Surbana

STRATEGIC URBAN PLAN

A FINAL REPORT

OCTOBER 2008

SIKKIM

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- District Collectorates
- Education Department
- Energy & Power Department
- Forest Department
- Health Care Human Services & Family Welfare Department
- Land Revenue Department
- Mines, Minerals & Geology Department
- Roads & Bridges Department
- Rural Management Development Department
- Tourism Department
- Transport Department
- Urban Development & Housing Department
- Water Security & Public Health Engineering Department

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In particular, great appreciation is expressed to:

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  - Secretary-In-Charge, Urban Development & Housing Department
  - Secretary-In-Charge, Tourism Department
  - PCE-cum-Secretary, Roads & Bridges Department
  - PCE-cum-Secretary, Water Security and Public Health Engineering Department
  - Director, Mines, Minerals and Geology Department
  - Director, Department of Economics, Statistics, Monitoring & Evaluation

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Executive Summary

Sikkim is a growing state with an increasing population from 200,000 people in the 1970s to 580,000 by 2006. It is projected that the State population could expand to as much as 1.1 million by Year 2040. In response to such rate of growing population, the Government of Sikkim sees the importance of formulating a State Strategic Urban Plan as a structured development blueprint to guide how Sikkim should be developed over next 30 years.

Approach and Methodology

The State Strategic Urban Plan will first examine the existing condition of Sikkim in order to identify the driving forces and changes which will constitute as key issues and trends to explore. A few urban development scenarios are then constructed and evaluated such that an appropriate urban center structure will be recommended. The proposed urban development structure will become the planning basis to work out population distribution, urban land requirements for township development, transportation connection and facilities provisions and distribution across the State. For planning purpose, 3 staging milestones are defined: short term by Year 2015, medium term by Year 2025 and Long term by Year 2040.

Urban Center Structure

The recommended structure is to adopt a "multiple nuclei structure" for the State: to grow Namchi as a new center and also to give Gangtok a slightly larger share of urban population in recognition of its status as the State capital – urban population is proposed to be 50% of the total State population in the long term.

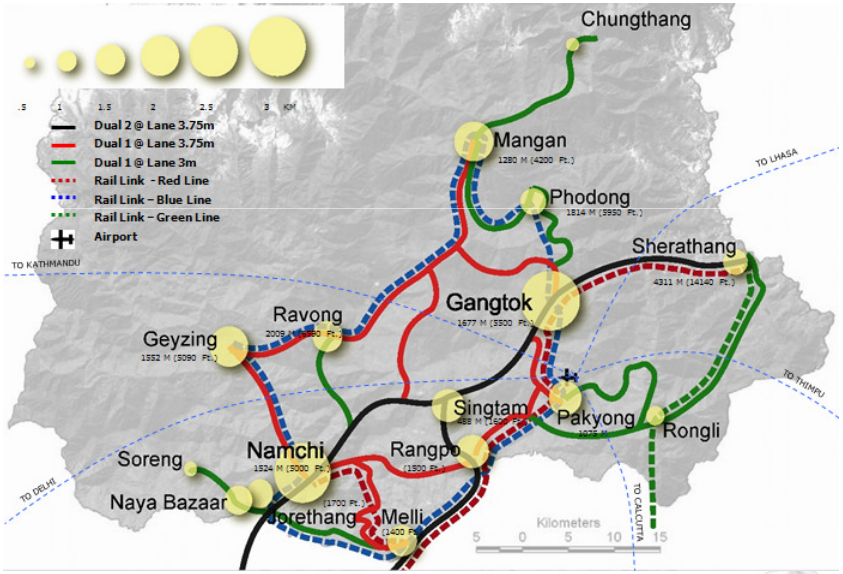
A township hierarchy will emerge such that Gangtok and Namchi are the 1st Tier urban center followed by Mangan and Geyzing as the 2nd Tier urban center. Mangan and Geyzing will play a supporting role to Gangtok and Namchi. In terms of urban population distribution, Gangtok and Namchi will take the largest share of 45% and 35% respectively. Mangan and Geyzing will be given 10% each. 16 urban centers across the current 4 districts will be set up and categorized based on the defined township hierarchy using the Indian Constitutional Classification of Municipalities.

	East	South	West	North
Tier 1	•Gangtok	•Namchi		
Tier 2			•Geyzing	•Mangan
Tier 3	•Singtam •Rangpo •Sherathang	•Ravong •Jorethang •Melli	•Nayabazaar •Soreng	•Phodong •Chungthang

Executive Summary

State Strategic Urban Plan

The eventual Long term State Strategic Plan by Year 2040 (as seen below) has taken into consideration the projected population size and spread, anticipated township scale of the 16 centers and their roles according to the proposed population density for individual urban centers, inter-state and intra-state major transportation linkages, in particular for connections between the 16 urban centers in terms of road and rail transport. The road system is structured based on a 3-tier road hierarchy defined according to expected commuting traffic between urban centers. The State Strategic Plan is to ensure a balanced development of urban centers across the State and to enable better transportation linkages between the key centers of Sikkim in terms of shorter commuting time and direct route of travel.



The floating population arising mainly from tourists visiting Sikkim is projected in the tourism analysis. It will have impacts on the provision of infrastructure and selective facilities such as hotels, larger scale commercial facilities. The provision of facilities in terms of types and quantity primarily follow the principles of the Indian Standards for Facilities Provision but with some moderations to the norms in order to ensure applicability into the context of Sikkim. Facilities provisions for Sikkim are planned for 4 geographical levels (State, District, Community and Neighbourhood) in 3 milestones aligning with the defined time scale of short, medium and long terms. The specific locations for the identified facilities for urban centers will only be examined at the next level of DGP planning.

Executive Summary

Prospects of Tourism

Apart from land use planning for long term development in Sikkim as discussed earlier, the tourism industry, being a key economic driver, is singled out and critically examined.

Sikkim has enjoyed tremendous growth in tourism arrivals over the past decade. Since 1997, the number of visitors to Sikkim has grown almost tripled to 349, 100 in 2007. This growth is a reflection of Sikkim's unique strengths as a holiday destination. Sikkim offers nature, religion and adventure experiences to both domestic and international visitors.

Nevertheless, Sikkim as a tourism destination has weaknesses in the areas of access connectivity and uniform standards of its tourism facilities. In addition, there are many challenges in the form of competing regional destinations, unrestrained growth in visitors and possible negative perceptions of Sikkim due to their inconsistent quality of tourism experience.

Based on current data and the assumption that Sikkim's pro-growth tourism policies will continue, the following visitor arrivals for Sikkim for 2015, 2025 and 2040 are projected.

Visitor Projections			
	2015	2025	2040
Domestic	763,958	2,036,027	6,178,936
International	33,631	74,306	244,030
Total	797,590	2,110,333	6,422,966

Based on these visitor projections, it is estimated that hotel demand in Sikkim will grow to 8, 811 hotels in Sikkim by 2040.

To prepare for the increasingly important role that tourism will play in Sikkim, there are several important issues that will need to be urgently addressed.

The Sikkim Tourism Department is responsible for the overall development of tourism in Sikkim and will play a key role in providing direction and leadership in the growth of tourism. A well developed and articulated Tourism Master Plan for Sikkim is crucial to chart the way forward and guide the tourism industry's development.

The frequency and quality of tourism data currently collected by Tourism Department and the Department of Economics, Statistics Monitoring and Evaluation needs to be upgraded to guide tourism policy formulation and industry development.

Sikkim has much potential for growth as a tourism spot with many areas in the four districts ready for development into tourism spots. However, without a master plan to guide developments, there is always possibility of tourism expansion growing unbridled and resulting in environmental degradation. The impact of new tourism products such as the planned casinos and expansion of tourism activities to new communities need to be studied more closely to allow the economic benefits of tourism to reach all strata of society.

Executive Summary

State Infrastructure Plan

Given the above long term physical planning and tourism analysis, relevant infrastructure provisions are required to support future developments. The following highlights the future plans of water supply management, waste water treatment, solid waste management and power supply facilities.

For water supply, the main challenges for urbanised areas in Sikkim are infrastructural costs, distribution of water, old piping, water leakage and water quality. With an increasing urban population by 2040, a conservative assessment suggests a water shortage in Mangan (2040), Geyzing-Pelling (in lean period by 2015 onwards) and Namchi (2015 onwards). It is important that water supply be given high priority, especially in Namchi. Support should also be given to innovative ways and technologies to augment water supply sources and water treatment methods to overcome constraints.

There is currently limited wastewater treatment in Sikkim state except for Gangtok town. With increasing urbanisation, it is paramount that infrastructure investments in this segment for the other towns are considered. More modular units should also be considered given the difficult terrains for outlying rural area around the town, to reduce high infrastructural cost. Population projections for planned urban towns forecast a shortage of wastewater treatment and distribution for all towns, with an urgent need to serve expanded areas.

Increasing population in major towns of Sikkim has generated more solid waste. The amount is expected to outstrip current capacity at East District as early as 2012. An integrated Municipal Solid Waste (MSW) plan is proposed. A sustainable form of solid waste collection by NGOs with proper planning of transfer station/composting/landfill facilities needed over the short, medium and long term are proposed. These include adopting latest technologies (on-the-ground adaptation, e.g. biological systems, size reduction, etc) and best practices in waste management.

For power supply, Sikkim has no lack of natural resources (hydro) and upcoming forecast demand over long term can be met with the existing/upcoming power generation project. Improvements should be made to the transmission system, having sufficient capability to meet peak demand (including floating population), with a reliable network. Future urban planning needs to take into consideration a buffer zone for high voltage transmission line in populated areas, and underground cables for urban centres with a high population density.

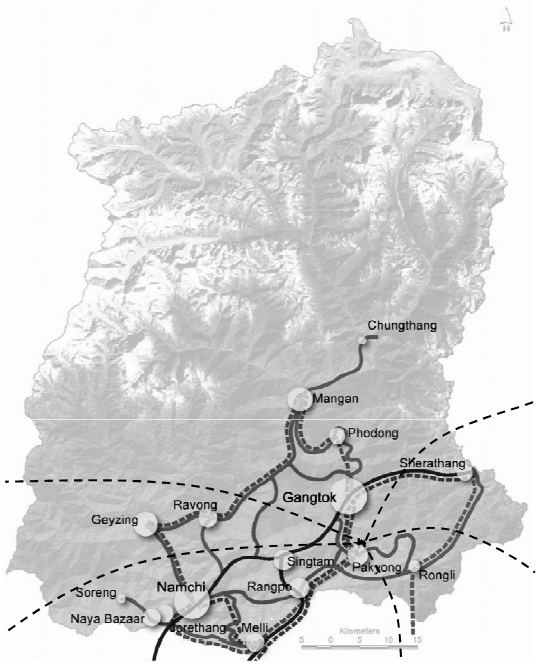
There should also be a sustained effort on environmental management. Gangtok has an active 3R program in solid waste that can be duplicated in other towns. Sikkim can learn from relevant active programs in other nations. The health risks related to MSW management should also be given attention. A review of the existing environmental standards and regulation, together with comparison with existing international standards was also presented.

Moving Forward

In order to ensure proper execution of the State Strategic Urban Plan, various measures and planning mandates are recommended. For example, gazetting the Plan and development control regulations as official documents, reviewing the Plan every 5 yearly, setting up a permanent Strategic Planning Review Panel of at least 11 relevant government agencies, and increasing the UD&HD's involvement in all development projects and proposals. Similarly, the same strategy can be extended to the implementation and administration of the Infrastructure Strategic Plan by the relevant authorities.

Part I :

State Strategic Urban Plan



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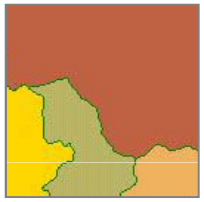
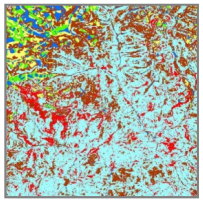
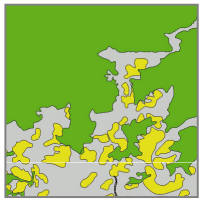
1.1 Preface
1.2 Approach & Methodology
1.3 A Dissected View of Sikkim
1.4 Current Tourism Scenario
1.5 Overall SWOT Analysis





1.1 Preface

The Government of Sikkim (GoS) and the Building & Construction Authority (BCA) of Singapore signed a MOU in June 2006 in which BCA agreed to assist in forming a consortium to undertake various important projects in Sikkim.

In Dec 2007, Surbana International Consultants Pte Ltd, led by BCA and in collaboration with other Singapore-based specialists, Master Consult and Institute of Environmental Science & Engineering of Nanyang Technological University, were commissioned to carry out urban planning consultancy services for preparation of Master Plans for 4 selected towns in the State of Sikkim. The project team has commenced work since.

This consultancy service covers 2 key components:

- Develop a State Strategic Urban Plan to guide development of Sikkim in next 25 - 40 years
  - A State Strategic Plan 2040 is a planning guide for long term growth of the State of Sikkim to ensure structured and coordinated development.

- Prepare a Master Plan (or Development Guide Plan) for each of the 4 District capitals: namely, Gangtok, Namchi, Mangan, and Geyzing
  - A Development Guide Plan is a Land Use Structure Plan that guides different uses of land within the Urban Area.

As part of the interactive planning process to brainstorm and to develop a State Strategic Urban Plan, a workshop was held in late January 2008 among the Steering Committee, senior Sikkim Government Officials, and the Consultants to deliberate the possible scenarios and strategies so that a right direction was set for the strategic study. The workshop was followed up by the Stakeholders' Meeting at Chintan Bhawan of Gangtok in September 2008 to deliberate the draft Strategic Urban Plan for the State of Sikkim. The Honourable Chief Minister, Shri Pawan Chamling, together with other Ministers, high level officials of Government of Sikkim, Sikkim residents and business community, attended the meeting and shared their views on the proposed plan. Thereafter, Surbana International Consultants has reviewed and refined the proposed Strategic Urban Plan.

This report is a final submission of the revised Strategic Urban Plan for the State of Sikkim.

1.2 Approach & Methodology

To enable a right focus on the Strategic Urban Plan for the State, the analysis is divided into three broad categories:

- Socio-economic sector analyzing what Sikkim can do and how to do it.
- Urban planning and transport sector studying city hierarchy and roles, connectivity and development patterns.
- Environment sector tackling issues relating to water supply, waste disposal and management and environment management to support the State development in short and long terms.

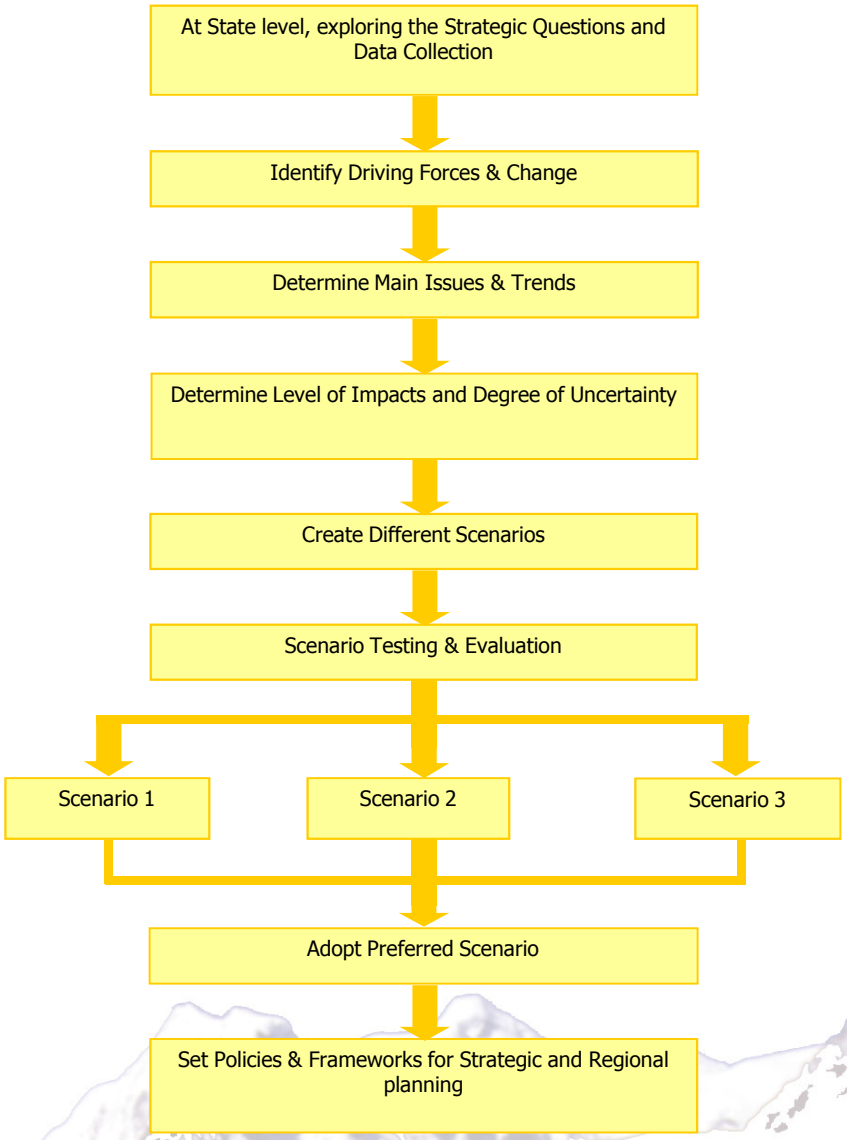
Different Scenarios will be illustrated and weighted considering the implications. Policies will then be formulated to set appropriate framework to steer toward realization of the goals.

As the Strategic urban Plan is a visionary planning document setting a long-term direction for the State in next 30 years, physical development will be gradually implemented and hence it is essential to define development milestones at various time scale to review the growth progress.

For the purpose of this Strategic Urban Plan, 3 stages are proposed as follows:

- Short Term By Year 2015
- Medium Term By Year 2025
- Long Term By Year 2040

Table 1.2.1 Framework for Developing the State Strategic Urban Plan



1.2 Approach & Methodology

Based on the defined time scale, analysis will first focus on the projected growth and scale of population over time since population is the fundamental factor dictating urban development. The following 4 key areas will be deliberated in the report. Rural development is however not within the study scope of this Strategic Urban Plan.

Population & Distribution

Analyze possible scenarios for geographical distribution of the population across the State based on the projected population size and expected growth of individual towns.

Urban Land Area/Township Hierarchy

Upon setting of the population model, analyze and evaluate the possible hierarchy of township and related scale of urban land requirement to accommodate the targeted population over next 5 - 10 yrs, 15 – 20 yrs and 30 – 35 yrs.

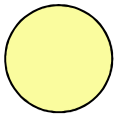
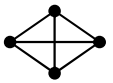
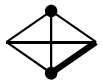
Connections

While urban land development is determined, explore possible efficient routes of connections among key centers and towns to be developed by 2015, 2025 & 2040.

Facilities

Take a further step to ascertain various facilities requirements based on the proposed town hierarchy & population threshold, as well as relevant planning standards in India.

Table 1.2.2 Key Issues to be Addressed in the State Strategic Urban Plan

	2006	2015	2025	2040
State Population & Distribution	581546	660000	790000	1100000
	2006	2015	2025	2040
Urban Land Area & Township Hierarchy				
	2006	2015	2025	2040
Connections				
Facilities				

1.3 A Dissected View of Sikkim

Analysis of Existing Sikkim

Before planning scenarios and proposals are conceived, it is important to first understand what is happening in Sikkim today by ascertaining the main driving forces and development issues.

The analysis on the existing condition of Sikkim herein will serve as a key platform to develop planning strategies which are to be practical and relevant to the context of Sikkim.

Figure 1.3.1 Location of Sikkim

1.3 A Dissected View of Sikkim

Geographical Character

Sikkim is the smallest state in India with land area of 7096 sq km. The State of Sikkim is encircled by three different international boundaries including the additional neighboring state of West Bengal.

- East - Bhutan
- West – Nepal
- North & East - Tibet Autonomous Region of PRC
- South – West Bengal

The State is divided into 4 main districts, out of which three are of similar land sizes while the north district due to its mountainous nature accounts for a larger share as much as 60% of total State land area.

- East District - 13%
- South District - 11%
- West District - 16%
- North District – 60%

Figure 1.3.2 Location of Sikkim

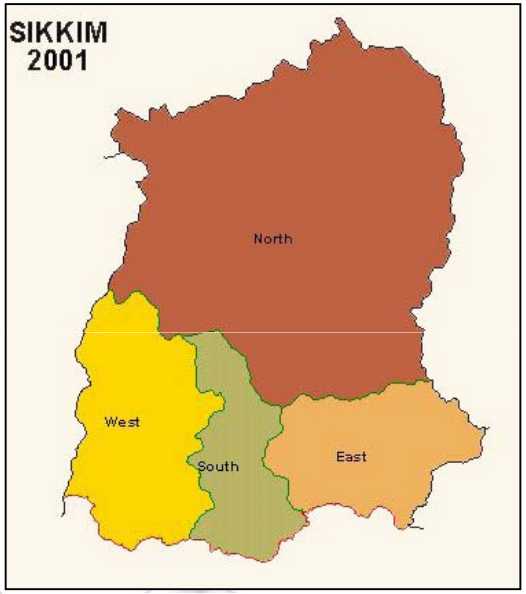


Figure 1.3.3 Districts in Sikkim

1.3 A Dissected View of Sikkim

Administrative Zone

The four districts are further divided into 9 Sub-divisions in total, which cater to the rural population for basic administrative / local facilities.

- Mangan*
- Ravong
- Gangtok*
- Geyzing*
- Chungthang
- Namchi*
- Pakyong
- Soreng
- Rongli

Four of the above listed subdivision heads are the district headquarters – Gangtok being State Capital serving the East District, Namchi as administrative district head quarter for South District and Geyzing and Mangan for West and North Districts respectively.

In long term planning, all of these subdivision heads are expected to grow into a much larger community that will hold state significance.

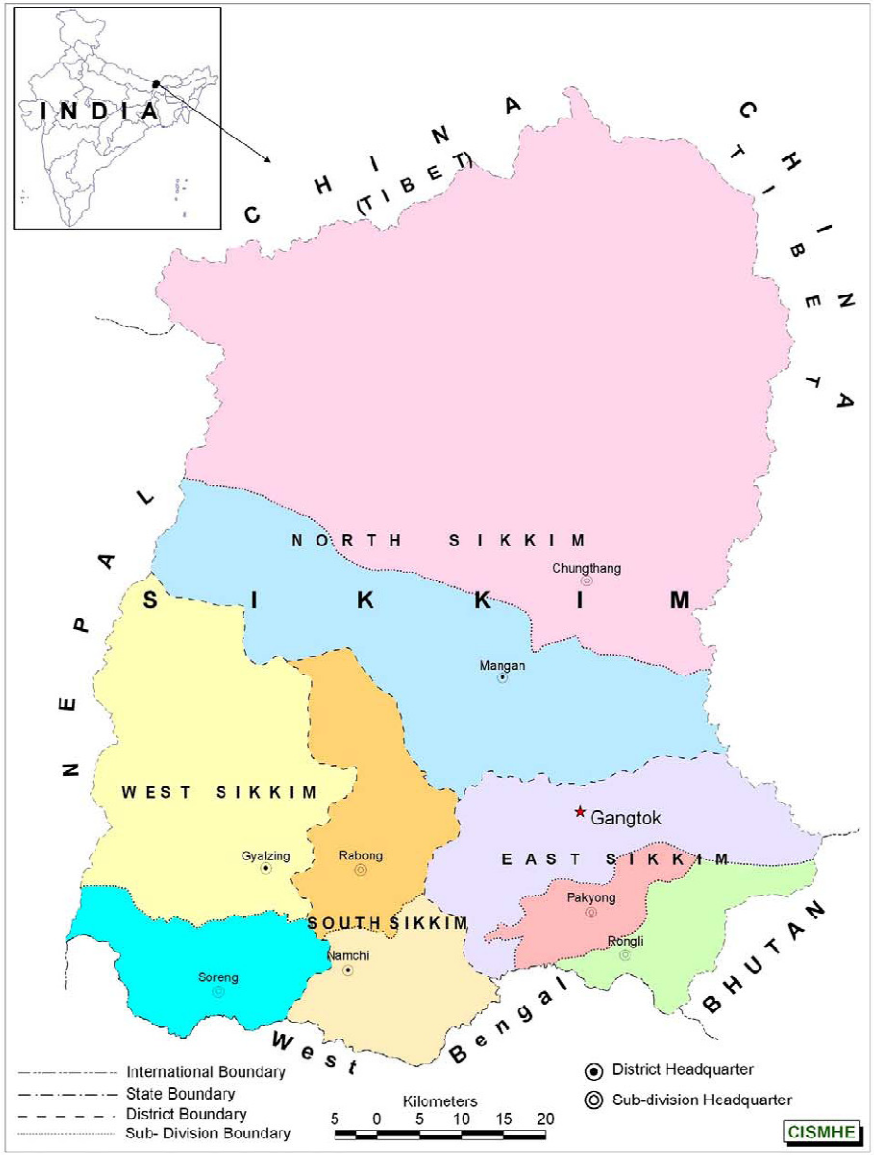


Figure 1.3.4 Districts and Sub-districts in Sikkim

Source: Carrying Capacity Study of Teesta Basin, Ministry of Environment & Forest, GOI

1.3 A Dissected View of Sikkim

Administrative Zone

Based on the current urban agglomerations, the state urban population is mainly accommodated in 8 towns. These eight identified urban centers are as below.

- Mangan*
- Gangtok*
- Geyzing*
- Namchi*
- Singtam
- Jorethang
- Nayabazaar
- Rangpo

Four of the above listed urban centers, namely Mangan, Gangtok, Geyzing and Namchi, are the district headquarters. Gangtok holds the major significance. The rest of the urban centers and towns are largely dependent on Gangtok for most of the major facilities and services. Namchi, being located towards the South and in closer proximity to the Highway and the State of West Bengal, has a potential to become a major urban centre. Singtam is one of the major market centers and holds the grade of Class – I Bazaar category. Jorethang and Nayabazaar function as industrial activity nodes and local commercial centers. In addition to being a market center, Rangpo also offers institutional activities along its stretch.

A proper planning hierarchy shall be identified for the urban centers and townships to avoid lopsided developments concentrating in the East.

Figure 1.3.5 Identified Urban Centers in Sikkim

1.3 A Dissected View of Sikkim

Trade / Commerce / Industrial Development Pattern

The existing industrial activities in Singtam and Rangpo give rise to a potential of expanding their roles as trade/industrial nodes for Sikkim due to their locations along the National Highway enabling good accessibility and transportation of goods/industrial products.

Other industrial activities such as breweries, distilleries, tanning, watch making etc are found in the southern reaches of the state in the towns of Melli and Jorethang.

Therefore, there is an inherent potential for lining up these four towns to form an industrial corridor along the N31A Highway. This corridor can be extended further toward the Nathu La Pass since the latter will become an important border trade route in time to come.

Figure 1.3.6 Existing Industrial Pattern in Sikkim

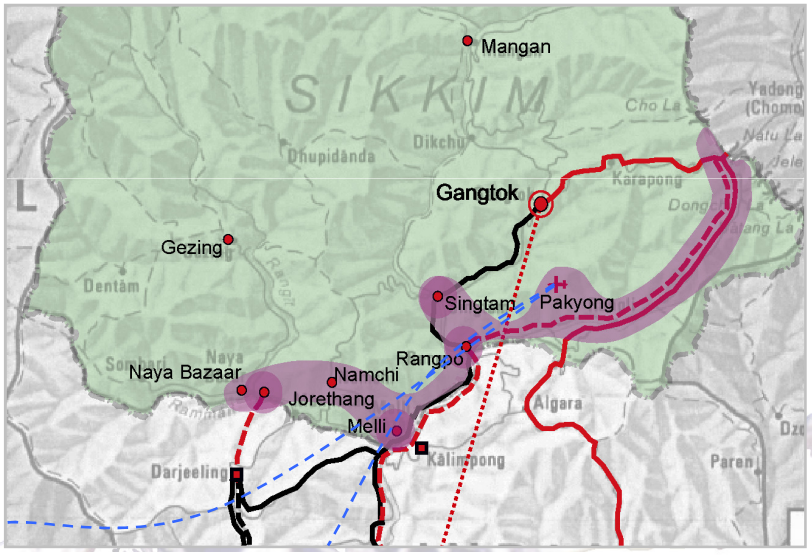


Figure 1.3.7 Potential Industrial Pattern in Sikkim

1.3 A Dissected View of Sikkim

External Border Connections

Connection points with the 3 neighboring countries and the State of West Bengal are illustrated on the map. Out of 19 existing points of connection, three are interstate connections and sixteen others are cross border links as sourced from the Sikkim Road Guide and the Political Map.

The recently opened Nathu La Pass is a major cross border activity node with significant impact on future growth and development of Sikkim. Other potential activity nodes near the neighboring countries, namely Nepal, Bhutan and Tibet, offer another business fronts where potential cross border activities can be capitalized to strengthen economic development of towns at the fringe of Sikkim.

Interstate connection is currently established by the only National Highway NH31A linking Siliguri of West Bengal to Gangtok, which is heavily used to transport tourists and cargoes to Sikkim and holds a strategic significance to the future growth of Sikkim.

Figure 1.3.8 Location of External Linkages into Sikkim

1.3 A Dissected View of Sikkim

Physical Landscape

The state is rich in biological diversity with flora & fauna of tropical, temperate and alpine zones. Land use classifications reflect a limited 1643.59 sq km of land available for economic uses with around 82% of land recorded as reserved forest which lies under administrative control of Forest, Environment & Wildlife Management and hence is unavailable for development of human settlement. The limitation is further imposed to the available Revenue Area due to the constraints such as heavy slope, unstable soil conditions and the land slide prone areas. Broad Land uses are classified as:

- Reserved, Khasmal & Gorucharan Forests - 37.34%
- Alpine Pasture and Scrub (RF) – 14.44%
- Perpetual Snow Cover(RF) – 29.5%
- Revenue Area - 23%

Other than broad land use classification, all the existing land uses statewide should be listed in details covering commercial, residential, educational, public/ private facilities, open spaces and roads etc. and with each respective growth pattern over the last 10, 20 yeas. The inventory shall be the basis for planning the future land uses. However, such comprehensive set of data is not easily available.

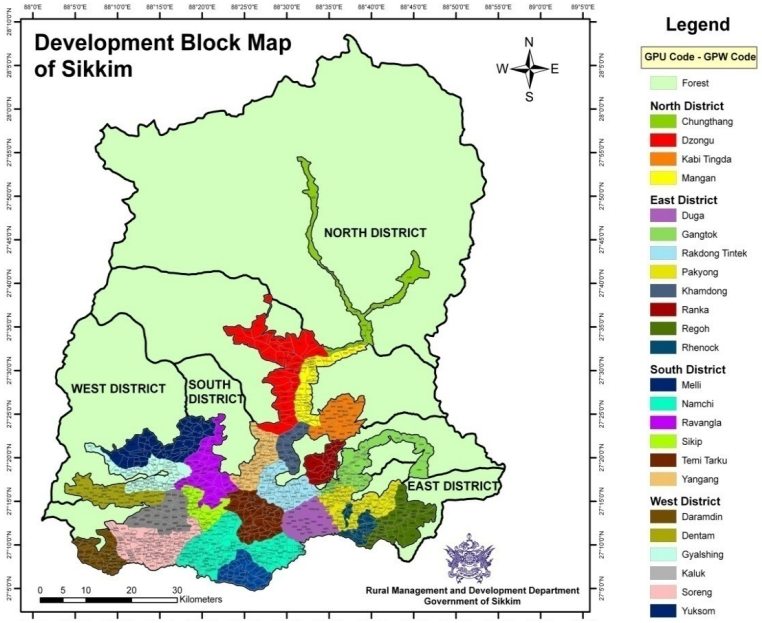


Figure 1.3.9 Development Block Map of Sikkim

Source: Gangtok Block Development Office, GOI

1.3 A Dissected View of Sikkim

Constraints - Protected Areas within Reserved Forest Land

About 30% of land area (Total 2176.11 sq km) is protected under a national park and six wildlife sanctuaries. They spread within the 4 districts with North and West Districts mostly affected.

- Khangchendzonga National Park - 1784.00 sq km
- Shingba Rhododendron Sanctuary - 43.00 sq km
- Kyongnosla Alpine Sanctuary - 31.00 sq km
- Fambonglho Wildlife Sanctuary - 51.76 sq km
- Pangolakha Wildlife Sanctuary - 128.00 sq km
- Mainam Wildlife Sanctuary - 34.35 sq km
- Barsey Rhododendron Sanctuary - 104.00 sq km

Figure 1.3.10 Views of Protected Areas in Sikkim

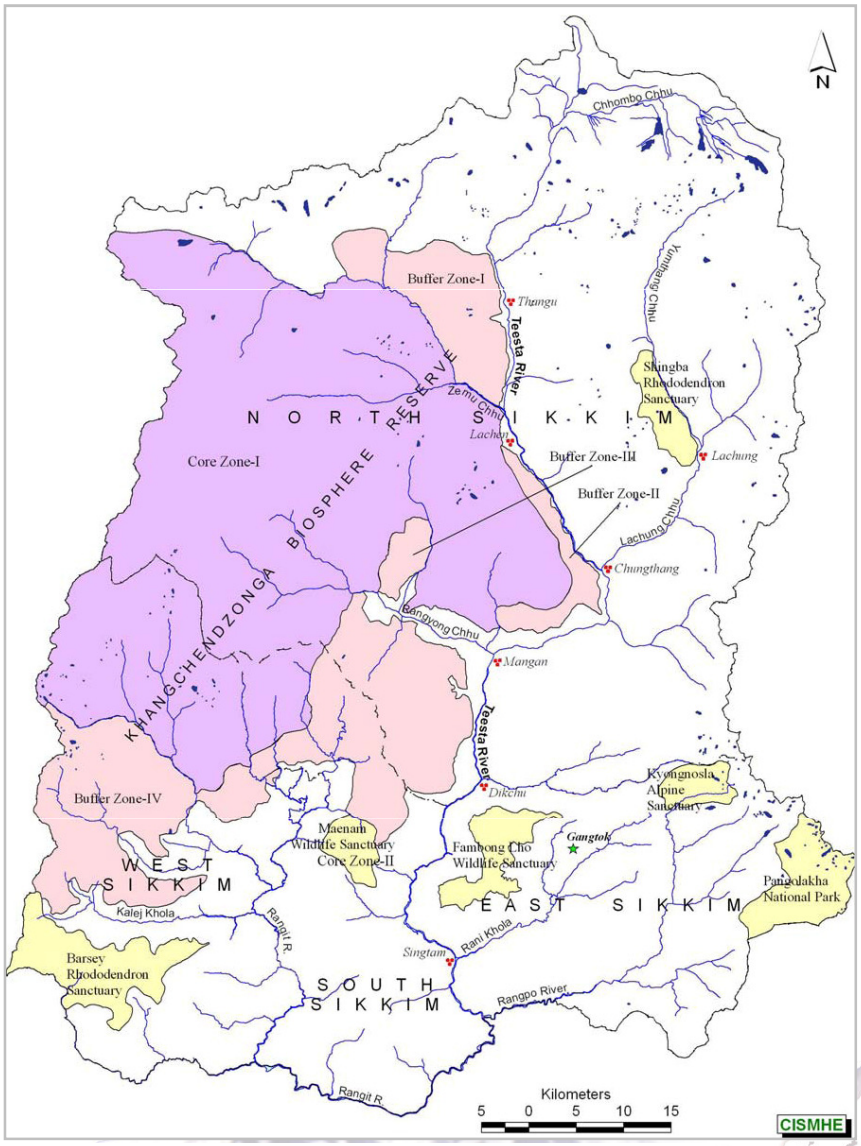


Figure 1.3.11 Location Map of Protected Areas

Source: Carrying Capacity Study of Teesta Basin, Ministry of Environment & Forest, GOI

1.3 A Dissected View of Sikkim

Constraints - Altitude Analysis

The physical terrain is entirely hilly with diverse range of altitude from 213m to 8500m. The Princeton Altitude Study indicate that land above 3000m amsl inhibits human habitation. As the harsh climate restrict extent of human habitation within attitudes of 3000m. However, large portion of Sikkim area lies above and much beyond 3000m, thus limiting the land mass available for human activities (see Figure 1.3.12).

When different constraints are overlaid, the possible land area available for urbanization is apparently limited toward the southern part of Sikkim, as shown in Figure 1.3.14 below. The potential profile of land availability will further be examined for its suitability for urbanization.

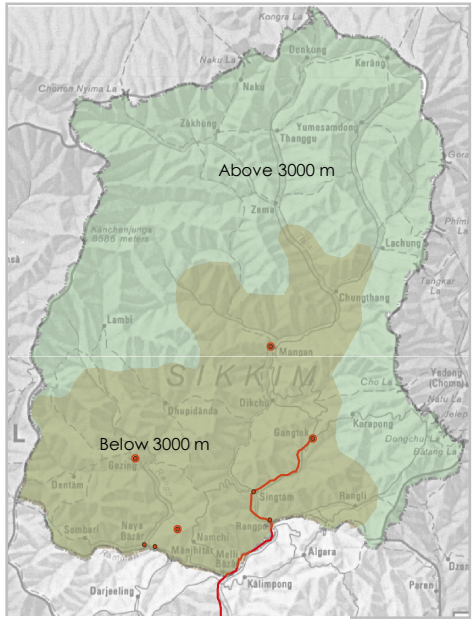


Figure 1.3.12 Altitude Profile

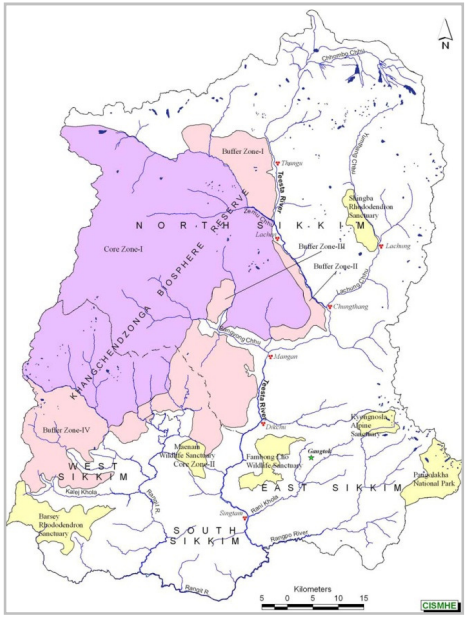


Figure 1.3.13 Protected Areas Profile

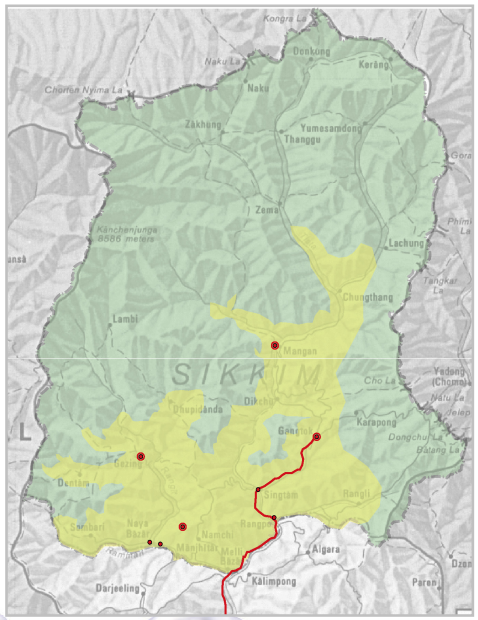


Figure 1.3.14 Potential Profile of Land Availability in Sikkim represented by yellowish-green shaded area

1.3 A Dissected View of Sikkim

Constraints - Slope Analysis

Slope steepness is the primary determinant of land developability. More than 43% of geographical area lies above 50% slope category that is difficult to use or almost non-developable and hence such area lies uninhabited.

The restrictive hillside ordinance prohibit development on slopes in excess of 20%. However, low density residentials could be developed in hillsides with slopes ranging from 25%-35% as indicated by APA Hill side grading report. In Sikkim's context, due to larger limitations on available land, moderately steep areas of less than 30% slope could be considered for land development.

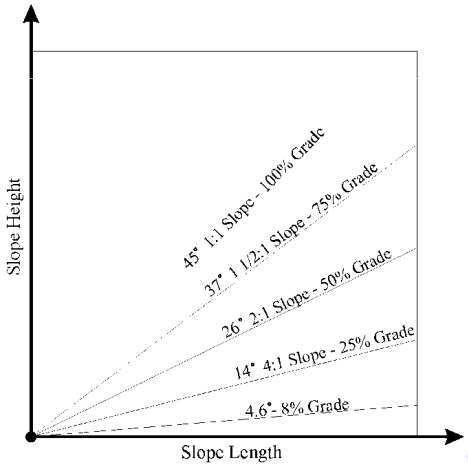


Figure 1.3.15 Classification of Slope Steepness

Source: APA Hillside Grading Seminar, May 1991.

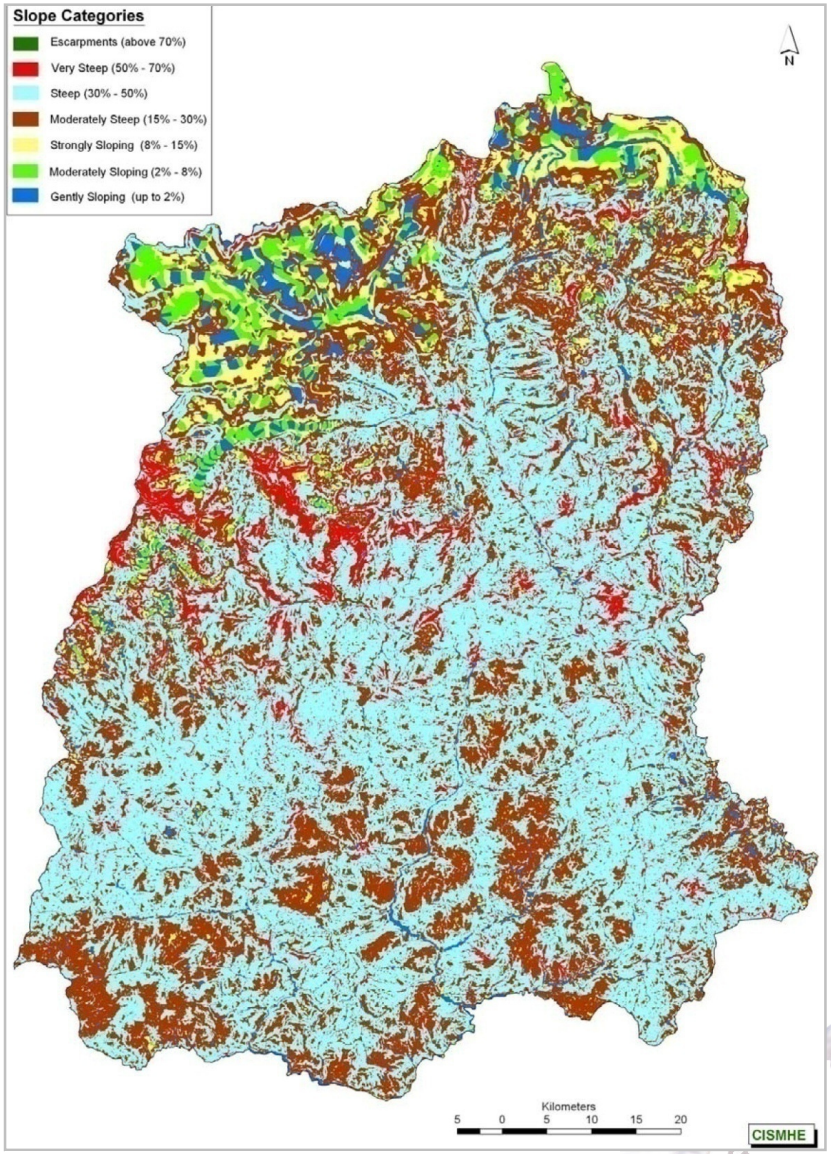


Figure 1.3.16 Map Showing Slope Steepness in Sikkim

Source: Carrying Capacity Study of Teesta Basin, Ministry of Environment & Forest, GOI

1.3 A Dissected View of Sikkim

Constraints - Slope Analysis

Difficult terrain imposes significant development constraints. In addition to the altitude factor determining suitability of land for development, slope gives another dimension of constraint. Developments should be maximized in areas with gentle terrain. As the existing habitable profile includes substantial land area classified as Steep Area (30 -50% slope), it is necessary to ascertain the Moderately Steep Area (15 – 30% slope) within the Habitable region as development priority area.

When the slope constraint layer is superimposed on the existing habitation profile (see Figure 1.3.19), an additional profile of 7% of moderately steep area within the habitable region may emerge and it will be considered as high priority area for urban development (areas in yellow on the plan below).

