






LAKE TOBA

BASELINE DEMAND & SUPPLY, MARKET DEMAND FORECASTS, AND INVESTMENT NEEDS

MARKET ANALYSIS AND DEMAND ASSESSMENTS TO SUPPORT THE DEVELOPMENT OF INTEGRATED TOURISM DESTINATIONS ACROSS INDONESIA

World Bank Selection #1223583

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INTRODUCTION

The Government of Indonesia in the National Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah Nasional*, RPJMN) 2015 to 2019, has set a number of objectives to increase the role of tourism in the Indonesian economy. Between 2015 and 2019, its goals together with the Ministry of Tourism's goals are to increase:

- international visitors from 9 million to 20 million;
- domestic visits from 250 million to 275 million;
- the tourism contribution to GDP from 4 percent to 8 percent;
- tourism foreign exchange revenues from IDR120 trillion to IDR240 trillion;
- Indonesia's Travel and Tourism Competitiveness Index ranking from 70th to 30th place; and
- tourism sector employment from 11 million to 13 million workers.

To achieve these goals President Joko Widodo urged his cabinet to accelerate the development of 10 priority tourism destinations (Figure 1):

- **Borobudur (Jogjakarta, Solo, Semarang: Central Java)**
- **Lake Toba (North Sumatra)**
- **Mandalika (Lombok)**
- Bromo, Tengger, Semeru (East Java)
- Labuan Bajo (Flores)
- Wakatobi (South East Sulawesi)
- Pulau Seribu / Kota Tua (DKI Jakarta)
- Morotai (North Maluku)
- Tanjung Lesung (Banten)
- Tanjung Kelayang (Bangka Belitung)

The 3 destinations in bold are considered high priority destinations with additional effort being expended to encourage and develop tourism.

The World Bank has been requested by the Government of Indonesia to support, through financing, advisory support, and analytics, the Government's efforts to accelerate tourism development in the 10 priority destinations. As part of this support, in August 2016 the World Bank engaged Horwath HTL (HHTL) and Surbana Jurong to conduct a market analysis and demand assessment for the 10 priority destinations, with a focus on Lombok, Borobudur, and Lake Toba.

FIGURE 1: LOCATION OF 10 PRIORITY TOURISM DESTINATIONS IN INDONESIA

Source: Google Maps, Surbana Jurong

The key objective of the Assessment is to assist the Government of Indonesia in identifying and prioritizing infrastructure, skill and SME development, planning and other tourism-related expenditures to accelerate the development of the 10 priority tourism destinations. The scope comprises of (1) market demand and supply analysis, plus investment analysis and (2) demand assessment (projections) and investment needs (including infrastructure). The findings are expected to inform the government's integrated tourism master plans for these destinations.

To this end, the following key tasks were undertaken:

Task 1: Understanding governmental decentralization & its effect on decision making plus preliminary information gathering.
Task 2: Collection and analysis of the government's statistical data.
Task 3: Survey of international and domestic tourism stakeholders for collection of public and private sector information.
Task 4: Survey of tour-operators in selected key markets.
Task 5: Secondary research on tourism supply and demand.
Task 6: Analysis of the image of Indonesia and the 10 priority destinations.
Task 7: Future market demand analysis.
Task 8: Investment and infrastructure needs assessment.
Task 9: SMEs and Skills assessment and needs.

Appendix I contains a list of interviews undertaken with both the public and private sectors to gather primary research that was used to supplement secondary research. The list includes the number of interviews, the organization (where appropriate) and the location.

This Report is part of a series of reports:

- report for Indonesia, country level;
- reports for the 3 high priority destinations (Lombok, Borobudur, and Lake Toba); and,
- reports for the 7 other priority destinations (Bromo/Tengger/Semeru, Labuan Bajo, Wakatobi, Pulau Seribu/Kota Tua, Morotai, Tanjung Lesung and Tanjung Kelayang).

Assessment of the Destination and Key Tourism Areas

The 3As terminology (Attraction, Amenities and Accessibility) can help explain how the supply and demand analysis and needs assessment was carried out for the destination with respect to the destination boundary and the key tourism areas.

- **Attractions**: attractions specifically focused on engaging and drawing visitors to the destination. The destination is defined by its attractions and their ability to draw visitors. Within the destination boundary, (existing and future) clusters of attractions with potential for tourism development and propensity to generate overnight stays and revenue and/or (existing and future) key accommodation areas are identified and henceforth called "key tourism areas".
- **Accessibility**: methods of reaching the destination via the main gateways (external accessibility) plus transport links between gateways, attractions and key accommodation areas all of which support the destination (internal accessibility). For external accessibility, the focus is on the gateway hubs (such as airports and ports). For internal accessibility, the Report assesses the transport infrastructure; the existing, the gaps and the required transportation network that facilitates accessibility within the destination.
- **Amenities**: support the destination and the attractions such as hotels, restaurants and entertainment facilities together with basic capacity infrastructure. Within the destination boundary, and generally within the key tourism areas, the Report assesses:
  - the existing basic infrastructure capacity (water supply, power supply, telecommunication, waste water and waste management, etc.);
  - identifies any basic infrastructure capacity gaps;
  - analyses demand and supply of existing attractions and amenities;
  - provides projections for future attractions and amenities; and
  - provides an assessment of infrastructure needs of the destination to ensure success of the attraction and amenities. In some cases, when amenities within the destination boundary have a direct effect on the attractiveness of the key tourism areas, the scope of the baseline and investment needs of basic capacity infrastructure is conducted beyond the key tourism areas.

BASELINE DEMAND & SUPPLY

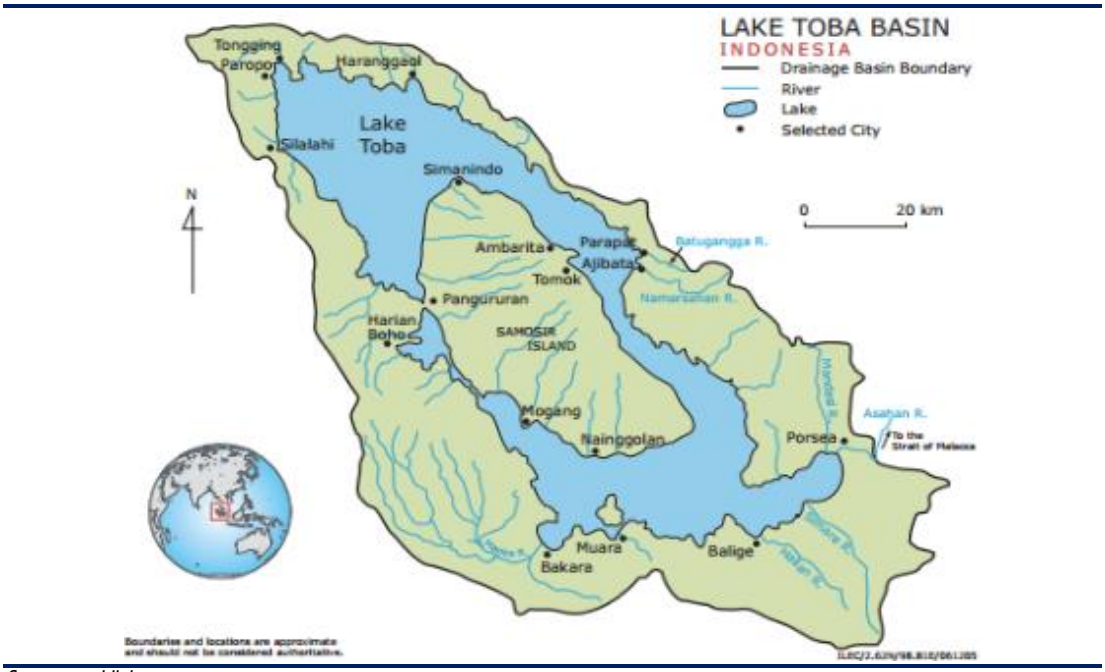
1. DESTINATION CHARACTERISTICS

1.1 GEOGRAPHY

Lake Toba is a large natural volcanic lake located in Sumatera Utara (North Sumatra), 176 kilometers to the south of Medan. The lake itself, approximately 100 kilometers long, 30 kilometers wide and up to 505 meters deep, has a surface elevation of 904 meters. It is the largest lake in Indonesia that was formed as a result of mega-volcanic activity during the Quaternary Era[1].

In the middle of the lake lies Samosir Island – one and a half times larger in size than Singapore. The lake basin area (Figure 2) is surrounded by steep cliffs with elevations ranging from 400 to 1,200 meters above lake-water level. Lake Toba is known for its stunning scenery and the unique Batak culture. Abundant freshwater and dense tropical rain forests in Lake Toba and its surrounding areas provide livelihood for settlements in the area.

FIGURE 2: MAP OF LAKE TOBA BASIN



Source: worldlakes.org

The volcanic island of Samosir was formed after the eruption some 75,000 years ago. The island was originally connected to the surrounding caldera wall by a small isthmus (where the city of Pangururan is located), which was cut through to aid navigation. At 640 square kilometers, Samosir Island is the largest island within an island, and the fifth largest lake island in the world. It also contains two smaller lakes, Lake Sidihoni and Lake Aek Natonang.

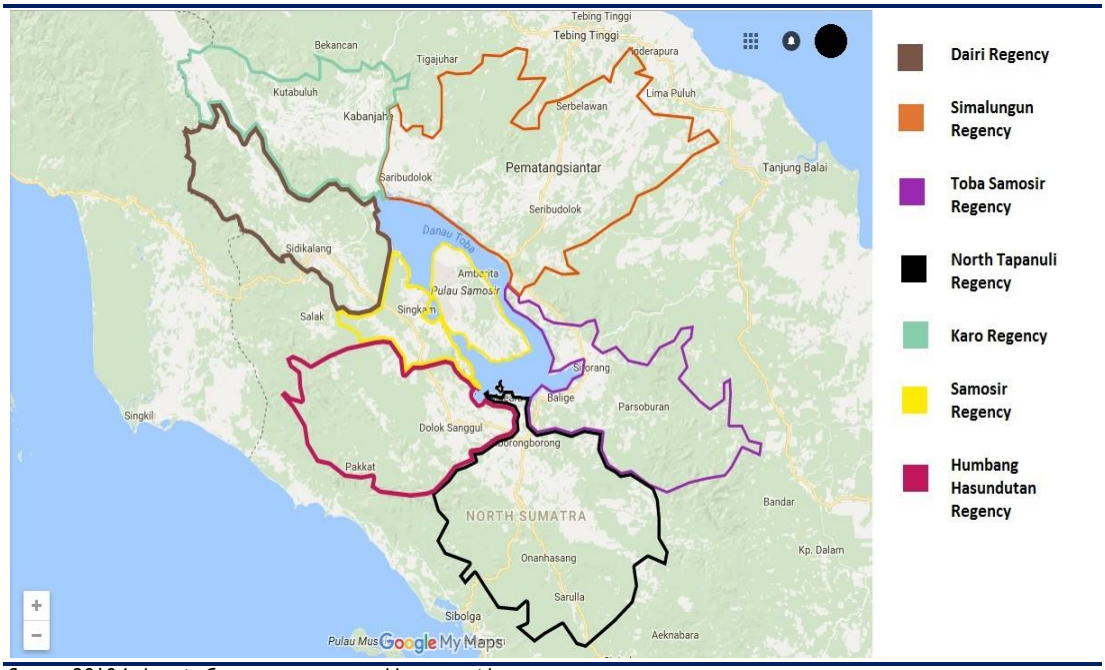
[1] http://www.geo.mtu.edu/~raman/papers/ChesnerGeology.pdf, March 1991

Samosir Island is a popular tourist destination due mainly to the vistas it offers. The tourist resort properties of Samosir Island are concentrated mainly in the Tuktuk area, which is located across the lake from the town of Parapat. The island is the center of the Batak culture and numerous traditional houses of the Toba Batak remain on the island.

The natural beauty of Lake Toba stems from its tranquil environment and views. Fishing is a source of livelihood for the local communities along the shoreline; however, several species are being threatened as a result of pollution. The basin is also a provider of abundant freshwater; for more than 20 years, two hydropower plants in Siguragura and Tangga have been powered with water from Lake Toba. Furthermore, there is a variety of flora and fauna around Lake Toba. Flora in the lake includes various types of phytoplankton and macrophytes, while the surrounding mountainous countryside comprises tropical pine forests. These surrounding forests provide wood and various herbs to the local population[2].

The area surrounding Lake Toba consists of 7 Kabupaten (Figure 3): Samosir, Toba Samosir, Simalungun, North Tapanuli, Humbang Hasundutan, Karo, and Dairi.[3] The 8th kabupaten included in the destination boundary is Kab. Pakpak Bharat however this is not included in Figure 3 as it does not border the lake.

FIGURE 3: 7 KABUPATEN SURROUNDING LAKE TOBA



Source: 2010 Indonesia Census, sumut-expose.blogspot.co.id

[2] *http://www.liquisearch.com/lake_toba/flora_and_fauna; http://www.worldwildlife.org/ekeygions*

[3] In Indonesia, subnational governance includes four levels: (1) province/Provinci, (2) city/Kota and regency/Kabupaten, (3) sub-district/Kecamatan or district/Distrik, and (4) urban community/Kelurahan or village/Desa.

1.2 CLIMATE

Lake Toba has a tropical climate, with temperatures of approximately 28 degrees Celsius throughout the year. Monsoon season stretches from November to February when heavy rainfall is generally expected, while the dry season extends from May to September, when it is typically the best time to visit (especially June and July). The months of March, April and October are considered shoulder periods.

In 2015, variation in precipitation between the driest and wettest months was 659 millimeters, while monthly temperature varied by around 4 degrees Celsius. The least amount of rainfall occurred in June with an average of 86 millimeters. In December, precipitation reached a peak of 745 millimeters (Figure 4).

FIGURE 4: AVERAGE MONTHLY WEATHER PATTERN, LAKE TOBA – 2015

	Climate											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min - Max ^{0}C	21-34	19-35	22-35	21-35	22-35	22-37	20-36	21-35	22-35	22-33	20-34	21-35
Rainfall mm	353	154	144	254	250	86	161	199	234	345	499	745

Source: BPS Sumatera Utara

2. DESTINATION DEFINITION

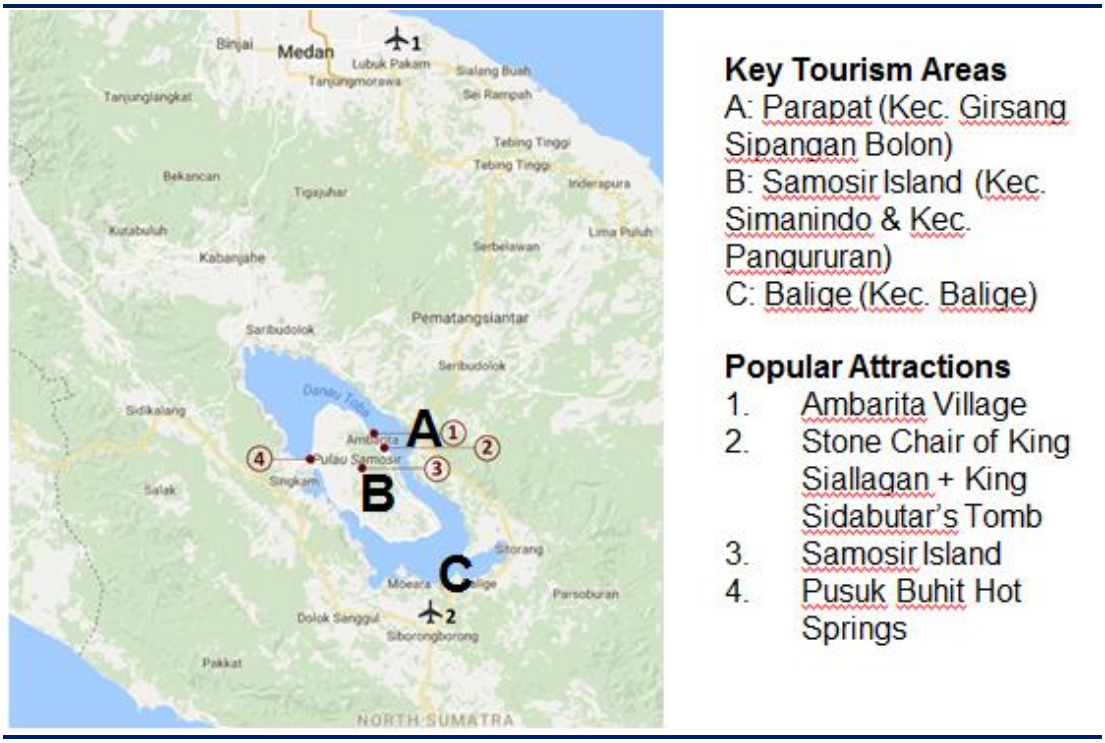
2.1 KEY ATTRACTIONS & TOURISM AREAS

The following section outlines an assessment of the various "attractions" surrounding Lake Toba, the locations of which are indicated in Figure 5. The attractions listed are more areas of interest / things to do, and the **principal key attraction** is the lake itself. The following attractions are currently the top draws for the tourism industry in Lake Toba:

- Samosir Island;
- Stone Chair of King Siallagan;
- King Sidabutar's Tomb;
- Ambarita Village; and
- Pusuk Buhit Mountain and its Hot Springs.

Lake Toba's key tourism areas (within 4 kecamatan as per Figure 5) are driven by accessibility, current services/products and current demand.

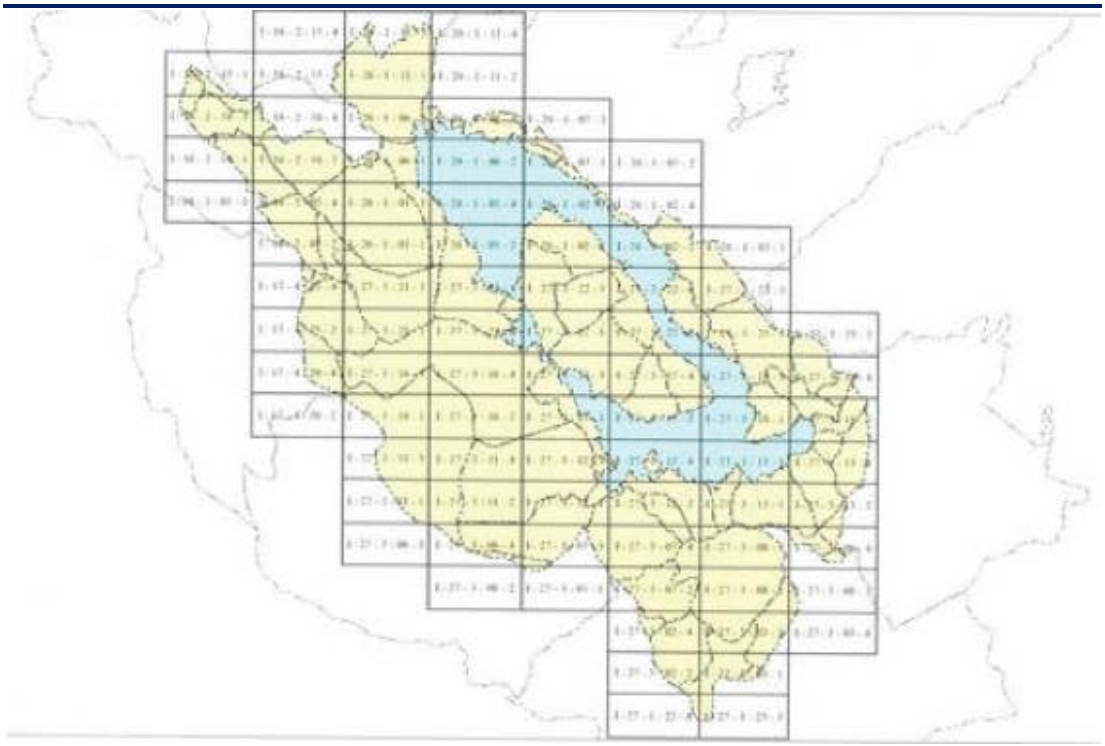
FIGURE 5: LAKE TOBA'S POPULAR TOURISM ATTRACTIONS & KEY TOURISM AREAS



Source: Google Images

The Lake Toba tourism destination is defined by Presidential Regulation 81 of 2014 on "Spatial Plan of Lake Toba and the Surrounding Area" (Figure 6)[4].

FIGURE 6: MAP OF DESTINATION BOUNDARY



Source: Ministry of Tourism

2.1.1 KAB. SAMOSIR ATTRACTIONS

2.1.1.1 *SAMOSIR ISLAND (KEC. SIMANINDO & KEC. PANGURURAN)*

Samosir Island is a key tourism area for Lake Toba. The relative popularity of the island can be linked back to 1960s-70s, when star-rated hotels began development in Parapat. The tourism industry began in the 1970s when Lake Toba's unspoilt nature became well-known, especially to travelers from Asia and Europe (specifically the Netherlands and Germany). Locations of interest on Samosir Island are described as follows.

[4] *Confirmed by guidance by Director of Infrastructure Development and Tourism Ecosystem, Ministry of Tourism, during a meeting on 12 August 2016.*

2.1.1.2 *STONE CHAIRS OF KING SIALLAGAN*

The stone chairs are located in Ambarita, a Batak village where King Siallagan ruled more than 400 years ago. Like most Batak villages, the village is surrounded by stone walls as protection against other warring tribes. The stone chairs are located at a center of a courtyard where village matters were discussed and wrongdoers tried. A stone figure – the God of Justice – occupies one of the chairs. Daily cultural shows are also performed for visitors to the village. The site is easily accessible from Tomok / Tuktuk via a short drive and is normally included as a tour package. Freelance guides are available on site and the tour includes a peek into Batak houses with its unique architecture. The stones present a rather brief insight into the history and culture of the Batak tribe. The stones are exposed to the elements and they don't appear to be well maintained. Apart from the stones and the Batak houses, there are no other attractions to interest visitors. The stone chair is a top draw for tourists and is expected to be so in the long term. The attraction is unique in that it is relates to the Batak culture.

2.1.1.3 *TOMOK VILLAGE - KING SIDABUTAR'S TOMB*

According to legends, King Sidabutar was the first man ever to set foot on Samosir Island. He and his descendants were believed to have resided in an area that is now Tomok, approximately 5 kilometers from Tuktuk. Before the arrival of Christianity, King Sidabutar and his subjects practiced an indigenous belief called Parmalim, another form of animism. The tomb is easily reached from Tomok. Apart from the tomb (with the king's image carved on the tombstone), there are other tombstones of the king's bodyguard and the missionary who converted the tribe in the 19th century, and some well-preserved Batak houses, that may interest visitors. Similar to the stone chairs, the tombs are normally included in tour packages.

The aforementioned 2 attractions are cultural legacies of the Batak tribe and Samosir Island is the origin of Batak culture. Bataks are only found in Sumatera Utara and nowhere else in Indonesia. Similar to the Stone Chairs, the Tomb is expected to be a top draw as it provides further insight into the Batak culture.

2.1.1.4 *TUKTUK VILLAGE*

The tourist village of Tuktuk located approximately 10 minutes' drive from the ferry terminal of Samosir Island is a collection of guesthouses, hotels, restaurants and retail shops targeting foreign as well as domestic visitors not travelling in tour groups. Due to the concentration of accommodation and food and beverage facilities, the village is popular with independent travelers and families. The hotels are normally small to medium size; hence, tour groups do not normally stay in Tuktuk. As an attraction, there is nothing of interest to a visitor save for a variety of restaurants and some shopping.

2.1.1.5 *AMBARITA VILLAGE*

Located north of Tuktuk, is a traditional village that provides glimpses of the Batak culture. Batak houses are noted for their curved and pointed roofs. The village of Ambarita is located approximately 45 minutes to an hour's walk (20 minutes' drive) from Tuktuk. Compared to the village with the Stone Chairs, there are no other attractions within Ambarita Village. Nevertheless, the village still holds some interest to visitors due to the Batak culture link.

2.1.1.6 *PARBABA BEACH*

The white sand beach of Parbaba is a 250-metre beach to the east of the island close to Pangururan. The driving distance from Tomok to the beach is approximately 1.5 hours. The beach is quite popular with domestic visitors due to the novelty of a beach by a freshwater lake. Swimming, pedal-boats, banana boats and beach volley ball are some of the activities that are possible on the beach with the Gunung Pusuk Buhit (Pusuk Buhit Mountain) in the background. The beach is expected to continue drawing domestic tourists; however, it holds little interest to foreign tourists, especially tour groups.

2.1.1.7 *GUNUNG PUSUK BUHIT / AEK RANGAT*

The mountain is 1,982 meters high and is considered sacred by the Bataks. The still-active volcanic mountain is located on the mainland close to Pangururan. The mountain is approximately 2 hours from Tomok and is normally combined with a visit to the hot springs located nearby. Trekking can be done on the mountain and the mountain offers views of the surrounding hills and the lake itself. There are several trails leading to the peak but the two most popular trails are via the Huta Ginjang Village and the Aek Rangat Village. The trek to the summit takes approximately 5 to 6 hours. The mountain draws mainly tourists seeking some physical activity and adventure. Due to the views the mountain top afford, Gunung Pusuk Buhit is a popular destination.

Aek Rangat is hot springs located near the foothills of Gunung Pusuk Buhit. The hot springs are managed by the local village and whilst the setting at the foothills of a mountain is quite spectacular, the quality of the experience is considered sub-standard. The upkeep and maintenance of the bathing cubicles is rather poor in that the walls are covered with lichen. There are other hot springs located close by, such as the Simbolon Hot Springs and the Pangururan Hot Springs. Whilst not considered world-class in terms of management and upkeep, each of the hot springs is popular with domestic visitors.

2.1.2 KAB. TOBA SAMOSIR ATTRACTIONS

2.1.2.1 *BALIGE (KEC. BALIGE)*

Balige, being the most touristic town in Kab. Toba Samosir, offers some interesting Batak architecture (for example the Balairung Traditional Market and the Dinas Pariwisata Toba Samosir) and the TB Silalahi Centre Batak Museum. Balige is located beside Lake Toba and is the capital of Kab. Toba Samosir. Balige is a key gateway to Samosir Island for visitors arriving by air from Silangit airport and therefore a potential key tourism area.

Balige is also the location of the TB Silalahi Centre that also includes the Batak Museum. TB Silalahi, a prominent Batak personality, served as Minister of Administrative and Bureaucratic Reform from 1993 to 1998. Within the vicinity of the TB Silalahi Centre are other attractions such as the Huta Batak, an outdoor museum built like a traditional Batak village, a convention hall and a swimming pool.

2.1.2.2 *LAKE TOBA TOURISM AREA*

The Government has established a single tourism management authority for Lake Toba (Badan Otorita Prioritas (BOP), Peraturan Presiden no. 49, 2016) to emulate the Bali Tourism Development Corporation that successfully turned Nusa Dua into a world class destination. The BOP will have the authority to manage the Lake Toba Tourism Area and organize licensing and non-licensing services.

The Lake Toba Tourism Area spans 500 - 600 hectares in Toba Samosir Kab. The area will offer star-rated hotels, golf course and a convention center. Being located by the edge of Lake Toba, it is positioned as a new tourist attraction when the proposed development is completed[5].

More details of the Lake Toba Tourism Area are contained in Appendix II.

2.1.3 KAB. SIMALUNGUN ATTRACTIONS

2.1.3.1 *PARAPAT (KEC. GIRSANG SIPANGAN BOLON)*

Parapat is the main gateway to Samosir Island. Parapat has a high number of star-rated hotels and the city is considered to possess the most developed tourism infrastructure amongst the 7 Kab. Geographically, Parapat is located close to Samosir Island where the ferry journey is approximately 40 minutes and then a short convenient car ride to Tuktuk. The position of Parapat as the main gateway to Lake Toba will be further strengthened with the completion of the proposed toll road from Medan that will reduce travelling time. For these reasons, it is considered a key tourism area.

2.1.4 OTHER KABUPATEN

The remaining 5 Kab. of Pakpak Bharat, Karo, Dairi, North Tapanuli and Humbang Hasundutan have many areas of interest but do not possess significant attractions. The locations of the potential tourist attractions require long travel times, some of them are located inland, away from Lake Toba and the key tourism areas and do not form part of visitor itineraries. Attractions considered but excluded are as follows:

[5] *https://en.tempo.co/read/news/2016/12/16; http://www.antaranews.com/en/news/103620/government-accelerating-development-of-lake-toba-area*

2.1.4.1 *KAB. NORTH TAPANULI*

- Sibandang Island: Sibandang Island is the second largest island in Lake Toba after Samosir Island. Located to the south of Samosir Island, access to the island is via the ports of Muara (10 minutes) or Balige (2 hours). There is nothing of interest on the island which is known for its mangoes.
- The religious cross of Siatas Barita: The cross is to commemorate the arrival of the Christian faith in North Tapanuli. The site is located approximately 60 kilometers inland to the south of Balige.
- Soda Water Lake in Aek Siansimun.
- Hot springs at Kota Tarutung.

2.1.4.2 *KAB. DAIRI*

- Taman Wisata Iman Sitinjo (Faith Park) is in the village Sitinjo, and has religious artifacts for five different religions. It is about 2 hours' drive from Samosir Island to the north east.
- Sidikalang coffee plantation is understood to be close to Sitinjo.

2.1.4.3 *KAB. KARO*

- Sipiso-piso: located near Tongging, the Sipiso-piso Waterfall in the Batak highlands is located at the northern end of Lake Toba. The waterfall, at 120 meters, is the highest waterfall in Indonesia. Formed by a small underground river of the Karo Plateau and flowing out into the Lake Toba caldera, it is a renowned tourist attraction and offers spectacular views of the fall and lake. The distance from Parapat to the waterfall is more than 90 kilometers with the driving time of approximately 2.5 hours. The waterfall flows throughout the year; however, during the dry months between May and September, the flow of water is not as strong as rainy months (October to April). Due to the height and dramatic setting of the waterfall, Sipiso-piso is popular.
- Sikulikap waterfall (30 meter falls).
- Volcanic mountains of Mount Sibayak (2,094 meters) and Mount Sinabung (2,640 meters). Mount Sibayak is located approximately 50 kilometers to the north of Sipiso-piso Waterfalls while Mount Sinabung is to the northeast of Sipiso-piso, approximately 60 kilometers.

2.1.4.4 *KAB. HUMBANG HASUNDUTAN*

- The Palace of Sisingamangaraja: the Batak palace is located 16 kilometers to the southwest of Dolok Sanggul. The original structure was burnt down twice and the current structure was reconstructed in 1978. Apart from the palace building, there are tombstones of King Sisingamangaraja X and XI. The car journey from Parapat to the Palace of Sisingamangaraja is more than 3 hours.

- Waterfalls at Binanga Janji (30 meters fall).

2.1.4.5 *KAB. PAKPAK BHARAT*

- Simbilulu Waterfall is located in Kec. Tinada, Prongil Village and around 65 kilometers or over 2 hours' drive from Pangururan.

2.1.5 ACCESSIBILITY & ENTRANCE FEES FOR AREAS OF INTEREST

A summary of ease of access and the entrance charges of the aforementioned key main attractions is summarized as follows:

Attraction	Accessibility	Pricing (IDR)	Inclusion in Tours	Notes
Stone Chair	10 mins by car from Tuktuk	2,000	Yes	An attraction unique to the Batak culture.
King Sidabutar Tomb	10 mins by car from Tuktuk	No Entrance Charge	Yes	A tomb craft unique to the Batak culture.
Parbaba White Sand Beach	1 hour drive from Tuktuk	No Entrance Charge	No	Unique to Indonesia as it is a beach by a fresh water lake.
Gunung Pusuk Buhit	1.5 hours' drive from Tuktuk	No Entrance Charge	Yes	An active volcano.
Hot Springs of Pusuk Buhit	1.5 hours' drive from Tuktuk	2,000	Yes	A hot spring by an active volcano, its uniqueness offset by poor management and upkeep.
Sipiso-piso Waterfall	2 hours' drive from Parapat	5,000	Optional	One of the tallest waterfalls in Indonesia.
Tuktuk Village	40 minutes' boat trip from Parapat, followed by 10 minutes' drive from Tomok	No Entrance Charge	Yes	A concentration of tourism services that appeal to FIT travelers.
TB Silalahi Centre Batak Museum	1.5 hours' drive from Parapat	Child: 5,000 Adult: Domestic 10,000 International 50,000	Optional	A museum dedicated to the Batak culture.

2.2 CONCLUSIONS ON ATTRACTIONS

Within the destination boundary, as defined by Presidential Regulation 81 of 2014 (Figure 6), the cluster of attractions with the highest potential for tourism development and propensity to generate overnight stays and revenue are within the following key tourism areas:

- Parapat (Kab. Simalungun, Kec. Girsang Sipangan Bolon): is the main gateway because of the available accommodation and services and the ease of access to the other areas of interest around Lake Toba. It is also the closest lake-side village to Medan;
- Samosir Island (Kab. Samosir, Kec. Simanindo & Kec. Pangururan): Samosir Island should form the backbone of tourism development to Lake Toba. It was the jewel in the crown of Lake Toba in the 1990s and should be the focus of the redevelopment of the destination with its Batak attractions and Tuktuk village for accommodation and dining options; and
- Balige (Kab. Toba Samosir, Kec. Balige): is the closest lakeside village to Silangit Airport with ferry connections to Samosir Island (journey time of approximately an hour) and is a potential key area for tourism. From the southern part of Samosir Island it is a further one hour drive to the village of Tuktuk.

These 3 areas, within 3 kabupaten and 4 kecamatan, will be referred to as the Destination and should be developed in priority, as the key tourism areas of Lake Toba with additional support infrastructure.

The above listed "attractions" support the star attraction of Lake Toba that is the lake itself. Most of these attractions are mostly related to the history and culture of the Batak, indigenous to Sumatera Utara and not found elsewhere in Indonesia.

3. VISITOR ARRIVALS & DEMOGRAPHICS

3.1 INTRODUCTION

Lake Toba attracted an estimated 1.7 million visitors in 2015. It is mainly a domestic destination with only 60,000 international visitors annually, representing approximately 4% of the total. About half the total visitors uses commercial accommodation and growth over the last years has been steady. Domestic visitors staying with friends and relatives represent an estimated 598,000 visits in 2015.

The visitor numbers have been estimated based on various assumptions and data sources which are outlined in the sections below.

3.2 DAY VISITORS & VISITORS STAYING WITH FRIENDS & RELATIVES

At the Sumatera Utara level, it is estimated that the number of visits to friends and relatives (VFR) accounted for 63% of total domestic arrivals, i.e. 6.7 million visits in 2015. A household hosts an average of 2.1 guests during the year[6].

As the Domestic Survey does not provide such details at kabupaten level, the estimate of VFR for Lake Toba is derived by using the same ratio of 2.1 visits per household.

FIGURE 7: ESTIMATE OF TOTAL VFR VISITS IN THE 3 KEY KAB. 2015

	Total VFR visits	No. Households	VFR visits per household
Sumatera Utara	6,704,256	3,257,205	2.1
3 Key Kab. of Lake Toba	598,158	290,610	2.1

Source: Horwath HTL, BPS Sumatera Utara

Total VFR Visit represents an estimated 598,158 visits for the 3 kabupaten.

Day visitors (persons who make a day trip and do not spend the night in the destination) represented an estimated 483,000 visits in 2015 (estimated based on the share of local customers at food and beverages facilities, according to interviews with local operators (30%)).[7]

6 Estimates based on the Domestic Survey and the Population Census, BPS

7 Reasonableness check based on:

- *The population of the Northern Coast Kab. of Sumatera Utara.*
- *% of urban population.*
- *Estimated % of urban population with propensity to go on day trips (20%).*
- *Estimated number of trips per year (4).*

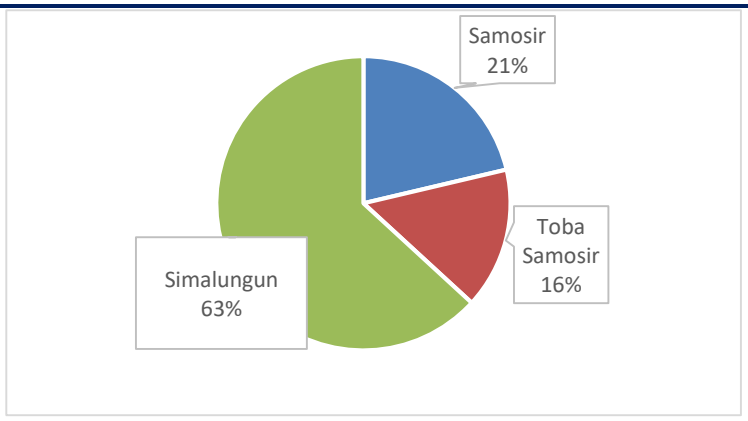
Estimated % of trips captured by Lake Toba (10%).

3.3 VISITORS IN COMMERCIAL ACCOMMODATION

According to BPS Sumatera Utara, the total number of visitors in commercial accommodation in the Destination of Kab. Simalungun, Kab. Samosir and Kab. Toba Samosir reached **721,200 in 2015.**[8]

The following chart shows the breakdown of visitors by kabupaten showing that Kab. Simalungun captured the greatest proportion (63%), which is not surprising given the predominance of accommodations in Parapat.

FIGURE 8: DOMESTIC & FOREIGN VISITOR ARRIVALS IN COMMERCIAL ACCOMMODATION IN THE DESTINATION IN % TERMS, 2015

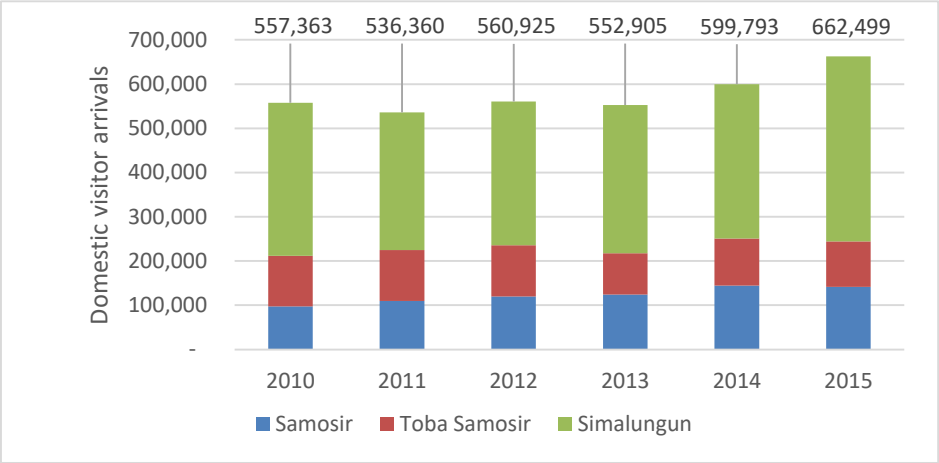


Source: BPS Utara

3.3.1 DOMESTIC VISITORS IN COMMERCIAL ACCOMMODATION

Lake Toba is a predominantly domestic tourism destination: domestic visitors represented 92% of total visitors in commercial accommodation in 2015.

FIGURE 9: DOMESTIC VISITORS AT COMMERCIAL ACCOMMODATION IN THE 3 KABUPATEN, 2010 TO 2015



Source BPS Sumatera Utara

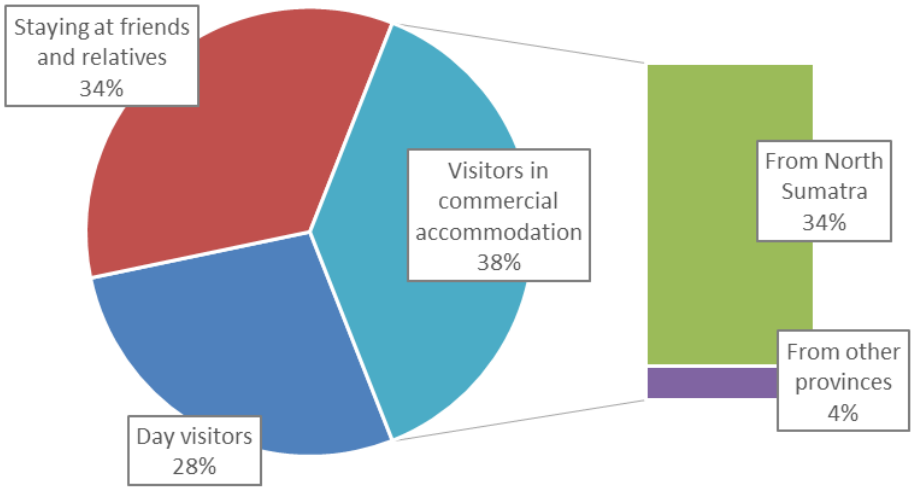
[8] *Source: Accommodation Survey, BPS*

- The number of domestic visitors has steadily increased over the last 6 years, except in 2011 and 2013. The haze in June and July in those years had a negative impact on visitor arrivals. The CAGR of domestic visitors between 2010 and 2015 is approximately 4%.
- 90% of domestic visitors come from Medan and cities within its vicinity, in Sumatera Utara. Other main areas of origin are the other Sumatran provinces (Aceh, Sumatera Barat), Jakarta and Surabaya.
- Domestic visitors are principally middle to upper middle class urban residents. They go to Lake Toba repeatedly on weekends. They are attracted by the natural scenery, tranquility, local gastronomy and cooler climate.
- Peak months for domestic visitors are the months of June and July, December, January and during the festivals of Lebaran and Chinese New Year.
- The leisure segment contributes to the bulk of domestic demand (95%) while the balance is corporate and Government segments. The leisure demand is highly seasonal, with peaks during public and school holidays and weekends). This explains the low occupancy rates of the Lake Toba hotels[9].
- The most popular activities of domestic visitors are sightseeing on Samosir Island and spending time at its lakeshore, with little time spent on activities such as hiking and cycling.
- The average length of stay (ALOS) in commercial accommodation varies from 1 to 2 nights, with an average of 1.5 nights. Leisure guests staying at Samosir Island normally stay longer than those on the mainland. This is due mainly to the quiet ambiance as well as more diverse activities such as hiking, visiting a Batak village and cycling.
- Guests travelling on group tours generally stay between 1 and 2 nights with a tour of Samosir Island normally taking up one whole day. They normally arrive late in the afternoon with a tour of Samosir Island the next day.

Figure 10 provides a summary of domestic visitors in accommodation and their point of origin.

[9] *Weekday occupancy levels are normally in single digits while during weekends, public holidays and school holidays, the occupancy levels increase to 75 – 85%.*

FIGURE 10: DOMESTIC VISITORS' ACCOMMODATION CHOICE + ORIGIN OF VISITORS IN COMMERCIAL ACCOMMODATION



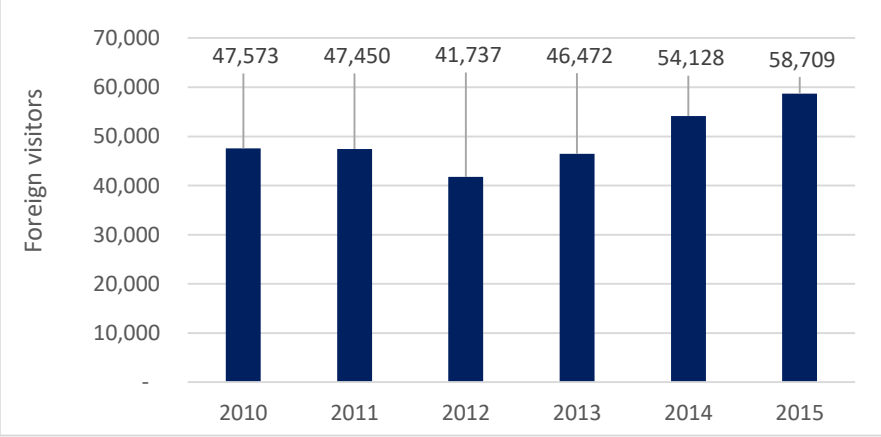
Source: Horwath HTL, based on BPS Indonesia Domestic Survey

3.3.2 FOREIGN VISITORS IN COMMERCIAL ACCOMMODATION

Foreign visitor arrivals in commercial accommodation at Lake Toba were approximately 58,700 in 2015, compared to 662,500 domestic visitors. Lake Toba captured less than 20% of international visitors to Sumatera Utara (370,000), and less than 1% of total international visitors to Indonesia.[10]

The number of international visitors to Lake Toba has steadily increased over the last 5 years, except in 2012 (with potentially poor data collection accounting for the observed drop) according to the Dinas Pariwisata Kab. Simalungun (Figure 11).

