah Pouzin
- Mr Stanley Ong Yeow Teng
- Mr Toh Kwee Siong

3. We also thank concerned Singaporeans and members of the public who have given us their inputs through various feedback channels.

Focus Group on Land Allocation
22nd December 2000
EXECUTIVE SUMMARY

1 The URA projects that an additional supply of 8,000 ha for housing, 6,000 ha for industry and 2,000 ha for parks would be needed for a population of 5.5 million. However, only 12,000 ha of land is available for development, leaving a potential shortfall of 4,000 ha. The Focus Group was tasked to study the implications of this shortfall and make recommendations for its solution.

2 The Group sought to minimise the land take for each of the necessary land uses by adopting the following principles:

• Adopt a conserving approach to land development;

• Optimise infrastructure by raising the intensity of development in areas served by MRT, utility installations, etc.;

• Adopt compact city principles that promote high-density and mixed use urban form and functions;

• Encourage land use integration to promote efficient utilisation of space and the sharing of common facilities and utilities;

• Re-examine the continuing relevance of existing development paradigms and norms;

• Adopt innovative planning, engineering and architectural concepts;

• Encourage environmental sustainability;

• Substitute capital and technology for land; and

• Develop a distinctive ‘softscape’.

3 Detailed proposals were discussed for housing space, work space, green space, and roads and infrastructure.
**HOUSING SPACE**

4 Manhattan-style housing with an average gross plot ratio (GPR) of 8.0 would be injected into the New Downtown to yield 64,000 dwelling units. Average GPRs of other high-density private and HDB areas should also be increased from 2.5 to 3.65. Where possible, taller buildings with smaller site coverage should be built to achieve higher plot ratios while maintaining greater spacing between blocks.

5 Recognising that Singaporeans want to live in more spacious homes, the space standard for high-density developments is proposed to be increased to 40 sq m gross (31 sq m net) per person. The current size of dwelling units can be maintained despite the projected reduction in household sizes from 4 to 3 per household.

6 A variety of housing types could still be maintained as 7% of new housing is proposed to be low-density, 18% medium-density and 75% high-density.

7 An additional 4,350 ha of land would be required to house the 800,000 dwelling units instead of the 8,000 ha computed by URA based on current density mix.

**WORK SPACE**

8 *Industry.* The group felt that the demand projection should be viewed with caution because of the long projection time frame of 40 to 50 years and the numerous assumptions made. Nevertheless, the use of industrial and business park land could still be intensified beyond the GPRs proposed by JTC.

9 For new industrial land, GPR 2.5 should be set as the industry norm and exemptions granted by JTC on a case-by-case basis. In areas where accessibility is good, GPRs should be allowed to exceed 2.5. For industries which cannot go high because of operational reasons, the air space above industrial developments should be allowed to be used for non-industrial uses such as offices, recreation and even living purposes. Existing industrial areas should also be redeveloped and intensified. Based on these strategies, the requirement for industrial land could be reduced to 4,300 ha instead of 6,000 ha as projected by JTC.
More mixed-use developments should also be encouraged to optimise the use of industrial land. Compatible uses should be allowed within industrial developments, and more industrial sites should be designated ‘Industrial-White’ to allow flexibility to change uses. ‘Work-live-learn-play’ environments should also be developed to allow multiple and integrated uses in industrial and business park land.

Commerce. The group proposed intensifying commercial use by increasing commercial GPRs and introducing multiple uses in appropriate areas. The decentralisation strategy proposed in the 1991 Concept Plan should still be pursued, but the numbers and locations of Regional Centres need to be reviewed. Town Centres and Fringe Centres should be further developed to support higher levels of commercial function.

GREEN SPACE

As green spaces are essential to maintain and enhance the quality of life, their justification cannot be restricted to economic reasons alone or measured solely by quantitative factors such as number of or frequency of visits.

Nature areas. Nature areas are essentially non-renewable. All of them should be retained and gazetted for protection. The Nature Conservation Review Committee’s (NCRC) recommendations to include five additional areas as nature areas and expand five other existing nature areas should also be adopted.

Parks. The target of 0.8 ha per 1,000 persons as set out in the 1991 Concept Plan should be met for the 5.5 mil population. This would require an additional 2000 ha of park land. There should be a variety of parks provided ranging from activity-based types such as East Coast Park to the more natural ones like Labrador Park. The existing network of green corridors should be expanded and leftover ‘sterile’ space within HDB estates should be creatively re-used as green spaces.

Golf Courses. There is no need for more golf courses as there is already a high provision of golf courses on the island. Where reclaimed land is available for interim use, it should be used for parks to benefit more Singaporeans.
“Blue Space’. Pulau Ubin, Pulau Tekong and the Southern Islands should be left in their natural states for as long as possible. All land reclamation should seek to minimise the loss of mangrove swamps, beaches, coral reefs, and other marine ecosystems.

ROADS & INFRASTRUCTURE

17 Roads. The group addressed the question of whether the demand for road space could be reduced through further car restraint and encouraging public transport use. There is currently a wide discrepancy in the travel time between the car and public transport. A reduction in the travel time advantage of the car vis-a-vis public transport can most effectively be achieved by seeking to reduce travel distances. This change of policy focus from mobility to accessibility leads to the concept of a high density, mixed-use compact city where home, work, play and social activities are juxtaposed. However, simply aggregating the concrete structures for these activities will not be sufficient. The ‘hardscape’ of buildings and facilities needs to be complemented with the ‘softscape’ which captures the more deep-seated emotional needs of Singaporeans.

18 Our existing transport spaces could be more creatively used by having more surface tunnels and converting, during weekends, under-utilised road spaces into recreation spaces. Rail networks should be built underground and the spacing between stations should be reduced. As intensive developments are proposed in the New Downtown, the capacity of the rail network there should be increased. Parking space standards should be reviewed in the compact city situation so as to reduce the overall land given to car parks. Public transport should be improved by expanding the existing rail network, providing different levels of bus services, which will help in reducing commuting time.