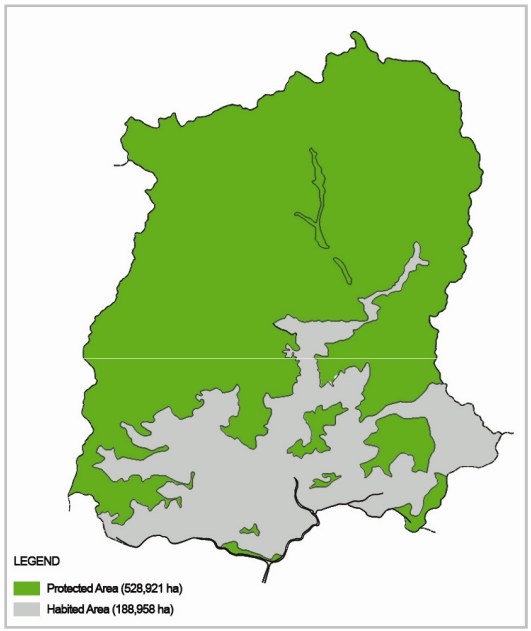


Figure 1.3.17 Habitable Area represented by grey

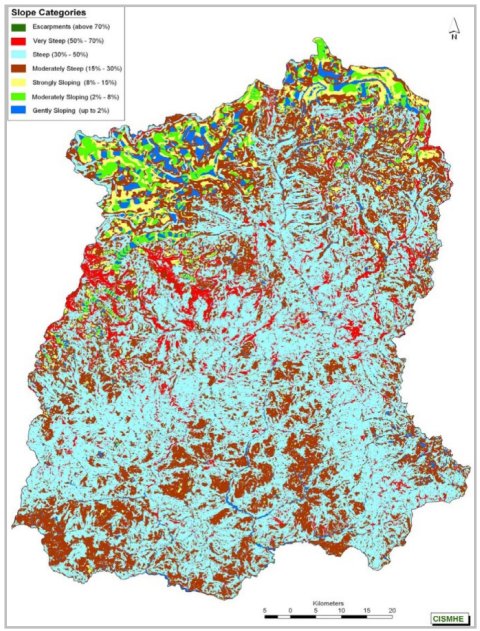


Figure 1.3.18 Slope Profile

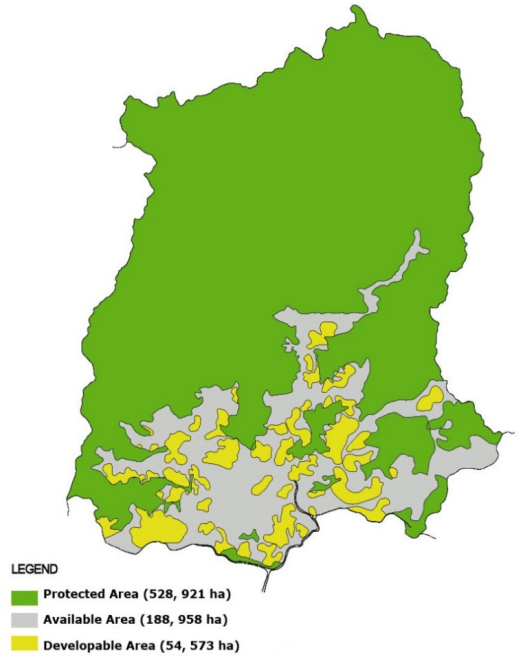


Figure 1.3.19 Developable Land within Sikkim

1.3 A Dissected View of Sikkim

Water Resource

Sikkim is rich in water resources comprising the main Himalayan River Teesta and its several tributaries, and a large number of other glacial lakes. The current hydro power projects along River Teesta can create opportunities for growth of towns such as Mangan.

However, flash floods and related land slips are important issues that need to be considered in planning of future expansions. Existing information indicate that Thirteen Townships: Chungthang, Dikchu, Ranipool, Singtam, Sirwani, Rangpo, Rorathang, Rongli, Legship, Reshi, Melli, Jorethang and Mazitar suffer flashfloods.

Figure 1.3.20 Waterbodies Plan of Sikkim

Source: Carrying Capacity Study of Teesta Basin, Ministry of Environment & Forest, GOI

1.3 A Dissected View of Sikkim

Existing Regional Transportation

Road Network

External road link is limited to National Highway 31A which enters the State at Rangpo and connects to Gangtok via Singtam. With only 1 point of connection and its restrictive capacity of dual 1 carriageway, bottleneck traffic may result and hence more links or a wider road will have to be explored in tandem with expected growth of Sikkim.

Air Link

There is no airport in Sikkim at present. External arrivals by air rely solely on the Bagdogra Airport in West Bengal. Visitors to Sikkim may then either change to the 5-seater helicopter connecting Gangtok directly with the Bagdogra Airport, or take land transport for about 4-hour ride to Gangtok. The necessity of transit may, to a certain extent, undermine the appeal to visitors going to Sikkim.

Rail Link

West Bengal Towns of Darjeeling, Siliguri, Sevoke and Damdim are the closest rail link to Sikkim. These towns being already accessible by rail opens up the possible State linkages to the rest of the country.

Figure 1.3.21 Existing Regional Transport Routes

1.3 A Dissected View of Sikkim

Transportation Schemes Explored

Given the prevailing transportation issues, some new schemes have been raised to improve the transportation system. While some still remain as concept, a few have been studied and are to be implemented. They shall be considered in the making of the State Strategic Urban Plan.

Road Network

- Alternative Highway from Melli to Gangtok.
- Extension of the existing Highway Rangpo – Gangtok to Nathu La (Concept).
- Alternative route to Nathu La from Damdim via Lava – Pedong –Kupup – Nathu La (Concept).
- Expressway: Sevoke to Gangtok tunnel (Concept).
- Bypass from Ranipul to Kyangnosla to be implemented (approx.45.5 Km)

Air Link

- New airport at Pakyong to be implemented.

Rail Link

- Rail connection between Nathu La – Sevoke.
- Rail link between Rangpo and Siliguri by 2012.
- Rail Link between New Jalpaiguri & Jorethang.
- Rail Link near to trading point at Sherathang, Nathu La (Concept).

Note: New Proposal assumed to use the existing road network

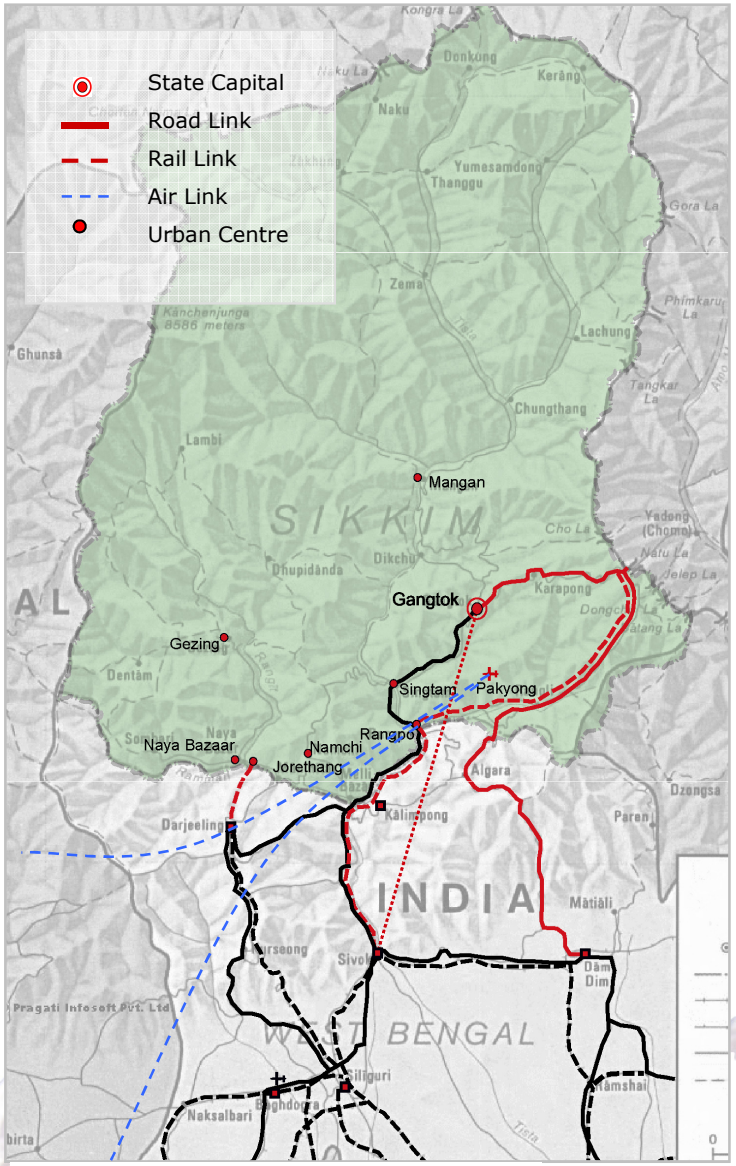


Figure 1.3.22 New Transport Routes Explored

1.3 A Dissected View of Sikkim

Existing Transportation Issues

Road Network

Within Sikkim, key highways are NH31A from Gangtok to Rangpo and North Sikkim Highway (NSH) from Gangtok to Chungthang.

Though existing road network provides connections to most of the important towns, journeys from one town to another are usually long due to winding and narrow routes of poor surface condition. So, it is essential for future planning

(i) to upgrade these routes to higher traffic carrying capacity in accordance with the respective road hierarchy; and

(ii) to shorten commuting distance where possible.

Existing road network shall also be rationalized such that a clear road structure and hierarchy is defined to determine the level of upgrading/improvements and their priority.

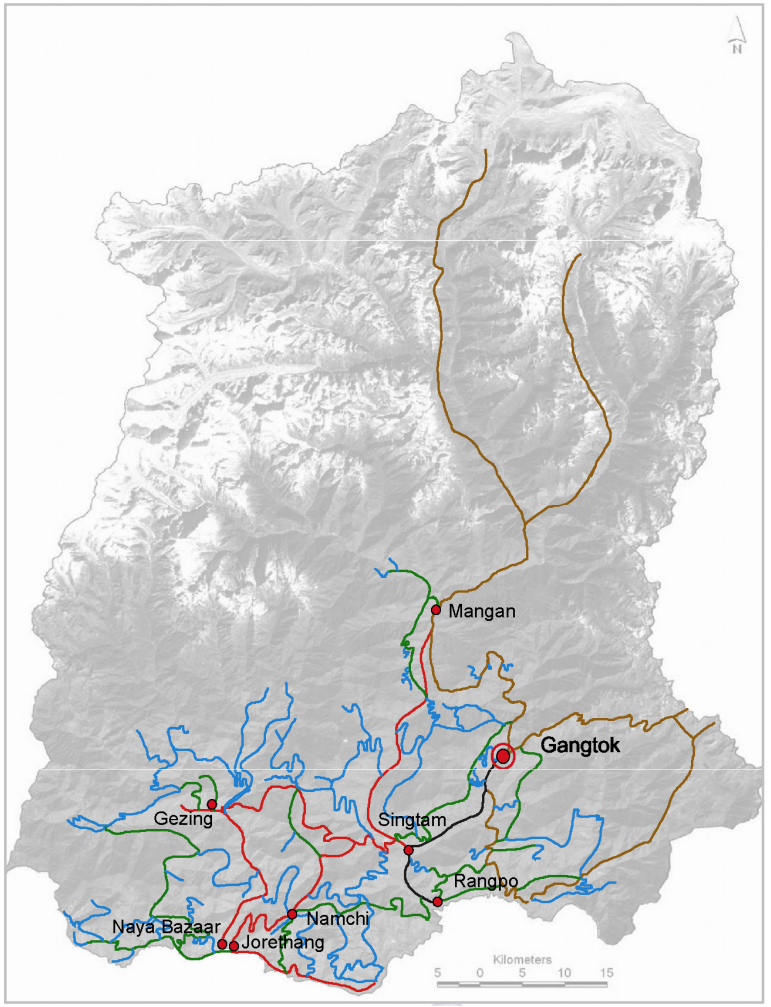


Figure 1.3.23 Existing Road Networks in Sikkim

Source: Road Department

1.4 Current Tourism Scenario

As the tourism support for the overall urban planning master plan, Master Consult Services, Tourism Specialist of the Surbana Team, reviewed the existing tourism facilities and activities within Sikkim. The visitors arrivals numbers supplied by the UDHD was reviewed and the expected visitors (domestic and international) and the required rooms over the next 25-40 years was then projected.

Tourism has an important contribution to urban planning, especially where it has a high impact on the state's resources, as it is in Sikkim. To determine the scale of tourism's contribution and impact, the following analysis will be undertaken:

- Tourism Trends
- Visitor Arrivals
- Hotel Demand and Supply

The rate and scale of tourism development in Sikkim is dependent on many internal and external factors, where benign global conditions and aggressive promotion may lead to higher tourism growth; or where difficult global conditions and a more measured tourism strategy may result in moderate tourism expansion.

Figure 1.4.1 Mountains in Sikkim

Different scenarios and an optimal tourism growth strategy will be examined and outlined in next chapter. Recommendations on policies to achieve this optimal strategy and its consequences for Sikkim's long term urban planning are also examined.

1.4 Current Tourism Scenario

Based on the defined time scale, analysis will first focus on the projected visitor arrivals growth over time since visitor arrivals and the consequent demand for hotel accommodations is a fundamental factor dictating the scale of tourism development. The following 4 key areas will be deliberated in the report.

Tourism Trends

International tourism trends will be analyzed to discuss their impact on Sikkim's tourism. Specifically the specific market segments where Sikkim has particular comparative strengths will be examined.

Visitor Arrivals

Sikkim's tourism arrivals, their mix in terms of source of origin, type of visitor, accommodation needs and length of stay will be analyzed.

Tourism Attractions and Facilities

Tourists have an impact on the demand of a variety of attractions and facilities as part of the tourism experience. An analysis on the number, nature, type and location of tourism attractions and facilities commensurate to Sikkim's tourism development will be carried out.

Figure 1.4.2 Temples

Accommodation Needs

To meet the accommodation needs of tourists, separate analyses of the hotel industry and their demand for space and their likely impact on the environment will be carried out.

1.4 Current Tourism Scenario

World Tourism Trends

Tourism Continues To Grow – According to the United Nations World Tourism Organization (UNWTO), 2006 exceeded expectations with over 846 million international tourist arrivals, corresponding to an increase of 5.4% over the previous year. The tourism sector continued to enjoy above average results and recorded a third year of sustained growth.

Asian Growth Impressive – Although Africa registered the highest tourist arrivals growth rate in 2006 over a low base, tourism in Asia continued its impressive growth of 7.1%.

Tourism Expenditure Grows – For many tourism destinations, the total visitor expenditure on accommodation, food and drink, local transport, entertainment, shopping etc, continues to be a strong source of foreign exchange and an important pillar of their economies, creating much needed employment and opportunities for development. Some 75 countries earned more than US$ 1 billion from international tourism in 2006. UNWTO estimates that worldwide receipts from international tourism reached US$ 733 billion in 2006.

Table 1.4.1 Breakdown of World Market Share of Tourists

	International Tourist Arrivals (millions)					Market Share (%)	Change (%)		Average Annual Growth (%)
	1990	1995	2000	2005	2006*	2006*	05/04	06*/05	'00-'06*
World	**436**	**536**	**684**	**803**	**846**	**100**	**5.5**	**5.4**	**3.6**
Europe	262.3	310.8	392.5	438.7	460.8	54.4	4.3	5	2.7
Asia Pacific	56.2	82.5	110.6	155.3	167.2	19.8	7.8	7.7	7.1
Americas	92.8	109	128.2	133.2	135.9	16.1	5.9	2	1
Africa	15.2	20.1	27.9	37.3	40.7	4.8	8.8	9.2	6.5
Middle East	9.6	13.7	24.5	38.3	41.8	4.9	5.9	8.9	9.3

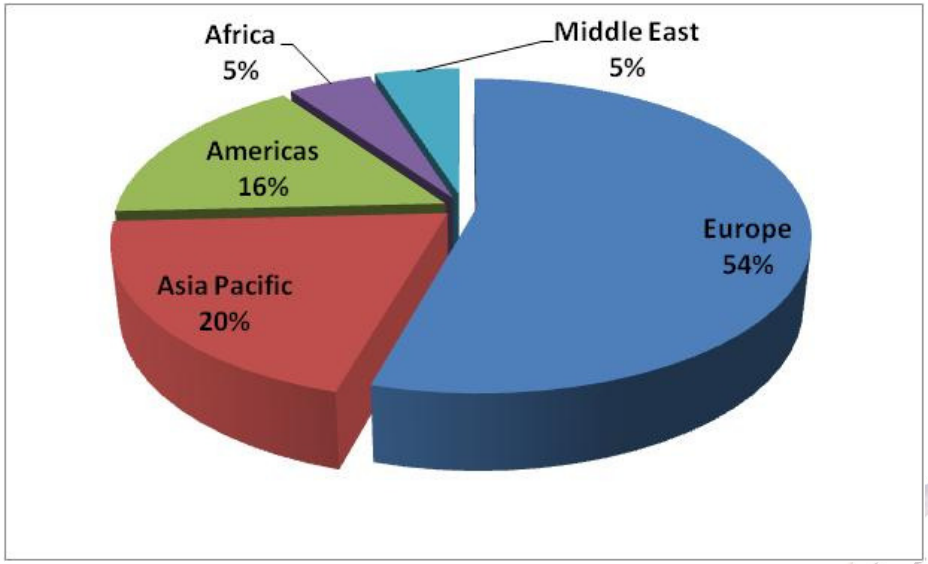


Figure 1.4.3 Graphical Representation of World Market Share of Tourists

1.4 Current Tourism Scenario

World Tourism Trends

Leisure, recreation and holidays dominate – In 2006, just over half of all international tourist arrivals were motivated by leisure, recreation and holidays (51%) – a total of 430 million. Business travel accounted for some 16% (131 million), and 27% represented travel for other purposes, such as visiting friends and relatives (VFR), religious reasons / pilgrimages, health treatment, etc (225 million).

Growing importance of Market Niches – With an increasingly sophisticated travelling public, tourists are now seeking more specialised and specific tourism experiences. The growing awareness of environmental concerns and green issues have made *eco-tourism* and *sustainable tourism* hot themes in tourism today. Another important and growing segment is religious tours and pilgrimages where devotees and adherents visit places of religious interest and significance.

Air transport to grow faster – Air transport (46%) and transport over land – whether by road (43%) or rail (4%) – generate roughly equal shares of all arrivals, while arrivals over water accounted for 7% in 2006. For the past three years, the trend has been for air transport to grow at a faster pace than ground and water transport.

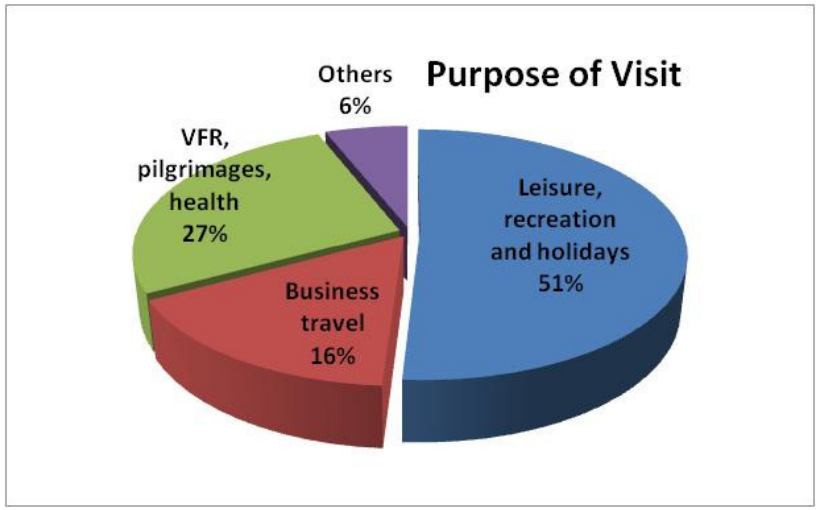


Figure 1.4.4 Graphical Representation of World Tourism Trends – Purpose of Visit

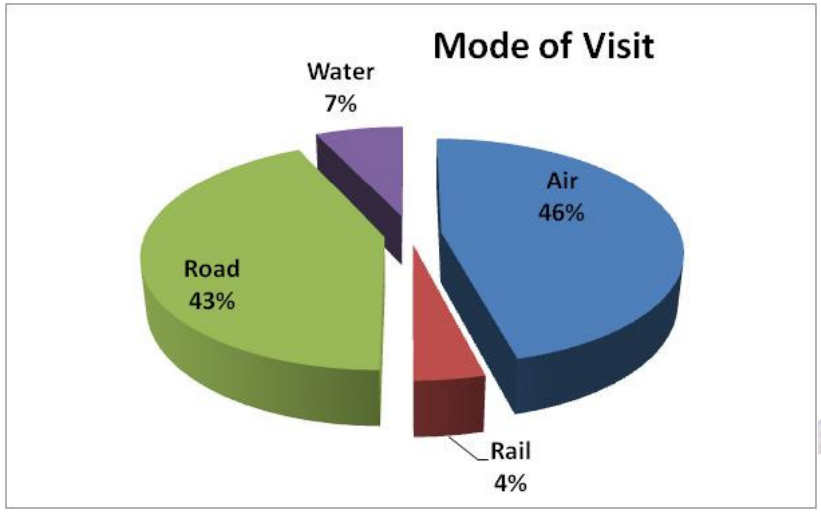


Figure 1.4.5 Graphical Representation of World Tourism Trends – Mode of Visit

1.4 Current Tourism Scenario

India Tourism Trends -
Visitor Arrivals Analysis

International Tourism into India Grows – According to the UNWTO, India received 4.4 million international tourists in 2006, an increase of 13.5% over 2005 when it recorded 3.9 million visitors. This amounted to 2.7% of Asia's total tourist arrivals. This is a relatively miniscule figure for an important destination like India and this is explained by the emphasis on domestic tourism rather than international tourism.

Table 1.4.2 Number and Receipts of International Tourists Traveling into India

	International Tourist Arrivals				
	x 1000		Change (%)		Share (%)
	2005	2006*	04/05	06*/05	2006*
Asia Pacific	155,272	167,228	7.8	7.7	100
India	3,919	4,447	13.3	13.5	2.7
	International Tourism Receipts				
	(US$ million)				Share (%)
	2005		2006*		2006*
Asia Pacific	134,473		152,615		100
India	7,524		8,885		5.8

Receipts Rise – International visitors to India spent US8.9b or 5.8% of Asia's international tourism receipts. Visitors to India spend significantly more per capita compared to international visitors to other Asia Pacific destinations.

Table 1.4.3 Breakdown of International Tourists Visiting India by Nationality

Country	Arrivals	% share
UK	0.647	16.5%
USA	0.618	15.8%
Canada	0.156	3.9%
France	0.151	3.8%
Sri Lanka	0.138	3.5%
Germany	0.129	3.3%
Japan	0.102	2.6%
Malaysia	0.098	2.5%
Australia	0.096	2.4%
Singapore	0.071	1.8%
Others	1.715	43.9%
Total	**3.920**	**100%**

1.4 Current Tourism Scenario

India Tourism Trends –
Visitor Arrivals Analysis

Domestic tourism predominates – It is estimated that the size of domestic tourism in India is some 20 to 25 times that of international tourism. There is a strong domestic market for day-trippers and weekend getaways for India's burgeoning middle class.

Table 1.4.4 Breakdown of Number of Domestic Visits by Year

Years	Domestic Visits	% Change
1991	66.7	-
1992	81.5	22.2%
1993	105.8	29.8%
1994	127.1	20.1%
1995	136.6	7.5%
1996	140.1	2.6%
1997	159.9	14.1%
1998	168.2	5.2%
1999	190.7	13.4%
2000	220.1	15.4%
2001	236.5	7.5%
2002	269.6	14.0%
2003	309.0	14.6%
2004	366.2	18.5%
2005	382.1	4.3%

Source : Department of Tourism, Government of India

1.4 Current Tourism Scenario

Sikkim Tourism Trends – Visitor Arrivals

According to tourist arrival data collected, Sikkim enjoyed continuous growth in visitor arrivals over the past decade. One significant feature of Sikkim's tourism is the predominance of domestic visitors, making up about 95% of the total visitors.

The visitors are drawn to Sikkim by the picturesque sceneries and many places of worship. Sikkim is also a quick getaway destination for day-trippers from the neighboring state of West Bengal.

A detailed analysis of the visitors is covered in Chapter 2.

Table 1.4.5 Breakdown of International and Domestic Tourists Visiting India by Year

Year	International	Domestic	Total
1997	8,068	116,500	124,568
1998	6,111	133,158	139,269
1999	8,563	139,085	147,648
2000	8,794	144,203	152,997
2001	7,757	146,923	154,680
2002	8,539	160,789	169,328
2003	10,954	176,659	187,613
2004	14,646	230,719	245,365
2005	16,827	241,697	258,524
2006	18,026	292,486	310,512
2007	17,837	331,263	349,100

Source: Urban Development and Housing Department

1.4 Current Tourism Scenario

Sikkim Tourism – Overview

Sikkim has been cited as a tourism wonderland by travellers. Overlooked by Mt. Kanchenjunga, the world's third highest peak, Sikkim is a destination attractive for the sightseeing, trekkers and religious travellers.

With cold winters generally in the months of November to February and the monsoon season from May to September, visitors tend to visit Sikkim between March and early May and September to October. These seasonal influences have a direct and noticeable effect on the visitor arrivals during the year.

As there are no railway stations or airports in Sikkim, international tourists visiting Gangtok take a 3-4 hour car ride from the nearest airport located in Bagdogra. A 30-minute helicopter ride is also available but its frequency is only once a day and can be disrupted or cancelled due to adverse weather conditions.

Divided into four districts, Sikkim's tourism attractions can also be categorized geographically. The major tourism spots are mainly located in the East (near Gangtok) and the West (the trekking zones).

Table 1.4.6 Important Tourism Spots in Sikkim

IMPORTANT TOURISM SPOTS			
East	**West**	**North**	**South**
1 Rumtek Monatery	1 Pelling	1 Kabi Lungchok	1 Namchi
2 Enchain Monastery	2 Singshore Bridge	2 Phodong Monastery	2 Tendong Hill
3 Cottage Industry	3 Khechopairi Lake	3 Lachung	3 Temi Tea Garden
4 Flower Show	4 Yuksom	4 Yumthang	4 Menam Hill
5 Tibetology	5 Tashiding Monastery	5 Phensong Monastery	5 Phur Tsa-Chu
6 Chorten	6 Pemayangtse Monastery	6 Chungthang	6 Rabongla
7 Saramsa Garden	7 Sangacholing Monastery	7 Singik	7 Jorethang
8 Hanuman Tok	8 Dubdi Monastery	8 Lachen	
9 Ganesh Tok	9 Geyzing Bazar		
10 Tashi View Point	10 Versey		
11 Nam-Nam View Point	11 Rabdentse Palace Ruins		
12 Changu Lake	12 Dzongri		

Source: Sikkim : A Statistical Profile 2004-05

1.4 Current Tourism Scenario

Sikkim Tourism – Overview

According to data obtained from the Sikkim: A Statistical Profile 2004-05, there are about 39 tourism spots located in the four districts.

There are also five important trekking routes and they are namely:

- Monastic Trek
- Rhododendron Trek
- Khangchenzonga Trek
- Coronation Trek
- Kasturi Orar Trek

The major nature parks and sanctuaries are

- Kanchenzanga National Park
- Fabong Lho Wildlife Sanctuary
- Shingba Rhododendron Sanctuary
- Kyongnosla Alpine Sanctuary
- Mainam Wildlife Sanctuary
- Barsey Rhododendron Sanctuary

The important monasteries are

- Rumtek Monastery (East)
- Enchey Monastery (East)
- Zurmang Monastery (East)
- Pemayantse Monastery (West)
- Sanga-Choling (West)
- Dubdi Monastery (West)
- Tashiding Monastery (West)
- Phensang Monastery (North)
- Phodong Monastery (North)
- Tholung Monastery (North)
- Ralong Monastery (South)

The highest mountains are located in the west district and the three tallest ones are

- Mt Kang-Chen-Dzonza (28,156 ft)
- Mt Kabru (24,215 ft)
- Mt Siniolchu (22,600 ft)

1.5 Overall SWOT Analysis

Physical Environment Analysis

From the preceding illustrations of existing condition, an overall SWOT can be summarized as below:

Strengths

- Already established Urban Centers validate the growing pace and trend of urbanization, Gangtok in particular.
- Multiple road connections exist for most of the towns and they can be made good use for transportation between towns by selective road upgrading.
- A new airport to be constructed at Pakyong will open up wider opportunities for future growth of the State economy.
- Rich in biological diversity, multi-climatic zones, and mountainous nature may sustain the attractiveness of Sikkim to both domestic and international tourists.
- The abundant water resources of fresh quality create opportunities for many hydro power projects to deal with the increasing demand for power as a result of urbanization.

Weaknesses

- Imbalance of development of existing towns results in domination by the East District especially the congested Gangtok town.
- Limited point of external connection via N31A Highway is causing a high risk of bottleneck traffic
- Current long travelling time between towns due to poor road condition and winding routes with narrow lanes is undermining desire of travelling by roads.
- The limited 7% of total State land ready for economic uses, hilly terrain of generally very steep slope, and unfavourable high altitude, are imposing multi-dimensional constraints on future urban growth.
- Incomplete data on existing land use profile across the State is making future planning rather difficult, since existing issues may not have been understood thoroughly .

1.5 Overall SWOT Analysis

Physical Environment Analysis

From the preceding illustrations of existing condition, an overall SWOT can be summarized as below:

Opportunities

- The 4 subdivision heads have already formed a township hierarchy for Sikkim, with individual potential to grow as a key urban center.
- Uptapped or underdeveloped points of border connection could become possible future business nodes of cross-border trade activities.
- Established industries along N31A Highway create an opportunity to form a vibrant business corridor for synergy of different trades.
- New physical infrastructures e.g. the 2 bypasses and the new airport at Pakyong will help to shorten travel time and hence raise Sikkim's attractiveness as a tourist and business destination.

Threats

- With limited developable land area of 7%, a long-term planning approach is constrained by the need to deal with environmental sensitivity.
- Future infrastructure improvements with such difficult terrain require substantial and heavy financial commitments that is a huge challenge to a small state like Sikkim.
- Current developments dominantly in Gangtok make efforts to decentralize population and growth in other towns more difficult as rural-urban migrants will still favor Gangtok to others.
- The State's location within the high seismic IV zone is carrying potential risk of high cost of damage due to urbanization of greater density.

1.5 Overall SWOT Analysis

Policy Perspective

The analysis of the existing condition in Sikkim and interactions with the departments of the Sikkim Government also reveal many challenges in administration of various policies affecting developments in Sikkim. General observation is as follows:

Strengths

- Strong governance in the State facilitates smooth adoption and implementation of new regulatory policies.
- Complementary rural development planning in particular on infrastructure provision in areas beyond urban periphery is laying a good foundation for future urbanization.
- Many ad-hoc planning initiatives within the urban area such as local streetscape upgrading scheme for M G Marg show great improvements at the local level.
- Strong awareness of environmental protection and established environmental/ forest policies protect the sensitive assets of Sikkim.

Opportunities

- A central agency to coordinate the physical development in urban areas can be set up to ensure better utilization of resources.
- There is a need for a macro strategic plan to see how future urbanization can tap on the rural infrastructure developments when an urban centre expands. All the ad-hoc planning initiatives may be collated at the macro planning level so that priority can be assigned to enable balanced development across the State.
- More developments especially industrial uses will put the existing environmental protection policies to test and certain rule tightening measures may be required to uphold the "Green State" image.

1.5 Overall SWOT Analysis

Policy Perspective

The analysis of the existing condition in Sikkim and interactions with the departments of the Sikkim Government also reveal many challenges in administration of various policies affecting developments in Sikkim. General observation is as follows:

Weaknesses

- While planning regulations are documented as statutory rules, they are weakly enforced and that results in inconsistent development controls.
- As every department takes care of its own individual development plans or projects, the execution of these individual plans or projects, if without proper coordination with other departments in terms of timing, is likely to cause regular social disruptions and inconvenience as well as wastage of resources. Laying or repair of utility services under roads is a common problem.
- Without a comprehensive State Strategic Plan to give a big picture at the State level, resource management and utilization may not be put to optimum practice.

Threats

- Haphazard developments will continue to mar the landscape of urban centers if enforcement of the prevailing regulatory planning policies and rules remains inconsistent.

1.5 Overall SWOT Analysis

Tourism Perspective

Strengths

- Sikkim is rich in biological diversity, multi-climatic zones, and mountainous nature.
- Sikkim is home to many important religious sites, monasteries and places of religious significance to Hinduism and Buddhism.
- The high altitude and cool weather in Sikkim make it an ideal location for get-away holidays for Indian nationals living in the plains and cities.
- Proximity to major cities in India and Tibet / China

Weaknesses

- Poor international connectivity due to the absence of airport
- Road and rail access to and within Sikkim is poor with many roads often impassable during severe weather
- Hotels and other types of accommodation are unregulated and of inconsistent quality and standards
- Seasonal weather patterns dictate months available for tourism
- Lack of depth and range of tourism attractions and facilities
- Service quality in Sikkim not international level

Opportunities

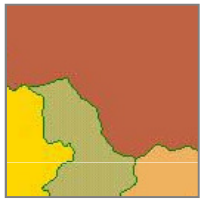
- The opening of an airport at Pakyong will herald a quantum improvement in connectivity to other major Indian cities and international markets.
- The proposed casinos in 5-star hotels will attract a steady stream of Indian and other visitors
- Eco-tourism and wildlife
- Wellness and medical tourism
- Village and tea tourism tourism
- Religious, culture and heritage tourism
- More trekking trails and adventure tourism
- Opening of Natula Pass

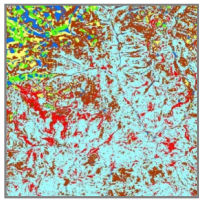
Threats

- Unrestrained growth in tourists can result in environmental degradation
- Lack of quality control can result in negative tourism image for Sikkim
- Continued popularity of regional destinations (e.g. Nepal and Bhutan) can sideline Sikkim for years to come as an eco tourism destination

2.0 Strategy Development Process

2.1 Analysis Approach
2.2 Tourism Prospects
2.3 Demographics
2.4 Scenario Analysis



2.1 Analysis Approach

The analysis for strategic development process shall consider two major components:

- Resident Population Analysis
  Based on the Sikkim's Demographic Trends
- Floating Population Analysis
  Based on the Sikkim's Tourism Trends

While demographic analysis helps us look at the resident population projection for Sikkim when coming up with a practical demographic figure for future, tourism prospects will help us to ascertain the floating population profile which is a major contributor to Sikkim's economic development.

Building upon this, a scenario analysis is conducted to test the suitable urban development model for Sikkim's urban centers. The mobile population may not affect the overall scenario development and therefore the Scenario Analysis is largely based on the Resident Population. However, as the floating population would influence the infrastructure and facilities provisions, the later assessments for detailed development plans shall be based on these projections.

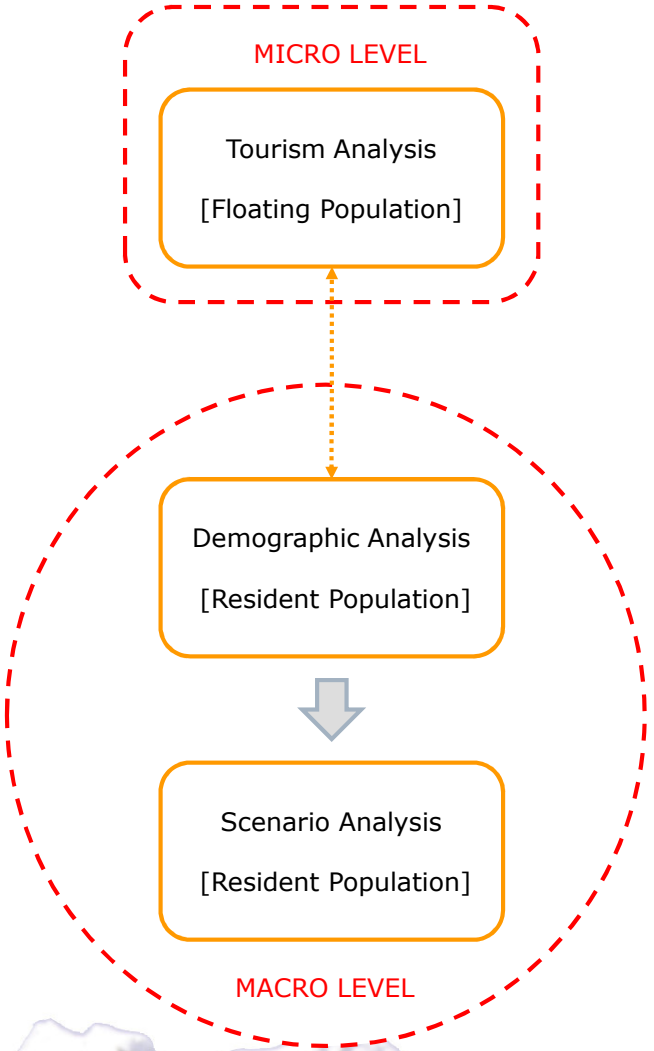


Figure 2.1.1 Analysis Approach

2.2 Tourism Prospects

Domestic Visitors

Table 2.2.1 Number of Domestic Visitors to Sikkim per Year

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	116,500	133,158	139,085	144,203	146,923	160,789	176,659	230,719	241,697	292,486	331,263

The State of Sikkim has seen tremendous growth in domestic visitor arrivals for the past decade. Data obtained from the Sikkim authorities indicated that the domestic visitor arrivals had been growing at an annualised rate of 18.4% over the past decade.

This growth rate is higher than that of the international visitor arrivals despite domestic arrivals having a much larger base. There is currently no official data on the breakdown of the domestic visitors to Sikkim by purpose of visit. However, discussions with the local travel trade suggest that the domestic Indian visitors to Sikkim can be classified in the following categories:

Day trippers: Sikkim's proximity to West Bengal and the existence of good road networks between Sikkim and West Bengal had resulted in many West Bengalis visiting Sikkim for day trips during weekends and holidays.

Summer Holidayers: The domestic visitors peak at the month of May and it was due to the fact that during summer, Sikkim's cool climate is attractive to Indians of other states who wanted to get away from the hot weather.

Religious Travelers: Sikkim's many religious sites and places of worship are important pilgrimage destinations for devotees living outside the state. There are many sacred lakes, caves, rocks and peaks in Sikkim which will attract visitors.

Visit Friends and Relatives: Many non-Sikkimese have migrated to Sikkim due to the better facilities and social welfare in the state. As a result, there are also more visitors coming to the state to visit their friends and relatives.

2.2 Tourism Prospects

Domestic Visitors

From Figure 2.2.1 on the right, it can be seen that prior to the year 2002, domestic visitor arrivals growth was confined to single digit growth. However, after 2002, growth accelerated to double digits.

While it is important to understand the reason for the surge in growth to better manage the growth in domestic travels, the future availability of more and better data on this area will assist tourism planners.

Figure 2.2.1 Graphical Representation of Domestic Visitors Arrival into Sikkim by Year

In addition, it can also be seen from the graph that the consistent growth in domestic visitors had been achieved over the past decade.

This indicates a very resilient domestic tourism market that can withstand various domestic issues such as weather changes, economic slowdown, strikes and accessibility disruptions etc.

2.2 Tourism Prospects

Domestic Visitors

Further analysis of the data also revealed that peak months for domestic visitors are April, May, October and November.

In particular, May is most popular month for travel to Sikkim with an average of about 21.21% of total annual visitor numbers over the past decade. April and October are important months with high number of visitors.

Domestic visitor arrivals to Sikkim are subject to high peaks and deep troughs.

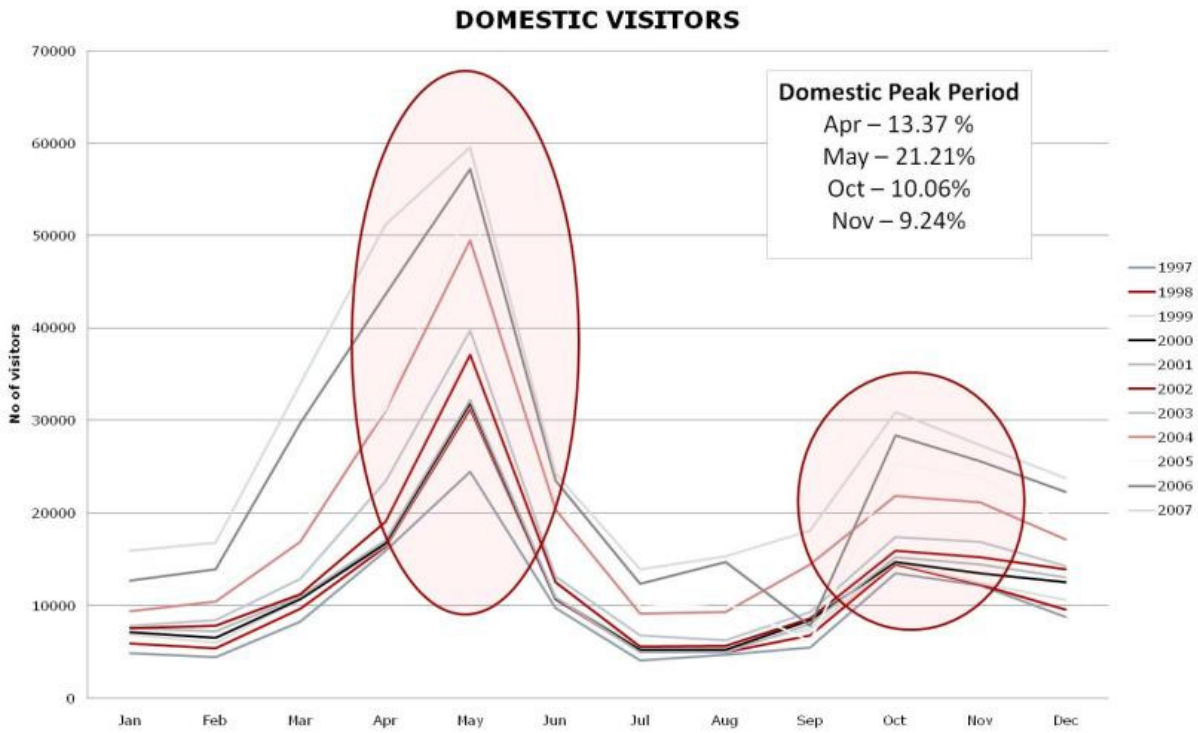


Figure 2.2.2. Graphical Representation of Domestic Visitors Arrival into Sikkim by Month

This uneven spread of demand during the year causes stress on the tourism infrastructure and public amenities and also creates a supply overhang during the months of fewer visitors.

Meteorological records indicate that the months from late May till September are generally wetter than other months, thus possibly contributing to these months having less visitors.

Nonetheless, current data available is unable to shed additional insight on the proportions of the domestic visitors as day-trippers, summer holiday makers, religious travelers or VFRs.

Each category of visitors has different needs and makes different demands on the tourism infrastructure and public amenities. More data need to be gathered to assess in detail their tourism requirements.

2.2 Tourism Prospects

International Visitors

Table 2.2.2 Number of International Visitors to Sikkim per Year

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Int'l	8,068	6,111	8,563	8,794	7,757	8,539	10,954	14,646	16,827	18,026	17,837

Despite the tremendous growth in global tourism, Sikkim has been relatively under-performing in attracting international visitors to Sikkim. From about 8,000 visitors in 1997, Sikkim welcomed 17,837 visitors in 2007, representing a growth rate of 12.1% that masked the low number of visitors. The proportion of international visitors as part of the overall visitors has consistently been between 4-6% (average 5.6%).

Table 2.2.3 Percentage of Domestic and International Visitors to Sikkim per Year

Year	Domestic	%	International	%	Total
1997	8,068	6.48%	116,500	93.52%	124,568
1998	6,111	4.39%	133,158	95.61%	139,269
1999	8,563	5.80%	139,085	94.20%	147,648
2000	8,794	5.75%	144,203	94.25%	152,997
2001	7,757	5.01%	146,923	94.99%	154,680
2002	8,539	5.04%	160,789	94.96%	169,328
2003	10,954	5.84%	176,659	94.16%	187,613
2004	14,646	5.97%	230,719	94.03%	245,365
2005	16,827	6.51%	241,697	93.49%	258,524
2006	18,026	5.81%	292,486	94.19%	310,512
2007	17,837	5.11%	331,263	94.89%	349,100

Average : 5.6%

Average : 94.4%

Data provided for 2002 indicated that the top overseas generating markets were the United States (860), Australia (491), Britain (1,127), France (1,041), Germany (770), Japan (391), Italy (273), Switzerland (263) and The Netherlands (365).

One important feature to note is the absence of Asian markets with only Japan the only Asian country in the list.

2.2 Tourism Prospects

International Visitors

Due to the unavailability of more detailed data on the purpose of visit of international visitors visiting Sikkim, the following deductions were made arising from discussions with the local travel trade.

The twin primary motivators that draw international visitors to Sikkim are nature and religion.

Eco Tourism: Sikkim's good climate and relatively pristine natural resources attract foreign visitors to the state. With a wide array of nature tracks, lakes, mountains and rare flora and fauna, Sikkim is a wonderful eco tourism destination. Pelling, a well-known starting point for trekkers, has a high concentration of hotels with many more being built.

Religious Tourism: According to official source in Sikkim: A Statistical Profile 2004-2005, Sikkim has 96 Monasteries, 179 Mani Lhakhangs, 35 Lakhangs & Tsamkhang, 6 Mosques, 2 Gurudwara, 1 Sai Baba Mandir 340 Mandirs and 74 Churches. Of the 39 important tourist spots cited, a large percentage are religious in nature.

Business Travelers: It is currently unclear how many visitors to Sikkim are in the state for the purpose of work and business. With the construction of the hydropower dams and frequent visits by developmental consultants, a significant proportion of the international visitor arrivals could be business travelers.

2.2 Tourism Prospects

International Visitors

From Figure 2.2.3 on the right, it can be seen that growth in international visitor arrivals is uneven, albeit on an upward trend.