FIGURE 11: FOREIGN VISITORS TO COMMERCIAL ACCOMMODATION IN THE DESTINATION, 2010 TO 2015



Source: BPS Sumatera Utara

[10] *Source: Accommodation Survey, BPS*

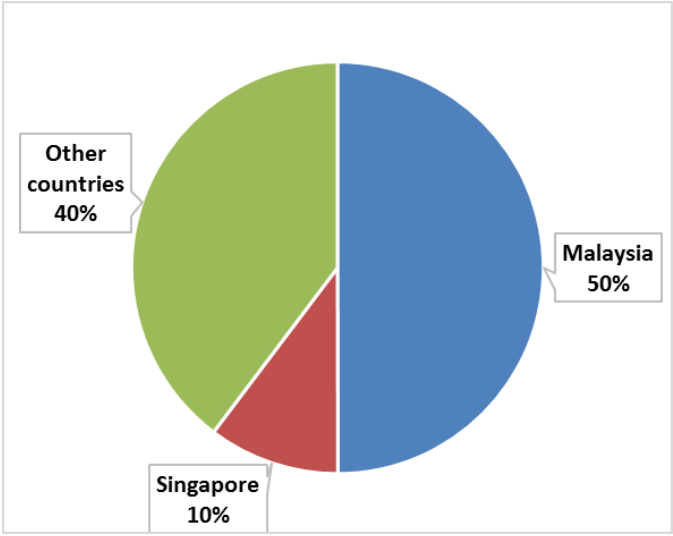
In 2015, at Sumatera Utara level, foreign visitors came mainly from Malaysia (50%) and Singapore (10%).[11] No other country accounted for more than 3% of foreign arrivals. Interviews with hoteliers and inbound travel agencies have confirmed these proportions are also applicable to Lake Toba.

Malaysian and Singaporean visitors come to Lake Toba for weekend getaways (between 2 and 3 nights), attracted by the specific characteristics of the destination for which there is no equivalent elsewhere in Southeast Asia (volcanic lake, cooler climate, Batak culture). Importantly Malaysian and Singaporean tour operators usually offer packages combining the destination with shopping in Medan.

Long-haul visitors (mainly from Northern Europe, especially the Netherlands and Germany) are mainly backpackers or flash-packers (backpackers who are inclined, if available, to spend higher on accommodation) staying in Indonesia for longer periods of time (2 weeks or more). Besides the scenery, they are attracted by the serene atmosphere of the destination, the Batak culture, and the fact that it is mainly frequented by domestic visitors (thus providing a certain element of "authenticity").

In the packages offered by European tour operators, Lake Toba is always sold as part of a long circuit in Sumatra, or a detour on the way to the orangutans in Bukit Lawang or the elephant sanctuary in Tangkahan. Visitors undertaking this circuit usually stay 1 or 2 nights in Lake Toba and rarely buy packaged tours that include Bali. European visitors are more inclined to take up this package than those from Asia or Australia.

FIGURE 12: EST. BREAKDOWN INTERNATIONAL VISITORS TO LAKE TOBA, 2015



Source: Horwath HTL, based on BPS Indonesia Exit Survey

[11] *Source: Exit Survey, BPS*

In 2015, Kab. Samosir captured 58% of foreign visitors due to Samosir Island, considered the 'jewel in the crown' of Lake Toba. Over the last 6 years, the average growth of foreign arrivals to Samosir Island has been approximately 10%. The other key kabupaten of Simalungun and Toba Samosir are also popular with foreign visitors due to tour groups and, to a lesser extent, independent travelers. Tour groups normally stay at hotels in Parapat (Kab. Simalungun), as well as individual travelers, who either cannot find rooms on Samosir Island or do not wish to pay higher room rates.

3.4 FOREIGN MARKET AWARENESS & VISITOR SENTIMENT

Even though Lake Toba is mainly frequented by domestic visitors, the destination is nevertheless fairly well known internationally. Out of the 36 tour operators and travel agents interviewed, 22 were aware of Lake Toba (only 1 out of 6 professionals interviewed in China, but 3/3 in France, 4/4 in Germany, 4/4 in Malaysia and 7/7 in Singapore). However, only about one third of these international operators offer packages that include Lake Toba, mainly those in Malaysia, Singapore and Germany. Interviewed international tour operators stated the following:

- The destination is becoming less and less appealing to international markets, principally because it is regarded as inconvenient to reach;
- Lake Toba is far away from the main tourism destinations in Indonesia (Bali, Jakarta), and therefore cannot be included in classic "mainstream" circuits, but rather on circuits focusing exclusively on Sumatera Utara; and
- The destination mainly appeals to visitors who have already visited the most popular destinations in Indonesia and who are looking for something different, or visitors seeking off-the-beaten track circuits that focus on nature, as illustrated in Figure 13.

FIGURE 13: PLACES IN PACKAGES OFFERED BY TOUR OPERATORS

Country	Destination associated
Australia	**Example 1**: **Only Sumatera /** Medan – Berastagi – Ketambe – Samosir Island – **Buffalo (7 days)**
France	**Example 1: Sumatra, Java, Bali** / Medan, Berastagi, Samosir, Lake Toba, Medan, Jogjakarta, Borobudur, Jogjakarta, Jombang, Brimi, Kalibaru, Ijen, Pemuteran, Ubud, Benoa, Denpasar – **Asia (17 days)**
Germany	**Example 1: Only Sumatera /** Medan, Samosir Island, Parapat, Ambarita, Simanindo, Tomok, Berastagi, Bukit Lawang, Lake Toba – **Tui (6 days)** **Example 2: Only Sumatera /** Medan, Bohorok, Berastagi, Parapat, Lake Toba, Samosir Island, Tomok, Ambarita – **Transorient (5 days)**
Malaysia	**Example 1: Only Sumatera /** Medan, Tebing Tinggi, Parapat, Samosir Island, Berastagi, Medan – **Mayflower (4 days)** **Example 2**: **Only Sumatera /** Medan, Parapat (Lake Toba, Samosir Island, Tomok, Ambarita), Berastagi (Simarjarunjung, Sipiso-piso Falls, Berastagi Highlands) **Golden destinations (4 days)**
Singapore	**Example 1: Only Sumatera** Sultan Deli Palace, Great Mosque, Lake Toba, Samosir Island, Batak Tobanese, Pematang Purba, Simalungun Bataks, Sipiso-piso Waterfall, Mt. Sinabung, Mt. Sibayak **Euro-Asia (4 days)**

Source: Analysis of a sample of packages offered by interviewed tour operators.

Lake Toba is considered by users of the TripAdvisor website as the top destination in "things to do" in Sumatera Utara. A comparative analysis, illustrated in Figure 14, suggests that if Lake Toba is the most famous lake in Indonesia (it benefits from more reviews than any other lake), it is less known than other volcanic landscapes; for example, the Kawa Ijen (East Sumatra) received 3 times more reviews than Lake Toba.

FIGURE 14: TRIPADVISOR REVIEWS ON SELECT DESTINATIONS IN INDONESIA

Point of Interest	Reviews	Location
Ijen Crater	1,772	East Sumatra
Lake Toba	639	Sumatera Utara
Lake Beratan	458	Candi Kuning, Tabanan, Bali
Lake Maninjau	262	Padang, West Sumatra
Patenggang Lake	318	Desa Patengan, Bandung, West Java
Lake Batur (Danau Batur)	420	Kintamani, Bali
Kelimutu Lake	180	Ende, Flores, Nusa Tenggara Est
Kaolin Lake	219	Bangka Belitung Islands, Sumatra

Source: Analysis of TripAdvisor Website by Horwath HTL in all available languages, 01/11/2016.

Attractions mainly associated with Lake Toba, either by the travel trade, tour guides or user-generated content websites suggest that the cultural features of Lake Toba (villages, Batak Museum, religious monuments) have as much importance as the natural attractions. This suggests that the unique selling point of the destination is the combination it offers between natural landscape and cultural elements.

Figure 15 illustrates the principal topics of satisfaction and reasons for visits identified in selected international markets: it shows that difficulties in accessibility are a serious source of visitor dissatisfaction.

FIGURE 15: VISITOR SENTIMENTS

Selected Markets	Attraction Satisfaction Reasons for Visiting Lake Toba	Topics of Dissatisfaction
France	Crater lake Batak culture	Lack of 3-star and 4-star hotels Poor maintenance and lack of road connection Cost of flights
Germany	Crater lake Hikes	Poor accessibility Lack of paths for hiking
Malaysia	Landscapes different than in Malaysia Prices, Nature Nice place for incentive groups Nice place for short breakaways	Accommodations: need upgrade or refurbishment Poor connectivity Lack of activities and entertainment
Singapore	Shopping (Medan) Well adapted for family Accessibility (getting better) View Prices Batak culture	Poor connectivity: Medan to Lake Toba (road issues) Poor accessibility Lack of quality accommodations

Japan	No tours sold
Australia	No specific information, limited tours sold but a secondary location with no specific customer feedback
China	No tours sold

Source: Qualitative interviews by Horwath HTL.

3.5 TOURISM PROMOTION / DESTINATION MARKETING

The Dinas Pariwisata Sumatera Utara in Medan and the many different kabupaten are active in promoting Lake Toba. The Dinas Pariwisata, Seni & Budaya (Tourism, Art & Culture) Kab. Samosir has a new marketing tag – "Samosir, Negeri Indah Kepingan Syurga" (Samosir, A Piece of Heaven).

In addition, the Kementerian Pariwisata provides support with budget allocation for events at the kabupaten level; encouraging various Dinas Pariwisata to participate in events held at province and national levels, and liaising with kabupaten offices on drawing up national programs.

3.6 CONCLUSIONS ON VISITOR ARRIVALS & DEMOGRAPHICS

Lake Toba is mostly a domestic destination (1.7 million in 2015), with domestic visitors representing 92% of total visitors, with 3 sub-segments of visitors:

- Day visitors were an estimated 483,000 in 2015;
- VFR represented 598,000 visits in 2015; and
- Visitors staying in commercial accommodation represented approximately 662,500 arrivals in 2015.

The international guests are predominantly Malaysian and Singaporean & they come to Lake Toba for weekend getaways, attracted by the unique characteristics of the destination in Southeast Asia. Long-haul visitors mostly come from Northern Europe and they come to Lake Toba as part of a long stay in Indonesia. The global awareness of Lombok is fair but it is difficult to package with other destinations in Indonesia due to distance. Culture and the volcanic lake character are the key sources of satisfaction. Lack of accommodation choices and poor connectivity are the key sources of dissatisfaction.

Around 95% of domestic visitors are coming to Lake Toba for leisure purposes and they mostly come from Medan and cities within its vicinity, along the north coast of Sumatra.

Various levels of government have undertaken some marketing and promotions activities in Lake Toba with a new tagline being developed: "Samosir, Negeri Indah Kepingan Syurga" (Samosir, A Piece of Heaven).

4. ACCESSIBILITY HIGHLIGHTS

4.1 EXISTING MODE OF TRAVEL AND VISITOR'S MOVEMENT

4.1.1 ORIGIN OF VISITORS

The origin of visitors is important for the accessibility assessment as it indicates the mode of arrival of visitors as well as visitor distribution patterns within the destination. In 2015:

- From 1.7 million visitors, around 97% were domestic. Domestic visitors comprised of day-trippers, VFR and visitors in commercial accommodation;
- 39% of domestic visitors stayed at commercial accommodation, out of which 90% were from Sumatera Utara; and
- 60% of foreign visitors came from Malaysia (50%) and Singapore (10%).

4.1.2 EXISTING MODE OF ARRIVAL AND VISITOR'S MOVEMENT

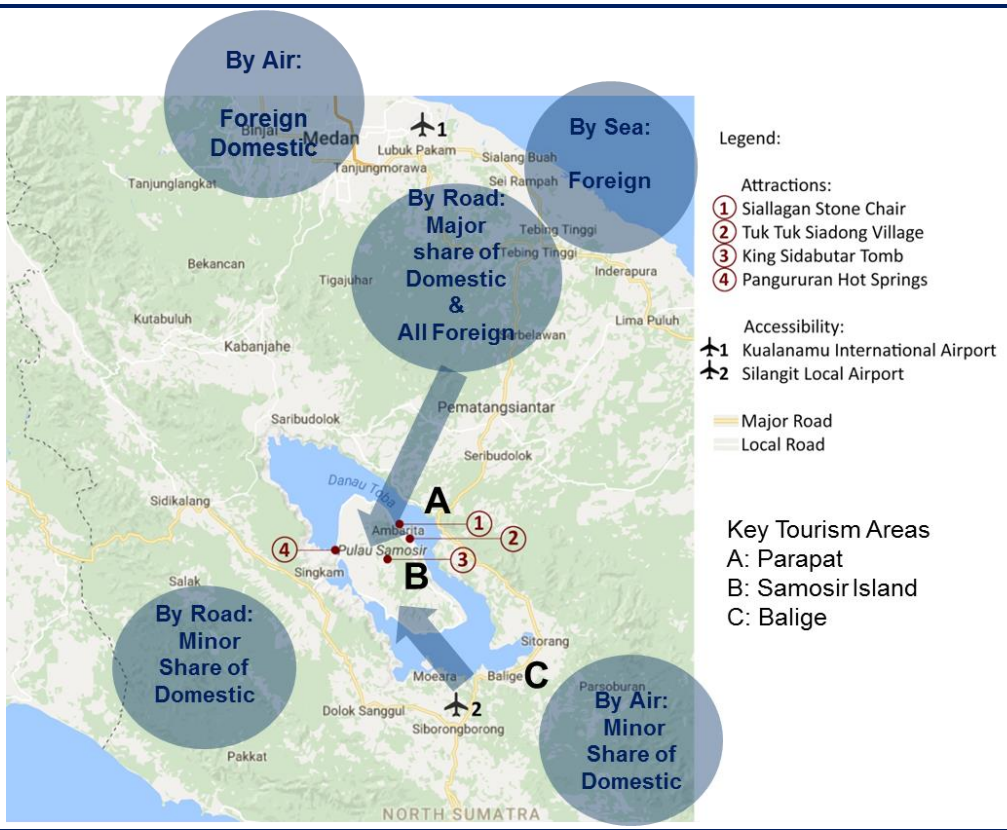
Domestic visitors rely on land transport. In 2015, 97% of domestic visitors arrived by land and the remaining by air. Less than 1% of visitors arrived through Silangit Airport. Hence, land transport is an important mode of commuting for domestic visitors.

In 2015, 85% of foreign visitors arrived by air and the remaining by sea. All international visitors to Lake Toba arrive at Kualanamu International Airport, Medan. Hence, Medan is an important gateway for Lake Toba tourism.

Other than domestic visitors travelling by road, all other visitors arriving by air and sea use roads to reach Parapat. Hence, road infrastructure to Parapat plays an important role in terms of accessibility to Lake Toba.

Based on the visitor arrival modes, the visitor's distribution can be illustrated in Figure 16.

FIGURE 16: LAKE TOBA VISITOR MOVEMENT



Source: HHTL

Around 90% of visitors come to Parapat from Medan via the Medan- Tebing Tinggi – Pematang Sinatar – Parapat corridor (178km). Depending on traffic congestion, the travel time to Parapat via this corridor is approximate 5 hours' drive by car and more than 6 hours by bus.

The second important road corridor for domestic visitors is the southern national road access via the Siborong-borong - Parapat (77km). The travel time to Parapat via this corridor is approximately 2 hours' drive by car.

4.1.3 EXISTING MODES OF TRANSPORT

Figure 17 presents the summary of the existing modes of transport used by visitors to reach Lake Toba.

FIGURE 17: TRAVEL TIME AND CONDITIONS FOR LAKE TOBA

Transport Mode	Public Bus / Rail	Private Tour Bus / Taxi / Car Rental
Travel Time	• From Medan to Parapat by bus: ~6 hours (178 km) • From Medan to Pematang Siantar by rail: 4 hours (127km) • From Pematang Siantar to Parapat by bus: 1 hour 30 min (43km)	• From Medan to Parapat: 5 hours by car (178km) • From Silangit to Parapat: 1.5 to 2 hours (77km)
Service Conditions	• Some domestic tourists take public bus from Medan to Parapat (inconvenient for tourists). • Very few use rail as a mode of transport from Medan to Pematang Siantar. • Majority of tourists take the ferry to visit Samosir Island from Parapat. • No existing public transport from Silangit to Parapat	• Majority of tourists take car rental from Kualanamu Airport to Lake Toba. • Shared taxis from Kualanamu Airport (relatively convenient for tourists). • Limited taxis from Silangit to Parapat. • No taxis around Parapat. • Motorbikes are available for tourists as one of the modes of transport to tour Samosir Island

Source: Ground field study

In the current context, the majority of visitors (around 90%) take private tour buses, taxis and rental cars to Parapat from Medan. Very few of the domestic and foreign visitors take public transport. This is largely due to the additional time taken to reach the destination from Medan using public transport.

70% of domestic visitors use their own private cars or rental cars to visit Lake Toba, 20% use tour buses/vans, and the remaining 10% use public transport such as public bus and rail.

70% of foreign visitors are estimated to book through travel agents, thus use tour buses/vans to Lake Toba, 20% use rental cars or taxis and the remaining 10% use public transport.

Due to the long distance from Medan, the majority of visitors take private transport to Lake Toba.

5. HOTEL & LODGING OPTIONS (AMENITIES)

This analysis focuses on the Destination in which key attractions and key tourism areas are located: Kab. Samosir, Kab. Toba Samosir and Kab. Simalungun.

5.1 VOLUME OF ROOMS

5.1.1 HOTEL MARKET HISTORY / TRENDS

- At the end of 2015, there was a combined 147 hotels (3,391 guestrooms) within the Destination that surround Lake Toba, of which only 16 hotels (just over 10%) were star-rated (Figure 18).
- Star-rated hotels are focused in the main tourist towns of Tuktuk (Kab. Samosir, Kec. Simanindo) and Parapat (Kab. Simalungun, Kec. Girsang Sipangan Bolon).
- Kab. Simalungun and Kab. Samosir again dominate the non-star rated hotels with a total of 116 non-star-rated hotels.
- The dominance of Kab. Simalungun and Kab. Samosir is further shown in the total number of rooms (star-rated and non-rated).

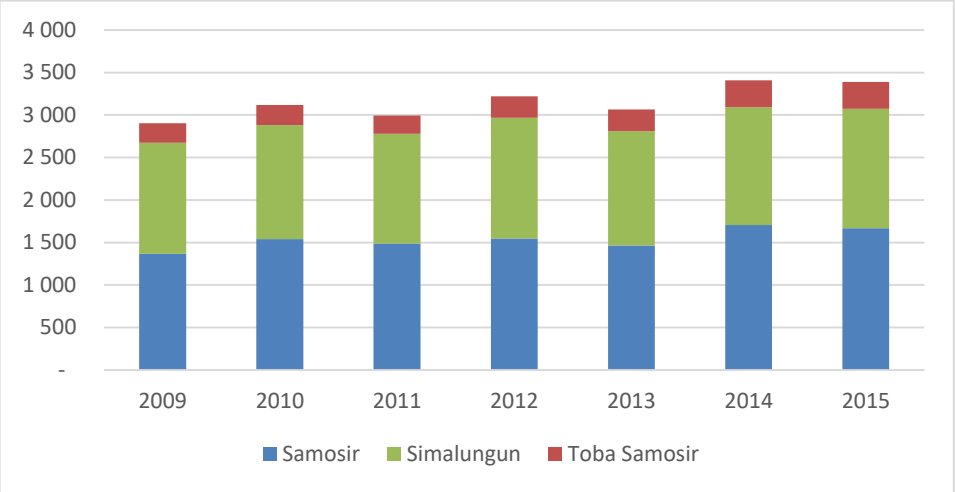
FIGURE 18: HOTEL & ROOM VOLUME BY KABUPATEN, 2015

Kab.	# of Star Rated Hotels	# of Non-Star Rated Hotels	Total # Of Hotels	# of Star Rated Rooms	# of Non-Star Rated Rooms	# of Rooms (Combined)	Overall Occ %
Simalungun	9	38	47	634	770	1,404	23%
Samosir	6	78	84	386	1,283	1,669	17%
Toba Samosir	1	15	16	14	304	318	18%
Total	16	131	147	1,034	2,357	3,391	17 -23%

Source: BPS Sumatera Utara

- The compound annual growth rate (CAGR) of hotel rooms from 2009 to 2015 in the Destination are: Kab. Simalungun 1%, Kab. Samosir 3% and Kab. Toba Samosir 6%.
- In total, the Destination registered a CAGR of hotel rooms of approximately 3% in the 6 years to 2015.

FIGURE 19: TOTAL NUMBER OF ROOMS IN THE DESTINATION, 2009 - 2015

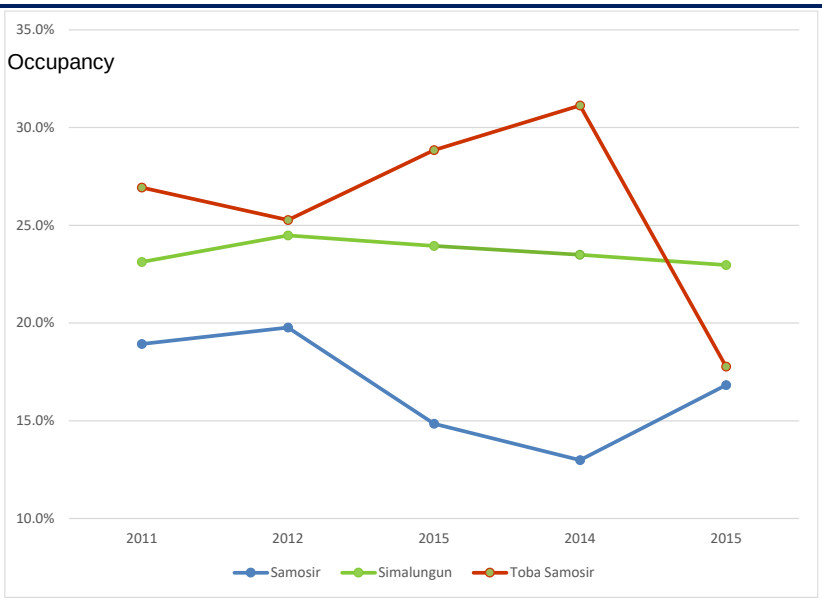


Source: BPS Sumatera Utara

- The star-rated hotels are mainly limited service / budget scale properties with only a handful of upscale hotels.
- The state of repair and maintenance of the hotels is generally below standard.

5.2 PERFORMANCE ESTIMATES

FIGURE 20: OCCUPANCY OF HOTELS IN THE DESTINATION, 2011 TO 2015



Source: BPS Sumatera Utara

With an industry that relies heavily on seasonal leisure demand, hotel occupancy in the Destination has varied from below 15% to just over 30% (as indicated in Figure 20):

- Kab. Simalungun (Parapat) occupancy has remained relatively flat at below 25%;

- Kab. Toba Samosir (Balige) has fluctuated, performing very poorly in 2015, at below 20%. This is driven by A fall in government MICE, but with only 318 rooms in the sample the shift is not considered structural, more a potential reporting issue; and
- Kab. Samosir has performed consistently below 20% over the last 5 years.

Overall market occupancy levels have remained relatively stable at between 19% and 22% over the 2011 – 2015 periods.

5.2.1 AVERAGE DAILY RATE (ADR) ESTIMATES

The 2015 ADRs were estimated based on our interviews with select star-rated hotels in the following areas:

- Tuk Tuk (Samosir Island, Kab. Samosir): between IDR 350,000 – 550,000 (~USD 25 – 40); and
- Parapat (Kab. Simalungun) and Balige (Kab. Toba Samosir) between IDR 250,000 – 450,000 (~USD 18 – 33).

The difference is attributed to a combination of (1) lower yielding tour groups in Parapat, (2) better quality, better maintained and appointed guestrooms on Samosir Island, and (3) a higher proportion of foreign guests on Samosir Island.

In general, non-star rated hotels registered ADRs around IDR 100,000 – IDR 250,000 (~USD 7 – 18) lower than star-rated hotels.

5.3 HOTEL FACILITIES

- Almost all star-rated hotels have a restaurant and swimming pool.
- Most star-rated hotels also provide meeting space in their attempts to attract mid-week meetings and corporate retreats to lessen the weekend leisure seasonality effects.
- As there is an abundance of local eateries, most hotels provide one restaurant only.
- Most non-star rated hotels offer guestrooms only.

Figure 21 is a facilities matrix of some of the top hotels in Kab. Samosir and Kab. Simalungun. The hotels were selected based on their quality (Horwath HTL judgment), and they are considered representative.

FIGURE 21: FACILITIES AT SELECT HOTELS IN THE DESTINATION

Top Hotels	Star Rating	No. Rooms	No. F&B Outlets	Meeting Rooms	Spa & Sauna	Swimming Pool
Inna Parapat	3	97	3	yes	no	no
Atsari Hotel Parapat	3	44	1	yes	no	no
Danau Toba Int'l Cottage Parapat	3	112	2	yes	yes	Yes
Surya Niagara Parapat	4	200	2	yes	no	Yes
Toledo Inn Samosir Island	2	172	1	no	yes	Yes
Ambaroba, Samosir Island	2	109	1	yes	no	No
Patra Jasa Parapat	2	56	1	yes	no	Yes
Tabo Cottage Samosir Is	3	20	1	yes	no	Yes
Samosir Cottages	3	85	1	yes	no	Yes
Tiara Bunga Hotel Balige	4	54	1	yes	no	Yes
Parapat View Hotel	3	73	1	yes	no	Yes
Total		**1,022**				

Source: Horwath HTL, Note: Hotel Sere Nauli is excluded as it is located quite a distance from Lake Toba.

5.3.1 FOOD & BEVERAGE

- Most of the hotels' food and beverage outlets cater breakfast to their guests, whilst lunch and dinner periods are quiet.
- Food selection ranges from Indonesian to international cuisine with an average check of between IDR 50,000 – 200,000 (~USD 4 – 15). Hotel restaurants on Samosir Island offer additional Western cuisine and charge higher prices due to their greater foreign guest mix.
- Upon tour operators' request, hotels will provide groups with lunch or dinner (set meal or buffet packages).

5.3.2 MEETING SPACE

- Meeting space is generally small with very low usage.
- The accessibility issue has prevented Lake Toba from attracting a higher number of companies to hold meetings and corporate events. The current travelling time by car or bus between Medan and Lake Toba, as well as the inconvenience of air travel between Medan and Silangit (which will entail another 1.5 to 2 hours' drive from Silangit Airport to Lake Toba) has been cited by hotel managers as the reason for the low capture of corporate meetings and demand. This is despite a conducive environment and the availability of meeting space to accommodate small to medium size groups. Regionally, resorts normally target meetings demand as fillers during low seasons in the leisure demand segment.

- Despite the setting with mountains and lake, the capture of social events such as weddings and birthdays is also insignificant due to accessibility.

5.3.3 OTHER FACILITIES

- Swimming pools are a common facility offered by star-rated hotels.
- Spa and sauna facilities and retail shops are uncommon.

5.3.4 MARKET LEADERS

The market leaders are the Surya Niagara Hotel, Danau Toba International Cottage, Samosir Cottage and Tabo Cottage. These hotels are generally better managed, maintained and appointed. For 2015, the estimated occupancy levels of the aforementioned hotels ranged between 42% and 53%.

6. SMES: SUPPORTING TOURISM INFRASTRUCTURE (AMENITIES)

The following discussion concerns existing small and medium sized enterprise tourism activities in Lake Toba.

6.1 INDEPENDENT FOOD & BEVERAGE

The independent food and beverage outlets mainly serve Indonesian and local cuisine as well as Chinese, with very limited other options. Samosir Island is the exception with greater variety on offer.

The scale of the restaurants ranges from small (seating capacity of up to 20) to large with seating capacity of up to 80. The average F&B check per person ranges from IDR 30,000 (~USD 2) at small local restaurants to IDR 300,000 (~USD 22) at more upscale restaurants (especially restaurants serving Western food).

Information received from the Dinas Pariwisata Sumatera Utara indicates that in 2015, there were 91 'food & beverage' outlets in Kab. Toba Samosir and 48 in Kab. Samosir. This is a combination of restaurants, cafes, warung, etc., as the information is not disaggregated. They did not have historical information. There is no data available for Kab. Simalungun, however, it is safe to assume that the number of food & beverage outlets exceeds 100 due to its position as a primary gateway.

6.2 RECREATIONAL CRUISES

There are currently (as of September 2016) no boat cruises on Lake Toba.

6.3 TRAVEL AGENCIES & TOUR SERVICES

Travel agency services are usually provided by agents based in Medan, where, as at 2015, there are 430 tour operators and 60 travel agents registered. There are also travel agents based in Parapat and Balige although fewer than in Medan (the number is unavailable). We would assume, based on the data in Medan, that there would be between 50 – 80 tour operators and between 10 and 20 travel agents in Parapat and Balige. These travel agencies normally provide services to individual travelers as tour groups typically have their services provided by travel agencies in Medan. Services such as fishing, mountain hiking, and bicycle and motorcycle rental are normally arranged through hotels.

6.4 TRANSPORT PROVIDERS

Car rentals and buses are also available, mainly from Medan.

6.5 TOURISM SERVICE PROVIDERS

- Tour groups from Medan are usually accompanied by tour guides from Medan. However, if visitors not on tour packages arrive at Lake Toba and require tour guides, local guides are normally provided, or sourced, by hotels.
- There is no association of tour guides.

6.6 OTHER SERVICE PROVIDERS

- Car-passenger ferry and passenger boat services are scheduled between the mainland and Samosir Island. There are approximately 33 operators (see Baseline Transport Infrastructure).
- Private speedboats ply between Parapat and hotel jetties on Samosir Island.
- Bicycle and motorcycle rentals are available on Samosir Island. There are approximately 40 operators on the island.
- Hot springs on Samosir Island.
- Other than scheduled ferry and passenger boat services, there are no statistics on the aforementioned service providers.

6.7 CONCLUSIONS ON SMES SUPPORTING TOURISM ACTIVITIES

There are currently a reasonable variety of SMEs supporting tourism activities in Lake Toba. These are more prevalent in the key tourism areas of Parapat, Tuktuk and to a lesser extent Balige. That said, the destination lack depths in small business and if Lake Toba is to develop in the future the number and variety of SMEs must be developed further to meet increasing tourism needs.

7. INVESTMENT ANALYSIS

7.1 REALISED FDI & DDI IN HOTELS & RESTAURANTS

Between 2010 and 2015, Kab. Karo was the only kabupaten within the Destination Boundary to record realized FDI:

FIGURE 22: REALIZED FDI IN TOURISM AND TOURISM RELATED PROJECTS (USD)

Year	Number of Project	Realized Value
2010	1	1,722,500
2011	1	4,522,300
2012	1	4,110,100
2013	2	992,000
2014	2	28,100
2015	2	Not declared yet

Source: BKPM & PTSP-SUMUT

Between 2010 and 2015, Kab. Karo was the only kabupaten within the Destination Boundary to record realized DDI, with investments of IDR 2.74 billion in 2 projects in 2011[12].

7.2 PLANNED DDI & FDI IN HOTELS & RESTAURANTS

Between 2004 and 2015, Kab. Karo was the only kabupaten within the Destination Boundary to record planned FDI in hotels & restaurants:

- USD 5.5m in star-rated hotels in 2015 (unrealized, planned but no construction investments have been made); and
- USD 7.7m in man-made attractions in 2014 (unrealized).[13]

Between 2004 and 2015, Kab. Toba Samosir was the only kabupaten within the Destination Boundary to record planned DDI in hotels & restaurants, with USD 150,000 planned for "other accommodations" in 2015.

7.3 KEY PLAYERS / INVESTORS

- There are no international branded hotels around Lake Toba.
- Most hotel owners are from Medan.
- The majority of hotels are independent and owner operated.
- Domestic chains represented in the area include:

[12] Source: BKPM

[13] Source: PTSP-SUMUT

- Inna Parapat which is owned and operated by PT Hotel Indonesia Natour (Persero), a state-owned enterprise. The Inna Hotel Group has 13 hotels across Indonesia; and
- Danau Toba International Cottage is part of the same local chain, PT Hotel Danau Toba International, which has a second hotel in Medan.

7.4 INVESTMENT SENTIMENT: DOMESTIC & FOREIGN INVESTORS

7.4.1 FOREIGN INVESTORS INTERVIEWED[14]

Foreign investors canvassed on Lake Toba were largely disinterested in the destination due to the lack of accessibility and the poor infrastructure surrounding the lake. There was one positive comment from one Chinese investor who thought the destination was unique. The investor expressed an interest in investing in the destination but only as part of a consortium of investors to reduce the element of risk. They would consider 50 hectares although they were not specific as to which asset class yet as they had done insufficient research.

Singaporean investors were less negative about the destination but expressed opinions that the destination was not yet ready for investment. The major deterrents to investment were the fundamentals of a leisure destination that include accessibility, infrastructure and general demand for the destination.

The lack of internationally branded hotels which typically add security to many travelers' accommodation choices and the lack of cheap land also detract from the investment attractiveness based on interviews with overseas developers.

7.4.2 DOMESTIC INVESTORS INTERVIEWED[15]

Not surprisingly the domestic investors interviewed had more to say about Lake Toba including:

- The environment has been affected by deforestation. Until this is addressed, the destination will remain unattractive to investment;
- Medan is interesting for a city hotel but not Lake Toba;
- One investor mentioned that he had looked at land but the prices made development difficult. With incentives, they would look again at the situation; and

[14] Investment sentiment gleaned from interviews with 25 potential and existing foreign investors from Australia, China, Japan, Malaysia, and Singapore. The questions were aimed to better understand their thoughts on pros and cons of SEZs, the tourism investment climate in Indonesia, the future of tourism investment and possible investment opportunities in Lake Toba.

[15] Investment sentiment gleaned from interviews with 9 existing Indonesian tourism investors. The investors chosen had interests in various tourism assets including hotels, restaurants, ground transportation and travel agencies. The questions were aimed at gathering their thoughts on the pros and cons of SEZs, the tourism investment climate in Indonesia, the future of tourism investment and possible investment in Lake Toba.

- Another mentioned that he was keen on developing hotels within the Badan Otorita Prioritas (BOP) area but that it would require Government subsidies on the land to be attractive.

7.5 WHERE IS THE DESTINATION ON THE INVESTMENT CYCLE

Lake Toba is at the mature stage (stagnating) on the investment cycle. The destination was already well-known nationally, regionally and internationally (especially in Europe) in the 1970s and very little has developed since the 1990s. To capture additional visitor arrivals and stimulate more private investment, government assistance is needed to kick start the destination. Currently, the investment risk is too high to invest in a market that requires significant infrastructure investment by the Government.

7.6 CONCLUSIONS ON INVESTMENT

Over the last 5 years, low levels of investments (by both domestic and foreign) in the tourism sector in Lake Toba reflects the general market sentiment. Hotels in the 3 main kabupaten are performing poorly, registering low / stagnant room night demand with low occupancies, and inevitably low profitability and low investment returns. Moving forward, the current situation is unlikely to change unless road infrastructure between Medan and Parapat is improved significantly. The environment issue of Lake Toba also requires immediate attention by the Government to safeguard its appeal as the main star attraction of the destination. Otherwise, the appetite for investments by the private sector is expected to remain minimal.

There is further discussion on the investment sentiment gleaned from interviews with existing Indonesian tourism investors and foreign investors in the accompanying Indonesia-level report.

8. SKILLS ASSESSMENT

8.1 WHAT SKILLS EXIST

- The hotel industry in Lake Toba has been around since the 1970s and 1980s; hence skills at the lower levels are solid.
- As of 2015, there were a total of 2,835 hotel employees in 7 of the 8 surrounding kabupaten (excluding Kab. Pakpak Bharat), of which the destination of Kab. Toba Samosir, Kab. Simalungun and Kab. Samosir comprised approximately 53% share.
- Entry level and supervisory level employees are sourced from the surrounding areas (information gleaned from interviews).
- Travel agents and tour companies at Medan are established and their level of spoken English is considered acceptable.

8.2 SKILLS GAPS[16]

- English proficiency in the Lake Toba area is limited other than on Samosir Island.
- Management level skills are lacking and management level staff are mainly sourced from other cities such as Medan and Jakarta.
- At the independent restaurant level, most staff (especially at family-run businesses) do not speak English well.
- As the volume of accommodation and quality improves skills gaps will emerge.
- Conservation / sustainability knowledge is limited and the community must focus attention on conservation if it wishes to develop into a successful destination.

8.3 TRAINING SCHOOLS

There are Sekolah Menengah Kejuruan (SMK) or vocational schools around Lake Toba and Medan to offer basic hospitality training for young people. Below are some of the SMK and courses offered:

- There are tourism SMKs in most of the kabupaten around Lake Toba; 4 in Kab. Simalungun, 3 in each of Kab. Samosir and Kab. North Tapanuli, and 2 each in Kab. Karo and Kab. Dairi.
- In addition, there are 4 tourism academies in Medan, one managed by the provincial Government in association with the Ministry of Tourism (Akademi Pariwisata Medan) and 3 privately owned (Akademi Pariwisata dan Perhotelan Dharma Agung, Akademi Pariwisata Nusantara, and Akademi Pariwisata Taman Harapan).

[16] Gleaned from interviews with existing local investors in various assets including hotels, restaurants, travel agencies, and interviews with local hoteliers, restaurant managers.

- In addition, the Akademi Pariwisata Medan dispatches its trainers to hotels in Lake Toba twice a year for on-site training.
- After completing SMKs, students can continue their tourism study with a two to four year program at universities (Akademi Pariwisata Medan, central Government funding) or colleges.
- Courses available are Hotel, Tour & Travel, and Food & Beverage Service.

DESTINATION SWOT & VISION

9. DESTINATION SWOT

This chapter takes the form of a SWOT analysis to summarize the main findings on tourism supply and demand in Lake Toba.

9.1 STRENGTHS

- An established holiday destination since the 1970s.
- Rich natural beauty of the lake considered by the travel trade as a world class attraction.
- Strong awareness of the destination at national and international level.
- Good air connections between Southeast Asia and Medan.
- A strong Batak culture and way of life that is unique in Indonesia.
- Toba Lake is the world's largest active volcanic caldera, created by an eruption 74,000 years ago. Reputably by far the biggest eruption of the last 2 million years.

9.2 WEAKNESSES

- Road infrastructure between Medan and Parapat.
- The deteriorating environment.
- Low quality and lack of variety in hotel accommodation.
- Limited corporate and MICE demand to improve weekly occupancy.
- Limited number and variety of supporting tourist facilities such as restaurants, retail and commercial leisure activities.
- Limited interest for investors.
- The almost annual haze caused by forest fires has a negative impact on visitation (mid-year).
- No reliable public transport around Samosir Island.

9.3 OPPORTUNITIES

- Road improvement between Medan and Tebing Tinggi is expected to reduce travelling time, making Lake Toba significantly more accessible to both foreign and domestic markets.
- There is strong support from the central government to promote Lake Toba.
- Possibility to introduce leisure attractions (boat trips, water sports and activities, golf, hiking and cycling).

- Lake Toba may be increasingly packaged with other attractions (shopping in Medan, Berastagi and Bukit Lawang).
- The government has applied for the Toba Caldera Geopark to be inscribed on UNESCO's Geopark Global Network in 2017.
- The opportunity of promoting Batak culture to tourists.
- With the new international Kualanamu airport at Medan, more air links could be established with other regional gateway cities.

9.4 THREATS

- The absence of proper waste management, sewerage dumping, deforestation and commercial fishing methods generate pollution.
- That regulations concerning lakeside development (zoning) are unenforced by the kabupaten /provincial government thereby allowing illegal development to scar the lakeshore.
- As Lake Toba lies near the Great Sumatran fault line, there is a risk of earthquakes (which have recently occurred around the vicinity of the Pusuk Bukit Volcano, notably in 1987 along the southern lakeshore).
- The haze caused by forest fires (due to industrial scale slash-and-burn practices in clearing land in Sumatra, especially in the provinces of Riau and Sumatera Selatan). The haze normally occurs over the dry season. Significant haze occurred in 1997, 2006, 2009, 2013 and 2015.

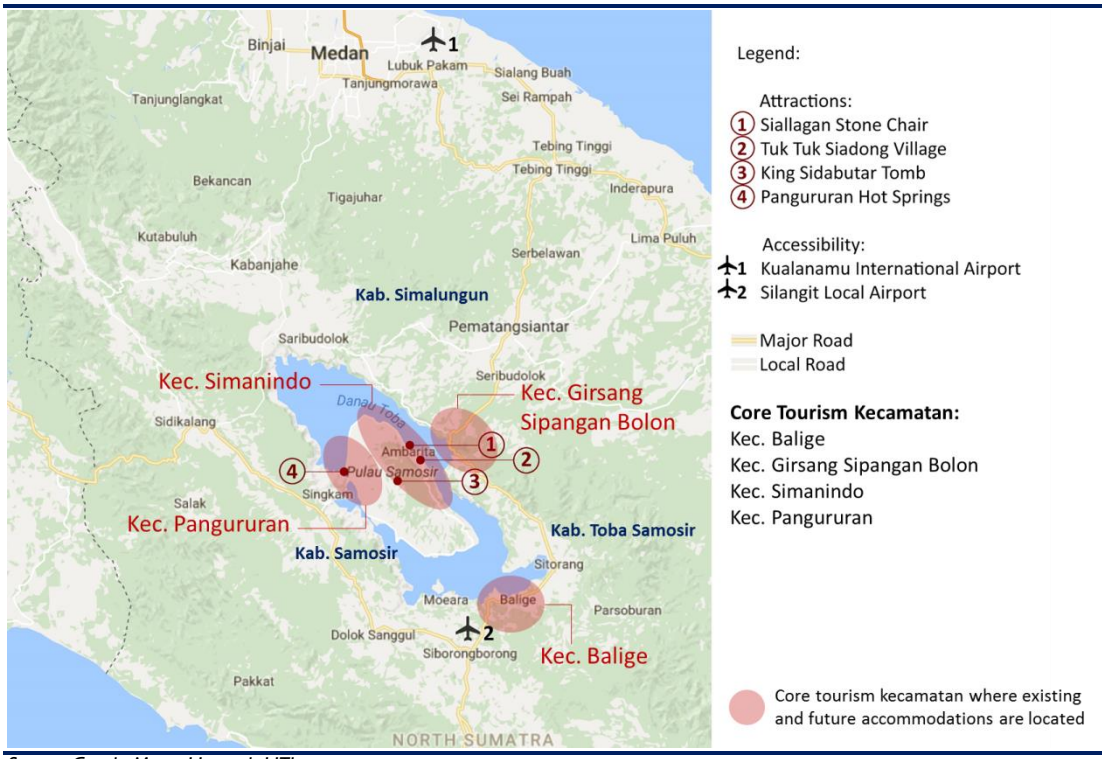
10. DESTINATION VISION STATEMENT

Figure 23 highlights the key areas of interest / attractions that help define the key tourism areas in and around Lake Toba, now and in the future. As has been pointed out, the Destination consists of 3 key kabupaten (Kab. Simalungun, Kab. Toba Samosir and Kab. Samosir) that have popular and established tourism attractions and tourism infrastructure in place, such as hotels and food and beverage outlets, airport and the main road access from Medan, the gateway to Sumatera Utara.

Going forward, the main road access from Medan to Parapat (in Kab. Simalungun) will be upgraded to a toll road that will shorten the driving distance between the 2 cities to approximately 2 – 2.5 hours from the current 5 – 6 hours. The road upgrade will further consolidate Parapat as the main gateway to Lake Toba for domestic as well as foreign visitors. Parapat is also the main access point for ferries to Samosir Island.

The proposed capacity expansion of the Silangit Airport (in Kab. Toba Samosir) underlines the commitment of President Jokowi to elevate the importance of tourism in Lake Toba and facilitates Balige developing into a key tourism area.

FIGURE 23 KEY ATTRACTIONS IN AND AROUND LAKE TOBA



Source: Google Maps, Horwath HTL

10.1 RECOMMENDED DESTINATION VISION

Lake Toba is a world-class environmentally sustainable destination focusing on its volcanic heritage combined with Batak culture, creating a niche mountain / lakeside retreat.

To foster the retreat character, Lake Toba offers a variety of accommodations, easily accessible from Medan. It also offers land and lake based activities for the whole family to enjoy the unique combination of nature and culture.

Key Tourism Areas

- Parapat: budget to mid-tier accommodation aimed at domestic visitors and some Malaysians. It should be developed as the main tourism support area and transport hub from Medan (the primary entry point).
- Samosir Island: should be the key area for small / low impact and high-end accommodation. This will attract Singaporeans and Europeans and high-end domestic weekenders. The focus should be on wellness, nature and the Batak culture.
- Balige: is a secondary accommodation area with some potential to attract domestic demand given its lake-side location and proximity to Silangit Airport (which is likely to remain the secondary entry point to Lake Toba).