19 Infrastructure. As our airports create a height constraint on our built environment, one suggestion would be to relocate one of the airports in the future and a feasibility study should be done to evaluate this possibility. In the long term, the port should be relocated to reclaimed land at Tuas to free up the entire southern coastline for higher density waterfront commercial-residential developments.
1 THE DILEMMA

Introduction

1.1 In the 1991 Concept Plan, URA planned for a residential population of 4 million. The 2001 Concept Plan assumes a long-term population of 5.5 million, which includes citizens, permanent residents, employment pass and work permit holders. According to National Development Minister Mah Bow Tan, this figure is an estimate for planning purposes, to evaluate the allocation of land in the next 40 to 50 years. A bigger population would demand more land for housing, industry, recreation, transportation, infrastructure and other needs.

The Dilemma

1.2 The projected land available when the population reaches 5.5 million is 76,000 ha, taking into account future reclaimed land. However, the demand projections by URA for each land use indicated that a total of 80,000 ha would be required, resulting in a shortfall of 4,000 ha.

1.3 The Focus Group was asked to study the implications of this shortfall on housing, industry and parks, and make recommendations for its solution. We sought to avoid the ‘either-or’ dilemma by minimising the land take for each land use through intensification. Trade-offs between the different land uses should only be considered if the land savings through this intensification exercise could not yield at least a land savings of 4,000 ha to resolve the dilemma.

1.4 The URA projected that a maximum additional supply of 8,000 ha for housing, 6,000 ha for industry and 2,000 ha for parks would be needed for a population of 5.5 million using current planning norms. Thus, the projected need for an additional 16,000 ha of land. However only 12,000 ha of land is available for development. Therefore some trade-offs may be necessary. For example, in order to have more space for industries and parks, we would have to intensify the use of housing land.
The Focus Group categorised land use into housing space, working space (industry and commerce), green space (parks, nature areas and reserves, sports and recreation, ‘blue space’), and roads and infrastructure (see Table 1-1).

**Table 1-1: Concept Plan Land Use Summary**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Existing Area ha (%)</th>
<th>Demand Projection ha (%)</th>
<th>Difference ha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Housing</strong></td>
<td>10,000 (15.1)</td>
<td>18,000 (22.5)</td>
<td>8,000</td>
</tr>
<tr>
<td><strong>Commerce</strong></td>
<td>1,000 (1.5)</td>
<td>1,500 (1.9)</td>
<td>500</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>8,000 (12.2)</td>
<td>14,000 (17.5)</td>
<td>6,000</td>
</tr>
<tr>
<td><strong>Parks</strong></td>
<td>2,500 (3.8)</td>
<td>4,500 (5.6)</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Community &amp; Institution</strong></td>
<td>4,000 (6.0)</td>
<td>5,500 (6.9)</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Sports &amp; Recreation</strong></td>
<td>1,600 (2.4)</td>
<td>2,000 (2.5)</td>
<td>400</td>
</tr>
<tr>
<td><strong>Infrastructure &amp; Utilities</strong></td>
<td>3,300 (5.0)</td>
<td>6,300 (7.8)</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Roads</strong></td>
<td>8,200 (12.5)</td>
<td>9,600 (12.0)</td>
<td>1,400</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>27,400 (41.5)</td>
<td>18,600 (23.2)</td>
<td>(-8,800)</td>
</tr>
</tbody>
</table>

**TOTAL**  
66,000 (100)     80,000 (100)     14,000

*Source: URA*

**Projected Shortfall**

<table>
<thead>
<tr>
<th>Supply (ha)</th>
<th>Demand (ha)</th>
<th>Shortfall (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>76,000</td>
<td>80,000</td>
<td>4,000</td>
</tr>
</tbody>
</table>
Key Considerations

16 The key considerations for the 3 main land uses are as follows:

16.1 **Maintaining a competitive economy**
Singapore was ranked by Fortune magazine as the “No. 1 City for business” in Asia. To maintain this coveted position, we need to maximise our comparative advantage by moving towards a more knowledge-based economy.

Translated into physical planning terms, this means that we have to provide land to cater to high value-added industries such as wafer fabrication, life sciences, and chemicals. These high value-added industries have low-intensity as opposed to land-optimising multi-storey industrial developments.

In terms of business needs, more prime and centrally located commercial space will have to be set aside to attract financial sector players. With the projected increase in commercial space within the Central Area, more rail lines would have to be provided to cater to the corresponding increase in commuters.

16.2 **Housing a 5.5 million population**
With a bigger projected population, more housing would be needed. Economic prosperity has led to rising aspirations of Singaporeans for bigger, better and more varied housing.

16.3 **Providing parks and recreational opportunities**
Singaporeans also want ample space to relax and play outside working hours. Hence, a wider range of outdoor activities and variety of parks and open spaces is needed to meet the needs of the people. The current park provision of 0.67 ha per 1,000 persons falls short of the target standard set in the 1991 Concept Plan, which is 0.8 ha per 1,000 persons.
Existing Constraints

1.7 Being an island state, Singapore has to accommodate all the institutions of nationhood. Land must be carved out for an international airport and a large port, for defence, and for catchment and storage of water. Apart from consuming large areas of land, the airports impose height constraints on wide areas surrounding them.

Governing Principles

1.8 The Group adopted the following principles in formulating the recommendations.

1.8.1 Adopt a conserving approach to land development
Given limited land, future development should start with looking at already developed areas. All areas that are presently sub-optimally used should be identified. Land development agencies should aggressively initiate programmes to upgrade and redevelop such areas to higher intensity before proceeding to open new areas for development.

1.8.2 Optimise Infrastructure
There has been heavy investment in infrastructure such as expressways, the MRT and utility installations. The level of intensity of development in the areas served by these installations should be raised to be commensurate with their carrying capacity and their respective capital investments.

1.8.3 Adopt Compact City Principles
The compact city principles that promote high-density and mixed-use urban form and functions should be adopted as they are more environmentally sustainable because they reduce dependence on car travel, optimise the use of local facilities and services, and promote economic agglomerations.
18.4 **Encourage Land Use Integration**
Planning policies and practices should promote integration of land uses and sharing of common facilities and utilities. These areas could be used on a 24/7 (24 hours, 7 days a week) basis. Apart from saving land, travel time and costs are reduced. Integrated mixed-use development is also a prerequisite for vitality and vibrancy of urban areas, as well as for promoting cultural development and social interaction.

18.5 **Re-examine Development Paradigms and Norms**
The relevance of existing planning paradigms and norms such as new town planning concepts and industrial parks, GPRs, setbacks and heights that were adopted during the early stages of our development should be reviewed in light of the limited land we have, and the new needs and aspirations of the people.