It may be surmised from the drop in international arrivals in 1998 and 2001 that the Asian economic crisis in 1997 and the aftermath of the September 11 attack had significantly impacted travel of international visitors into Sikkim.

Sikkim's international markets continue to grow at a high rates since 2003.

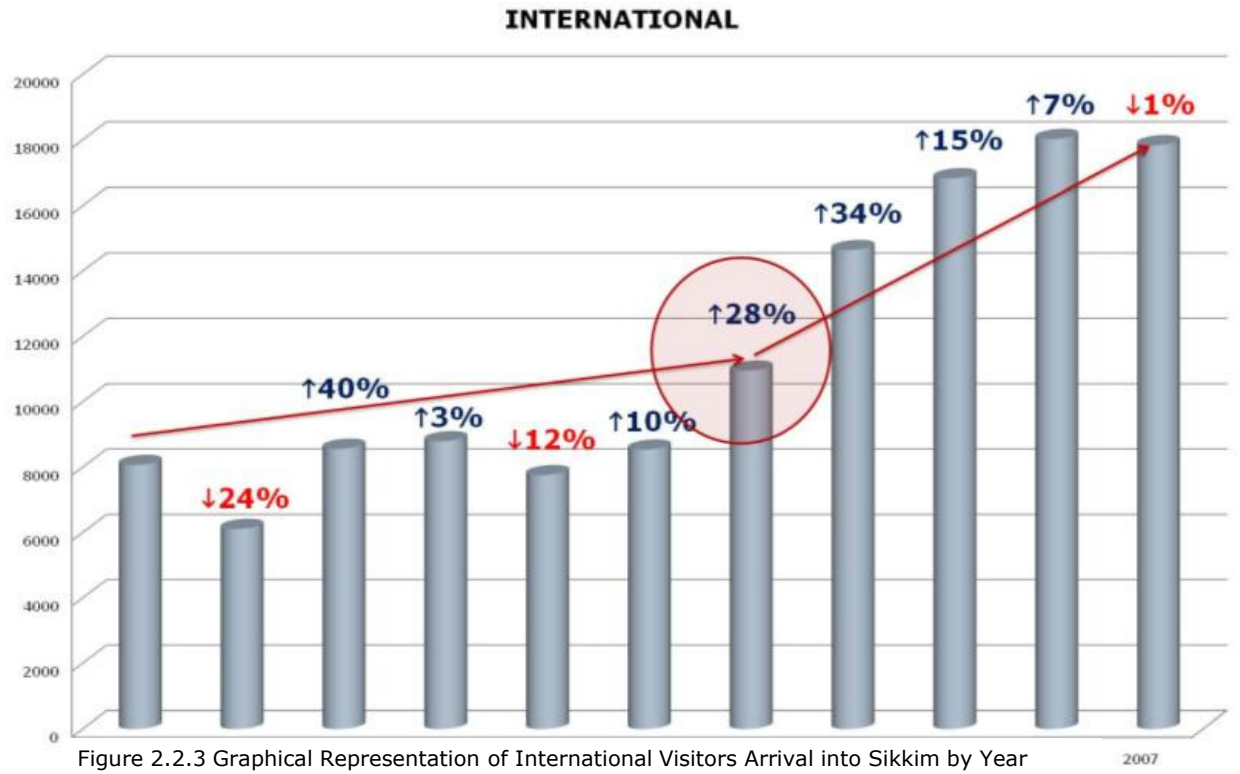


Figure 2.2.3 Graphical Representation of International Visitors Arrival into Sikkim by Year

Given that most visitors would have to travel a long distance before arriving at Sikkim, it could be reasonably assumed that they tend to stay longer in Sikkim and required hotel accommodation.

2.2 Tourism Prospects

International Visitors

Further analysis of the data also indicated that peak months for international visitors are March, April, October and November.

Unlike domestic visitors with high peaks, international visitor arrivals tend to be smoother in turns of numbers from month to month. The month of peak demand would be October with about 16.99% of the annual visitor arrivals.

Again, as in the domestic visitor arrivals, weather played an important role where the months from May till September generally had the least visitors.

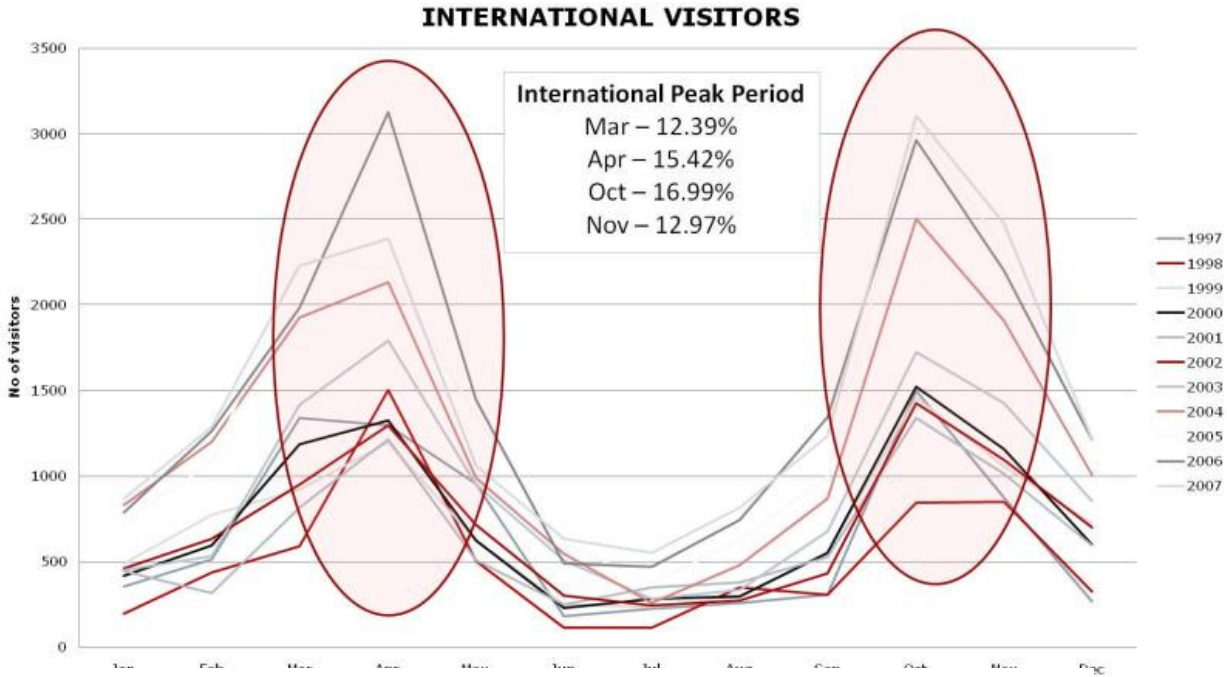


Figure 2.2.4. Graphical Representation of International Visitors Arrival into Sikkim by Month

2.2 Tourism Prospects

Domestic Visitors Projections

Table 2.2.4 Computation of the Compound Annual Growth Rate (CAGR) for Domestic Visitor Arrivals

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Domestic	116,500	133,158	139,085	144,203	146,923	160,789	176,659	230,719	241,697	292,486	331,263
4%	116,500	121,160	126,006	131,047	136,289	141,740	147,410	153,306	159,438	165,816	172,448
5%	116,500	122,325	128,441	134,863	141,606	148,687	156,121	163,927	172,124	180,730	189,766
6%	116,500	123,490	130,899	138,753	147,079	155,903	165,257	175,173	185,683	196,824	208,634
7%	116,500	124,655	133,381	142,718	152,708	163,397	174,835	187,074	200,169	214,180	229,173
8%	116,500	125,820	135,886	146,756	158,497	171,177	184,871	199,661	215,633	232,884	251,515
9%	116,500	126,985	138,414	150,871	164,449	179,250	195,382	212,967	232,134	253,026	275,798
10%	116,500	128,150	140,965	155,062	170,568	187,624	206,387	227,026	249,728	274,701	302,171
11.00%	116,500	129,315	143,540	159,329	176,855	196,309	217,903	241,873	268,479	298,011	330,793
11.01%	**116,500**	**129,328**	**143,567**	**159,373**	**176,920**	**196,399**	**218,023**	**242,027**	**268,675**	**298,256**	**331,094**
11.02%	116,500	129,341	143,594	159,418	176,986	196,490	218,143	242,182	268,871	298,500	331,395
11.03%	116,500	129,350	143,617	159,458	177,046	196,575	218,257	242,331	269,060	298,737	331,688
11.04%	116,500	129,363	143,644	159,503	177,112	196,665	218,377	242,486	269,256	298,982	331,989
12%	116,500	130,480	146,138	163,674	183,315	205,313	229,950	257,544	288,450	323,064	361,831
13%	116,500	131,645	148,759	168,098	189,950	214,644	242,547	274,079	309,709	349,971	395,467
14%	116,500	132,810	151,403	172,600	196,764	224,311	255,714	291,514	332,326	378,852	431,891
15%	116,500	133,975	154,071	177,182	203,759	234,323	269,472	309,892	356,376	409,833	471,307
16%	116,500	135,140	156,762	181,844	210,939	244,690	283,840	329,255	381,935	443,045	513,932

Calculating the compound annual growth rate (CAGR) for domestic visitor arrivals.

2.2 Tourism Prospects

Domestic Visitors Projections

Using the historical records, the growth rates of the visitors in the past decade were calculated and extrapolated to projections for 2015, 2025 and 2040.

Due to the peculiarities and differences between both the domestic and international visitor markets, the compound annual growth rate (CAGR) is calculated separately for each market.

For the domestic market, we are assuming a CAGR or 11.01% till 2015. 11.01% was obtained by calculating the growth rate over the past decade (see previous page).

The CAGR is then adjusted to 7.5% till 2015 and further adjusted downwards to 4% till 2040. This assumption is based on the continued growth in domestic visitor arrivals without any interference from the Sikkim authorities.

To adjust for the big increase in the base numbers over the years, the CAGR is adjusted downwards to 4% to reflect the median growth rate before 2002.

The resulting projection in domestic visitor arrivals can be seen in the table below.

Table 2.2.5 Computation of the Compound Annual Growth Rate (CAGR) for Domestic Visitor Arrivals at Year 2015, 2025 and 2040

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total	116,500	133,158	139,085	144,203	146,923	160,789	176,659	230,719	241,697	292,486	331,263
CAGR	2008	2009	2010	2011	2012	2013	2014	2015			
11.01%	367,735	408,223	453,168	503,062	558,449	619,934	688,189	763,958			
CAGR	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
7.50%	821,255	882,850	980,051	1,087,955	1,207,739	1,340,711	1,488,323	1,652,187	1,834,093	2,036,027	
CAGR	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
4.00%	2,117,468	2,202,167	2,444,625	2,713,778	3,012,565	3,344,249	3,712,451	4,121,192	4,574,935	5,078,635	
CAGR	2036	2037	2038	2039	2040						
4.00%	5,281,780	5,493,052	5,712,774	5,941,285	6,178,936						

2.2 Tourism Prospects

International Visitors Projections

Table 2.2.6 Computation of the Compound Annual Growth Rate (CAGR) for International Visitor Arrivals

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
International	8,068	6,111	8,563	8,794	7,757	8,539	10,954	14,646	16,827	18,026	17,837
4%	8,068	8,391	8,726	9,075	9,438	9,816	10,209	10,617	11,042	11,483	11,943
5%	8,068	8,471	8,895	9,340	9,807	10,297	10,812	11,352	11,920	12,516	13,142
6%	8,068	8,552	9,065	9,609	10,186	10,797	11,445	12,131	12,859	13,631	14,449
7%	8,068	8,633	9,237	9,884	10,576	11,316	12,108	12,955	13,862	14,833	15,871
8.00%	8,068	8,713	9,411	10,163	10,976	11,855	12,803	13,827	14,933	16,128	17,418
8.10%	8,068	8,722	9,428	10,192	11,017	11,910	12,874	13,917	15,044	16,263	17,580
8.20%	8,068	8,730	9,445	10,220	11,058	11,965	12,946	14,007	15,156	16,399	17,743
8.25%	**8,068**	**8,734**	**9,454**	**10,234**	**11,078**	**11,992**	**12,982**	**14,053**	**15,212**	**16,467**	**17,826**
8.30%	8,068	8,738	9,463	10,248	11,099	12,020	13,018	14,098	15,268	16,536	17,908
8.40%	8,068	8,746	9,480	10,277	11,140	12,076	13,090	14,190	15,382	16,674	18,074
9%	8,068	8,794	9,586	10,448	11,389	12,414	13,531	14,749	16,076	17,523	19,100
10%	8,068	8,875	9,762	10,739	11,812	12,994	14,293	15,722	17,294	19,024	20,926
11%	8,068	8,955	9,941	11,034	12,248	13,595	15,091	16,750	18,593	20,638	22,908
12%	8,068	9,036	10,120	11,335	12,695	14,219	15,925	17,836	19,976	22,373	25,058
13%	8,068	9,117	10,302	11,641	13,155	14,865	16,797	18,981	21,448	24,237	27,387
14%	8,068	9,198	10,485	11,953	13,627	15,534	17,709	20,188	23,015	26,237	29,910
15%	8,068	9,278	10,670	12,270	14,111	16,228	18,662	21,461	24,680	28,382	32,640
16%	8,068	9,359	10,856	12,593	14,608	16,946	19,657	22,802	26,450	30,682	35,591

Calculating the compound annual growth rate for international visitor arrivals.

2.2 Tourism Prospects

International Visitors Projections

Using the historical records, the growth rates of the visitors in the past decade were calculated and extrapolated to projections for 2015, 2025 and 2040.

For the international market, we are assuming a CAGR of 8.25% till 2040. 8.25% was obtained by calculating the growth rate over the past decade (see previous page).

Due to the small base in international visitors and impending opening of Natula Pass and the airport at Pakyong, it was decided that the CAGR will not be adjusted.

The resulting projection in international visitor arrivals can be seen in the table below.

Table 2.2.7 Computation of the Compound Annual Growth Rate (CAGR) for International Visitor Arrivals at Year 2015, 2025 and 2040

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total	8,068	6,111	8,563	8,794	7,757	8,539	10,954	14,646	16,827	18,026	17,837
CAGR	2008	2009	2010	2011	2012	2013	2014	2015			
8.25%	19,309	20,902	22,626	24,493	26,513	28,700	31,068	33,631			
CAGR	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
8.25%	36,406	39,409	42,661	46,180	49,990	54,114	58,579	63,412	68,643	74,306	
CAGR	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
8.25%	80,436	87,072	94,256	102,032	110,449	119,562	129,425	140,103	151,661	164,174	
CAGR	2036	2037	2038	2039	2040						
8.25%	177,718	192,380	208,251	225,432	244,030						

2.2 Tourism Prospects

Total Visitors Projections

Table 2.2.8 Projected Number of Visitors at Year 2015, 2025 and 2040

Visitor Projections			
	2015	**2025**	**2040**
Domestic	763,958	2,036,027	6,178,936
International	33,631	74,306	244,030
Total	797,590	2,110,333	6,422,966

Table 2.2.9 Projected Monthly Number of Visitors at Year 2015, 2025 and 2040

Peak Period Projections - Domestic					
		2008	2015	**2025**	2040
Apr	13.37%	55,424	102,141	272,217	826,124
May	reduced to 19%	71,252	145,152	386,845	1,173,998
Oct	10.06%	-NA-	76,854	204,824	621,601
Nov	9.24%	-NA-	70,590	188,129	570,934

Peak Period Projections - International					
		2008	2015	**2025**	2040
Apr	15.42%	2,411	5,186	11,458	37,629
May	7.70%	1,857	2,590	5,722	18,790
Oct	16.99%		5,714	12,625	41,461
Nov	12.97%		4,362	9,637	31,651

The tourism component of this study will also use the stages used by the urban planning document for its planning purposes: Short Term by Year 2015, Medium Term by Year 2025 and Long Term by Year 2040.

Collating the numbers from the two markets, the visitor projections for 2015, 2025 and 2040 are reflected in the table above. To assist in calculating the demand for rooms by these visitors, we chose the most busy month to calculate the maximum stress that the visitors will impose on the facilities. May is used as the reference month for calculation.

The following assumptions were made.

Domestic visitors

- assuming 20% as day-trippers, visitors visiting friends and relatives and religious travelers staying with monasteries who do not require accommodation;
- the month of May to remain as peak month for visitors but its percentage share as a proportion of annual visitor arrivals is reduced to 19% to reflect current and future efforts to diversify Sikkim's attractions and encourage visitors to visit Sikkim in non-peak months;
- average stay of about 7 nights.

International visitors

- average stay of about 7 nights.

2.2 Tourism Prospects

Hotel Statistics

According to a detailed census survey conducted by the Department of Economics, Statistics, Monitoring and Evaluation (DESME) in early 2008, there are currently 543 hotels located in Sikkim. The majority of the hotels are located within the East District. Table 2.2.10 below shows the current distribution of hotels in Sikkim.

Table 2.2.10 Current Distribution of Hotels in Sikkim

Number of Hotels by District		
District	**Total**	**%**
East	322	59.3%
North	69	12.7%
South	34	6.3%
West	118	21.7%
State	**543**	**100%**

From the data provided, it can be observed that the East district has 59.3% of the hotels in Sikkim while the South district has only 6.3% (which is less than half of the north district with 12.7%).

This is the result of Gangtok being the administrative and commercial centre of Sikkim, where most visitors have to come to Gangtok, in turn creating much higher demand for hotels as compared to other districts.

When viewed using the statistics on beds available, the concentration of beds available becomes even more pronounced within the East district having 68.5% of the beds available in Sikkim and the South district's portion reduced to 4.8%.

Table 2.2.11 Current Distribution of Number of Beds in Sikkim

Number of Beds by District		
District	**Total**	**%**
East	8,954	68.5%
North	1,147	8.8%
South	624	4.8%
West	2,346	17.9%
State	**13,071**	**100%**

It can be deduced that larger hotels are prevalent in Gangtok given that the beds concentration is higher than the hotels concentration. Typically, a larger hotel with more beds will have more amenities (restaurants, business desk etc). This confirms the observation that hotel developments in Gangtok are more sophisticated with where visitors are demanding better services / amenities (which are more easily provided by larger hotels).

2.2 Tourism Prospects

Hotel Statistics

According to the DESME findings, a total of 2,501 staff worked in the hotel sector in Sikkim. 42% (1,051) are locals while 58% (1,450) are non-locals. 74.8% of these staff are employed in the East district, again demonstrating the economic dominance of the East District.

Table 2.2.12 Existing Number of Hotel Staff by District

Number of Staff Employed in Hotels by District		
District	**Total**	**%**
East	1,871	74.8%
North	180	7.2%
South	80	3.2%
West	370	14.8%
State	**2,501**	**100%**

We reviewed the staffing ratios (i.e. the number of staff available per bed/room/hotel) for each district and noted that again the East District has the highest staffing ratio.

Table 2.2.13 Existing Staffing Ratio by District

District	Staff/Bed	Staff/Room	Staff/Hotel
East	0.21	0.47	27.81
North	0.16	0.33	16.62
South	0.13	0.30	18.35
West	0.16	0.34	19.88

Noting the current standards of hotels in Sikkim, it is assumed that the East District offers the highest standards in hospitality services. To achieve a higher standard of hospitality services throughout Sikkim, it would be important for the other states to attain a staffing ratio closer to that of the East district.

2.2 Tourism Prospects

Hotels and Beds Projections

Table 2.2.14 Projected Number of Rooms Required During Tourism Peak Months

Peak Period Rooms Projection - Domestic					
Assumptions - Assume average length of stay = 7 nights; Using peak month (May) as reference point					
		Current 2008	**2015**	**2025**	**2040**
May	reduced to 19%	71,252	145,152	386,845	1,173,998
Deducting 20% non hotel users		57,002	116,122	309,476	939,198
Tourist stay	Nights	399,011	812,852	2,166,333	6,574,388
Beds required	Beds / Month	332,509	677,377	1,883,767	5,976,716
Beds required	Beds / Night	10,726	21,851	60,767	192,797

Peak Period Rooms Projection - International					
Assumptions - Assume average length of stay = 7 nights; Using domestic peak month (May) as reference point					
		Current 2008	**2015**	**2025**	**2040**
May	7.70%	1,857	2,590	5,722	18,790
Tourist stay	Nights	12,999	18,127	40,051	131,532
Beds required	Beds / Month	12,999	18,127	40,051	131,532
Beds required	Beds / Night	419	585	1,292	4,243

Total Beds Required	**11,145**	**22,436**	**62,059**	**197,040**

Based on the assumptions provided previously, the number of beds required per night during the peak period is calculated at 22,436 beds in 2015, 62,059 beds in 2025 and 197,040 beds in 2040.

In addition to deducting 20% for non-hotel users for domestic visitors, we also noted from discussions with travel agents and hoteliers that domestic travelers tend to have more persons staying in a room. Adjusting for this practice, we have further reduced the beds required by another 20%.

However, as the Indian economy grows and with increasing affluence of the Indian travelers in the future, we expect their demands on hotel services to increase as well. The adjustment on beds required is reduced to 15% in 2025 and 10% in 2040 to reflect future developments.

International visitors are assumed to require one bed per person.

2.2 Tourism Prospects

Hotels and Beds Projections

Table 2.2.15 Projected Percentage Distribution of Beds by District at Year 2015, 2025 and 2040

Projected % Distribution of Beds by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	68.5%	67.5%	64.5%	61.0%
North	8.8%	9.0%	10.0%	11.0%
South	4.8%	5.5%	7.0%	9.0%
West	17.9%	18.0%	18.5%	19.0%

Table 2.2.16 Projected Distribution of Beds by District at Year 2015, 2025 and 2040

Projected Distribution of Beds by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	8,954	17,699	45,074	129,367
North	1,147	2,360	6,988	23,328
South	624	1,442	4,892	19,087
West	2,346	4,720	12,928	40,295
State	**13,071**	**26,221**	**69,882**	**212,077**

Table 2.2.17 Projected Distribution of Hotels by District at Year 2015, 2025 and 2040

Projected Distribution of Hotels by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	322	735	1,873	5,375
North	69	98	290	969
South	34	60	203	793
West	118	196	537	1,674
State	**543**	**1,089**	**2,903**	**8,811**

While it is expected that the supply of accommodation available in all the districts will increase, the North, South and West districts should increase at a faster rate compared to the East district as the development strategy of decentralising tourism activities outside Gangtok takes effect and the tourism attractions in and around Namchi are completed and gain in awareness.

With the increasing importance of tourism attractions in Pelling, Namchi, Ravongla, Lachen, Lachung and Tsongo Lake, there will be more hotels being constructed within these areas to meet the needs of the visitors.

The projections of the number of hotels required is derived from the projected bed demand divided by 24, the current average number of beds per hotel.

2.3 Demographics

Past Population Growth Profile

As highlighted earlier, population is the key factor dictating urban development and hence future demography has to be examined first. The demographic analysis will discuss the long-term resident population size as well as floating population due to the highly important tourism industry for Sikkim

In last few decades, Sikkim's population grew by decennial rates consecutively with an average annual growth rate of 3%. Though the population increases in reducing rates, the absolute growth in terms of person is still positively expanding.

- 1961 - 137725
- 1971 – 209843
- 1981 – 316385
- 1991 – 406457
- 2001 – 540851
- 2006 – 581546

The State density per square km has increased from 57 to 76 persons over last decade.

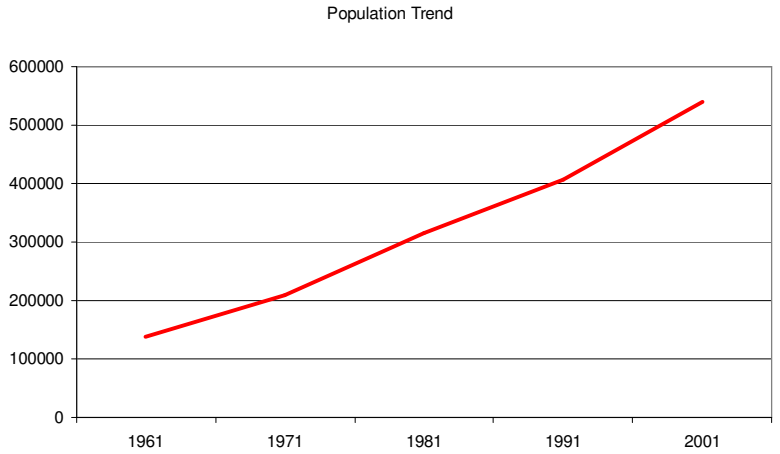


Figure 2.3.1 Graph Showing Population Growth in Sikkim from Year 1961 to 2001

Source : UDHD

Based on the population projection by Shristi Urban Infrastructure Development Ltd which was engaged by UDHD for the City Development Plan of Gangtok, the state population of Sikkim is estimated to reach 852,000 people by Year 2041. The substantial growth will push pressure on urban development when urban growth is increasingly enlarging over time.





2.3 Demographics

Current Population Distribution

The existing population distribution within the State points to an imbalance of spread. There is a high concentration of population (density of 257persons/sq km) in East District with lesser land area, while low population concentration (density of 10 persons/sq km) is recorded in North District which accounts for the largest share of the State land area (as in the diagram).

Past studies revealed that in 2001, more than 80% of the State population were rural dwellers and 11% of the State urban population inhabited in 8 urban centers. A huge disparity is observed in the urban population distribution between these 8 urban centers. While East District accounts for a majority 88% of urban dwellers, most are staying in the State Capital, Gangtok. This pattern reflects an imbalance of town hierarchy and needs to be addressed by revisiting the possibilities of decentralizing population from Gangtok and East District by accelerating growth of major towns in other Districts.

The discussion with the local officials has further revealed that the percentage share of urban population is much higher than 11% in reality as the urban figures published in the various reports only reflect the population within the notified town boundary which however has already been expanded to cover a larger population. Therefore, the current total urban population including undeclared urban areas is estimated to have reached between 25% and 30%.

With the rapid urbanization, the percentage share of urban population is expected to increase beyond 30%. Hence, it is essential to identify the urban population growth anticipated in future and put in place the growth management strategies in terms of urban land expansion and facilities that are required to support the inevitable growth.

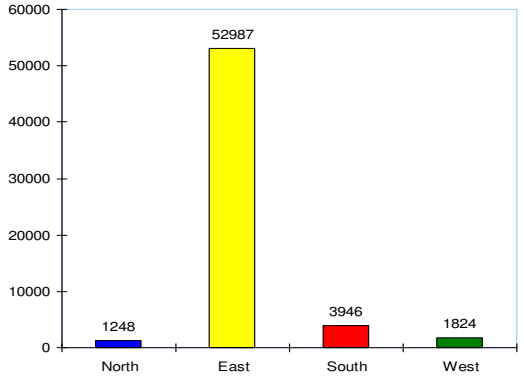


Figure 2.3.2 Graph Showing Urban Population Distribution among the 4 Districts in Sikkim

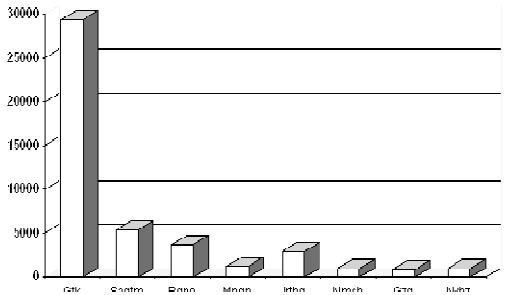


Figure 2.3.3 Graph Showing Urban Population Distribution in the 8 Established Towns

2.3 Demographics

Future Population Growth – Projection Analysis

Projected Resident Population In Sikkim

Table 2.3.1 Three Methods used for Projecting Resident Population Growth

Year	State Population	Arithmetic Progression Method	Incremental Increase Method	Geometrical Increase Method
2006	581546			
2015		682556 (18%)	**659331 (13%)**	969657 (67%)
2025		794789 (17%)	**787865 (20%)**	1711288 (77%)
2040		963138 (21%)	**1063769 (35%)**	4012177 (135%)

Based on the most recent population of 581546 in the year 2006 as base year, three projection methods are used to project the long-term population by Year 2040. The Arithmetic Progression Method gives a total population of over 960,000 by 2040, while the Geometrical Increase Method results in an extreme size of 4 million people. The Incremental Increase Method, which is commonly used by Ministry of Urban Development, Government of India, produces a moderate and realistic population size of over 1,060,000 by 2040.

After comparison of the 3 projection methods, it is generally agreed that **1.1 million** is considered logical and can be adopted for the long term strategic planning. Of this 1.1 million people within Sikkim, it is essential to further identify the scale of urban population anticipated in future and then to put in place growth management strategies in terms of urban land needs and facilities in order to support the gradual growth.

Projected Urban Population

Table 2.3.2 Existing and Projected Urban and Rural Population Distribution

Year	Urban Population (%)	Rural Population (%)
1991	9	91
2001	11	89
2005	25-30	70-75
2015	**40**	**60**
2025	**45**	**55**
2040	**50**	**50**

Given the fast pace of urbanization taking place in Sikkim, the urban population is expected to account for an increasing percentage share of the total State population beyond 30%. With reference to the UN Habitat Report, by the year 2050, some 6 billion people representing two-thirds of humanity will be living in towns and cities. 60% of the world's population will have been urbanized by 2030. In Asian context, urbanization is expected at a conservative rate of 55%. Since urban centers in Sikkim are not as mature as other world's cities, its pace of urbanization should be slower. Therefore, the urban population rate of **50% by Year 2040 (i.e. 550,000)** is considered more realistic with a gradual increment from 25-30% to 40% and 45% in 2015 and 2025 respectively. The assumption of 50:50 urban-rural population ratio is a balanced split and is desired in order to protect the rural natural environment of Sikkim.

2.3 Demographics

Floating Population

In addition to the resident population stated earlier, the overall planning will have to take into consideration the floating population arising especially from the flourishing tourism in Sikkim because this floating population would have to be catered for in terms of facilities and infrastructure provisions for the State.

The tourism analysis suggests that tourism in Sikkim will grow in coming years due to key factors such as global tourism trends, new tourism products, and improved accessibility to Sikkim. Based on the historical tourism peak period in May as the reference month, the maximum visitors per month is projected to hit as much as 1.3 million people, of which 98% is expected to be domestic tourists (see Table 2.3.3). More than 70,000 rooms will be required during the tourism peak.

This projected 1.3 mil people could represent a substantial share of the floating population in Sikkim by 2040, given the important tourism share of Sikkim's GDP. Such huge scale will add pressure on the provisions of hotel and commercial facilities as well as infrastructure services.

In addition to tourists as the main source of floating population, there may be foreign workers seeking employment from the growing manufacturing sector in Sikkim. However, the quantum is not expected high and significant enough to influence the key facilities' provisions, since Sikkim is not considered a manufacturing base as substantial in size as other major industrial bases in India.

Table 2.3.3 Projected Peak Number of Visitors at Year 2015, 2025, 2040

Visitors Projections (at Peak Period)			
	2015	**2025**	**2040**
Domestic - May - 19.00% of year total	145,152	386,845	1,173,998
International - May - 7.70% of year total	2,590	5,722	18,790
Total Rooms Required	22,436	62,059	197,040

2.4 Scenario Analysis

Key Assumptions

As mentioned in Section 2.3, the projected State population by Year 2040 adopted for this Strategic Urban Plan is about 1.1 million (rounded up for ease of planning – see Table 2.4.1).

Following the recommended ratio of urban to rural population, the preferred urbanization pattern of agglomeration and magnitude of urban density across different urban centers, 2 possible planning scenarios will be analyzed by outlining different permutations for desired urban population distribution among the 4 districts by Year 2040. A suitable scenario will be defined and recommended as the basis for further infrastructure planning.

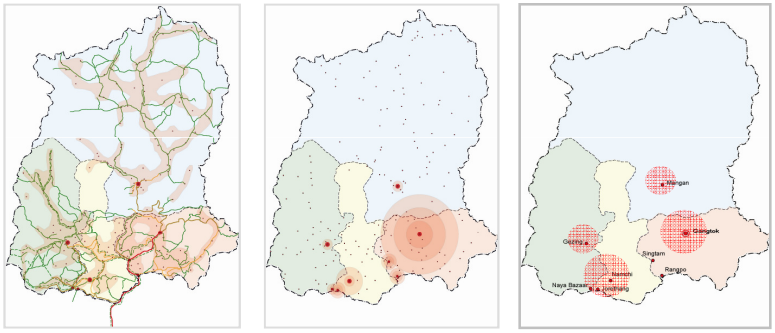
Table 2.4.1 Projected State, Urban and Rural Population for year 2015, 2025 and 2040

Year	State Population	Incremental Increase Method	Urban Population (%)	Rural Population (%)
2006	581, 546			
2015		659, 331	40	60
2025		787, 865	45	55
2040		1, 063, 769	50	50

2.4 Scenario Analysis

Planning Parameters

Urban Agglomeration



Existing Habitat Pattern | Existing Urban Focus | Desired Urban Mass

Figure 2.4.1 Current and Desired Urbanization Pattern in Sikkim

The existing habitat pattern indicates multiple linear developments of settlements along the rivers & roads, which is a natural and common phenomenon for hillside developments against steep slopes. However, such largely unregulated linear form of developments should be controlled and made to form a structured network of local connections such that those unsuitable accesses or abrupt dead-end roads within the settlements can be avoided.

Nevertheless, urbanization in the pattern of agglomeration has been seen in and around Gangtok. Such pattern is preferred as urban center model because of its key strength of efficient use of resources within a controlled physical space, especially in a highly space constraint area like Sikkim.

Urban Density

Urban density dictates land requirement for a given population. 3 population density models are identified and evaluated in order to determine the most appropriate scale of urban development for each major town in Sikkim.

2000 / sq km

Model One : This Rural Oriented Model is appropriate for lower level urban centers of rural character and atmosphere.

4000 / sq km

Model Two : The desired scale of density for Namchi is to match the city such as Zurich @ 4000 persons/sq km. It is appropriate for major urban centers of medium density.

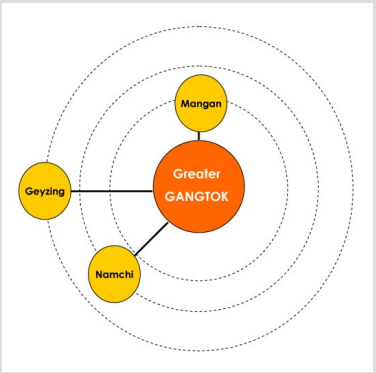
6000 / sq km

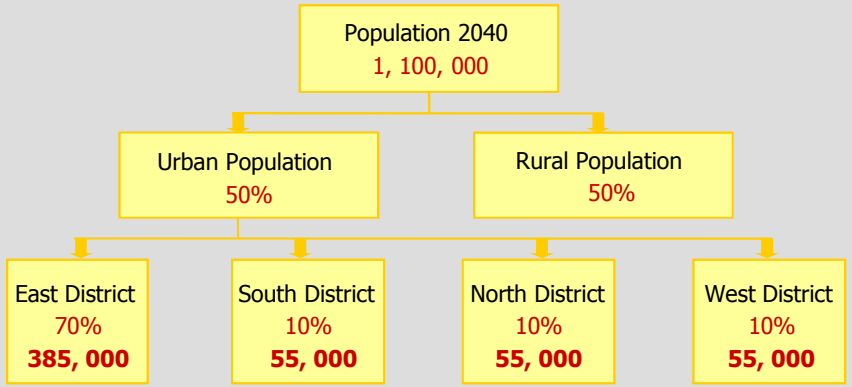
Model Three : The current density of Gangtok is around 6000 persons/sq km. Such density is generally found in High Density Urban Area (Current Darjeeling @ 8000 & Singapore @ 6600) and is appropriate for urban cores to enable optimal and efficient use of resources.

2.4 Scenario Analysis

SCENARIO ONE :

Mega Town Structure





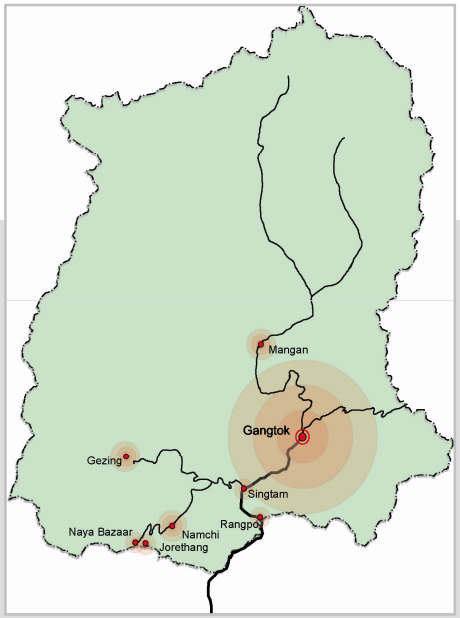


Figure 2.4.2 Mega Town Structure - Suggested Urban Population Distribution among the 4 Districts by 2040

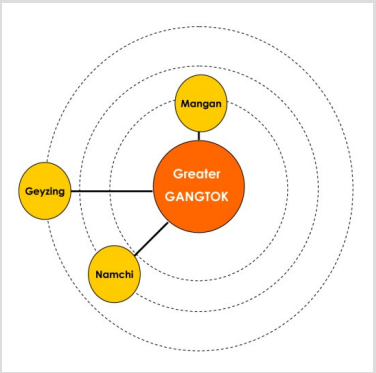
Concept

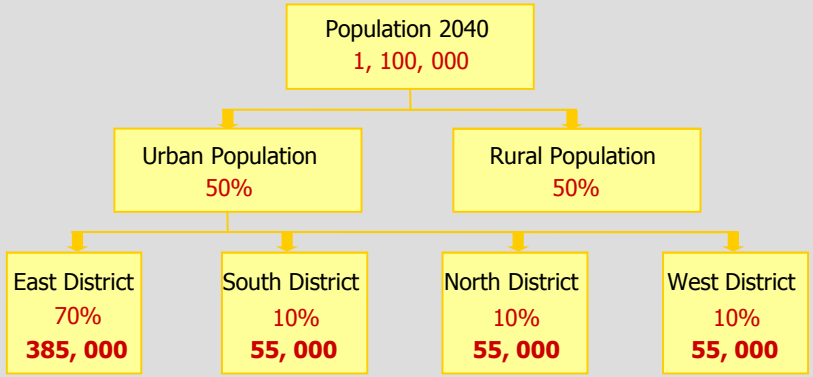
- In recognition of the established scale of development at Gangtok, the idea is to consolidate and enhance the status of Gangtok as the most important urban center in Sikkim by making it a dominant and mega town in the State with continuous expansion in the future.
- As the dominant urban center in the State, Gangtok will account for 70% of the urban population with the State.
- The other 3 key towns, namely, Namchi, Geyzing, and Mangan, will continue its role as district headquarters and will be categorized as the 2-tier urban center with 10% of urban population each. They will play a supporting role to the State capital of Gangtok.

2.4 Scenario Analysis

SCENARIO ONE :

Mega Town Structure





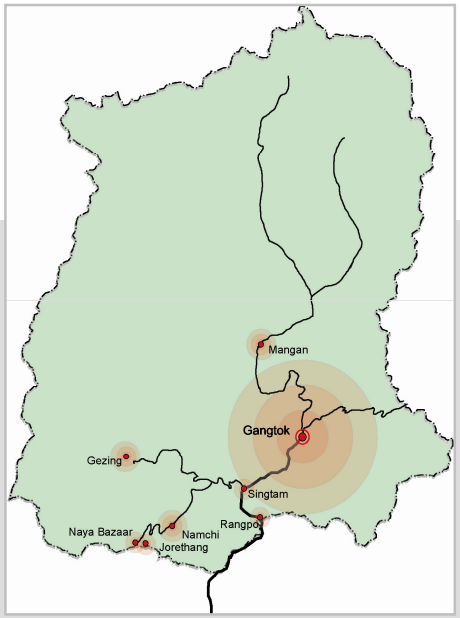


Figure 2.4.2 Mega Town Structure - Suggested Urban Population Distribution among the 4 Districts by 2040

Strengths

- Single focus on Gangtok by riding on the established structure and developments there.
- Consolidation of resources for quality infrastructure.
- External linkage boosted by new Airport at Pakyong.

Weaknesses

- Excessively urbanized at the expense of other township growth.
- Existing overcrowding problems to be aggravated

Opportunities

- Capitalize on Gangtok's existing infrastructure.
- Stretching the development limit of Gangtok and hence making it a well-known city representing Sikkim in the world map.

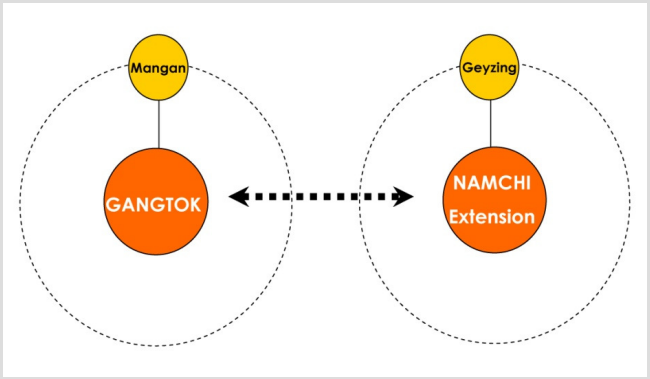
Threats

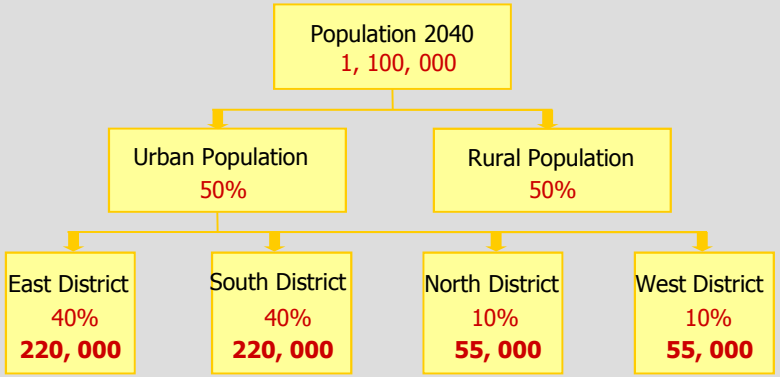
- Imbalance of development across the State to continue and hence to cause social and physical problems in Gangtok and other towns.
- Added stress on the already insufficient infrastructure in Gangtok.

2.4 Scenario Analysis

SCENARIO TWO :

Multiple Nuclei Structure





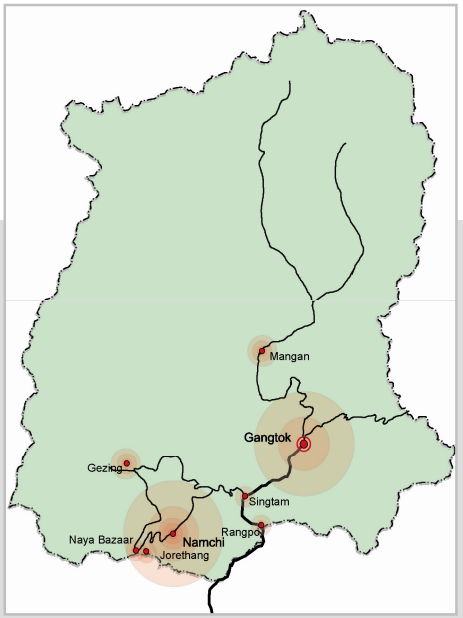


Figure 2.4.3 Multiple Nuclei Structure - Suggested Urban Population Distribution among the 4 Districts by 2040

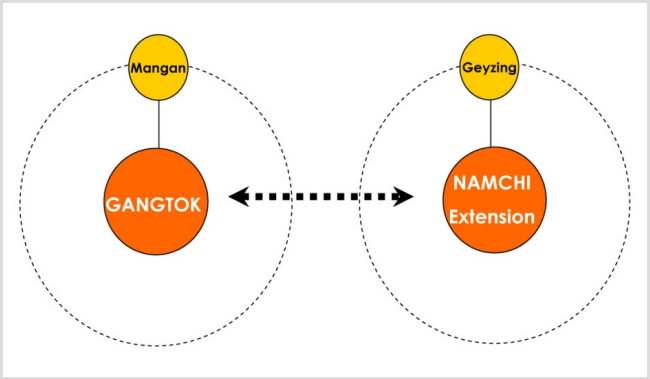
Concept

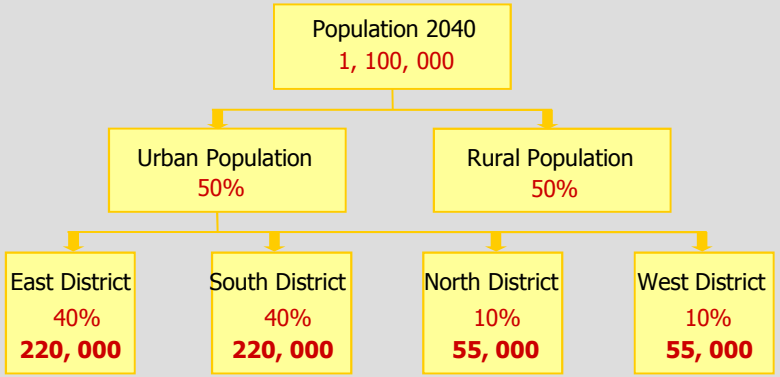
- The idea is to accelerate the growth of Namchi as a new satellite urban center to overcome the current lopsided growth of Gangtok.
- In terms of geographical distribution, the 2 multiple nuclei approach will result in a much balanced urban development across the State. Namchi may be seen as a core urban center serving the southern and western part of Sikkim, while Gangtok already being the State capital may serve the eastern and northern part of Sikkim.
- The township hierarchy will emerge such that Gangtok and Namchi are the 1st Tier urban center followed by Mangan and Geyzing as the 2nd Tier urban center. Mangan and Geyzing will play a supporting role to Gangtok and Namchi respectively.
- In terms of urban population distribution, Gangtok and Namchi will take the largest share of 40% each. Mangan and Geyzing will be given 10% each.