MARKET DEMAND FORECASTS

11. FUTURE MARKET DEMAND ANALYSIS

11.1 INTRODUCTION: METHODOLOGY

The purpose of this section is to develop detailed projections for the scale, origin and characteristics of future visitor demand to the Destination. The steps are:

- Assess and analyze potential market demand for the Destination to identify target market segments (based on the segment's ability to generate value for the Destination in a sustainable manner), building on the baseline supply and demand analysis;
- Define two demand scenarios based on the conditions required for the development of the Destination: a "best-case" scenario where these conditions are met and a "business as usual" scenario where they are not; and
- Provide quantitative forecasts of future visitor demand from source markets depending on the scenarios.

The next sections of the Report use this assessment of future demand to identify opportunities for the development of Lake Toba (accommodation, transportation, leisure activities, etc.) in terms of scale, location, and timing, and to assess public investment needs (transport and basic services and infrastructure).

11.2 PRIORITY MARKETS FOR THE DESTINATION

11.2.1 DOMESTIC VISITORS

- Domestic visitors (including day and overnight visitors) will continue to represent the majority of visitors to Lake Toba in the future.
- For accessibility reasons, domestic visitors will mostly come from Medan and cities within its vicinity (by road), and to a lesser extent from other provinces of Sumatra (Aceh, Sumatera Barat) and from Jakarta (by air).
- Domestic visitors to Lake Toba will be principally middle to upper middle-class Sumatera Utara residents, and will tend to go to Lake Toba repeatedly on weekends (with an increasing share of day visitors as accessibility improves, and for 1 or 2 night stays).
- Due to the nature of the Destination's offering, Lake Toba is likely to attract repeat visitors (unlike heritage monuments which are often considered as "once in a lifetime" must see).
- While the majority of visitors (day and overnight visitors alike) will still travel to Lake Toba for leisure purposes, there is a potential MICE market to be developed among Sumatra and Jakarta-based companies.

11.2.2 FOREIGN VISITORS

- Target foreign markets with the greatest potential for increasing visitors are **Malaysia and Singapore**. Visitors from these countries are expected to visit Lake Toba for weekend getaways (1 to 3 nights), with a longer ALOS (2.4 nights) than domestic visitors, attracted by the unique characteristics of the destination for which *there is no equivalent elsewhere in Southeast Asia (volcanic lake, cooler climate, Batak* culture). As connectivity to Medan improves, it is expected that tour packages combining Lake Toba with shopping in Medan will continue to develop.
- **European travelers** (especially Dutch, German and French) will remain a minor share of foreign travelers, but their absolute numbers are also likely to grow. As other destinations in Indonesia develop, Sumatera Utara will increasingly attract European visitors seeking off-the-beaten track circuits that focus on nature. They are expected to favor domestic-centric destinations that appeal to them as more "authentic". We infer that a short stay (1 to 3 nights) in Lake Toba will be increasingly sold as part of a long circuit in Sumatra, or as a detour on the way to see the orangutans in Bukit Lawang or the elephant sanctuary in Tangkahan.
- **Chinese visitors** represent a minor share of foreign visitors currently, but as there is a significant population in Medan and Tebing Tinggi that are ethnically Chinese, this could generate visits from China due to near or distant family ties. With accessibility improvements, Chinese visitors will more likely make day trips or short overnight stays in Lake Toba as part of a visit to friends and relatives in Sumatra.[17]

Two scenarios of future demand are presented:

- Business as Usual scenario:
  - "organic" development of the destination driven by the forces of the market; and
  - no specific effort is made to improve the two major obstacles restricting development of the destination: (1) travel time by road will remain a disadvantage for the visitors and potential investor; and (2) continued degradation of the natural environment of Lake Toba.
- Best Case scenario:
  - Accessibility from Medan and the Northern Coast Regencies of Sumatera Utara improves by between 2016 & 2021 (travel time from Medan to Parapat falls from > 5 hrs. to a maximum of 2 hrs. 30 minutes);
  - Better scheduling of flights between Jakarta & Silangit Airport to facilitate weekend trips from Jakarta; and

[17] *Though there is no evidence of a correlation between the importance of the domestic population with Chinese origins and the number of arrivals of Chinese visitors in the provinces of Indonesia.*

- An integrated tourism masterplan is successfully undertaken to develop Lake Toba destination.

11.3 BUSINESS AS USUAL SCENARIO

11.3.1 SCENARIO SUMMARY DESCRIPTION

The demand and supply analyses revealed two major problems:

- The travel time by road between Medan and Lake Toba constrains the development of markets, and
- The degradation of the natural environment of Lake Toba.

The Business as Usual scenario is based on the assumption that no specific effort is made by the Government to improve the situation on these two fronts.

The market response to this scenario will depend on the following parameters:

- The recent trend in visitor growth, which has been muted due to the remoteness of the destination (average growth of 3.5% for the domestic visitors in commercial accommodation);
- Evolution of socio-economic factors (demographic trends, purchasing power, car availability per household, increased appetite for day trips and travel of the urban population); and
- In the long run, the degradation of the environment, which should decrease visitor demand for the Destination.

As a result, accommodation growth will be limited, in line with demand trends. The ALOS will be in line with the past trends, whereas visitor expenditure will remain low due to the lack of high-quality accommodation products and commercial activities.

11.3.2 QUANTITATIVE FORECAST OF DOMESTIC VISITORS: BUSINESS AS USUAL SCENARIO

Figure 24 presents the quantitative forecast of domestic visitors in the Business as Usual scenario.

FIGURE 24: FORECAST OF DOMESTIC VISITORS TO LAKE TOBA, 2015-2041 (BUSINESS AS USUAL SCENARIO)

	Number of visitors				CAGR (%)		
		Projections					
	2015	2021	2026	2041	2016-2021	2022-2026	2027-2041
Total domestic visitors	**1,743,500**	**1,954,700**	**2,076,600**	**2,210,500**	**1.9%**	**1.2%**	**0.4%**
Day visitors	483,000	514,100	524,600	541,200	1.0%	0.4%	0.2%
Staying at friends and relatives	598,000	625,500	651,400	700,600	0.8%	0.8%	0.5%
In commercial accommodation	662,500	815,100	900,600	968,700	3.5%	2.0%	0.5%
From North Sumatra	596,250	737,800	819,200	881,100	3.6%	2.1%	0.5%
From other provinces	66,250	77,300	81,400	87,600	2.6%	1.0%	0.5%

Source: Horwath HTL

NOTE: The forecast periods are 2016 – 2021 (6 years), 2022 – 2026 (5 years) and 2027 – 2041 (15 years).

The quantitative forecasts are based on the following detailed assumptions.

11.3.2.1 *DAY VISITORS*

2016-2021

CAGR of 1.0%, estimated based on the share of the regional day trip market captured by Lake Toba, using the following assumptions:

- Population growth of 1.1% for the kabupaten in the North Coast area of Sumatera Utara (assumed equal to census projections of population growth of the entire province);
- Increasing propensity of the urban population in these kabupaten to go on day trips (from 20% of the population in 2015 to 21%), reflecting socio-economic trends favoring increased travel (i.e. rising household purchasing power, car ownership, etc.);
- Estimated number of day trips per year (4); and
- Slight decline in the market share of Lake Toba in the regional day visitor market (from 10% in 2015 to 9.5%), reflecting reduced attractiveness of the Destination on account of environmental degradation and poor road access.

2022-2026

CAGR of 0.4%; estimated based on same methodology as for 2016-2021 period, assuming a further increase in travel propensity of the urban population (to 22%) based on socio-economic drivers, and continued loss of Lake Toba's regional day trip market share (to 8.5%) due to environmental degradation and poor road access.

2027-2041

CAGR of 0.2%; same methodology as previous two periods, assuming an additional increase in travel propensity of the urban population (to 25%), and further loss of day trip market share by Lake Toba (down to a long-run average of 7.5%).

11.3.2.2 *VISITORS STAYING WITH FRIENDS AND RELATIVES*

2016-2021	No change assumed in the number of incoming VFR trips per household (2.1) in the Destination (Kab. Toba Samosir, Kab Samosir, and Kab. Simalungun); visitor growth therefore evolves in line with forecast of the annual population growth in the Destination (CAGR 0.8%).
2022-2026	Same reasoning as previous period; estimate based on the forecast of annual population growth in the Destination (CAGR 0.8%).
2027-2041	Same reasoning as previous period; estimate based on the forecast of annual population growth in the Destination (CAGR 0.5%).

11.3.2.3 *DOMESTIC VISITORS STAYING IN COMMERCIAL ACCOMMODATION*

2016-2021	Estimated visitor growth is equal to its recent 5-year trend (CAGR of 3.6% from 2010-2015). The demand from Sumatera Utara residents will grow faster (CAGR 3.6%) than the demand from other provinces (2.6%) due to better awareness of the destination and better accessibility.
2022-2026	Estimate based on the 2010-2015 growth trend, adjusted downwards (CAGR 2.0%) to reflect the reduced attractiveness of the Destination. The demand from Sumatera Utara residents will grow faster (CAGR 2.1%) than the demand from other provinces (1.0%) due to better awareness of the destination and better accessibility.
2027-2041	Based on an estimate of the annual growth of the population at national level (Source: Census Administration) adjusted downwards (CAGR 0.5%), considering the reduced attractiveness of Lake Toba due to environmental degradation.

11.3.2.4 *QUANTITATIVE FORECAST OF FOREIGN VISITORS: BUSINESS AS USUAL SCENARIO*

Figure 25 presents the quantitative forecasts of foreign visitors in the Business as Usual scenario.

FIGURE 25: FORECAST OF FOREIGN VISITORS TO LAKE TOBA 2015-2041 (BUSINESS AS USUAL SCENARIO)

	2015	Projections			CAGR (%)		
		2021	2026	2041	2016-2021	2022-2026	2027-2041
Total foreign visitors	**58,709**	**78,800**	**87,300**	**87,300**	**5.0%**	**2.1%**	**0.0%**
Overnight visitors	58,709	78,800	87,300	87,300	5.0%	2.1%	0.0%
Malaysia	29,340	40,200	46,500	46,500	5.4%	3.0%	0.0%
Singapore	6,057	7,400	8,000	8,000	3.5%	1.5%	0.0%
Other countries	23,312	31,200	32,800	32,800	5.0%	1.0%	0.0%

Source: Horwath HTL

The reasoning for each market segment for 2021, 2026 and 2041 is presented below.

11.3.2.5 *SINGAPORE AND MALAYSIA*

2016 – 2021	Estimate based on forecast growth of Malaysian and Singaporean visitors at national level, i.e. CAGR 5.4% for Malaysia, and 3.5% for Singapore.
2022 – 2026	Estimate based on forecast growth of Malaysian and Singaporean visitors at national level (CAGR 4.6% and 3.1% respectively), adjusted downwards (CAGR 3% for Malaysia, 1.5% for Singapore) considering lower attractiveness of Lake Toba compared with other developing Indonesian destinations and due to environmental degradation.
2027 – 2041	Zero growth considering the loss of attractiveness of Lake Toba compared with other developing Indonesian destinations and due to environmental degradation.

11.3.2.6 *OTHER FOREIGN VISITORS (MOSTLY EUROPEANS[18])*

2016 – 2021	Estimate based on projected growth of European visitors at national level (CAGR 5%).
2022 – 2026	Estimate based on growth of European visitors at national level (CAGR 1.8%), adjusted downwards (to CAGR 1.0%) considering lower attractiveness of Lake Toba compared with other developing Indonesian destinations and due to environmental degradation.
2027 – 2041	Zero growth considering the loss of attractiveness of Lake Toba compared with other developing Indonesian destinations and due to environmental degradation.

[18] *Interviews with local operators indicate that the broad majority other foreign visitors to Lake Toba are from Europe (consistent with interviews with Tour operators in key international markets).*

11.4 BEST CASE SCENARIO

11.4.1 SCENARIO SUMMARY DESCRIPTION

This scenario is based on the assumptions that:

- Accessibility from Medan and the other kabupaten of Sumatera Utara to Lake Toba will improve by 2021 (Medan - Parapat will be 2h30 drive maximum);
- Better scheduling of flights between Jakarta and Silangit Airport from 2016 will facilitate weekend trips from Jakarta;
- An integrated tourism master plan will be successfully undertaken to develop the Destination (Lake Toba)[19] involving:
  - Significant efforts to rehabilitate and preserve the environment of the Lake; and
  - Successful master planning of new tourism facilities including: beautification of the environment, paths for bikes, MICE facilities and related recreational activities, marina and real-estate development in the key tourism areas.

11.4.1.1 *MARKET RESPONSE*

Once accessibility has improved, the potential increase in day trips and short stays will be unlocked, significantly increasing the number of visitors. This should subsequently trigger investments in the destination.

- 2016 – 2021: the Jakarta market could grow with better scheduling of flights from Jakarta to Silangit Airport to facilitate weekend trips. Some investments to enhance the environment and tourism amenities have already been carried out. Hence, demand patterns still follow past trends, but exhibit slight improvement.
- 2022 – 2041: the potential for growth is further unlocked with increased road accessibility, while the attractiveness of the Destination is enhanced with its development. A virtuous circle is thus created: investment in the destination is enabled by improved accessibility and the subsequent increase in visitor demand. Demand growth will also be shaped by socio-economic factors (demographic trends, purchasing power, car availability per household, increased appetite for day trips and travel of the urban population).

ALOS for visitors increases as the destination becomes more accessible and benefits from a more diverse product offering.

Average expenditure in the destination increases as commercial activities and services are developed.

[19] *Detailed scenario description with recommendation on the marketing positioning and investment is undertaken in Chapter 10.*

11.4.1.2 *QUANTITATIVE FORECAST OF DOMESTIC VISITORS: BEST CASE SCENARIO*

Figure 26 presents the quantitative forecast of domestic visitors in the Best Case scenario.

FIGURE 26: FORECAST OF DOMESTIC VISITORS TO LAKE TOBA 2015-2041 (BEST CASE SCENARIO)

	2015	Projections			CAGR (%)		
		2021	2026	2041	2016-2021	2022-2026	2027-2041
Total domestic visitors	**1,743,500**	**2,041,950**	**2,498,160**	**3,083,420**	**2.7%**	**4.1%**	**1.4%**
Day visitors	483,000	568,200	771,500	902,000	2.7%	6.3%	1.0%
At friends and relatives	598,000	641,400	722,500	777,000	1.2%	2.4%	0.5%
In commercial accommodation	662,500	832,350	1,004,160	1,404,420	3.9%	3.8%	2.3%
From North Sumatera	596,250	745,600	895,800	1,221,100	3.8%	3.7%	2.1%
From other provinces	66,250	86,750	108,360	183,320	4.6%	4.5%	3.6%

Source: Horwath HTL

The reasoning for each market segment for 2021, 2026 and 2041 is presented below.

11.4.1.3 *DAY VISITORS*

2016 – 2021	CAGR of 2.7%; estimate based on same day trip market share capture methodology used in Business as Usual scenario, with same assumptions about evolution of population and socio-economic parameters. However, share of day trip market captured by Lake Toba increases slightly (from 10% to 10.5%) to take into account the effect of investments made to protect the environment and improve tourism amenities.
2022 – 2026	CAGR of 6.3%; estimate based on the same approach as for 2016 – 2021, with market share of Lake Toba rising further to 12.5% as road accessibility improves.
2027 – 2041	CAGR of 1.0%; estimate based on the same approach as for the previous period, assuming Lake Toba's market share remains unchanged at 12.5%, as most of the benefits from improvements in tourism amenities and road accessibility would have been reaped by this point.

11.4.1.4 *VISITORS STAYING WITH FRIENDS AND RELATIVES*

2016 – 2021	The ratio of incoming VFR trips per household in the Destination is estimated to increase by 2.5%, reflecting the effect investments made to protect the environment and improve tourism amenities. This implies a visitor CAGR of 1.2%, slightly above the population growth rate.
2022 – 2026	The ratio of incoming VFR trips per household in the Destination is assumed to increase a further 7.5%, due to the improved road accessibility, for a cumulative total increase of 10%. The implied visitor CAGR is 2.4%. ALOS will slightly decrease (5.6 to 5.3 nights) as the frequency of visits increases.
2027 – 2041	No further change in the ratio of VFR trips per household, as most benefits gained from improvements to the environment and road accessibility would have been reaped by this point. CAGR of visitors is therefore in line with the forecast of the annual growth of population in the Destination (CAGR 0.5%).

11.4.1.5 *DOMESTIC VISITORS STAYING IN COMMERCIAL ACCOMMODATION*

2016 – 2021	Visitors from Sumatera Utara: estimated based on recent 5-year growth trend (2010 – 2015, CAGR 3.5%), adjusted upwards (CAGR 3.8%) to take into account the effect of investments to protect the environment and improve tourism amenities. Domestic visitors from other provinces: come predominantly from Jakarta, and their potential for weekend trips to Lake Toba is expected to increase significantly as a result of the improved flight connectivity between Jakarta and Silangit Airport that facilitates weekend trips. The size of this market for domestic leisure travelers from Jakarta staying in commercial accommodation was 1.15 million trips in 2015, of which Lake Toba captured only 5.8%. By 2021, Lake Toba's market capture percentage is expected to increase to 6.5%, which implies a visitor CAGR of 4.6%. ALOS will increase slightly (from 1.5 days to 1.7) as visitors stay longer to engage in the increasing number of activities offered at the destination.
2022 – 2026	Visitors from Sumatera Utara: estimated based on the forecast of domestic visitor growth at the national level (CAGR 1.9%), adjusted upwards (to CAGR 3.7%) to take into account the improved attractiveness of the destination. For visitors from other provinces, same rationale as for 2016 – 2021, with a further increase in Lake Toba's market share of Jakarta's weekend domestic leisure traveler market to 7.5%, implying visitor CAGR is 4.5%. ALOS will increase further to 1.8 nights as additional activities are offered.

2027-2041	Visitors from Sumatera Utara: estimated based on the forecast of domestic visitor growth at the national level, adjusted upwards (to CAGR 2.1%) to take into account the improved attractiveness of the destination. For visitors from other provinces, same rationale as for 2016 – 2021, with a further increase in Lake Toba's market share of Jakarta's weekend domestic leisure traveler market to 10%, implying visitor CAGR is 3.6%. ALOS will increase further to 2 nights[20] as additional activities are offered.

11.4.1.6 *FORECAST OF FOREIGN VISITORS – BEST CASE SCENARIO*

Figure 27 presents the quantitative forecasts of foreign visitors in the Best Case scenario.

FIGURE 27: FORECAST OF FOREIGN VISITORS TO LAKE TOBA, 2015 – 2041 (BEST CASE SCENARIO)

		Projections			CAGR (%)		
	2015	2021	2026	2041	2016-2021	2022-2026	2027-2041
Total foreign visitors	**58,709**	**81,070**	**116,850**	**264,650**	**5.5%**	**7.6%**	**5.6%**
Overnight visitors	58,709	80,490	116,050	263,650	5.4%	7.6%	5.6%
Malaysia	29,340	41,320	56,800	127,300	5.9%	6.6%	5.5%
Singapore	6,057	7,670	23,150	93,650	4.0%	24.7%	9.8%
Other countries	23,312	31,500	36,100	42,700	5.1%	2.8%	1.1%
Cruise passengers	-	580	800	1,000	--	6.6%	1.5%

Source: Horwath HTL

The reasoning for each market segment for 2021, 2026 and 2041 is presented below.

11.4.1.7 *SINGAPORE AND MALAYSIA*

2016 – 2021	Estimated based on expected growth of Malaysian and Singaporean visitors at national level (CAGR 5.4% for Malaysia and 3.5% for Singapore), adjusted upwards (to CAGR 5.9% for Malaysia and CAGR 4% for Singapore) to take into account the increased relative appeal of Lake Toba due the effect of investments to protect the environment and improve tourism amenities. ALOS will not change compared to Business as Usual scenario (2.4 nights). [21]

[20] *This segment favors mostly weekend getaway, especially for short haul destinations such as Lake Toba, therefore the ALOS is unlikely exceed 2 nights.*

[21] *These visitors favor mostly weekend getaways, especially for short haul destinations such as Lake Toba; therefore, the ALOS cannot exceed 2.5 nights.*

2022 – 2026	For Malaysia, estimated based on visitor growth forecast at national level, adjusted upwards (from CAGR 4.6% to CAGR 6.6%) due to increased attractiveness and consequently higher market share of Lake Toba. For Singapore, the visitor number is increased by the same amount in absolute terms as for Malaysia (15,480 additional visitors), reflecting the similarity of the two outbound markets (despite different population size, they have a similar sized market with the propensity and income level to travel abroad) in terms of their proximity to Lake Toba and preference for short-haul weekend leisure trips. ALOS will remain unchanged (2.4 nights).
2027 – 2041	For Malaysia, estimated based on visitor growth at national level (adjusted upwards (CAGR 5.5%) due to increased attractiveness of Lake Toba. By 2041, Lake Toba's share of total Malaysian arrivals to Indonesia reaches 2.7% (compared to 2.1% in 2015). For Singapore, same reasoning as for 2022 – 2026 (70,500 additional visitors). By 2041, Lake Toba's share of total Singaporean visitors to Indonesia reaches 2.6% (compared to 0.4% in 2015).

11.4.1.8 *OTHER COUNTRIES (MOSTLY EUROPEAN)*

2016 – 2021	Estimated based on forecast European visitor growth at national level, adjusted upwards (from CAGR 3.8% to CAGR 5.1%) to take into account the effect of investments to protect the environment and improve tourism amenities.
2022 – 2026	Estimated based on forecast European visitor growth at national level (CAGR 1.8%), adjusted upwards (to CAGR 2.8%) to take into account increased attractiveness (and consequently higher share) of Lake Toba compared with other Indonesian destinations. ALOS will increase (1.5 to 1.8 nights) to take into account new packaged products.[22]
2027 – 2041	Estimated CAGR is equal to forecast European visitor growth at national level (1.1%), as Lake Toba's market share is not expected to improve further at this point.

Foreign Cruise Passengers

2016 – 2041	The estimate is based on the number of port calls already scheduled for 2017 and 2018 and the global trends for the Asian market. It is estimated that 5% of the total cruise passengers will make a day trip excursion to Lake Toba as of 2022 (when the new Medan-Parapat motorway is open).

[22] *Lake Toba will be increasingly included in multi-destinations stays in Indonesia, most likely as a 2-night stop on the itinerary.*

11.5 ECONOMIC IMPACT OF THE BEST CASE SCENARIO

In the Best Case scenario, Lake Toba will remain a predominantly domestic destination (92% of visitors) as shown in Figure 28 which summarizes the projected number of domestic and foreign visitors.

FIGURE 28: FORECAST OF VISITORS TO LAKE TOBA, 2015 – 2041 (BEST CASE SCENARIO)

	2015	Projections			CAGR (%)		
		2021	2026	2041	2016-2021	2022-2026	2027-2041
Domestic visitors	1,743,500	2,041,950	2,498,160	3,083,420	2.7%	4.1%	1.4%
Foreign visitors	58,709	81,070	116,850	264,650	5.5%	7.6%	5.6%
Total visitors	**1,802,209**	**2,123,020**	**2,615,010**	**3,348,070**	**2.8%**	**4.3%**	**1.7%**

Source: Horwath HTL

Figure 29 presents the projected number of guest nights of visitors to the Destination in the Best Case scenario (total visitors less day visitors). Guest nights are expected to reach 5.1 million in 2021, 5.9 million in 2026 and 7.7 million in 2041.[23]

FIGURE 29: FORECAST OF GUEST NIGHTS FROM VISITORS TO LAKE TOBA, 2015 – 2041 (BEST CASE SCENARIO)

	2015	*Projections*		
		2021	2026	2041
Total domestic visitors	**4,297,000**	**4,970,800**	**5,633,300**	**7,063,700**
Staying at friends and relatives	3,324,900	3,566,200	3,825,800	4,114,400
In commercial acccommodation	972,100	1,404,600	1,807,500	2,949,300
Total foreign visitors	**120,700**	**165,900**	**258,500**	**611,600**
Malaysia	71,000	100,000	137,500	308,100
Singapore	14,700	18,600	56,000	226,600
Other countries	35,000	47,300	65,000	76,900
Total visitors	**4,417,700**	**5,136,700**	**5,891,800**	**7,675,300**

Source: Horwath HTL

Comparatively, in the Business as Usual scenario, the projected number of guest nights in accommodations in Lake Toba is projected to reach 4.8 million in 2021, 5.1 million in 2026 and 5.5 million in 2041.

[23] *The number of guest nights has been calculated on the basis of the following lengths of stay:*
- *For domestic visitors in non-commercial accommodation: 5,6 nights in 2015 (source Domestic survey) and 5.3 nights for 2026 and 2041*
- *For domestic visitors in commercial accommodation: 1.5 nights in 2015 (source Accommodation survey), rising to 2.1 nights in 2041*
- *For foreign visitors in commercial accommodation: 2.1 nights in 2015 (source Accommodation survey) rising to 2.3 in 2041*

The average expenditure of the visitors depends on their origin and the type of accommodation used. Calculations are based on projected daily expenditure in real terms (constant 2015 USD). Average daily expenditure will increase from USD 12.60 in 2015 to USD 23.40 in 2041 for domestic visitors and from USD 124.30 to USD 142.90 for foreign visitors, due to the additional spend on leisure activities developed over time in Lake Toba and the change in the structure of visitors.

FIGURE 30: FORECAST OF AVERAGE EXPENDITURE PER DAY (IN USD) FROM VISITORS TO LAKE TOBA, 2015 – 2041 (BEST CASE SCENARIO)

		Projections		
	2015	**2021**	**2026**	**2041**
Total domestic visitors	**12.6**	**15.5**	**21.6**	**23.4**
Day visitors/at friends and relatives	10.0	12.3	17.2	18.4
In commercial acccommodation	16.4	18.6	23.6	24.8
Total foreign visitors	**124.3**	**134.7**	**137.2**	**142.9**
Overnight visitors	123.9	134.4	136.8	142.9
Malaysia	133.2	142.9	142.9	142.9
Singapore	142.0	154.6	154.6	154.6
Other countries	97.5	108.4	108.4	108.4
Cruise ship visitors		75.5	75.5	75.5
Total visitors	**15.6**	**19.3**	**26.7**	**32.9**

Source: Horwath HTL

As presented in Figure 31, in the Best Case scenario, total domestic and foreign visitors are expected to spend a total of USD 252.8 million in 2041 (USD 99.2 million in 2021 and USD 157.2 million in 2026), which is 3.7 times the current expenditure of visitors.

FIGURE 31: FORECAST OF ANNUAL EXPENDITURE (IN THOUSAND USD) FROM VISITORS TO LAKE TOBA 2015-2041 (BEST CASE SCENARIO)

	2015	Projections		
		2021	2026	2041
Total domestic expenditure	**54,000**	**76,900**	**121,700**	**165,400**
Day visitors	4,800	7,000	13,300	16,600
Staying at friends and relatives	33,300	43,700	65,800	75,700
At commercial acccommodation	15,900	26,200	42,600	73,100
Total foreign expenditure	**15,000**	**22,340**	**35,460**	**87,380**
Overnight visitors	15,000	22,300	35,400	87,300
Malaysia	9,500	14,300	19,700	44,000
Singapore	2,100	2,900	8,700	35,000
Other countries	3,400	5,100	7,000	8,300
Cruise ship visitors	-	40	60	80
Total expenditure	**69,000**	**99,240**	**157,160**	**252,780**

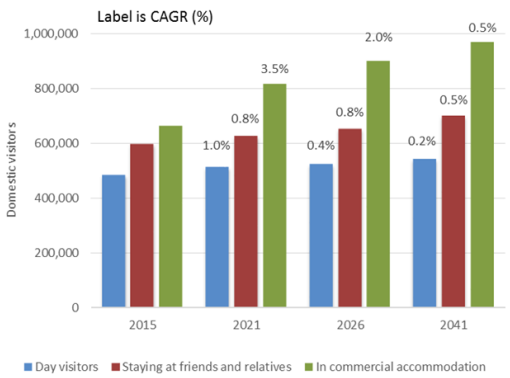
Source: Horwath HTL

Comparatively, in the Business as Usual scenario, the total expenditure by visitors is only USD 90.3 million in 2041 (USD 79.6 million in 2021 and USD 85.7 million in 2026).

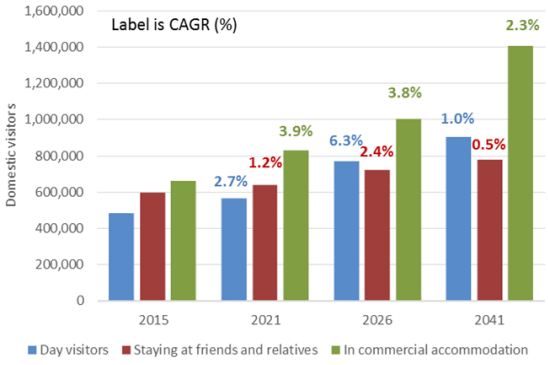
11.6 SUMMARY OF CONCLUSIONS IN CHARTS

FORECAST OF DOMESTIC VISITORS TO LAKE TOBA, 2021-2041

BUSINESS AS USUAL SCENARIO

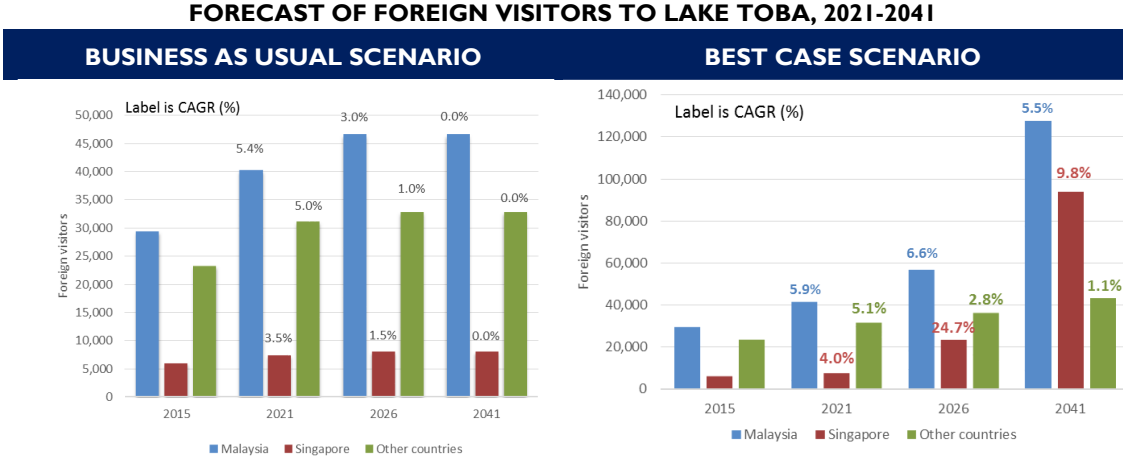


BEST CASE SCENARIO



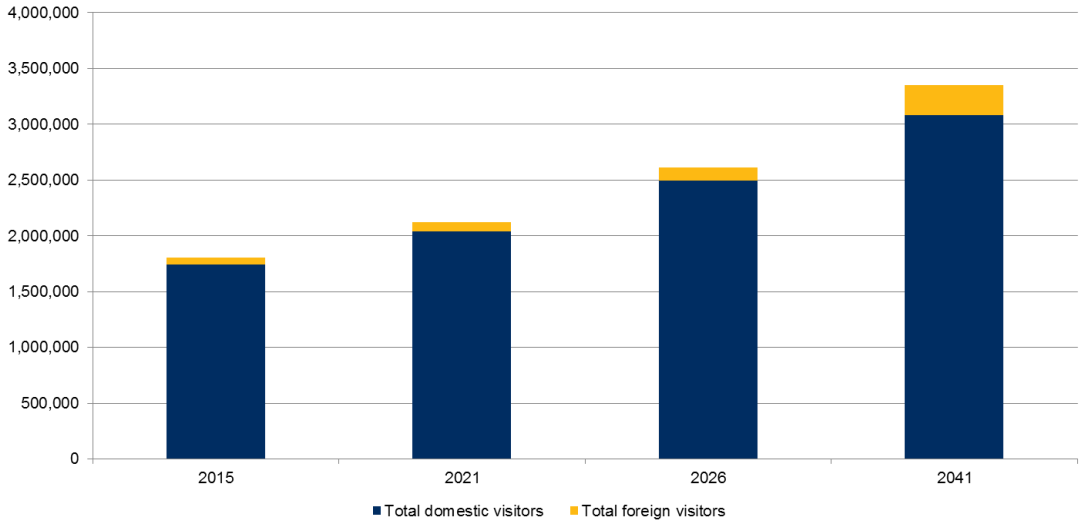
Source: Horwath HTL

FORECAST OF FOREIGN VISITORS TO LAKE TOBA, 2021-2041



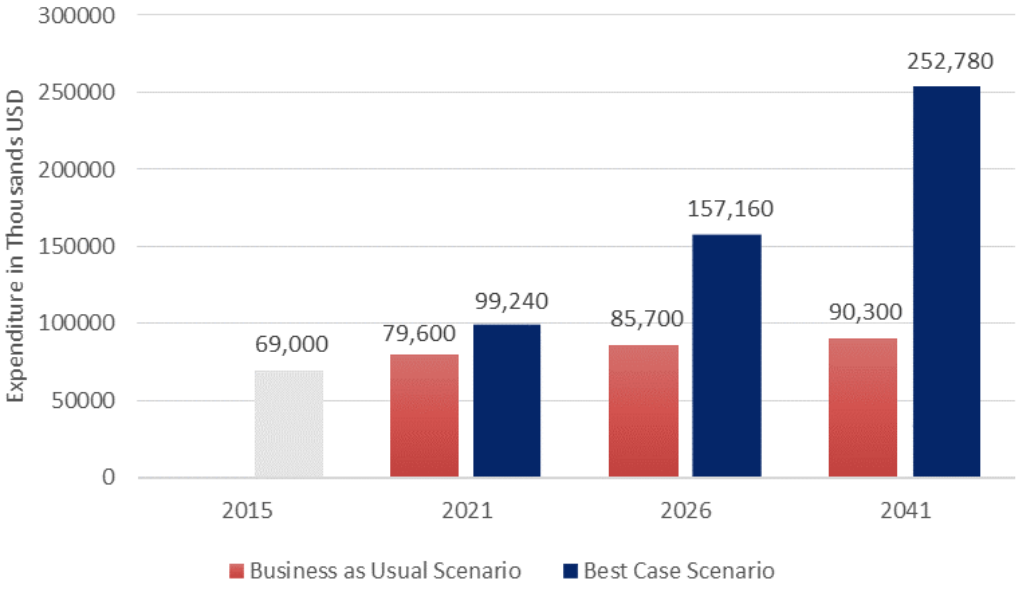
Source: Horwath HTL

BEST CASE SCENARIO: TOTAL VISITORS



Source: Horwath HTL

FORECAST OF ANNUAL VISITOR EXPENDITURE IN LAKE TOBA 2015 – 2041 (CONSTANT USD THOUSANDS, BASE 2015)



Source: Horwath HTL

INVESTMENT NEEDS

12. AMENITIES: KEY RECOMMENDATION

12.1 HOTELS & LODGING OPTIONS

As per the Destination vision, the area must preserve its "natural-quiet-authentic" reputation while developing a new "playful-dynamic-leisure based" reputation. It is to become a world-class environmentally sustainable destination focusing on its volcanic heritage combined with Batak culture, creating a niche mountain / lakeside retreat. To foster the retreat character, Lake Toba offers a variety of accommodations, easily accessible from Medan. It offers land and lake based activities for the whole family to enjoy the unique combination of nature and culture.

The following developments in the 3 key kabupaten are believed in line with this vision.

12.1.1 PARAPAT (KAB. SIMALUNGAN, KEC. GIRSANG SIPANGAN BOLON)

Parapat is and remains the hub and tourism center, preserving Samosir Island as a more niche eco-tourism location, as shown in Figure 32.

FIGURE 32: LOCATION OF TOURISM DEVELOPMENT IN LAKE TOBA (OPTION 1)

Source: Horwath HTL

Development of tourism infrastructure in Parapat should be planned with the objective of focusing tourism activities and creating as much as possible, a pleasant, walkable urban atmosphere (favorable for the development of dining and shopping options).

Potential private investment opportunities within Parapat include:

- A marina with hotel and real estate;
- A ferry terminal for cruise boats around the lake;
- A conference and associated recreational facilities, hotel and real estate;
- Well managed homestays as support for the entry towns of Balige and Parapat;
- International and locally branded, professionally managed hotels with meetings facilities. Currently, there are no branded hotels around Lake Toba as well-known hotel brands could increase the awareness / attractiveness of a destination;
- Cliff top high-end properties with sweeping views of the lake and with low guestroom inventory (50 – 90), which would be well placed for their location and views to attract higher paying guests; and,
- Lakeview dining facilities In Parapat town that would create a vibrant "urban" atmosphere (today mostly confined to hotels).

Lake Toba Tourism Area (LTTA): The Government of Indonesia has identified a 600-hectare site on the lakeside in Kab. Toba Samosir, 10 kilometers south of Parapat and plans several luxury hotels, a convention center and golf course. The LTTA will have a more secluded resort feel, with real-estate development potential (secondary-residences for upper middle-class Medan and Jakarta residents). This project could absorb some of the forecast new room nights although the proposed scale is believed optimistic.

More information on the LTTA is provided in Appendix II, the site location is shown in Figure 33.

FIGURE 33: LTTA 600-HECTARE DEVELOPMENT, KAB. TOBA SAMOSIR

Source: Ministry of Tourism, Note: Development area marked by red border

12.1.2 SAMOSIR ISLAND (KAB. SAMOSIR, KEC. SIMANINDO & PANURURAN)

Urban development on Samosir Island should be regulated and restricted, considering its configuration, remoteness and natural/cultural assets. Samosir Island is inappropriate for mass tourism. Opportunities for private investment on Samosir Island could include accommodation and facilities supported by the different markets presented in the previous section:

- High-end eco-lodges and homestays;
- Lakeview dining facilities in Tuktuk, to create a vibrant "urban" atmosphere (today mostly confined to hotels);
- Water-based activities;
- Hiking and cycling itineraries;
- Better managed museums (perhaps a large centralized museum) on the culture of the Batak tribe as well as geological and ecological resources of the lake and its volcano;
- The geo-thermal features of Lake Toba should be harnessed to provide spa resorts, however, there are slight accessibility issues as current hot springs are located on the west side of the island as opposed to Tuk Tuk, a journey of more than an hour; and,
- Local cultural events, such as the Harvest Festival, could be developed and promoted to increase visitation during less frequented periods.

12.1.3 BALIGE (KAB. TOBA SAMOSIR, KEC. BALIGE)

The city of Balige will continue to develop as a secondary key tourism area, relying on the presence of Silangit Airport and the port serving Samosir Island. Well managed homestays and non-star-rated hotels are likely to prevail given the forecast mid-tier domestic demographic.

This development scenario is considered relatively balanced as it allows the concentration of development in the 3 key tourism areas, hence controlling costs for the development of supporting infrastructure, but at the same time maximizing the dissemination of economic spillover across the destination boundary.

12.2 FORECASTING FUTURE LODGING SUPPLY NEEDS

The assessment of the number of rooms required has taken into account the present situation (5,590 rooms available), the leisure and MICE facilities planned and the forecast of future demand, and the fact that visitor arrivals are expected to be concentrated on week-ends and holiday periods.

Under the Business as Usual scenario, the existing capacity of 5,590 rooms is sufficient to satisfy any additional demand until 2021.

The situation is different in the Best Case scenario, as shown in Figure 34:

- The existing capacity is also sufficient to satisfy demand until 2021;
- In 2026, 6,900 rooms (1,310 additional rooms) are required to satisfy the demand during week-ends (with an average occupancy rate of 43%[24]); and
- In 2041, a total of 10,600 rooms will be required, i.e. 5,010 additional rooms compared with the situation in 2015 (with an annual occupancy rate of 48%).

FIGURE 34: FORECAST OF REQUIRED ACCOMMODATION IN LAKE TOBA (NUMBER OF ROOMS) 2021 – 2041

	Baseline	Best Case scenario		
	2015	2021	2026	2041
Arrivals	721,209	913,420	1,121,010	1,669,070
Room nights	571,300	821,200	1,079,300	1,856,000
Occupancy rate	28%	39%	43%	48%
Total Rooms Required	5,590	5,770	6,900	10,600
Available rooms	5,590	5,590	5,590	5,590
Registered rooms	3,391			
Non registered rooms	2,199			
Additional Rooms Required	-	180	1,310	5,010

Source: Horwath HTL

12.3 SUPPORTING TOURISM INFRASTRUCTURE (AMENITIES)

Based on the demand forecasts and Destination vision, the following section outlines the types and scale of supporting tourism infrastructure / activities that would complement the development of the Destination. These activities would require public investment in basic infrastructure and the tourism amenities could by developed using private investment, a significant proportion of which could be owned and operated by SMEs.

12.3.1 WATER LEISURE ACTIVITIES

There are opportunities to develop nautical-based activities based on likely future demand.

YACHTING, SAILING AND POWER BOATS

Yachting could become a leisure activity on Lake Toba and contribute to its identity, especially since there are no other sites in Indonesia for lake yachting.

DAY TRIPS & PASSENGER BOAT CRUISES

[24] In 2015 the market-wide occupancy was a low 28%. We have assumed that this will increase as the Destination develops and mid-week demand increases. It is not expected to be higher than that forecast as it includes all accommodation types, star and non-star-rated hotels, independent and brand affiliated some of which perform poorly due to management, location etc.

Boat trips around Lake Toba are another potential leisure activity, which could be undertaken by both visitors and day trippers. We propose that the service be extended to different types of packages, for example 2 hour day cruises, dinner cruises and hop on-hop off cruises to various points around Samosir Island.

This requires the acquisition by private operators of appropriate boats (with a capacity of 50 to 200 passengers) and probably the construction of reception facilities in Parapat, Tuktuk and Balige.

WATER SPORTS

Facilities for water sports could be developed to cater to the needs of families and adrenalin-seeking visitors.

12.3.2 CYCLING & HIKING

Samosir Island is likely to become a popular place for walking and hiking:

- The banks of the lake and especially the circular road along Tele – Pangururan – Ambarita – Tomok within the Samosir Island need to be equipped with proper sidewalks and bicycle paths;
- Existing hiking trails will need to be redeveloped and marked plus new paths should be created on Samosir Island offering panoramic views of the lake;
- The use of non-motorized transportation modes should be promoted particularly on Samosir Island; and
- Hotels and homestays should offer bicycle rental and trail maps. This would require public investments on sidewalks, bicycle paths and trails.

12.3.3 MEETING & CONFERENCE FACILITIES

The development of a conference facilities, independent or within hotels should be encouraged. Ideally this would be located in Parapat or in the BOP, given the central location and ease of access from Medan where the majority of MICE demand is expected to originate. Once conference facilities have developed, there might be opportunities to develop related recreational facilities such as golf.

13. STAFF REQUIRED & SKILLS NEEDED

13.1 ACCOMMODATION STAFF REQUIRED

Figure 34 highlights the number of additional rooms required in Lake Toba to meet the forecast tourism demand. Based on these additional rooms, Figure 35 provides an estimate of the number of staff required at entry, supervisor and management levels by assumed hotel positioning. The hotel positioning is split into 5 categories based on actual achieved daily rates in 2015 across the country, and not specifically in Lake Toba, where insufficient information is available from which to draw staffing ratio conclusions.

Additional assumptions:

- % Total Rooms: the percentage of total rooms per rate category. For example, if the figure is 0.42 this means that 42% of total rooms are within this rate category. The estimates are based on the data collected in the Horwath HTL Indonesia Hotel Industry Survey of Operations 2016;
- Staff / Room Ratio: staffing levels or full time equivalents (FTE) per room. For example, if the figure is 0.53 this means, that 0.53 FTE are required per room. The estimates are based on the data collected in the Horwath HTL Indonesia Hotel Industry Survey of Operations 2016; and
- The staffing level split or proportion of total staff within each of entry level, supervisor and management level are based on estimates from market research:
  - Under USD40 (achieved average daily rate, 2015) is 10% management and 90% entry level. It is assumed this category includes homestays, smaller properties, family owned and less professionally managed properties. These are assumed to have a slightly different staff split between management (who are often owner relatives) and entry level, no supervisor level; and,
  - Over USD40 (achieved average daily rate, 2015) is 5% management, 10% supervisor and 85% entry level. These categories are assumed to include a higher proportion of star-rated hotels, greater professionalism, larger properties and are assumed to include 3 levels of staffing; entry level, supervisor and management levels.