18.6 **Adopt Innovative Planning, Engineering and Architectural Concepts**
There should be an open, bold and experimental attitude towards innovative planning, engineering and architectural concepts such as underground and offshore development, building under flyovers and MRT viaducts, and inner city high-density living.

18.7 **Encourage Environmental Sustainability**
Long-term ecological sustainability should take priority over short-term fiscal benefits. Strict guidelines against developments that destroy nature areas, consume large amounts of energy, pollute the environment and bring about climatic changes should be formulated and enforced.

18.8 **Substitute Capital and Technology for Land**
Capital intensive rather than land intensive development should be favoured even if the initial outlays may be heavier; for example, installation of sophisticated anti-pollution devices rather than land buffers.
Develop a distinctive ‘softscape’

A high-density landscape with all the required amenities nearby will be a necessary but not sufficient condition for the vibrant, soulful environment sought after by Singaporeans of the future. The ‘hardscape’ of buildings and facilities needs to be complemented with the ‘softscape’ which captures the more deep-seated emotional needs of Singaporeans.

New ideas would have to come from the ‘ground’ through a consultative, grassroots approach. People would increasingly want to give their own meanings to their living spaces and see these meanings expressed in the physical character of the landscape.
2 HOUSING SPACE

Background

2.1 Currently, 10,000 ha of land is used for housing, accommodating 1 million dwelling units with a density mix of 9% low, 13% medium and 78% high density as shown in Table 2-1. With this existing density mix, an additional 8,000 ha of land is required to accommodate the additional 800,000 dwelling units.

Table 2-1 Existing Housing Scenario

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High Density</th>
<th>Medium Density</th>
<th>Low Density</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average GPR</td>
<td>2.5</td>
<td>1.6</td>
<td>1.0</td>
<td>-</td>
</tr>
<tr>
<td>Dwelling Units</td>
<td>780,000</td>
<td>130,000</td>
<td>90,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Density Mix</td>
<td>78%</td>
<td>13%</td>
<td>9%</td>
<td>100%</td>
</tr>
</tbody>
</table>

2.2 The idea of accommodating the additional housing without more land take was initially considered. However, the following constraints had to be accommodated:

2.2.1 The horizontal landmass of Singapore could only be extended marginally as its national boundaries are fixed;

2.2.2 Five airports and ICAO requirements place an invisible ceiling covering much of the island under a 60-90m AMSL height control. The exception is the Central Area, which has an overall height control of 153m with pockets extended to 280m AMSL. This leaves the Central Area, in particular, the New Downtown for very tall buildings with higher GPRs;

2.2.3 As height control imposed by airports is very critical in defining Singapore’s future built environment, the relocation of one of the airports was suggested. A feasibility study should be conducted; and

2.2.4 There are current microwave constraints due to equipment on top of buildings. However, new technologies would reduce these constraints in future
Proposal

2.3 It is proposed that an additional 4,350ha of land is required to house another 800,000 dwelling units with a resultant density mix for new housing at 75% high, 18% medium and 7% low as shown in Table 2-2.

Table 2-2 Proposed Housing Scenario

<table>
<thead>
<tr>
<th></th>
<th>New Downtown</th>
<th>High Density</th>
<th>Medium Density</th>
<th>Low Density</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Area (ha)</td>
<td>90</td>
<td>2,200</td>
<td>1,060</td>
<td>1,000</td>
<td>4,350</td>
</tr>
<tr>
<td>Average GPR</td>
<td>8</td>
<td>3.65</td>
<td>2.1</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>Efficiency</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>-</td>
</tr>
<tr>
<td>Gross Space</td>
<td>30</td>
<td>40</td>
<td>60</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>Standard (net)</td>
<td>(23)</td>
<td>(31)</td>
<td>(31)</td>
<td>(46)</td>
<td>-</td>
</tr>
<tr>
<td>Dwelling Units</td>
<td>64,000</td>
<td>535,000</td>
<td>148,000</td>
<td>53,000</td>
<td>800,000</td>
</tr>
<tr>
<td>Density Mix</td>
<td>75.0%</td>
<td>18%</td>
<td>7%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

2.4 The strategies proposed to achieve the additional land requirement of 4,350 ha instead of 8,000 ha are as follows:

2.4.1 Manhattan-style Housing in New Downtown

The present URA-proposed GPR for residential areas within the New Downtown is 5.0. This will yield approximately 40,000 dus at 80% efficiency. The New Downtown should be intensified from a GPR of 5.0 to an average of 8.0, which would increase the yield to 64,000 dwelling units.

Whenever possible, the GPR of residential developments within the New Downtown should increase beyond 8.0 to 12.0 or 15.0. One theoretical example would be the Millennium Tower by Norman Foster at Tokyo Bay. This 150-storey mega-block project of GPR above 20 and a built-up space of 1 million sq m would be able to accommodate 50,000 people (about 17,000 dwelling units) on a footprint of 1.7 ha. This idea could be applied similarly to landmark sites within the New Downtown and allow greater savings in the land take of housing.
2.4.2 **Inject Housing into the Central Area**

More housing should also be provided in the Central Area to rejuvenate it. This can be done by allowing buildings to be built taller at higher plot ratios. Additional amenities such as urban schools may need to be provided within the residential areas.

2.4.3 **Intensify the GPR of High-Density Areas to an Average of 3.65**

The current average GPR of high-density housing should be increased from 2.5 to 3.65 for both private developments and HDB estates. Where technical height constraints permit, this can be achieved by building taller housing with smaller footprints.

HDB should consider higher plot ratios wherever possible. The higher plots ratios should be achieved by increasing the storey height of buildings up to the height controls, and not by reducing spacing between blocks. This strategy is justifiable based on the following:

a **HDB household survey**

According to a survey carried out by HDB, it was found that people were prepared to live in the higher floors. In 1977, only 20 per cent of those surveyed were prepared to live above the 12th storey. In 1998, the figure more than doubled to 44 per cent. While 44 per cent were prepared to live above the 12th storey, less than 10 per cent actually do so in the current HDB context.

b **HDB residents’ feedback**

HDB residents were generally supportive of the proposal to increase building heights. However, they expressed their concern that spacing between buildings could be reduced and privacy affected. They felt that the new flats in Sengkang were built too close to each other and residents could look directly into the flats in neighbouring blocks. However, they agreed that good design and layout could be used to mitigate concerns about privacy. They also felt that more green and communal spaces for people to interact within the living environment were important.
2.4.4 **Intensify Established Housing Estates**

In established HDB and private housing estates, land can be intensified through en-bloc redevelopment.