2.4 Scenario Analysis

SCENARIO TWO :

Multiple Nuclei Structure





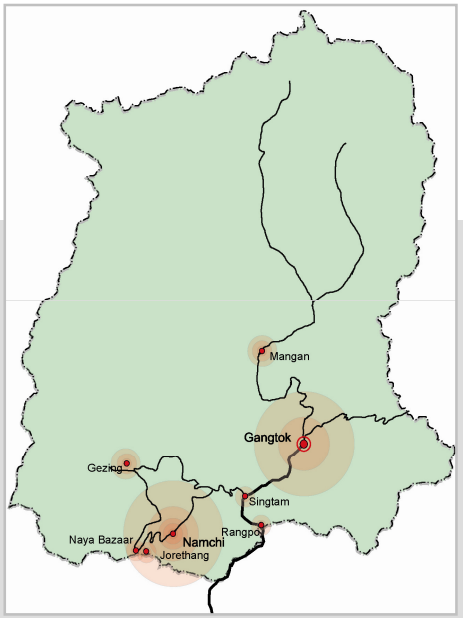


Figure 2.4.3 Multiple Nuclei Structure - Suggested Urban Population Distribution among the 4 Districts by 2040

Strengths

- Opening up new growth center to avoid over concentration of development in Gangtok.
- Resulting in a balance of urban development across the State with multiple high level urban centers catering to smaller towns.

Weaknesses

- Limiting growth in the established town of Gangtok by spreading and stretching the tight resources elsewhere.

Opportunities

- Forming multi focused urban developments allowing more choices of urban centers for people to settle in.
- Assigning special roles and functions for different towns, e.g. Gangtok as State Administrative Centre and tourist center; Namchi as Centre for Trade & Commerce.

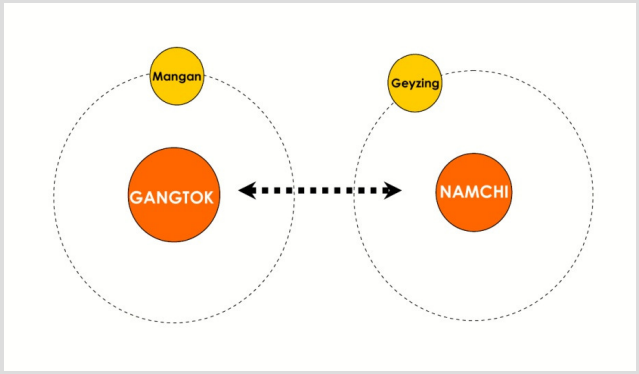
Threats

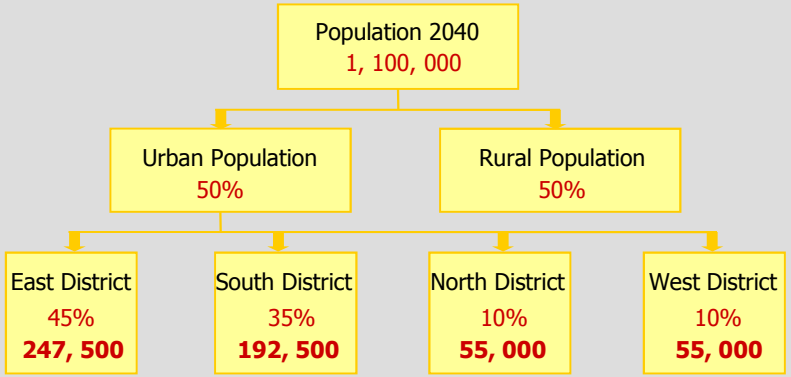
- Gangtok to be limited to rejuvenation more than expansion as focus shifts to Namchi.
- Requiring more urgent improvement to the existing inter-town road linkages in order not to result in 2 isolated urban centers.

2.4 Scenario Analysis

MODERATED SCENARIO:

Multiple Nuclei Structure





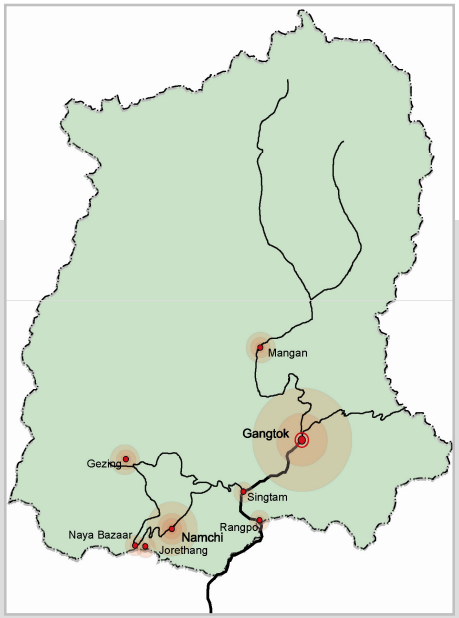


Figure 2.4.4 Moderated Multiple Nuclei Structure - Desired Urban Population Distribution among the 4 Districts by 2040

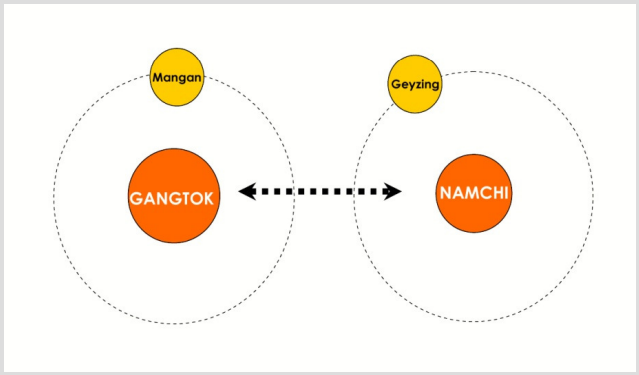
Concept

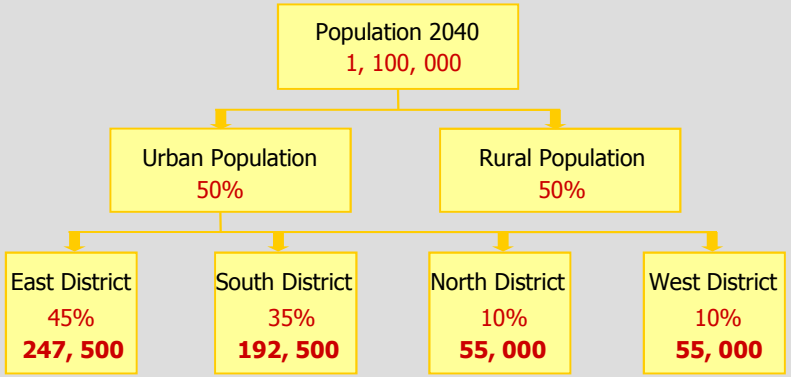
- After weighting the pros and cons of Scenarios One and Two, a recommended scenario should, on the one hand, allow rapid growth of another new urban center comparable to the scale of Gangtok in order to balance the overall urban development across the State, and on the other, give more rooms for Gangtok to expand in order to ride on the established physical infrastructure and urban development.
- The final recommendation is therefore to adopt and moderate the "multiple nuclei structure" for the State; i.e. to grow Namchi as a new center and also to give Gangtok a slightly larger share of urban population in recognition of its status as the State capital.
- The township hierarchy will emerge such that Gangtok and Namchi are the 1st Tier urban center followed by Mangan and Geyzing as the 2nd Tier urban center. Mangan and Geyzing will play a supporting role to Gangtok and Namchi.
- In terms of urban population distribution, Gangtok and Namchi will take the largest share of 45% and 35% respectively. Mangan and Geyzing will be given 10% each.

2.4 Scenario Analysis

MODERATED SCENARIO:

Multiple Nuclei Structure





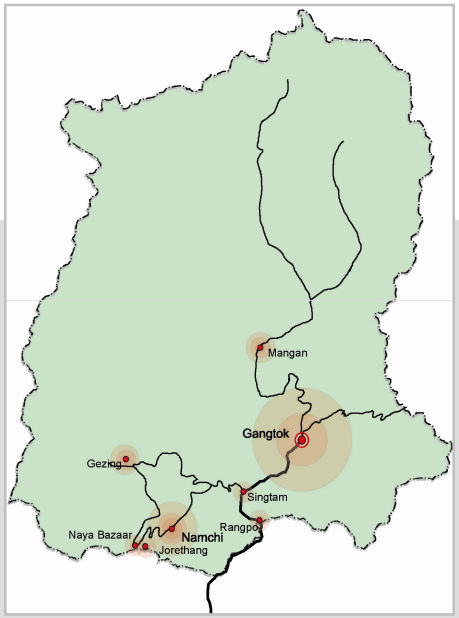


Figure 2.4.4 Moderated Multiple Nuclei Structure - Desired Urban Population Distribution among the 4 Districts by 2040

Strengths

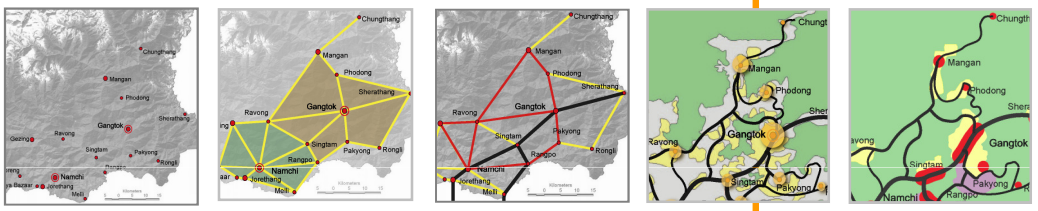
- Spreading growth focus on both Gangtok & Namchi and hence enabling decentralization from the overcrowded Gangtok.
- Enabling greater infrastructure improvement in southern and western towns.
- Having multiple high level urban centers catering to smaller towns.
- Giving a more balanced and non-dominant township hierarchy.

Opportunities

- Forming multi focused urban developments allowing more choices of urban centers for people to settle in.
- Still allowing Gangtok to grow and capitalize on its existing infrastructure.
- Assigning special roles and functions for different towns, e.g. Gangtok as State Administrative Centre and tourist center; Namchi as Centre for Trade & Commerce.

3.0 State Strategic Concepts

3.1 Identification of Significant Towns
3.2 Urban Population Distribution
3.3 Urban Land Requirement
3.4 Urban Linkages
3.5 Tourism Development



3.1 Identification of Significant Towns

While there are only 8 urban centers across Sikkim at present, 8 other potential areas can be identified as prospective urban centers in future due to their individual significant functions. These 16 towns (see Figure 3.1.1) across the 4 districts will form the township framework within Sikkim for distribution of the projected urban population.

East District Planning Area

[Growth Driver : State Capital, Tourism & Urban Amenities : Education, Health, Cultural facilities, Administrative Center]

- Gangtok Urban-Area: "State Capital with the highest level of Urban Amenities" to reinforce its current status as the State Capital
- Singtam Sub-Area: "State Trade Center" due to its strategic location along NH31A and presence of established industries
- Rangpo Sub-Area: "Fringe Center" which is self-contained since it is a 'welcoming town' and all travelers to Sikkim will have to pass through the area; "Institutional Development-University Town" to capitalize on the existing Engineering and Medical Colleges facilities
- Sherathang Sub-Area: "Border Trade Center" due to its proximity to the Nathu La Pass, China and Bhutan
- Pakyong Sub-Area: "Transport Hub" to create a multi-nodal transport system comprising the new State airport, railway and highway transit
- Rongli Sub-Area: "Local Trade Centre" to cater to the population in the far south of the East District

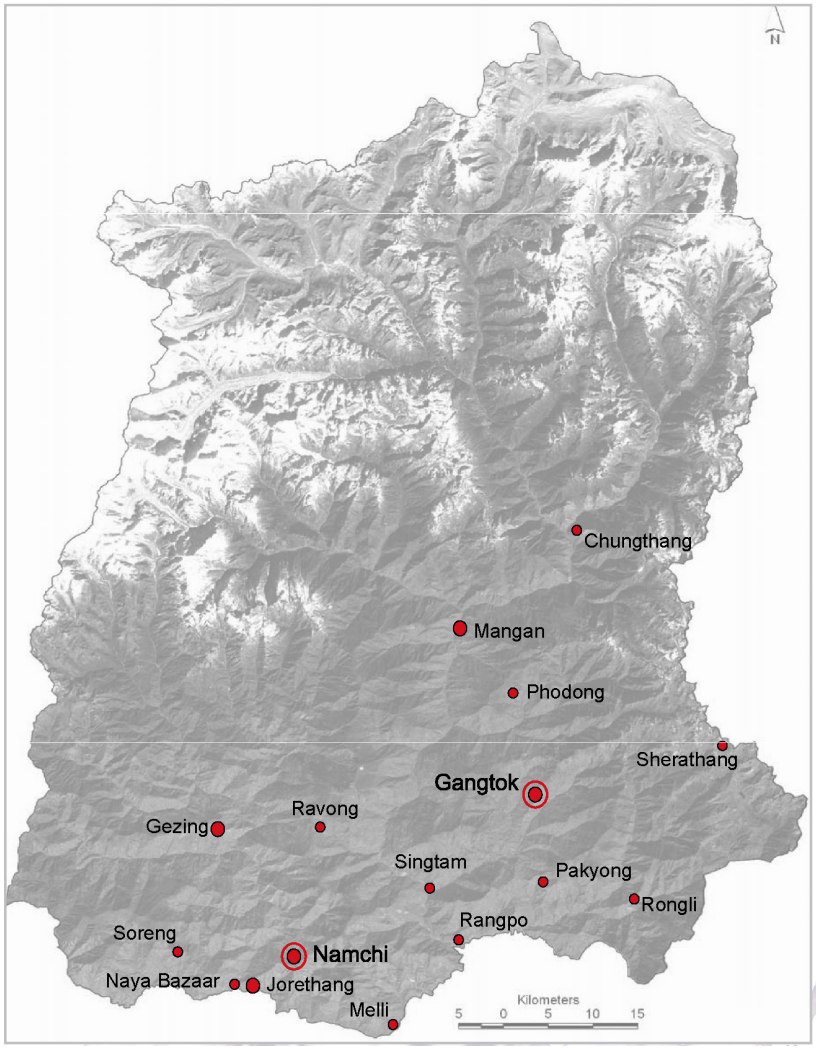


Figure 3.1.1 Proposed 16 Urban Centers for State Strategic Plan – Inclusive of 8 Established Towns and 8 Additional Towns

3.1 Identification of Significant Towns

South District Planning Area

[Growth Driver : Industrial Development, Administrative Center]

- Namchi Urban-Area: 2nd "Administrative Center" supporting Gangtok as a sub-Capital
- Jorethang Sub-Area: "Interstate Trade Center" due to its proximity to West Bengal
- Ravong Sub-Area: "Tourism Development Zone" to capitalize on the attractions in the area
- Melli Sub-Area: "Fringe Center" which is self-contained since it is seen as the face of Sikkim to welcome arrivals of visitors to Sikkim; potential to be another "Interstate Trade Center" due to its proximity to West Bengal

West District Planning Area

[Growth Driver : Geyzing – Pelling Tourism]

- Geyzing Urban-Area: "Tourism Development Zone" to capitalize on the attractions in the area
- Nayabazaar Sub-Area: "Interstate Trade Center" due to its close proximity to West Bengal
- Soreng Sub-Area: "Local Trade Center" to cater to the population in the south part of West District

North District Planning Area

[Growth Driver : Hydel Projects, Tourism Development]

- Mangan Urban-Area: "Northern Service Center, Hydro Electric Projects" to capitalize the possible hydro power generated along Tista River
- Phodong Sub-Area: "Tourism Development Zone" to capitalize on the attractions in the area
- Chungthang Sub-Area: "Tourism Development Zone" to capitalize on the attractions in the area

3.2 Urban Population Distribution

A Re-structure

Multiple Nuclei Structure

	2006	2015	2025	2040
State Population	581546	660000	790000	1100000

As stated in preceding Section 1.5, the projected population for State of Sikkim by Year 2040 is about 1.1 million persons. This long-term target is further extrapolated to align with the proposed staging plans of short-term (2015), medium-term (2025) and long-term (2040), as shown in the above table. Using the moderated Multiple Nuclei Structure, population distribution in each town across the State can be estimated accordingly.

With the re-calibrated population sizes for different towns, the hierarchy of the 16 towns can be restructured based on a 3-class system as defined in the Indian Constitutional Classification of Municipalities (see Table 3.2.1 below).

Table 3.2.1 Indian Constitutional Classification of Municipalities

Large Urban Area	Smaller Urban Area	Transitional Area
>3,00,000	Class A 150,000 – 300,000	<25,000
	Class B 75,000 – 150,000	
	Class C 25,000 – 75,000	

Table 3.2.2 Proposed Township Hierarchy for the 16 Urban Centers

Township Hierarchy		
Tier 1 **(75000 - 150000)**	**Tier 2** **(25000- 75000)**	**Tier 3** **(< 25000)**
Gangtok	Geyzing	Singtam
Namchi	Mangan	Ranpo
		Pakyong
		Jorethang
		Ravong
		Melli
		Sherathang
		Rongli
		Nayabazaar
		Soreng
		Phodong
		Chungthang

The new hierarchy, as in Table 3.2.2 above, has applied the 3-class system concept to the the Multiple Nuclei Structure with some moderations in the population scales in Sikkim's context. The hierarchy places Gangtok and Namchi as the 1st Tier Town to stress upon their importance as core towns. It is then followed by the 2nd Tier for Geyzing and Mangan. The remaining 11 towns fall under the 3rd Tier Category.

3.2 Urban Population Distribution

Table 3.2.3 below shows the proposed distribution of urban population across the 16 towns. As highlighted earlier, urban population is assumed to hit 50% of the overall State population in the long-term from the current 25%. An interval of 5% gradual increment is assumed over the short-term and medium-term.

Table 3.2.3 Projected Urban Population Distribution by 2015, 2025 and 2040

	2015	% share	2025	% share	2040	% share
Urban Population	**264000**	**40%**	**355500**	**45%**	**550000**	**50%**
East district*	**184800**	**70%**	**213300**	**60%**	**247500**	**45%**
Gangtok	138600	75%	149310	70%	160875	65%
Singtam	14784	8%	17064	8%	22275	9%
Rangpo	14784	8%	17064	8%	22275	9%
Pakyong	9240	5%	17064	8%	22275	9%
Sherathang	3696	2%	6399	3%	12375	5%
Rongli	3696	2%	6399	3%	7425	3%
West District	**13200**	**5%**	**21330**	**6.0%**	**55000**	**10%**
Geyzing - Pelling	7920	60%	12798	60%	35750	65%
Nayabazaar	3960	30%	6399	30%	13750	25%
Soreng	1320	10%	2133	10%	5500	10%
North District	**13200**	**5%**	**21330**	**6.0%**	**55000**	**10%**
Mangan	7920	60%	12798	60%	35750	65%
Phodong	3960	30%	6399	30%	13750	25%
Chungthang	1320	10%	2133	10%	5500	10%
South District	**52800**	**20%**	**99540**	**28%**	**192500**	**35%**
Namchi	31680	60%	64701	65%	134750	70%
Jorethang	10560	20%	14931	15%	23100	12%
Ravong	5280	10%	9954	10%	17325	9%
Melli	5280	10%	9954	10%	17325	9%

3.3 Urban Land Requirement

	Current	2015	2025	2040
Urban Land Area				

Increasing urban population will require a larger urban area equipped with all the basic urban infrastructure and amenities. Hence, it is essential to address the demand for additional developable land.

Given our analysis and evaluation of the current urban land profile and constraints in Section 1.3, developable urban land across the State can be scoped. With the estimated population for each of the key towns in Section 3.2 and related assumption on the development density, urban land requirement for short-term, medium-term, and long-term can be determined.

In addition to the population factor determining urban land requirement, the existing fabric of towns and their potential functions will add an extra dimension to the land requirement. For instance, operation of Nathu La Pass is likely to require a larger trade zone at the border for greater cross-border trade activities. The present Sherathang Bazaar could be developed into a prime Commercial/ Trade Zone, besides the current industrial towns of Rangpo, Singtam and Jorethang.

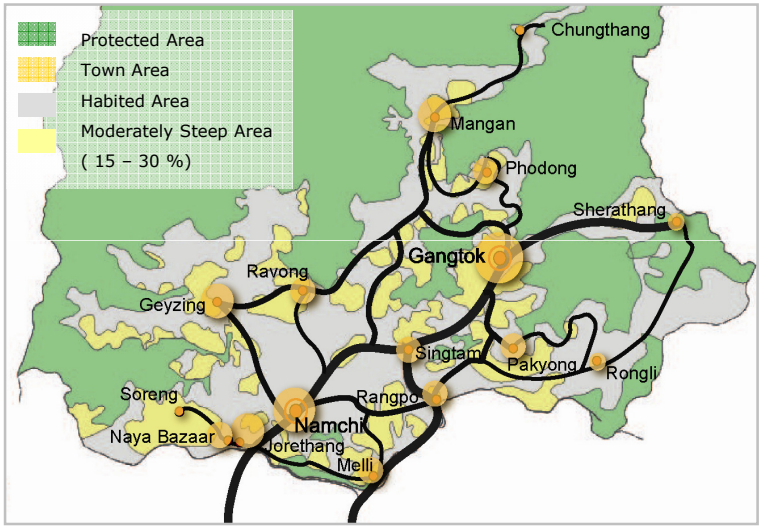


Figure 3.3.1 Potential Development Zones

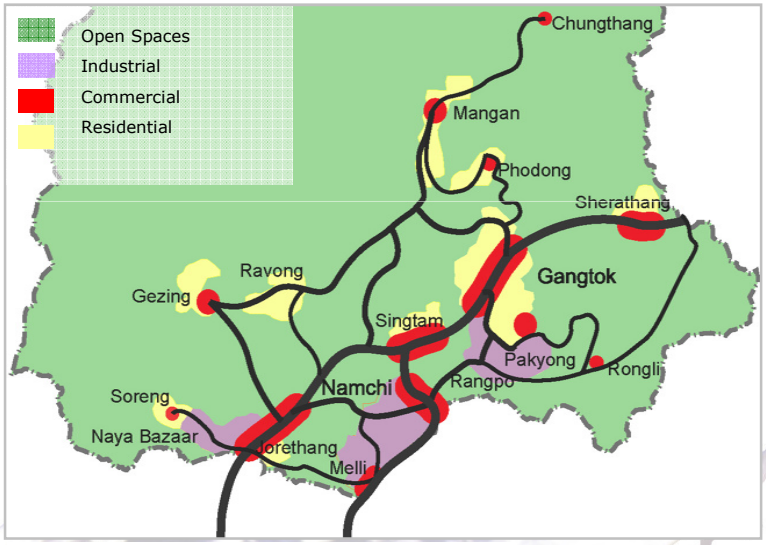
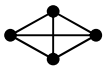
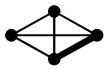
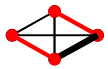


Figure 3.3.2 Potential Activity Zones

3.4 Urban Linkages

Principles for Road Connections & Hierarchy Planning

	Current	2015	2025	2040
Connections				

It is important that the re-defined township hierarchy has to be supported by an effective and efficient structure of transportation system. As illustrated in next two pages (Figures 3.4.3 to 3.4.7), the existing transport connections are the skeleton of the overall road structure. Road enhancement schemes in the forms of localized upgrading and/or re-routing to reduce traveling time between towns will be the planning focus. They are explored with considerations of the recommended township hierarchy as well as the current road linkages between the significant towns.

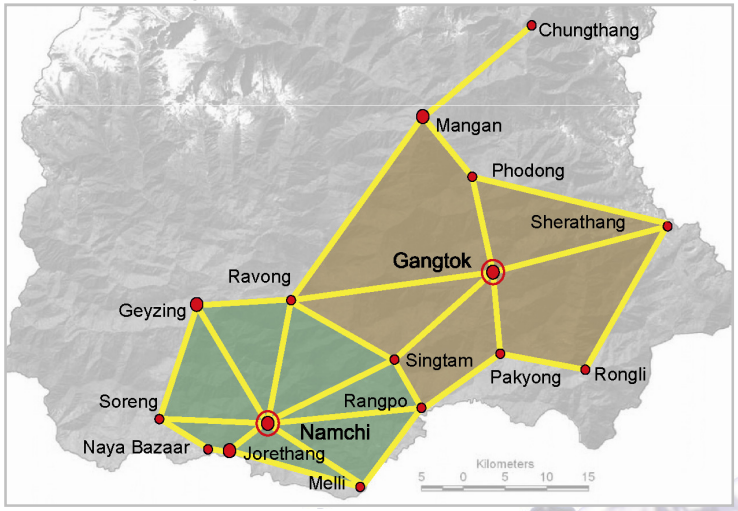


Figure 3.4.1 Spread of Urban Area

Based on the stated general principles a conceptual structure of the road network is developed for linkages between the significant towns in Figure 3.4.2 below. As seen in the plans, the boundaries of urban area spread in tandem with the desired road connections between towns. To give a complete picture, external linkages (e.g. inter-state connections) are included in this planning. For example, the NH31A could be extended from its current route to form a loop connecting Darjeeling-Naya Bazaar-Namchi-Singtam.

In addition, a road hierarchy will be established according to the expected frequency of usage of a particular route by commuters which in turn is assessed by the significance of the route fitting into the township hierarchy.

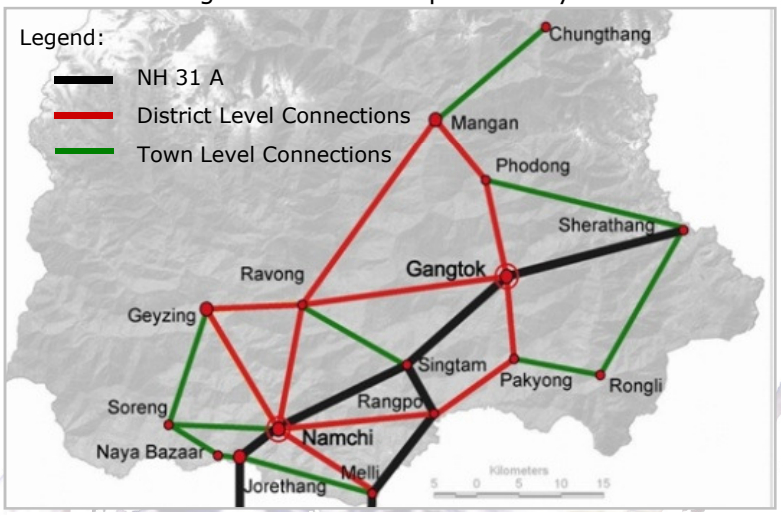


Figure 3.4.2 Conceptual structure of Connections between significant towns

3.4 Urban Linkages

Development of Concept for Road Connections & Hierarchy

To facilitate an outline of the overall road structure enabling efficacy of traveling by roads, the shortest existing physical road connections (assumed equally with the shortest traveling time) between towns are first ascertained as an underlying planning factor because existing roads should be made good use of wherever possible (see Figures 3.4.3 and 3.4.4 below).

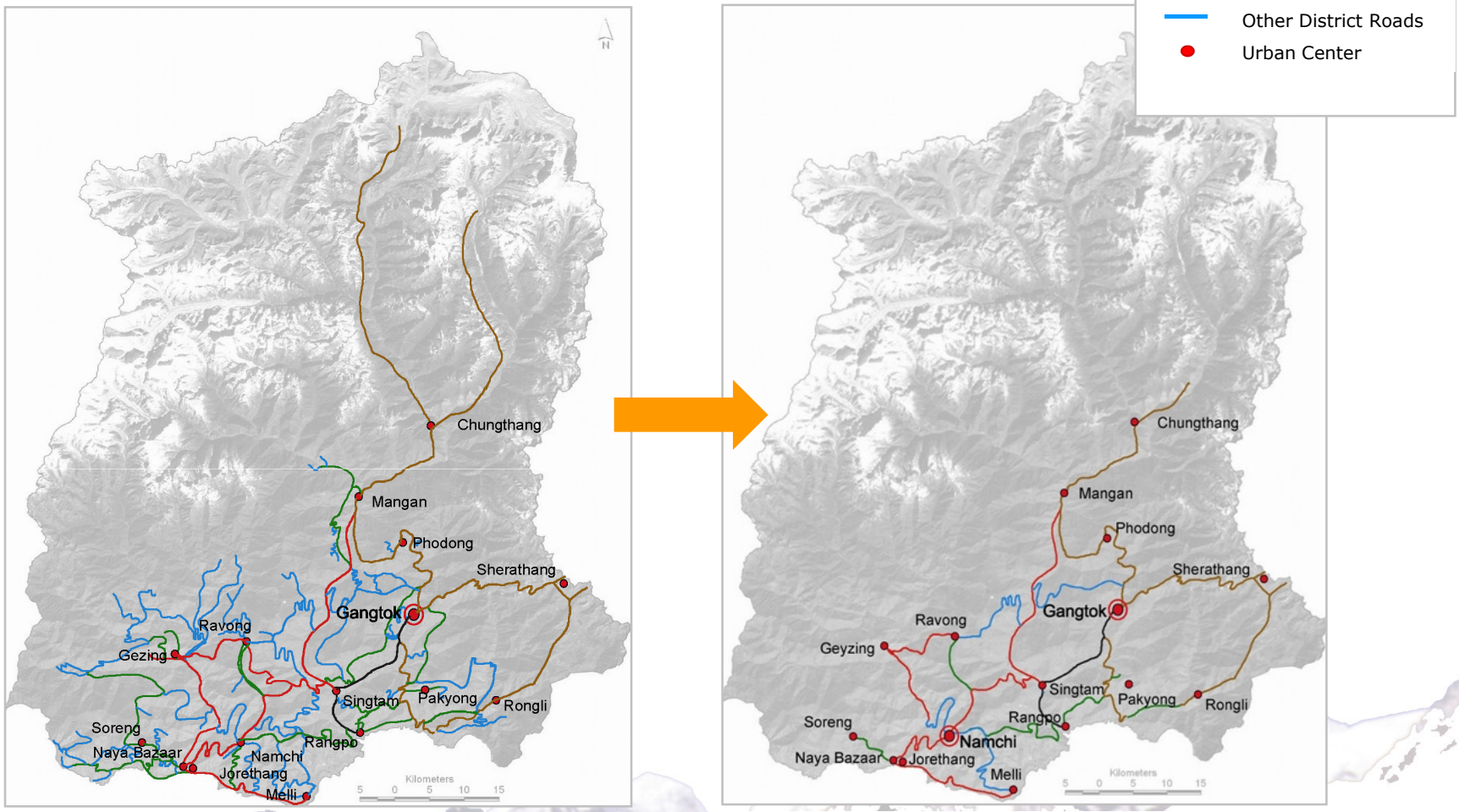


Figure 3.4.3 Existing Road Networks

Figure 3.4.4 Shortest Existing Road Connections

3.4 Urban Linkages

Development of Concept for Road Connections & Hierarchy

Upon identification of the shortest road connections between the significant towns, it is measured against the conceptual structure of road network between the significant towns under the adopted township hierarchy. The result of a road hierarchy in Sikkim hence emerges in Figure 3.4.7.

Key emphasis is placed upon the linkage between two 1st Tier towns , Gangtok and Namchi, by upgrading it to be the national highway to Darjeeling. Other State highways (represented in red lines) are proposed between the four district capitals.

Legend:

- NH 31 A
- Boarder Roads
- State Highway
- Major District Roads
- Other District Roads
- Urban Center
- Dual 2 @ Lane 3.75m
- Dual 1 @ Lane 3.75m
- Dual 1 @ Lane 3m

Figure 3.4.5 Shortest Existing Road Connections

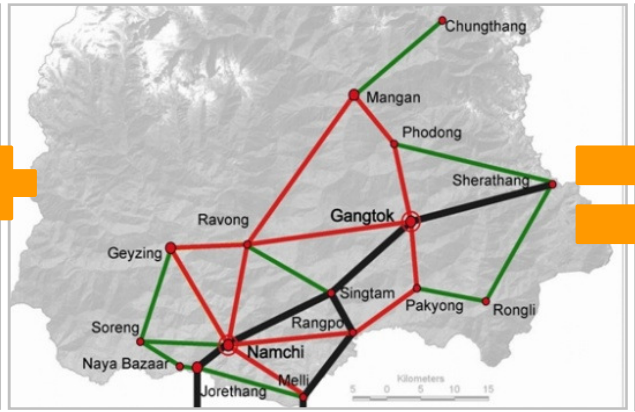


Figure 3.4.6 Conceptual structure of Connections between significant towns

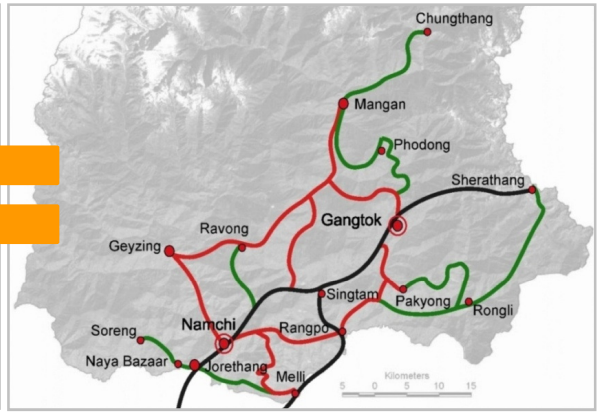


Figure 3.4.7 Proposed Hierarchy for Road Connections

3.4 Urban Linkages

Specific Road Schemes

- Based on the Multiple Nuclei Township Structure in which Gangtok and Namchi are proposed to be the core 1st Tier towns in Sikkim, a direct road linkage is important to connect the 2 major nodes and hence a dual-2 national highway is proposed as a high volume of traffic between these 2 main centers is anticipated. (see Figure 3.4.9). It will connect with the existing N31A highway to from a loop road.

- However, the topographical constraints offering very limited space may cause implementation of a dual-2 road difficult. Since Roads & Bridges Department reveals that there has been a confirmed proposal to build a new highway from Rangpo to Gangtok parallel to the existing N31A Highway but on the other side of the river, this will give an expanded traffic carrying capacity as good as a dual-2 road (see Figure 3.4.11). Only connecting bridges at selective locations will be sufficient.

- In support of this spine road, a ring road system through improvements to the existing road condition is proposed to enhance connections between Gangtok, Namchi and other adjacent towns (red lines in Figure 3.4.8). The road improvements consisting of road straightening and widening and elevated viaducts for selective segments will facilitate comfortable travel at higher speed and hence reduction of travel time (Figures 3.4.10 and 3.4.12)

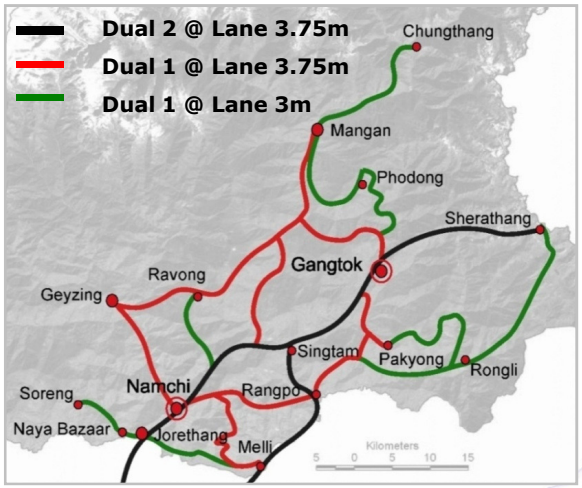


Figure 3.4.8 Proposed Hierarchy for Road Connections

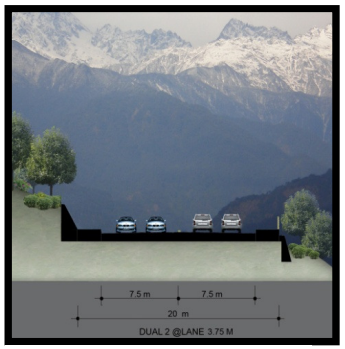


Figure 3.4.9 Proposed dual-2 road to be constructed

Figure 3.4.10 Proposed dual-1 road (3.75m) to be constructed

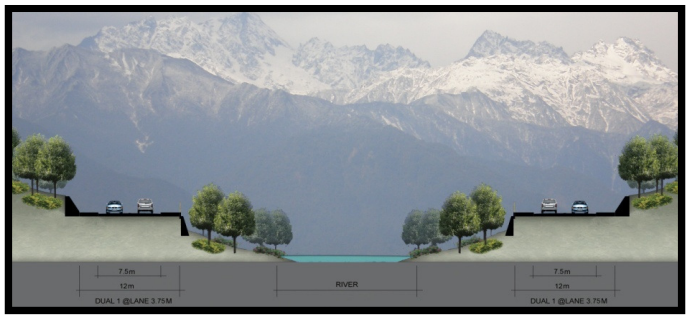


Figure 3.4.11 Proposed dual-2 road to be implemented

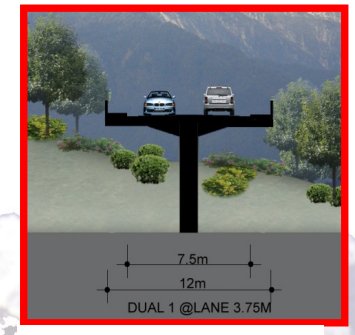


Figure 3.4.12 Proposed dual-1 road (3.75m) to be constructed

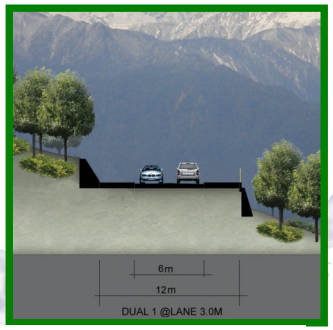


Figure 3.4.13 Proposed dual-1 road (3m) to be constructed

3.4 Urban Linkages

Possible Rail Schemes

- As there is no rail available within the State of Sikkim, passenger and cargo transportations rely heavily on roads. The planning strategy is to introduce a comprehensive rail system, despite the harsh physical terrain, as rail services will greatly improve travel time between towns.

Figure 3.4.15 State Rail

- The overall rail network proposal stresses upon creation of a main State Rail trunk service (red dotted-line in Figure 3.4.14, Figure 3.4.15) connecting the future trade nodes at Nathu La, Gangtok, Pakyong (new airport), Namchi, and then West Bengal.

- The interchange at Pakyong will further allow inter-modal transfer for both passengers and cargoes. This rail link (Figure 3.4.17) is strategically significant because it will enable fast physical connectivity between towns and trade/business activity spots in support of economic development in Sikkim.

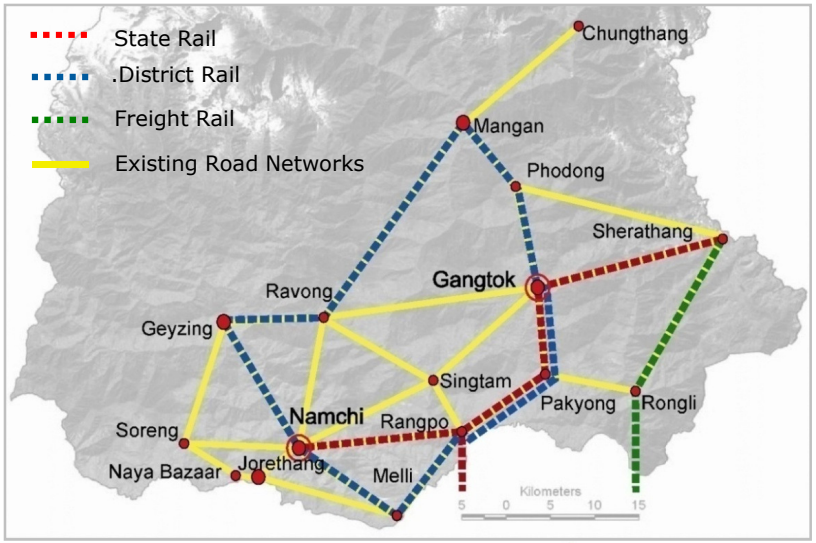


Figure 3.4.14 Proposed Rail Linkages

Figure 3.4.16 Possibility of Monorail for District Rail

- A further District Rail sub-system in ring pattern (blue dotted-line in Figure 3.4.14) is added to connect other urban centers and towns to enhance inter-town accessibility. A separate technical feasibility study will be needed to identify the suitable type of subsystem such as Light Rail Transit or Monorail (see Figure 3.4.16).

Figure 3.4.17 Freight Rail

3.5 Tourism Development

Tourism Master Plan for Sikkim

Following the overview of tourism in Sikkim for the Urban Master Plan, it is apparent that tourism can play a significant role in strengthening the Sikkim economy and provide meaningful business and employment opportunities over the next years and decades.

It is highly recommended that a proper Tourism Master Plan for the state of Sikkim be undertaken to systematically guide the development of tourism in Sikkim to its full potential.

Tourism is a dynamic and lucrative industry with the potential of developing Sikkim's natural assets to full advantage. However without a professionally prepared tourism master plan to guide the growth, there may be a danger of unintended consequences of over-development, misused resources or wrong policy decisions.

Figure 3.5.1 Streets of Sikkim

3.5 Tourism Development

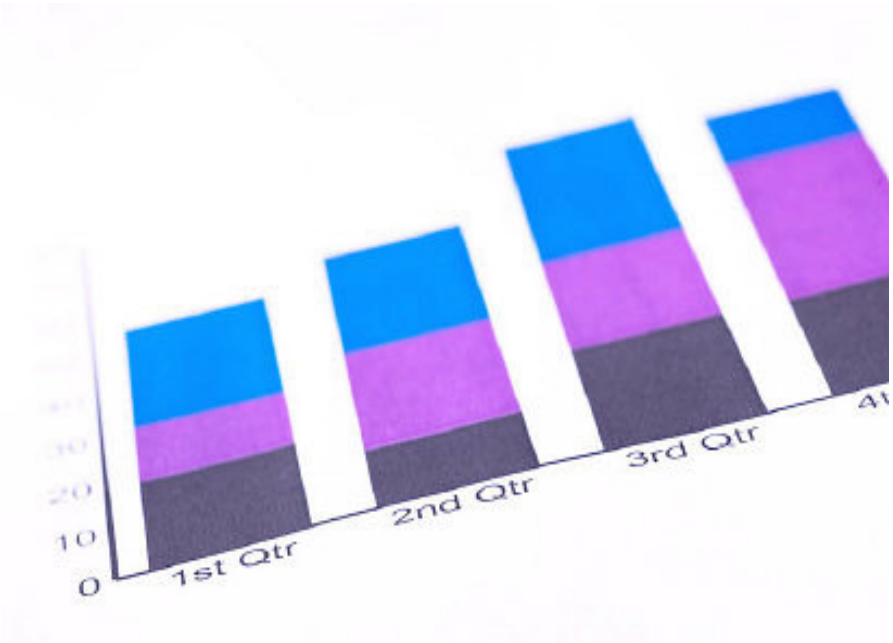
Tourism Statistics and Data

One of the observations resulting from the overview of tourism in Sikkim for the Urban Master Plan is the very basic state of tourism statistics and data in Sikkim.

The available data on visitors is limited to arrivals and their places of origin. This should be further supplemented with the full range of other demographic, behavioral and psychographic information to assist in tourism marketing and product development.

Information on the hotel sector is also scanty. Ideally there should be a centralized agency for licensing and regulation of the hotel sector with full overview of performance standards and demand and supply needs to properly regulate the sector to bring maximum returns to the state.

Data from the various professional associations within the tourism industry like hotels, travel agents, tour guides, handicraft makers, restaurants and retail can also be strengthened to enable them to play more positive roles to strengthen tourism in Sikkim. Full and up-to-date information on their members and the activities will allow various programmes to be introduced to benefit these associations to further tourism in Sikkim.



3.5 Tourism Development

Expansion of Tourism Space

One of the key areas to be addressed within the proposed Tourism Master Plan for Sikkim is the consideration to expand the tourism space of Sikkim.

Tourism in Sikkim is currently most developed within Gangtok and at Geyzing / Pelling. Tourism development in and around the other district administrative centres of Namchi and Mangan is also noted.

To reduce the impact of tourism's negative consequences, and to spread the benefits of tourism throughout the state, the tourism master plan for Sikkim should also address the development of secondary and alternate tourism areas, in particular opening new trails, developing the areas around and north of Mangan, and the route to and from the Natula Pass.

Figure 3.5.2 Mountain Ridges in Sikkim

3.5 Tourism Development

Environmental / Social Considerations

Tourism development, as discussed in their overview for the Urban Master Plan, is likely to result in a very positive contribution to Sikkim in terms of GDP and employment generated. It is important to note however that tourism development is sometimes also fraught with dangers which policy makers should be aware of, so that appropriate steps and policies can be taken to minimize or negate these potential ills.

Tourism in Sikkim relies heavily on the pristine environmental conditions, glorious walking and trekking trails and unspoiled natural beauty. There is evidence already that there is some degradation of this beauty through uncontrolled littering and indiscriminate development. Efforts must be initiated to ensure that the natural assets of the state are preserved sustainably. In fact tourists and trekkers are often well disposed to assist Sikkim in pro-conservation initiatives like re-forestation if proper programmes are in place.