FIGURE 35: ESTIMATED NUMBER OF STAFF BY HOTEL CATEGORY

	< USD 40	USD 40 - 80	USD 80 - 120	USD 120 - 240	> USD 240	Total
Staff / Room Ratio	0.53	0.83	1.15	1.56	2.70	
% Total Rooms	0.42	0.31	0.11	0.13	0.03	
Additional Rooms:						
Existing						5,590
2026	554	407	146	167	37	1,310
2041	1,564	1,151	411	471	103	3,700
Total						10,600
Additional Staff:						
2026	**294**	**338**	**168**	**260**	**99**	**1,159**
Entry Level	265	287	143	221	84	1,000
Supervisor	-	34	17	26	10	87
Management	29	17	8	13	5	73
2041	**831**	**956**	**473**	**735**	**279**	**3,274**
Entry Level	748	813	402	625	237	2,824
Supervisor	-	96	47	74	28	244
Management	83	48	24	37	14	205

Source: Horwath HTL

By 2026, it is forecast that an additional 1,159 staff will be required to meet the needs of the additional rooms projected. Between 2026 and 2041 a further 3,274 staff will be required.

Given that this volume is not considerable, additional efforts could be placed into upskilling and improving the quality of staff.

13.2 ADDITIONAL STAFF REQUIRED

In addition to the forecast increase in arrivals, the recommended additional services and augmentation of the experience are expected to have a positive net effect on employment surrounding Lake Toba. Based on the following projections we can make estimates on how many additional staff will be required:

- Foreign arrivals are projected to increase 4-fold;
- Domestic day trippers and visitors staying with friends are expected to double; and
- Domestic visitors' staying overnight is expected to increase by 2.5 times.

13.2.1 FOOD & BEVERAGE

As indicated above, there is very little information about licensed food & beverage outlets around Lake Toba. In 2015, there were 91 and 48 'food & beverage' outlets in Kab. Toba Samosir and Kab. Samosir respectively. Figure 36 provides estimates of the additional food and beverage staff required for the forecast arrivals increase.

FIGURE 36: ADDITIONAL F&B STAFF

		2015	2021	2026	2041
Foreign Visitors					
	Per annum	58,709	81,070	116,850	264,650
	Per day total	161	222	320	725
Domestic Visitors					
	Day trippers	483,000	568,200	771,500	902,000
	Visiting F&F	598,000	641,400	722,500	777,000
	Overnight	662,500	832,350	1,004,160	1,404,420
Weekly					
	Day trippers	9,288	10,927	14,837	17,346
	Visiting F&F	11,500	12,335	13,894	14,942
	Overnight	12,740	16,007	19,311	27,008
Peak Days	(Sat & Sun)				
	Day trippers	2,064	2,428	3,297	3,855
	Visiting F&F	2,530	2,714	3,057	3,287
	Overnight	2,803	3,522	4,248	5,942
Per day total		7,397	8,663	10,602	13,084
Peak Seats*					
	Restaurant	3,859	4,554	5,621	7,267
	Warung	3,698	4,332	5,301	6,542
No. Outlets**					
	Restaurant	77	91	112	145
	Warung	370	433	530	654
Total Staff***					
	Restaurant	1,930	2,277	2,811	3,633
	Warung	1,849	2,166	2,651	3,271
Restaurant#					
	Entry Level	1,641	1,935	2,389	3,088
	Supervisor	193	228	281	363
	Managers	97	114	141	182
Warung##					
	Entry Level	1,757	2,058	2,518	3,107
	Managers	92	108	133	164

		2015	2021	2026	2041
Total Staff		**3,779**	**4,443**	**5,462**	**6,904**
	Entry Level	**3,398**	**3,993**	**4,907**	**6,195**
	Supervisor	**193**	**228**	**281**	**363**
	Managers	**189**	**222**	**274**	**346**

*Source: Horwath HTL. Assumptions * Assuming domestic daily visitors eat 50:50 restaurant & warung, foreign eat 100% restaurant ** Restaurants have an average of 50 seats, warung an average of 10 seats *** Restaurants have an average of 25 staff / outlet, warung an average of 5 / outlet. # Restaurant: entry level = 85%, supervisor = 10%, managers = 5%. ## Warung: entry level 95%, managers 5%*

13.2.2 OTHER TOURISM SERVICES

- Tour Guides: that can bring the cultural and maritime experience to life for visitors to Lake Toba. If foreigners engage a tour guide every second day they spend in Lake Toba in groups of 2, there could be an additional 150 jobs by 2041. Assuming 25% of overnight domestic guests engage a tour guide, in groups of 4, on peak days an additional 330+ guides will be needed by 2041.
- Boat Transport (ferries, cruises): we understand there are currently 33 operators of car-passenger ferry and passenger boat services between the mainland and Samosir Island. This number of operators seems adequate but they will require additional staff to cater to the anticipated additional visitors', perhaps an additional 1,000+ jobs (33 operators x 30 staff).
- Museum / cultural sites: the development or nurturing of traditional Batak crafts and skills is a key component of the entire experience. The number of cultural positions is perhaps around 200 additional jobs (4 sites x 50 people).
- Golf Course: should the recommended golf course be developed this will require around 170 staff including club house (100 seats, 50 staff), grounds (20 staff), caddies (40 staff), miscellaneous (including security, parking, retail etc., 50 staff) and management (10 staff).
- Marina: the marina is expected to require around 100 staff including club house (100 seats, 50 staff), operations (40 staff) and management (10 staff).
- Retail: as an extension to the experience, tourism souvenirs if produced and marketed correctly could also employ a large number of local people. If an additional 100 retail stores open to cater for the doubling of arrivals, this will employ an additional 500+people.
- Travel Agencies / Tour Operators: we are not aware of the number of active travel agencies around Lake Toba however the majority of agents selling tours to Lake Toba are located in Medan. In any case, the number is likely to increase with the influx of additional arrivals and more complex tourism offerings. However, given that Medan is the gateway the majority will remain in Medan. The impact on employment around Lake Toba is estimated to be around 100 additional travel agents to coordinate ground services.
- Other small business opportunities for increased employment include:
  - Private speedboats: the local community will benefit from increasing 'taxi' services between Parapat and hotel jetties on Samosir Island. The regulations must be enforced re licensing, safety and the environment however there are opportunities for increased employment.
  - Bicycle and motorcycle rentals.
  - Hot springs on Samosir Island.

The total additional staffs required in the surrounding villages are estimated to be between 1,500 and 2,000 people.

13.3 CONCLUSIONS ON STAFF

In the Best Case scenario as described, the forecast volume of additional staff is around 4,500 hotel staff, 7,000 food & beverage staff and 2,000 staff providing other tourism services.

14. TRANSPORT INFRASTRUCTURE BASELINE & NEEDS

BASELINE

14.1 ROAD TRANSPORT

14.1.1 EXISTING CONDITIONS

The existing network of roads in Sumatera Utara includes national, provincial and kabupaten/kota level roads. The total road length is 39,085 km. The road network for Sumatera Utara is shown in Figure 37. 85% of national roads are in normal (good and sufficient) condition; however, 24% of the provincial roads are damaged (bad and very bad) roads. The rate of pavement is 96% for the national road, 86% for the provincial road, and 68% for kabupaten/kota roads.

FIGURE 37: ROAD CLASS AND CONDITION IN SUMATERA UTARA IN 2015

	National		Provincial		Kab./Kota	
Road Condition (km)	Length	%	Length	%	Length	%
Good (IRI <= 4)	572.08	22%	1,236.23	41%	12,343	37%
Sufficient (4<IRI <8)	1,665.71	63%	1,083.97	36%	6,994	21%
Bad (8<IRI<=12)	202	8%	259.72	9%	7,409	22%
Very Bad (IRI >12)	192.44	7%	468.581	15%	6,660	20%
Total	**2,632.23**		**3048.5**		**33,405**	
Road Surface (km)						
Pavement	2,530.33	96%	2,633.46	86	22,556.18	68%
Non Pavement	101.9	4%	415.4	14	10,849.96	32%
Total	**2,632.23**		**3048.5**		**33,405**	

IRI: International Roughness Index

Source: Department of Public Works Sumatera Utara

14.1.2 EXTERNAL ACCESS ROADS

External road access from and to Lake Toba is dominated by two main external access roads (Figure 38).

Roads connecting Medan with Lake Toba includes the 178 km national road between Medan and Parapat via Tebing Tinggi and Pematang Siantar. The road is well paved, and the section between Pematang Siantar and Parapat partly runs through oil palm plantations, but it rises to an elevation of about 1,000 meters; the road width is about 5.9 meters which is slightly narrower compared to the Bina Marga standard. The Bina Marga standard specifies the need for 7-metre-wide roads with an additional 2 meter shoulder on each side.

The second important road corridor is the 77 km national road between Siborong-borong and Parapat. Currently, this corridor is important to support domestic visitors arriving at Silangit Airport and going to Parapat. The road is well paved.

Other alternative roads from Medan to Lake Toba include the 78 km national road between Medan and Kabanjahe; and the 105 km national road between Kabanjahe, Saribudolok and Pematang Siantar. The elevation gradually increases in the section between Medan and Karo (elevation 1,400 meters). The slope gets steeper from Sibolangit, and the roads get narrower with poor alignment. Kab. Karo produces vegetables, fruits and flowers, which are exported to Singapore and Malaysia through the Belawan Port. These agricultural products are shipped on trucks at night, thus making it an industrial route instead.

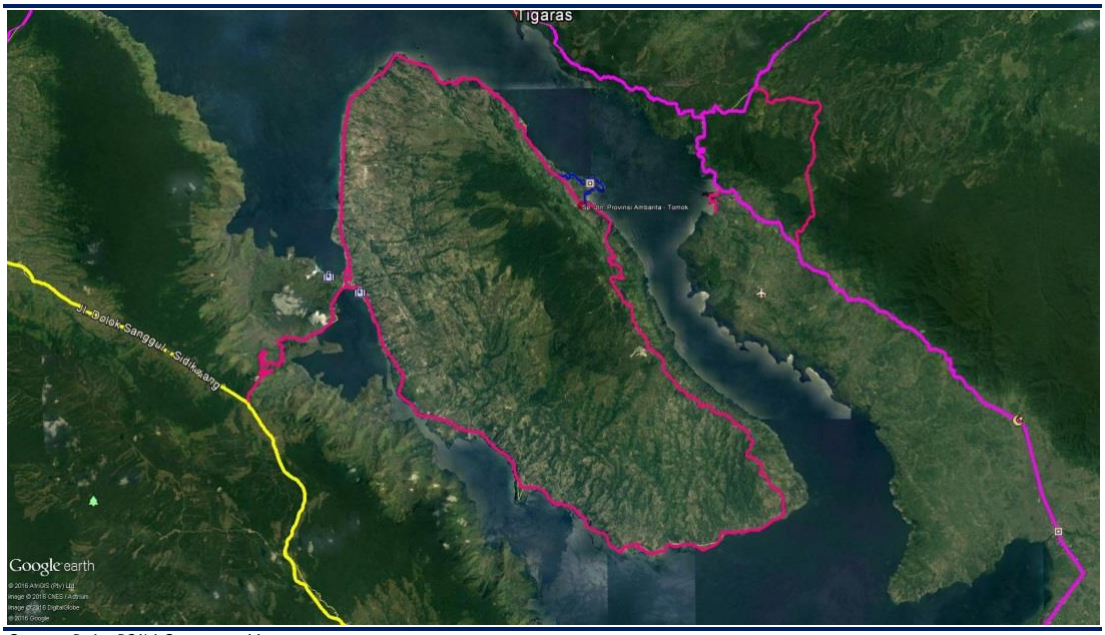
FIGURE 38: ROAD ACCESS TO LAKE TOBA FROM MEDAN AND SILANGIT

Source: Balai P2JN Sumatera Utara

14.1.3 INTERNAL ACCESS ROAD

There are national roads currently being upgraded to Bina Marga standard on Samosir Island. The road network is shown in Figure 39, which indicates 145.9 km of national roads. National roads are in good and sufficient condition; however, 18% of the roads are damaged (bad and very bad) roads.

FIGURE 39: SAMOSIR ISLAND INNER RING ROAD



Source: Balai P2JN Sumatera Utara

Regarding the road conditions around the key points of interest on Samosir Island, the Tuktuk outer ring-road has been constructed under the supervision of the Kab. Samosir. The road is narrow (4-5 meters) although mostly paved. The roads to the tourism attractions south of Parapat are in good condition.

Figure 40 provides a summary of road conditions of the national roads within the key tourism areas in Lake Toba.

FIGURE 40: INTERNAL ACCESS ROAD CONDITION – NATIONAL ROADS

No	Road Section	Status	Width (m)	Length (Km)	IRI <=4	<IRI<=8	<IRI<=12	IRI >12
					Good	Sufficient	Bad	Very Bad
093	Tomok – Ambarita	National	4.5	5.30	0.30	3.90	0.90	0.20
094	Ambarita – Simanindo	National	4.5	18.30	4.10	12.30	1.60	0.30
095	Simanindo - Pangururan	National	4.5	19.30	0.40	15.70	2.30	0.90
096	Pangururan - Nainggolan	National	4.5	40.00	2.70	33.60	3.20	0.50
098	Tele – Pangururan	National	4.5	22.00	0.40	13.60	5.50	2.50
100	Nainggolan – Onan Runggu	National	4.5	7.00	0.10	4.90	0.00	2.00
101	Onan Runggu - Tomok	National	4.5	34.00	7.90	19.50	1.50	5.10
092	Tomok – Ambarita	National	5.5	2.80	0.10	1.60	0.90	0.20

Source: Department of Public Works Simalungun, Toba Samosir, Samosir Island

Figure 41 provides a summary of the kabupaten roads within the key tourism areas in Lake Toba. The details of road conditions for the kabupaten level roads are unavailable.

FIGURE 41: INTERNAL ACCESS ROADS– KAB. ROADS

No	Road Section	Status	Width (m)	Length (Km)
7	Jalan Lingkar Tuktuk	Kab.	4.0	9.00
8	Tomok - Lontung - Silima Lombu	Kab.	4.0	11.00
1606A	Jalan Pelabuhan Tigaraja, Parapat	Kab.	5.0	0.15
1607	Jalan Josep Sinaga, Parapat	Kab.	5.0	1.45
1623	Jalan Terminal Sosor Saba, Parapat	Kab.	3.5	0.36
013	Balige –Tarabunga, Balige	Kab.	4.0	12
104	Lumban bulbul, Balige	Kab.	4.0	5.6
164	Dalam Kota, Ajibata	Kab.	5.5	1,8
171	Sialalahi Dolok	Kab.	4.5	2.1

Source: Department of Public Works Simalungun, Toba Samosir, Samosir Island

14.1.4 REGISTERED VEHICLES

The number of vehicles registered in Sumatera Utara was 5.8 million in 2015. Classified by the type of vehicle, about 85% of the total number are motorcycles. The yearly changes as presented in Figure 42 indicate a rising trend in vehicle registration, which implies that the traffic volume will increase further in the future in Sumatera Utara.

FIGURE 42: NUMBER OF REGISTERED VEHICLES IN 2015 IN SUMATERA UTARA

Year	Car	Bus	Truck	Motorcycle	Total	Growth
2011	356,931	71,112	217,254	3,924,007	4,569,304	
2012	386,144	71,590	231,750	4,292,933	4,982,417	9.04%
2013	416,405	71,900	242,445	4,584,431	5,315,181	6.68%
2014	441,191	71,087	249,919	4,795,755	5,557,952	4.57%
2015	470,280	72,137	258,060	5,022,752	5,823,229	4.77%

Source: Traffic Police Department Sumatera Utara

14.1.5 VEHICLE OWNERSHIP

As shown in Figure 43, the motorization rate of cars is still low at the level of 33 vehicles per 1,000 persons. However, the motorization rate of motorcycles is considerably higher; 360 vehicles per 1,000 persons.

FIGURE 43: RATE OF MOTORIZATION IN SUMATERA UTARA

Year	Number of vehicles per 1,000 persons in Sumatera Utara			
	Car	Bus	Truck	Motorcycle
2011	27.2	5.4	16.6	299.5
2012	29.2	5.4	17.5	324.8
2013	31.2	5.4	18.2	344.0
2014	32.0	5.2	18.2	348.4
2015	33.7	5.2	18.5	360.4

Source: BPS Sumatera Utara for population in 2015 and Sumatera Utara Traffic Police for vehicle registration in 2015

The rate of motorization will increase as per socio-economic growth, which will have an added impact on the road capacity.

14.1.6 TRAFFIC VOLUME

Within the destination boundary including key access routes to the Destination, the largest traffic volume is observed in the section between Medan and Tebing Tinggi. The average daily traffic volume is recorded as 75,129 vehicles for road section BTS Kota Medan - BTS Kota Lubuk Pakam. The other important road section running between Tebing Tinggi and Pematang Siantar recorded vehicles per day of 26,386 for the road segment BTS Kota Tebing Tinggi - BTS Kab. Sima. The trunk road section between Pematang Siantar and Parapat recorded traffic volume of 7,213 vehicles per day. The details of road traffic volume on roads supporting the Destination are presented by road segments in Appendix III. The congestion analysis is conducted based on vehicle over capacity analysis in the following section for the key road corridors.

14.1.7 ASSESSMENT OF EXISTING ROAD INFRASTRUCTURE

The connectivity between Medan and Parapat via Tebing Tinggi and Pematang Siantar are the major roads providing access to Lake Toba. Appendix III shows the detailed calculation of existing road capacity based on the Indonesia Highway Capacity Manual and IRMS database. Figure 44 shows the summary of the traffic volumes on the key roads, existing road conditions and the adequacy of existing road infrastructure.

FIGURE 44: EXISTING ASSESSMENT OF KEY ROADS

Section	AADT*	PCU**	VCR	Existing Assessment
Medan to Tebing Tinggi (83 km) Travel Time: 2 hours 20 min	61,830	98,290	2.3	8.7 m wide, sufficiently paved, combination dual 2 and 1, current capacity inadequate.
Tebing Tinggi to Pematang Siantar (52 km) Travel Time: 1 hour 40 min	31,864	47,314	1.7	5.9m wide, sufficiently paved, dual 1, Serdang Bedagai to Pematang Siantar current capacity inadequate.
Pematang Siantar to Parapat (43 km) Travel Time: 1 hour 10 min	7,213	10,120	0.4	7 m wide, sufficiently paved, dual 1, current capacity adequate.
Parapat to Balige (60km) Travel Time: 1 hour 30 min	7,498	10,427	0.6	5.6 m wide, sufficiently paved, sections to Ajibata needs to be improved in terms of pavement conditions.
Balige to Siborong Borong (19.6km) Travel Time: 1 hour	8,121	9,883	0.5	6.3 m wide, sufficiently paved, current capacity adequate.
Toba – Berastagi – Medan via Tigaras (147km) Travel Time: 6 hours	19,159	26,101	1.1	7 m wide, sufficiently paved, combination dual 2 and 1, Kaban Jahe and Deli Serdang section current capacity inadequate. Kaben Jahe road segment passes through the city center.

**AADT - Annual Average Daily Traffic; ** Passenger Car Unit (PCU) Source: Indonesia Road Management System Database, Department of Public Works, Sumatera Utara 2016, Surbana Jurong*

Note: The AADT is average of the road segment for the respective road corridor.

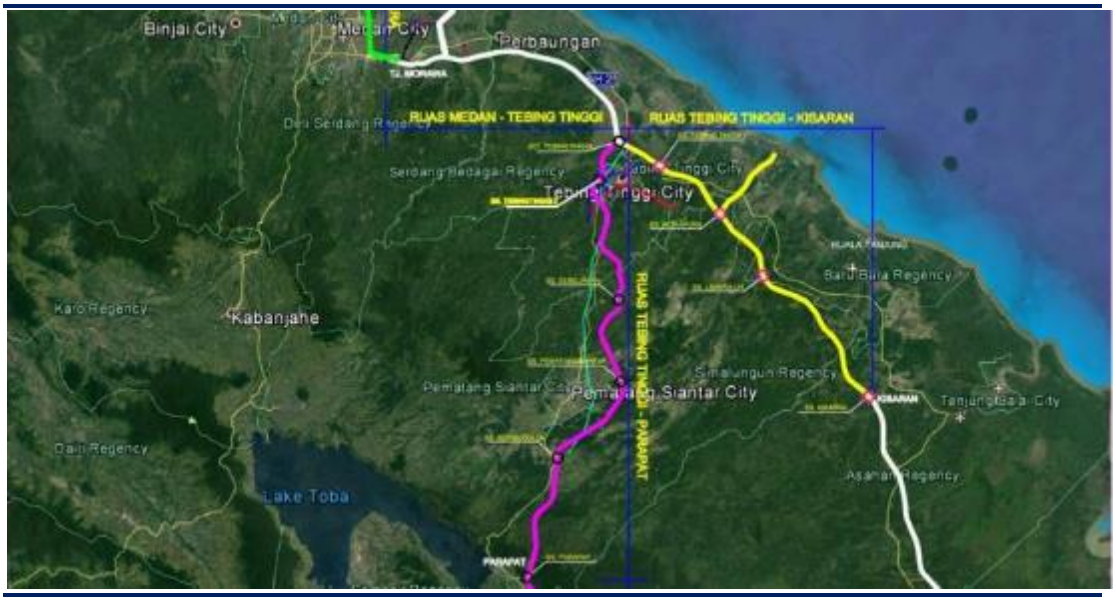
14.1.8 FUTURE PLANS FOR ROAD INFRASTRUCTURE

The current government plans include a proposal for a 124 km toll road linking Medan, Tebing Tinggi and Parapat with 4-lane highway standards. The travel time from Medan to Parapat (more than 5 hours) is expected to reduce to around 2 hours. The toll road proposal connecting Medan to Parapat would increase capacity with about 9,200 vehicles per hour.

Other government plans include Berastagi road upgrading, road improvements within the Destination area including roads around Lake Toba, and the Samosir Island ring road. Almost all roads are proposed to be upgraded and widened to national road standards.

Once the toll road is operational, the traffic conditions are expected to ease along the Medan – Tebing Tinggi segment. The need for upgrading from tourism perspective will be assessed based on future tourism demand.

FIGURE 45: TEBING TINGGI – PARAPAT TOLL ROAD PROPOSAL



Proposed Toll Road	Travel Time	Plan Status
Medan – Tebing Tinggi (61.7 km)	50 min	Committed to operate in 2019
Tebing Tinggi – Pematang Siantar (35 km)	30 min	Feasibility Study, scheduled construction in 2019
Pematang Siantar – Parapat (27 km)	20 min	Feasibility Study

Source: Ministry of Public Works and Housing

14.2 RAILWAY

14.2.1 EXISTING CONDITION

In 2015, approximately 379 million passenger kilometers were registered by rail in Sumatera Utara. However, it has been decreasing over the years as shown in Figure 46.

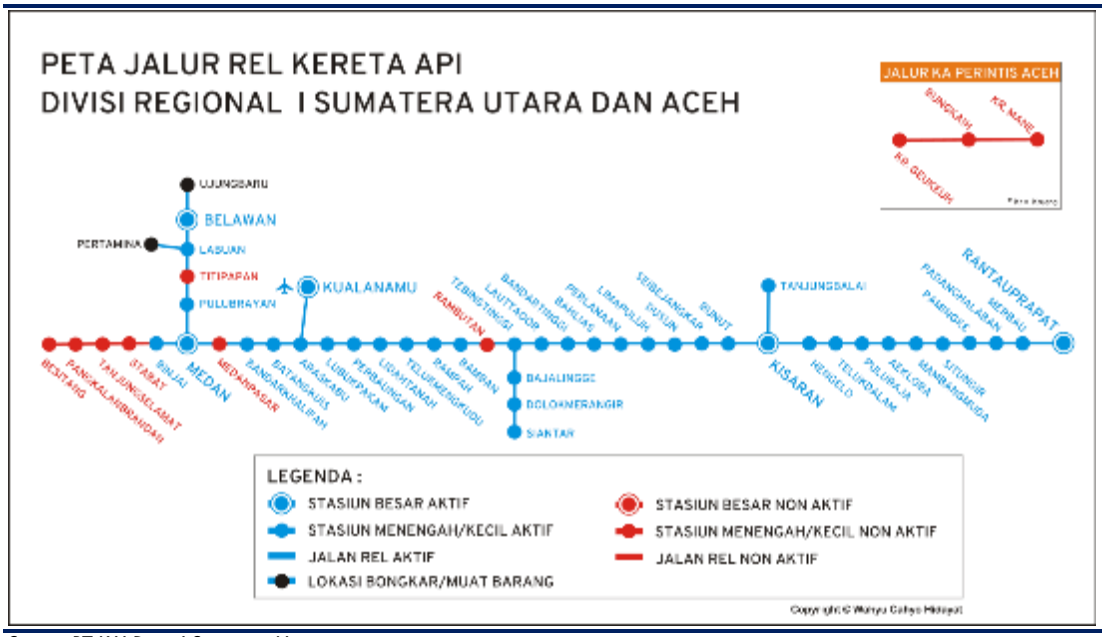
FIGURE 46: KM PASSENGER AND KM FREIGHT BY RAILWAY

Year	Passenger-Kilometres	Freight (Ton Kilometre)		
		Plantation	Fuel	Other
2011	475,004,932	58,021,020	34,940,270	5,360,783
2012	445,088,621	92,700,199	36,121,969	1,995,954
2013	316,555,656	80,728,051	36,817,017	4,249,837
2014	397,471,175	80,017,382	35,278,978	3,996,852
2015	379,552,994	72,772,090	33,707,245	3,597,101

Source: PT KAI Divre I Sumatera Utara

There is a rail provision in regions connecting Medan, Belawan, Kualanamu, Kisaran and Rantau Prapat; however, there is no railway connection to the key tourism areas. The rail line connects Medan to Pematang Siantar via Tebing Tinggi.

FIGURE 47: EXISTING RAILWAY NETWORK IN SUMATERA UTARA AND ACEH



Source: PT KAI Divre I Sumatera Utara

Despite good track maintenance for the Medan – Pematang Siantar segment, the rail journey takes around 4 hours. The bus trip from Pematang Siantar to Parapat takes another 90 minutes, stretching the total travel time, including transfer, to more than 6 hours, thus making it an unattractive alternative for visitors.

Less than 5% of foreign visitors and 10% of domestic visitors use rail transport and there is no demand identified for rail tours in the leisure market.

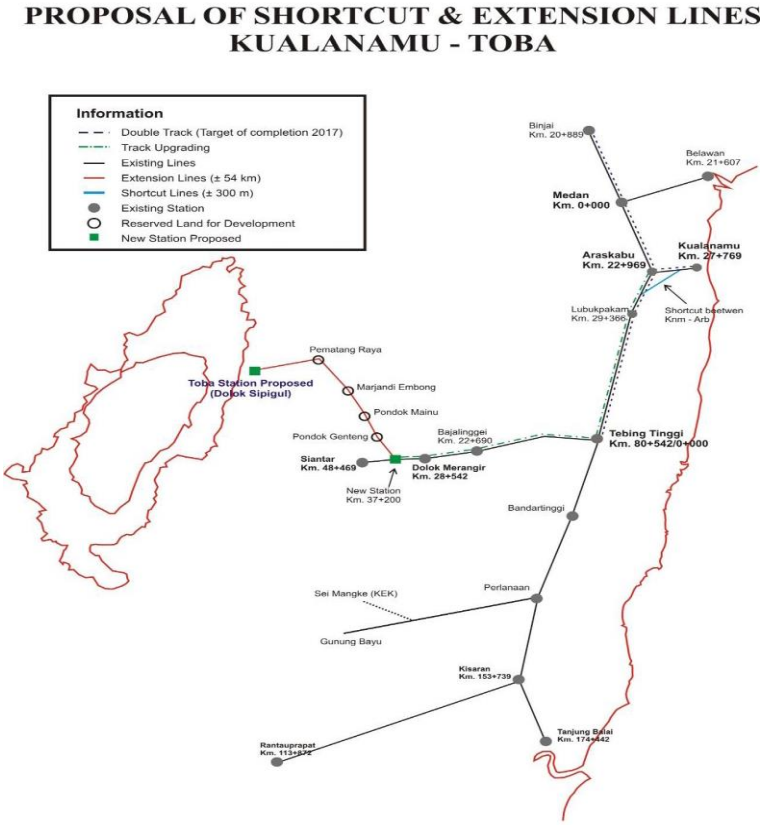
14.2.2 ASSESSMENT OF EXISTING RAILWAY INFRASTRUCTURE

Considering the small share of rail users, and the planned toll road reducing the road travel time between Medan and Lake Toba to around 2 hours, investments in railway facilities are not justifiable from a tourism perspective.

14.2.3 FUTURE PLANS FOR RAILWAY INFRASTRUCTURE

With regards to railway transport, there is good maintenance for the Medan – Pematang Siantar track and the enhancement of a double – track between Medan – Tebing Tinggi is currently under way. A preliminary study on the Lake Toba rail link shows that the existing line is proposed to be extended (54 km) to Dolok Sipigul as shown in Figure 48 below, which would result in a total travel time from Medan to Dolok Sipigul of 3.5 hours. From Dolok Sipigul to Parapat, visitors could use car or bus and this would take approximately 45 minutes.

FIGURE 48: RAILWAY EXTENSION TO DOLOK SIPIGUL



Source: PT Kereta Api Indonesia

The investment in railway facilities for the track from Pematang Siantar to Lake Toba is difficult to justify from a tourism development perspective. Convenient bus transport from Pematang Siantar to Parapat could provide alternative choices; however, it is uncompetitive for visitors visiting Lake Toba on short trips.

14.3 AIR

14.3.1 EXISTING CONDITIONS

There are three main airports used for access to Lake Toba (Figure 49). These airports include the Kualanamu International Airport at Medan, Silangit Airport located near Balige, and the Sibisa Airport located close to Parapat. The Kualanamu International Airport is the primary gateway to Lake Toba as almost 99% of the total visitors arriving by air arrive at the airport. Hence, it is important to ensure the adequacy of the airport to support tourism in Lake Toba.

For the other 2 airports, less than 1% of the visitors traveling by air arrive at the Silangit Airport, and the operations of Sibisa Airport ceased in 2014.

FIGURE 49: EXISTING ANALYSIS OF 3 AIRPORTS, LAKE TOBA

Parameters	Kualanamu	Silangit	Sibisa
Frequency of flights per day in 2016	108 flights: 87 domestic flights and 21 international flights.	7 flights between Silangit and Jakarta. 1 flight between Silangit and Batam. 1 flight between Silangit and Medan.	Operation ceased (1 flight a week from Medan to Parapat, operated by Susi Air until 2014).
Air passengers handled in 2015	8,004,791	17,784	NA
Aircraft movement in 2015	63,607	955	NA
Distance (km) and travel time by car (hours)	170 km to Parapat, 6 hours.	77 km to Parapat, 2 hours. 19.6 km to Balige, 30 minutes.	10 km from Parapat.

Source: Flightradar24.com, Angkasa Pura II

The details on connectivity of the Kualanamu International Airport are shown in Figure 50.

FIGURE 50: NUMBER OF FLIGHTS AT KUALANAMU INTERNATIONAL AIRPORT (DAILY)

	Destination	Number of flights
Domestic	Aek Godang	1
	Banda Aceh	4
	Bandar Lampung	1
	Bandung	4
	Batam	6
	Denpasar	1
	Gunung Sitoli	9

	Destination	Number of flights
	Sibolga	3
	Silangit	2
	Simeulue	2
	Surabaya	4
	Takengon	1
	Tapaktuan	1
	Yogyakarta	1

	Destination	Number of flights
	Jakarta	30
	Jakarta Halim Pk	5
	Jambi	1
	Lhokseumawe	1
	Meulaboh	1
	Padang	3
	Palembang	1
	Pekanbaru	4
	Pulau Tello Nias	1
	Subtotal	87
International	Bangkok Don Mueang	1
	Kuala Lumpur	8
	Madinah	1
	Penang	6
	Singapore	4
	Subang Malaysia	1
	Subtotal	21
Total		108

Source: Flightradar24.com

Existing airport infrastructure conditions for both the Kualanamu International Airport and the Silangit Airport are provided in Figure 51.

FIGURE 51: AIRPORT FACILITIES AT KUALANAMU INTERNATIONAL AIRPORT AND SILANGIT AIRPORT

Facilities	Kualanamu International Airport	Silangit Airport
Runway	3,750 m x 60 m	2,250 m x 30 m
Taxiway (Parallel)	(A) 3,750 m x 30 m	75 m x 15 m
	(B) 2,000 m x 30 m	150 m x 23 m
Loading Apron Requirements	7 Wide Body Aircraft	2 Narrow Body Aircraft
	28 Narrow Body Aircraft	
Terminal Building Capacity	9,000,000 passengers/year	36,500 passengers/year

Source: Aeronautical Information Publication, DGCA and PT. Angkasa Pura 2

14.3.2 ASSESSMENT OF EXISTING AIRPORT INFRASTRUCTURE

KUALANAMU INTERNATIONAL AIRPORT

Passengers Handling Capacity

As per existing annual airport capacity, the Kualanamu International Airport can handle 9 million passengers. The existing passenger demand is 8 million passengers per year. This indicates that the passenger handling capacity of this airport is adequate to meet the present demand.

Runway Capacity

Based on the existing runway infrastructure assessment, the runway capacity is estimated to cater for approximately 29 aircraft movements during peak hour (80% of full capacity). The current aircraft movements are recorded at 27 during peak hour. The annual capacity for aircraft movement is estimated at 105,850 aircraft. (Technical details on runway capacity analysis are presented in Appendix IV). This indicates that the existing runway capacity is adequate to meet the current aircraft movements.

Summary of Existing Infrastructure at Kualanamu International Airport

Considering existing air passenger demand[25] of 8 million passengers and 63,607 aircraft movements with 27 peak hour movements, the existing airport infrastructure is adequate as summarized in Figure 52:

FIGURE 52: EXISTING GAPS IN AIRPORT FACILITIES AT KUALANAMU INTERNATIONAL AIRPORT

Facilities	Kualanamu	Assessment
Runway	3,750 m x 60 m	Adequate to meet existing aircraft movement.
Parallel Taxiway	3,750 m x 30 m 2,000 m x 30 m	Adequate to meet existing aircraft movement.
Loading Apron Requirements	22 aircrafts during peak hours Capacity: 32 aircrafts stands	Adequate to meet existing aircraft movement.
Terminal Building Capacity	9 million	Adequate to meet existing air passenger demand, but reaching capacity.

SILANGIT AIRPORT

Passenger Handling Capacity

As per existing airport annual capacity, the Silangit Airport can handle 36 thousand passengers. The existing passenger demand of 17,800 in 2015 indicates that the airport is adequate to handle the current air passenger demand. There are plans for expansion (increased capacity to handle 100,000 passengers a year, with terminal upgrade and runway extension to 2,650 meters), which will meet increased air passenger demand in the future.

[25] *Air Passenger Demand refers to overall passenger traffic comprising of both visitors and residents.*

Runway Capacity

The estimated capacity of the existing single runway is approximately 16 aircraft movements. As the estimated annual passengers handled are less than 1 million, the Silangit Airport can be categorized as a small airport. Therefore, distribution of peak-hour aircraft movements would not be essential to determine the capacity of its runway. According to the Silangit Airport's Aeronautical Information Publication, the airport hours of service fall under category HS, meaning the airport will be operated based on "During Hours of Scheduled Operations".

Based on the flight schedule, the slot movement for airlines operating at the Silangit Airport shows that the airport only uses 2 slots per hour. This means the existing infrastructure capacity can cater to future demand if there are new airlines flying to the Silangit Airport.

Considering a typical airline slot movement, the hourly runway capacity can be converted to daily runway capacity in multiples of 10. With this consideration and the existing runway capacity for 16 aircraft movements, annual capacity for aircraft movements is estimated to be 58,400.

Summary

Considering existing air passenger demand of 17,784 passengers and 955 aircraft movement with 2 peak hour movements, the existing airport infrastructure at the Silangit Airport is adequate as summarized in Figure 53:

FIGURE 53: EXISTING GAPS IN AIRPORT FACILITIES AT SILANGIT AIRPORT

Facilities	Silangit	Assessment
Runway	2,250 m x 30 m	Adequate to meet existing aircraft movement.
Parallel Taxiway	None	Not required.
Loading Apron Requirements	2 aircrafts during peak hour Capacity: 2 aircrafts stands	Adequate to meet existing aircraft movement.
Terminal Building Capacity	36,500	Adequate to meet existing air passenger demand.

SIBISA AIRPORT

The Sibisa Airport is a small airport with minimal airport infrastructure (runway: 750 m x 18 m and Terminal: 120 m^2). It has a favorable location in terms of proximity to Lake Toba; however, it is not feasible to extend the runway to accommodate medium sized aircrafts due to physical site constraints (obstacle limitation surfaces).

In summary, the Kualanamu International Airport is the main gateway for all international arrivals, and the Silangit Airport provides an alternative option for visitors from Jakarta/Medan until the toll-road between Medan and Parapat is completed.

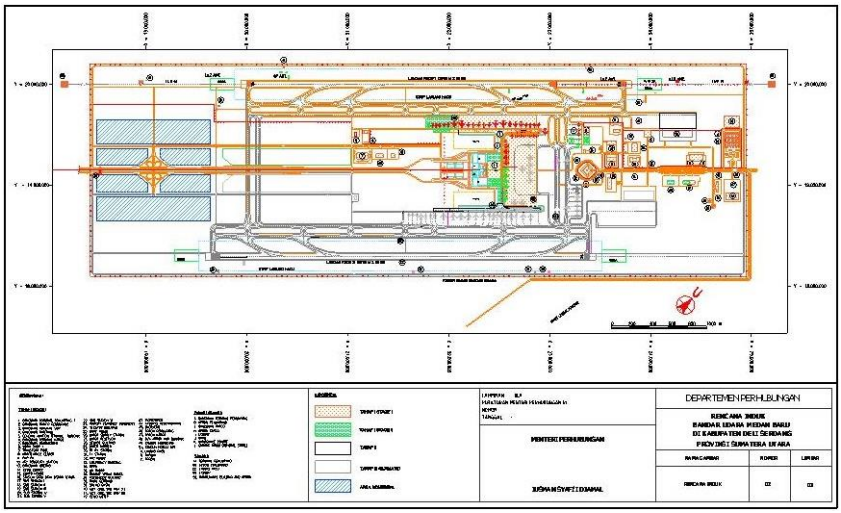
14.3.3 FUTURE PLANS FOR AIRPORT INFRASTRUCTURE

KUALANAMU INTERNATIONAL AIRPORT DEVELOPMENT PLAN

The ultimate development plan for Kualanamu International Airport as prepared by Angkasa Pura II, is summarized in figure 54.

FIGURE 54: KUALANAMU AIRPORT DEVELOPMENT PLAN

Description	Existing Condition (Stage 1)	Ultimate Development
Airport Area	1.365 ha	1.365 ha
Runway	3,750 m x 60 m	2 x 3,750 m x 60 m
Parallel Taxiway	TW 1: 3,750 m x 30 m	2x TW 1: 3,750 m x 30 m
		2x TW 2: 2,000 m x 30 m
Apron Area	200,000 m^2	664,664 m^2
Terminal Area	118,930 m^2	224,256 m^2
Terminal Capacity	10 million pax / year	22 million pax / year
Commercial Area	20,433 m^2	20,433 m^2
Cargo Warehouse	13,000 m^2	27,318 m^2
Parking Area	50,820 m^2	138,750 m^2



Source: Angkasa Pura II

According to the plan (Figure 54), the runway will be extended to parallel induction runway and the terminal building will be expanded to accommodate 22 million passengers by 2023. This plan will prepare the Kualanamu International Airport to meet future demand. It is noted that the proposed improvements will enable the airport to accommodate Code F aircrafts[26] (large aircrafts). These improvements will support the Kualanamu International Airport as one of the gateway airports for ASEAN Open Skies.

In summary, the existing Kualanamu International Airport capacity is adequate to accommodate the current demand. The Airport Development Plan is important as the existing passenger terminal capacity is operating at 89% of its total passenger handling capacity. However, the phasing of further improvements to airport capacity in terms of air or land side infrastructure should be balanced with actual growth of demand.

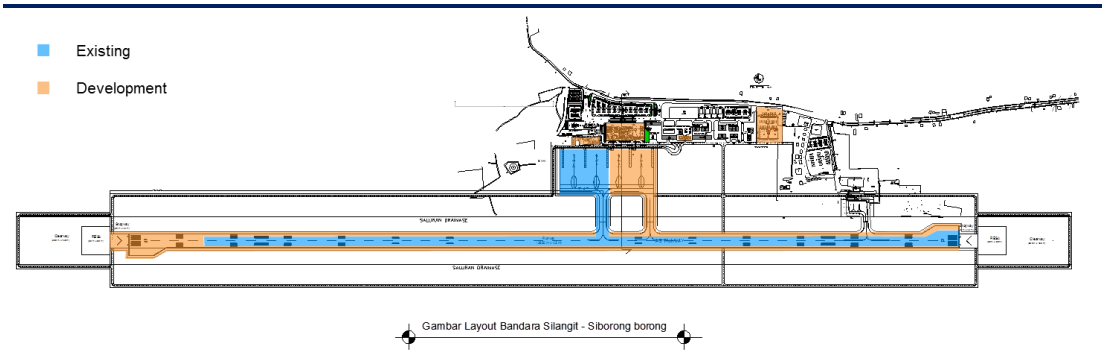
SILANGIT AIRPORT DEVELOPMENT PLAN

According to Angkasa Pura II airport development plan, the runway at the Silangit Airport is planned to be extended to 2,650 meters and the terminal building will be expanded to accommodate 100,000 passengers by 2017. The details are shown in Figure 55.

FIGURE 55: SILANGIT AIRPORT IMPROVEMENT PLAN

Characteristic	Size
Area	196.5 Ha
Runway	2,650 m x 45 m (PCN : 65/F/C/X/T)
Taxiway	Taxiway A 75 x 15 m
	Taxiway B 150 x 23 m
	Taxiway C 150 x 23 m
Apron	28,400 m^2
	4 aircraft (Narrow Body)
Terminal Capacity	1. Phase I (1,706 m^2) 2. Design Capacity 10,499 m^2 (ultimate)
	Phase I : 100,000 Pax/Year Ultimate Phase : 1,000,000 Pax/Year

[26] *Based on the ICAO Aerodrome Reference Code, the typical wingspan of aircraft is 65 m but < 80 m and outer main gear is14 m but < 16 m, e.g. Boeing 747-8/Airbus A-380-800*



Source: Angkasa Pura II

The existing Silangit Airport infrastructure is adequate to meet the current air passenger and aircraft movement capacity. Phase 1 of the Silangit Airport Improvement Plan will provide an alternative choice for visitors until the primary road (toll road) from Medan-Tebing Tinggi-P. Siantar is completed in a few years' time. With the toll road operating, the Silangit Airport may not remain competitive. Hence, the airport has little significance for medium to long term tourism development.

14.4 SEA TRANSPORT

14.4.1 EXISTING SEA TRANSPORT SERVICE

The Belawan Port is located approximately 26 km north of Medan, and historically, was connected with Singapore, Penang, and Kuala Lumpur. The service from Penang ceased in 2009 due to increasing competition from budget airlines. Currently, the port only serves domestic inter-island service to Jakarta via Batam every 4-5 days, operated by PT. PELNI. Visitors arriving at Belawan bound for Lake Toba would take approximately 5 to 6 hours by road to Parapat depending on traffic and road conditions.

Alternatively, Sumatera Utara can be reached from Malaysia via the Tanjung Balai Asahan Port. Some visitors prefer to use the ferry from Port Klang (Malaysia) to the Tanjung Balai Port due to its frequent services (5 times a day). The service is sustained mainly due to Indonesians working in Malaysia. From the port of Tanjung Balai Asahan, the car journey to Parapat is approximately 5 to 6 hours (170 kilometers), depending on traffic and road conditions.