2.5 **Increase Space Standard to an Average 40 sq m gross (31 sq m net) per person for High-Density Developments**

Findings from the HDB household survey indicate that Singaporeans want a more spacious dwelling unit. The existing average living space standard for high-density developments is proposed to be increased to an average of 40 sq m gross (31 sq m net) per person except for the New Downtown. The current size of the dwelling unit is thus being maintained in spite of the projected reduction of household size from 4 to 3 per family.

2.6 **Provide a Variety of Housing Types**

There is also a need to continue to provide a variety of housing types (e.g. landed, low density, etc.) to retain and attract talents and meet the housing aspirations of Singaporeans. Although the GPRs for both low- and medium-density housing have been increased from the existing average GPRs, the proposed additional 4,350 ha of housing land would still result in an acceptable density mix.

2.7 **Mixed-Use Developments**

Multi-purpose blocks which integrate housing, community and commercial facilities should be developed in the future.
3 WORK SPACE

INDUSTRY

Background

3.1 Currently, the manufacturing sector contributes about 25% of our GDP, and EDB’s projection is that this is likely to be maintained in the future. Land for industrial use has been projected to increase from the present 8,000 ha to 14,000 ha, a 75% increase.

Basis of the Projection

3.2 A demand-based methodology was used by JTC to project the need for an additional 6,000 ha of industrial land. The methodology was based on a series of assumptions, the main ones being that total industrial labour force was expected to increase by 40% by 2040 to 2050, and the average space standard would be increased from 45 sq m per worker to 84 sq m per worker in the same period (see Table 3-1).

<table>
<thead>
<tr>
<th>Table 3-1 Industrial Land Demand Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
</tr>
<tr>
<td>Population</td>
</tr>
<tr>
<td>Industrial Labour Force (ILF)</td>
</tr>
<tr>
<td>Land Take</td>
</tr>
<tr>
<td>Land Take per Worker (Average Space Standard)</td>
</tr>
</tbody>
</table>
3.3 This projected requirement must be viewed with caution because of the very long projection time frame and the numerous assumptions made. The following are some of the factors that could affect the projection:

3.3.1 Changes in economic structure, particularly manufacturing versus the service sector;

3.3.2 Technologies and innovations that affect the efficiency of manufacturing processes;

3.3.3 Social changes, work hours and labour productivity;

3.3.4 Globalisation affecting distribution of labour and capital resources;

3.3.5 Borderless world that would result in a redistribution of industries according to comparative advantage of regions, e.g. land and labour supply, and costs; and

3.3.6 Digital revolution that would result in the blurring of industry and commercial demarcations.

**Proposals**

3.4 Assuming that the projections are correct, the following strategies that would intensify the use of industrial land should be considered:

3.4.1 **Increase plot ratios for new industrial land**

As industrial processes become increasingly automated, the worker per floor space would decrease over time. Under JTC’s current projections, this is translated into higher land take given the higher population base. However, this need not be so if the GPR is concurrently increased.

Currently, the maximum plot ratio adopted for industrial use is 2.5. However, due to the very low plot ratios for industries such as petrochemical plants, the average plot ratio achievable is only 0.42. J TC’s proposal is to raise the average to 1.45 by 2040 to 2050.
The proposed average plot ratio is still too low, and the following are recommended:

a A plot ratio of 2.5 should be adopted as the industry norm for new land as JTC has already built stack-up and ramp-up factory and warehouse buildings of plot ratios above 3.0, demonstrating that much higher plot ratios are achievable. Exemptions should be considered by JTC on a case-by-case basis, based on a number of factors which should include value-addedness, land take (or value), domestic multiplier and environmental impacts (see Table 3.2).

**Table 3-2 Manufacturing Value-added per Square Metre of Net Land Area by Industry ($ psm, nominal)**

<table>
<thead>
<tr>
<th>Industry</th>
<th>1998 estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>6,630</td>
</tr>
<tr>
<td>Electronics</td>
<td>4,640</td>
</tr>
<tr>
<td>Printing &amp; Publishing</td>
<td>1,920</td>
</tr>
<tr>
<td>Wearing Apparel</td>
<td>1,620</td>
</tr>
<tr>
<td>Instrumentation Equipment</td>
<td>1,220</td>
</tr>
<tr>
<td>Leather &amp; Footwear</td>
<td>1,090</td>
</tr>
<tr>
<td>Beverages</td>
<td>720</td>
</tr>
<tr>
<td>Industrial / Speciality Chemicals</td>
<td>650</td>
</tr>
<tr>
<td>Electrical Machinery</td>
<td>560</td>
</tr>
<tr>
<td>Paper Products</td>
<td>540</td>
</tr>
<tr>
<td>Food</td>
<td>460</td>
</tr>
<tr>
<td>Rubber &amp; Plastic Products</td>
<td>430</td>
</tr>
<tr>
<td>Petrochemicals</td>
<td>380</td>
</tr>
<tr>
<td>Non-metallic Mineral Products</td>
<td>380</td>
</tr>
<tr>
<td>Fabricated Metals</td>
<td>360</td>
</tr>
<tr>
<td>Machinery</td>
<td>300</td>
</tr>
<tr>
<td>Textiles</td>
<td>250</td>
</tr>
<tr>
<td>Transport Equipment</td>
<td>250</td>
</tr>
<tr>
<td>Petroleum</td>
<td>240</td>
</tr>
<tr>
<td>Basic Metals</td>
<td>200</td>
</tr>
<tr>
<td>Wood Products</td>
<td>50</td>
</tr>
<tr>
<td><strong>MANUFACTURING AVERAGE</strong></td>
<td><strong>710</strong></td>
</tr>
</tbody>
</table>

*Source: JTC*
b Table 3-3 illustrates the impact of plot ratio changes on land take. Currently, low-density industries such as chemical clusters and wafer fab factories account for 60% of total new industrial land. The remaining 40% of future industrial land could potentially be developed at the recommended plot ratio of 2.5. This could yield land savings of up to 1,109 ha.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Current Assumptions</th>
<th>Revised Assumptions</th>
<th>Land Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>145</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Land Area</td>
<td>2,640 ha</td>
<td>1,531 ha</td>
<td>1,109 ha</td>
</tr>
</tbody>
</table>

c In areas where good accessibility and infrastructure is available (and no height constraints), plot ratios should be allowed to exceed 2.5. In particular, where industrial and commercial land are adjacent, there is no reason to suggest lower plot ratios for industrial use if operationally there is no difficulty of attaining plot ratios similar to commercial use. The higher than 2.5 plot ratio will raise the overall average to offset the lower figure achievable for industries such as petrochemicals.