One of the most important developments within Sikkim is the planned introduction of casino licenses with certain 5-star hotels in the next years. This is likely to bring an influx of visitors, both Indians and foreigners, into Sikkim to partake of this casino facility, a boon to tourism in Sikkim.

While the entry criteria and limitations of these casinos are not yet known, it is pertinent to remember that in many other places, the introduction of casinos is almost always accompanied by in increase in crime and prostitution, and social ills like problem gambling, break-up of families, weakening of the social fabric due to the belief of 'easy money'. It is important that authorities are alerted to these so as to mitigate these ills with appropriate policies and programmes.

4.0 Short-Term Strategies : 2 0 1 5

4.1 Urban Land Requirement
4.2 Urban Linkages
4.3 State Strategic Structure

4.1 Urban Land Requirement : 2015

Based on the respective density models mentioned in Section 1.5, the land requirement for the growth of each town is calculated as shown in Table 4.1.1. Figure 4.1.1 on next page illustrates the land requirement projections:

While growth will be decentralized from Gangtok; other smaller surrounding towns of Singtam, Rangpo, Namchi, Mangan and Geyzing will continue to grow. Gangtok will require about 24 sq km of developable land area in total. As Namchi is to grow at a faster pace, adequate developable land should be made available by 2015. Based on the population and density assumed, Namchi will require a total of about 8 sq km of land; for Singtam and Rangpo, an approximate developable land area of 7.5 sq km each.

Pakyong Airport, once completed, will be a catalyst to stimulate growth in Pakyong as well as its surrounding region. Around 5 sq km of developable land area will be required by 2015.

Table 4.1.1 Land Required for Growth of Towns by 2015

2015			
	Population	**Land Required**	**Residential Units*** **
Urban Population / Land	**264000**	**sq km**	
East district	**184800**		
Gangtok*	138600	23.1	34650
Singtam	14784	7.4	3696
Rangpo	14784	7.4	3696
Pakyong	9240	4.6	2310
Sherathang	3696	1.8	924
Rongli	3696	1.8	924
West District	**13200**		
Geyzing	7920	4.0	1980
Nayabazaar	3960	2.0	990
Soreng	1320	0.7	330
North District	**13200**		
Mangan	7920	4.0	1980
Phodong	3960	2.0	990
Chungthang	1320	0.7	330
South District	**52800**		
Namchi**	31680	7.9	7920
Jorethang	10560	2.6	2640
Ravong	5280	2.6	1320
Melli	5280	2.6	1320

Note:

* Land Requirement for Gangtok is based on Density Model 6000/sq km.

** Land Requirement for Namchi is based on Density 4000/sq km.

Land Requirement for remaining towns are based on Low Density Model 2000/sq km.

*** Number of Residential Units @ 4 Persons / Household.

4.1 Urban Land Requirement : 2015

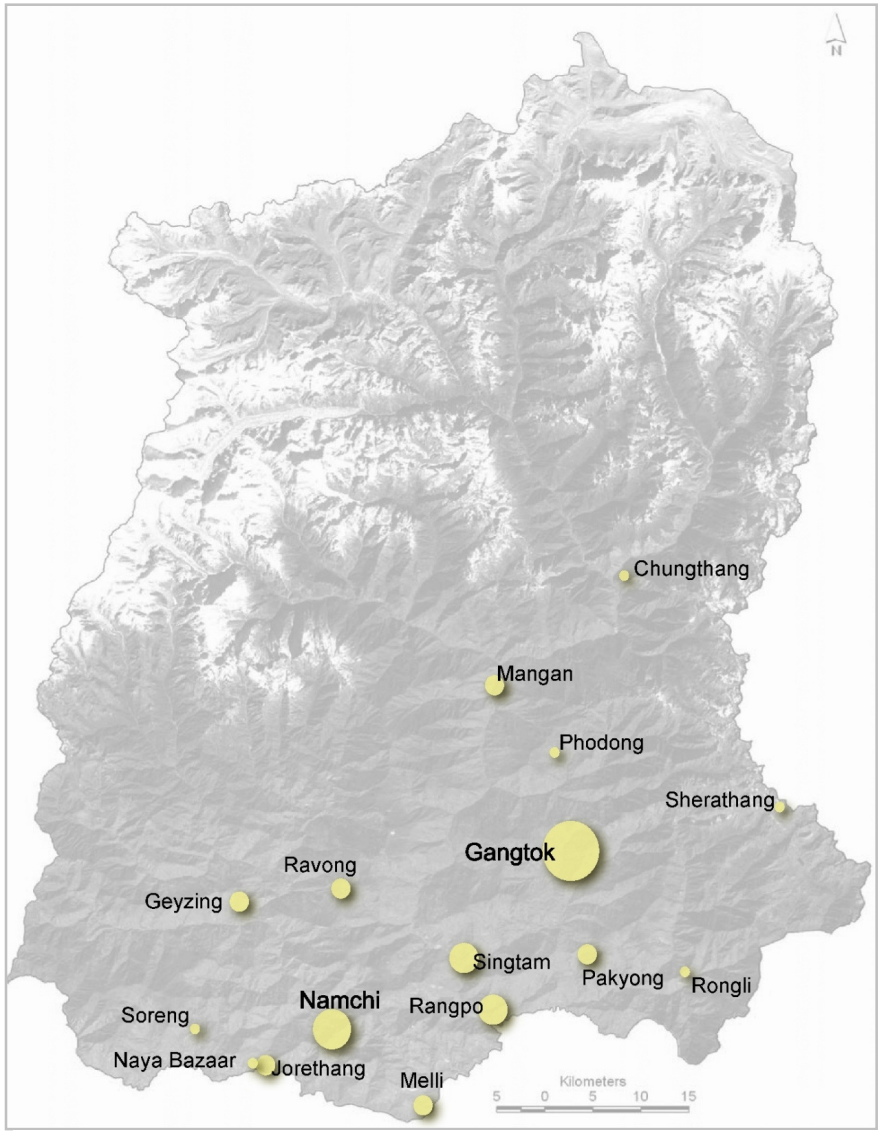
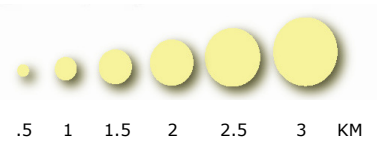


Figure 4.1.1 Illustration of the extent of land required per town for expansion by 2015.

Sherathang will also encounter growth pressure due to Nathu La cross border trades and hence it should be provided with adequate infrastructure and developable land area of around 1.8 sq km. Rongli in the same district is expected to need 1.8 sq km of buildable land. Similarly, growth of Namchi will impact on Jorethang and Nayabazaar. Jorethang is expected to expand to as much as 2.6 sq km in land area, while Naya Bazaar could reach 2 sq km in land size.

Smaller towns like Soreng & Chungthang being remotely located will be less impacted by the growth pressure and hence land size of less than 1 sq km is estimated. Phodong and Rongli should remain secondary towns and require 2 and 1.8 sq km of developable land respectively. Ravong and Melli in the South District hold both tourism and industrial significance and each will need a larger land area of 2.6 sq km of land.

Land Area Measure



Radius (km)	0.5	1	1.5	2	2.5	3
Area (sq km)	0.8	3.1	7.1	12.6	19.6	28.3

4.2 Urban Linkages : 2015

Road Link

Referring to Figure 4.2.1, Road Links for the four district headquarters shall be strengthened. In addition to the ongoing proposal of continuing the NH31A from Rangpo–Gangtok till Nathu La (Sherathang) in the East, it is also essential to connect it to the West linking Namchi further down to the NH31A in Darjeeling. The main corridor consists of all the major roads and are proposed to be upgraded to a dual-2 lane roads with a fifteen meter wide carriageway (20 m Formation) for efficient vehicular movement. The road linking Mangan & Pakyong to Gangtok and Gezing to Namchi are the other significant linkages that connect these towns to the main corridor. It will be widened to proper 2 lanes of total 7.5 meter for two-way traffic; total road dimension is 12m inclusive of side-table.

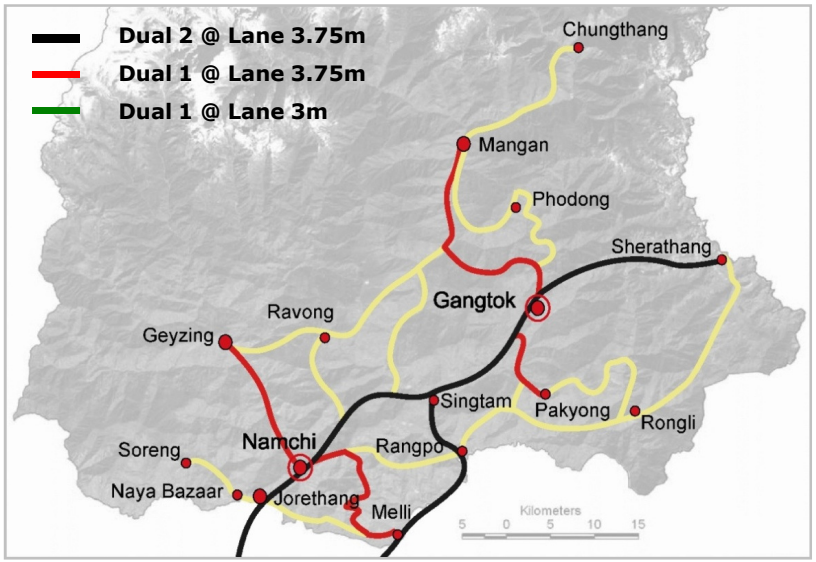


Figure 4.2.1 Proposed Road Network by 2015

Rail Link

Referring to Figure 4.2.2, the Red Line is to be established along the major towns from Sherathang to Namchi via Gangtok, Pakyong, Rangpo, Melli & Jorethang. This Rail Link is an expansion of the ongoing scheme between Gangtok to Siliguri which has already been approved.

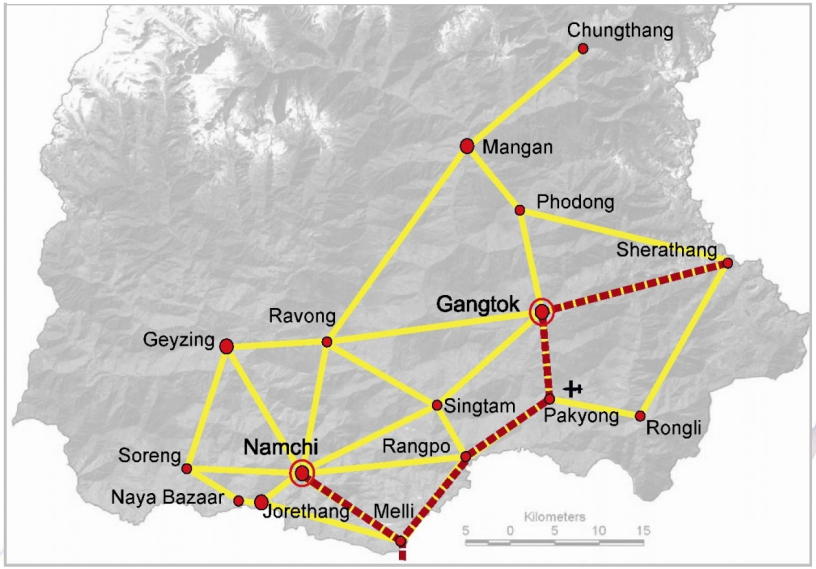


Figure 4.2.2 Proposed Conceptual Rail Link
[Physical alignment to be studied after feasibility studies]

Airport

The Pakyong Airport shall first be well connected to the two mega towns of Gangtok & Namchi as well as the cross border trade center at Sherathang. This idea is reflected in both the road & rail link proposals. Domestic flights for Delhi-Pakyong and Kolkata–Pakyong will stand to boost higher domestic tourists' visits. The present Helicopter service in Gangtok could also be used for tourism purposes such as scenic flights around the region. Helicopter Services from Pakyong to Namchi, Geyzing and Mangan shall also be explored since air travel can substantial cut travel time in this mountainous place.

4.3 State Strategic Structure : 2015

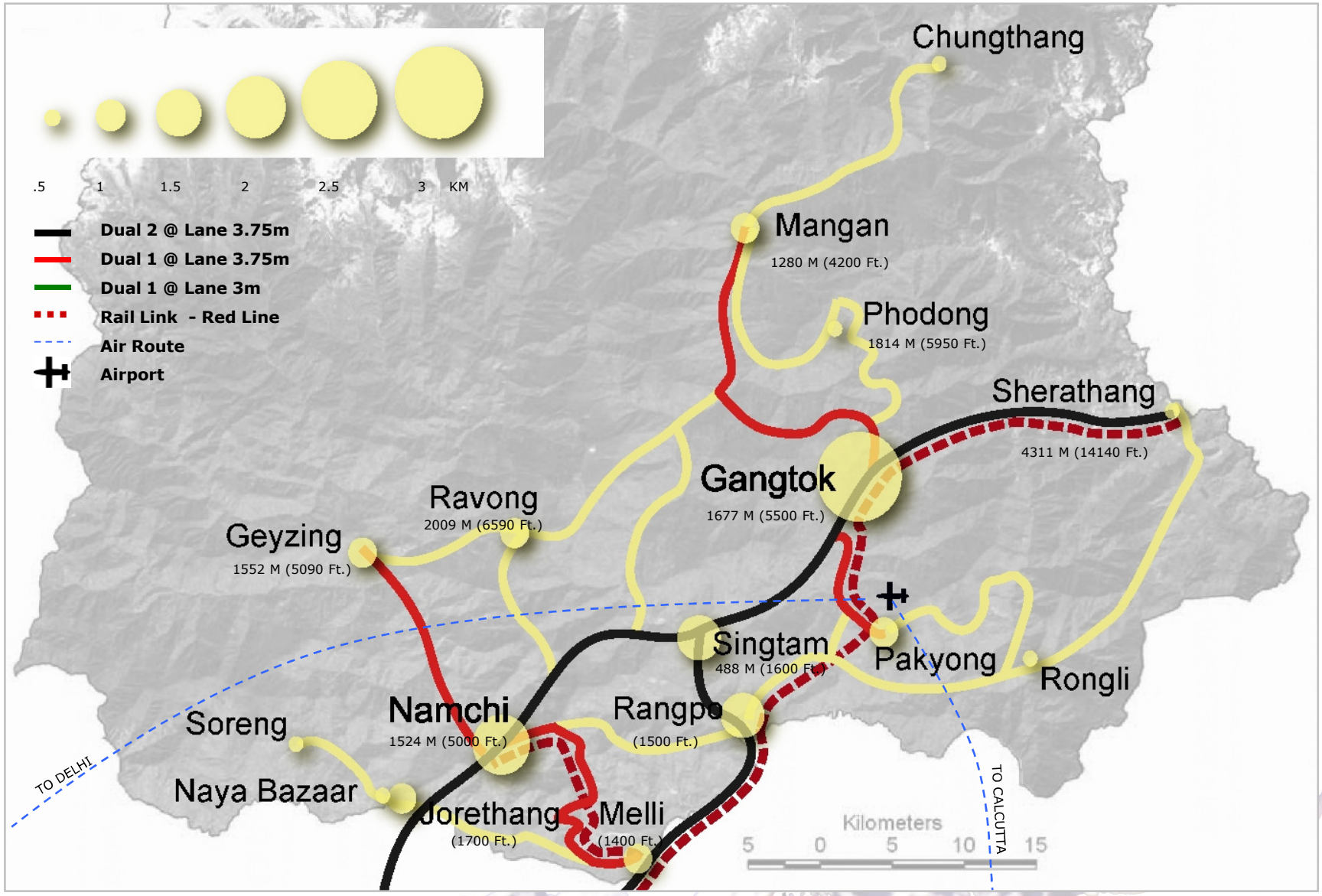


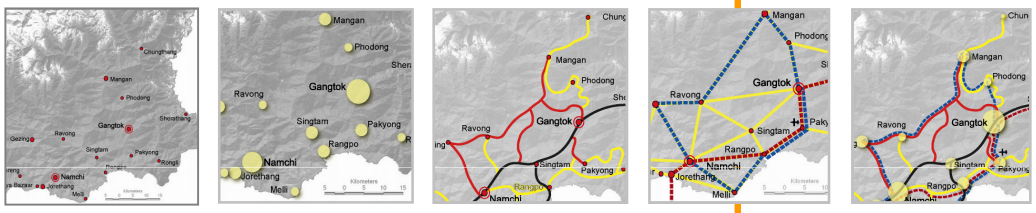
Figure 4.3.1 Overall State Strategic Plan by 2015

5.0 Medium-Term Strategies : 2025

5.1 Urban Land Requirement

5.2 Urban Linkages

5.3 State Strategic Structure



5.1 Urban Land Requirement : 2025

Based on the respective density models mentioned in Section 1.5, the land requirement for the growth of each town is as shown in Table 5.1.1. Figure 5.1.1 on next page illustrates the land requirement projections:

Both Namchi & Gangtok become the Mega Towns catering to the other smaller towns around the region. While Gangtok requires a limited 2 sq km of additional developable land, focus will set mainly on urban redevelopment and rejuvenation. However, Namchi will continue to grow at a fast pace and require an additional 8 sq km of developable land between 2015 to 2025.

The expansion of Namchi will stimulate growth in the adjacent Jorethang & Nayabazaar which are expected to need 7 sq km of developable land together for this municipality. Pakyong shall see sizeable growth requiring 8.5 sq km of developable land by 2025. All infrastructure and facility provisions shall be planned according to the eventual population size.

Note:

* Land Requirement for Gangtok is based on Density Model 6000/sq km.

** Land Requirement for Namchi is based on Density 4000/sq km.

Land Requirement for remaining towns are based on Low Density Model 2000/sq km.

*** Number of Residential Units @ 4 Persons / Household.

Table 5.1.1 Land Required for Growth of Towns by 2025

	2025		
	Population	**Land Required**	**Residential Units*** **
Urban Population / Land	**355500**	**sq km**	
East district	**213300**		
Gangtok*	149310	24.9	37328
Singtam	17064	8.5	4266
Rangpo	17064	8.5	4266
Pakyong	17064	8.5	4266
Sherathang	6399	3.2	1600
Rongli	6399	3.2	1600
West District	**21330**		
Geyzing	12798	6.4	3200
Nayabazaar	6399	3.2	1600
Soreng	2133	1.1	533
North District	**21330**		
Mangan	12798	6.4	3200
Phodong	6399	3.2	1600
Chungthang	2133	1.1	533
South District	**99540**		
Namchi**	64701	16.2	16175
Jorethang	14931	3.7	3733
Ravong	9954	5.0	2489
Melli	9954	5.0	2489

5.1 Urban Land Requirement : 2025

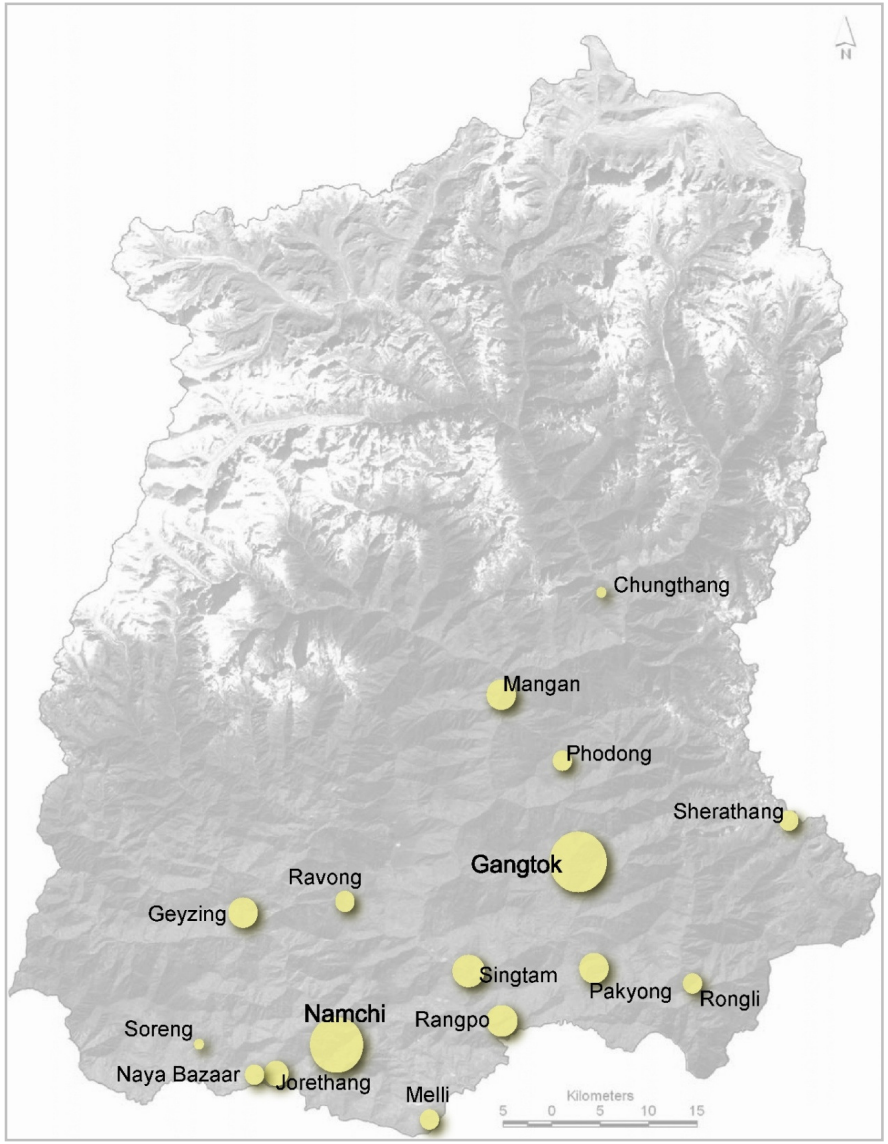
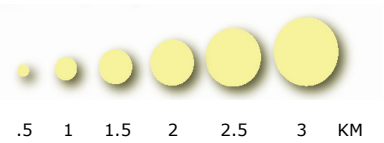


Figure 5.1.1 Illustration of the extent of land required per town for expansion by 2025.

Geyzing, Mangan, Singtam, Rangpo will become communities that offer all the basic community level services. Geyzing & Mangan are expected to require 6.4 sq km of developable land. However, Singtam & Rangpo will see a slower growth with just additional 1 sq km of developable land required for each town.

Ravong, Phodong, Sherathang, Rongli & Melli will continue to grow bigger; however, Soreng & Chungthang shall remain as tertiary towns. Both towns face physical limitations from the Protected Areas in the West. However, the availability of Moderately Steep Land (15–30 % Slope) gives potential scope for future developments. Most of these towns are within the commuting range of Namchi & Gangtok and therefore will remain dependent on these mega towns for most of the amenity services. Chungthang, however, will depend on Mangan for basic services.

Land Area Measure



Radius (km)	0.5	1	1.5	2	2.5	3
Area (sq km)	0.8	3.1	7.1	12.6	19.6	28.3

5.2 Urban Linkages : 2025

Road Link

Referring to Figure 5.2.1, a shorter link for Geyzing – Mangan via Ravong and Dikchu shall be upgraded to 12m wide, of which 7.5 meter is reserved for 2-way traffic on 2 lanes. Geyzing – Gangtok & Namchi – Mangan are other essential connections to be strengthened by 2025. These linkages shall all be upgraded to the 12m wide road category with dual carriageways of 7.5 meters in total.

Rail Link

Referring to Figure 5.2.2, a separate peripheral District Rail Link is proposed as the alternative mode of transportation to lessen the traffic load on the major roads. This second Rail Link is shown as a blue-circle line and is to be aligned with the rest of the significant towns of Geyzing, Ravong, Mangan, Phodong, Pakyong, Rangpo, Melli, Jorethang, Nayabazaar with major Interchanges at Gangtok, Namchi and Pakyong Airport. A technical feasibility study to identify the most suitable rail system should be carried out for this linkage.

Airport

The circle line & red line, once implemented, shall provide an effective airport connections with all the significant towns. Other than the proposed domestic flight routes between Delhi–Pakyong & Kolkata–Pakyong in 2015, more routes even beyond domestic arena could be explored. Kathmandu-Pakyong, Lhasa– Pakyong and Thimpu–Pakyong are some of the potential air routes and could be phased as per the flight route demand.

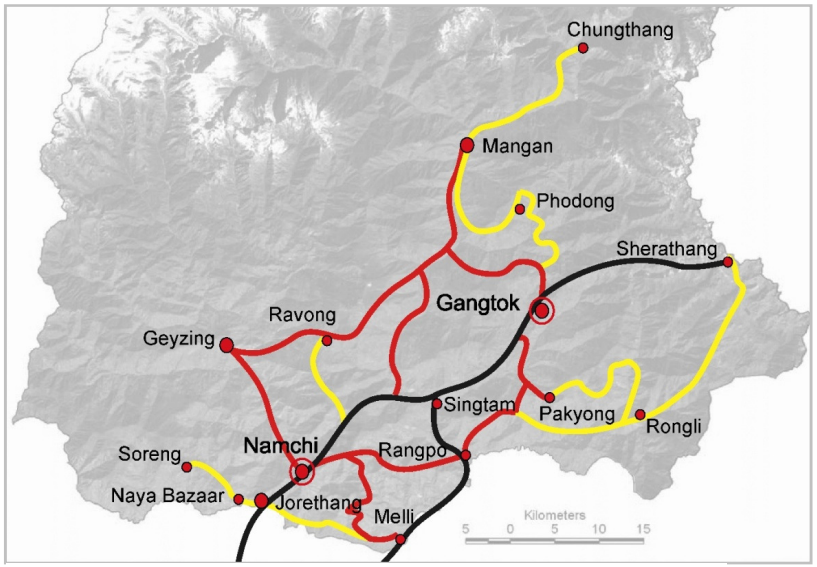


Figure 5.2.1 Proposed Road Structure in 2025

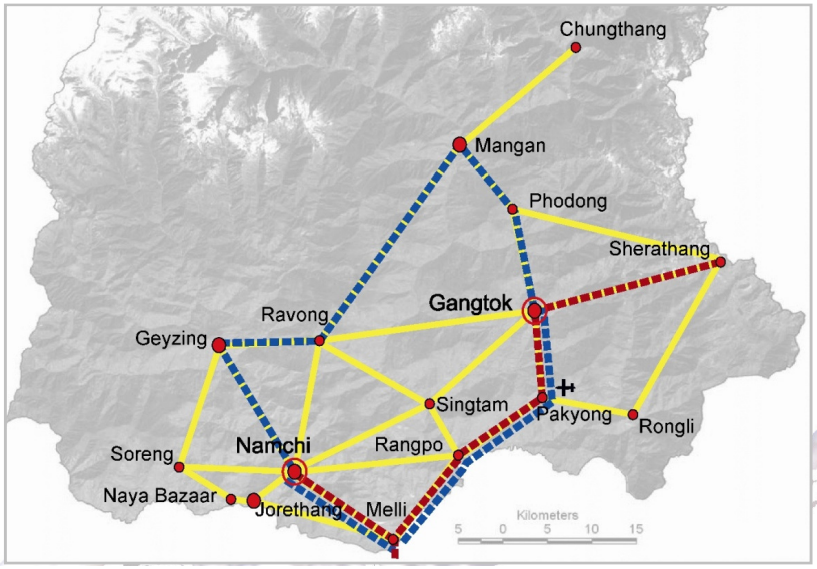


Figure 5.2.2 Proposed Conceptual Rail Link
[Physical alignment to be studied after feasibility studies]

5.3 State Strategic Structure : 2025

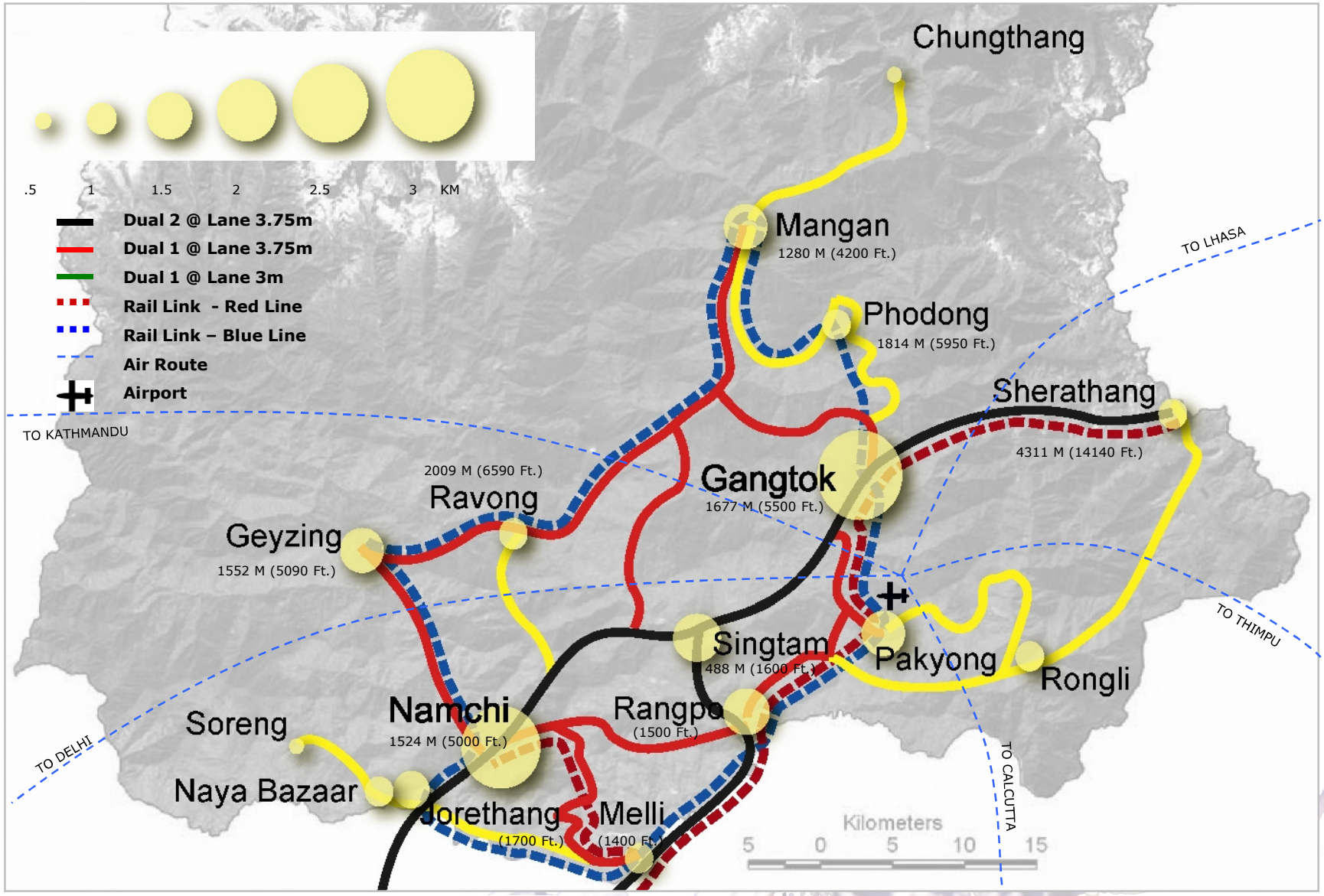
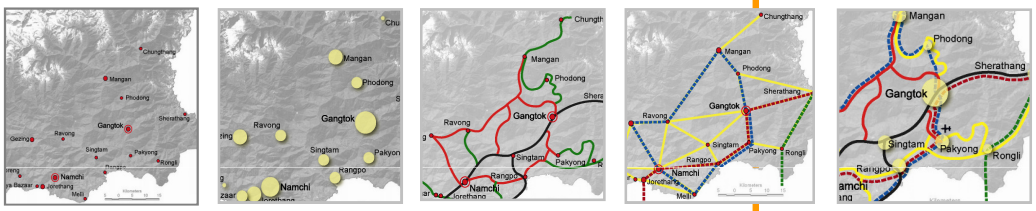


Figure 5.3.1 Overall State Strategic Plan in 2025

6.0 Long-Term Strategies : 2040

6.1 Urban Land Requirement
6.2 Urban Linkages
6.3 State Strategic Structure



6.1 Urban Land Requirement : 2040

Based on the respective density models mentioned in Section 1.5, the land requirement for the growth of each town is calculated as shown in Table 6.1.1. Figure 6.1.1 on next page illustrates the land requirement projections:

Gangtok & Namchi continue to become a 1st Tier urban centers catering for higher level services such as State Universities, Specialized Health Services, State Defense, etc., to the towns around the region. Again, Gangtok is not proposed to see significant growth and therefore the major focus shall remain in redevelopment of the existing land uses while further expansion is limited to 2 sq km. Namchi shall continue to grow to its planned scale of a mega town. It will require a total of 34 sq km of developable land by 2040. The west ward growth of Namchi together with Jorethang and Nayabazaar may reform an urban agglomeration to become a larger urban area.

Note:

* Land Requirement for Gangtok is based on Density Model 6000/sq km.

** Land Requirement for Namchi is based on Density 4000/sq km. Land Requirement for remaining towns are based on Low Density Model 2000/sq km.

*** Number of Residential Units @ 4 Persons / Household.

Table 6.1.1 Land Required for Growth of Towns by 2040

2040			
	Population	**Land Required**	**Residential Units*** **
Urban Population / Land	**550000**	**sq km**	
East district	**247500**		
Gangtok*	160875	26.8	40219
Singtam	22275	11.1	5569
Rangpo	22275	11.1	5569
Pakyong	22275	11.1	5569
Sherathang	12375	6.2	3094
Rongli	7425	3.7	1856
West District	**55000**		
Geyzing	35750	17.9	8938
Nayabazaar	13750	6.9	3438
Soreng	5500	2.8	1375
North District	**55000**		
Mangan	35750	17.9	8938
Phodong	13750	6.9	3438
Chungthang	5500	2.8	1375
South District	**192500**		
Namchi**	134750	33.7	33688
Jorethang	23100	5.8	5775
Ravong	17325	8.7	4331
Melli	17325	8.7	4331

6.1 Urban Land Requirement : 2040

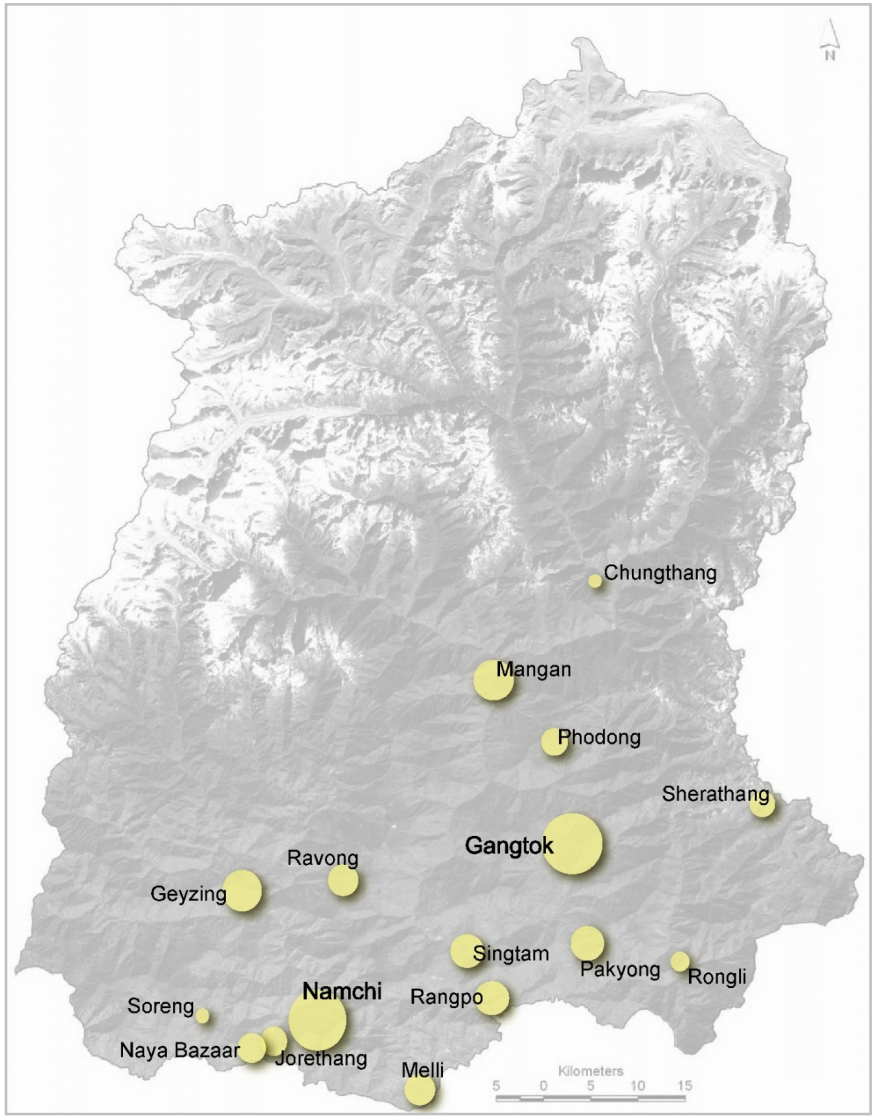
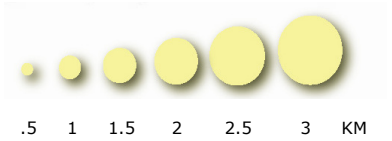


Figure 6.1.1 Illustration of the extent of land required per town for expansion by 2040.

Geyzing & Mangan will become the major urban centers for the surrounding rural, semi – rural communities in North and the West District. Singtam, Rangpo and Pakyong are expected to grow up to a physical size of about 11.1 sq km in total each.

The other towns of Ravong, Phodong and Melli will require a significant expansion in developable land area up to 7 to 9 sq km of land. Soreng and Chungthang being located in the far-west and up-north may not see significant growth; however, they will remain as a prime activity node within their respective zone.

Land Area Measure



Radius (km)	0.5	1	1.5	2	2.5	3
Area (sq km)	0.8	3.1	7.1	12.6	19.6	28.3

6.2 Urban Linkages : 2040

Road Link

Referring to Figure 6.2.1, the shorter route for Pakyong-Namchi shall be upgraded to 12m wide road of which 7.5 meter is reserved for a 2-lane carriageway for two-way traffic. Shorter connections between all the towns shall be strengthened and upgraded to 6 meter wide road of dual one lane.

Rail Link

Referring to Figure 6.2.2, the green line Local Rail Link is proposed as a separate mode of transportation for freight to lessen the heavy vehicle traffic load on the major roads and to divert the cross-border trade activities right from the source. This Local Rail Link shall connect Sherathang with the closest National Rail Service at Damdim in the State of West Bengal.

Airport

The airport service shall be expanded depending on future flight demands. As mentioned earlier, Kathmandu-Pakyong, Lhasa– Pakyong and Thimpu–Pakyong are some of the potential air routes and could be phased as per the flight route demand.

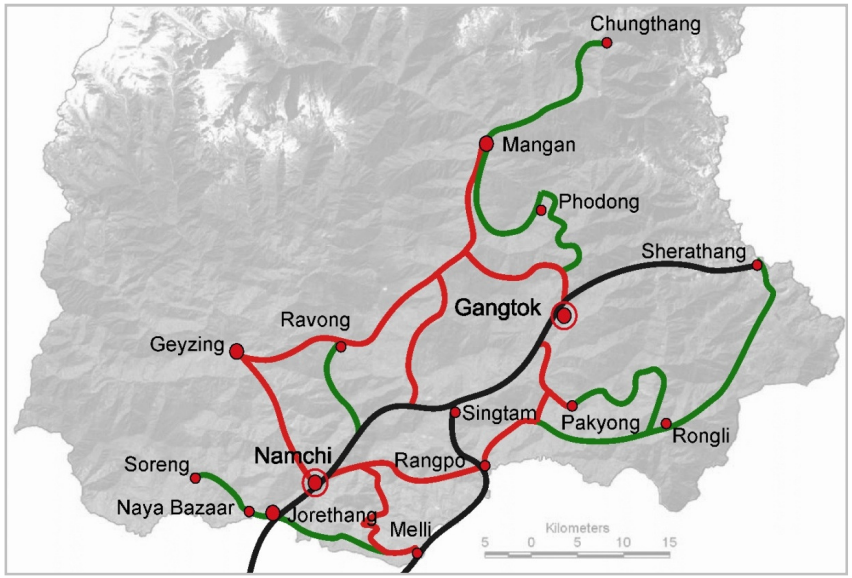


Figure 6.2.1 Proposed Road Structure in 2040

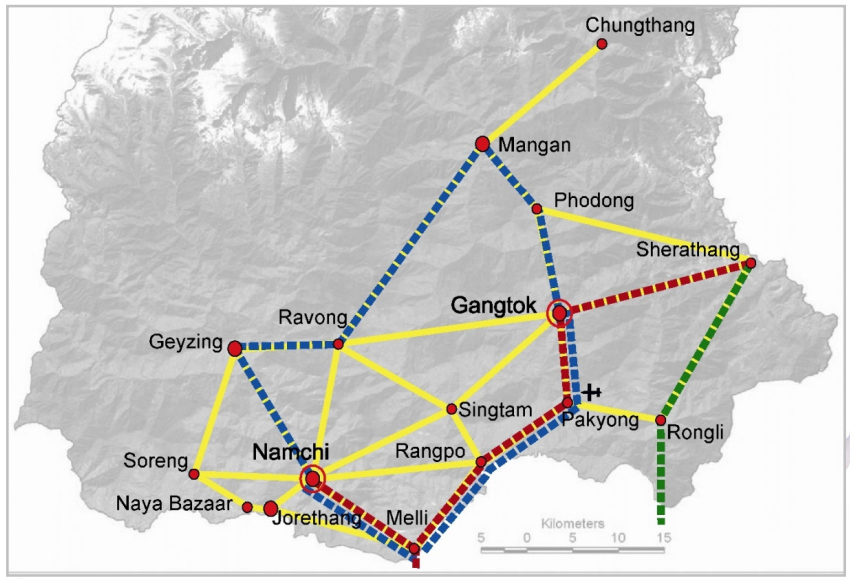


Figure 6.2.2 Proposed Conceptual Rail Link
[Physical alignment to be studied after feasibility studies]

6.3 State Strategic Structure : 2040

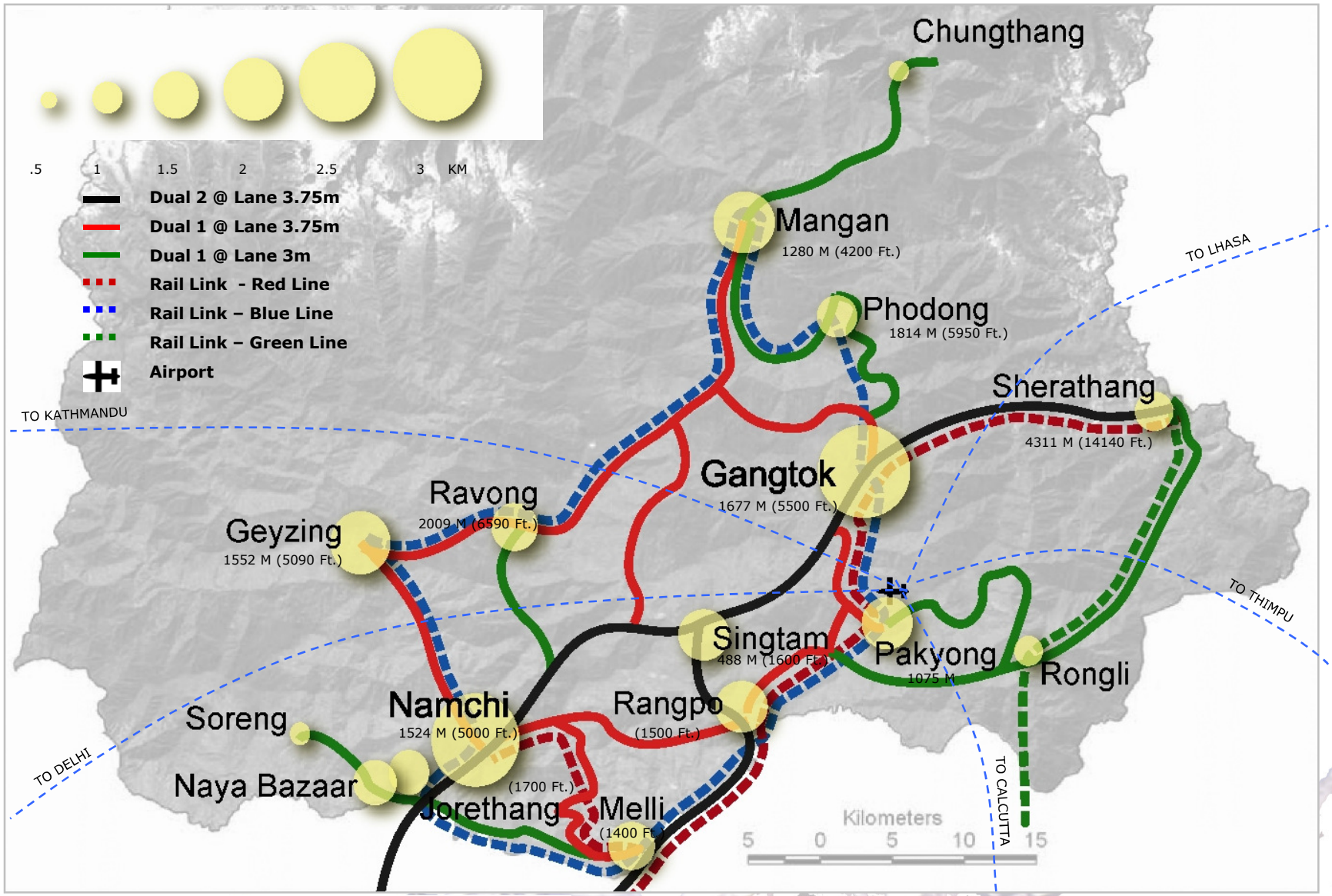
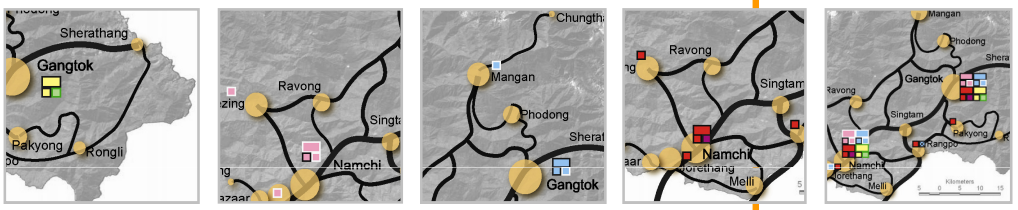


Figure 6.3.1 Overall State Strategic Plan in 2040

7.0 Urban Amenities

7.1 Facilities
7.2 Civic/Cultural Facilities
7.3 Health Facilities
7.4 Institutional Facilities
7.5 Commercial Facilities



7.1 Facilities

Methodology

The planning for amenities in Sikkim will be approached in 3 stages as described in flowchart in Figure 7.1.2 on the right:

1. In order to provide an idea of the basic facilities requirements for Sikkim, an indicative quantity and types of facilities needed in Sikkim will be projected based on the Indian Provisional Standards for amenities.