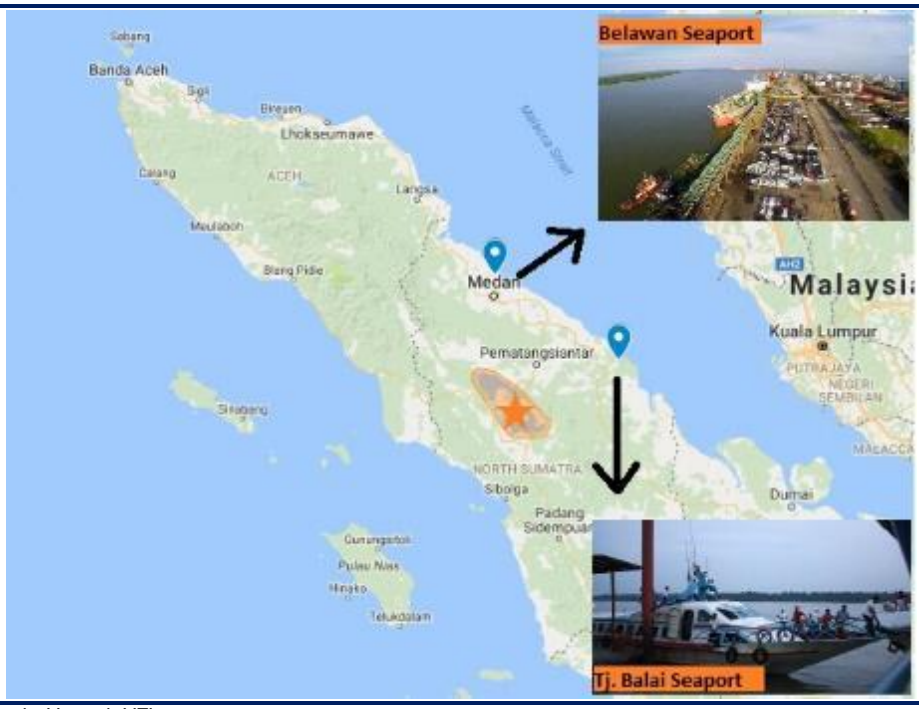
FIGURE 56: ARRIVALS AT BELAWAN AND TANJUNG BALAI ASAHAN PORTS

Year	Belawan	Tanjung Balai Asahan	Total
2011	18,975	11,501	30,476
2012	22,132	13,856	35,988
2013	22,631	11,118	33,749
2014	24,769	11,344	36,113
2015	20,916	10,554	31,470

Source: Sumatera Utara Dakam Angka, 2016 (BPS). These figures include arrivals of indonsian workers in Malaysiai

The Belawan Port received 4 cruise ship calls in 2015. The main user groups are European tour groups on short excursions. The MS Crystal Symphony is by far the biggest cruise ship calling at Belawan Port with 51,044 GT and carried roughly 1,000 passengers.

FIGURE 57: ENTRY PORTS OF BELAWAN & TANJUNG BALAI



Source: Google, Horwath HTL

The third port at Kuala Tanjung is located 120 km from Medan and 133 km from Parapat is aimed at multi-purpose cargo serving the industrial zone in Sumatera Utara, hence not favorable for cruise tourism.

14.4.2 BELAWAN PORT INFRASTRUCTURE

An approach channel to the Belawan Port is about 12 km in length and an approaching vessel takes 30 minutes to one hour navigating through the channel. The depth of channel is 14 m and its width is enough only for vessels with capacity of 5,000 – 6,000 twenty-foot equivalent unit (TEU).

There are six terminals: Container Terminal, Pertamina Jetty, IKD, Citra, Ujung Baru and Belawan Lama. The passenger terminal is located at the eastern edge of Ujung Baru. The location of these terminals is shown in Figure 58; and dimensions of the facilities of each terminal are shown in Figure 59.

FIGURE 58: BELAWAN PORT LAYOUT

Source: Google Earth Map

FIGURE 59: BELAWAN PORT FACILITIES

No	Facilities	Length (m)	Depth (m)	Yard
A	Ujung Baru	1,670 m	9 m	20,906 m^2
B	Old Passenger Terminal	Capacity of passenger building 700 pax/international, 2,450 pax/domestic		
C	Pertamina Jetty	Max vessel 17,000 deadweight tonnage (DWT)		
D	Container Terminal	500 m	10 to 11 m	73,000 m^2
E	IKD	300 m	4 to 6 m	7,500 m^2
F	Citra	625 m	5 to 8 m	8,938 m^2
G	Belawan Lama	689 m	5 to 7 m	9,833 m^2

Source: Pelindo I

The length of the Belawan Lama quay is 689 m, suitable for sun class cruise ships. Recently, Pelindo I upgraded the Bandar Deli passenger terminal building with a Garbarata connection. The passenger terminal has been completely repaired and improved since June 2016 with a capacity of 2,000 - 2,500 passengers. In the future, the terminal is expected to integrate with the Belawan railway with pedestrian overhead bridge connectivity.

14.4.3 ASSESSMENT OF EXISTING SEA PORT INFRASTRUCTURE

The existing Belawan Port has adequate sea side and passenger terminal infrastructure to receive the existing cruise calls.

14.5 LAKE TRANSPORT

14.5.1 EXISTING CONDITION

The most common access used by visitors to Samosir Island is by ferry, either on passenger-only boats or vehicle-passenger ferries. Figure 60 shows the schedule and frequency of these boats services around Lake Toba.

FIGURE 60: DEPARTURE TIMES OF FERRY AND BOAT

Passenger-only Boat		Vehicle-Passenger Ferry	
Tigaraja (Parapat)	*Tomok (Samosir Is)*	*Ajibata*	*Tomok (Samosir Is)*
08.30	07.00	08.30	07.00
09.30	08.00	11.30	10.00
10.30	09.00	14.30	13.00
11.30	10.00	17.45	16.00
12.30	11.00	21.00	19.30
13.30	12.00	*Muara*	*Sipinggan (Samosir Is)*
14.30	13.00	15.30	09.00
15.30	14.00	*Tigaras*	*Simanindo (Samosir Is)*
16.30	15.00	09.00	07.30
18.00	16.00	12.00	10.30
19.00	17.30	15.00	13.30
		18.00	16.30

Passenger-only Boat		Vehicle-Passenger Ferry	
Tigaraja (Parapat)	*Tuktuk (Samosir Is)*		
8:30	7:00		
9:30	8:00	*Balige*	*Onan Runggu (Samosir*
10:30	9:00	16.30	10.30
11:30	10:00		
12:30	11:00		
13:30	12:00		
14:30	13:00		
15:30	14:00		
16:30	15:00		

Source: Dinas Pariwisata UPT Dinas Perhubungan Danau Toba

- From Ajibata in Parapat, the vehicle-passenger ferry to Tomok on the island takes approximately 45 minutes. There are 5 daily services each way with a capacity of approximately 16 – 26 vehicles and up to 20 seated passengers. During the peak season the frequency of service will be 8 trips a day. Current fleets in operations are KMP Tao Toba I and II, and the service is run by PT. ASDP (Indonesia state owned company).

- From Balige, the vehicle-passenger ferry departs once a day each way to the terminal at Onan Runggu in Samosir Island. The ferry journey takes approximately an hour. Current fleet in operation is KMP Sumut I with a capacity of approximately 16 vehicles and up to 20 seated passengers, and the service is run by Dinas Perhubungan Kab.
- Another two vehicle-passenger ferry terminals are available, but mainly used by the local community – Tigaras (32 kilometers away to the north-west of Parapat) to Simanindo on the island, a ferry journey of 30 minutes, and between Muara (approximately 39 kilometers to the west of Balige) and Sipinggan on the island, a journey of approximately 45 minutes. The ferry service (4 daily) between Tigaras and Simanindo can accommodate up to 16 vehicles and 20 seated passengers.
- For the passenger-only boat, there are 20 services daily between Tiga Raja (Parapat) and Tuktuk (Samosir Island). The journey time is approximately 30 minutes and the cost is IDR 10,000 (adults, ~USD 0.75) each way. The boat can accommodate up to 70 – 80 seated passengers. The service is operated by a local private operator. According to UPT Dinas Perhubungan Danau Toba, the number of boats currently in service is estimated to be about 19.
- The Tomok – Tigaraja service has two different ports (visitor and public). In 2015, the largest transport volume was recorded for the Tomok – Tigaraja service (Figure 61) mainly used by residents (public). The ferry docks at Tomok and Tigaraja are the major access points for visitors and local residents to Samosir Island.

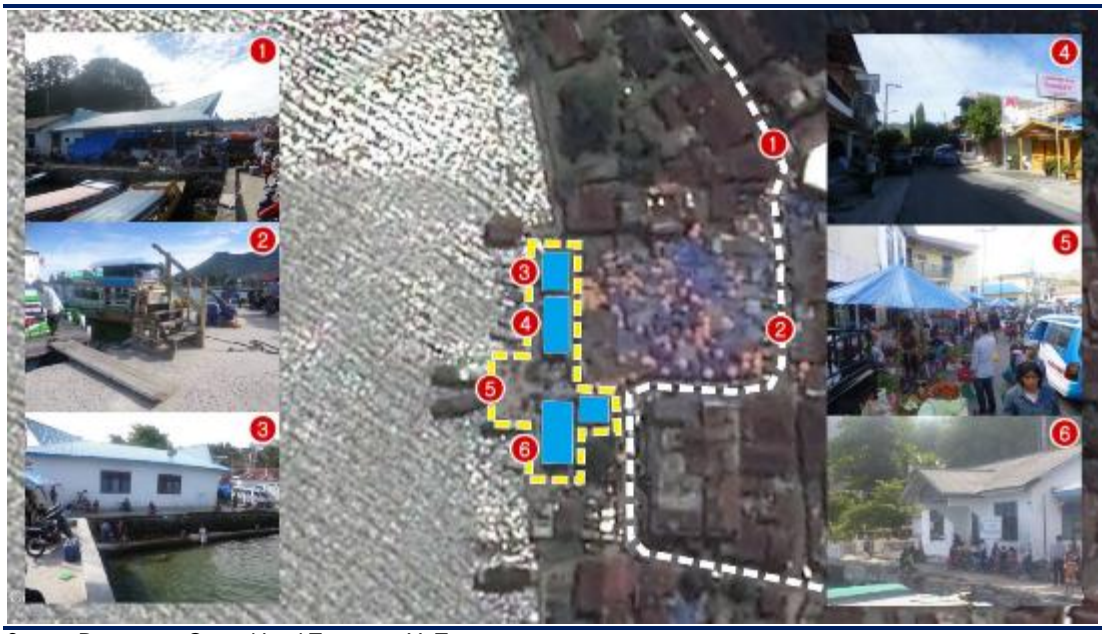
FIGURE 61: NUMBER OF PASSENGERS ON LAKE TOBA

Route	Frequency	2012	2013	2014	2015
Balige – Onan Runggu	1 trip	21,688	21,752	30,735	34,802
Ajibata – Tomok	5 – 8 trips	186,540	167,400	179,750	172,980
Tomok – Tigaraja (Public)	11 trips	267,363	335,922	356,707	357,948
Tomok (Visitor) – Tigaraja	9 trips	137,370	227,438	181,180	205,024
Simanindo - Tigaras	4 trips	110,666	96,730	126,028	124,374

Source: Kab. Samosir Dakam Angka, 2016 (BPS), Kab. Simalungun Dalam Angka, 2016 (BPS), Kab. Toba Samosir Dalam Angka, 2016 (BPS)

Figures 62 to 65 show the major lake transport infrastructure used by visitors in the Destination.

FIGURE 62: TIGARAJA PORT



Source: Directorate General Land Transport, MoTr

FIGURE 63: AJIBATA PORT

Source: Directorate General Land Transport, MoTr

FIGURE 64: TOMOK TOURIST PORT

Source: Directorate General Land Transport, MoTr

FIGURE 65: TOMOK FERRY PORT

Source: Directorate General Land Transport, MoTr

It is observed that most of these lake ports are located in dense waterfront areas with limited space for expansion on the land side.

14.5.2 ASSESSMENT OF EXISTING LAKE TRANSPORT

Based on the ground study and considering the frequency of ferry services (every one hour for passenger ferries and 2 – 3 hours for vehicle-passenger ferry), the capacity of the passenger and car ferries, and the lake port infrastructure, the lake transport system is sufficient to satisfy the existing demand. However, during festive seasons such as Idul Fitri, Christmas and New Year, current operation does not satisfy the demand at Tigaraja with long queues for transport to the island.

The exact fleet size for passenger boats is unknown since it is being operated by private operators. However, based on interviews with UPT Dinas Perhubungan, total number of passenger boat service from Tigaraja – Tomok – Tuktuk is estimated to be 19 boats. Given the number of boats, frequency and capacity, estimated daily capacity is about 15,000 passengers.

Moving forward, the need for boat transportation should be assessed as per demand needs. From a tourism perspective, slow boats plying at high frequencies (reduced waiting time) may provide a popular recreational activity.

14.5.3 FUTURE PLANS FOR LAKE TRANSPORT

There is a Government proposal for rehabilitation and widening of the Tano Ponggol canal and the construction of a new bridge crossing the canal which is based on the expectation of potential lake cruises.

TRANSPORT INFRASTRUCTURE INVESTMENT NEEDS

14.6 FUTURE MODE OF TRAVEL

14.6.1 MARKET SHARE OF VISITORS

According to this market study, there will be no major shifts in the origin of visitors in the future:

- From 1.7 million visitor arrivals in 2021 and 3.2 million visitor arrivals in 2041, more than 90% are estimated to be domestic visitors, mainly from Sumatera Utara; and
- From total foreign visitors, a significant share is forecast to originate in Malaysia and Singapore.

14.6.2 MODE OF ARRIVAL

The mode of arrival and visitor movement pattern remains similar to the current trends.

Domestic visitors rely on land transport. In 2021 and 2041, around 97% of domestic visitors are expected to arrive by land and the remaining by air. Hence, land transport remains an important means of commuting for domestic visitors.

Airports will remain the principal gateway for foreign visitors. Around 85% of foreign visitors are estimated to arrive by air in 2021 and 2041. Remaining foreign visitors are expected to arrive by sea.

97% and 95% of visitors arriving by air are forecast to arrive at the Kualanamu International Airport in 2021 and 2041 respectively. Hence, the airport will remain the predominant gateway and the majority of visitors will still travel to Parapat from Medan.

14.6.3 TRANSPORT MODAL SPLIT

Based on this market study, private transport will remain the preferred mode of transport for tourists comprising of visitors, day trippers and VFR. The following modal split assesses the impact of tourism on the road infrastructure capacity (Figure 66).

FIGURE 66: FUTURE SCENARIO OF TRANSPORT MODAL SPLIT

Domestic Visitor Share (%)			Foreign Visitor Share (%)		
Mode of Transport	**2015**	**Future Scenario**	**Mode of Transport**	**2015**	**Future Scenario**
Tour Bus	10%	10%	Tour Bus	30%	30%
Tour Van	10%	10%	Tour Van	40%	40%
Public bus/Railway	10%	10%	Public bus/Railway	10%	10%
Private car/Car rental/Taxi	70%	70%	Private car/Car rental/Taxi	20%	20%
Total		100	Total		100

Source: Surbana Jurong and HHTL

Based on the above modal split, Figures 67 (2021) and 68 (2041) present the distribution of peak visitors using different modes of transport.

FIGURE 67: ESTIMATE OF TOURISM PASSENGERS BY TRANSPORT MODES IN 2021

Domestic Share (%)				Foreign Share (%)			
Peak visitor per day			21,782	Peak visitor per day			6,328
Mode of Transport Arrival				Mode of Transport Arrival			
	Air	Sea	Land		Air	Sea	Land
No of Visitor	740	0	21,042	No of Visitor	5,525	803	0
Mode of Transport to reach tourism attractions				Mode of Transport to reach tourism attractions			
Tour Bus	74	0	2,104	Tour Bus	1,657	803	0
Tour Van	74	0	2,104	Tour Van	2,210		0
Public bus/Railway	74	0	2,104	Public bus/Railway	276		0
Private car/Car rental/Taxi	518	0	14,729	Private car/Car rental/Taxi	1,381		
Total	740	0	21,042		5,525	803	0

Source: Surbana Jurong

FIGURE 68: ESTIMATE OF TOURISM PASSENGERS BY TRANSPORT MODES IN 2041

Domestic Share (%)				Foreign Share (%)			
Peak visitor per day	28,921			Peak visitor per day	15,278		
Mode of Transport Arrival				Mode of Transport Arrival			
	Air	Sea	Land		Air	Sea	Land
No of Visitor	1,548	0	27,373	No of Visitor	13,408	1,870	0
Mode of Transport to reach tourism attractions				Mode of Transport to reach tourism attractions			
Tour Bus	155	0	2,737	Tour Bus	4,023	1,870	0
Tour Van	155	0	2,737	Tour Van	5,363		0
Public bus/Railway	155	0	2,737	Public bus/Railway	670		0
Private car/Car rental/Taxi	1,083	0	19,161	Private car/Car rental/Taxi	3,352		
Total	1,548	0	27,373		13,408	1,870	0

Source: Surbana Jurong

14.7 ROAD TRANSPORT NEEDS

14.7.1 FUTURE TRAFFIC VOLUME AND ROAD CAPACITY

Traffic analysis constitutes general traffic and traffic generated by visitors. Considering the new toll road project, a significant part of future traffic will be diverted to the toll road. (Traffic diversion analysis is presented in Appendix III).

General Traffic Volume and Road Capacity

The traffic volume on roads to and from the tourism destination area will be affected by the traffic increases as a result of other economic activities in the Sumatra region. For the purpose of this study, the future traffic volume has been estimated based on the future demographic scenario and visitor arrivals. The forecast number of vehicles in 2021 and 2041 in Sumatera Utara is presented in Figure 69. By 2041, registered vehicles are estimated to more than double in Sumatera Utara, from the existing 5.8 million vehicles to an estimated 13.5 million.

FIGURE 69: NUMBER OF VEHICLES IN PAST AND FUTURE

Sumatera Utara		
Year	No of Vehicles	Growth
2015	5,823,229	Base
2021	7,761,807	4.90%
2041	13,567,237	2.83%

Source: Surbana Jurong

Visitors Traffic Volume

All foreign visitors and 90% of domestic visitors arrive via the Medan-Parapat corridor. The remaining 10% of domestic visitors arrive via the Siborong- Balige corridor. Based on the assumed modal split for domestic and foreign visitors, the apportionment rate of each traffic facility and number of visitors per vehicle are presented in Figures 70 and 71.

FIGURE 70: TRAFFIC VOLUME ESTIMATION IN 2021

Domestic	MES	DTB	Pax / Vehicle	Foreign	MES	DTB	Pax / Vehicle
Tour Bus	56	7	35	Tour Bus	70	-	35
Tour Van	139	17	14	Tour Van	158	-	14
Public Bus/Railway	56	7	35	Public Bus/Railway	8	-	35
Private Car/Car Rental/Taxi	3,403	409	4	Private Car/Car Rental/Taxi	345	-	4
Total	3,653	439		Total	581		

MES = Medan – Parapat corridor, DTB = Siborong-borong – Balige corridor

FIGURE 71: TRAFFIC VOLUME ESTIMATION IN 2041

Domestic	MES	DTB	Pax / Vehicle	Foreign	MES	DTB	Pax / Vehicle
Tour Bus	74	9	35	Tour Bus	168	-	35
Tour Van	185	22	14	Tour Van	383	-	14
Public Bus/Railway	74	9	35	Public Bus/Railway	19	-	35
Private Car/Car Rental/Taxi	4,522	539	4	Private Car/Car Rental/Taxi	838	-	4
Total	4,854	579		Total	1,409		

MES = Medan – Parapat corridor, DTB = Siborong-borong – Balige corridor

The summary of visitor traffic in key road corridors is shown in Figure 72.

FIGURE 72: TRAFFIC VOLUME ESTIMATION IN 2021 AND 2041 (ADT)

Corridor	2021 ADT	2021 PCE	2021 Peak	2041 ADT	2041 PCE	2041 Peak
Medan - Parapat	4234	4615	462	6263	6948	695
Siborong - Balige	439	465	46	579	613	61

PCE: Passenger Car Equivalent was adopted from Djohar (1984) Passenger Car Unit value and Saturation Flow for Junctions in Bandung

In summary, the traffic volume generated by visitors is estimated to be less than 6% in comparison to general traffic volume (see Appendix III). The only road section with a substantial percentage of visitor related traffic is Pematang Siantar-Parapat. The overall traffic volume on this road section is relatively low. During peak periods, approximately 30% of traffic between P. Siantar and Parapat is estimated to consist of visitors of the Lake Toba Tourism Destination Area.

Road Performance

Road performance supporting the Destination is assessed by Level of Service (LOS), as a measure to indicate the effectiveness of the proposed road infrastructure. The LOS is categorized into six different classes, ranging from A to F, where A is the best. The Indonesia Highway Capacity Manual (IHCM) 1997 has recommended that the LOS should not be allowed to reduce to lower than "D" which is the accepted international standard. Figure 73 presents the LOS in relation to congestion as a V/C ratio (volume over capacity) for a given traffic density.

FIGURE 73: LEVEL OF SERVICE ROAD CAPACITY

LOS	V/C ratio
A	0.26
B	0.42
C	0.63
D	0.84
E	1.00
F	⩾ 1.00

The results of the future traffic volume analysis at the road segment supporting the Destination are presented in Figures 74 to 76 (refer to Appendix III for detailed calculations).

FIGURE 74: PROPOSED TOLL ROAD CAPACITY

Proposed Toll Road	Travel Time	Plan Status	Average VCR 2021	Average VCR 2041	Remarks
Medan – Tebing Tinggi (62 km)	50 min	Committed to operate in 2019	0.8	1.4	The toll road is needed to improve current planned capacity for general traffic. The toll road will have adequate capacity until 2030.
Tebing Tinggi – Pem. Siantar (35 km)	30 min	Feasibility Study, Scheduled Construction in 2019	0.6	1	The toll road is needed to improve current capacity. The toll road will have adequate capacity until 2041.
Pem. Siantar – Parapat (27 km)	20 min	Feasibility Study	NA	NA	Existing national road capacity is adequate assuming betterment and widening to 7m road width. The toll road will not be needed for this section due to low average annual daily traffic volume.

FIGURE 75: EXTERNAL ROAD ACCESS CAPACITY

Section	Average VCR 2021	Average VCR 2041	Remarks
Medan to Tebing Tinggi (83 km) Travel Time: 2 hour 20 min	1.4	2.5	Inadequate Capacity
Tebing Tinggi to Pematang Siantar (52 km) Travel Time: 1 hour 40 min	0.3	0.6	Adequate Capacity
Pematang Siantar to Parapat (43 km) Travel Time: 1 hour 10 min	0.6	1	Betterment and widening to 7m needed in 2021-2041
Parapat to Balige (60km) Travel Time: 1.5 Hours	0.8	1.4	Capacity needs to be improved in 2021-2041
Balige to Siborong Borong (20 km) Travel Time: 1 Hour	0.8	1.3	Capacity needs to be improved in 2021-2041
Toba – Berastagi – Medan via Tigaras (147 km) Travel Time: 6 Hours	1.5	2.3	Kaban Jahe and Deli Serdang section capacity inadequate

FIGURE 76: INTERNAL ROAD ACCESS CAPACITY

Section	Length (km)	Average VCR 2021	Average VCR 2041	Remarks
Tomok – Ambarita	5.3	0.6	1.0	Capacity needs to be improved in 2021-2041
Ambarita – Simanindo	18.3	0.5	0.9	Capacity needs to be improved in 2021-2041
Simanindo - Pangururan	19.3	0.8	1.3	Capacity needs to be improved in 2021-2041
Pangururan - Nainggolan	40	0.0	0.1	Capacity is adequate
Tele – Pangururan	22	0.5	0.9	Capacity needs to be improved in 2021-2041
Nainggolan – Onan Runggu	7	0.0	0.1	Capacity is adequate
Onan Runggu - Tomok	34	0.4	0.6	Capacity is adequate
Parapat - Ajibata	2.8	0.9	1.5	Capacity needs to be improved in 2021-2041

14.7.2 ROAD INFRASTRUCTURE NEEDS

Based on the above forecasts, some of the existing road capacity is inadequate to meet the estimated traffic volume within the desired Level of Service. Figure 77 presents the summary of infrastructure needs for the key roads in the Destination.

FIGURE 77: ROAD INFRASTRUCTURE AND INVESTMENT NEEDS

Section	Infrastructure Needs
Medan to Tebing Tinggi	Toll Road Plan will be needed urgently. Proposed Toll Road is estimated to have adequate capacity until 2035 (Medan – Tebing Tinggi). Although, the toll road proposal would add capacity to carry about 4,600 vehicles per direction, improvements of existing road would be needed to relieve traffic congestion and improve conditions for general traffic, motorcycle traffic in particular. Perbaungan to Tebing Tinggi needs to be widened to dual 2 in the short term
Tebing Tinggi to Pematang Siantar	Proposed Toll Road is estimated to have adequate capacity until 2040 (Tebing Tinggi – P. Siantar). Due to diversion of traffic to the toll road the capacity of the national road from Tebing Tinggi – P.Siantar is adequate.
Pematang Siantar to Parapat	Adequate capacity in the short term. Considering the low volume of traffic between Pematang Siantar and Parapat, a toll road is not necessary. However, from tourism point of view the travel time is an issue. Hence, this section could also be upgraded to 7m road width and realigned which would bring overall travel time between Medan and Parapat down from 5 to 6 hours to less than 2 hours which should be sufficient to unlock the tourism potential of Lake Toba. For the long term until 2041 normalization (widening to 7m) is sufficient to cope with projected traffic volumes.
Parapat to Balige	Inadequate capacity in the long term. Sections to Silimbat need to be improved in terms of standardization of road width (7 meters).
Section	**Infrastructure Needs**
Balige to Siborong Borong	Inadequate capacity in the long term. Sections to Siborong-borong from Tobasa boundary needs to be standardized to 7 meters width.

Toba – Berastagi – Medan via Tigaras	Kaban Jahe and Deli Serdang sections - current capacity inadequate. Urban traffic management needed for Kaban Jahe. Deli Serdang needs to be standardized to dual 2. However, the road improvement based on the tourism point of view is not needed.

Following improvements are recommended in the five year program.

- Improvement of Medan - Tebing Tinggi - P. Siantar is vital to support tourism development and general traffic operations. The share of the visitor's traffic is estimated to be around 6%, which is considered low. However, as per the market study, the reduction in travel time on this corridor is identified as one of the key contributors to the success of Lake Toba tourism development. Hence, the toll road proposal must be implemented in a timely manner to support tourism development.
- Perbaungan – Tebing Tinggi (59 km) part of Medan – Tebing Tinggi corridor needs to be upgraded for dual two carriageways. However, this should be developed from an inter-regional traffic perspective.
- Other sections of the national road network around Lake Toba and on Samosir Island need to be selectively improved to/from tourism attractions to support tourism development. Improvements include good maintenance and betterment of roads in key tourism areas such as Ambarita, Tomok and Simanindo.
- All other access roads in key tourism areas should be well maintained in terms of pavement conditions targeting for IRI < 6. The roads include the following key sections:
  - Section Parapat – Ajibata (2.8 km)
  - Tomok – Ambarita (5.3 km)
  - Jalan Lingkar Tuktuk (9 km)
  - Jalan Tomok – Lontung – Silimbu (11 km)
- Eventually, all national roads within the Destination, and the provincial/kabupaten roads within the key tourism areas including Parapat (Kec. Girsang Sipangan Bolon, Kab. Simalungun), Samosir Island (Kec. Simanindo and Kec. Pangururan in Kab. Samosir) and Balige (Kec. Balige in Kab. Toba Samosir) needs to be well maintained in terms of pavement conditions targeting for IRI <6.
- Cycling / hiking tracks should be improved to facilitate visitor movements and support tourism. Pedestrian facilities need to be improved in key tourism areas such as Parapat and Tuktuk.

For the 2021 – 2041 programs, the following improvements are recommended:

- Pematang Siantar – Parapat (49.4 km) road width needs to be standardized to 7 meters (existing width is 5.9 meters);
- Sections to Silimbat (part of the Parapat – Balige corridor) needs to be improved in terms of standardization of road width to 7 meters (existing 5.9 meters); and

- Sections to Siborong-borong from Tobasa boundary need to be standardized to 7 meters width (existing 6.1metres).

14.8 RAIL TRANSPORT NEEDS

Rail access to Lake Toba is currently unavailable. The government plans to revitalize the railway service from Medan to Pematang Siantar with a possible extension to Dolok Sipigul. From a tourism development perspective, this is unnecessary because upgrading of the Medan – P. Siantar road will make rail transport uncompetitive.

14.9 AIR TRANSPORT NEEDS

14.9.1 FUTURE AIR PASSENGER DEMAND

KUALA NAMU AIRPORT

- Air passenger movements at Kualanamu Airport are forecast to reach 11 million in 2021 and about 18 million by 2041.
- The yearly aircraft movements are forecast to reach 82,400 aircrafts in 2021 and 124,749 aircrafts by 2041.

SILANGIT AIRPORT

- The Silangit Airport is forecast to receive 101,000 passenger movements in 2021 and about 409,000 by 2041.
- The yearly aircraft movements are forecast to be 2,744 aircraft in 2021 and 8,693 aircraft by 2041.

Appendix IV shows the detailed calculations of projected yearly and hourly aircraft movements for the respective airports.

14.9.2 AIRPORT INFRASTRUCTURE NEEDS

KUALA NAMU AIRPORT

In 2021 and 2041, passenger demand is forecast to exceed the number of passengers that could be accommodated by the current airport infrastructure. The main airport facilities will need to be improved according to the estimated passenger and aircraft demand in 2021 and 2041 as shown in Figure 78.

FIGURE 78: KUALANAMU AIRPORT – INFRASTRUCTURE NEEDS

	Existing (2015)	Airport Improvement Plan 2019	Short Term (2021)	Long Term (2041)
Air Passenger Demand	8 million	NA	10.8 million	18 million
Aircraft landing and Take Off Demand	63,607 aircraft per year 27 peak hour movements	NA	82,400 aircraft per year 29 peak hour movements	124,749 aircraft per year 54 peak hour movements
Runway (Lm X Wm)	3,750m x 60m Estimated Capacity: 29 movements per hour Existing Capacity Adequate	Ultimate Phase (2023) : 2nd runway 3,750m x 60m Estimated Capacity: 58 movements per hour 214,610 aircraft / year for ultimate phase	**Adequate** in 2021 but must build **2nd runway by 2030** with capacity of 58 aircraft per hour	Adequate with parallel runway system
Parallel Taxiway	Yes	Yes	Adequate	Adequate
Loading Apron Requirements	22 aircraft in peak hour Capacity: 32 aircraft stands	Ultimate Phase (2023) Capacity: 64 stands	27 active stands needed for aircraft in peak hour Adequate in 2021 but it will reach its capacity. Apron must be expanded in 2025	41 aircraft stands needed in peak hour by 2041 Adequate with capacity of 64 aircraft stands
Terminal Building	9 million	22 million pax / year	**Needs to be expanded** by 2017	22 million passenger capacity will be adequate

It is important that the Kualanamu International Airport Improvement Plan 2023 is carried out in phases in line with actual growth of air traffic. The passenger terminal capacity is critical in the short term. Airside capacity is also nearing its limits during peak hours.

However, in terms of annual aircraft movement, the single runway is sufficient to cater to demand until 2030, based on the upper limit capacity and through improved air traffic management. Proper management of flight schedules will be required to fill up the vacant slots of the peak hour distribution (>10) which account for 77.6% of the day.

In addition, the reduction of the arrival aircraft in-trail spacing policy needs to be reviewed as the current policy in Indonesia is 6 NM (Nautical Miles) between departure and arrival, while practice in USA is 3 NM (FAA, 2015). Reduction of the minimum separation should be prepared and implemented when feasible as the air traffic control capacity needs to be upgraded to allow for this efficiency. Other aspects such as airspace design or navigational aids must also be studied in detail. Therefore, it may well be that the new runway infrastructure not only can be delayed to 2030, but can be further used until 2041.

The needs for apron expansion as planned in 2023 could possibly be postponed until 2026.

The terminal building is expected to reach full capacity by 2017, and will need to be expanded urgently to cater for the additional 3 million passengers by 2021.

SILANGIT AIRPORT

In 2021 and 2041, the passenger demand is estimated to exceed the number of passengers that could be accommodated as per the existing airport infrastructure. The main airport facilities that will need to be improved according to the projected passenger and aircraft demand in 2021 and 2041 are shown in Figure 79.

FIGURE 79: SILANGIT AIRPORT – INFRASTRUCTURE NEEDS

	Existing (2015)	Airport Improvement Plan 2019	Short Term (2021)	Long Term (2041)
Air Passenger Demand	17,784	NA	102,000	409,000
Aircraft landing and Take Off Demand	955 aircraft / year 2 peak hour movements	NA	2,744 aircraft / year 6 peak hour movements	8693 aircraft / year 18 peak hour movements
Runway (Lm X Wm)	2,400m x 30m Estimated Capacity: 16 movements per hour	Phase 2 Runway Capacity: 2,650m x 45m Estimated Capacity: 16 movements per hour The extended runway can cater to larger aircraft.	Runway capacity adequate	Runway capacity will be adequate as the peak can be distributed to different slots.
Parallel Taxiway	None	None	Not required	Not required
Loading Apron Requirements	Capacity: 2 aircraft stands	Capacity : 4 aircraft Narrow Body	5 aircraft stands needed in peak hour. However, demand can be spread to non peak hour time slots.	5 aircraft stands needed in peak hour. However, demand can be spread to non peak hour time slots.
Terminal Building	36,500	Planned capacity 100,000 passengers per year by 2017. Planned capacity 1 million passengers per year ultimate phase	Terminal building expansion needed by 2021.	Expansion plan for 1 million passengers not needed and subject to review.

Silangit Airport provides an alternative travel choice for visitors from Jakarta until the toll road connecting with Medan is completed.

The existing capacity and current slots of aircraft take-off and landing can be managed by the current airside infrastructure. Therefore, the runway infrastructure at Silangit Airport will be adequate in the short and long term. The planned terminal capacity expansion to 100,000 passengers is sufficient to cater for demand until 2021.

With the toll road operating in 5 years and with reduced travel time, the vast majority of visitors are expected to arrive at Medan Airport and travel by road from Medan to Parapat. Hence, the Silangit Airport will lose its significance for tourism development and the ultimate plan (Phase 2 of the Silangit Airport Improvement Plan) to expand terminal capacity to 1 million passengers may not be feasible and should be reviewed in 5-10 years' time before implementation. This will depend on the growth of its airport catchment area such as Kab. Toba Samosir, Kab. Tapanuli Utara and Kab. Humbang Hasundutan. Therefore, it cannot be assessed purely based on tourism.

14.10 SEA TRANSPORT NEEDS

14.10.1 FUTURE SEA CRUISE DEMAND

According to this market study, the Belawan Port is estimated to receive 10 and 18 cruise calls by 2021 and 2041, respectively. The average capacity per cruise call is 2,100 passengers, similar to current levels. With improvement in land transport connectivity, there is a possibility that 5% of cruise passengers will visit Lake Toba on day trips. However, this number is very small to have any significant impact on infrastructure requirements.

14.10.2 SEA TRANSPORT INVESTMENT NEEDS

Based on this assessment, the existing port infrastructure has the capacity to accommodate cruise ships with 77,441 GT that carry roughly 2,000 passengers. The existing passenger terminal facility is sufficient to accommodate 2,000 to 2,500 passengers and therefore there is no need for port facility improvements for the Port of Belawan to cater to Lake Toba tourism.

14.11 LAKE TRANSPORT NEEDS

14.11.1 FUTURE LAKE TRANSPORT PASSENGERS

Lake transport to Samosir Island is estimated based on the understanding that 90% of day visitors and 30% of VFR will visit Samosir Island.

Figure 80 shows estimated visitor flows around Lake Toba in 2021 and 2041, according to assumed visitor distribution.

FIGURE 80: VISITORS (PEAK DAY) AT LAKE TOBA PORTS

	2021		2041	
	Parapat - Samosir	Balige Samosir	Parapat - Samosir	Balige Samosir
Foreign	2,571		7,221	
Domestic	5,147	682	5,286	694
Total	7,718	682	12,507	694

14.11.2 LAKE TRANSPORT INFRASTRUCTURE NEEDS

Existing passenger boat capacity for Parapat–Samosir is around 15,000 passengers per day. Based on the above estimates, these boat services will be unable to meet the projected day-time visitors to Samosir Island in 2041, especially considering the boats are also used by local residents. For Balige, since there are no such services currently available, there is a need to make provisions for passenger boat services.

Since, the existing passenger boat services are managed by local private operators, it can be concluded that the overall needs will be addressed by these local operators based on demand. However, for visitors, it is recommended to provide hop-on hop-off electric lake boats with higher frequency services (every half an hour).

The growing number of visitors and vehicles will require improved lake port infrastructure, especially parking areas in Ajibata, Balige, and Tiagaras. As per this market study, Samosir Island should be retained as an eco-friendly destination. Hence, rather than increasing the number of RORO ferries for vehicles, the parking spaces should be expanded.

Currently, there are no proper docking facilities. Proper jetties should be developed and ferry docking facilities are needed for the maintenance of RORO ferries.

14.11.3 FUTURE LAKE CRUISE DEMAND AND INFRASTRUCTURE NEEDS

Boat trips around Lake Toba are potential leisure activities for visitors and day trippers. Boat cruises of 2 hours are proposed and run by private operators who will acquire appropriate boats. From a public investment perspective, there is a need for the construction of reception facilities in Parapat, Tuktuk and Balige.

The demand for boat cruises in Lake Toba is still limited and there is no firm evidence of strong growth potential that would justify rehabilitating and widening Tano Ponggol Canal and building a new bridge.

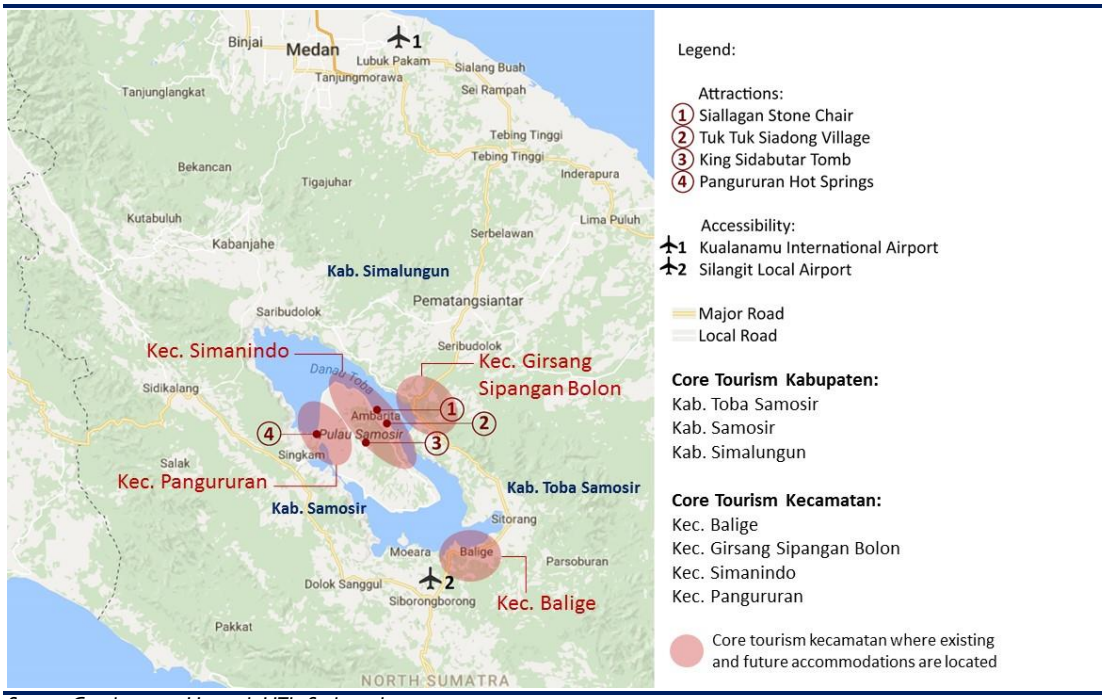
15. BASIC CAPACITY INFRASTRUCTURE (AMENITIES)

BASELINE

15.1 KEY TOURISM AREAS

The basic infrastructure assessment is conducted for key tourism Kab. of Samosir, Toba Samosir and Simalungun; with a focus on tourism Kecamatans Balige, Girsang Sipangan Bolon, Simanindo, and Pangururan (Figure 81). Considering the significance of the lake environment, the assessment of existing sanitation and wastewater is conducted for another 27 kecamatans surrounding the lake and on Samosir Island (Ajibata, Lumban Julu, Uluan, Porsea, Siantar Narumonda, Sigumpar, Laguboti, Tampahan, Harian, Nainggolan, Onan Runggu, Palipi, Ronggur Nihuta, Sianjur Mulamula, Sitiotio, Pematang Silimahuta, Silimakuta, Purba, Haranggaol Horison, Dolok Pardamean, Pematang Sidamanik, Silahisabungan, Merek, Baktiraja, Lintongnihuta, Paranginan, and Muara); meanwhile assessment of solid waste management is conducted at kabupaten level for 7 kabupaten surrounding the lake (Kab. Pakpak Bharat is excluded as it does not border the lake).

FIGURE 81: LAKE TOBA TOURISM DESTINATION AND KEY ATTRACTIONS



Source: Google maps, Horwath HTL, Surbana Jurong

15.2 WATER SUPPLY

15.2.1 EXISTING WATER SUPPLY CONDITIONS

Areas surrounding Lake Toba have abundant water resources which include water sources from Lake Toba, surface water and groundwater.

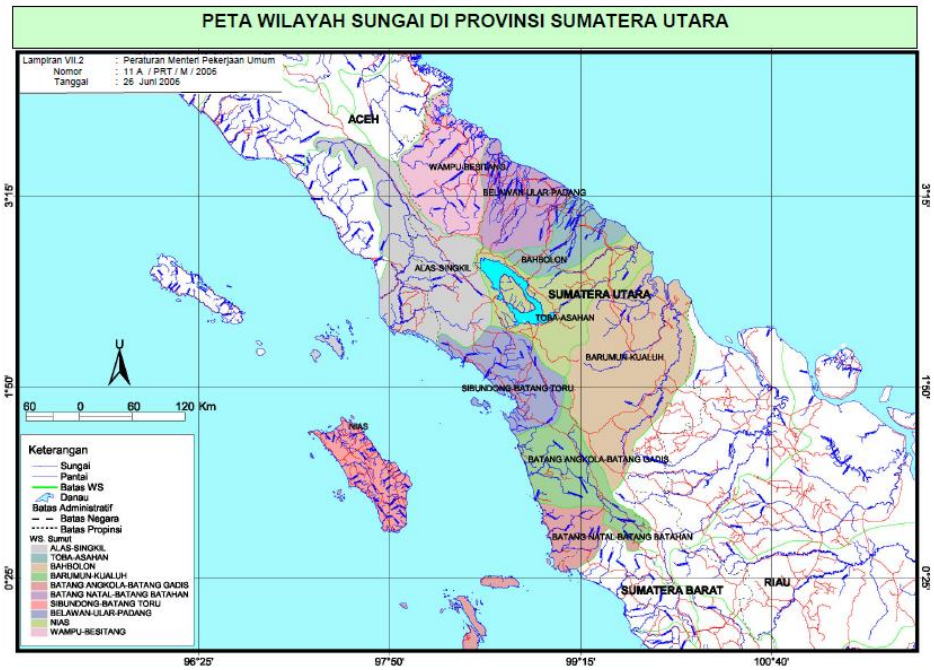
15.2.2 WATER FROM LAKE TOBA

The total available capacity of water from the lake is 120 cubic meters/s (120,000 L/s)[27]. Although the amount of water from the lake is plentiful, it has not been used extensively by the water supply company due to geological constraints and poor water quality as compared to other sources of raw water. Currently, three local PDAM (Perusahaan Daerah Air Minum, or the Regional Water Company) companies, namely PDAM Balige, PDAM Laguboti and PDAM Pangururan use the water of Lake Toba as the source of raw water.

15.2.3 SURFACE WATER (RIVER)

Surface water (mainly from the rivers) is the main source of water supply in the region. Kab. Samosir, Kab. Toba Samosir, and Kab. Simalungun are located within the water basin (Wilayah Sungai) of Toba Asahan, Bahbolon, and Belawan-Ular-Padang. Total capacity of raw water sources from these rivers is made up to 52,755 L/s (14,140 L/s from Kab. Samosir and Kab. Toba Samosir, and 38,615 L/s from Kab. Simalungun) (Figures 82 and 83).