d For industries that cannot go high because of operational or functional reasons, the air space above industrial developments should be allowed for non-industrial uses such as offices, dormitories, civic and institutional uses, recreation, and even living purposes.

e The present Business Park guidelines should be reviewed for plot ratios to be brought up to at least 2.5.
3.4.2 Upgrade/Redevelop Existing Industrial Areas

Currently, older industries that were implemented in the early years of Singapore’s industrialisation drive occupy large sites at very low plot ratios. JTC is already undertaking various measures to ‘recover land’ from these industries through en-bloc redevelopment schemes and upon lease expiry. The expected land saving by 2040 to 2050 has been projected to be 1,410 ha. Since such industries occupy 5,300 ha of the present industrial land of 8,000 ha, more proactive and aggressive measures should be undertaken to address such sub-optimal usage. More could be done, for example, new schemes suggested include buying back at market value (long term cost-benefit studies should be done), incentives to relocate to flatted or ramp-up factories and enforced relocation or upgrading at lease expiry.

Currently, JTC’s redevelopment scale is about 250 ha per decade, i.e. 750 ha over the next 30 years. Assuming that the rate of redevelopment remains unchanged, a conservative estimate is that some 15% of the present land stock could be successfully redeveloped to the average plot ratio of 2.5 over the next 30 to 40 years. This could yield potential land savings of 334 ha (see Table 3-4). These potential savings could be enhanced if redevelopment is stepped up more aggressively.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Current Assumptions</th>
<th>Revised Assumptions</th>
<th>Land Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>1.45</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Land Area</td>
<td>795 ha</td>
<td>461 ha</td>
<td>334 ha</td>
</tr>
</tbody>
</table>

Table 3-4 Potential Land Savings from Intensification of Existing JTC Land
The proposed freeing-up of the current maximum plot ratio control of 2.5 for new industrial land should also be applicable to the existing 900 ha of private industrial land. This could be implemented immediately. Table 3-5 illustrates the situation if 80% of private developers are able to take advantage of this, and the plot ratio increases to an average of 4.0, a notional land saving of 270 ha could be achieved. However, this could only be translated into actual savings when redevelopment takes place in the longer term.

Table 3-5  Notional Savings from Intensification of Private Land

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Current Assumptions</th>
<th>Revised Assumptions</th>
<th>Land Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPR</td>
<td>2.5</td>
<td>4.0</td>
<td>-</td>
</tr>
<tr>
<td>Land Area</td>
<td>720 ha</td>
<td>450 ha</td>
<td>270 ha</td>
</tr>
</tbody>
</table>

3.4.3 Encourage More Mixed-Use Developments to Optimise Land Use

a  Allow more flexibility in uses

With the shift toward the New Economy, the concept and meaning of ‘Industry’ is changing. The boundaries between industry and business uses have blurred. Compatible uses such as showrooms, dormitory housing and institutional uses should be allowed within industrial developments. More industrial sites should be designated ‘Industrial-White’ to allow flexibility in changes of use. Existing rules and regulations need to be reviewed, e.g. reclassifying industrial and business uses. To address the concern of office uses pushing out industrial use with resultant higher land costs for industries, JTC can safeguard industrial sites for strategic industries.
b **Develop ‘work-live-learn-play’ environments**

With the advent of the New Economy and new work processes (which transcend conventional work hours), there is a need to allow multiple and integrated uses in industrial and business park land. One example is the ‘work-live-learn-play’ concept where work, living, education and recreation are integrated and are considered as part of industrial and business park zoning.

The trend toward 24-hour work and living space - ‘work-live’ environment would also call for a review of present strict zoning regulations. However, there would still be a need to protect residential areas from possible disamenities generated by the work component. Also, better building designs are necessary to make the work-live concept more attractive. This concept might be more easily implemented in new purpose-built buildings or areas rather than existing ones.

3.4.4 **Other Strategies**

Wherever possible, more shared infrastructure (e.g. water treatment plants, district cooling systems) should be encouraged among industries to achieve land savings.

Buffer zones imposed on pollutive industries should be reduced and pollution control measures reinforced.
COMMERCE

Background

3.5 Currently, commercial uses occupy 1000 ha of land. Projected land demand for commercial uses for the 5.5 million population is 1,500 ha.

Proposals

3.6 Intensify Commercial Uses

3.6.1 Increase Commercial GPRs
At present, the average plot ratio within the CBD ranges from 12.0 to 15.0. Outside the Central Area, plot ratios range from 3.0 to 8.0. Overall, average commercial GPRs should be raised, particularly in locations that are well served by good transportation networks and other infrastructure, for example, around MRT stations and at the fringe of the CBD. In the New Downtown where new infrastructure is being planned, GPRs should also be increased.

3.6.2 Relax Height and Urban Design Controls
Present urban design controls may have been too stringent. Height controls should be reviewed to allow more intensive use unless they are due to technical constraints such as flight paths.

3.6.3 Multiple Uses
Increase in plot ratios will facilitate the development of multiple use buildings which will allow common spaces to be used by different occupiers at different times, e.g. car parks, MRT.

An increase of GPR 0.5 across the present 1,000 ha of commercial land would result in an additional 5 million sq m of commercial and ancillary space. This will translate into potential land savings of 100 ha, about one-fifth of the projected requirement. The additional GPR should be implemented not by merely adding floor space above existing buildings, but also by innovative design solutions; such as underground / sunken podiums with atriums.
3.7 **Planning Strategies**

Commercial intensification should not be confined to the CBD. The decentralisation strategy started in the 1991 Concept Plan should be pursued vigorously. Planned decentralisation of commercial functions creates a better balance between resident and worker populations. This minimises commuting costs and allows firms to tap on labour resources in heavily populated suburban locations.

The 1991 decentralisation strategy can be further refined.

3.7.1 **Develop Existing Town Centres**

In addition to Regional Centres, existing HDB town centres should be further developed to accommodate more commercial uses as they are well served by public transportation systems and provided with good amenities.