2. As Sikkim has its own characters and need profile based on the geographic structure of 4 districts, some moderations are necessary. The indicative figures obtained from the Indian Provisional Standards will then be matched against the current needs and availability of facilities across Sikkim so that any shortfall can be identified.

3. Final adaptation and adjustment of the indicative figures to the Sikkim environment will be examined during next level of DGP planning.

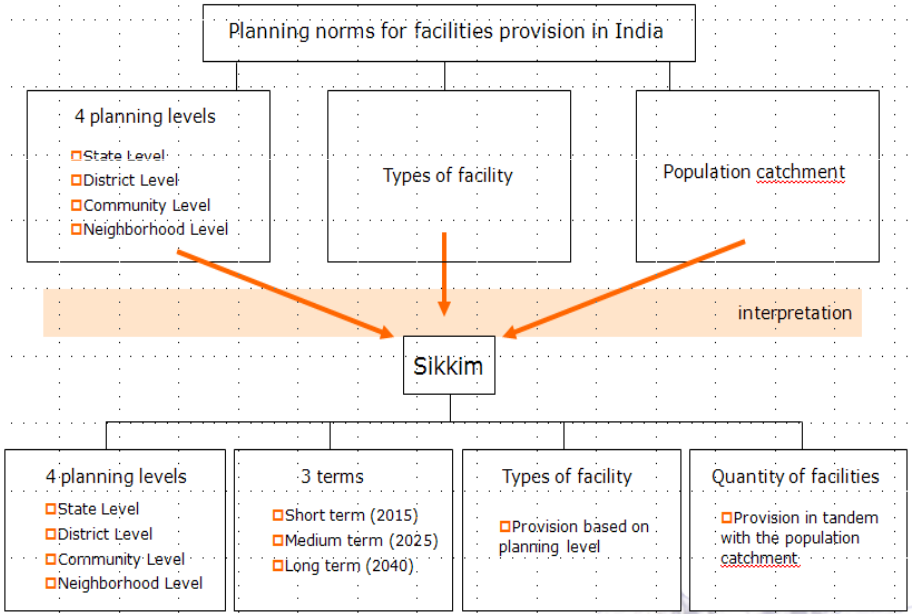


Figure 7.1.2 Flowchart Illustrating the Approach for Determining the Types and Quantity of Facilities for Sikkim

Figure 7.1.1 (from left) Bazaar, School with Football Grounds, Church, Temple, Hospital

7.1 Facilities

Indian Provisional Standards for Amenities

Current pattern of facilities distribution serving the threshold population at State Level, District Level, Community Level and Neighborhood Level in India is illustrated in Table 7.1.1 below.

Table 7.1.1 Indian Provisional Standards for Amenities

Planning level	Type of facility	Pop. Served
State level	University	500,000
	New University	500,000
	Technical Education Centre	1,000,000
	Engineering College	250000
	Medical College	250,000
	National Level Institute	400,000
	General Hospital	250,000
	Specialized Health Care	250,000
	Socio-cultural Centre	1,000,000
	Museum and Art Gallery	500,000
	Cinema/ Theatre	400,000
	Central Library	2,000,000
	Cremation/ Burial	250,000
	Bus Depot	500,000
	Bus Terminal (Local)	500,000
	Head Post Office	250,000
	District Jail	1,000,000
	Civil Defense & Home Guards	1,000,000
	Fire Station	200,000
	City Centre	5,000,000
	Sub-city Centre	2,500,000
	Divisional sports Centre	1,000,000
	Sports Centre & Play Grounds	500,000
District Level	Intermediate Hospital	100,000
	Integrated School without Hostel	100,000
	Integrated School with Hostel	100,000
	College	125000
	Research Institute	100,000
	Polyclinic	100,000
	Nursing, child/ maternity	45,000
	Health club / Gymnasium	100,000
	Recreational Club	100,000
	Cultural : Music/ Dance/ Drama	100000
	Meditation Spiritual Centre	100,000
	Police Station	90,000
	Police Post	40000
	District Centre	250,000
	Parks & Open Spaces	100,000
	District Sports Centre	100,000
Community level	Nursery school / Kindergarten	2500
	Primary school	5000
	Senior Secondary school	7500
	Dispensary	15000
	Community Room	5000
	Community Hall	15000
	Religious Site	10,000
	Taxi Grounds	15000
	Post Office (Local)	15000
	Community Centre	100,000
	Neighborhood Play area	15000
	Neighborhood Park	15000
Neighborhood	Sector Centre	15000
	Convenient Shopping	5000
	Residential Unit Play Area	5000

7.2 Civic / Cultural Facilities

Table 7.2.1 Existing Civic and Cultural Facilities in Sikkim

Type of facility	North	South	East	West
Library	2	2	2	2
Community / Cultural Center	1	1	1	1
Police Station	2	6	7	5
Police Post : Out Post/ Check Post/ Picket Post	13	9	19	13
Religious Site	96	183	250	195

Source: Sikkim Statistical Profile 2006

The above mentioned facilities (see Table 7.2.1) are few of the civic and cultural facilities that has been recorded and hence sourced from Sikkim Statistical Profile 2006 - 2007. With numerous Monasteries, Manilakhangs, Lakhangs & Tsamkhang, Temples, Gurudwaras, Churches and Mosques being established all over the State of Sikkim, a strong significance of Religious Institutions has been realized. A fair distribution of Police Stations and Police Post is indicative of the low crime rate and the State's initiative for public safety.

Other civic and cultural facilities such as the Outdoor and Indoor Stadium in Gangtok and Namchi; Cinema/ Theatre in Gangtok; Fire Stations in all 4 towns; few parks, playgrounds and open spaces; taxi grounds; Museum under construction in Namchi; allocated cremation, burial grounds in Gangtok are some of the amenities already existing in the State. While, some of these amenities such as Fire Station require a proper infrastructure, many of the open amenities such as parks and play grounds both at district and community level are highly inadequate. The State does have a wealth of reserved forests but lacks urban landscape that offers public recreation area.

With reference to the provisional standards for facilities in India, the projected quantity of civic and cultural facilities for Sikkim is as shown in Table 7.2.2 below. The types of facilities mentioned are derived from the Indian Provisional Standards (see Table 7.1.1) and are indicative for the current hierarchy of civic and cultural amenities within Sikkim.

Table 7.2.2 Civic and Cultural Facilities Based on the Indian Provisional Standards

Type of facility	2015	2025	2040
Museum and Art Gallery	0	0	1
Cremation / Burial	1	1	2
Head Post Office	1	1	2
Fire Station	1	2	3
Sports Centre & Play Grounds	0	0	1
Health Club / Gymnasium	3	4	6
Recreational Club	3	4	6
Cultural : Music / Dance / Drama	3	4	6
Meditation Spiritual Centre	3	4	6
Police Station	3	4	6
Police Post	7	9	14
Parks & Open Spaces	3	4	6
District Sports Centre	3	4	6
Religious Site	26	36	55
Taxi Grounds	18	24	37
Post Office (Local)	18	24	37
Neighborhood Play area	18	24	37
Neighborhood Park	18	24	37
Residential Unit Play Area	53	71	110

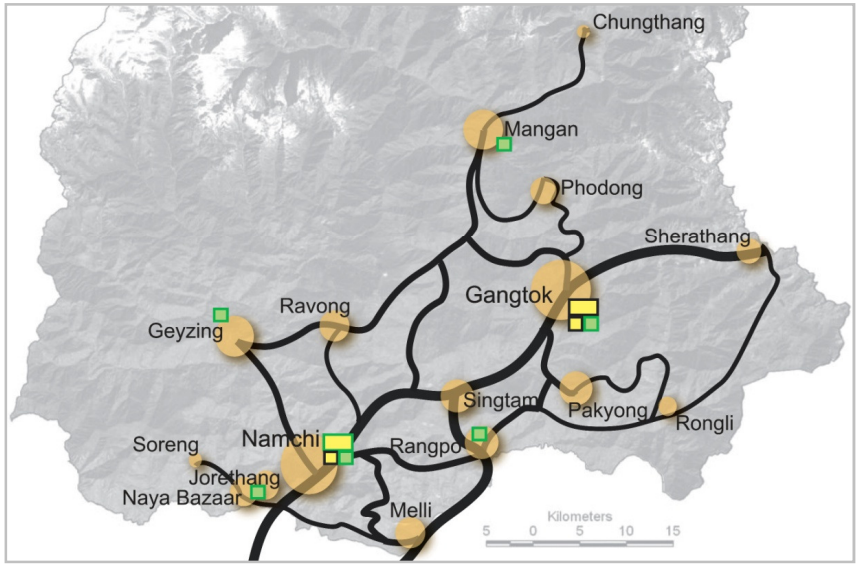
7.2 Civic / Cultural Facilities

State level facilities such as Socio Cultural Centre may not have a sufficient catchment as indicated in the Indian provision. However being a culturally rich State, they may be accommodated within Gangtok. The Museum under construction in Namchi shall hold the State significance and hence be upgraded if required.

Similarly, facilities such as Cinema / Theater may not have sufficient catchment for multiple Cinema's. As a source of entertainment commonly seen in urban areas other than India, it could be accommodated in both the major towns like Gangtok and Namchi. Head Post Office shall be provided in both Gangtok and Namchi as well (see Figure 7.2.1 for an illustration).

Major District facilities such as Fire Station, Recreational Club, Cultural Centre, Parks and Open Spaces, Playground, District Sports Centre etc, shall be provided in all 4 towns and Rangpo and Jorethang .

Adequate land reservations shall be made for the most basic civic/ cultural facilities such as Religious Site, Taxi ground, Post Office, Police Station, Residential Unit Play Area, Neighborhood Play Area, Neighborhood Park, etc in all the 16 communities. Religious establishments are comparatively higher than the average Indian provisions, and therefore need to be extrapolated and adapted into the local requirements of Sikkim. Social Safety services such as Police Posts shall be provided in all rural areas.



Civic / Cultural Facilities	
	Socio Cultural Centre
	Museum & Art Gallery
	Head Post Office, Cinema/ Theater
	Play Ground, Fire Station, Health Club/ Gymnasium, Recreational club, Cultural: Music/ Dance/ Drama, Meditation Spiritual Centre, Parks and Open Spaces, District Sports Centre, Cremation / Burial
Provided in all communities	Religious Site, Taxi ground, Post Office, Police Station, Residential Unit Play Area, Neighborhood Play Area, Neighborhood Park

Figure 7.2.1 Illustration of Indicative Civic/Cultural Facilities Distribution

7.3 Health Facilities

Table 7.3.1 Existing Health Facilities in Sikkim

Existing Health Services (2006)	North	South	East	West
State Referral / STNM Hospital	0	0	1	0
Community Health Center (District Hospital)	1	1	1	1
Primary Health Center	3	6	8	7
Primary Health Sub Center	19	39	48	41

Source: Sikkim Statistical Profile 2006

Health infrastructure, as defined in Sikkim, consists of 4 major levels of health care services: namely, State Referral Hospital, Community Health Center (CHC), Primary Health Center (PHC) and Primary Health Sub Center (PHSC) with some other medical facilities for Tuberculosis, Mental Health and Leprosy.

According to the Sikkim Human Development Report 2001, Sikkim has well achieved the National Norms which indicates the requirement of establishment of 1 PHC for 20,000 population and 1 PHSC for 3000 population. The existing State Referral Hospital is500 bedded, CHC in average are 100 bedded, PHC's are 7 bedded and PHSC's are generally micro level health care services. However, the capacity of these District hospitals, PHC and PHSC would require to be upgraded and the hierarchy of primary health care shall be redefined. It is recommended to follow the current Indian practice for urban area which requires provisions of Polyclinics, Nursing / Child / Maternity and Dispensaries that may have been functioning as PHC's and PHSC's earlier.

With reference to the provisional standards for facilities in India, the projected quantity of health facilities for Sikkim is as shown in Table 7.3.2 below. The types of health facilities mentioned are derived from the Indian Provisional Standards and are indicative for the current hierarchy of medical amenities within Sikkim.

This hierarchy which also includes Specialized Health Care, Polyclinic, Nursing / child / Maternity and Dispensaries in addition to the existing hierarchy of Community Health Centers, Primary Health Centers and Primary Health Sub Centers, shall be distributed within the State. The PHSC, with its catchment of 3000 population, shall be provided in the rural areas, while all the urban centers shall at least have a PHC-equivalent medical services that has been substituted by the Nursing / child / Maternity and Dispensaries.

Table 7.3.2 Health Facilities Based on the Indian Provisional Standards

Type of facility	2015	2025	2040
General Hospital (State Referral Hospital)	1	1	2
Specialized Health Care	1	1	2
Intermediate Hospital (District Hospital / CHC)	3	4	6
Polyclinic	3	4	6
Nursing, Child / Maternity (PHC)	6	8	12
Dispensary (PHC)	18	24	37

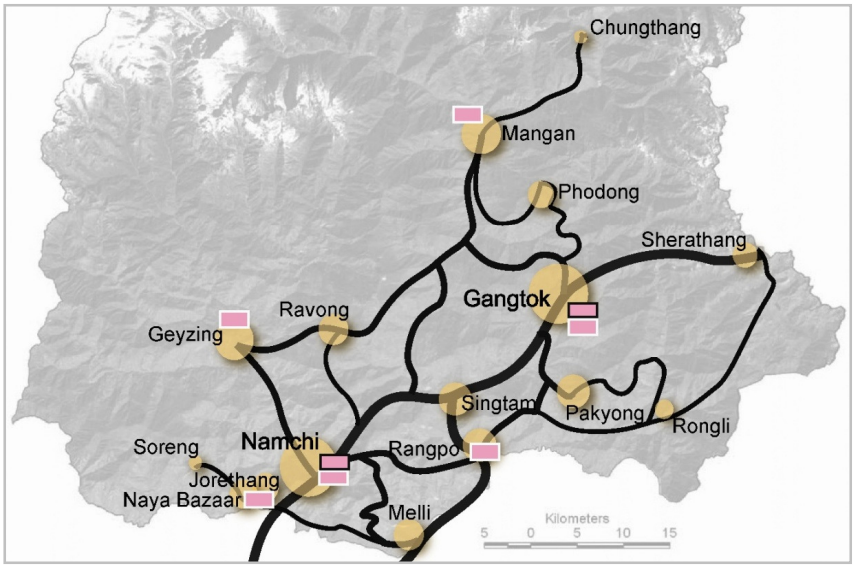
7.3 Health Facilities

Indian Practices require the General Hospital to be 500 bedded, Intermediate Hospital to be 200 bedded, Polyclinics to be 20 bedded and Nursing/ Child/ Maternity to be 25 bedded and Dispensaries to be 10 bedded respectively.

A strategic distribution of facilities is illustrated in Figure 7.3.1. The distribution shown is based on the provisional Indian Practices of health infrastructure requirement indicated earlier. As illustrated, the preliminary idea is for health facilities such as General Hospital and Specialized Health Care to be distributed between the major towns of Gangtok and Namchi; with an adequate number of Intermediate Hospitals and Polyclinics provided in both of these towns as well as Geyzing and Mangan.

Basic Town level health facilities such as Nursing, Child / Maternity care and the Dispensary shall be provided in all 16 communities.

Hence, the Health infrastructure requirements bring about the significant health services opportunities particularly in Namchi. The Health Services Industry may further capitalize on the "Healing with Nature" factor which shall draw people from beyond the State catchment.



Health Facilities	
	General Hospital, Specialized Health Care
	Intermediate Hospital, Poly Clinic
Provided in all communities	Nursing, child/ maternity, Dispensary

Figure 7.3.1 Illustration of Indicative Health Facilities Distribution

7.4 Institutional Facilities

Table 7.4.1 Existing Institutional Facilities in Sikkim

Existing Educational Facility (2006)	North	South	East	West
University (SMU)	0	0	1	0
Engineering College (SMIT)	0	0	1	0
Medical College (SMIMS)	0	0	1	0
Other Institute (ITI, Polytechnics)	0	1	2	0
Senior Secondary School	3	9	20	10
Secondary School (SS)	11	29	29	23
Junior High School (JHS)	16	46	47	41
Primary School (PS)	39	90	111	87
Nursery school / Kindergarten (LPS)	21	48	35	65

Source: Economic Survey 2006

As stated in the Economic Survey 2006-2007, GOS, on an average the Sikkemese Schools handle around 90 students per school with a minimum of 79 students/school in North District to 121 students per school in East District. The strength of less than 100 students per school is comparatively smaller than the Indian national standards schools that are required to be housing 500 students.

The existing school strengths may be well justified for current population base. With the increasing urban population and the critical mass of the urban centers, the existing schools shall be upgraded to larger Schools with better educational and technological resources to meet the demand of future population.

The current distribution of Schools indicate that as low as 1.52 number of Schools per 1000 people in East district to as high as 2.19 Schools in North District. Majority of the existing higher education facilities are distributed in East District.

There is also an untapped education industry such as integrated schools with hostels, institutions for research and higher education which shall be of utmost significance to the long-term growth and development of Sikkim.

With reference to the provisional standards for facilities in India, the quantity of institutional facilities are projected for Sikkim and is shown in Table 7.4.2 below. The types of institutional facilities have been adapted to the Sikkim's context, although the figures are indicative and will be adjusted in the next level of planning.

Table 7.4.2 Institutional Facilities Based on the Indian Provisional Standards

Type of facility	2015	2025	2040
University	1	1	1
New University	1	1	1
Engineering College	1	1	2
Medical College	1	1	2
Integrated School with Hostel	3	4	6
College	2	3	4
Research Institute	3	4	6
Nursery school / Kindergarten (LPS)	106	142	220
Primary School (PS)	53	71	110
Junior High School (JHS)	44	59	92
Secondary School (SS)	44	59	92
Senior Secondary School (SSS)	35	47	73

7.4 Institutional Facilities

As illustrated in Figure 7.4.1, State level institutional facilities such as Universities could be distributed between the major towns of East and West District. The existing Sikkim Manipal University in Gangtok has its Engineering and Medical Colleges in Majhitar near Rangpo. This educational infrastructure shall be further enhanced to accommodate additional faculties. A new University shall be explored in Namchi with additional Engineering and Medical Colleges including other Colleges focusing on management, tourism, horticulture, bio technology etc. Other than the existing institutional facilities near Rangpo, Integrated Schools with Hostel, other Colleges and Research Institutes shall be provided in Gangtok, Namchi, Geyzing and Mangan. The earlier illustrated table provides a strong indication of potential opportunities for integrated schools and research facilities.

State initiatives on provision of basic level of education is quite commendable. However, these facilities are yet to meet the national standards and require further upgradation. Other than the improvements of existing Schools, additional basic educational facilities such as nursery school, kindergarten, primary school, junior high school, secondary school and senior secondary school shall be distributed among all the 16 communities based on the population and commuting range. The seventh All India School Education Survey indicated the percentage of population who had access to primary schools within 1km walking distance, upper primary school within 3 km, secondary school within 5 km and the senior secondary school within 8km. However, based on other Indian practices, the comfortable commuting range of 1km for Primary School, 2km for Junior High School, 4km for Secondary School, and 6 km for Senior Secondary School is recommended to be considered for the distribution of schools in the State.

Institutional Facilities	
	University
	New University,
	Engineering, Medical College
	Other Colleges, Research Institute, Integrated School with Hostel,
Provided in all communities	Nursery School / Kindergarten, Primary School, Junior High School, Secondary School, Senior Secondary School

Figure 7.4.1 Illustration of Indicative Institutional Facilities Distribution

7.5 Commercial Facilities

Table 7.5.1 Existing Commercial Facilities in Sikkim

Type of facility	North	South	East	West
Bazaar Class - I	0	0	2	0
Bazaar Class - II	5	4	6	1
Bazaar Class - III	0	7	4	16
Rural Marketing Centre	19	21	42	22

Source: Sikkim Statistical Profile 2004

The existing classification of Commercial Uses in the State of Sikkim has been sourced from Sikkim Statistical Profile 2004-5 and is indicated in Table 7.5.1 above. The larger markets such as Gangtok and Singtam in East District are categorized as Bazaar Class – I. Other than Nayabazaar and Pelling in West District which holds the commercial services at Bazaar Class – III, all the remaining 12 towns as projected to be the future urban centers presently hold the commercial services at Bazaar Class- II. The State is also serviced with substantial number of Rural Marketing Centers which are the important commercial activity zones in the rural areas.

With an increased population base, the hierarchy of commercial centers need to be re-defined and adapted to suit the local needs. A cross reference to the Indian provisions are made in terms of securing adequate area for commercial centers. In common practices, these centers are classified as District Center, Community Center, Sector Center and Convenient Shopping to meet different levels of commercial requirements in the urban area.

Other than commercial facilities such as Grocery Stores, Private Clinics, Boutique Shops, Offices, Shopping Malls etc, relevant public facilitating uses like relevant Government Administrative Buildings and Post Office, etc could be accommodated in these Urban core zones. A conceptual distribution of these facilities for different hierarchy of commercial centers are indicated in Table 7.5.2 below.

Table 7.5.2 Commercial Facilities Based on Indian Provisional Standards

		Redefined Bazaar Hierarchy		
Type of facility	District Center (≈ 44 ha)	Community Center (≈ 5 ha)	Sector Center (≈ 0.6 ha)	Convenient Shopping (≈ 0.08 ha)
Government Administration Buildings	✓			
Shopping Malls	✓			
Offices	✓	✓		
Boutique Shops	✓	✓	✓	
Clinics	✓	✓	✓	
Post Offices	✓	✓	✓	
Grocery Stores	✓	✓	✓	✓

7.5 Commercial Facilities

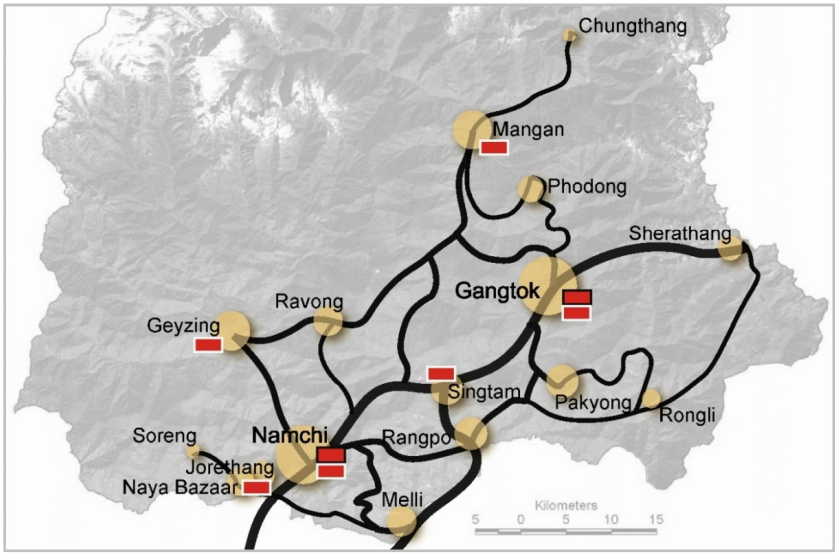
Table 7.5.3 Projected Commercial Facilities in Sikkim

Type of facility	2015	2025	2040
District Centre	1	1	2
Community Centre	3	4	6
Sector Centre	18	24	37
Convenient Shopping	264	356	550

With reference to the provisional standards for facilities in India, the projected quantity of commercial facilities for Sikkim is as shown in Table 7.5.3. The types and quantity of commercial facilities are indicative and shall be adjusted for adaptation to the Sikkim context at next level of planning.

Adequate land reservations for District Centre shall be made in the major towns of Gangtok and Namchi. Other than Geyzing and Mangan, current commercially active towns of Singtam and Jorethang shall also be provided with the Community Centers.

Similarly, local level basic commercial facilities such as Sector Center shall be provided in all the 16 towns. The existing RMC's shall be upgraded to become the Sector Centers as well. The Convenient Shopping facilities are distributed amongst all the 16 significant Towns and the RMC's shall still be planned to cater the rural communities (see Figure 7.5.1 for indicative distribution of facilities).



Institutional Facilities	
Provided in all communities	District Centre
	Community Centre
	Sector Centre, Convenient Shopping

Figure 7.5.1 Illustration of Indicative Commercial Facilities Distribution

7.5 Commercial Facilities

Hotel Facilities

Table 7.5.4 Projected Percentage Distribution of Beds by District at Year 2015, 2025 and 2040

Projected % Distribution of Beds by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	68.5%	67.5%	64.5%	61.0%
North	8.8%	9.0%	10.0%	11.0%
South	4.8%	5.5%	7.0%	9.0%
West	17.9%	18.0%	18.5%	19.0%

Table 7.5.5 Projected Distribution of Beds by District at Year 2015, 2025 and 2040

Projected Distribution of Beds by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	8,954	17,699	45,074	129,367
North	1,147	2,360	6,988	23,328
South	624	1,442	4,892	19,087
West	2,346	4,720	12,928	40,295
State	**13,071**	**26,221**	**69,882**	**212,077**

Table 7.5.6 Projected Distribution of Hotels by District at Year 2015, 2025 and 2040

Projected Distribution of Hotels by District				
District	**Current 2008**	**2015**	**2025**	**2040**
East	322	735	1,873	5,375
North	69	98	290	969
South	34	60	203	793
West	118	196	537	1,674
State	**543**	**1,089**	**2,903**	**8,811**

As highlighted earlier in demography, floating population as a result of large influx of visitors to Sikkim during the tourism peak period will increase requirements for commercial services such as hotels. The scale of this "extra" requirement will have to be examined further in tandem with further investigations on the tourism data. These tourism based commercial activities could be integrated with the above mentioned commercial centers.

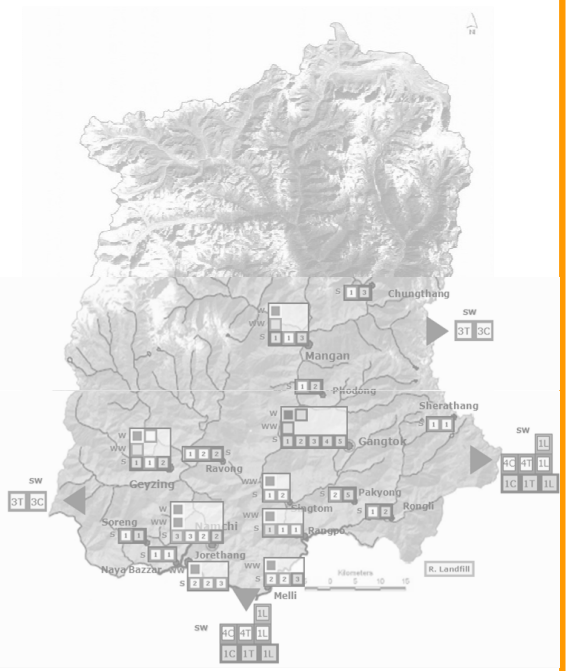
The supply of accommodation available in all the districts is expected to increase as per the analysis highlighted earlier. Again, the North, South and West districts should increase at a faster rate compared to the East district as the development strategy of decentralizing tourism activities outside Gangtok takes effect.

With the increasing importance of tourism attractions in Pelling, Namchi, Ravongla, Lachen, Lachung and Tsongo Lake, there will be more hotels being constructed within these areas to meet the needs of the visitors.

The projections of the number of hotels required is derived from the projected bed demand divided by 24, the current average number of beds per hotel.

Part II :

Environmental Infrastructure



1.0 Water Supply
2.0 Wastewater Treatment
3.0 Municipal Solid Waste
4.0 Power Supply Facilities
5.0 Overall Environmental Infrastructure
6.0 Environmental Management

1.0 Water Supply

1.1 Background

1.2 Projections for the Short, Medium and Long Term

1.3 Conceptual Strategies

1.4 Current and Proposed Plants

1.5 Water Catchment Protection

1.1 Background

There is no lack of pristine water in the State of Sikkim especially in the North and East District. The main challenges in urbanised areas are infrastructural costs, distribution of water, old piping, water leakage (as high as 79%), and water quality. Rural areas currently receive only untreated water from springs. As they rapidly urbanise, they will need an adequate amount of treated water.

East District: The Selep Water treatment plant, governed by the Water Security and Public Health Engineering Department (PHED), obtains water from the Ratey chu river which emerges from the glacial fed Lake Tamze. It provides 36 MLD of treated water to the urban population in the Greater Gangtok area. This is sufficient to meet the current population. However, because of distribution problems from the old piping system and significant leakages (as high as 79%), households only obtain intermittent water supply.[1a]

Water quality is also a problem caused by potential contamination of pipes. In the PHED's 11th development plan, besides augmenting the water distribution system in the Greater Gangtok area, PHED plans to provide major water supply works to Pakyong, Rongli, Rongpo, Singtam and Upper Tadong. Going beyond 2001, PHED expects water demands to be about 41 MLD.[1b]

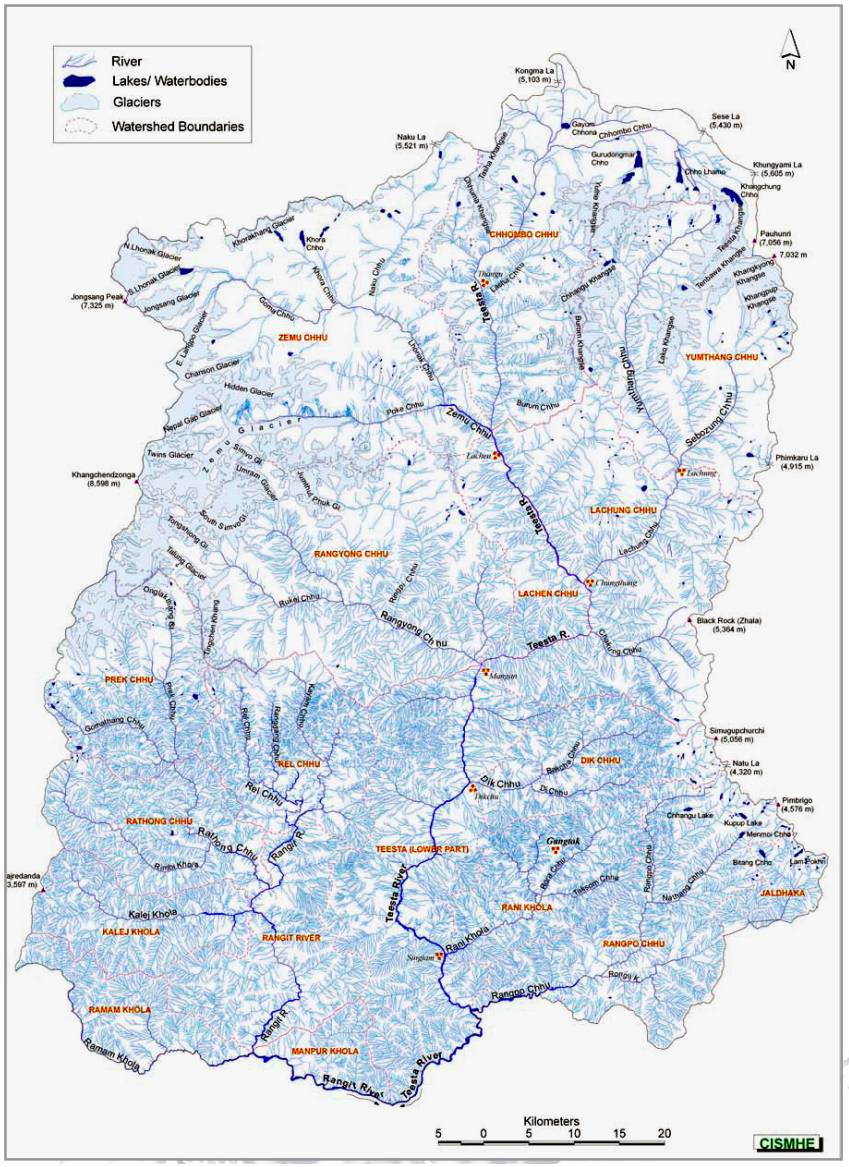


Figure 1.1.1 Drainage Map of Testa River Basin in Sikkim [1c]

1.1 Background

The PHED is responsible for providing treated water to urban areas, and the Rural Development District (RDD) is incharge of providing untreated water to the rural communities. The source of the untreated water is from springs. Although mostly untreated, some of the spring water undergoes minimal physical (sand filtration) and chemical (disinfection with chlorine) treatment. The rural sector comprises a significant portion of the Greater Gangtok area. While the source of spring water is of relatively good quality, distribution of untreated water is subjected to potential contamination from many urban sources such as livestock, waste dumping, wastewater pipe leakage, and sewage leakage from underground septic tanks. With rapid urban expansion, it is unclear how the two governmental entities (PHED and RDD) will cooperate to provide sufficient amount of good quality water to both the urban and rural populations.

North District: Mangan currently receives "untreated" water from springs with supply capacity of 0.292MLD (peak) and 0.121MLD (lean) with 0.45ML water reservoir capcity. At the current population growth rates, the existing system will not be able to meet water demands. Additional capacity of 1.77MLD will be completed by 2009. [1d]

South District: Namchi's current average water supply capacity is 1.77MLD from Bermely, about 46km away. In some area, the water is supplemented from river water pumped from the Rangit river, by RDD, with a designed capacity of 3.0MLD. [1e] Current capacity is 1.45MLD according to ground feedback.

1.1 Background

West District*:

Geyzing-Pelling areas have an existing combined water supply of 3.92MLD respectively during peak period and 0.39MLD during lean period.

An additional water supply capacity of 4.32MLD (peak) and 0.43MLD (lean) will be added to Geyzing-Pelling areas by March 2009 with additional reservoir tanks. (0.3MLD for Geyzing and Pelling respectively)

** Source: PHED staff*

1.2 Short, Medium and Long Term Projections

Assumption: 135 liters per capita per day (lpcd)*

Table 1.2.1 Projections of Water Demand by Towns at Year 2015, 2025 and 2040

Water Supply	2015	Water Demand (MLD)	2025	Water Demand (MLD)	2040	Water Demand (MLD)
East district	**184,800**	**24.95**	**213,300**	**28.80**	**347,500**	**33.41**
Gangtok	138,600	18.71	149,310	20.16	160,875	21.72
Singtam	14,784	2.00	17,064	2.30	22,275	3.01
Rangpo	14,784	2.00	17,064	2.30	22,275	3.01
Pakyong	9,240	1.25	17,064	2.30	22,275	3.01
Sherathang	3,696	0.5	6,399	0.86	12,375	1.67
Rongli	3,696	0.5	6,399	0.86	7,425	1.00
West District	**13,200**	**1.78**	**21,330**	**2.88**	**55,000**	**7.43**
Geyzing - Pelling	7,920	1.07	12,798	1.73	35,750	4.83
Nayabazaar	3,960	0.53	6,399	0.86	13,750	1.86
Soreng	1,320	0.18	2,133	0.29	5,500	0.74
North District	**13,200**	**1.78**	**21,330**	**2.88**	**55,000**	**7.43**
Mangan	7,920	1.07	12,798	1.73	35,750	4.83
Phodong	3,960	0.53	6,399	0.86	13,750	1.86
Chungthang	1,320	0.18	2,133	0.29	5,500	0.74
South District	**52,800**	**7.13**	**99,540**	**13.43**	**192,500**	**25.99**
Namchi	31,680	4.28	64,701	8.73	134,750	18.19
Jorethang	10,560	1.43	14,932	2.02	23,100	3.12
Ravong	5,280	0.71	9,954	1.34	17,325	2.34
Melli	5,280	0.71	9,954	1.34	17,325	2.34

** Source: Central Public Health and Environmental Engineering Organisation (CPHEEO)*

1.3 Conceptual Strategies

Table 1.3.1 Relationship between the Demand and Capacity of Water Treatment Plants at Years 2015, 2025 and 2040

	2015			2025			2040		
	Demand (MLD)	Capacity (MLD)		Demand (MLD)	Capacity (MLD)		Demand (MLD)	Capacity (MLD)	
Gangtok*	18.7	45	✓	20.16	45	✓	21.7	45	✓
Mangan	1.07	1.9 – 2.1	✓	1.73	1.9 – 2.1	✓	4.83	1.9 - 2.1	x
Geyzing-Peling	1.07	0.8 – 8.3	✓	1.73	0.8 – 8.3	✓	4.83	0.8 – 8.3	✓
Namchi**	3.92	4.28	x	8.73	3.22	x	18.19	3.22	x

East District:

Currently, the Selep Water Treatment Plant provides 36 MLD. From now (2008) to **2015**, the treatment plant needs to increase capacity to at least 45 MLD and reduce current rate of Unaccounted For Water (UFW) 79% to at least 50% by then. Only then will this amount of water meet the population growth for **2015 and through 2040**. The major challenge in providing adequate water is not in the sourcing, but in the distribution and controlling UFW. During this period (2008 to 2015), the following augmentations and enhancements on the current system are aggressively planned and will be implemented:[1b]

- Reduce water loss from 79% to 50% and to an adequate level thereafter.*
- Implement augmentation plan to rehabilitate old pipes, improve distribution to the majority of urban and rural populations.
- Develop and implement DPRs to increase water distribution to the other 5 major towns (Pakyong, Rongli, Rongpo, Singtam and Upper Tadong).
- Protect the water catchment areas at Lake Tamze and Ratey Chu to prevent potential pollution from urban activities (see slides on water catchment protection).

Note: Water Loss status unclear for North, West and South District. Actual demand may be higher

* Source [1a]. Assume a conservative reduction to 50% by 2015

** Seasonal supply of raw water not factor in. Lack of information.

1.3 Conceptual Strategies

North District

By 2009, Mangan will have 2.062 MLD of water supply, with lean period reducing to 1.891MLD. An additional capacity of 2.8 to 3.0 MLD is needed by 2040.

West District

By 2009, Geyzing-Peiling will have water supply capacities ranging from 0.82MLD to 8.26MLD. Additional capacity of 0.25, 0.91 and 4 MLD is needed during the lean period by 2015, 2025 & 2040 respectively.

South District

Namchi current water capacity is 1.77 MLD with additional 1.45 MLD "Spring Water" capacity. By 2040, Namchi will need 14.97 MLD of additional capacity. According to the future Urban Plan, Namchi has been designated as the 2nd Nuclei town other than Gangtok. To accommodate the huge increase in population, there is a need for highest priority to address the shortage of water. An integrated approach is recommended to address the water shortage issue in Namchi which will be further addressed in DGP level 2 studies in the town of Namchi.

1.3 Conceptual Strategies

For All Districts:

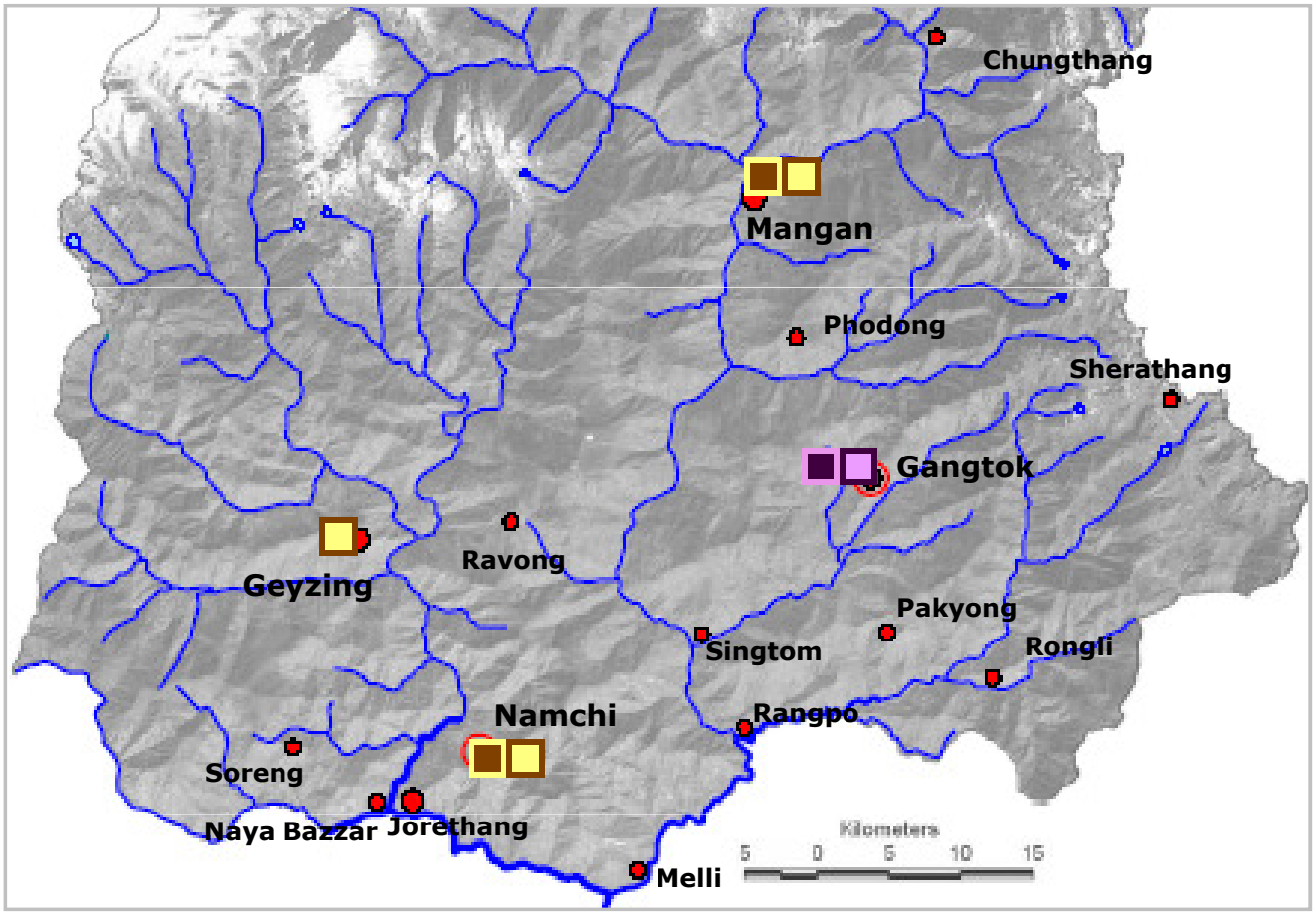
The water providers of Sikkim have multiple reports done up by previous external consultants. They are aware of the challenges faced in providing waters to the people of Sikkim. To highlight a few, the following were drawn from the information gathered which are important and on going improvement are being carried out.

- Reduce current UFW to acceptable rate, including wastage.
- Protect designated water catchment areas to prevent pollution and water loss from direct or indirect human activities.
- Mission by ADB & JNNURM under UIDSSMT (2005-2012)
- i) Improve/tighten water supply connection policies to weed out illegal or unregistered connections.
- ii) Metering of water consumption.

It is a challenge to incorporate the improvement work done by the water departments of Sikkim into this Strategic Urban Planning for Sikkim state. The team has identified a few strategic points which will complement the solution measures for Sikkim water issues.

- Include policies to support the augmentation of current water supply with alternate sources. E.g.
  - Rainwater harvesting system to augment lean period demand
  - Collection of gray water or surface runoff for non-potable usage (e.g. fire fighting)
  - Wide adoption of pumping based water supply system
- Need for close coordination between various water suppliers (PHED, RDD, Private) and foster win-win partnerships between the private, public and people sectors.
- Improve water quality of existing "Spring water" supply through new and innovative technologies, with on-the-ground adaptation.
  - E.g. Supplement conventional systems with "packaged small portable systems" that have smaller footprints, uses hollow-fiber membrane-based technology. This can be implemented in rural areas, eco-tourist resorts, and small towns <1000 persons.