FIGURE 82: WATER BASIN MAP OF SUMATERA UTARA



Source: Ministry of Public Works, 2006

[27] *Source: Rencana, Pengelolaan Sumber Daya Air Wilayah Sungai Toba Asahan Tahun 2015*

FIGURE 83: CAPACITY OF SURFACE WATER (RIVER) IN KAB. SAMOSIR, TOBA SAMOSIR AND SIMALUNGUN

No	Name	Capacity (L/s)
1	Aek Siarsikarsik River	1,010
2	Aek Gopgopan River	1,070
3	Aek Mandosi River	3,710
4	Aek Salak River	1,220
5	Aek Simare River	1,950
6	Aek Halian River	2,800
7	Aek Sitobu River	2,380
8	Bahapal River	46,830 (maximum) in September 30,400 (minimum) in April Average = 38,615
9	Bah Karei River	
10	Bah Biak River	
11	Bah Lombut River	
12	Bah Kasindir River	
13	Aek Silou Tuh River	
14	Bah Boluk River	
15	Bah Tongguran River	
16	Bah Bolon/ Bah Binoman River	
Total Capacity		52,755

Source: Rencana, Pengelolaan Sumber Daya Air Wilayah Sungai Toba Asahan Tahun 2015, Operational Pemantauan Alokasi Air WS Toba – Asahan, 2011

15.2.4 GROUND WATER

Kab. Samosir is located at the groundwater basin of Samosir (CAT Samosir) and Sikalang (CAT Sikalang). Kab. Toba Samosir is located at the groundwater basin of Porsea-Parapat (CAT Porsea-Parapat), whilst Kab. Simalungan is located at several groundwater basins, namely Bah Bolon, Silou, Wampu, Begadai, Asahan, Padang, Silou Tua, Ular and Bahapal. The available capacities of CAT Samosir and CAT Sikalang are 339.0 $x10^6$ m^3 and 973.0 $x10^6$ m^3, and for CAT Porsea-Prapat is 307 $x10^6$ m^3 respectively. Groundwater is used by the rural communities residing in the villages, remote areas and the hilly areas of Samosir Island.

15.2.5 COVERAGE

According to the national service standards for public works and spatial planning (SPM Permen PU 01/PRT/M/2014) sustainable water supply is defined as having access to a safe and reliable water source that can supply at least 60l/cap/day. For the key tourism areas, the higher quality SNI 3-7065-2005 standard is assumed, meaning that the population and visitors in key tourism areas should have access to sustainable piped water supply which is defined as having a house connection and 24 hours water supply at 120l/cap/day for domestic users and 250l/cap/day for visitors staying overnight.

The national statistical office (BPS) has baseline information on service provision. BPS collects this information by sample surveys and aggregate data are available at the Provincial level and sometimes at the Kabupaten/Kota level. In practice, it was not possible to arrive at a reliable baseline for water supply service provision in the key tourism areas because data were either not available or were only available at the Provincial level which is not sufficiently detailed to serve as a baseline for the tourism areas.

As a proxy, data have been collected on population connected to piped networks of water supply companies (PDAM), because these data are widely available by PDAM at Kabupaten and Kecamatan level. It should be noted however that these data should be regarded as minimum number of people served by piped water supply, because apart from PDAM many local networks exist, often community operated, that deliver sustainable water supply.

In the context of this study PDAM data as presented here should therefore not be taken as absolute figures for current water supply service levels but should be considered as an indication of variation in service levels between the several tourism areas. More detailed study at Kecamatan level is needed to arrive at a thorough baseline for each of the key tourism areas. PDAM water supply service covers 8.19% of households in Kab. Toba Samosir, 8.76% in Kab. Samosir, and 8.05% of households in Kab. Simalungun.[28]

15.2.6 ASSESSMENT OF EXISTING WATER SUPPLY INFRASTRUCTURE

The capacity of the existing raw water sources is sufficient to serve the residents of Kab. Samosir, Kab. Toba Samosir and Kab. Simalungan however the existing coverage of PDAM piped water supply is low (Figure 84). Although the percentage coverage is higher in the key tourism areas (Kec. Balige, Girsang Sipangan Bolon, and Simanindo), the conditions are still unsatisfactory.

FIGURE 84: COVERAGE OF PDAM WATER SUPPLY

Key Tourism Area	PDAM Coverage (% of households served)
Kab. Toba Samosir	8.19
Kab. Samosir	8.76
Kab. Simalungun	8.05
Kec. Balige – Balige	27.95
Kec. Girsang Sipangan Bolon – Parapat	63.29
Kec. Simanindo – Tuktuk	39.44
Kec. Pangururan	29.05

Source: BPS Toba Samosir, Samosir, and Simalungun

Residents of Samosir Island and Kab. Simalungan (especially those not served by PDAM) experience water supply shortage during dry season. Water storage tanks or reservoirs are used to store water for usage during dry seasons.

[28] *Source: Badan Pusat Statistik*

15.2.7 FUTURE PLANS FOR WATER SUPPLY

The local government has announced a few plans to improve the coverage of the piped water supply, to maximize the usage of the existing raw water capacity within the region, and to improve the quality of existing water sources. The key water improvement plans are elaborated as below:

National Spatial Plan 2016-2036 (Buku Rencana RTRW Kab. Samosir)

- Development of urban water supply systems and to further enhance efficiency.
- Increase water supply to the community through the development of water distribution networks.
- Increase in capacity / production of potable water.
- Development of new sources of raw water.

WS Toba Asahan Water Management Plan (Rancangan Rencana PSDA WS Toba Asahan) proposed by Coordination Team of Water Resources Management (TKPSDA) WS Toba Asahan

- Maintenance and recovery of Toba Asahan water catchment.
- Water Preservation: to construct a water reservoir on Samosir Island to increase water capacity by reducing the amount of water being discharged directly to the lake.
- Increase piping network by PDAM for water supply to meet MGD's (Millennium Development Goals) target: 50% by 2016, 70% by 2021, and 80% by 2031.
- Establishment of regulations for Lake Toba water usage.

The focus has been on expansion and upgrading of the water supply network which is necessary to widen the piped water coverage. Expansion of existing water treatment plants' capacities or construction of new water treatment plants are essential to ensure sufficient potable water is distributed, and shall be implemented as soon as possible. The target is to provide sustainable piped water supply to all households, hotels and restaurants in the key tourism kecamatans (Balige, Girsang Sipangan Bolon, Simanindo and Pangururan) by 2021.

The construction of water reservoirs on Samosir Island would help mitigate the problems of water shortage among the island residents, with appropriate and sufficient water storage facilities. Proposals and planning are in place in preserving and recovery of Lake Toba and Toba Asahan water catchment by the coordination team, Water Resources Management (TKPSDA) WS Toba Asahan. These are essential to safeguard the water quality of the lake and rivers, and promote a healthy living environment.

15.3 WASTEWATER AND SANITATION

15.3.1 EXISTING WASTEWATER AND SANITATION CONDITIONS

According to the national service standards for public works and spatial planning (SPM Permen PU 01/PRT/M/2014) sustainable sanitation is defined as having access to a private or a communal (MCK) toilet connected to a septic tank or to a piped sewer system with downstream treatment facilities. If population density is higher than 300 inhabitants/ha an off-site sewer system is required with centralized wastewater treatment plant. Waste water treatment facilities must meet specified technical and effluent quality standards.

The national statistical office (BPS) has baseline information on service provision. BPS collects this information by sample surveys and aggregate data are available at the Provincial level and sometimes at the Kabupaten/Kota level. In practice, it was not possible to arrive at a reliable baseline for sanitation service provision in the key tourism areas because data were either not available or were only available at the Provincial level which is not sufficiently detailed to serve as a baseline for the tourism areas.

As a proxy STBM (Sanitasi Total Berbasis Masyarakat) data have been collected, because these data are widely available up to Kecamatan level. It should be noted however that STBM data in general give a much too positive picture of current service levels because the STBM service level represents a much lesser quality than the level required in SPM Permen PU 01/PRT/M/2014. STBM's definition of adequate sanitation includes sanitation facilities which are:

1. Avoid water contamination;
2. Avoid contact between human and faeces;
3. Avoid contact between insects/ animals and faeces;
4. Not smelling unpleasant; and
5. Easy to clean.

The STBM definition actually means that all sanitation facilities are included, even pit latrines and temporary structures, and only open defecation practice is excluded. Percentage of population served as indicated by STBM data is therefore much higher than population served in accordance with SPM Permen PU 01/PRT/M/2014 service level quality. In the context of this study STBM data as presented here should therefore not be taken as absolute figures for current sanitation service levels but should be considered as an indication of variation in service levels between the several tourism areas. More detailed study at Kecamatan level is needed to arrive at a reliable baseline for each of the key tourism areas.

According to STBM data, 81.2% of households in Kabupaten Toba Samosir has access to adequate sanitation. The coverage at Kab. Samosir and Kab. Simalungun is 71.2% and 84.3%, respectively.

15.3.2 ASSESSMENT OF EXISTING WASTE WATER AND SANITATION

Coverage of adequate sanitation as defined by STBM standards is tabulated in Figures 85 and 86:

FIGURE 85: COVERAGE OF SANITATION (KEY TOURISM AREAS)

Key Tourism Areas	Adequate Sanitation (% of households equipped with/ has access to adequate sanitation)
Kab. Toba Samosir	81.18
Kab. Samosir	71.17
Kab. Simalungun	84.26
Kec. Balige – Balige	87.54
Kec. Girsang Sipangan Bolon – Parapat	87.03
Kec. Simanindo – Tuktuk	75.38
Kec. Pangururan	67.02

Source: Sanitasi Total Berbasis Masyarakat

FIGURE 86: COVERAGE OF ADEQUATE SANITATION (KECAMATAN SURROUNDING LAKE TOBA AND INSIDE SAMOSIR ISLAND)

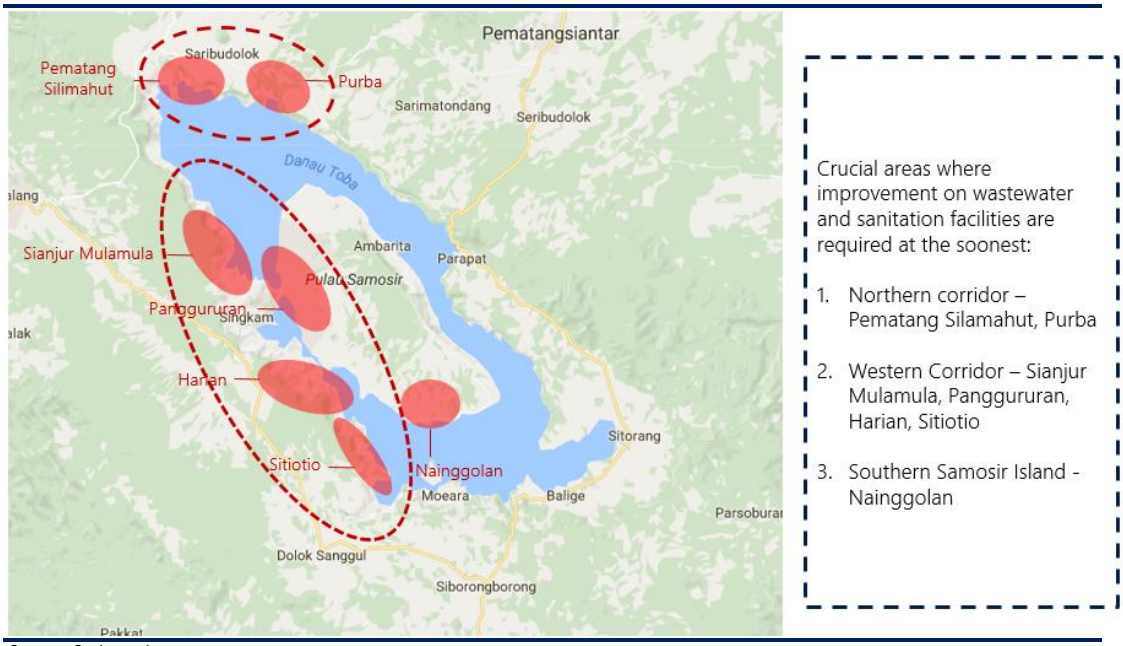
Kecamatans surrounding Lake Toba that will impact environmental health of the lake	Adequate Sanitation (% of households equipped with/ has access to adequate sanitation)
Kec. Ajibata	80.14
Kec. Lumban Julu	85.95
Kec. Uluan	76.3
Kec. Porsea	83.96
Kec. Siantar Narumonda	76.2
Kec. Sigumpar	80.67
Kec. Laguboti	84.36
Kec. Tampahan	77.2
Kec. Harian	71.41
Kec. Nainggolan	74.45
Kec. Onan Runggu	80.81
Kec. Palipi	75.07
Kec. Ronggur Nihuta	58.85
Kec. Sianjur Mulamula	62.61
Kec. Sitiotio	70.61
Kec. Pematang Silimahuta	74.99
Kec. Silimakuta	80.9
Kec. Purba	74.99
Kec. Haranggaol Horison	87.9
Kec. Dolok Pardamean	80.01
Kec. Pematang Sidamanik	79.97
Kec. Silahisabungan	92.13
Kec. Merek	89.36

Kec. Baktiraja	78.38
Kec. Lintongnihuta	80.63
Kec. Paranginan	83.29
Kec. Muara	76.42

Source: Sanitasi Total Berbasis Masyarakat

In conclusion, wastewater and sanitation facilities are not satisfactory in the key tourism areas, especially for Kec. Pangururan. As a primary tourism destination, the existing gaps must be closed at the soonest. Wastewater and sanitation conditions in all 27 kecamatans have direct impact on the water quality and environmental health of the lake. Based on STBM standards coverage of adequate sanitation varies from 59% to 92%, meaning that actual coverage is even lower with reference to the SPM Permen PU 01/PRT/M/2014 service level quality. Similarly, the existing gaps must be closed at the soonest, with a focus on the northern corridor, western corridor, and southern Samosir Island where coverage of adequate sanitation is low. This is an important approach to ease and stop pollution of Lake Toba and other water bodies within the region caused by untreated wastewater.

FIGURE 87: CRUCIAL AREAS FOR WASTEWATER AND SANITATION IMPROVEMENT



Source: Surbana Jurong

15.3.3 FUTURE PLANS FOR WASTE WATER AND SANITATION

The Government has announced several plans to improve wastewater and sanitation management within the region.

National Spatial Plan for Kab. Samosir (2016-2036) (Buku Rencana RTRW Kab. Samosir 2016-2036)

In high density and commercial areas – to introduce on-site septic tanks (communal) IPAL (*Instalasi Pengolahan Air Limbah*, or Wastewater Treatment Plant). These treatment systems are planned to be constructed at Sianjur Mula-mula, Harian, Panguruan, Onan Runggu, Ronggur Nihuta, and Tomok. These treatment plants are to be equipped with a shallow sewerage system. However, if shallow sewers cannot be implemented over the short term, an alternative is to have individual septic tanks with leach field that are centered at each kecamatan. Locations of these proposed on-site communal with IPAL are shown in Figure 88.

FIGURE 88: PROPOSED ON-SITE SEPTIC TANKS (COMMUNAL) IPAL IN SAMOSIR

Proposed On Site (Communal) IPAL

1. Sianjur Mula Mula
2. Harian
3. Pangururan
4. Onan Runggu
5. Ronggur Nihuta
6. Tomok

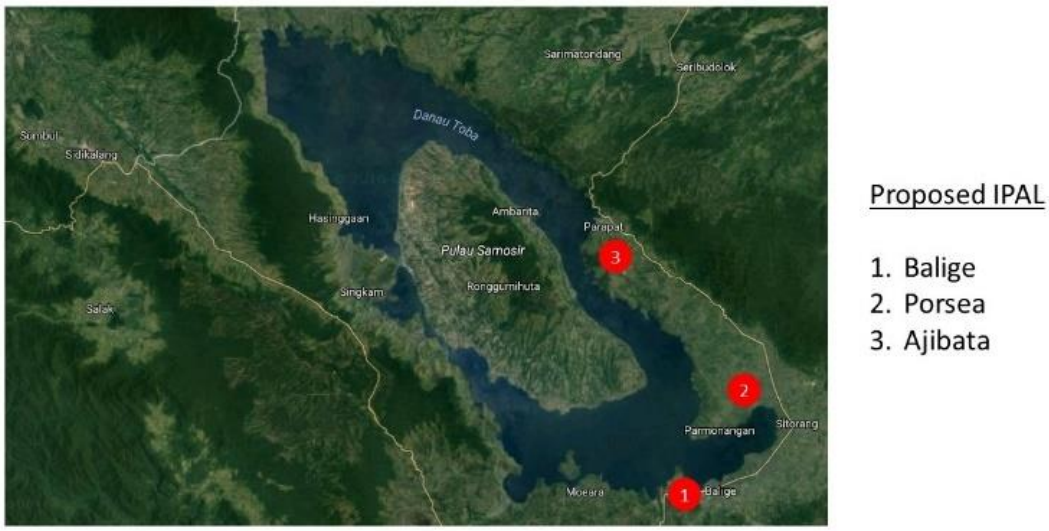
Source: Buku Rencana RTRW Kab. Samosir (2016-2036), Google Earth

In low density and irregular settlements, on-site septic tanks (with or without leach fields) should be introduced.

National Spatial Plan for Kab. Toba Samosir (2016-2036) (Buku Rencana RTRW Kab. Toba Samosir 2016-2036)

- Development of integrated and centralized wastewater treatment in industrial areas.
- Development of wastewater treatment plants (IPAL) in Balige, Porsea, and Ajibata. An assessment is in progress to determine the most suitable locations from the technical, environmental, social, and regulation perspective.
- Development of sludge treatment plants (IPLT). Assessment is in progress to determine the most suitable locations from the technical, environmental, social, and regulation perspective.
- In Kab. Simalungan, the authority is proposing a sewage treatment plant (IPLT) and to improve the sanitation facilities in the rural areas.

FIGURE 89: PROPOSED ON-SITE SEPTIC TANKS (COMMUNAL) IPAL IN KAB. TOBA SAMOSIR



Source: Buku Rencana RTRW Kab. Toba Samosir (2016-2036), Google Earth

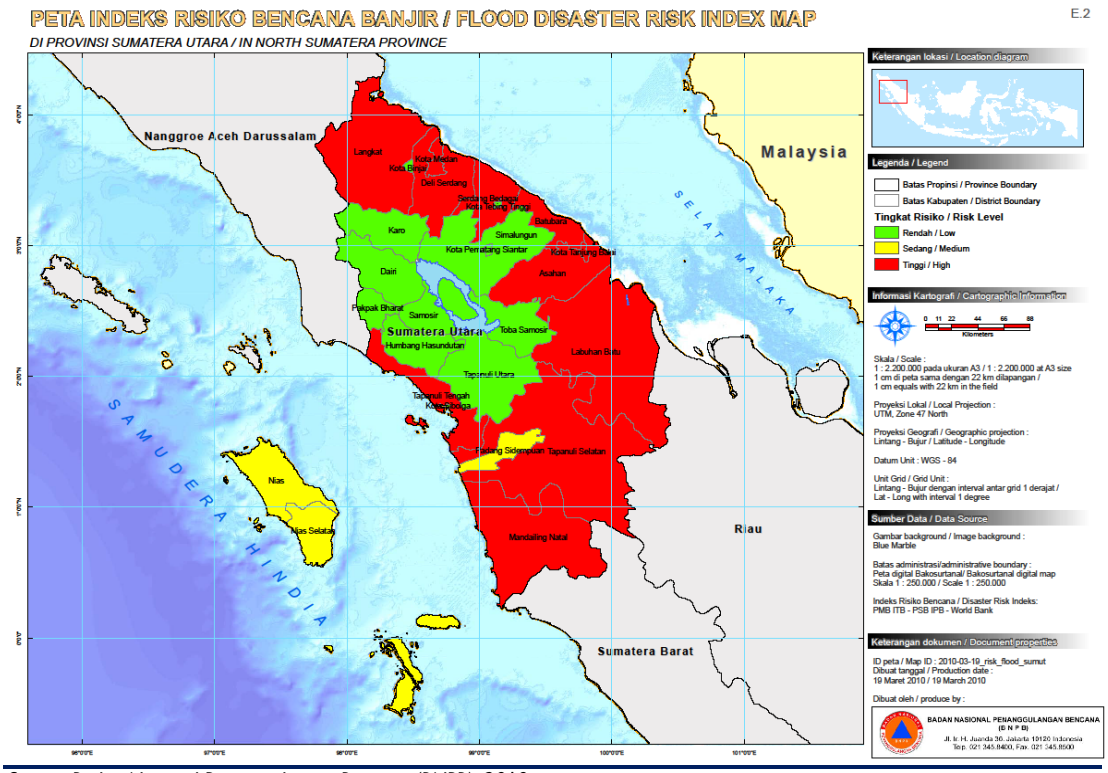
Focus has been given in providing sludge and wastewater treatment facilities to promote a more integrated and sustainable wastewater management system. This is the ultimate goal but implementation and realization of these proposals takes time. The immediate target is to close the existing gaps of inadequate sanitation, especially settlements along the lakeshore and areas surrounding the lake.

15.4 DRAINAGE

15.4.1 ASSESSMENT OF EXISTING DRAINAGE AND FLOODING ISSUE

The 7 kabupaten surrounding Lake Toba are categorized as low risk flood zones. Kab. Pakpak Bharat is excluded from examination as it does not border the lake. Areas located downstream of water catchment experience severe flooding problems. Logging activities and sedimentation of major rivers are among the main factors causing floods in the downstream areas however these flooding events do not cause direct impact on tourism activities of Lake Toba.

FIGURE 90: FLOOD DISASTER RISK INDEX MAP



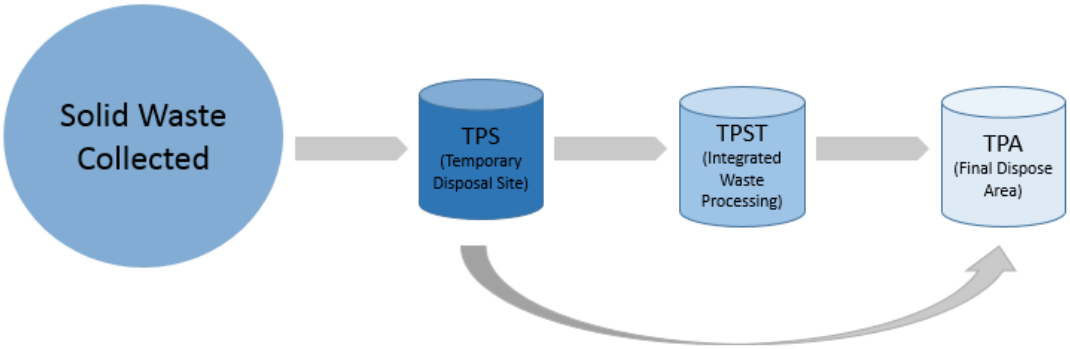
Source: Badan Nasional Penanggulangan Bencana (BNPB), 2010

15.5 SOLID WASTE INFRASTRUCTURE

15.5.1 EXISTING SOLID WASTE COLLECTION AND DISPOSAL CONDITIONS

Generally, solid waste is collected manually and transported to TPS (Tempat Pembuangan Sementara, or Temporary Disposal Site), located in residential and community centres. From the TPS, waste is transported to TPST (Tempat Pengolahan Sampah Terpadu, or Integrated Waste Processing). Most of the TPSTs are located near markets and managed by kecamatan agencies. Segregation of waste takes place at TPSTs. The remaining waste is then transported to TPA (Tempat Pembuangan Akhir, or Final Disposal Area). The procedure of solid waste collection and disposal is shown in Figure 91.

FIGURE 91: PROCEDURE OF SOLID WASTE COLLECTION AND DISPOSAL



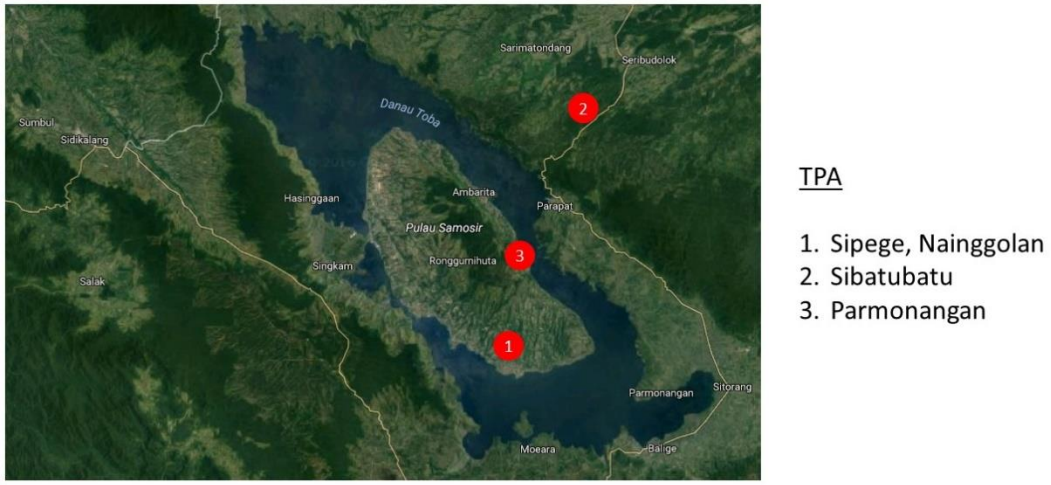
Source: RTRW, Rencana Tata Ruang Wilayah

According to the national service standards for public works and spatial planning (SPM Permen PU 01/PRT/M/2014) sustainable solid waste management is defined as having access to a solid waste collection services of at least twice a week and transport of waste collected to a transfer station or a processing unit. Solid waste management operations must be in accordance with national technical standards for management of solid waste facilities (Permen PU 03-2013) and for urban waste management techniques (SNI 19-2454-2002).

Existing service level data were collected for each of the key tourism areas at the Kabupaten/Kota level. More detailed and disaggregated data were not encountered. Note that in many Kabupaten the solid waste collection services are limited to the most densely populated and urbanized kecamatans whereas rural areas are often not yet served. More detailed study is needed at Kecamatan level to arrive at a thorough baseline for the key tourism areas.

Solid waste management (collection and disposal at designated TPA) varies among kabupaten. The percentage of coverage (households served) for Kab. Toba Samosir, Samosir, and Simalungun are 28%, 50% and 65%, respectively. Only a small percentage of the solid waste is delivered to the TPST for segregation. Most is transported directly to the TPA. Locations of the existing TPAs are shown in Figure 92. In areas where solid waste collection is unavailable, residents dispose of their waste by open burning or by indiscriminate dumping.

FIGURE 92: LOCATION OF EXISTING FINAL DISPOSED AREA (TPA)



Source: Google Earth

15.5.2 ASSESSMENT OF EXISTING SOLID WASTE INFRASTRUCTURE

Coverage of sustainable solid waste management (collection and disposal at designated TPA) is tabulated in Figure 93:

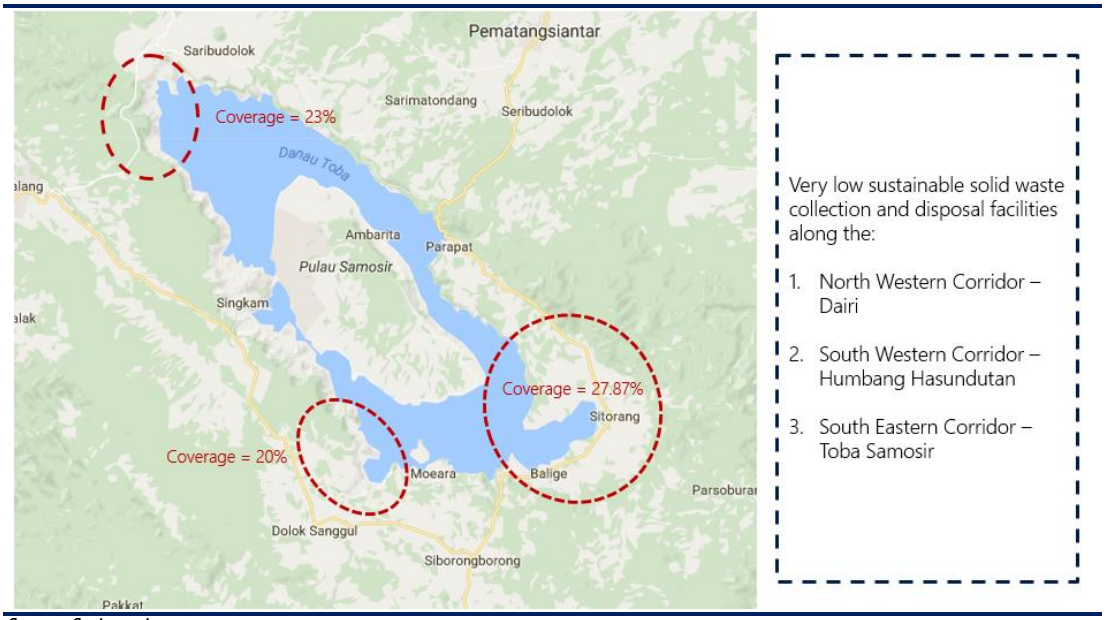
FIGURE 93: COVERAGE OF SUSTAINABLE SOLID WASTE MANAGEMENT

	Sustainable Solid Waste Management (% of households served)
Key Tourism Kab.:	
Kab. Toba Samosir	27.87
Kab. Samosir	50.00
Kab. Simalungun	65.00
Kab. surrounding Lake Toba that will impact environmental health of the lake:	
Kab. Dairi	23.00
Kab. Karo	59.63
Kab. Humbang Hasundutan	20.00
Kab. Tapanuli Utara	68.00

Source: Local authorities and Dinas Kebersihan of each Kab.

The existing solid waste management system is insufficient in the key tourism kabupaten as well as the other 4 kabupaten surrounding Lake Toba, which have environmental impact on the lake. The existing garbage collection system is unable to handle the amount of waste generated. The numbers of garbage trucks or frequency of waste collection should be increased. The existing TPAs are using open dumping methods which may potentially pollute the groundwater and surface water. Focus should be given to the north western, south western and south eastern corridors.

FIGURE 94: CRUCIAL AREAS FOR SOLID WASTE MANAGEMENT IMPROVEMENT



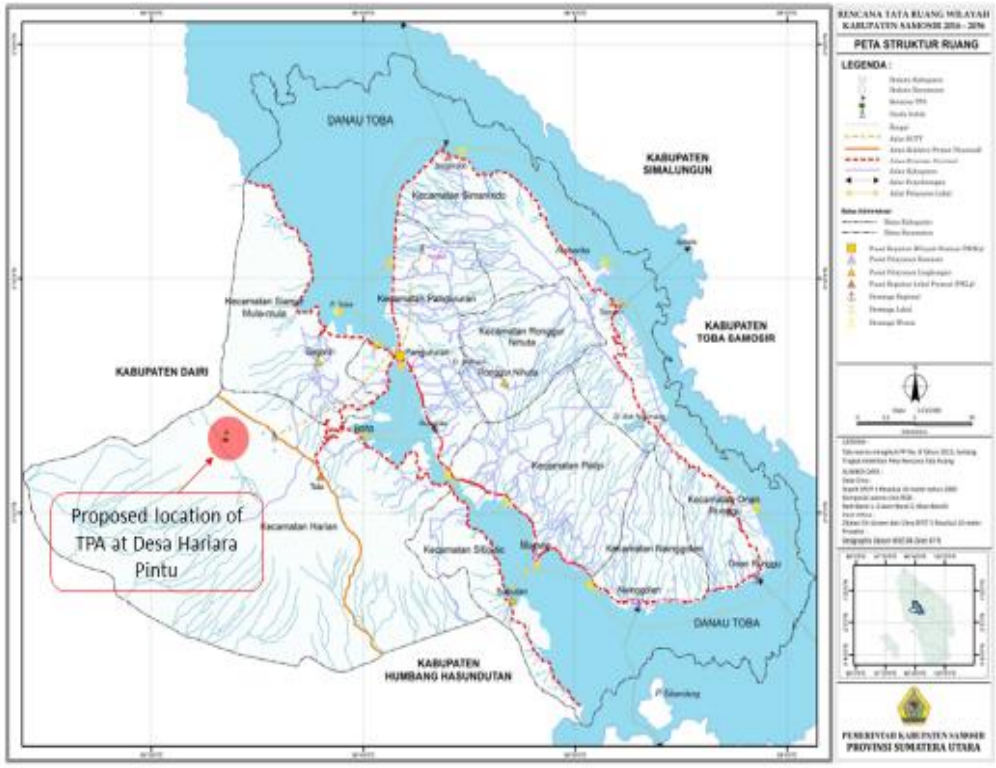
Source: Surbana Jurong

15.5.3 FUTURE PLANS FOR SOLID WASTE INFRASTRUCTURE

National Spatial Plan for Kab. Samosir (Buku Rencana RTRW Kab. Samosir 2016-2036):

- Reclamation of existing landfill sites: TPA Sipege Kecamatan Nainggolan, TPA Sibatubatu, and TPA Parmonangan.
- Development of more temporary TPS in urban areas.
- About 10ha of TPAs will be developed at Desa Hariara Pintu (Kecamatan Harian).
- Development of recycling facilities at TPST and TPA.

FIGURE 95: PROPOSED TPA AT DESA HARIAN PINTU



Source: Bencana Tata Ruang Wilayah Kab. Samosir 2016-2036

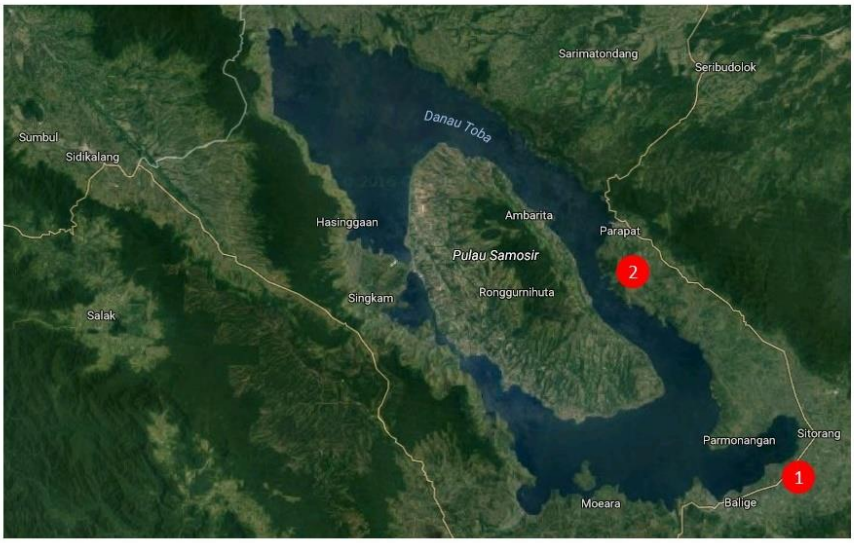
National Spatial Plan for Kab. Toba Samosir (Buku Rencana RTRW Kab. Toba Samosir 2016-2036):

- Development of TPA at Laguboti and Ajibata.
- Development of more temporary TPS.
- Development of sanitary landfill sites.

Penyusunan Revisi Tata Ruang Kab. Simalungan (Period 2011-2031):

- Development of TPAs to serve the population at Kecamatan Pamatang Raya.
- Improvement of the waste collection and transportation system.

FIGURE 96: PROPOSED TPA AT TOBA SAMOSIR



Source: Google Earth

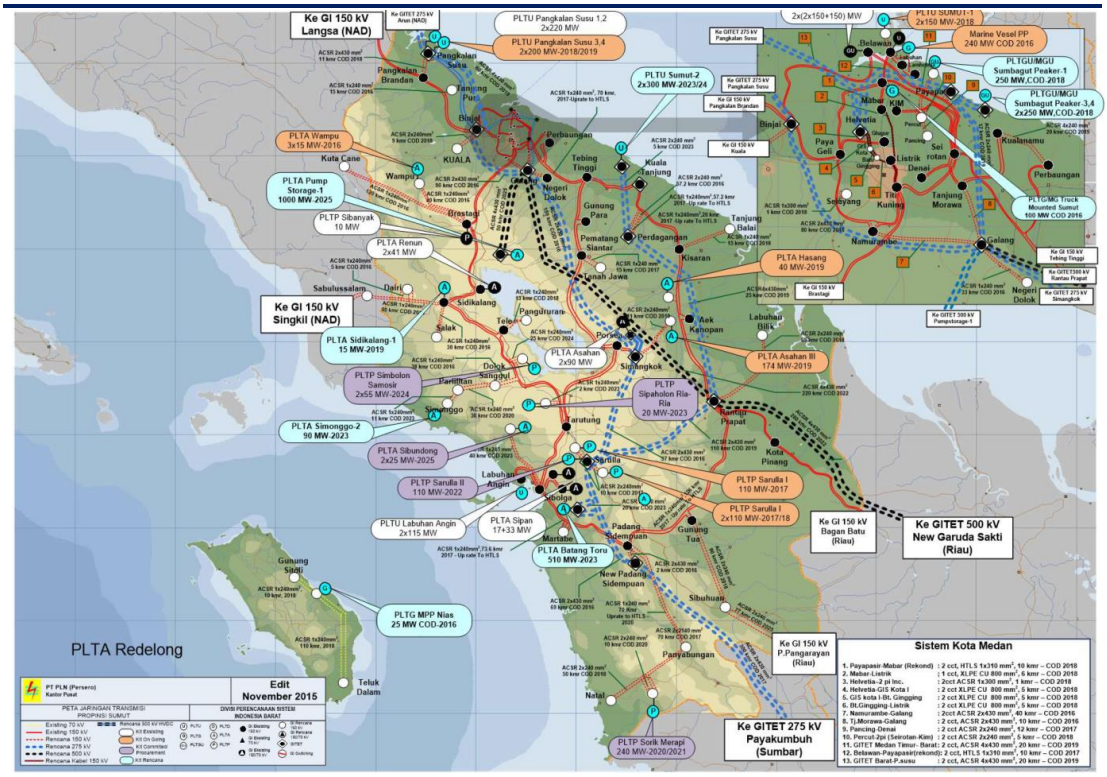
The proposed upgrading of existing TPAs and construction of new TPAs would definitely benefit the solid waste management system. The authorities also plan to upgrade the solid waste collection and transportation system however no detailed strategies or plans were made known. The immediate focus should be given to the expansion of the existing coverage of sustainable solid waste management by providing sufficient TPSs (including trash bin) and increasing the frequency of solid waste collection and transportation. This must be done at the soonest so that no solid waste ends up in the water bodies, specifically Lake Toba, irrespective of tourism development in the destination.

15.6 POWER SUPPLY

15.6.1 EXISTING POWER SUPPLY CONDITIONS

The existing power supply in Sumatera Utara is produced at the Belawan power plant, Medan power plant, Pandan power plant and the Labuhan Angin power plant. Other than that, PLN (National Power Company) also transmits electricity from Aceh to meet peak demand. Electricity produced is then transmitted through 150kV and 275kV transmission cables. Coverage of PLN power supply in the key tourism kabupaten is satisfactory, with an average of 93% (92% at Kab. Toba Samosir, 91% at Kab. Samosir, and 94% at Kab. Simalungun).

FIGURE 97: POWER SUPPLY SYSTEM IN SUMATERA UTARA



Source: RUPTL PLN 2016 – 2025

15.6.2 ASSESSMENT OF EXISTING POWER SUPPLY INFRASTRUCTURE

Existing coverage of the power supply network is tabulated in Figure 98:

FIGURE 98: COVERAGE OF POWER SUPPLY NETWORK

Key Tourism Area	PLN Coverage (% of households served)
Kab. Toba Samosir	92.28
Kab. Samosir	90.51
Kab. Simalungun	94.36
Kec. Balige – Balige	98.83
Kec. Girsang Sipangan Bolon – Parapat	94.36
Kec. Simanindo – Tuktuk	98.39
Kec. Pangururan	92.94

Source: BPS Toba Samosir, Samosir, and Simalungun

Although power outages occur in the Lake Toba region, overall performance of the power supply is satisfactory. It may not be the same in the rural areas, because existing power supply networks are concentrated at cities and urban areas. Expansion of the power network is thus necessary to supply power to residents of these rural areas.

15.6.3 FUTURE PLANS FOR POWER SUPPLY

Several plans are proposed by the authority and PLN to improve power supply conditions.

New power plants:

- PTLP Simbolon Samosir with a total capacity of 110Mw. This power plant is expected to be completed by 2024;
- PLTA Asahan III, Asahan – Tobasa with a total capacity of 174Mw;
- PLTM Parluasan with a total capacity of 4.2Mw; and
- PLTMH at Tanah Jawa, Simalungan.

PLN has identified several potential water sources that can generate power:

- 153Kw of capacity at Sitapigagan River, Desa Hasinggaan, Kecamatan Sianjur Mula-Mula;
- 19.87Kw of capacity at Bolon River, Desa Hasinggaan, Kecamatan Sianjur Mula-Mula; and
- 42Kw of capacity at Sampuran River, Desa Sosor Dolok, Kecamatan Harian.

New power plants are required to fulfil the existing demand and to support the potential growth of demand. PLN should target 100% coverage in key tourism areas (Kec. Balige, Kec. Girsang Sipangan Bolon, Kec. Simanindo and Kec. Pangururan.

15.7 TELECOMMUNICATION INFRASTRUCTURE

15.7.1 ASSESSMENT OF EXISTING TELECOMMUNICATIONS INFRASTRUCTURE

As many as 91% of households in the key tourism kabupaten (93% in Kab. Simalungun, 92% in Kab. Samosir, and 88% in Kab. Toda Samosir)[29] have no access to internet service. Although coverage of households with internet access is low, there is no major issue with regards to the telecommunication infrastructure in the Destination. Tourism attractions and key tourism areas are well covered by sufficient mobile signals.

The Government's expansion plan was not known by our interviewees. Most of the BTS and telecom towers are owned by telecom companies and as long as there are potential new subscribers, the telecom companies are willing to invest and set up new BTS and telecom towers to widen their coverage and improve their service.

15.8 SUMMARY OF EXISTING BASIC INFRASTRUCTURE

A summary of existing coverage and gap of basic infrastructure in Lake Toba is tabulated in Figure 99.

[29] *Source: Population Census 2010, World Bank*

FIGURE 99: SUMMARY OF EXISTING BASIC INFRASTRUCTURE ASSESSMENT

Infrastructure		Existing Coverage (%)	Existing Gap (%)	Remarks
Water Supply (households served by PDAM)	Kab. Toba Samosir	8.19	91.81	Low coverage at key tourism kabupaten. Relatively higher coverage in key tourism kecamatan, but still unsatisfactory, especially at Kec. Balige, Kec. Simanindo, and Kec. Pangururan. Note that actual current coverage is higher because non-PDAM piped supply is not captured in the baseline.
	Kab. Samosir	8.76	91.24	
	Kab. Simalungun	8.05	91.95	
	Kec. Balige	27.95	72.05	
	Kec. Girsang Sipangan Bolon	63.29	36.71	
	Kec. Simanindo	39.44	60.56	
	Kec. Pangururan	29.05	70.95	
Wastewater and Sanitation (households with access to STBM standard sanitation)	Kab. Toba Samosir	81.18	18.82	Note that actual current sanitation coverage is lower because STBM standards are inferior to national standard SPM Permen PU 01/PRT/M/2014. Existing gap has to be closed at the soonest at key tourism kecamatan and the kecamatan surrounding Lake Toba to reduce and mitigate pollution of Lake Toba caused by untreated wastewater.
	Kab. Samosir	71.17	28.83	
	Kab. Simalungun	84.26	15.74	
	Kec. Balige	87.54	12.46	
	Kec. Girsang Sipangan Bolon	87.03	12.97	
	Kec. Simanindo	75.38	24.62	
	Kec. Pangururan	67.02	32.98	
Drainage	All the 7 kabupaten surrounding Lake Toba (including Samosir Island) are categorized as low risk flood zones.			No direct and major impact on tourism activities of Lake Toba.
Solid Waste (households served with sustainable solid waste facilities)	Kab. Toba Samosir	27.87	72.13	Existing gap has to be closed at the soonest at key tourism kecamatan and all the kecamatan surrounding Lake Toba to reduce and mitigate pollution of Lake Toba caused by garbage.
	Kab. Samosir	50	50	
	Kab. Simalungun	65	35	

Infrastructure		Existing Coverage (%)	Existing Gap (%)	Remarks
Power Supply (households served by PLN)	Kab. Toba Samosir	92.28	7.72	Satisfactory coverage at key tourism kabupaten. Relatively higher coverage at key tourism kecamatan, should aim for 100% coverage.
	Kab. Samosir	90.51	9.49	
	Kab. Simalungun	94.36	5.64	
	Kec. Balige	98.83	1.17	
	Kec. Girsang Sipangan Bolon	94.36	5.64	
	Kec. Simanindo	98.39	1.61	
	Kec. Pangururan	92.94	7.06	
Telecommunication	No major problem with the existing coverage of telecommunication facilities in Lake Toba. Key tourism areas are well covered with mobile signals.			