3.7.2 **Enhance the Fringe and Other Centres**

Fringe centres identified in the 1991 Concept Plan should be given priority in development plans. They are close to the city and enjoy the agglomeration benefits of city centre locations. Other areas such as the Science Hub, Holland Village and Pasir Panjang also appear to be evolving into urban centres that can support higher levels of commercial function.

3.7.3 **Review Regional Centres**

If existing commercial areas and other centres can be enhanced with higher plot ratios, there may not be a need for four regional centres. The location of office spaces should be market driven rather than prescribed by planning.

3.7.4 **Mixed Use**

Existing planning guidelines would need to be relaxed to allow for mixed use where offices can be integrated with high-tech industries, institutional uses and living space. ‘White’ sites, which facilitate interchangeability of uses, should be allowed to spread to new towns and neighbourhood centres.
3.8 Other Ideas

Currently, land under viaducts is not well used. Planning concepts should be developed to facilitate linear developments that capitalise on the extensive MRT corridors for optimal use of land.

Optimal use of the underground should be explored. For example, commercial uses could be located underground because they do not need natural lighting and ventilation. Neighbouring underground developments should also be better coordinated. Underground corridors outside the city area should be safeguarded for future use.
4 GREEN SPACE

Background

4.1 Currently, 2,500 ha of land is occupied by parks at the provision standard of 0.67 ha per 1,000 persons. This falls short of the target of 0.8 ha per 1,000 persons set in the 1991 Concept Plan. If the set target were to be met for the 5.5 million population, an addition of at least 2,000 ha of land would be required for parks.

4.2 Singapore has 2 gazetted nature reserves and 17 other nature areas. Altogether, they occupy 3,600 ha of land. Parts of the nature reserves and nature areas (e.g. Labrador Park) are also counted as parks, since they are accessible to the public.

4.3 Green spaces are essential to maintain and enhance the quality of life we enjoy. Thus, the justification for different types of green spaces cannot be restricted to economic reasons alone or measured solely by quantitative factors such as number of, or frequency of, visits.

Proposals

Nature Areas and Reserves

4.4 In addition to recreational and aesthetic value, nature reserves and nature areas have scientific, medical, educational and economic value. The entire naturally vegetated area of Singapore totals up to about 10% of our present land area. Secondary forest of the sort in the water catchment area takes 60 to 70 years to regenerate and primary forest (less than 0.5% of our land area) is essentially non-renewable. Our present depleted and severely threatened nature reserves should be sacrosanct and protected as assiduously as our fiscal reserves.
4.5 The following strategies are proposed:

4.5.1 **Retain Existing Nature Areas**

The existing 19 nature reserves / areas, which make up 5% of the total land area, should be retained and protected by statutory mechanisms.

4.5.2 **Increase the Number of New Nature Areas**

The Nature Conservation Review Committee (NCRC) has recommended that 5 additional areas be safeguarded as nature areas. They are:

- a Chestnut Drive area between BKE and Nature Reserves;
- b Kent Ridge Campus;
- c Sungei China mangrove (Woodlands);
- d Loyang Forest; and
- e Sungei China mangroves (Lim Chu Kang).

The NCRC also recommended the expansion of the following existing nature areas:

- a Pulau Tekong;
- b Pulau Ubin;
- c Sungei Khatib Bongsu / Sungei Simpang;
- d SAFTI Live Firing Area; and
- e Pulau Sudong Islands Group (to include terrestrial habitat).

Altogether, the above constitute 3% of our total land area.

As far as possible, the NCRC’s recommendations should be adopted because the quantum of nature areas should preferably increase as the population increases, so that the quantum of open space per person is maintained.
In view that some existing nature reserves / areas also double up as parks (e.g. Labrador Park), the overlapping quantum of land could be deducted from the total park provision standard to avoid double counting.

4.5.3 **Reclaim Lost Nature Areas**
Nature areas tend to be encroached upon or affected by development. For example, part of the Bukit Timah Nature Reserve has been truncated by the construction of the Bukit Timah Expressway. The expressway could be converted into a tunnel by the construction of a structure over it so as to allow Bukit Timah Nature Reserve to be reconnected to the Central Water Catchment Area.

4.5.4 **Offer Nature Areas Better Protection**
All nature reserves should be gazetted and protected by statutory mechanisms. A National Trust for Parks, Nature Areas and Reserves should be instituted to govern and regulate such areas. Further protection can be enforced if Environmental Impact Assessments (EIAs) are carried out before development on both public and private land.

**Parks & Open Space**

4.6 We support the target provision standard of 0.8 ha per 1,000 persons. In addition, the following are recommended:

4.6.1 **Provide a Variety of Parks**
Parks should be of different types, ranging from activity-based types such as East Coast Park to more natural ones such as Labrador Park. In addition to nature reserves, selected parks should be planned as ‘nature parks’ with appropriate vegetation. While neighbourhood or smaller parks are necessary for easy access, these should not be developed at the expense of larger regional parks.
4.6.2 More and Improved Park Connectors
The popularity of the network of park connectors initiated in the early '90s is evidenced by public demand for a more extensive network of green corridors. Improved planning and a denser network could provide ‘alternative roads’ for Singaporeans who would rather walk or cycle than use cars and buses. ‘Blue corridors’ or waterways should also be linked or combined with green corridors.

4.6.3 Balance of Natural Green, Man-made Green and Concrete
A balance should be achieved between manicured lawns and planting and more natural vegetation. Natural areas should not be overly landscaped, resulting in a greater cost of development and maintenance and a concomitant loss of bio-diversity. In the case of coastal nature areas, e.g. Sungei Buloh, the natural shoreline should be kept.

4.6.4 Role of Government and Private Sector in the Greening of Singapore
Individuals and organisations other than NParks should be encouraged to do their share for the greening of the environment. Rooftop gardens and planters for vertical gardens should be developed.

4.6.5 Innovative and Usable Green Spaces in HDB Precincts
HDB precincts would be the ideal place for government and the public to plan and work together towards a greener environment. Underground and podium car parks could be developed to free up open spaces for green spaces. Current planning models should be modified so as to generate more usable space in suitable sizes.
Golf Courses

4.7 Singapore has 22 golf courses on leases and 3 temporary golf course sites, which together occupy 88% of the 1,600 ha of land used for sports and recreation, or 2.2% of Singapore’s total land area.