1.4 Current and Proposed Plants



Water Treatment Plants	
	Existing Water Treatment Plants (as of 2008)
	Proposed PHED Treatment Plants (2015)
	Proposed PHED Expansion of Existing Plants (2015)
	Proposed expansion of capacity by consultant (2025)* Beyond existing municipal boundary

Figure 1.4.1 Distribution of Existing and Years 2015 , 2025 Proposed Water Treatment Plants

1.5 Water Catchment Protection

Measures for Protection of the Water Catchment Area

1. **Land use planning**
   - Setup of special administrative protection zones (only for designated and limited uses) according to protective requirements.

2. **Monitor and control**
   - Forbid human activities within drinking-water catchment boundary to prevent the damaging activities such as quarrying, deforestation and mining activities from happening.
   - Control population residing and density of population
   - Prohibit camping and tourism activities in catchment other than designated sites.
   - Activation of legislation and ensure environmental management plan for the site is developed, implemented and audited
   - Imposition of waste disposal requirements for solid and liquid wastes generated nearby.
   - Effectively regulate livestock grazing.
   - Implement water monitoring program including sampling at source, lakes, rivers, and intake.

4. **Introduce financial incentive measures and education program**
   - Ensure the public is aware that only approved events are permitted in the catchment.

5. **Conduct environmental impact assessments**

6. **Regulate and plan the tracks, roads, railway lines and traffic nearby to minimize the risks of erosion and pollutants from vehicles access**

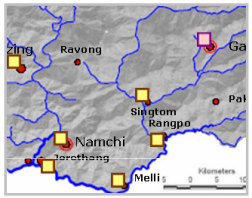
2.0 Wastewater Treatment

2.1 Background

2.2 Projections for the Short, Medium and Long Term

2.3 Conceptual Strategies

2.4 Current and Proposed Wastewater Treatment Facilities



2.1 Background

There is only one wastewater treatment plant (WTP) in the entire State. A significant amount of domestic wastewater is discharged directly to the sensitive receiving water bodies through direct discharge, illegal overflows of septic tanks, and leaking wastewater treatment pipes.

East District: There is only one WTP at Adampul with a total capacity of 4.8MLD. Assuming that the water consumption is 100LPCD (liters per capita per day) and 75% is intercepted as wastewater, the amount generated is 100 LPCD. Since only about 60% of the Gangtok area is connected to the sewer system, this treatment capacity is sufficient for about 80,000 people.

Households and villages that are not connected to the sewer system uses the septic tank system where waste is stored in underground tanks and removed by tankers when full. There is significant illegal discharge of wastewaters directly into the jhoras and from overflows of the septic tanks. The PHED 11th sewerage development plan includes planning and construction of a WTP each at Singtam and Rangpo.

North and West Districts: There is no WTP currently in the North and West Districts. Pre-feasibility reports are planned for Mangan and Geyzing-Pelling.*

South District: There is no WTP in this District. However, the PHED 11th plan includes DPRs (planning and construction) of a WTP each at Namchi (7.3 MLD by 2040*), Jorethang and Melli.

** Source: PHED.[2a,2b]*

2.2 Short, Medium and Long Term Projections

Assumption: 100 lpcd (75% of water consumed generated as wastewater)*

Table 2.2.1 Projections of Waste Water by Towns at Year 2015, 2025 and 2040

Wastewater	2015	Wastewater (MLD)	2025	Wastewater (MLD)	2040	Wastewater (MLD)
East district	**184,800**	**18.71**	**213,300**	**21.60**	**347,500**	**25.06**
Gangtok	138,600	14.03	149,310	15.12	160,875	16.29
Singtam	14,784	1.50	17,064	1.73	22,275	2.26
Rangpo	14,784	1.50	17,064	1.73	22,275	2.26
Pakyong	9,240	0.94	17,064	1.73	22,275	2.26
Sherathang	3,696	0.37	6,399	0.65	12,375	1.25
Rongli	3,696	0.37	6,399	0.65	7,425	0.75
West District	**13,200**	**1.34**	**21,330**	**2.16**	**55,000**	**5.57**
Geyzing - Pelling	7,920	0.80	12,798	1.30	35,750	3.62
Nayabazaar	3,960	0.40	6,399	0.65	13,750	1.39
Soreng	1,320	0.13	2,133	0.22	5,500	0.56
North District	**13,200**	**1.34**	**21,330**	**2.16**	**55,000**	**5.57**
Mangan	7,920	0.80	12,798	1.30	35,750	3.62
Phodong	3,960	0.40	6,399	0.65	13,750	1.39
Chungthang	1,320	0.13	2,133	0.22	5,500	0.56
South District	**52,800**	**5.34**	**99,540**	**10.08**	**192,500**	**19.49**
Namchi	31,680	3.21	64,701	6.55	134,750	13.64
Jorethang	10,560	1.07	14,932	1.51	23,100	2.34
Ravong	5,280	0.53	9,954	1.01	17,325	1.75
Melli	5,280	0.53	9,954	1.01	17,325	1.75

** Source: CPHEEO manual specifies generally 80%. We assume 75% here.*

2.3 Conceptual Strategies

East District

PHED's Plan:

To provide sufficient treatment capacity for growth to 2040, current plans are to further expand the Adampul WTP by:

- augmentation and replacement of leaking pipes;
- laying of new pipes to serve the Greater Gangtok area (from 60% to 95%).[1b]

By 2015, additional capacity will be built at Singtam and Rangpo to meet the population growth:

- Singtam: 1.4 MLD (14,784)
- Rangpo: 2.0 MLD (14,784)

For Singtam, additional capacity needed (0.1MLD) by 2015. A total of 2.26MLD needed for both towns by 2040.

Consultant's findings:

Total projected capacity demand for East district is 25MLD by 2040.

More sanitary engineers may need to be hired and trained to efficiently maintain and operate the WTP at Adampul, and in future other towns (Singtam and Rangpo). Additional responsibilities include optimal maintenance of the wastewater distribution systems.

For rural areas (such as large remote villages) not served by the conventional sewerage treatment systems but in the ambit of the town municipal, we suggest to explore Small Packaged Systems to compliment the rural rudimentary network. This allow provision for large scale upgrading in the future when the developed urban surrounding reach an economic scale.

Toxic wastewater discharge from industries (e.g. Singtam and Rangpo) should be regulated separately from domestic wastewaters. Such industries include breweries, pharmaceutical, and also agricultural processing facilities. On-site treatment of the industrial wastewaters should be monitored before permitted discharge to water bodies.

2.3 Conceptual Strategies

PHED's Plan:

South District

Proposed 2007 DPR plan to build a WTP at Namchi with a capacity of 7.3 MLD is insufficient to meet a projected urban population of 134,750 by 2040. A shortfall of 6.3MLD is projected.

Proposed DPRs for WTP treatment capacities need to increase for both Jorethang (1.4 to 2.4 MLD) and Melli (0.6 to 1.8 MLD).

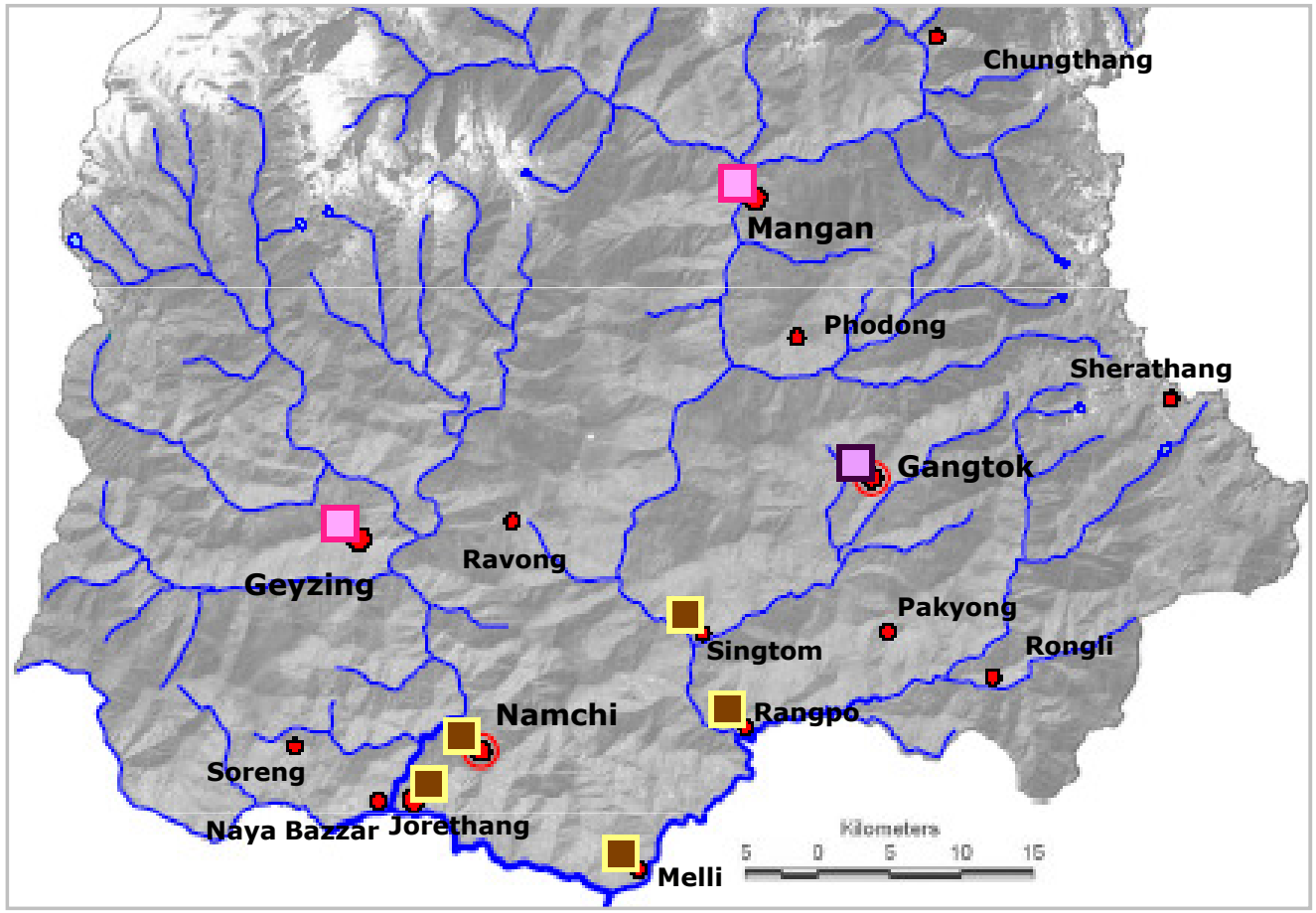
Consultant's findings:

North and West District

WTP (3.62 MLD) will be needed in Mangan and Geyzing-Pelling for a population of 35,750 by 2040. floating population is not factored in yet.

Note: Floating population has not been factored in. See slide on other considerations.

2.4 Current and Proposed Plants



Wastewater Treatment Plants	
	Existing wastewater treatment plants (as in 2008)
	Proposed wastewater treatment plant by PHED (2015)
	Proposed wastewater treatment plant by consultant (2025)*

Figure 2.4.1 Distribution of Existing and Years 2015, 2025 Proposed Water Treatment Plants

** Pre-feasibility report for WTP done by PHED*

3.0 Municipal Solid Waste

3.1 Background

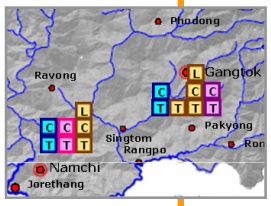
3.2 Proposed Integrated Municipal Plan

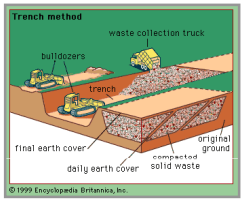
3.3 Projections for the Short, Medium and Long Term

3.4 Conceptual Strategies

3.5 Current and Proposed MSW Facilities

3.6 Factors to Consider in Landfill Design





3.1 Background

In order to secure a safe environment for the future, the extensive amount of municipal solid waste (MSW) generated has to be systematically collected, sorted, treated and disposed.

East District*: In this district, MSW collection is marginal. Only about 40% of MSW is collected in the Gangtok area. A significant amount of wastes are dumped into the nearest water course (jhora), streets and valleys. There is also no provision for collection & disposal of hazardous toxic wastes generated from industries. With the increasing numbers of industries (e.g. pharmaceutical) starting up, these wastes have to be collected and treated separately from the MSW.

In 2005, the AusAID project conducted a demonstration project to collect household waste in the Arithang sub-district of Gangtok. Through technical innovation, appropriate institutional arrangements and intensive community mobilisation, the demo project introduced a new operating systems on a sustainable basis.

Waste disposal and treatment is poor. Disposal is at an open grounds at Marchak, located next to the river. Some waste is segregated and collected for recycling by rural labourers at the dump site. Composting of waste is barely working because of operational problems. After collection of valuables for recycling and some composting, the remainder of the waste is dumped on-site. It is expected that this site will reach "capacity" in 4 years and a new site is needed.

The current practice of waste disposal at open grounds near the river are discouraged without appropriate pollution control measures. At the current and previously abandoned disposal sites (e.g. Martam), there is huge potential for contamination of the underlying soils, groundwater and the adjacent river.

Contamination occurs from rapid leaching of toxics from the waste both vertically downwards and horizontally to adjacent areas.

* Source[3a – d]

Toxics include nitrates (decomposing organic material), and metals (metallic waste scrap e.g. batteries, and electronic components). Other industrial pollutants such as chemicals from industrial wastes could also be present.

North District: There is limited information, and no proper MSW management system or disposal site.

South and West Districts: MSW collected from urban areas around Geyzing-pelling and Namchi is currently dumped at an open disposal site near Jorethang. This dump site poses serious contamination problems for the surrounding areas. A new MSW treatment and compost production plant at Sipchu (Phase 1) West Sikkim is being constructed and expected to be completed by end 2008. The new site will cater to the South and West Districts, designed for 20 years with a daily capacity of 1020 MT/day.

3.2 Proposed Integrated MSW Plan

In order to tackle this massive solid waste problem, an Integrated MSW Plan is proposed for the State. The framework is summarised in Figure 3.2.1 in the next page, and described below.

Description of Integrated MSW Plan

Wastes: Waste collected at the source are categorised into wet waste (A) and dry waste (B). The MSW is considered as an kind of garbage generated at residences, shops, hotels, and commercial establishments. It includes kitchen waste, plant waste, dry waste, paper, cardboard, glass, as well as demolition ash produced from minor modifications of households / buildings. An aggressive program to collect all the waste at source has to be implemented.

As much as 50% of the waste collected can be recycled as valuable materials (40%) and composted (10%). Separate garbage bins for wet and dry wastes are provided. This program will be modeled after the AusAID Arithang 2005 demonstration project.

A. Wet Waste: These wastes include kitchen waste, vegetable peels, fruit waste and uneaten food.

B. Dry Waste: These wastes include plastic bottles, glass bottles, metal waste, rubber items, articles made up of textiles, and other items which have resale value.

B.1 Transfer Station (dry waste): The dry waste collected is transported to specific transfer stations for sorting. Sorting is performed to group them into valuable materials (B3) and other materials (B2). The sorting process is performed by a combination of equipment sorters and trained workers.

B.2 Unsorted Waste (dry waste): Unsorted waste that has no value will be transported to a regional landfill (B.4). Please refer to description of the regional landfill in the next section.

B.3 Valuable Materials (dry waste): These are materials that can be sold for value including metal parts (e.g. aluminum and steel cans, scrap metal, computers, metal electronic parts), plastic bottles (clear, opaque), rubber, glass, textile. Each type of materials is sorted separately, packed and weighed. These materials are then transported by contracted waste haulers to West Bengal (e.g. Siliguri) for sale to recycling vendors.

A.1 Composting (wet waste): All wet waste collected are trucked to a composting facility.

A.2 At the facility, two waste streams are produced – **fine composted residue** (A.2), which can be sold as fertilizers (A.4); and

A.3 Uncomposted materials (wet waste): The uncomposted materials will be transported to the regional landfill (B.4).

B.4 Regional Landfill (dry waste): Because of the steep mountainous terrain, it would be very difficult to locate an engineered MSW landfill in Sikkim. Additionally, there is a recent call for collaboration from large urban cities in neighbouring states to jointly combine resources to select an engineered landfill. (Source: Guidance note for private sector participation and regional municipal waste management facilities. Jan. 2007). Thus, transporting the Unsorted wastes (B.2) and Uncomposted residues (A.3) to a regional landfill would be a reasonable option. Therefore, to avoid the current practice of open dumping, there is urgency to source for this regional landfill outside of Sikkim. It is imperative that UDHD lead this effort to jointly work with the neighbouring states (e.g. West Bengal) to locate and manage the engineered landfill. Details of selecting a typical engineered MSW landfill are summarised in Section 3.5.

(Note: A possible landfill site in a relatively flat area could be selected around the Jerathang vicinity.)

3.2 Proposed Integrated MSW Plan

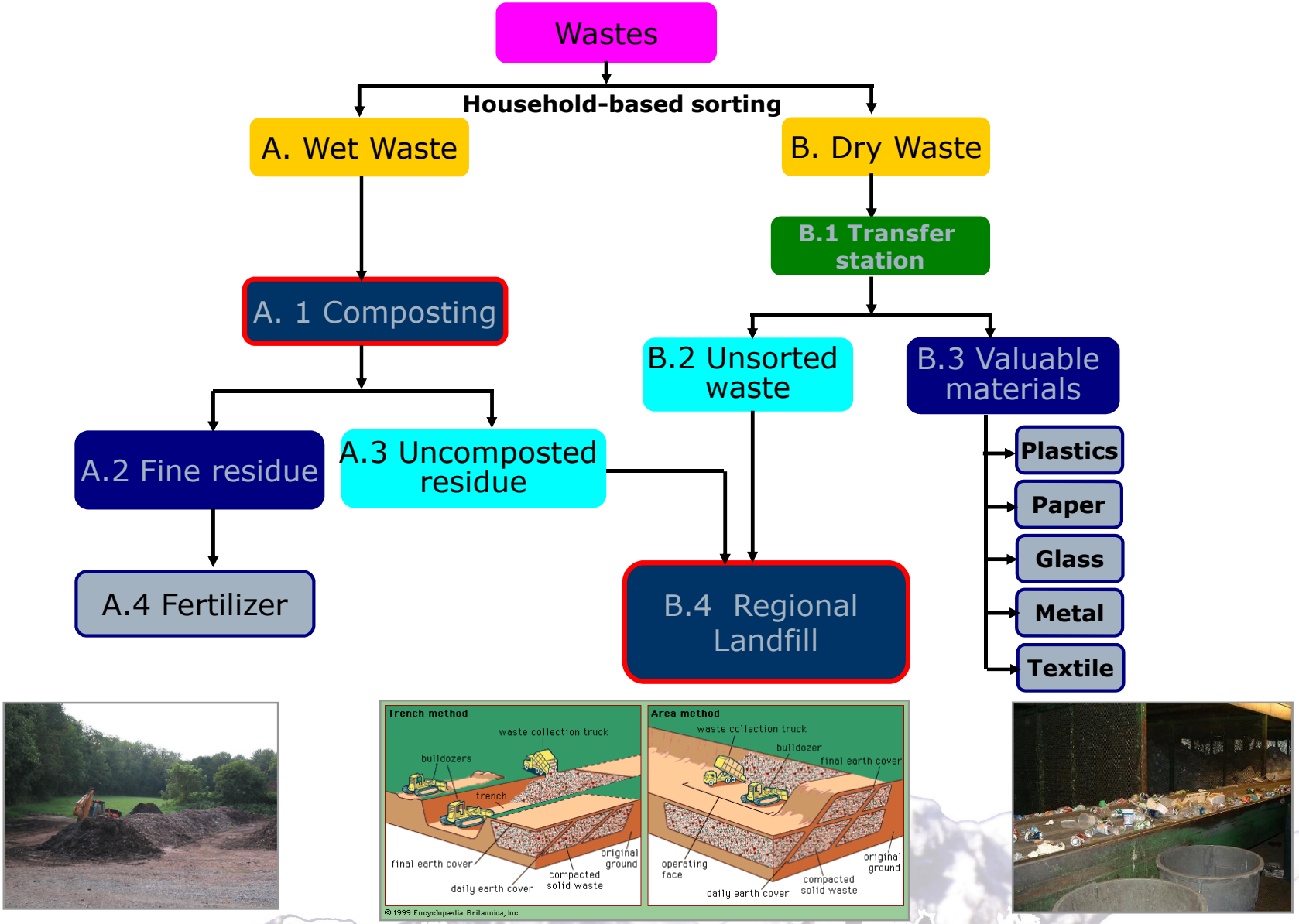


Figure 3.2.1 Flowchart illustrating Proposed Integrated MSW Plan

3.3 Short, Medium and Long Term Projections

Assumption: 0.4 kg solid waste per day per person [3b]

Table 3.3.1 Projections of Solid Waste by Towns at Year 2015, 2025 and 2040

Solid Waste	2015	Solid Waste (MT/day)	2025	Solid Waste (MT/day)	2040	Solid Waste (MT/day)
East district	**184,800**	**74**	**213,300**	**85**	**347,500**	**99**
Gangtok	138,600	55.4	149,310	59.7	160,875	64.4
Singtam	14,784	5.9	17,064	6.8	22,275	8.9
Rangpo	14,784	5.9	17,064	6.8	22,275	8.9
Pakyong	9,240	3.7	17,064	6.8	22,275	8.9
Sherathang	3,696	1.5	6,399	2.6	12,375	5.0
Rongli	3,696	1.5	6,399	2.6	7,425	3.0
West District	**13,200**	**5.3**	**21,330**	**8.5**	**55,000**	**22.0**
Geyzing - Pelling	7,920	3.2	12,798	5.1	35,750	14.3
Nayabazaar	3,960	1.6	6,399	2.6	13,750	5.5
Soreng	1,320	0.5	2,133	0.9	5,500	2.2
North District	**13,200**	**5.3**	**21,330**	**8.5**	**55,000**	**22.0**
Mangan	7,920	3.2	12,798	5.1	35,750	14.3
Phodong	3,960	1.6	6,399	2.6	13,750	5.5
Chungthang	1,320	0.5	2,133	0.9	5,500	2.2
South District	**52,800**	**21.1**	**99,540**	**39.9**	**192,500**	**77**
Namchi	31,680	12.7	64,701	25.9	134,750	53.9
Jorethang	10,560	4.2	14,932	6.0	23,100	9.2
Ravong	5,280	2.1	9,954	4.0	17,325	6.9
Melli	5,280	2.1	9,954	4.0	17,325	6.9

3.4 Conceptual Strategies

To meet the MSW collection, treatment and disposal challenges, the integrated MSW plan needs to be planned, funded and implemented.

East District:

- The AusAID Arithang demo program, followed by outsourcing to NGOs/Private sectors should be expanded to other Gangtok sub-districts and other district towns to implement: a systematic waste collection system and moved to transfer stations; treated at composting plants; and disposed properly at designated landfills.
- Existing facilities of 40 MT/day composting facility at Marchak is not operating optimally and may need repairs, maintenance, and operational changes.
- For 2025, possible additional facilities required: 4 transfer stations, 4 composting facilities and 1 landfill.

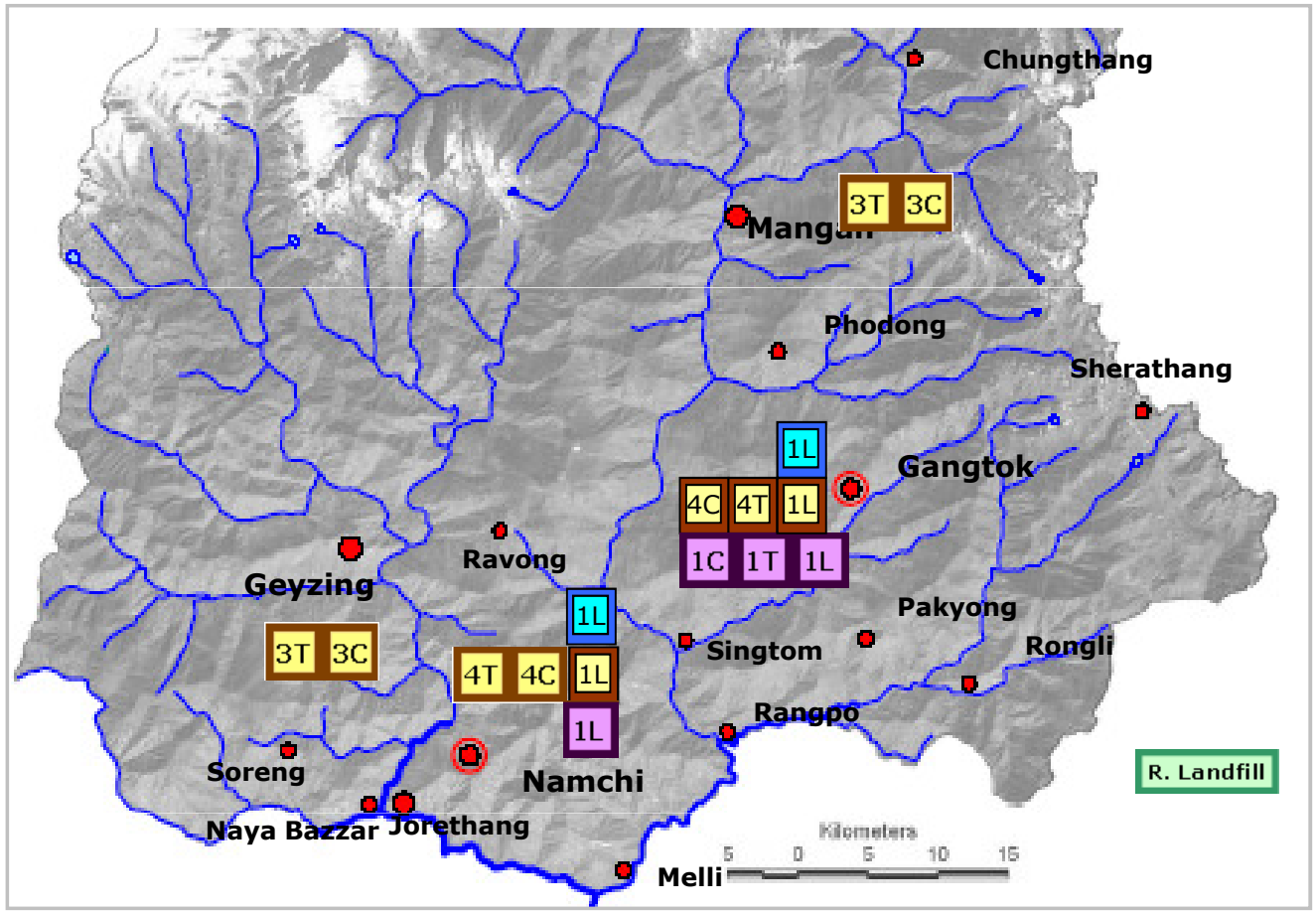
North and West Districts: For each of the town for 2025, one new facility is required - transfer station and composting facility.

South Districts: For 2025, possible additional facilities required: 4 transfer stations, 4 composting facilities and 1 landfill.

Regional Landfill

Beyond 2025, it is anticipated that a new sanitary engineered landfill will need to be sited, designed and built either in Sikkim State or out-of-state in collaboration with regional states like West Bengal.

3.5 Current and Proposed MSW Facilities



Transfer station/ Composting/ Landfill *	
	Existing infrastructure (as in 2008)
	Proposed possible infrastructure by consultant (for 2025)
	Proposed possible infrastructure by consultant (for 2040)

Substation capacity

T ▶ Transfer station **C** ▶ Composting

L ▶ Landfill

R. Landfill ▶ Alternate Regional Landfill

*For each district except for landfill. Landfill serves North & East, South & West districts

Figure 3.5.1 Distribution of Existing and Years 2025, 2040 Proposed Transfer Stations/Composting/Landfills

3.6 Factors to Consider in Landfill Design

Table 3.6.1 Landfill Design Considerations

Factors	Features
Access	Paved all-weather access roads to landfill site. Temporary roads to unloading areas.
Land Area	Area should be large enough to hold all community wastes for 10 - 25 years. Area for buffer strips must also be included. In the Jan 2007 draft report on the concept of a regional landfill, the proposed landfill capacity for an estimated population of 500,000 is about 250 tons / day.
Landfilling Method	Method will vary with terrain and available cover. The most common method is excavated cell and trench. (see figure 2).
Completed Landfill Characteristics	Finished slopes of landfill: 3to1; height of bench, if used 50 - 75ft; slope of final landfill cover: 3 - 6%.
Surface Drainage	Install drainage ditches to divert surface water runoff; maintain 3 - 6% grade on finished landfill cover to prevent ponding; develop plan to divert stormwater from lined but unused portions of landfill.
Intermediate Cover Material	Maximise use of onsite soil materials, other materials such as compost produced from yard waste and MSW can also be used to maximise landfill capacity.
Final Cover	Use multilayer design. Slope of final landfill cover: 3-6%.
Landfill Liner	Single clay layer (2 - 4 ft) or multilayer design incorporating the use of a geomembrane.
Cell Design and Construction	Each day's wastes should form one cell; cover at end of day with 6ft of earth or other suitable material; typical cell width 10-30ft; typical lift height including intermediate cover 10-14ft; slope of working faces 2:1 to 3:1.
Groundwater Protection	Divert any underground springs, if required, install perimeter drains, well point system, or other control measures.
Landfill Gas Management	Develop landfill gas management plan including extraction wells, manifold collection system, condensate collection facilities, vacuum blower and flaring facilities and/or energy production facilities.
Leachate Collection	Determine maximum leachate flow rates and size leachate collection pipe and / or trenches; size leachate pumping facilities; select collection pipe materials to withstand static pressures corresponding to the maximum length of the landfill.
Environmental Requirements	Install Vadose zone gas and liquid monitoring system; install up and downgradient groundwater monitoring facilities; locate ambient air monitoring stations.

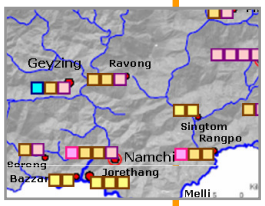
4.0 Power Supply Facilities

4.1 Background

4.2 Short, Medium and Long Term Projections

4.3 Conceptual Strategies

4.4 Current and Proposed Substations



4.1 Background – Power Supply

The development level of a country directly related to its economical and social level. One of the most important factors that takes an active role in achieving such development level is "energy". The demand for energy increases rapidly in parallel with the population increase, industrialization and technological development.

Power Sources

According to the most recent official report provided by Energy & Power Department, Government of Sikkim (Annual Report 2006-07), the sources of power supply (127.7 MW) in Sikkim are originated from three major sources: State Sector or Sikkim Government 40.7 MW, Central Sector or Indian Government 77 MW, and Interstate Sector or Independent Power Producers (IPPs) 10 MW. From these numbers, almost 70% of power supplied in Sikkim is imported. However, Teesta V (510MW), the second biggest hydropower project in Sikim, has been recently commissioned.

Power Generation in Sikkim

Regardless of Teesta V, there are currently fourteen power generation plants in Sikkim. Among these fourteen plants, there are twelve hydropower plants (35.7MW) and with two diesel generating plants (5MW) used for emergency cases [4a]. The developed hydropower plants are dependent directly on the flow rate of the rivers having no dam or major reservoir for generation of rated capacities, especially during the lean period or the winter months (November till early March). The peak power demand also occurs during these winter months when the hydropower generation diminishes down to less than half of the installed capacity. In 2008, Teesta V has been recently commissioned and this results in an additional installed capacity of 510 MW. Therefore, a total installed capacity of power generation plants in Sikkim is around 550MW.

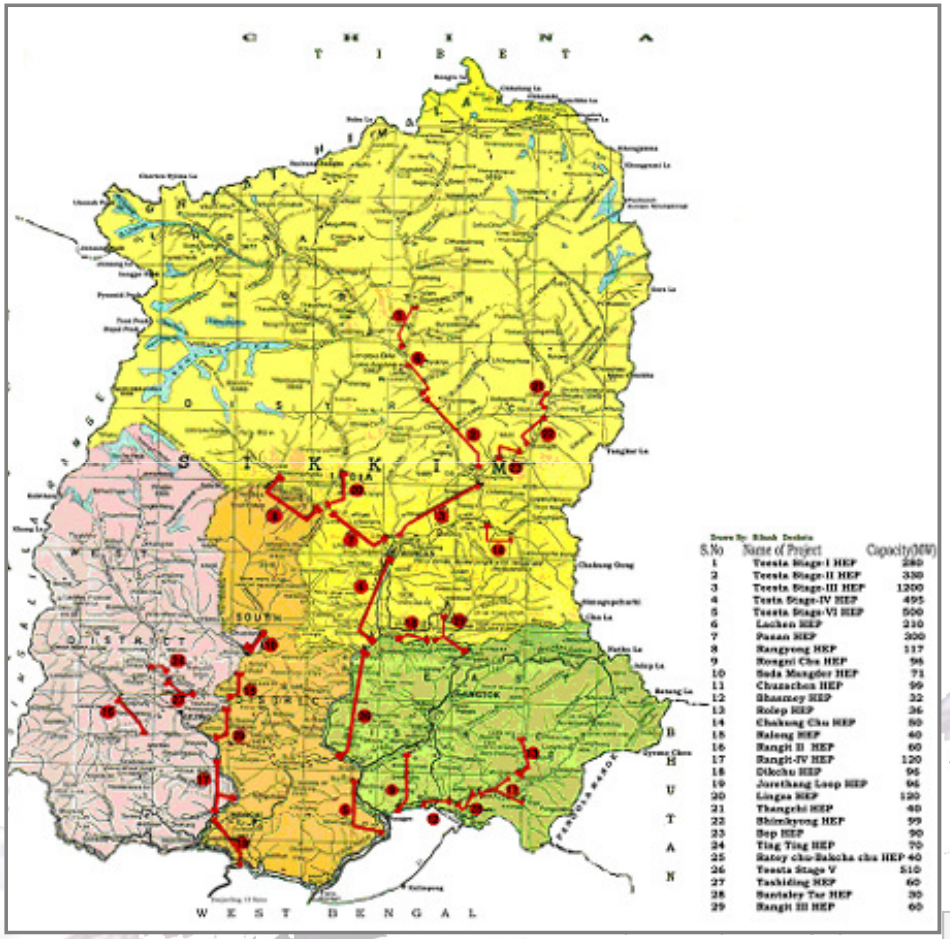
Transmission System

The import and export of power relies solely on the transmission system belonging to West Bengal State Electricity Board. This system is considered as a "*weak system*" and it is one of major causes of blackout in Sikkim.

Also, most of the substations are in the east district, especially in Gangtok, the most developed city in Sikkim.

Ongoing/Upcoming Power Generation Projects

The presence of rivers and their tributaries allows the state to fully exploit the usage of hydro power. Accordingly, the Sikkim Government has initiated 29 projects with a total installed capacity of 5,347 MW throughout the State. As mentioned previously, one of the 29 projects, Teesta V, has been commissioned in 2008. All of the 28 projects are expected to be commissioned by 2012.



4.2 Short, Medium and Long Term Projections

In 2005-2006, Sikkim energy demand is ranked 23rd out of 33 states in India. The average per capita annual consumption of energy in Sikkim is 430 kWh while that of India is 630 kWh [4d]. In order to provide sufficient electric power to sustain the development, the projection of the peak demand is based on the average number in India and peak hours is considered to be 6 hours. From these, peak power consumption per capita = 287.7 W. The projections of peak power consumption for each urban centres for the short-term, medium-term and long-term are provided in the below table.

Table 4.2.1 Projections of Power Demand by Towns at Year 2015, 2025 and 2040

Power Demand	2015	Peak Demand (MW)	2025	Peak Demand (MW)	2040	Peak Demand (MW)
East district*	**184,800**	**53.1**	**213,300**	**61.4**	**347,500**	**71.2**
Gangtok	138,600	39.9	149,310	43	160,875	46.3
Singtam	14,784	4.3	17,064	4.9	22,275	6.4
Rangpo	14,784	4.3	17,064	4.9	22,275	6.4
Pakyong	9,240	2.7	17,064	4.9	22,275	6.4
Sherathang	3,696	1.1	6,399	1.8	12,375	3.6
Rongli	3,696	1.1	6,399	1.8	7,425	2.1
West District	**13,200**	**3.8**	**21,330**	**6.1**	**55,000**	**15.8**
Geyzing - Pelling	7,920	2.3	12,798	3.7	35,750	10.3
Nayabazaar	3,960	1.1	6,399	1.8	13,750	4
Soreng	1,320	0.4	2,133	0.6	5,500	1.6
North District	**13,200**	**3.8**	**21,330**	**6.1**	**55,000**	**15.8**
Mangan	7,920	2.3	12,798	3.7	35,750	10.3
Phodong	3,960	1.1	6,399	1.8	13,750	4
Chungthang	1,320	0.4	2,133	0.6	5,500	1.6
South District	**52,800**	**15.2**	**99,540**	**28.7**	**192,500**	**55.5**
Namchi	31,680	9.1	64,701	18.6	134,750	38.8
Jorethang	10,560	3.1	14,932	4.3	23,100	6.7
Ravong	5,280	1.5	9,954	2.9	17,325	5.0
Melli	5,280	1.5	9,954	2.9	17,325	5.0

4.3 Conceptual Strategies

Power Generation

Assuming that all of the 28 hydro power projects are going to get commissioned by end of 2012, the government will be able to tap approximately 640 MW of free power(12% of total installed capacity) from 2012 until 2027. At the end of 2027, the government will be able to tap approximately 800 MW of free power(15% of total installed capacity).

In conjunction with existing 12 power plants of 40.7 MW, the confirmed capacity will be around 340 MW from 2012 to 2027 and around 400 MW from 2027 onwards. At glance, power generation should be sufficient throughout the periods of planning, i.e. 2015, 2025 and 2040. However, South District does not seem to have sufficient power but this can be made amend with allocation from either East or West Districts. Thus, the power generation is no longer a pertinent issue in Sikkim.

Table 4.3.1 Relationship between the Demand and Generation of Power Supple at Years 2015, 2025 and 2040

	2015			2025			2040		
	Peak Demand (MW)	Generation (MW)		Peak Demand (MW)	Generation (MW)		Peak Demand (MW)	Generation (MW)	
East district	53.1	95	✓	61.4	95	✓	71.2	115	✓
West District	3.8	20	✓	6.1	20	✓	15.8	24	✓
North District	3.8	210	✓	6.1	210	✓	15.8	262	✓
South District	15.2	15	x	28.6	15	x	55.4	19	x
Total	75.9	340	✓	102.3	340	✓	158.2	420	✓



4.3 Conceptual Strategies

Transmission System

Regarding transmission loss, the ongoing/upcoming plants are distributed throughout the state and this can greatly enhances the reduction of transmission loss.

The recent problem lies in the transmission system. The major criteria of the good transmission system consists of having sufficient capability to meet peak demand, providing satisfactory continuity of service to the connected consumer, being "*networks*" for reasons of reliability and operating flow – if any of the element (line) fails, there is an alternative route and thus, power flow is not interrupted. It provides a strong electrical tie between generators so that each can stay synchronized with the system and with the other generators as well. From all these reasons in conjunction with the expansion of urban centres, the substations used for transmission are recommended to be commissioned in 2015, 2025 and 2040. Apart from Gangtok, there will be a need to cater for more substations as the population sizes multiplies, especially in urban centres like Numchi and Rangpo. The location and capacities of the required substations are shown in Appendix C.

For Gangtok, it is the most populated city whereby the population growth is controlled and at the same time, it is equipped with reasonably adequate infrastructure, including substations. In case of Pakyong, for example, it is envisaged that Pakyong will be developed into an aviation centre. Apparently, the existing substation capacity is more than sufficient, but however, it does not provide any business continuity contingency. Henceforth, another substation is required in order to serve as a backup to the existing system.

Environmental Concerns

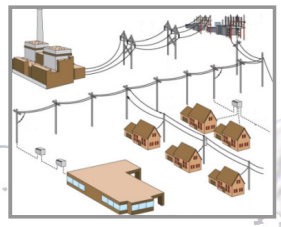
Another issue that is needed to be considered is the "*Effect of electromagnetic field"* on people who live under or nearby high voltage transmission lines is still controversial.

According to previous studies, the electromagnetic field can cause leukemia. However, the results leading to the conclusion were still obscure, i.e. no effect = 70% and cancer = 30%. Although the results did not show the obvious trend, this still need to be taken into the consideration. In order to reduce the impact of electromagnetic field on human, corridor sharing of transmission line with other infrastructures, especially roads and trains, should be explore.

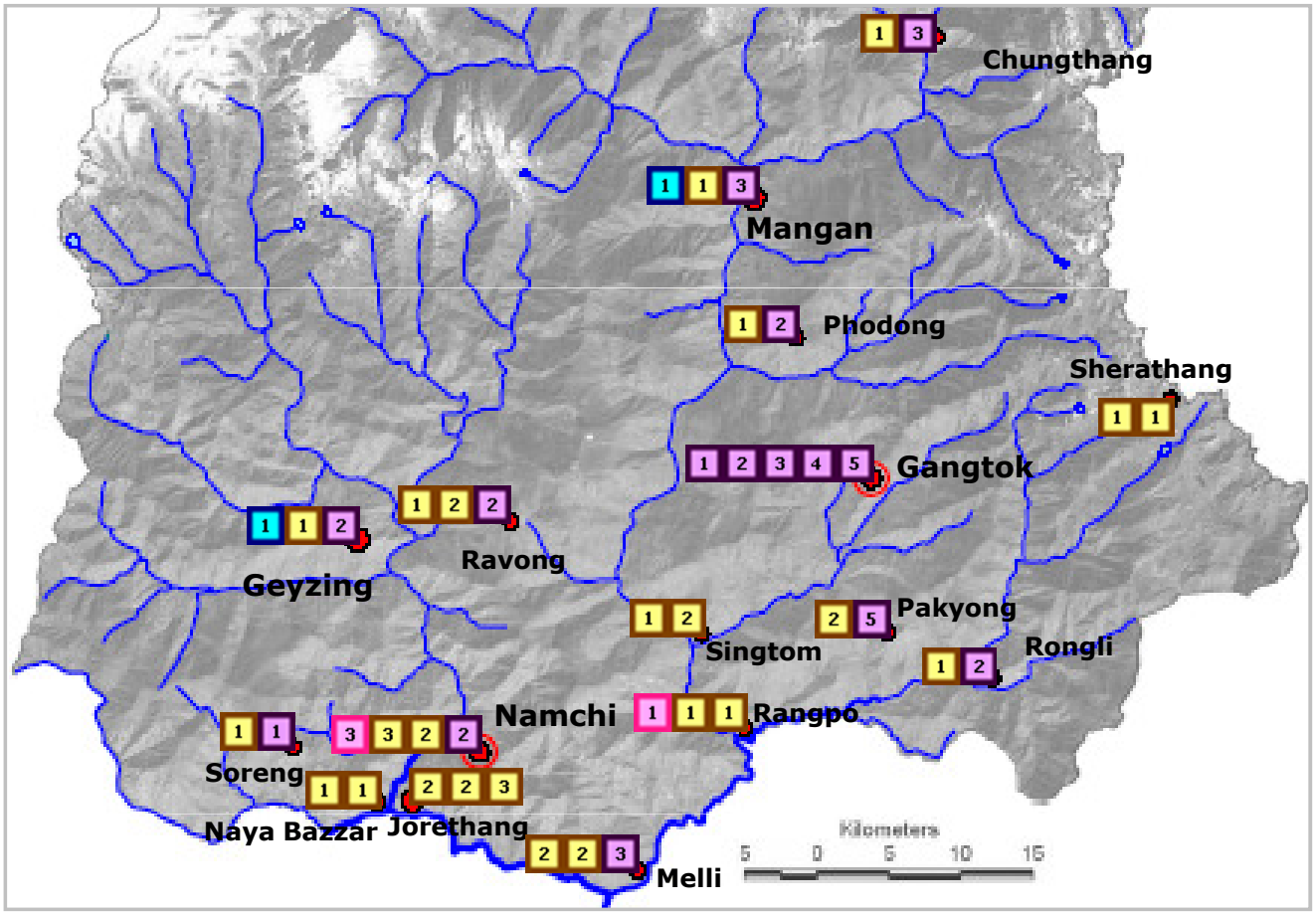
Other Concerns

Power generation is not an issue for floating populations. However, transmission will be critical problems for some urban centres, especially Numchi and Geyzing-Pelling. These urban centres will require additional substations in order to support the floating population, i.e. tourists, seasonally. However, concerns over capital cost must be factored in.

There is a need for power transmission line to be laid underground for major urban centres with high density of population.