Most residential settlements are concentrated in areas surrounding Lake Toba. Tourism attractions and activities are also focused and very much built upon the lake. Therefore, preservation of water bodies is crucial not only to protect the natural beauty of Lake Toba, but also to attract more visitors, and more importantly, to promote healthy living conditions of the local people.

Lake Toba is one of the most polluted lakes in Indonesia. A water quality survey was carried out by the environmental agency (Badan Lingkungan Hidup, BLH) to investigate the water quality of Lake Toba. Twenty three water samples were taken from different locations of the lake and they revealed that the water quality is at the status of "medium polluted" (cemar sedang)[30]. Among pollutants in Lake Toba are domestic waste, shipping fuel, waste from small industries and livestock farming. Deforestation due to illegal logging and agricultural activities have also caused erosion and led to pollution of Lake Toba. Hence, proper water treatment should be carried out. Residents should not be encouraged to consume water from the lake without any treatment.

Wastewater management is very important. Untreated wastewater is often discharged directly to the lake and water bodies, hence causing contamination and pollution to the environment. Wastewater may also seep into the ground and pollute the groundwater. The existing gap (households without adequate sanitation) has to be closed urgently. Focus should be given particularly to the settlements along the lakefront on Samosir Island and surrounding Lake Toba, where wastewater discharge from these settlements have direct impact on the lake. Improvement of water supply services will only be meaningful when the quality of water sources is safe.

Although raw water sources are sufficient in the region, potable water supply service is low. Hence, it is recommended to improve the water supply systems by i) increasing the numbers of water treatment plants, ii) expanding the existing water supply network, and iii) increasing the water storage facilities to cater for water usage during the dry season.

Solid waste management facilities are in place in Kab. Samosir, Toba Samosir, and Simalungan. However, these facilities are unable to handle the increasing waste generated. The number of temporary disposal sites and frequency of waste collection must be increased urgently. Planned upgrading and improvement works by the authorities should be implemented.

The power supply coverage is satisfactory in the key tourism areas; however, it should be expanded to serve the rural communities. Construction of new power plants with new sources of energy already identified by the authorities should be implemented to support future power demand.

[30] *Source: Pengelolaan Sumber Daya Air Wilayah Sungai Toba Asahan*

Key tourism areas in Lake Toba are well covered by mobile signals. Although telecommunication facility is generally controlled by the private sectors, the authorities should take initiative to invite more private investment.

All kabupaten surrounding Lake Toba are categorized as low risk flood zone. There is no direct and major impact of flooding events on tourism activities in Lake Toba.

BASIC CAPACITY INFRASTRUCTURE INVESTMENT NEEDS

15.9 FORECAST POPULATION & VISITOR ARRIVALS

Basic infrastructure analyses are carried out for the short and long term with reference to the projected population and visitor arrivals as shown in Figures 100 to 102.

The population growth for each kabupaten is based on the growth rate produced by BPS at Province level.

FIGURE 100: FORECAST OF POPULATION

Key Tourism Kab.	2015	2021	2041
Kab. Toba Samosir	179,704	192,417	205,255
Kab. Samosir	123,789	134,227	143,183
Kab. Simalungun	849,405	973,446	1,038,396

Source: HHTL

The distribution of visitors staying at family & relatives by kabupaten is proportionate to the residential population distribution.

The forecast of VFR visitors is presented in the Demand Forecast.

The peak day visitors are estimated at three times the average number of visitors per day.

FIGURE 101: FORECAST OF PEAK DAY VISITORS STAYING AT FAMILY & RELATIVES (VFR)

	2015	2021	2041
Kab. Toba Samsosir	1,387	1,505	1,875
Kab. Samosir	6,577	7,949	12,263
Kab. Simalungun	6,558	7,116	8,862
Total	14,522	16,570	23,000

* estimated 90% of total day trip visitors are visiting Samosir Island, and remaining 10% to Kab. Toba Samosir and Simalungun

Source: HHTL

Visitors staying in commercial accommodation are assumed to be distributed in accordance with the existing and the recommended location for new accommodation (Figure 34):

FIGURE 102: FORECAST OF COMMERCIAL ROOMS REQUIRED

	2015	Scenario 1**		Scenario 2***	
		2021	2041	2021	2041
Kab. Samosir	2,751	4,616	8,480	1,154	2,120
Kab. Toba Samosir	525	-	-	-	-
Kab. Simalungun	2,314	1,154	2,120	4,616	8,480
Total	5,590	5,770	10,600	5,770	10,600

** Scenario 1 = 80% of future commercial rooms is located in Kab. Samosir, while remaining 20% located in Kab. Simalungun
*** Scenario 2 = 20% of future commercial rooms is located in Kab. Samosir, while remaining 80% located in Kab. Simalungun

Guest per room = 1.9

Source: HHTL

Basic infrastructure demand projections are carried out based on the projected population in the key tourism kabupaten (Kab. Toba Samosir, Kab. Samosir and Kab. Simalungun), and the number of visitor arrivals (VFR, day visitors, and overnight guests staying in commercial accommodation). As for the basic infrastructure demand of overnight guests staying in commercial accommodation, projections are executed for two (2) scenarios as explained in Figure 102 above.

Basic Infrastructure Demand Projection =

Domestic Demand (Population) + Visitor Demand (VFR* + Commercial Accommodation**)

* VFR = Day Trip Visitor + Visitors staying at friends and relatives
** Commercial Accommodation = Overnight guest staying at commercial accommodation

15.10 WATER SUPPLY

15.10.1 FUTURE DEMAND

With reference to the projected population and visitor arrivals and water consumption rates (as shown in Figure 105), water demand forecasts are tabulated in Figures 103 to 105. Note that these projections represent maximum requirements assuming that all piped water supply would be provided by PDAM. In reality, many non-PDAM local piped water supply networks exist, often community operated, that deliver sustainable water supply.

FIGURE 103: WATER DEMAND PROJECTION (L/S)

			2015			Scenario 1		Scenario 2	
			Demand	Served by PDAM	Not Served by PDAM	2021	2041	2021	2041
Domestic	Kab. Toba Samosir		208	17	191	267	285	267	285
	Kab. Samosir		143	12	132	186	199	186	199
	Kab. Simalungun		983	81	903	1,352	1,442	1,352	1,442
Visitor	VFR + day visitors	Kab. Toba Samosir	1	0	1	2	2	2	2
		Kab. Samosir	6	1	6	10	15	10	15
		Kab. Simalungun	6	1	6	9	11	9	11
	Commercial Accommodation	Kab. Samosir	12	1	11	25	47	18	18
		Kab. Toba Samosir	2	0	2	3	3	3	3
		Kab. Simalungun	10	1	9	13	13	25	47
Total			1,373	113	1,261	1,867	2,016	1,872	2,022

Source: Surbana Jurong

Figure 103 above showcases estimated water demand (L/s) by different categories of consumers in 2015 (with amount of water served and not served by PDAM). Projected water demand by different categories of consumers in 2021 and 2041 are also presented for both scenarios. A summary of the existing and projected water demand for each of the key tourism kabupaten are tabulated in Figure 104; while the ratio of estimated water demand to support tourism activities with respect to overall demand is shown in Figure 105.

FIGURE 104: SUMMARY OF WATER DEMAND PROJECTION (L/S)

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Kab. Toba Samosir	212	272	290	272	290
Kab. Samosir	162	221	260	214	232
Kab. Simalungun	1,000	1,373	1,466	1,386	1,500
Total	1,373	1,867	2,016	1,872	2,022

Source: Surbana Jurong

FIGURE 105: ESTIMATED WATER DEMAND RATIO

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Domestic	1,334	1,806	1,926	1,806	1,926
Visitor	39	61	90	67	96
% of visitor / total	2.83%	3.28%	4.48%	3.57%	4.74%

Source: Surbana Jurong

Key Assumptions:

The average water demand for the study area is estimated by using unit water demand per capita for local residents and visitors. The SNI 3-7065-2005 standard has been used, meaning that the population and visitors should have access to sustainable piped water supply which is defined as having a house connection and 24 hours water supply at 120l/cap/day for domestic users and 250l/cap/day for visitors staying overnight. The adopted water consumption rate in lpcd (liters per capita per day) for residents and visitors are tabulated in Figure 106. The projected water demand is then converted to L/s (litres per second). The unit rates of water consumption for different usages are expected to increase by 20% - 25% in 2021 due to an upturn in living standards and water accessibility; and then remain constant to 2041, considering sufficient water conservation approaches and awareness among residents. [31]

FIGURE 106: WATER CONSUMPTION RATE

Type of Usage		Unit Rate (lpcd)		
		2015	2021	2041
Domestic		100	120	120
Visitor	VFR	85	105	105
	Commercial Accommodation	200	250	250

[31] *Reference: IS - 1172 (1993) - Code of Basic Requirements for Water Supply, Drainage and Sanitation, De Stefano, L. Freshwater and Tourism in the Mediterranean. 2004. American Water Works Association Research Foundation, "Residential End Uses of Water", 1999.*

Based on the above considerations, total existing water demand is forecast to be 1,400 L/s for Kab. Toba Samosir, Kab. Samosir, and Kab. Simalungun. From total demand, only 8.2% are provided by piped water supply. Water demand in 2021 and 2041 is estimated to be about 270 L/s and 290 L/s in Kab. Toba Samosir, 220 L/s and 250 L/s in Kab. Samosir, and 1,400 L/s and 1,500 L/s in Kab. Simalungun, respectively. The total water demand at the key tourism kabupaten of Lake Toba is estimated to be 1,900 L/s in 2021, and 2,100 L/s in 2041. Existing water demand for tourism activities is about 3% of the overall water demand, and forecast to increase to about 4% in 2021, and about 5% in 2041.

15.10.2 WATER SUPPLY INFRASTRUCTURE NEEDS

Existing raw surface water sources available at water catchments of Lake Toba region are about 45,000 L/s. Assuming full production of raw water capacity, 33% water loss during distribution and the sharing of raw water sources with other kabupaten about 15,000 L/s of water is available to serve the key tourism kabupaten (Kab. Toba Samosir, Kab. Samosir, and Kab. Simalungun). It is assumed that water loss in Indonesia will be reduced to 20% by 2021 and 10% by 2041. With such assumptions, the available capacity of water deliverable to the key tourism kabupaten will be increased to 18,000 L/s in 2021 and 20,000 L/s in 2041 (Figures 107 and 108).

FIGURE 107: ESTIMATED CAPACITY OF WATER SUPPLY

	Existing	2021	2041
Raw Water Source (L/s) [1]	45,000	45,000	45,000
Water Loss [2]	~33%	To reduce to 20%	To reduce to 10%
Total Water Supply Capacity [3]	30,000	36,000	40,000
Water Supply Capacity (L/s) for Kab. Toba Samosir, Samosir & Simalungun [4]	15,000	18,000	20,000

Source: Surbana Jurong

[1] *Capacity of surface water (excluding water from Lake Toba) is taken, since water from the lake is not the main source of water supply according to DG Sumber Daya Air*

[2] *Water lost during distribution*

[3] *Total water supply capacity, assuming full utilization/ production from the available raw water source, and water loss of 33% (existing), 20% (2021), 10% (2041)*

[4] *Water supply capacity to serve key tourism kabupaten, assuming half of total water supply capacity*

FIGURE 108: COMPARISON OF WATER DEMAND AND WATER SUPPLY CAPACITY AT KEY TOURISM KAB.

Estimated Water Demand	Existing		2021			2041		
	Demand (L/s)	Water Supply Capacity	Scenario 1 Demand (L/s)	Scenario 2 Demand (L/s)	Water Supply Capacity	Scenario 1 Demand (L/s)	Scenario 2 Demand (L/s)	Water Supply Capacity
Domestic	1,334	15,000	1,806	1,806	18,000	1,926	1,926	20,000
Visitor	39		61	67		90	96	
Total	1,373		1,867	1,872		2,016	2,022	

Source: Surbana Jurong

As can be seen from Figures 107 and 108 that there are no major concerns with regards to the availability of raw water sources to fulfil water demand.

Short Term Recommendations (2021)

- 100% piped water coverage in the key tourism kecamatan.
- For the key tourism areas, the higher quality SNI 3-7065-2005 standard is assumed, meaning that the population and visitors in key tourism areas should have access to sustainable piped water supply which is defined as having a house connection and 24 hours water supply at 120l/cap/day for domestic users and 250l/cap/day for visitors staying overnight.
- Expansion of existing water supply networks and construction of new networks to meet the above mentioned targets.
- Expansion of existing water treatment plants (if there is room for expansion) or construction of new water treatment facilities to utilize the existing water sources available. Available capacity of the surface water and groundwater should be utilized to meet water demands.
- Existing water storage facilities which are damaged (Embung Hairi Gorat, Embung A.Porokan) should be repaired or replaced by building new water storage facilities.
- Effective and necessary efforts should be put in place to reduce water loss to 20%.

Long Term Recommendations (2041)

- Construction of new water treatment plant(s) to produce potable water from the existing and identified water sources will be needed. A feasibility study should be carried out to consider prioritizing the raw water from the lake due to its high capacity and location near to the settlements and hotels surrounding the lake. Shorter water supply networks will be required. Other than that, the quality of water from Lake Toba will be improved once the Government's water restoration proposals are implemented. Currently, surface water (rivers) is the main source of potable water production.
- Expansion of existing water supply networks and the construction of networks to serve the potential growth of population and visitor arrivals.
- Effective and necessary efforts should be made to reduce water loss to 10%.
- Construction of water storage facilities for usage during the dry season, particularly on Samosir Island.

15.11 WASTEWATER AND SANITATION

15.11.1 FUTURE DEMAND

With reference to the projected population and visitor arrivals, the forecast sewage generation is tabulated in Figures 109 to 111. Sewage generation is assumed at 80% of water supplied. Note that current coverage of adequate sanitation in this analysis relates to STBM standards. Actual current sustainable sanitation coverage is lower because STBM quality standards are inferior to national standard SPM Permen PU 01/PRT/M/2014.

FIGURE 109: SEWAGE GENERATION PROJECTION (L/S)

			2015			Scenario 1		Scenario 2	
			Demand	Adequate Sanitation	Inadequate Sanitation	2021	2041	2021	2041
Domestic	Kab. Toba Samosir		166	135	31	214	228	214	228
	Kab. Samosir		115	82	33	149	159	149	159
	Kab. Simalungun		786	663	124	1,082	1,154	1,082	1,154
Visitor	VFR	Kab. Toba Samosir	1	1	0	1	2	1	2
		Kab. Samosir	5	4	1	8	12	8	12
		Kab. Simalungun	5	4	1	7	9	7	9
	Commercial Accommodation	Kab. Samosir	10	10	-	20	37	15	15
		Kab. Toba Samosir	2	2	-	2	2	2	2
		Kab. Simalungun	8	8	-	10	10	20	37
Total			1,099	908	191	1,493	1,613	1,498	1,618

Source: Surbana Jurong

Figure 109 above showcases estimated sewage generation (L/s) by different categories of consumers in 2015 (with the amount of adequate and inadequate sanitation as per STBM standards). Projected sewage generation by different categories of consumers in 2021 and 2041 are also presented for both scenarios. The summary of existing and projected sewage generation for each of the key tourism kabupaten are tabulated in Figure 110, while the ratio of estimated sewage generation from tourism activities with respect to overall generation is shown in Figure 111.

FIGURE 110: SUMMARY OF SEWAGE GENERATION PROJECTION (L/S)

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Kab. Toba Samosir	169	218	232	218	232
Kab. Samosir	129	177	208	172	186
Kab. Simalungun	800	1,099	1,173	1,109	1,200
Total	1,099	1,493	1,613	1,498	1,618

Source: Surbana Jurong

FIGURE 111: ESTIMATED SEWAGE GENERATION RATIO

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Domestic	1,068	1,445	1,541	1,445	1,541
Visitor	31	49	72	53	77
% of visitor / total	2.83%	3.28%	4.48%	3.57%	4.74%

Source: Surbana Jurong

The total current sewage generation is estimated to be 1,100 L/s for Kabupaten Toba Samosir, Samosir, and Simalungun combined. From the total generated sewage 82.6% is discharged and managed by STBM standard sanitation facilities. Sewage generation in 2021 and 2041 is forecast to be about 220 L/s and 240 L/s, respectively, for Kab. Toba Samosir, 180 L/s and 200 L/s for Kab. Samosir, and 1,100 L/s and 1,200 L/s for Kab. Simalungun. Total sewage generation from the key tourism kabupaten of Lake Toba is estimated to be 1,500 L/s in 2021, and 1,600 L/s in 2041. Current sewage generation from visitors is about 3% of the overall sewage generation, and is estimated to increase to about 4% in 2021, and 5% by 2041.

15.11.2 WASTEWATER AND SANITATION INFRASTRUCTURE NEEDS

As the lake itself is Lake Toba's main attraction, it is crucial that adequate sanitation and wastewater treatment facilities are provided so that the water quality of Lake Toba can be preserved.

As such, the following key projects for wastewater and sanitation infrastructure are recommended for the short term (2021):

- 100% coverage of sustainable sanitation in all kecamatans that impact the environmental health of the lake (4 key tourism kecamatan – Kec. Balige, Girsang Sipangan Bolon, Simanindo and Pangururan plus 27 other kecamatan surrounding Lake Toba);
- In accordance with the national service standards for public works and spatial planning (SPM Permen PU 01/PRT/M/2014) sustainable sanitation is defined as having access to a private or a communal (MCK) toilet connected to a septic tank or to a piped sewer system with downstream treatment facilities. If population density is higher than 300 inhabitants/ha an off-site sewer system is required with centralized wastewater treatment plant. Waste water treatment facilities must meet specified technical and effluent quality standards.
- Installation of sufficient numbers of septic tanks in residential areas in the key tourism kecamatans;
- Small scale wastewater treatment plants are recommended at the hotels/ resorts; and
- Public toilet and sanitation facilities should be provided at tourism sites.

Recommendations for the long term (2041) are as below:

- 100% coverage of sustainable sanitation as per SPM Permen PU 01/PRT/M/2014 standard in all the kabupaten that impact the environmental health of the lake (3 key tourism kabupaten – Kab. Toba Samosir, Samosir, and Simalungun, and 4 other kabupaten surrounding Lake Toba – Kab. Dairi, Karo, Humbang Hasundutan, and Tapanuli Utara); and
- Development of integrated sewage treatment facilities, including sewage treatment plants and sewerage networks in all the kecamatans surrounding Lake Toba.

15.12 DRAINAGE

15.12.1 DRAINAGE INFRASTRUCTURE NEEDS

There is no major issue with regards to the drainage system and flooding events in the key tourism areas of Lake Toba. Maintenance and upgrading the existing drainage systems is necessary as more developments are expected. It should be planned and designed in accordance with the regional master plan.

15.13 SOLID WASTE INFRASTRUCTURE

15.13.1 FUTURE DEMAND

With reference to the projected population and visitor arrivals, and rate of solid waste generation (as shown in Figure 114), the forecast solid waste generation is tabulated in Figures 112 to 114:

FIGURE 112: SOLID WASTE GENERATION PROJECTION (L/DAY)

			2015			Scenario 1		Scenario 2	
			Demand	Sustainable Management	Unsustainable Management	2021	2041	2021	2041
Domestic	Kab. Toba Samosir		404,334	112,688	291,646	432,938	554,189	432,938	554,189
	Kab. Samosir		278,525	139,263	139,263	302,011	386,594	302,011	386,594
	Kab. Simalungun		1,911,161	1,242,255	668,906	2,190,254	2,803,669	2,190,254	2,803,669
Visitor	VFR (staying at family & friends + day visitors)	Kab. Toba Samosir	2,220	619	1,601	2,409	3,600	2,409	3,600
		Kab. Samosir	10,523	5,261	5,261	12,718	23,546	12,718	23,546
		Kab. Simalungun	10,493	6,820	3,672	11,385	17,015	11,385	17,015
	Commercial Accommodation	Kab. Samosir	18,317	9,158	9,158	30,735	67,757	22,222	26,666
		Kab. Toba Samosir	3,494	974	2,520	3,494	4,193	3,494	4,193
		Kab. Simalungun	15,410	10,017	5,394	15,410	18,492	30,735	67,757
Total			2,654,477	1,527,054	1,127,422	3,001,354	3,879,053	3,008,165	3,887,227

Source: Surbana Jurong

Figure 112 above showcases estimated solid waste generation (L/day) by different categories of consumers in 2015 (with amount of sustainable and unsustainable management). Projected solid waste generation by different categories of consumers in 2021 and 2041 is presented for both scenarios and the summary of existing and projected solid waste generation for each of the key tourism kabupaten are tabulated in Figure 113. The ratio of estimated solid waste generation from tourism activities with respect to overall generation is shown in Figure 114.

FIGURE 113: SUMMARY OF SOLID WASTE GENERATION PROJECTION (L/DAY)

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Kab. Toba Samosir	410,048	438,841	561,981	438,841	561,981
Kab. Samosir	307,365	345,464	477,896	336,950	436,806
Kab. Simalungun	1,937,064	2,217,049	2,839,176	2,232,374	2,888,440
Total	2,654,477	3,001,354	3,879,053	3,008,165	3,887,227

Source: Surbana Jurong

FIGURE 114: ESTIMATED SOLID WASTE GENERATION RATIO

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Domestic	2,594,021	2,925,203	3,744,452	2,925,203	3,744,452
Visitor	60,456	76,151	134,601	82,963	142,775
% of visitor / total	2.28%	2.54%	3.47%	2.76%	3.67%

Source: Surbana Jurong

15.13.2 KEY ASSUMPTIONS:

The average solid waste generation for the study area is estimated by using solid waste generation unit rates per capita for local residents and visitors. The adopted rate in L/c/d (litres per capita per day) for residents and visitors is tabulated in Figure 115. It is forecast that there will be no changes in unit rate of solid waste generation over the short term (2021), but it will increase by 20% in the longer term (2041).

FIGURE 115: RATE OF SOLID WASTE GENERATION[32]

Type of Usage		Unit Rate (L/capita/day)		
		2015	2021	2041
Domestic		2.25	2.25	2.7
Visitor	VFR	1.6	1.6	1.92
	Commercial Accommodation	3.5	3.5	4.2

[32] *Reference: Standard for Setting of Town Environmental Sanitation Facilities, China and Ministry of the Environment and Water Resources, Singapore, Kosuke. K, Tomohiro. T. Revisiting Estimates of Municipal Solid Wastes Generation per Capita and Their Reliability, 2015.*

Our analysis shows that total solid waste generation in 2015 is forecast to be 411,000 L/day in Kab. Toba Samosir, 308,000 L/day in Kab. Samosir, and 1,938,000 L/day in Kab. Simalungun. From the total solid waste generated, only 57.5% is collected and disposed at the designated TPAs. Solid waste generation in 2021 and 2041 is estimated to be about 439,000 L/day and 562,000 L/day in Kab. Toba Samosir, 342,000 L/day and 458,000 L/day in Kab. Samosir, and 2,225,000 L/day and 2,864,000 L/day in Kab. Simalungun. Total solid waste generation in the key tourism kabupaten of Lake Toba is estimated to be 3,005,000 L/day in 2021 and 3,884,000 L/day in 2041. Existing solid waste generated from tourism activities is about 3% of the overall generation, and estimated to remain at 3% in 2021, and increase slightly to 4% in 2041.

15.13.3 SOLID WASTE INFRASTRUCTURE NEEDS

Sustainable solid waste management services shall be made available in all key tourism areas. According to the national service standards for public works and spatial planning (SPM Permen PU 01/PRT/M/2014) sustainable solid waste management is defined as having access to a solid waste collection services of at least twice a week and transport of waste collected to a transfer station or a processing unit. Solid waste management operations must be in accordance with national technical standards for management of solid waste facilities (Permen PU 03-2013) and for urban waste management techniques (SNI 19-2454-2002).

As such, the following solid waste infrastructure projects are recommended for the short term (2021):

- 100% sustainable solid waste management (collection and disposal at designated TPAs) in all the kecamatans that impact the environmental health of the lake (4 key tourism kecamatans – Kec. Balige, Girsang Sipangan Bolon, Simanindo, and Pangururan, and 27 other kecamatans surrounding Lake Toba);
- Allocation of sufficient numbers of Temporary Disposal Sites (TPS);
- Increase in the capacity of trash trucks and frequency of collection is needed;
- Education and enforcement is needed to create awareness among the residents of the importance of solid waste management and to forbid them from disposing rubbish into the water bodies; and
- Expansion of existing Final Disposal Sites (if there is room for expansion) or allocation of new Final Disposal Sites (to adopt sanitary landfill methods), if the planned new Final Disposal Sites at Desa Harian Pintu, Laguboti and Ajibata (capacity unknown) are not up to the required capacity. The location of the proposed disposal sites should be studied with extra caution, so that the environment surrounding Lake Toba is preserved.

Recommendations for the long term (2041) are as below:

- 100% coverage of sustainable solid waste management in all the kabupaten that impact the environmental health of the lake (3 key tourism kabupaten – Kab. Toba Samosir, Samosir, and Simalungun, and 4 other kabupaten surrounding Lake Toba – Kab. Dairi, Karo, Humbang Hasundutan, and Tapanuli Utara);
- Solid waste collection and disposal facilities should be increased and expanded accordingly;
- Allocation of more Integrated Waste Processing Sites (TPST) will be needed so that solid waste is sorted and segregated before transporting to Final Disposal Sites (TPA). This can reduce the amount of waste delivered and is a more sustainable and environmental friendly approach; and
- Development of sanitary landfill site(s) with sufficient capacity. Location of the landfill sites should be studied taking into consideration the future master plan of Lake Toba, distance from the residential and tourism attractions, and environmental sensitivity. Landfill sites can fill up quickly if waste is not reduced and reusable waste is not collected, separately and recycled. There is also the risk of groundwater contamination if not sealed correctly or the liner system of the landfill site is damaged. Hence, landfill sites protect community health only if well managed.

15.14 POWER SUPPLY

15.14.1 FUTURE DEMAND

With reference to the projected population and visitor arrivals, and power consumption rate (as shown in Figure 118), the forecast power demand is tabulated in Figures 116 to 118:

FIGURE 116: POWER DEMAND PROJECTION (MWH)

			2015			Scenario 1		Scenario 2	
			Demand	Served by PLN	Not Served by PLN	2021	2041	2021	2041
Domestic	Kab. Toba Samosir		179,704	165,831	13,873	481,043	974,961	481,043	974,961
	Kab. Samosir		123,789	112,041	11,748	335,568	680,119	335,568	680,119
	Kab. Simalungun		849,405	801,499	47,906	2,433,615	4,932,381	2,433,615	4,932,381
Visitor	VFR (staying at family & friends + day visitors)	Kab. Toba Samosir	1,387	1,280	107	3,764	8,905	3,764	8,905
		Kab. Samosir	6,577	5,953	624	19,872	58,251	19,872	58,251
		Kab. Simalungun	6,558	6,188	370	17,790	42,093	17,790	42,093
	Commercial Accommodation	Kab. Samosir	11,004	9,959	1,044	23,080	50,880	20,024	20,024
		Kab. Toba Samosir	2,099	1,937	162	2,624	3,148	3,148	3,148
		Kab. Simalungun	9,258	8,735	522	11,572	13,886	27,696	50,880
Total			1,189,780	1,113,423	76,357	3,328,925	6,764,626	3,342,518	6,770,764

Source: Surbana Jurong

Figure 116 above showcases estimated power demand (Mwh) by different categories of consumers in 2015 (with amount of power served and not served by PLN). Projected power demand by different categories of consumers in 2021 and 2041 are also presented for both scenarios. The summary of existing and projected power demand for each of the key tourism kabupaten are tabulated in Figure 117; while the ratio of estimated power demand to support tourism activities with respect to overall demand is shown in Figure 118.

FIGURE 117: SUMMARY OF POWER DEMAND PROJECTION (MWH)

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Kab. Toba Samosir	183,190	487,430	987,015	487,954	987,015
Kab. Samosir	141,369	378,519	789,250	375,463	758,395
Kab. Simalungun	865,220	2,462,976	4,988,361	2,479,101	5,025,354
Total	1,189,780	3,328,925	6,764,626	3,342,518	6,770,764

Source: Surbana Jurong

FIGURE 118: ESTIMATED POWER DEMAND RATIO

	2015	Scenario 1		Scenario 2	
		2021	2041	2021	2041
Domestic	1,152,898	3,250,225	6,587,462	3,250,225	6,587,462
Visitor	36,882	78,700	177,165	92,293	183,302
% of visitor / total	3.10%	2.36%	2.62%	2.76%	2.71%

Source: Surbana Jurong

Key Assumptions:

The adopted rate Kwh (Kilowatt hours) for residents and visitors is tabulated in Figure 119. It is estimated that the unit rate of power consumption will increase in the short term (2021) and long term (2041).

FIGURE 119: POWER CONSUMPTION RATE[33]

Type of Usage		Unit Rate (Kwh)		
		2015	2021	2041
Domestic (per person), including VFR		1,000	2,500	4,750
Visitor	Commercial Accommodation (per room)	4,000	5,000	6,000

Based on the above considerations, total existing power demand is forecast to be 1,190,000 Mwh for Kab. Toba Samosir, Samosir, and Simalungun. Out of the total demand, 93.6% is fulfilled by the PLN power network. Power demand in 2021 and 2041 is estimated to be about 488,000 Mwh and 988,000 Mwh in Kab. Toba Samosir, 376,000 Mwh and 774,000 Mwh in Kab. Samosir, and 2,469,000 Mwh and 5,007,000 Mwh in Kab. Simalungun. The total power demand in the key tourism kabupaten of Lake Toba is estimated to be 3,332,000 Mwh in 2021 and 6,768,000 Mwh in 2041. Power demand for tourism activities remains at about 3% of the overall demand.

[33] *Reference: National Energy Council, Republic of Indonesia. Bin Su, Hotel Design and Energy Consumption, 2012.*

15.14.2 POWER SUPPLY INFRASTRUCTURE NEEDS

There is no major concern with regards to power supply to support the tourism activities due to its relatively small demand as compared to the residents demand. Power outages occur from time to time in Lake Toba and improvement and upgrading is necessary to mitigate problems of insufficient power capacity during peak hours.

As such, the following key power supply infrastructure projects are recommended for the short term (2021):

- 100% coverage of PLN power supply at the key tourism kecamatans; and
- Expansion of existing power transmission and distribution networks and construction of new networks to meet the above mentioned target.

Recommendations for the long term (2041) are as below:

- Expansion of existing power plants (if there is room for expansion) and construction of new power plants to generate sufficient power; and
- Expansion of existing power supply networks and construction of new networks to transmit and distribute generated power from PLN's power plant to support potential growth of power demand, particularly in the key tourism kecamatans.

15.15 TELECOMMUNICATION INFRASTRUCTURE

15.15.1 TELECOMMUNICATION INFRASTRUCTURE NEEDS

The expansion of existing telecommunication coverage is required to cater for the additional population and visitor arrivals, particularly in the key tourism kecamatans. This is important to ensure sufficient connectivity in case of emergencies, and for the visitors to share their travel experiences. Collaboration between the authorities and the telecom companies is needed to improve the telecommunication infrastructure. Projected population and visitor arrivals should be made known to the telecom companies so that upgrading and expansion of telecommunication facilities can be planned in advanced.

KEY RECOMMENDATIONS

16. WHAT WILL TRIGGER INVESTMENT

Investment responds to actual increases or future anticipated increases in demand. To mobilize private investment, investors need to be convinced that the anticipated future increases in demand will materialize and that the process of investment will be satisfactory.

In the following sections we will provide:

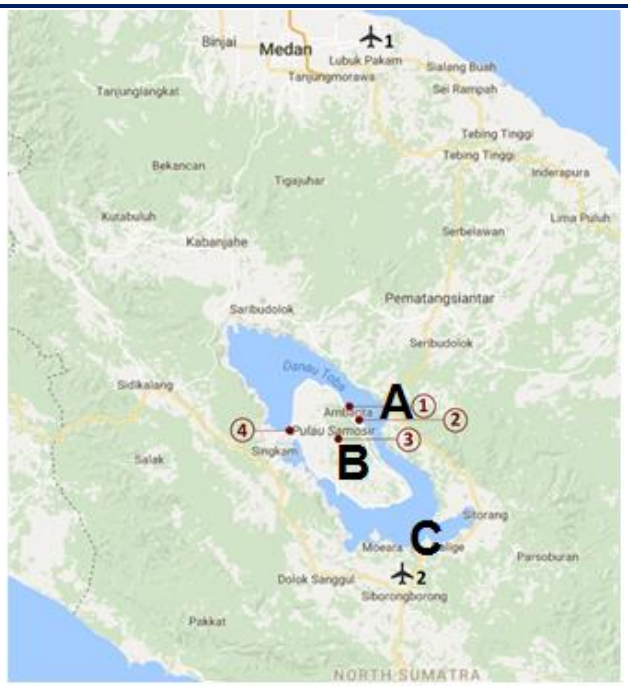
- a recap of the existing supply and demand dynamics in the Destination together with our projections for visitor arrivals (as discussed in detail above);
- recommendations for improvements in the regulatory environment and destination management;
- recommendations on products and services that are suitable for development and management by SMEs; and
- recommendations on tourism driven infrastructure investments, both transport and basic capacity.

16.1 RECAP OF THE DESTINATIONS' DEMAND & SUPPLY DYNAMICS

16.1.1 KEY ATTRACTIONS & KEY TOURISM AREAS

To recap the above findings, there are many areas of interest / things to do, but the only key attraction is the lake itself. Figure 120 highlights the existing identified key attractions and key tourism areas.

FIGURE 120 – POPULAR ATTRACTIONS & KEY TOURISM AREAS



Key Tourism Areas

A: Parapat (Kec. Girsang Sipangan Bolon)
B: Samosir Island (Kec. Simanindo & Kec. Pangururan)
C: Balige (Kec. Balige)

Popular Attractions

1. Ambarita Village
2. Stone Chair of King Siallagan + King Sidabutar's Tomb
3. Samosir Island
4. Pusuk Buhit Hot Springs

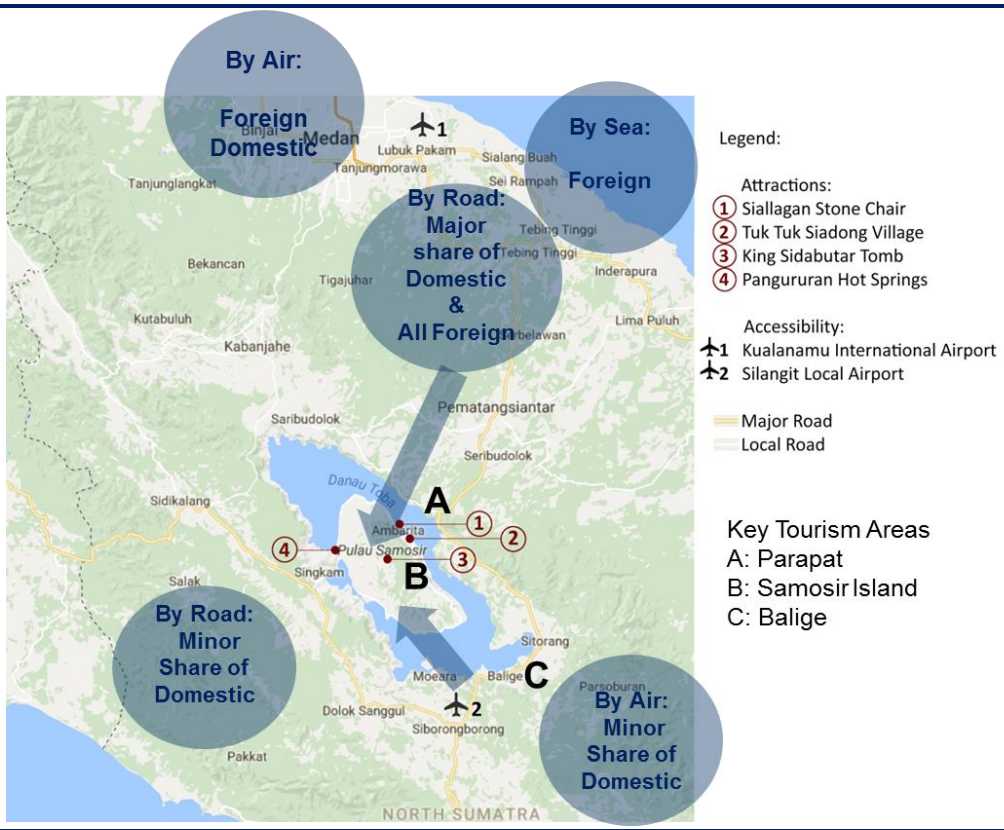
Source: Google maps, Horwath HTL

We have identified several popular attractions as identified (numbered) in Figure 120 and 3 key tourism areas (4 kecamatan) on which to focus including Parapat, Samosir Island and Balige.

16.1.2 VISITORS TO THE DESTINATION ARRIVE MAINLY BY AIR & ROAD

Around 90% of all visitors come to Parapat from Medan. Domestic visitors rely on land transport for travelling (97% by road) and airports are the predominant gateways for international visitors (85% by air) coming from Singapore and Malaysia.

FIGURE 121 – MAIN ARRIVAL POINTS, DOMESTIC AND FOREIGN VISITORS (2015)



Source: Google maps, Horwath HTL

16.1.3 ACCOMMODATION SNAPSHOT

At the end of 2015, there was a combined 131 hotels (3,391 guestrooms) within the 3 key kabupaten surrounding Lake Toba, of which only 16 hotels (just over 10%) were star-rated.

Star and non-star-rated hotels are focused in the main tourist towns of Tuktuk (Kab. Samosir) and Parapat (Kab. Simalungun). The state of repair and maintenance of the hotels is generally below standard.

There is a heavy reliance on seasonal leisure demand and consequently weak demand results in consistently low occupancy. In 2015 it is estimated that ADRs on Samosir Island were around IDR 100,000 (~USD 7) higher than in Parapat (Simalungun) and Balige (Toba Samosir) due to a combination of (1) lower yielding tour groups in Parapat, (2) better quality, better maintained and appointed guestrooms on Samosir Island, and (3) higher proportion of foreign guests on Samosir Island.

16.1.4 INVESTMENT SENTIMENT

Domestic investors are attracted by the market potential of the Destination however they did comment that:

- The environment has been affected by deforestation. Until this is addressed, the destination will remain unattractive for investment; and
- Land prices made development difficult but with incentives they would relook at the situation.

Foreign investors are largely disinterested in tourism investments in Lake Toba and the major deterrents to investment were seen to be:

- the lack of fundamentals of a leisure destination in Lake Toba that include accessibility, infrastructure and general demand for the destination; and
- The lack of internationally branded hotels which typically add security to many travelers' accommodation choices.

16.1.5 SKILL LEVELS

There is a long history of hospitality around Lake Toba, so the core skills are solid. Entry level and supervisory level employees are typically sourced from the surrounding areas whilst management level staff are mainly sourced from other cities such as Medan and Jakarta.

There are several hospitality training options including SMK and universities (in Medan). If skill gaps are to be identified, additional effort could be placed into training for conservation / sustainability as knowledge is limited and the community must focus attention on conservation if it wishes to develop into a successful destination.

16.1.6 FOREIGN VISITOR ARRIVALS & DEMOGRAPHICS

- There were an estimated 58,700 foreign visitors to the Destination in 2015 (3% of total visitors).
- Top source countries for the destination are Malaysia and Singapore with some long haul guests from Europe.

16.1.7 DOMESTIC VISITOR ARRIVALS & DEMOGRAPHICS

- There were an estimated 1.7 million domestic visitors in 2015, representing 97% of total visitors to the Destination.

- Domestic VFR + day visitors represented an estimated 1.08 million and those staying in commercial accommodation represented 0.66 million (95% leisure).
- They mostly come from Medan and cities within its vicinity, along the north coast of Sumatera Utara and are attracted by the natural scenery, tranquility, local gastronomy and cooler climate.

16.1.8 THE DESTINATION'S IMAGE

Lake Toba has a fair level of awareness amongst international markets but it is difficult to package with others.

The cultural features of Lake Toba (villages, Batak Museum, religious monuments) have as much importance as the natural attractions. Lake Toba's unique selling point is its combination of natural landscape and culture). The lack of accommodation choice and poor connectivity are the key sources of dissatisfaction.

16.1.9 DESTINATION POSITIONING

Lake Toba is a world-class environmentally sustainable destination focusing on its volcanic heritage combined with Batak culture, creating a niche mountain / lakeside retreat. To foster the retreat character, Lake Toba offers a variety of accommodations, easily accessible from Medan. It offers land and lake based activities for the whole family to enjoy the unique combination of nature and culture.

Key Tourism Areas

- Parapat: budget to mid-tier accommodation aimed at domestic visitors and some Malaysians. It should be developed as the main tourism support area and transport hub from Medan (the primary entry point).
- Samosir Island: should be the key area for small / low impact and high-end accommodation. This will attract Singaporeans and Europeans and high-end domestic weekenders. The focus should be on wellness, nature and the Batak culture.
- Balige: is a secondary accommodation area with some potential to attract domestic demand given its lake-side location and proximity to Silangit Airport (which is likely to remain the secondary entry point to Lake Toba).

16.1.10 FUTURE DEMAND & SUPPLY

2 contrasted scenarios were developed to gauge the effectiveness of investment:

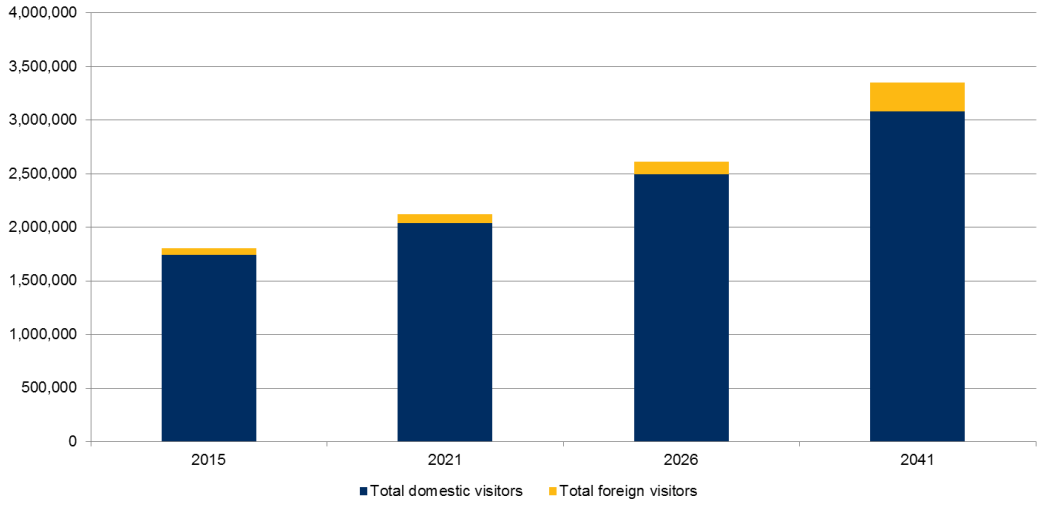
- Business as Usual scenario which is represented by:
  - "Organic" development of the destination driven by market forces;

- No specific effort is made to improve the two major obstacles restricting development of the destination: (1) travel time by road will remain a disadvantage for the visitors and potential investor; and (2) continued degradation of the natural environment of Lake Toba.

- Best Case scenario which is represented by:
  - Accessibility from Medan and the Northern Coast Regencies of Sumatera Utara improves by between 2016 & 2021 (travel time from Medan to Parapat falls from > 5hrs to a maximum of 2h30);
  - Better scheduling of flights between Jakarta & Silangit Airport to facilitate weekend trips from Jakarta; and
  - An integrated tourism masterplan is successfully undertaken to develop Lake Toba destination.

The repercussions on visitor arrivals of the Best Case scenario are shown in Figure 122.