4.8 Cap Existing Golf Courses

The existing golf courses are generally located in constrained areas, such as land within water catchment areas (e.g. Singapore Island, Seletar, Orchid and Jurong Country Clubs), under flight paths of airports (e.g. Tanah Merah and SAFRA Country Clubs) or affected by MINDEF constraints. The existing 22 golf courses should be capped even if the population increases. Many golf courses in neighbouring countries are within easy travel reach from Singapore and could thus cater to potential increases in demand.

Where reclaimed land is available for interim use before it is developed, it should be used for parks instead of golf courses to benefit more Singaporeans.

‘Blue Space’

4.9 Proposed reclamation projects in Tuas, Changi Airport and Pulau Tekong and on a smaller scale at Sentosa, Punggol, Coney Island, Kranji, East Coast Park, Pulau Ubin and the Southern Islands, destroy the existing mangrove swamps, coral reefs and beaches which are our scarce marine resources.
4.10 Our already-damaged coastlines on the main and outer islands should be left to rejuvenate themselves. New land requirements for housing, industry, ports or resorts should be built as new reclaimed islands, floating docks or finger piers. In this approach, we save our existing corals, mangrove swamps and beaches. And in decades to come, our extended coastlines through the ‘island reclamation’ concept would embrace rich marine life for future generations to enjoy.

4.11 Pulau Ubin, Pulau Tekong and the Southern Islands should be left in their natural states for as long as possible. The proposed HDB new town for 65,000 people on the reclaimed land of Pulau Ubin would urbanise the island and rob the island of its rustic beauty and rich bio-diversity. 60% of the corals around the Southern Islands are already dying. The STB’s proposed additional land reclamation of 34 ha for resort and housing development would further upset the marine ecosystem of these islands. They should be reserved for locals as ‘blue space’ recreation.

4.12 Rivers should be perceived as our rare ‘blue space’ heritage. Riverbanks and air space over rivers should be sensitively protected. Rivers can also be harnessed for appropriate recreational and transportation uses.
5 ROADS AND INFRASTRUCTURE

ROADS

Background

5.1 Roads currently account for 12.4 per cent (8,200 ha) of the total land area of Singapore. It is projected that roads will need 9,600 ha in the 5.5 million population context. The population would have grown by 40 per cent while the land requirement for roads would only expand by 14 per cent. The total road space would probably expand by a larger figure as some new roads could be built without additional land take such as flyovers, multi-tiered roads, and underground roads. LTA will also rely on a host of intelligent transport systems (ITS) technologies and other road management schemes to expand the capacity of existing roads. This includes converting junctions into flyovers, and converting major roads into expressways.

Proposals

Taming the Car

5.2 The question of further restricting the growth of the car population as a means of reducing the need to build new roads was addressed. It was felt that the car would always be in demand if it is significantly better than public transport. Currently, the time difference between using a car and using public transport is quite significant. According to an Asiaweek survey of 40 capital cities in Asia (feature on Asia’s Best Cities 1999), Singapore was ranked 30th in terms of the average time taken to commute to work.

5.3 It was felt that the car is indeed an inefficient mode of transport both in terms of land-take and environmental effects. Car ownership could be limited by imposing stricter vehicle quotas and more road pricing, but these policies would not address the growing aspiration to own cars, which would continue to grow as standards of living increase and there is a wide discrepancy in the level of service between the car and public transport.
Land Use, Mobility and Accessibility

5.4 Transport planning in Singapore has long focused on reducing congestion, that is, achieving acceptable traffic speeds. The main goal is to achieve free-flowing traffic on the roads. However, if land use in a city is planned such that people have to travel far to get to their workplaces, schools, shops and markets, and other amenities, there would always be a need for convenient transport.

5.5 The challenge is to reduce significantly the demand for road space. One way is to price roads higher and to restrict car ownership, but this only makes people very grudgingly choose public transport. The only effective way would be to reduce the need for travel. Instead of looking at mobility and traffic speeds, there is a need to shift focus to improving accessibility. Mobility is an inadequate index since it implies that movement is an end in itself rather than a means to an end. The best transportation indices focus on ‘access’, the ability to reach goods, services, activities and destinations. Access can often be achieved with reduced movement, for example by telecommuting to work, by improving goods delivery systems, and through land use changes that reduce the distances between residences, employment and services.

5.6 If the places people want to go to are very near where they are, they would be able to walk or cycle there, or take public transport as it would become an acceptable alternative. This argument can be illustrated by the following example that assumes a person at A wanting to travel to amenity B:

<table>
<thead>
<tr>
<th>Situation 1</th>
<th>A and B are far apart,</th>
</tr>
</thead>
<tbody>
<tr>
<td>* A ____________________________ * B</td>
<td></td>
</tr>
<tr>
<td>Car: 20 minutes</td>
<td></td>
</tr>
<tr>
<td>Public transport: 45 minutes</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Situation 2</th>
<th>A and B are very close,</th>
</tr>
</thead>
<tbody>
<tr>
<td>* A _______ * B</td>
<td></td>
</tr>
<tr>
<td>Car: 5 minutes</td>
<td></td>
</tr>
<tr>
<td>Public transport: 15 minutes</td>
<td></td>
</tr>
</tbody>
</table>

Even though public transport takes 3 times as long as the car in Situation 2, it is an acceptable alternative to the car because the absolute time taken is not much.
A Sustainable Compact City

5.7 Unlike other uses that can be zoned into distinct parcels of land, transport requirements cut across all uses. In order to achieve a sustainable, integrated urban landscape where the dependence on the car could be minimised, land-use planning needs to take into account four factors:

5.7.1 Integrated Mixed Land Use
As a first step, planning should strive at bringing work closer to home (decentralisation) and bring home closer to work (re-vitalisation of the CBD). Integration, however, needs to go beyond the work-home realm and cover the other important amenities as well. These include recreation, schools, shops, hospitals, banks, and public services.

5.7.2 Comprehensive Network of Good Public Transport Services
Another requirement is the improvement of public transport services. The rail network needs to be expanded significantly and access to rail stations should be improved. For new lines, stations could be located closer to one another so that no one has to walk more than 5 to 10 minutes. If integration is achieved, the demand for feeder services within the Regional, Sub-Regional or Fringe centres would increase so this requires attention as well. With growing affluence and standards of living, commuters would become increasingly more time-sensitive and would want a ‘seamless’ public transport service, which is comfortable and convenient.