4.4 Current and Proposed Substations



Infrastructure for Substations	
	Existing substations (as in 2008)
	Proposed substations by consultant (2015)
	Proposed substations by consultant (2025)
	Proposed substations by consultant (2040)

Substation capacity

1 ▶ 1x2.5 MVA
2 ▶ 2x2.5 MVA, 1x5 MVA
3 ▶ 2x5.0 MVA, 1x10 MVA
4 ▶ 3x5.0 MVA
5 ▶ 2x10.0 MVA

Figure 4.4.1 Distribution of Existing and Years 2015, 2025, 2040 Proposed Substations

5.0 Overall Environmental Infrastructure

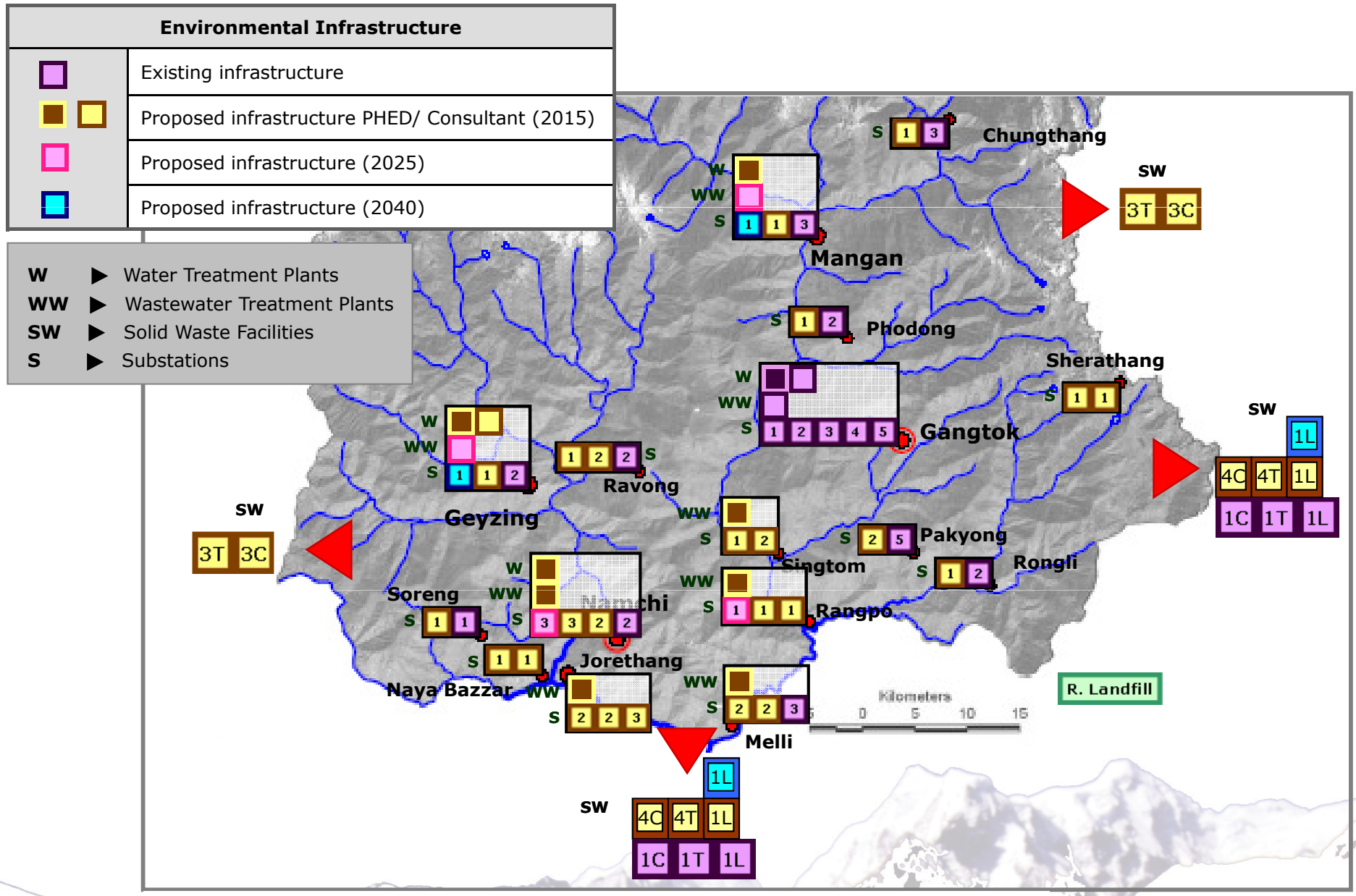


Figure 5.1 Overall Distribution of Existing and Years 2015, 2025, 2040 Proposed Environmental Infrastructure

5.1 Other Considerations

Tourism

Table 5.1.1 Projected Number of Visitors to Sikkim at Peak Period

	*Total Tourist Projection to Sikkim		
	2015	2025	2040
May (Peak Season)	147,742	392,567	1,192,788
Ave. 7 days stay	34,473	91,599	278,317

** Assume average stay of tourists at Sikkim is 7 days*

** Tourist projection numbers from Strategic Planning - Tourism*

Table 5.1.2 Projected Capacity of Infrastructure Required by Visitors to Sikkim During Peak Period

	Projected Tourist's Capacity to Sikkim		
	2015	2025	2040
Water needs (MLD)	4.65	12.37	37.57
Waste Water Generation (MLD)	3.49	9.27	28.18
Solid Waste (MT/D)	14	37	111
Power Consumption (MW)	9.9	26.4	80

With the inclusion of the tourist's floating population, the above additional projected capacities are required for the state of Sikkim. Specific capacity at each town will depend on the visit pattern of the tourists.

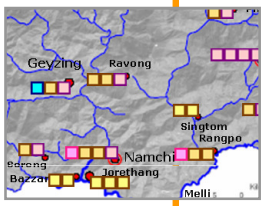
6.0 Environmental Management

6.1 Reduce, Reuse and Recycle (3R) Programme

6.2 Illness Associated with Municipal Management

6.3 Review of Environmental Policies, Rules and Regulations

6.4 Environmental Awareness Amongst the Public



6.1 Reduce, Reuse and Recycle (3R) Program

In order to reduce the amount of waste headed for final disposal, it is strongly recommended that the "***Integrated Solid Waste Programme***" should be promoted in all urban centres in Sikkim. The integrated solid waste programme, also known as "***3R programme***" is a sustainable waste management approach which consists of: Reduce, Reuse and Recycle. Currently, full scheme of 3R program has not yet been planned in any area of Sikkim. Since Gangtok is the most populated and manageable city and the program, it should be started from Gangtok.

Main Players: Three groups in society are key main players in this process: government, industry & commerce and individuals. Policies need to be designed to change behaviors of all these groups.

Policies: It is necessary for government to provide some support through policy measures. Policies which encourage waste avoidance and minimization are to be preferred over those which focus purely on further encouraging present recycling, recovery and reuse. Five types of policy options that should be considered are as follows:

1) Producer Responsibility
2) Eco-labeling
3) Charges and economic incentives: pay-as-you-throw
4) Persuasion measures
5) Integrated product policy

Approach: Approaches used in different countries are given in Table 6.1.1.

Technologies: Whatever success is achieved in reducing waste arising and in separating materials for recycling, some waste will always remain. To achieve high waste reduction rate in terms of landfill demand, a technology component is required. Available options are listed below:

1.Size reduction technologies: baling, pulverization/shredding, homoginization/wet pulping
2.Weight reduction technologies: separation, materials recycling facilities, waste derived fuel
3.Waste to energy generation: Mass burn incineration, fluidized bed incineration, combustion of prepared waste derived fuel
4.Other combustion technologies: Aggregate/block production, cement kiln firing, wood burning power/CHP (Combined Heat and Power) stations, tyre burning power/CHP stations, gasification, pyrolysis
5.Biological systems: Composting, Vermicuture, hydrolysis, anaerobic digestion

6.1 Reduce, Reuse and Recycle (3R) Program

Table 6.1.1 Criteria for Reduce, Reuse, Recycle (3R) Program

CRITERION	GERMANY	NETHERLANDS	CALIFORNIA	AUSTRALIA
Principal recycling drivers	• Landfill disposal costs • Organic waste landfill ban • Consumer waste charges • Strong public relation	• Landfill ban • High cost of incineration	Volume-based billing system	Community awareness and endorsement
Recycling targets	• Recycling of 80% of collected recyclable materials • Organic waste-a maximum of 120 kg per capita • Bulky waste – 50% of generation to be collected	• At national level, 60% for reuse and recycling • Organic waste-a maximum of 120 kg per capita • Arnhem has set a target of 60%+10%	Reduce amount of MSW by 50% by 2000, from a baseline 1990	No waste by 2010
Target achievement	Yes. Recyclate production of 210 kg per capita	No.37% recycling achieved	Yes, but not sustained. 38% recycling achieved	No. 57% recycling achieved
Legal/regulation	• Banning of organic landfill after 2005, phasing out of landfilling household waste by 2020 • Eco-labelling • Packaging ordnance	• Landfill ban on household waste from 1995 • Producer responsibility for various waste streams	• Reduction of solid waste by 2000 • California Beverage, Container Recycling and Litter Reduction Act • State law on purchase of recyclates	None
Markets for end products	• Compost: agricultural markets • Cork: insulating materials • Wood: shipboard and thermal treatment • Paper and glass: retailers	Markets are available for paper and compost. Paper price volatility is addressed by giving recovered product free	• Bottles/cans/paper: sold to Pacific rim • Yard/green waste: landfill cover, mulch • Tyres/wood: fuel for cement kiln and boilers	• Paper/compost: used by government • Aggregates/compost: construction firms and civil contractors
Public awareness	• Quarterly newsletters • Literature on recycling practice	Waste calendar	• Quarterly city newsletter • Cable channel providing information on service • Customer service line	• Literature dissemination • Media advertising

6.2 Illness Associated with MSW Management

As mentioned previously in Chapter 3 (Part II of the report), the proposed integrated solid waste management program consists of three major parts waste: waste recycling, composting and landfill. The health risk associated with these three component will be discussed here.

1. Waste recycling facilities

Household waste contains a diversity of materials and therefore potentially numerous hazards, with sheer volume exacerbating any difficulties. The potential health related problem of waste recycling facilities arise from the exposure of operatives with wastes due to hand-sorting of materials.

These hazards can be divided into three categories: physical, chemical and biological hazards.

1.1 Physical hazards

Manual handling of materials and the ergonomic aspects of materials handling hand-sorting are the main physical hazards, followed by the potential for accident, e.g. cuts (broken bottles), broken limbs etc. especially during interaction with heavy machinery and movement of vehicles. Many waste recycling facilities are also venerable to potential fires. Noise and vibration are present in waster recycling facilities due to the use of various sorting and baling machinery.

1.2 Chemical hazards

Chemical hazards include vapors and residues from household hazardous waste (HHW), e.g. garden chemicals, wood preservatives, paints, cleaning materials etc. Heavy metals are include in this category due to the possibility of exposure to cadmium and mercury from batteries in HWW. Volatile organic compounds (VOCs) are produced when waste is degrading, e.g. organic sulfur compounds are thought to contribute to nausea, irritation and intestinal problems experienced by some operatives.

1.3 Biological hazards

Biological hazards have caused most concern in waste recycling facilities. Collection and separation of household waste generates organic dusts. These include airborne bacteria and fungi (bioaerosols) and their cell wall components. Microbial cell wall components are an important constitute in organic dusts.

Dust generated in waste facilities could also include airborne viruses. Viable or live microorganisms are implicated in infection and allergy, and pathogenic species are of some concern in composting. They are implicated in fever, flu-like symptom, headache, excessive tiredness and joint pains (called Organic Dust Toxic Syndrome) and gastrointestinal problems. These symptoms have been reported in studies on waste sorting facilities.

2. Composting

Commonly in the composting systems, high concentration of bacteria and fungi are present in composts. Whenever composting materials are moved around, for example during the shredding, turning and screening processes, these microorganisms can be aerosolized, forming what is termed a bioaerosol. The handling of large quantities of compost potentially can lead to the release into the air of large quantities of the bacteria, fungi and actinomycetes and their components, found in compost, as a bioaerosol. Exposure to the microorganisms found in compost could potentially cause ill-health in the people exposed to them either by infection, allergy or an adverse response to toxins. The composting process generate heat, so any human pathogens present in the raw materials, such as coliform bacteria from faecal material which could give rise to gastrointestinal infection, should be rapidly killed off during the composting process. Some of the microorganisms which increase in number during the composting process are toxic and/or allergenic and still have the potential to cause problems when they are dead. They are two main routes of exposure to compost microorganisms: ingestion of the microorganisms or inhalation of bioaerosols created during the handling of compost.

Good hygiene practices such as wearing of gloves and provision of hand washing facilities on composting sites should control risk form ingestion. However, control of

6.2 Illness Associated with MSW Management

3. Landfill

The potential for a fundamental link between landfill and certain adverse health outcomes in neighboring residents is a matter of continuing concern. The primary potential exposure pathways that may occur as a result of landfill operations are summarized in the Table 6.2.1 below.

Table 6.2.1 Primary Potential Exposure Pathways Resulting from Landfill Operations

EXPOSURE PATHWAY	SOURCE	RELEASE/ TRANSPORT MECHANISM	POTENTIAL RECEPTORS AT RISK	EXPOSURE ROUTE	LIKELYHOOD OF COMPLETE PATHWAY	CIRCUMSTANCES LEADING TO POTENTIAL COMPLETE PATHWAY
Aerial gaseous emission	• Decomposing waste	Emission of trace constituents in landfill gas	Atmospheric dispersion	Residences, schools, hospitals, OAP home within up to app 3 km of landfill	Moderate: • Containment and treatment controls can reduce but cannot eliminate aerial gaseous emissions	• Sensitive receptors located in vicinity of site
Subsurface gas migration	• Decomposing waste	Emission of bulk and trace constituents in landfill gas	Subsurface migration	Properties within up to app 500 m of landfill	Low: • Migration generally limited by natural barriers (e.g. substrata, surface water courses, groundwater table) • Emissions limited by standard control	• Sensitive receptors located immediately adjacent to site • Site underlain by extensively fractured/fissured strata • Site linked to receptors by man-made structures (sewers, drains etc)
Airborne dust	• Unpaved haul roads • Soil stock piles • Bare earth • Earth works • Dusty waste inputs	Disturbance, by wind or mechanically, of surface dust onto which contaminants are adsorbed	Atmospheric dispersion	Residences, schools, hospitals, OPA homes, food outlet within app 250 m of landfill	Low: • Concentration diminish rapidly with distance • Emission limited by standard control	• Sensitive receptors located immediately adjacent to site • Site receives large inputs of highly dusty, hazardous wastes (e.g. incinerator ash, asbestos, industrial powder)
Deposited dust	See above	See above	See above	See above	Low: • See above	See above
Direct contact	• Uncovered waste • Contaminated soil	None required	None required	None required	Low: • Most sites not accessible by public	• Sites adjacent to residences or schools • Sites with no perimeters fencing or other security measures

6.3 Review of Environmental Regulations

The discharge norms pertaining to water, air, solid & hazardous waste and noise vary from country to country depending on the status of process and technology adopted, geographical location and environmental management practices used as well as public awareness and concern. However, some critical parameters are basically essential to be present in the standards in order to ensure that the environment is not polluted by any activities. This section is focused on the review of the existing environmental standards enforced by the Sikkim Government and the comparison of the existing standard with the international standards, especially World Health Organization Guideline. Finally, the recommendation is provided.

In Sikkim, the State Pollution Control Board has given the power to govern all the pollution regulations which were passed by Indian Parliament. The State Pollution Control Board Sikkim is entrusted with the implementation of following Acts & Rules:

1. Water (Prevention & Control of Pollution) Act, 1974

2. Water (Prevention & Control of Pollution) Cess Act, 1977

3. Air (Prevention and Control Pollution) Act, 1981

- National Ambient Air Quality Standards

4. The Environmental Protection Act 1986 and its amendment, 1999

- Primary Water Criteria, including drinking water
- General Standard for Discharge of Environment Pollutants Part-A: Effluent
- General Standard for Discharge of Environment Pollutants Part-B: Wastewater generation standard

5. Hazardous Waste (Management & Handling) Rules, 1989

6. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989

7. Public Liability Insurance Act, 1991

8. Biomedical Waste (Management & Handling) Rules, 1998

9. The Recycled Plastics Manufacture and Usage Rules, 1999

10. Noise Pollution (Regulation and Control) Rules, 2000

11. The Municipal Solid Wastes (Management & Handling) Rules, 2000

12. Ozone Depletion Substances (Regulation & Control) Rules, 2000

The review of criteria/standard specified in the above mentioned Acts and Rules are as follows.

6.3 Review of Environmental Regulations

1. The National Ambient Air Standard

Air pollution denotes a change of quality of air in the natural environment manifested generally in terms of identified parameters such as Suspended Particulate Matter (SPM), Sulfur dioxide, Nitrous oxide, Carbon monoxide, Lead, Poly-nuclear Aromatic Hydrocarbon (PHA), Heavy metals, Respiratory Particulate Matter (RPM), etc. From a review and a comparison of the notified standard and WHO standard, given in Table 6.3.1, the main findings are as follows:

1) Different standards, including SO_2, NO_2, PM_{10}, Pb and CO, have been laid down for industrial, residential and sensitive areas. The sensitive areas are to be notified by the State Government/State Board.

2) Apart from SO_2 concentration, all of the concentrations notified in the standards are comparable to the concentrations recommended by WHO. In general, the concentration of SO_2 recommended by WHO is much lower than that notified in this regulation.

3) Apart from *ozone concentration*, all basic parameters have been included in the Indian NAAQS (1994). The concentration of ozone recommended by WHO should not be higher than 100 µg/m^3.

Table 6.3.1 The National Ambient Air Standard Notified by Central Pollution Control Board and WHO Standard

POLLUTANT	TIME WEIGHT AVERAGE	National Ambient Air Quality Standard (1994)			WHO Standard
		Industrial area	Residential, Rural & other areas	Sensitive areas	
Sulphur dioxide (SO_2)	Annual avg	80 µg/m^3	60 µg/m^3	15 µg/m^3	-
	24 hour	120 µg/m^3	80 µg/m^3	30 µg/m^3	20 µg/m^3
Oxide of Nitrogen as NO_2	Annual avg	80 µg/m^3	60 µg/m^3	15 µg/m^3	40 µg/m^3
	24 hour**	120 µg/m^3	80 µg/m^3	30 µg/m^3	-
Suspended Particulate Matter (SPM)	Annual avg*	360 µg/m^3	140 µg/m^3	70 µg/m^3	-
	24 hour**	500 µg/m^3	200 µg/m^3	100 µg/m^3	-
Respiratory Particulate Matter (PM_{10})	Annual avg*	120 µg/m^3	60 µg/m^3	50 µg/m^3	20 µg/m^3
	24 hour**	150 µg/m^3	100 µg/m^3	75 µg/m^3	50 µg/m^3
Lead (Pb)	Annual avg*	1.0 µg/m^3	0.75 µg/m^3	0.50 µg/m^3	0.5-1 µg/m^3
	24 hour**	1.5 µg/m^3	1.0 µg/m^3	0.75 µg/m^3	-
Carbon monoxide (CO)	8 hours	5.0 mg/m^3	2.0 µg/m^3	1.0 mg/m^3	10.0 mg/m^3
Carbon monoxide (CO)	1 hour	10.0 mg/m^3	4.0 µg/m^3	2.0 mg/m^3	10.0 mg/m^3

6.3 Review of Environmental Regulations

2. The National Ambient Noise Standard

Noise can cause irritation and multiple health problems, including loss of hearing, hypertension, annoyance, fatigue and so no. Noise may be caused by a number of business activities related to community life, industry and transport. A comparative standard of National Ambient Noise Standard notified in Noise Pollution (Regulation and Control) Rules, 2000 and WHO guideline is given in Table 6.3.2. The noise standards are generally set on the basis of WHO stipulations. A comparison shows that in India the noise standard set are more or less in tune with the WHO guideline. But however, an issue to be considered is the implementation.

Table 6.3.2 The National Ambient Noise Standard Notified by Central Pollution Control Board and in a Comparison with WHO Guideline

AREA CLASS	**National Ambient Noise Standard**		**WHO Guideline (Day and Night time)** Limits in dB
	Day Time (6am-9pm)	**Night Time (9pm-6am)**	
Residential	55	45	45
Commercial	65	55	60
Industrial	75	70	65
Silence zone	50	40	45

NOTE: As stated in the National Ambient Noise Standard, *Silent zone* is an area comprising not less than 100 metres around hospitals, educational institution, courts, religious places or any other area which is declared as such by the competent authority.

6.3 Review of Environmental Regulations

3. Primary Water Quality Criteria

The Central Pollution Control Board has classified water resources of the country according to their uses for setting water quality objectives for different water bodies. Five water quality classes have been designated (A-E) on the basis of the water quality requirements for a particular use. The classification system is present in Table 6.3.3. The main finding of the regulation review are as follows:

Class A and C: Drinking water source

- WHO does not produce any guideline for quality of drinking water source. However, it is recommended that parameters specified for the drinking water source, either with/without treatment, should be based on drinking water standard.
- For parameters specified in the Primary Water Criteria (Total coliform, pH, DO and BOD), all the criteria, except total coliform organisms, are more or less in line with good quality surface water. It should be noted that all these parameters are not mentioned in drinking water quality guideline set by WHO. Pertaining to Total coliform organisms, it should be around 0 in 250 mL according to the EU standard.
- According to WHO guideline, the important parameters that are necessary to be considered consist of conductivity, cations, anions and chlorine dioxide (ClO_2).

Class B and D: Surface water for bathing and Propagation of wild life and fisheries

- Quality of water for the purpose of irrigation, industrial cooling and controlled waste disposal is not mentioned by WHO.
- The criteria indicated by the rules, including the coliform organisms, pH, BOD and DO are in line with international standards, indicating surface water with a good quality.
- The parameters specified should include heavy metals and organic pollutants.

Class E: Irrigation, industrial cooling, controlled waste disposal

- Quality of water for the purpose of irrigation, industrial cooling and controlled waste disposal is not mentioned by WHO.
- For Agricultural use & Irrigation, according to the international guidelines such as in Canadian guideline, it is emphasized on organic and inorganic substances. The organic substances include carbon tetrachloride and pesticides such as aldicarb, atrazine, bromacil, bromoform, bromoxynil, captan, carbofuran, chlordane and carbaryl. As for inorganic substances, these include aluminium, beryllium, boron, cadmium, calcium and arsenic. Apart from these, blue-green algae is also included in the guideline.

6.3 Review of Environmental Regulations

Table 6.3.3 Primary Water Quality Criteria for Various Uses of Fresh Water

CLASS	DESIGNATED BEST USE	CRITERIA
A	Drinking water source without conventional treatment but after disinfections	• Total coliform organisms MPN/100mL shall be 50 or less. • pH between 6.5-8.5 • DO 6 mg/l or more • BOD 2 mg/l or less
B	Outdoor bathing (organised)	• Total coliform organisms MPN/100mL shall be 500 or less. • pH between 6.5-8.5 • DO 5 mg/l or more • BOD 3 mg/l or less
C	Drinking water source with conventional treatment followed by disinfections	• Total coliform organisms MPN/100mL shall be 500 or less. • pH between 6-9 • DO 4 mg/l or more • BOD 3 mg/l or less
D	Propagation of wild life, fisheries	• pH between 6.5-8.5 • DO 4 mg/l or more • Free ammonia (as N) 1.2 mg/l or less
E	Irrigation, industrial cooling, controlled waste disposal	• pH between 6.0-8.5 • Electrical conductivity less than 2250 µmhos/cm • Free ammonia (as N) 1.2 mg/l or less

6.3 Environmental Policies, Rules and Regulations

The Environmental (Protection) Rules, 1986

Schedule –VI

General Standards for Discharge of Environment Pollutants Part-A: Effluent

Table 6.3.4 Environmental (Protection) Rules 1986

SI. NO.	PARAMETER	STANDARD			
		Inland surface water	Public Sewer	Land for irrigation	Marine coastal areas
1	Colour and odour	Sec.6 of Annexure-I	-	Sec.6 of Annexure-I	Sec.6 of Annexure-I
2	Suspended solids, mg/l	100	600	200	(a) For process waste water-100 (b) For cooling water effluent 10%above total suspended matter of influent
3	Particle size of suspended solids, µm	Shall pass 850 µm SI Sieve	-	-	(a) Floatable solids, max 3 mm (b) Settleable solids, max 850 µm
4	pH value	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0	5.5 - 9.0
5	Temperature, ° C	Shall not be exceed 5° C above the receiving water temperature	-	-	Shall not be exceed 5° C above the receiving water temperature
6	Oil and grease, mg/l	10	20	10	20
7	Total residual chlorine, mg/l	1.0	-	-	1.0
8	Ammonia nitrogen, mg/l (as N)	50	50	-	50
9	Total Kjedahl nitrogen, mg/l (as NH_3)	100	-	-	100
10	Free ammonia, mg/l (as NH_3)	5.0	0	-	5.0
11	BOD_5 @20° C, mg/l	30	350	100	100
12	COD, mg/l	250	-	-	250
13	Arsenic, mg/l (as As)	0.2	0.2	0.2	0.2
14	Mercury, mg/l (as Hg)	0.01	0.01	-	0.01

6.3 Environmental Policies, Rules and Regulations

The Environmental (Protection) Rules, 1986

Schedule –VI

General Standards for Discharge of Environment Pollutants Part-A: Effluent (Cont)

SI. NO.	PARAMETER	STANDARD			
		Inland surface water	Public Sewer	Land for irrigation	Marine coastal areas
15	Lead, mg/l (as Pb)	0.1	1.0	-	2.0
16	Cadmium, mg/l (as Cd)	2.0	1.0	-	2.0
17	Hexavalent chromium, mg/l (as Cr^{+6})	0.1	2.0	-	1.0
18	Total chromium, mg/l (as Cr)	2.0	2.0	-	2.0
19	Copper, mg/l (as copper)	3.0	3.0	-	3.0
20	Zinc, mg/l (as zinc)	5.0	15	-	15
21	Selenium, mg/l (as Sc)	0.05	0.05	-	0.05
22	Nickel, mg/l (as Ni)	3.0	3.0	-	5.0
23	Cyanide, mg/l (as CN)	0.2	2.0	0.2	0.2
24	Fluoride, mg/l (as F)	2.0	15	-	15
25	Dissolved phosphates, mg/l (as P)	5.0	-	-	-
26	Sulphide, mg/l (as S)	2.0	-	-	5.0
27	Phenol compounds, mg/l (as C_6H_5OH)	1.0	5.0	-	5.0
28	Radioactive materials: (a) alpha emitter, µcurie/ml (b) Beta emitter, µcurie/ml	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-7} 10^{-7}	10^{-7} 10^{-6}
29	Bio-assay test	90% survival of fish after 97 hours in 100% effluent	90% survival of fish after 97 hours in 100% effluent	90% survival of fish after 97 hours in 100% effluent	90% survival of fish after 97 hours in 100% effluent
30	Manganese, mg/l (as Mn)	2.0	2.0	-	2.0
31	Iron, mg/l (as Fe)	3.0	3.0	-	3.0
32	Vanadium, mg/l (as V)	0.2	0.2	-	0.2
33	Nitrate nitrogen, mg/l (as N)	10	-	-	20

6.3 Environmental Policies, Rules and Regulations

		WHO	EPA UK	USEPA National Ambient Air Quality Standard (NAAQS)	
POLLUTANTS	**TIME WEIGHT AVERAGE**	**Air Quality Guideline**		**Primary standard**	**Secondary standard**
1. Sulphur dioxide (SO_2)	Annual avg*	-		39 µg/m³	
	24 hour**	20 µg/m³		184 µg/m³	
	3 hour				1,300 µg/m³
	15 min	-	266 µg/m³		
	10 min	500 µg/m³			
2. Oxide of Nitrogen as NO_2	Annual avg*	40 µg/m³		100 µg/m³	100 µg/m³
	24 hour**				
	1 hour	200 µg/m³	200 µg/m³		
3. Suspended Particulate Matter (SPM)	Annual avg*			15.0 µg/m³	15.0 µg/m³
	24 hour**				
4. Respirable Particulate Matter (PM_{10})	Annual avg*	20 µg/m³			
	24 hour**	50 µg/m³	50 µg/m³	150 µg/m³	150 µg/m³
5. Lead (Pb)	Annual avg*	0.5-1 µg/m³	0.25 µg/m³		
	Quaterly avg			1.5 µg/m³	1.5 µg/m³
6. Carbon monoxide (CO)	Annual avg*				
	24 hour**				
	8 hour	10 mg/m³	11.6 mg/m³	10 mg/m³	None
	1 hour**	30 mg/m³		40 mg/m³	None
7. Ozone	8 hour	100 µg/m³	100 µg/m³	150 µg/m³	150 µg/m³
	1 hour			240 µg/m³	240 µg/m³
8. Benzene	Annual avg		11.25 µg/m³		
9. 1,3-Butadiene	Annual avg		2.25 µg/m³		

6.4 Environmental Awareness Amongst the Public

Activities Set up by the Government

Awareness is the fundamental tool for protection of the environment. In Sikkim, the Public Environmental Awareness Programmes had been carried out by the State Pollution Control Board of Sikkim in order to create awareness among the public about the importance of prevention and control of pollution at all levels. The activities, which are celebrated by State Pollution Control Board in 2004, are as follows:

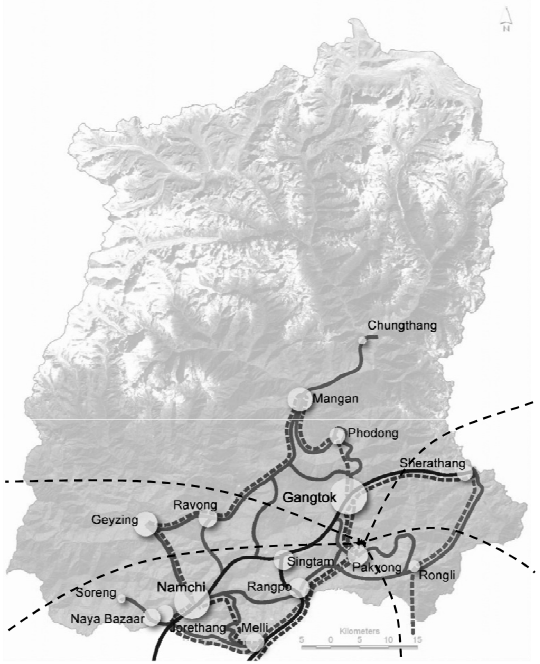
1) World Environmental Day on 5th June
2) International Ozone Day on 16th September
3) National Science Day.

Besides the above celebrations, the State Pollution Control Board also produced:

1) Documentaries and telecast them in the local cable TV network on environmental issue
2) Regular environmental reports
3) Advertisement in the local paper
4) The State Pollution Control Board also acts as a nodal agency in the Implementation of National Environmental Awareness Campaign funded by Ministry of Environment and Forest, Government of India.

Part III :

Implementation & Conclusion



1.0 Key Policy Considerations for Implementation of the State Strategic Urban Plan

2.0 The Significance of the Strategic Urban Plan

3.0 Next Step

4.0 References

5.0 Appendices

1.0 Key Policy Considerations

Key policies for realizing the State Strategic Urban Plan

The above State Strategic Urban Plan will remain as a documented proposal if no corresponding policies are put in place to enforce execution of the Plan. Therefore, the following actions are recommended:

1. Chart an "Action Plan" to guide the implementation of the Plan, which may include:

- Endorsing the State Strategic Urban Plan as an official planning document ready to be rolled out to guide all future developments across the State at different milestones

- Setting up a Strategic Planning Team within UD&HD to administer review of the State Strategic Urban Plan every 5 years so as to ensure that the plan is updated to address the prevailing needs due to any dynamic changes to the social, cultural, and economic environment of Sikkim

- Setting up a permanent Strategic Planning Review Panel comprising at least the following 11 government agencies:

  - UD&HD, Building & Housing Dept, Tourism Dept, Roads & Bridges Dept, Mines & Geology Dept, Rural Management & Development Dept, Transport Dept, PHED, Power Dept, District Collector, and Block Development Office.

  - In co-operation with Land Revenue Dept, Forest Dept, Health, Agriculture, Education, Sports Depts, etc., through consultations.

  - Panel to be chaired and administered by UD&HD.

In addition to the action plan stated for the State Strategic Urban Plan, the following points shall be considered for the implementation of infrastructure strategies:

- Set up a Strategic Infrastructure Planning Team comprising of PHED, RDD, Private Water suppliers as well as Energy & Power Department (EPD) to administer the State Water, Wastewater and Power Infrastructure Strategic Plan Review every 5 years.

- UD&HD should be represented in the Strategic Infrastructure Planning Team for the purpose of overall coordination amongst infrastructure and physical developments.

1.0 Key Policy Considerations

2. For day-to-day regular businesses, various planning mandates have to be given in support of enforcement of the Plan. They are:

- Formulate appropriate development control regulations according to respective Land Use Development Guide Plan for individual towns which should be given statutory significance

- Empower responsible agencies for enforcement through regular monitoring and inspection

- Require mandatory consultations with the Strategic Planning Team (SPT) of UD&HD on all development projects which are hence better coordinated

- Hold regular bi-weekly or monthly coordination meetings between SPT and the relevant infrastructure and development agencies to address planning issues arising from individual key development proposals

2.0 The State Strategic Urban Plan

The Significance of the State Strategic Urban Plan

As the population of Sikkim continues to grow from the current 580,000 people to the projected 1.1 million by 2040, many resources will be mobilized to meet the natural and inevitable growth of various urban centers which are expected to accommodate 50% of this population. It is therefore essential to have a structured Strategic Urban Plan at the State level to guide utilization and distributions of the precious resources across the State such that all physical developments from amenities to transport and utility infrastructures are thoroughly planned and work toward a balanced and healthy growth of urban centers across Sikkim in the interests of all urban dwellers in the State.

While the State Strategic Urban Plan offers a clear conceptual blueprint giving a big picture of how the physical development of Sikkim should take place in order to achieve an optimal result, the conceptual proposals outlined in the Plan will have to be examined further through separate or ad-hoc technical feasibility studies or detailed planning at a micro scale. Nevertheless, they will serve as useful references or pointers giving directions to the Sikkim Government on what should be done in next 35 years.

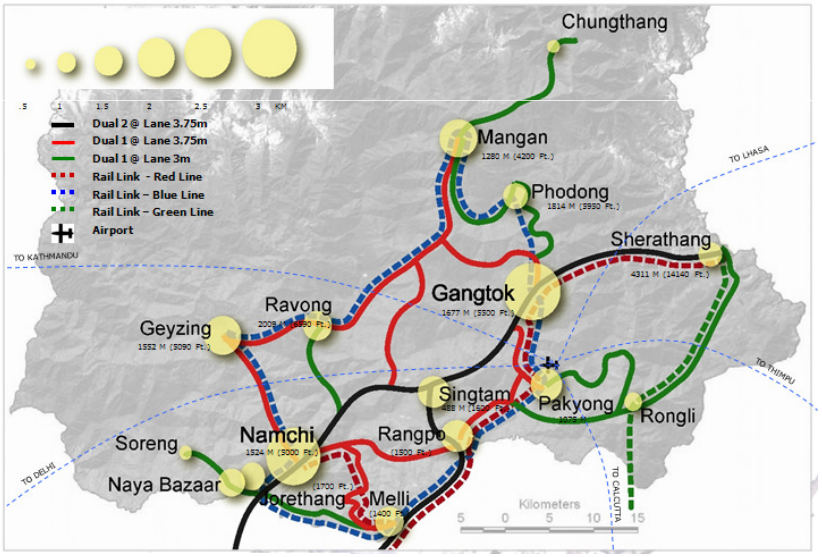


Figure 2.1 State Strategic Plan at Year 2040

3.0 Next Step

Going Forward

The planning proposals, as illustrated in the preceding chapters, will give a clear guide on development strategies in the short-term, medium-term and long-term for the State of Sikkim.

The various proposed planning parameters and infrastructure estimates will be used as key planning basis for next stage of planning task on formulation of Development Control Plans for 4 major urban centers in Sikkim.

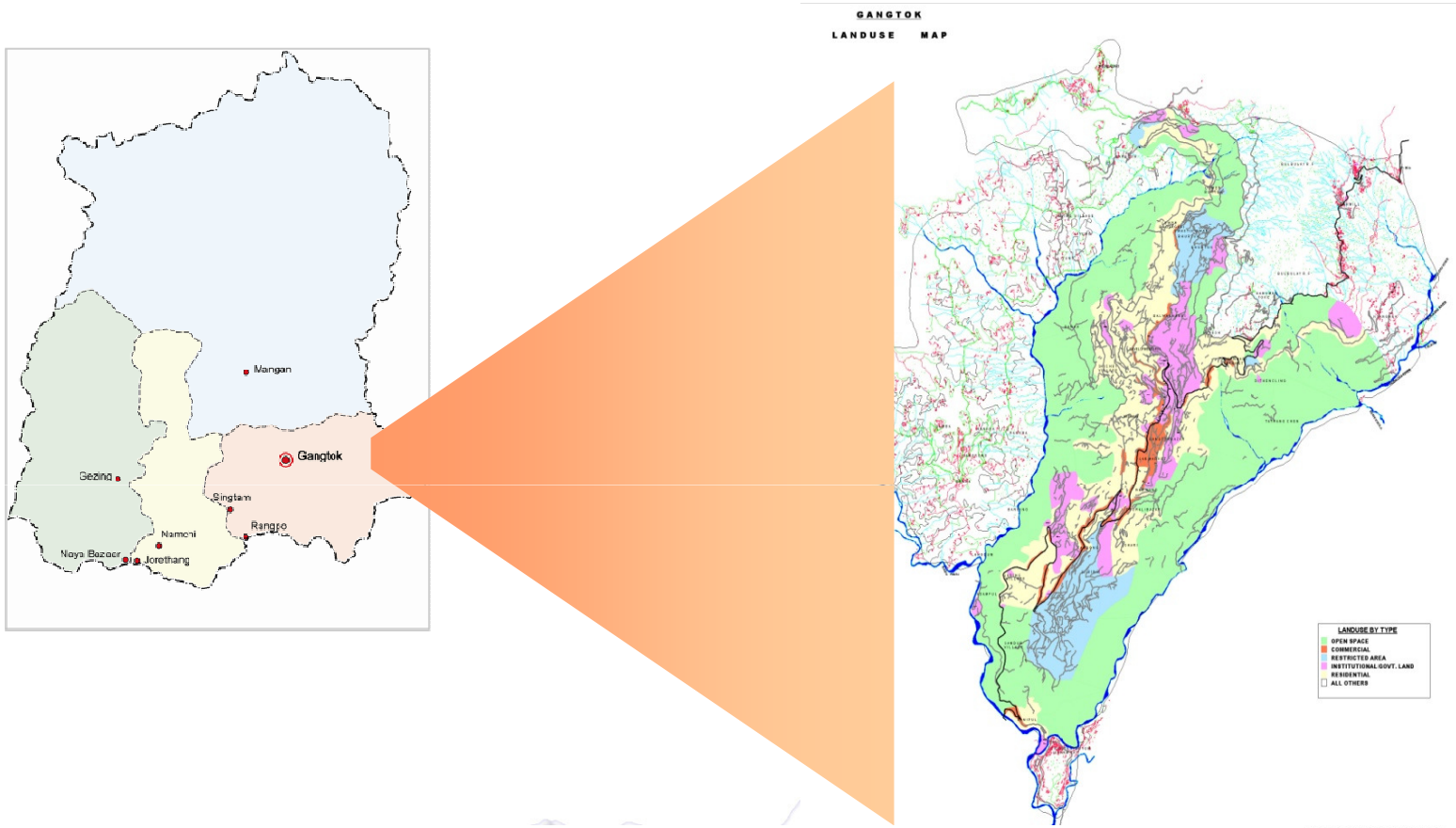


Figure 3.1 Illustration of Detailed Planning for Gangtok, Namchi. Mangan and Geyzing in the Next Level of Planning

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4. Downtown Core (Part) Planning Area: Planning Report 1995. Urban Redevelopment Authority, Singapore, 1995.
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4.1 References – Environmental Infrastructure

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1-b. Eleventh (XI) Plan and Annual plan 2007-08 for Gangtok. Water Security and P.H.E. Department. Government of Sikkim, Gangtok.

1-c. Carrying Capacity Study of Teesta Basin in Sikkim. Executive Summary and Recommendations. Commissioned by Ministry of Environment and Forests, Government of India. Sponsored by National Hydroelectric Power Corp. Ltd. Faridabad.

1-d. Augmentation of Mangan water supply scheme in North Sikkim. Government of Sikkim, Water Security & P.H.E Department Gangtok.

2. Wastewater Treatment

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5.0 Appendix A- MSW Facility

MSW Facilities		
	Existing	New
A. East District	L: Max out by 2012	L:279,225MT (2025), L:325,215MT (2040)
Gangtok	T: 1 x 20MT/d, C: 1 x 40MT/d	-
Singtam - Rangpo	0	T: 1 x 15MT/d, C: 1 x 15MT/d
Pakyong	0	T: 1x 5MT/d, C: 1 x 5MT/d
Sherathang	0	T: 1x 5MT/d, C: 1 x 5MT/d
Rongli	0	T: 1x5MT/d, C: 1 x 5MT/d
B. North District		L:27,923MT (2025), L:72,270MT (2040)
Mangan	0	T: 1x10MT/d, C: 1 x 10MT/d
Phodong	0	T: 1x5MT/d, C: 1 x 5MT/d
Chungthang	0	T: 1x5MT/d, C: 1 x 5MT/d
C. West District	L: 7.446mil MT (2009-2029)	L:27,923MT (2025), L:72,270MT (2040)
Geyzing-Pelling	0	T: 1x10MT/d, C: 1 x 10MT/d
Nayabazaar	0	T: 1x5MT/d, C: 1 x 5MT/d
Soreng	0	T: 1x5MT/d, C: 1 x 5MT/d
D. South District	Covered by West District	L:130,743MT (2025), L:252,945MT (2040)
Namchi	0	T: 1x30MT/d, C: 1 x 30MT/d
Jorethang	L: NA	T: 1x10MT/d, C: 1 x 10MT/d
Ravong	0	T: 1x5MT/d, C: 1 x 5MT/d
Melli	0	T: 1x5MT/d, C: 1 x 5MT/d

*For Landfill (L): MSW landfill waste x 365 days x 15 yrs

5.1 Appendix B – MSW Projection to Landfill

Assumption: 60% of MSW goes to Landfill [3b]

Solid Waste	2015	Landfill Waste (MT/day)	2025	Landfill Waste (MT/day)	2040	Landfill Waste (MT/day)
East district	**184,800**	**44.4**	**213,300**	**51**	**347,500**	**59.4**
Gangtok	138,600	33.24	149,310	35.82	160,875	38.64
Singtam	14,784	3.54	17,064	4.08	22,275	5.34
Rangpo	14,784	3.54	17,064	4.08	22,275	5.34
Pakyong	9,240	2.22	17,064	4.08	22,275	5.34
Sherathang	3,696	0.9	6,399	1.56	12,375	3
Rongli	3,696	0.9	6,399	1.56	7,425	1.8
West District	**13,200**	**3.18**	**21,330**	**5.1**	**55,000**	**13.2**
Geyzing - Pelling	7,920	1.92	12,798	3.06	35,750	8.58
Nayabazaar	3,960	0.96	6,399	1.56	13,750	3.3
Soreng	1,320	0.3	2,133	0.54	5,500	1.32
North District	**13,200**	**3.18**	**21,330**	**5.1**	**55,000**	**13.2**
Mangan	7,920	1.92	12,798	3.06	35,750	8.58
Phodong	3,960	0.96	6,399	1.56	13,750	3.3
Chungthang	1,320	0.3	2,133	0.54	5,500	1.32
South District	**52,800**	**12.66**	**99,540**	**23.94**	**192,500**	**46.2**
Namchi	31,680	7.62	64,701	15.54	134,750	32.34
Jorethang	10,560	2.52	14,932	3.6	23,100	5.52
Ravong	5,280	1.26	9,954	2.4	17,325	4.14
Melli	5,280	1.26	9,954	2.4	17,325	4.14

5.2 Appendix C – Proposed Substations

	Existing	2015	2025	2040
East district				
Gangtok*	(1) 2x 5 =10 MVA, (2) 3x 5 = 15 MVA, (3) 1x 5 = 5 MVA, (4) 2x10 = 20 MVA	-	-	-
Singtam	-	(1) 2x2.5 = 5 MVA, (2) 1x2.5 = 2.5 MVA	-	-
Rangpo	-	(1) 1x2.5 = 2.5 MVA, (2) 1x2.5 = 2.5 MVA	(1) 1x2.5 = 2.5 MVA	
Pakyong	(1) 2x10 = 20 MVA	(1) 1x5 = 5 MVA	-	-
Sherathang	-	(1) 1x2.5 = 2.5 MVA, (2) 1x2.5 =2.5 MVA	-	-
Rongli	(1) 2x2.5 = 5 MVA	(1) 1x2.5 = 2.5 MVA	-	-
West District				
Geyzing	(1) 2x2.5 = 5 MVA	(1) 1x2.5 = 2.5 MVA	-	(1) 1x2.5 = 2.5 MVA
Nayabazaar	-	(1) 1x2.5 = 2.5 MVA, (2) 1x2.5 = 2.5 MVA	-	-
Soreng	(1) 2x2.5 = 2.5 MVA	(1) 1x2.5 = 2.5 MVA	-	-
North District				
Mangan	(1) 2x5 = 10 MVA	(1) 1x2.5 = 2.5 MVA	-	(1) 1x2.5 = 2.5 MVA
Phodong	(1) 2x2.5 = 5 MVA	(1) 1x2.5 = 2.5 MVA	-	-
Chungthang	(1) 2x5 = 10 MVA	(1) 1x2.5 = 2.5 MVA	-	-
South District				
Namchi**	(1) 2x2.5 = 5 MVA	(1) 2x5 = 10 MVA, (2) 1x5 = 5 MVA	(1) 2x5 = 10 MVA	-
Jorethang	-	(1) 2x2.5 = 5 MVA, (2) 2x2.5 = 5 MVA, (3) 2x5 = 10 MVA	-	-
Ravong	(1) 1x5 = 5 MVA	(1) 2x2.5 = 5 MVA, (2) 1x2.5 = 2.5 MVA	-	-
Melli	(1) 2x5 = 10 MVA	(1) 2x2.5 = 5 MVA, (2) 1x5 = 5MVA	-	-