5.7.3 High-Density, High-Rise Living
Dense, compact neighbourhoods and centres can offer most of what people need within convenient distance either through walking or feeder public transport services. High quality trunk services can provide ready access to other parts of the city when necessary. The aspiration to own a car would naturally diminish and there would be no need for harsh restraint measures. There are quite a few examples of this observation. Hong Kong is often cited as a case in point by many transport scholars. The old neighbourhoods of Paris have some of the highest human occupancy
levels in the world. Some 60 per cent of the households living in these very dense neighbourhoods do not own a car, compared to only 12 per cent in the distant suburbs. Even with high ownership levels, the usage in terms of vehicle miles travelled (VMT) is actually low. In California, it was found that doubling the residential density reduced the annual car mileage per capita or per household by 20 to 30 per cent.

5.7.4 **A Distinctive ‘Softscape’**

The above three factors address the functional or technical requirements of a sustainable urban landscape. As incomes grow and Singapore achieves a developed country status, people will become more concerned with the less tangible issues and will desire a living environment which gives a strong sense of place and high quality of life.

The ‘hardscape’ of buildings and facilities needs to be complemented with the ‘softscape’ which captures the more deep-seated emotional needs of Singaporeans.

**Transport for Mobility-Impaired Singaporeans**

5.8 An emerging concern characteristic of the lifestyle trend above is the growing call by Singaporeans for the government to provide access for the mobility-impaired people. If Singaporeans feel they have ‘arrived’ economically speaking, they would want transport authorities to be less concerned with the economics of facilities provision, especially for disadvantaged people.

**Green Transportation Systems**

5.9 Another concern that would increasingly come to the fore is the application of technologies in motor vehicles that give out less pollution and that save on energy and non-renewable resources. The replacement of huge petrol-guzzlers with significantly smaller electric cars does seem like an attractive option for land-scarce Singapore.
5.10 Bicycle parks and lanes should be provided where possible to promote the bicycle as an alternative mode of transport (see 4.6.2).

Creative Use of Existing Transport Spaces

5.11 A number of proposals were made during the discussion on this issue:

5.11.1 Covered Roads
A number of countries have been investigating the use of covered roads (surface tunnels) to improve environmental conditions with less expenditure than building an underground tunnel. Surface tunnels are not inexpensive, but they open up a whole host of possibilities such as the development of open and recreational spaces over roads. One example is to cover the Bukit Timah Expressway in order to connect the nature reserve.

5.11.2 Converting Road Space to Weekend Recreation Spaces
Many roads in the current CBD carry large traffic volumes during the weekdays but are deserted during the weekends. Some of these roads could be closed to traffic on a regular basis and be used for events. This would be a means of appropriating additional value from spaces which are severely under-utilised during certain periods of the week.

Another area worth exploring is the utilisation of space below flyovers and road interchanges. Recently, a storm-water collection pond was built beneath the Seletar-Bukit Timah Expressway interchange.

5.11.3 Future Rail Network to be Underground
As far as possible, future rail lines (MRT and LRT) should be underground instead of above ground to save on land take and improve environmental aesthetics.
5.11.4 **Higher Rail Capacity in the New Downtown**

The proposed intensive development of the New Downtown will require a much higher rail capacity than currently envisioned.

5.11.5 **Review Parking Space Provision Standards**

High-density mixed-use, integrated land use would enable combining residential and work car park spaces. This would help to reduce the overall space given to car parks. The construction of parking spaces below buildings (especially HDB flats) instead of in separate buildings needs to be implemented. There would be a lot more elderly drivers in the years to come, and the availability of parking spaces below their blocks would help significantly.

The standards for parking provisions need to be reviewed in view of the increasingly smaller household sizes expected in the future. Parking provisions in the compact mixed-use developments should also be made more restrictive.

The use of smart space-saving car park systems should be considered. For example, Singapore’s first car stacking system, using rollers, optic sensors and frames, is in operation at the car park at Heritage Place (near Bugis Junction). LTA should explore the scope for a more widespread application of such technologies.
INFRASTRUCTURE

Airports

5.12 As mentioned earlier in Chapter 2, the height control imposed by airports is very critical in defining Singapore’s future built environment. A suggestion raised was to relocate one of the airports in the future and a feasibility study done to evaluate the possibility.

The Port

5.13 The port should explore space-saving approaches to port terminal development. Instead of side-berthing of ships, the possibility of developing slip-berthing was raised. The technology for this concept is only now beginning to evolve. If proved viable, it would certainly be useful in the Singapore context.

5.14 The idea of relocation of the port to alternative locations in the long term was also examined. The port occupies good waterfront land that could potentially be developed for attractive housing and recreation uses. The southern off-shore islands were considered but ruled out as an option given technical difficulties associated with building an overland bridge suitable for heavy vehicles. The transport of dangerous goods ruled out the possibility of an underground tunnel. In any case, the port at the Semakau group of islands would only yield a capacity of 19.5 million twenty-foot equivalent units (TEUs) (as compared with the 36 million TEU long-term capacity at Pasir Panjang).

5.15 A more viable option would be to use a large tract of reclaimed land at Tuas for the development of container terminal facilities. That land is currently allocated for industrial use. If the proposals to request JTC to increase the plot ratios of its industrial land were accepted, less land would be required for this category. The reclaimed land at Tuas consequently could be allocated to MPA for the
development of a container port in the long term to replace all its terminals in the southern waterfront, including Pasir Panjang, Keppel, Brani, and Tanjong Pagar. This exercise would free up the entire southern coastline for higher-density development. The last three terminals are especially useful for redevelopment into a more efficient mixed land use zone of commerce and housing similar to that of the New Downtown.
The strategies proposed in Chapters 2 to 5 resulted in the following land take for 5.5 million for the major land uses:

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Additional Demand (ha)</th>
<th>Focus Group's Proposal (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>8,000</td>
<td>4,350</td>
</tr>
<tr>
<td>Industry</td>
<td>6,000</td>
<td>4,300</td>
</tr>
<tr>
<td>Parks</td>
<td>2,000</td>
<td>2,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>16,000</td>
<td>10,650</td>
</tr>
</tbody>
</table>

They result in a land savings of 1,350 ha instead of the projected land shortfall of 4,000 ha.