FIGURE 122 – VISITOR ARRIVALS PROJECTIONS, 2015 TO 2041 (BEST CASE SCENARIO)

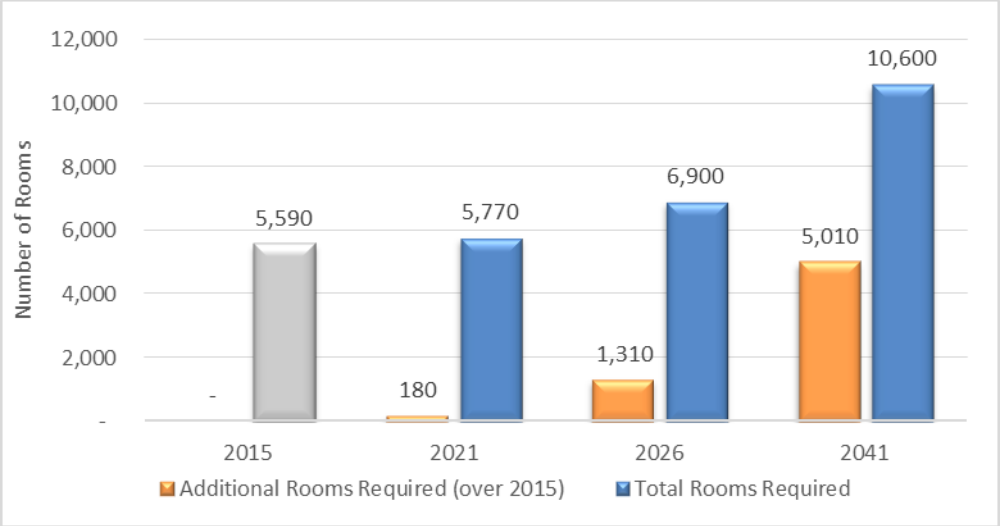


Source: Horwath HTL

Domestic and foreign visitors will generate an estimated annual expenditures of USD 253 million in 2041 (USD 99 million in 2021 and USD 157 million in 2026), which is 3.7 times the 2015 expenditures of domestic and foreign visitors.

The additional visitor arrivals will have a direct impact of the number of hotel rooms required (Figure 123) and the number of staff required to operate the hotels (Figure 124).

FIGURE 123 – NUMBER OF ROOMS REQUIRED, 2015 TO 2041 (BEST CASE SCENARIO)



Source: Horwath HTL

FIGURE 124 – NUMBER OF HOTEL STAFF REQUIRED, 2015 TO 2041 (BEST CASE SCENARIO)

	< USD 40	USD 40 - 80	USD 80 - 120	USD 120 - 240	> USD 240	Total
Staff / Room Ratio	0.53	0.83	1.15	1.56	2.70	
% Total Rooms	0.42	0.31	0.11	0.13	0.03	
Additional Rooms:						
Existing						5,590
2021	0	0	0	0	0	0
2026	554	407	146	167	37	1,310
2041	1,564	1,151	411	471	103	3,700
Total						10,600
Additional Staff:						
2026	**294**	**338**	**168**	**260**	**99**	**1,159**
Entry Level	265	287	143	221	84	1,000
Supervisor	-	34	17	26	10	87
Management	29	17	8	13	5	73
2041	**831**	**956**	**473**	**735**	**279**	**3,274**
Entry Level	748	813	402	625	237	2,824
Supervisor	-	96	47	74	28	244
Management	83	48	24	37	14	205

Source: Horwath HTL

Of course in addition to hotel staff, further staff will be needed to work in all supporting tourism facilities such as restaurants and travel agencies.

16.2 DESTINATION ENHANCEMENT

The following destination enhancements will help foster investment which will facilitate the Destination reaching the projected visitor arrival levels:

- Improved road access between Medan and Parapat, and between Silangit and Parapat;

- The protection of Lake Toba by the government from environmental degradation, pollution and contamination;
- Continual preservation and augmentation of the tourism experience surrounding Lake Toba;
- An integrated platform of information (both online and offline in Lake Toba) containing comprehensive information;
- Increased marketing efforts about Lake Toba and its surrounding nature and culture to broader international markets; and
- Infrastructure enhancement such as in waste management, sewage treatment and health care.

16.3 LEGAL & REGULATORY ENVIRONMENT ENHANCEMENTS

The following legal and regulatory environment enhancements will also help foster investor confidence and drive both domestic and foreign investment to the Destination specifically:

- The creation of the LTTA (BOP – Badan Otoriti Pariwisata) in 2016 should help facilitate investors interest in investing in the Lake Toba Tourism Area (500 – 600 ha). The tenure of the BOP has been set for 25 years between 2016 and 2041 however, there are provisions for extension;
- Sustainable development should be the main focus in Lake Toba to preserve the destination's natural and cultural heritage. Tourism-related stakeholders should make conscientious effort to employ sustainable operational practices. Regulations should be enforced by the Kab. Governments; and
- Developing the area around Lake Toba into a multi-purpose destination, will involve zoning the destination for different tourism schemes including accommodation, retail and food and beverage.

Further insights on legal and regulatory environment enhancements are provided in the accompanying Indonesia-level report including:

- Improved uniformity in Indonesia's fragmented tax regime by monitoring kabupaten level tax regulations so that guests are not taxed different amounts in different regencies for the same thing;
- Clear zoning regulations and enforcement;
- On-going support to potential investors by 1) simplifying registration process, 2) provide more comprehensive guides and parameters regarding legal framework and tax incentives, 3) security of tenure for investors;
- Regulations to encourage the prioritization of the local work force to help build communities;

- To improve communication between local governments and the federal government so that there is uniformity in advice and information; and
- To reduce sales tax for guests.

16.4 SME DEVELOPMENT INTERVENTIONS

For forecasts to be met, there must be a significant increase in businesses serving the tourism sector, many of which will be small and medium enterprises (SMEs). They will deliver services supporting the larger investments. To encourage sufficient SME development to meet the demand the GoI may need to mobilize assistance specifically targeted at SMEs.

SMEs are integral to the success of a destination, as they play significantly role in creating local employment and engaging local people in tourism industry, with the potential to foster long-term and sustainable economic development.

16.4.1 OPPORTUNITIES FOR SME IN THE DESTINATION

This vision for the Destination provides opportunities for SMEs in the following business areas:

- Small hotels & homestays operated by local people to cope with increasing arrivals;
- Art galleries showcasing local Batak culture and artwork;
- Handicraft workshops where visitors can learn to make traditional crafts and purchase souvenirs;
- Retail, both shop front and online platforms, for the sale of local handicrafts and attractions' branded souvenirs in nearby cities such as Medan;
- Regular bazaars for the various home industries to sell and showcase their work;
- Hot springs that are better maintained and managed with high standards of cleanliness and comfort;
- A more comfortable and clean ferry service;
- Yacht rental and cruise ship operators;
- Water sports centres catering to the needs of families and adrenalin-seeking visitors;
- Bicycle rental shops; and
- Supporting commercial spaces including banqueting / meeting spaces.

16.4.2 POSSIBLE SME DEVELOPMENT INTERVENTIONS

Our research has uncovered different SME support programs in Indonesia and the following section will outline a few of these programs that could be implemented in Lake Toba.

The Ministry of Cooperatives and Small and Medium Enterprises undertakes, amongst other things, the following 2 programs to encourage the development of SMEs:

- Kredit Usaha Rakyat (KUR) is the main program of the Usaha Kecil dan Menengah (Small and Medium Sized Enterprise) function of the Ministry. The KUR (low interest rate program) is currently offering loans at 9% which is understood to be the best effective rate in the market.
- Beginner's entrepreneur program / training course is also currently being developed. The program being developed is funded by the federal Government with a budget of IDR 100 billion. Beginner SMEs will receive business licenses for export (manufacturing) and retail at no cost:
  - The program started in 2015 offering tourism training courses. Select courses were introduced in 2016, and in 2017 they intend to increase the number of courses. In 2016, the program ran a human resource development for tourism course in Bali.
  - They are developing further courses for tour guides, home stay and other tourism entrepreneurs.
  - Bandung and Yogyakarta are planned as the next course locations.
  - The program aims to encourage 2% (4.6 million) of Indonesians to become entrepreneurs.

Other SME development options include:

- Development of community co-operatives (e.g. village co-operatives for cultural villages) to improve efficiency through shared access to management and development systems and product supply lines such as pooling resources, reservation systems and marketing activities. Village co-operatives could be funded to create an online platform displaying the various activities, events, routes, and accommodations of the cultural villages which can be accessed by both FITs and tour operators for enquiries and reservations.
- SME training support for the local communities:
  - Hospitality training on service, language skills, hygiene, culinary and use of information technology for locals at the cultural villages; and
  - Production of high quality handicrafts using traditional skills, patterns and local materials (bamboo, cane, stones, silver, or even volcanic ash) which would increase the local products appeal to tourists.
- Recruiting and retaining young talent is a challenge for SMEs; however, a steady flow of fresh talent is critical to the future success of SMEs. Options to encourage young talent include:

  - Study awards covering tuition fees, allowances, a sign-on bonus and job opportunities can be introduced by local schools to encourage students to join SMEs upon graduation; and
  - Government supported internship programs. Internship programs in accommodation or tourism facilities in Lake Toba can be launched for tourism university students in Medan/Jakarta to bring in more dynamic and new ideas to the destination.

- Government support schemes to minimize solid waste and water pollution, which is a plague across Indonesia and improve energy to support a more sustainable tourism industry.
- Government programs for infrastructure that supports SME development such as:
  - Basic infrastructure e.g. power and water;
  - Childcare services; and
  - Public facilities such as footpaths, parks and public transport.

16.5 KEY RECOMMENDATIONS FOR TRANSPORT INFRASTRUCTURE INVESTMENT

The key recommendations on investment needs for transport infrastructure to support tourism are presented below.

16.5.1 ROAD INFRASTRUCTURE

Considering the assessment of existing road conditions around Lake Toba, the following are the key road developments needed to support the Destination.

- Improvement of Medan - Tebing Tinggi - P. Siantar is part of an on-going regional infrastructure plan that will also benefit tourism development. Hence, the toll road proposal for this stretch should be implemented in a timely manner.
- Amongst the proposed national road improvements around Lake Toba and on Samosir Island, the national roads for the popular attractions, i.e. Ambarita - Tomok - Onan Runggu - Nainggolan must be well maintained.
- All roads in the key tourism area (Kec. Girsang Sipangan Bolon in Kab. Simalungun, Kec. Simanindo and Kec. Pangururan in Kab. Samosir plus Kec. Balige in Kab. Toba Samosir) should be well maintained in terms of pavement conditions, targeting an IRI < 6.
- Non-motorized transport facilities such as sidewalks (minimum 2 meters width) need to be developed for the following roads:
  - Jalan Lingkar Tuktuk (Kec. Simanindo) 10 km length of road, and
  - Jalan Kol Sinaga (Parapat) 1 km length of road.

- Cycling / hiking tracks to be improved to facilitate visitor movements.

16.5.2 RAIL INFRASTRUCTURE

At present, there is no rail access to Lake Toba. The Government plans to revitalize the railway from Medan to Pematang Siantar with a possible extension to Parapat. From a tourism development perspective, this is not necessary because upgrading of the Medan–Parapat road will reduce the travel time to around 2 hours and hence, make the rail transport uncompetitive.

16.5.3 AIRPORT INFRASTRUCTURE

Of the 3 airports, the Medan airport is the primary gateway for all international arrivals including the majority of domestic visitors arriving by air. While the Silangit Airport provides an alternative route for visitors from Jakarta, it cannot stay competitive after the road connectivity between Medan and Parapat is improved in terms of reduced travel time. Hence, the Medan airport with its Improvement Plan will be adequate for tourism development of Lake Toba. The third airport at Sibisa is constrained due to physical limitations on the site and is not needed from a tourism perspective.

16.5.4 SEA PORT INFRASTRUCTURE

The cruise passengers to Lake Toba are insignificant now and this is not forecast to change. The existing port infrastructure has the capacity to accommodate the anticipated future volume, and hence, there is no need for port facility improvements for the Belawan Port from a tourism perspective.

16.5.5 LAKE TRANSPORT

As it is recommended that Samosir Island be retained as an eco-friendly destination, there will be no need for increased RORO ferries from a tourism perspective. However, with the growing number of tourists and vehicles, it will require improved lake port infrastructure, especially in terms of parking areas near ferry ports. There will be a need for increased passenger boats, which is recommended to be developed as hop-on hop-off electric lake boats with higher frequency (every half an hour). The supporting tourist infrastructure such as jetties needs to be improved.

16.6 KEY RECOMMENDATIONS FOR BASIC INFRASTRUCTURE INVESTMENTS

Basic infrastructure such as water supply, wastewater and sanitation, and solid waste management is important because poor quality basic infrastructure results in unhygienic conditions, posing health hazards that impact the tourism development potential.

Wastewater and solid waste management for the entire area around the lake is sub-standard. All wastewater should be properly discharged and treated. Most people rely on individual septic tanks which is suitable in low density settlements however as densities increase more advanced solutions are needed. Sustainable solid waste management systems cover only part of the population, ranging from 20% in Kab. Humbang Hasundutan to 68% in Kab. Tapanuli. Final disposal practices are not sustainable. The upgrading of existing systems is necessary to prohibit solid waste being disposed in the water bodies and the lake. Hence, investments will be needed for improvements in wastewater and solid waste management for the kecamatans surrounding Lake Toba.

Coverage of PDAM piped water supply is low (about 8%) at the kabupaten level. Although the percentage is higher at key tourism kecamatans (ranging from 30% in Kec. Balige to 60% in Kec. Girsang Sipangan Bolon), coverage of the service is still insufficient. Investment will be needed to improve piped water supply with priority focus on key tourism kecamatan.

Drainage and flood control is not an issue around Lake Toba. The hilly terrain ensures adequate runoff. Improvement and upgrading are required for power and telecommunications, but are not impeding further tourism development.

16.7 RECOMMENDATIONS FOR SPATIAL PLANS

16.7.1 EXISTING SPATIAL PLANS AND REGULATORY FRAMEWORK

To ensure sustainable urban growth and tourism development, it is important to have a detailed spatial plan and development guidelines for tourism areas where the development pressures are increasing at a rapid pace.

Indonesia has an established system for spatial planning and most of the destinations have a Spatial Plan for the province, kabupaten or city level. As per the National Spatial Planning Act (Law No. 26/2007 amends Law No. 24/1992), the provincial governments and local governments (kabupaten and kota) are authorized to implement spatial planning. The Rencana Tata Ruang Wilayah (RTRW) and the Rencana Detail Tata Ruang (RDTR) are the two major Spatial Plans prepared at the regional level (province and kabupaten) and local level (kabupaten or Special Areas within kabupaten and kota), respectively.

In general, RTRW serves as the concept level Spatial Plan providing broad directions for provinces or kabupaten; and the RDTR serves as the detailed level Spatial Plan indicating detailed land uses such as residential uses by density, commercial uses, mixed uses, government uses, industrial uses, social facilities, etc., for the kota or other designated areas within the kabupaten.

The RTRW is managed by the provincial or kabupaten level Bappeda. It has been observed that the RTRW is prepared for the time horizon of 20 years. It is important to review the Master Plan considering the changing socio-economic conditions and infrastructure needs, including new tourism targets and plans. As discussed in the previous sections on Transport Infrastructure and Basic Services Infrastructure, there are several individual sector plans being prepared by the respective authorities, some of which are critical, while others are not needed. Based on the infrastructure needs assessment, the critical plans need to be incorporated into the revised RTRW. This will remove duplication and provide unified planning direction to the respective implementing agencies to execute development programs towards the common vision and goals.

The main tourism asset for Lake Toba is the lake itself. As such it is critical to have regulations to ensure protection of the lake and the immediate surrounding areas. Following is the status of RTRW, RDTR and other key regulatory Spatial Plans available for Lake Toba.

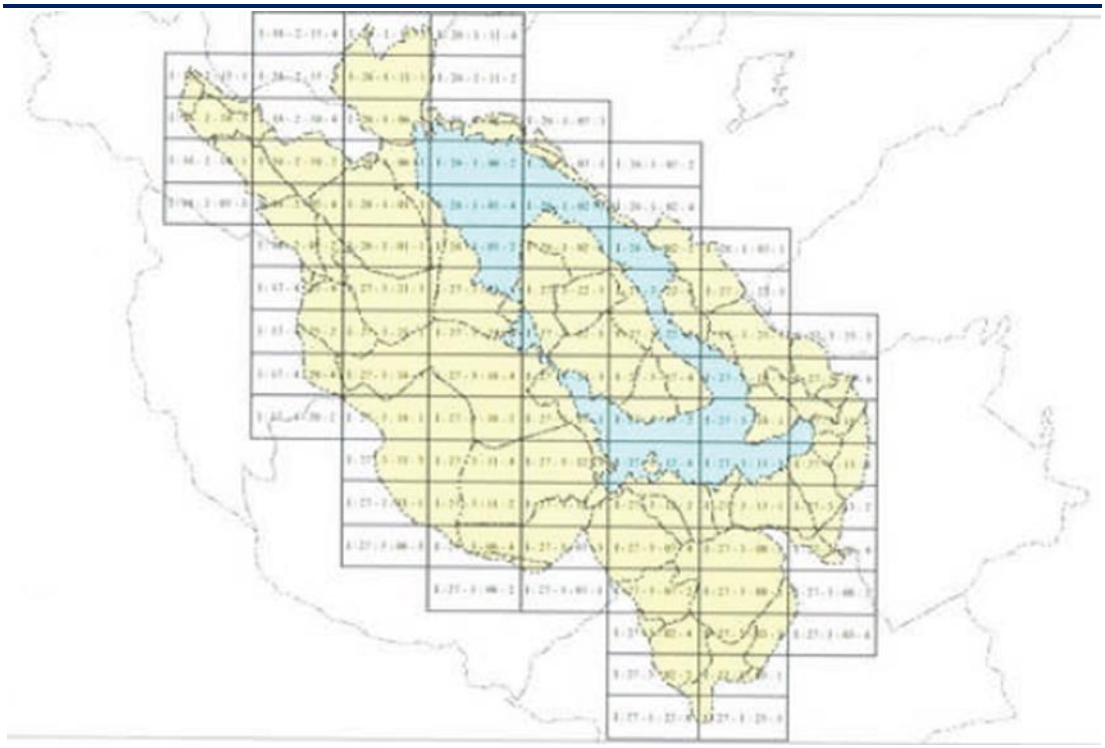
- At the point of study, the approved RTRW Master Plans for Kab. Simalungun (2011-2031) and Kab. Dairi (2010-2030) are available. The RTRW for the remaining kabupaten, including Samosir, Toba Samosir, Karo, Tapanuli Utara and Humbang Hasundutan are awaiting approval.
- There is no approved RDTR for the kabupaten in Lake Toba. In the absence of such Detailed Spatial Plan, there could be some inaccuracies in boundaries, especially with regards to the protected area delineations. The RDTR is essential to regulate the urbanization, especially in tourism areas and their immediate surroundings.
- However, there exists a regulatory Spatial Plan of Lake Toba and the Surrounding Area (Rencana Struktur Kawasan Strategis Nasional Danau Toba). This Spatial Plan is broader than RTRW as explained further below.

Spatial Plan of Lake Toba and the Surrounding Area (Rencana Struktur Kawasan Strategis Nasional Danau Toba)

- As per Presidential Regulation no. 81 of 2014, there is a Spatial Plan in place for Lake Toba and the surrounding area for the time horizon 2014 – 2033.
- The plan provides higher level directions on indicative urban/tourism areas and infrastructure such as major roads, airports, energy network, telecom, and utilities for Lake Toba and Surrounding Area planning boundary (Figure 125).
- The plan indicates the environmental protection zones such as protected areas, including lake shore regulations such as the need for 50-meter lake setback. It also covers vegetation type along the lake and the need to follow water quality regulations.
- Additionally, the plan shows the other cultivation zones and hierarchy of services center. However, like RTRW, the next level of broad land uses such as residential, commercial and industry uses are not defined in this Spatial Plan.

- The Plan covers the broad zoning intentions for the above-mentioned zones controlling the permitted and forbidden activities, minimum infrastructure needed, and highlighting enforcement mechanisms such as incentives, disincentives and penalties.

FIGURE 125: SPATIAL PLAN OF LAKE TOBA AND THE SURROUNDING AREA PLANNING BOUNDARY



Source: Ministry of Tourism

16.8 GAPS & NEEDS FOR IMPROVEMENT IN SPATIAL PLANNING FRAMEWORKS

The following is the summary of key gaps and improvements needed in planning frameworks for Lake Toba (Figure 126).

FIGURE 126: GAPS IN SPATIAL PLANNING FRAMEWORK, LAKE TOBA

Existing Plans	Assessment	Gaps /Needs for Improvement
Concept Spatial Plan Spatial Plan of Lake Toba and the Surrounding Area (Presidential Regulation no 81 of 2014).	The Plan provides high-level directions on development structure. RTRW in approval process for majority of the Kab. Hence, there is a gap in direction for broad level land uses. No Lake Environmental Management Plan known for Lake Toba.	The Spatial Plan for Lake Toba needs to be reviewed based on tourism demand, rationalized infrastructure needs, and detailed socio-economic assessments. There is a need to review the RTRW aligned to tourism demand, rationalized infrastructure needs, and

Existing Plans	Assessment	Gaps /Needs for Improvement
		detailed socio-economic assessments. The process of approval needs to be expedited. There is a need for Lake Environment Management Plan.
Detailed Spatial Plans RDTR for Toba Samosir being discussed.	No approved RDTR.	Detail Master Plan (RDTR) will be needed for all tourism/urban areas to regulate the development.

It is important to review and update the Spatial Plan and the RTRW for Lake Toba and surrounding areas in line with the tourism demand and related infrastructure needs, along with the future socio-economic potential of the Destination. The reviewed Spatial Plan and the RTRW will help establish a common goal for all implementing agencies and to execute the respective sector development plans.

There is no approved RDTR (Detailed Spatial Master Plans) for the tourism/urban areas or for the kabupaten in the Lake Toba tourism destination. Both the Spatial Plan and the RTRW only provide broad directions and are not enough to regulate the development especially in the key tourism/urban areas along the lakefront. Due to the absence of the RDTR for the key tourism/urban area, the exact demarcation of conservation/protection boundaries may not be clear. Hence, it is important to prepare the RDTR demarcating the clear boundaries of protection areas and further regulate development especially in potential urban and attractions areas (Ambarita, Parapat and Balige Towns) in Kab. Samosir, Kab. Simalungun and Kab. Toba Samosir.

No concrete or comprehensive environmental plan for Lake Toba is known to exist. For the long term sustainability of tourism, it is essential to incorporate hydrology, water quality and environmental planning strategies into the Spatial Plan.

16.9 RECOMMENDATIONS FOR SPATIAL MASTER PLAN

On the broader scale, there is a spatial planning framework to guide the development and safeguard the environmentally sensitive areas around Lake Toba. However, the approved RTRW is unavailable for 5 out of 7 kabupaten that border Lake Toba, and RDTR (Detail Spatial Plan) is unavailable for all kabupaten that border Lake Toba. Kab. Pakpak Bharat has not been examined.

The Government of Indonesia intends to develop the Integrated Tourism Master Plan for Lake Toba in the near future. It is important to update the RTRW for all kabupaten of Lake Toba based on the latest tourism demand, rationalized infrastructure needs and the potential socio-economic scenario. Hence, the Integrated Tourism Master Plan will need to consider tourism demand incorporating the environmental strategies, land use, transport, utilities infrastructure plans that are being planned and identified as needed. Both the Spatial Plan and the RTRW will need to be revised based on the Integrated Tourism Master Plan.

While the updated Spatial Plan and the RTRW will provide a single unanimous direction for development, the key gap in current framework is the lack of Detailed Spatial Plans such as the RDTR for existing settlements or attraction areas. It is important to have such plans to retain the character of the tourism destinations as well as safeguard it from becoming unattractive and polluted as a result of mismanaged growth of tourism and urbanization. Hence, it is recommended to prepare a detailed Spatial Plans (RDTR) for Kec. Girsang Sipangan Bolon (Parapat), Kec. Simanindo (Ambarita), Kec. Balige (Balige) and Kec. Pangururan (Pangururan). A detailed Spatial Plan would guide the developers and land owners on the intended local urban development through detailed zoning and development control regulations. The scope of the detailed Spatial Plan (RDTR) shall cover the following:

- Local Level Land Use Plans including clear delineation of protected areas (indicating no development zones) and detailed distribution of residential uses, commercial uses and public facilities (including tourism facilities), and recommended urban densities;
- Transportation Plans including transportation strategies, road network, public transport, parking plans and provisions of non-motorized transport;
- Infrastructure Plans including water supply, power supply, and storm water management and solid waste management strategies; and
- Zoning Plans and development guidelines regulating different types of developments. Further special lakefront urban design plan and urban design guideline for key tourism areas will help to regulate intended development scale, type, and identity for Lake Toba.

APPENDIX I: SOURCES OF INFORMATION USED

The methodology for evaluating the tourism potential of the Destination presented in this report has been developed using both primary fieldwork research and existing statistics. Quantitative data were provided by different government offices, while interviews provide qualitative information for the research. The source of primary and secondary data is referenced in the report and listed in the below section. However, in some cases the information presented is a product of experience and observation prior to and during the fieldwork, and as such it is not specifically attributed by source.

INTERVIEWS

Interviews were conducted with various government offices at central as well as provincial & kabupaten level. The interviews serve to gain a better understanding of tourism development and investment process in Indonesia and the Destination.

Central Government	Provincial / Kabupaten Governments
Badan Pusat Statistik	Dinas Pariwisata, Sumatera Utara & Kab. Simalungun, Kab. Toba Samosir, Kab. Samosir
BKPM, Jakarta	Badan Penanaman Modal dan Promosi Provinsi Sumatera Utara
Profil Kesehatan of each Kabupaten	Badan Pusat Statistik, Sumatera Utara
PLN (Perusahaan Listrik Negara)	Dinas Perhubungan (Local Transport Authority) Sumatera Utara
STBM (Sanitasi Total Berbasis Masyarakat)	Sumatera Utara Regional Development Planning Agency (Bappeda)
Bappenas	Kab. Toba Samosir Development Planning Agency (Bappeda)
Kementerian Pariwisata (International marketing, domestic marketing, investment, transport liaison, marketing communications)	Kab. Simalungun Development Planning Agency (Bappeda)
	Kab. Tapanuli Utara Development Planning Agency (Bappeda)
	Kab. Dairi Development Planning Agency (Bappeda)
	Kab. Humbang Hasundutan Development Planning Agency (Bappeda)
	Angkasa Pura I (Kualanamu Airport – Silangit Airport Operator)
	Kab. Karo Development Planning Agency (Bappeda)
	Kab. Samosir Development Planning Agency (Bappeda)

- Investment sentiment is gleaned from interviews with existing and potential tourism investors. The investors chosen had interests in various tourism-related assets including hotels, restaurants, ground transportation and travel agencies. The questions were aimed at gathering their thoughts on the pros and cons of SEZs, the tourism investment climate in Indonesia, the future of tourism investment and possible investment in the Destination. Potential and existing domestic investors (total of 6) and International investors (total of 25), from the current key arrivals source markets of Australia, China, Japan, Malaysia and Singapore.
- Tour operators/Travel agents:
  - Local: Medan and Jakarta; and
  - Foreign (total of 41): from the current key arrivals source markets of Australia, China, Japan, Malaysia and Singapore as well as France, Germany and the United Kingdom.
- Hotels in Parapat and Tuktuk.

STATISTICS

Quantitative data obtained from existing reports and surveys provide numerical information and allow statistical analysis of Indonesia and the Destination's tourism demand.

- BPS Accommodation Survey of Sumatera Utara.
- BPS Domestic Survey, with results available only at Province Level.
- BPS Exit survey with results available only at Province Level.
- BPS Census on population.
- Reviews on TripAdvisor Website.
- Horwath HTL Indonesia Hotel Industry Survey of Operations.

APPENDIX II: LAKE TOBA TOURISM AREA

Through Peraturan Presiden no. 49, 2016 (Presidential Regulation) the central Government created the Lake Toba Tourism Authority, a single tourism management authority for Lake Toba (Badan Otorita Prioritas (BOP)) to emulate the Bali Tourism Development Corporation that successfully turned Nusa Dua into a world class destination. Following its formation in September 2016, the agency will focus on enhancing infrastructure development in Lake Toba. A site measuring 500 - 600 hectares (which they will apply to become a Special Economic Zone) on the lakeside Kec. Ajibata in Kab. Toba Samosir, close to the Sibisa Airport, has been selected for tourism development, and to be managed by BOP. The BOP will function for 25 years (until December 31, 2041) and the period could be extended.

Planned development components include 5 luxury hotels, a convention center and a 100-hectare golf course. It has been reported that three developers from Medan will be undertaking the development although we cannot confirm this.

It is understood that investment amount of IDR 20 trillion would be required at the initial stage for the development of infrastructure and amenities such as roads, improving telecommunication systems and waste treatment facility. IDR 10 trillion will come from the Government while the other IDR 10 trillion will be sourced from the private sector. No timeframe for the infrastructure investment has been set. We are unaware of other potential investors.

The topography of the 500 – 600 hectares site is characterized by dramatic mountainside cliffs that sweep down to a valley and lake and flat tops that afford the site open views from most parts. These site features are considered strengths for hotel development. However, to attract investors, accessibility to the site from Medan, as well as from the Silangit Airport must be easy, convenient and comfortable, and the water pollution of the lake must be addressed immediately (as has identified by the central Government).

FIGURE 127: 600-HECTARE SEZ DEVELOPMENT AREA NEAR AJIBATA, LAKE TOBA

Source: Ministry of Tourism

Note: Development area marked by red border

Regulations on the 500 – 600 hectares SEZ Area

- Article 2 (2) Coverage of the Lake Toba Tourism Area shall include an area of at least 500 (five hundred) hectares, of which management rights will be given to the Lake Toba Authority.
- Article 28: The funding of the operation of the Lake Toba Authority shall be sourced from the State Budget, Regional Budget and other legitimate sources under the provisions of laws and regulations.
- Article 3: Organizational Structure of the Lake Toba Authority consists of:
    - The Advisory Board; and,
    - The Executive Board.
- Article 5: The Advisory Board as referred to in Article 3 Letter A, consists of:
    - Chairman concurrently as a member: Coordinating Minister for Maritime Affairs;
    - Chief Executive concurrently as a member: Minister of Tourism;
    - Members:
        - Minister of Home Affairs;
        - Minister of National Development Planning / Chairman of Bappenas;
        - Minister of Finance;
        - Minister of Environment and Forestry;
        - Minister of Agrarian Affairs and Spatial Planning / Chairman of the National Land Agency;
        - Minister of Public Works and Public Housing;
        - Minister of Transportation;
        - Minister of Maritime Affairs and Fisheries;
        - Minister of Energy and Mineral Resources;

- Minister of Manpower;
- Minister of Administrative Reform and Bureaucratic Reform;
- Chairman of the Investment Coordinating Board;
- Cabinet Secretary; and
- Governor of Sumatera Utara.

- Article 9: The Executive Board as referred to in Article 3 Letter B is a working unit under the Ministry of Tourism.

APPENDIX III: ROAD CAPACITY ASSESSMENT

GENERAL TRAFFIC VOLUME

Future traffic volume for general Traffic is estimated by using following method;

$$Traffic\ Volume\ in\ 2021 = Traffic\ Volume\ in\ 2015\ x\ \frac{Number\ of\ registered\ vehicles\ in\ 2021}{Number\ of\ registered\ vehicles\ in\ 2015}$$

$$Traffic\ Volume\ in\ 2041 = Traffic\ Volume\ in\ 2015\ x\ \frac{Number\ of\ registered\ vehicles\ in\ 2041}{Number\ of\ registered\ vehicles\ in\ 2015}$$

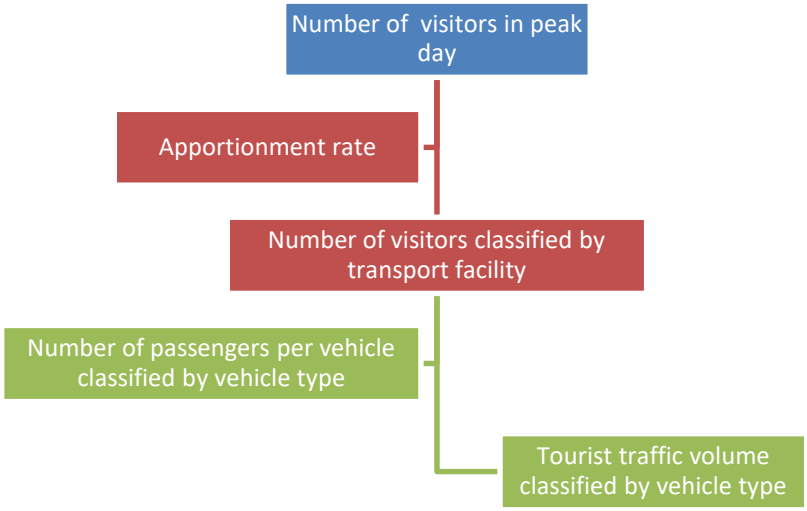
VISITORS TRAFFIC VOLUME

The traffic volume is estimated as follows:

- Obtain the number of visitors who enter each tourism destination and potential visitor's distribution around the destination.
- Distribute the number of the visitors in each transport facility.
- Based on the number of passengers per vehicle, the total visitor traffic volume is estimated.

Figure 128 illustrates the methodology of visitor traffic volume estimation.

FIGURE 128: FLOWCHART OF VISITOR TRAFFIC VOLUME ESTIMATION



Source: Surbana Jurong

GENERAL ROAD CAPACITY ASESSMENT

Road capacity is reviewed and calculated with the following formula.

$$C = C_o \times FC_w \times FC_{sp} \times FC_{SF} \times FC_{CS}$$

C capacity (PCU/hour)

Co free flow capacity (PCU/hour)

FCw link width capacity factor

FCSP link separated capacity factor

FCSF side friction capacity factor

Free Flow Capacity (Co)

		Urban	Inter Urban	
No	Type	Co (PCE/hour)		Notice
1	4 Lanes Divided or one way	1650	1900	each lane
2	4 Lanes undivided	1500	1700	each lane
3	2 Lanes undivided	2900	3100	all lanes

Link Width Capacity Factor (FCw)

Type	**Width (m)**	**FC_w**	**Remark**
4L D or one way	3	0.92	Width for each line
	3.25	0.96	
	3.5	1	
	3.75	1.04	
	4	1.08	
4L UD	3	0.91	Width for each line
	3.25	0.95	
	3.5	1	
	3.75	1.05	
	4	1.09	
2L UD	5	0.56	Width mean for whole segment
	6	0.87	
	7	1	
	8	1.14	
	9	1.25	
	10	1.29	
	11	1.34	

Link Separated Capacity Factor (FCsp)

FC_{SP} (%-%)	50-50	55-45	60-40	65-35	70-30

2/2	1	0.97	0.94	0.91	0.88
4/2	1	0.985	0.97	0.955	0.94

Side Friction Capacity Factor Value for Road with Shoulder

Road Type	Side Friction Category	FC_{SF} Shoulder Wide (m)			
		0.5	1.0	1.5	2.0
4/2 D	VL	0.96	0.98	1.01	1.03
	L	0.94	0.97	1.00	1.02
	M	0.92	0.95	0.98	1.00
	H	0.88	0.92	0.95	0.98
	VH	0.84	0.88	0.92	0.96
4/2 UD	VL	0.96	0.99	1.01	1.03
	L	0.94	0.97	1.00	1.02
	M	0.92	0.95	0.98	1.00
	H	0.87	0.91	0.94	0.98
	VH	0.80	0.86	0.90	0.95
2/2 UD	VL	0.94	0.96	0.99	1.01
	L	0.92	0.94	0.97	1.00
	M	0.89	0.92	0.95	0.98
	H	0.82	0.86	0.90	0.95
	VH	0.73	0.79	0.85	0.91

Side Friction Capacity Factor Value for Road with Curbs

Road Type	**Side Friction Category**	**FC_{SF} Curbs (m)**			
		<0.5m	1.0m	1.5m	>2.0m
4/2 D	VL	0.95	0.97	0.99	1.01
	L	0.94	0.96	0.98	1.00
	M	0.91	0.93	0.95	0.98
	H	0.86	0.89	0.92	0.95
	VH	0.81	0.85	0.88	0.92
4/2 UD	VL	0.95	0.97	0.99	1.01
	L	0.93	0.95	0.97	1.00
	M	0.90	0.92	0.95	0.97
	H	0.84	0.87	0.90	0.93
	VH	0.77	0.81	0.85	0.90
2/2 UD	VL	0.93	0.95	0.97	0.99
	L	0.90	0.92	0.95	0.97
	M	0.86	0.88	0.91	0.94
	H	0.78	0.81	0.84	0.88

VH	0.68	0.72	0.77	0.82

City Size Factor

Population (in millions)	FC_{CS}
<0.1	0.86
0.1-0.5	0.9
0.5-1.0	0.94
1.0-3.0	1
>3.0	1.04

FIGURE 129: ROAD CAPACITY OF EXISTING ROAD

Section	National Road	Length	Carriageway	Type	Co	Fcw	FCsp	FCsf	FCcs	C	2015 PCU	2015 ADT	2015 Peak	2015 VCR
7	BTS. KOTA MEDAN - BTS. KOTA LUBUK PAKAM	14.032	14.9	4/2 D	7600	0.96	1	0.94	1.04	7,133	118,727	75,129	11,873	1.7
10	TUGU KOTA LUBUK PAKAM - BTS. KAB. SERDAN	6.16	14.0	4/2 D	7600	0.96	1	0.94	1.04	7,133	91,237	57,803	9,124	1.3
11	BTS. KAB. DELI SERDANG - PERBAUNGAN	1.8	14.0	4/2 D	7600	0.96	1	0.94	1.04	7,133	83,420	51,191	8,342	1.2
12	PERBAUNGAN - BTS. KAB. DELI SERDANG/SEI	13.2	7.3	2/2 UD	3100	1	1	0.94	1.04	3,031	94,108	53,843	9,411	3.1
13	BTS. KAB. DELI SERDANG/SEI BULUH - SEI R	13.2	7.3	2/2 UD	3100	1	1	0.94	1.04	3,031	106,005	69,641	10,601	3.5
14	SEI RAMPAH - BTS. KOTA TEBING TINGGI	13.5	7.2	2/2 UD	3100	1	1	0.94	1.04	3,031	96,244	63,375	9,624	3.2
63	BTS. KOTA TEBING TINGGI - BTS. KAB. SIMA	19.5	7.0	2/2 UD	3100	1	1	0.94	1.04	3,031	41,457	26,386	4,146	1.4
1	KAB. KARO													
53.1	BTS. DELI SERDANG - SP. UJUNG AJI	12.7	6.2	2/2 UD	3100	0.87	1	0.94	0.94	2,383	62,816	43,461	6,282	2.6
53.21	JLN. J.M. GINTING (KABANJAHE)	1.24	11.6	4/2 UD	6800	0.91	1	0.94	0.94	5,468	48,654	37,328	4,865	0.9
53.22	JLN. VETERAN (KABANJAHE)	1.14	13.8	4/2 UD	6800	0.95	1	0.94	0.94	5,708	48,103	40,128	4,810	0.8
53.23	JLN. MARIAM GINTING (KABANJAHE)	1.83	7.0	2/2 UD	3100	1	1	0.94	0.94	2,739	43,809	28,344	4,381	1.6
54	JLN. KUTACANE - BTS. KOTA KABANJAHE - KUTA BULUH	58.5	5.0	2/2 UD	3100	0.56	1	0.94	0.94	1,534	14,590	9,680	1,459	1.0
54.11	JLN. KAP. BANGSI SEMBIRING (KABANJAHE)	0.53	13.3	4/2 UD	6800	0.95	1	0.94	0.94	5,708	11,450	8,553	1,145	0.2
55	KABANJAHE - MEREK	21.98	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	13,933	11,940	1,393	0.6
55.11	JLN. PALABANGUN (KABANJAHE)	1.1	8.2	2/2 UD	3100	1.14	1	0.94	0.94	3,123	15,452	11,923	1,545	0.5
56	MEREK - BTS. KAB. DAIRI	14.06	5.6	2/2 UD	3100	0.87	1	0.94	0.94	2,383	6,878	5,136	688	0.3
59	MEREK - BTS. KAB. SIMALUNGUN	2.668	6.0	2/2 UD	3100	0.87	1	0.94	0.94	2,383	6,327	4,268	633	0.3
2	KAB. SIMALUNGUN													
60	BTS. KAB. KARO - SERIBU DOLOK	8.59	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	5,144	3,484	514	0.2
61	SERIBU DOLOK - TIGA RUNGGU	14.95	5.6	2/2 UD	3100	0.87	1	0.94	0.94	2,383	6,179	4,404	618	0.3
62	TIGA RUNGGU - TANJUNG DOLOK	42.29	4.8	2/2 UD	3100	0.57	1	0.94	0.94	1,561	8,415	6,576	841	0.5
64	BTS. KAB. SERDANG BEDAGAI - BTS. KOTA PEMATANG SIANTAR	15.01	6.9	2/2 UD	3100	1	1	0.94	0.94	2,739	53,170	37,342	5,317	1.9
65	BTS. KOTA PEMATANG SIANTAR - PARAPAT	37.92	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	10,120	7,213	1,012	0.42
66	PARAPAT - BTS. KAB. TOBASA	10.47	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	7,566	6,247	757	0.3
90	BTS. KAB. SIMALUNGUN/BTS. KAB. BATU BARA - SP. MAYANG	3.65	6.5	2/2 UD	3100	0.87	1	0.94	0.94	2,383	11,410	5,621	1,141	0.5
96	JLN . LINGKAR LUAR PARAPAT	19.85	6.0	2/2 UD	3100	0.87	1	0.94	0.94	2,383	581	403	58	0.0
91	SP. MAYANG - SEI MANGKEI	2.5	5.3	2/2 UD	3100	0.56	1	0.94	0.94	1,534	7,839	3,062	784	0.5
3	KAB. DAIRI													
28	LAWE PAKAM (BTS. PROV. ACEH) - KUTA BULUH	42.64	5.1	2/2 UD	3100	0.56	1	0.94	0.86	1,403	1,918	1,201	192	0.1
29	KUTA BULUH - BTS. KOTA SIDIKALANG	54.4	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	1,092	646	109	0.1
29.11	JLN. AHMAD YANI (SIDIKALANG)	1.073	12.6	4/2 UD	6800	0.91	1	0.94	0.86	5,002	12,564	9,423	1,256	0.3
29.12	JLN. SISINGAMANGARAJA (SIDIKALANG)	2.65	10.7	4/2 UD	6800	0.91	1	0.94	0.86	5,002	16,319	11,495	1,632	0.3
29.13	JLN. TIGA LINGGA (SIDIKALANG)	0.72	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,448	2,297	345	0.2
30	BTS. KOTA SIDIKALANG - PANJI	3.62	5.0	2/2 UD	3100	0.56	1	0.94	0.86	1,403	8,631	6,209	863	0.6
30.12	JLN. PAHLAWAN (SIDIKALANG)	2.67	6.6	2/2 UD	3100	0.87	1	0.94	0.86	2,180	12,590	9,624	1,259	0.6
31	PANJI - BTS. KAB. SAMOSIR	29.38	4.8	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,802	4,254	580	0.4
57	BTS. KAB. KARO - PANJI	29.81	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,056	4,376	606	0.4
58.11	JLN. RUNDING (SIDIKALANG)	5.437	5.4	2/2 UD	3100	0.56	1	0.94	0.86	1,403	7,896	5,939	790	0.6

4	KAB. SAMOSIR													
93	TOMOK - AMBARITA	5.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,865	3,796	586	0.4
94	AMBARITA - SIMANINDO	18.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,417	3,466	542	0.4
95	SIMANINDO - PANGURURAN	19.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	8,007	4,803	801	0.6
96	PANGURURAN - NAINGGOLAN	40	6.0	2/2 UD	3100	0.87	1	0.94	0.86	2,180	581	403	58	0.0
98	TELE - PANGURURAN	22	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,524	3,266	552	0.4
100	NAINGGOLAN - ONAN RUNGGU	7	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	327	162	33	0.0
101	ONAN RUNGGU - TOMOK	34	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,705	2,076	371	0.3
5	KAB. HUMBANGHASUNDUTAN													
32	BTS. KAB. DAIRI - DOLOK SANGGUL	49.41	5.3	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,339	2,151	334	0.2
33	DOLOK SANGGUL - SIBORONG BORONG	28.48	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	12,693	8,839	1,269	0.9
6	KAB. TOBA SAMOSIR													
67	BTS. KAB. SIMALUNGUN - SILIMBAT	34.74	5.9	2/2 UD	3100	0.87	1	0.94	0.86	2,180	13,287	8,748	1,329	0.6
68	SILIMBAT - BTS. KAB. TAPANULI UTARA	26.65	6.8	2/2 UD	3100	1	1	0.94	0.86	2,506	8,608	6,721	861	0.3
92	PARAPAT - PELABUHAN AJIBATA	2.8	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	9,194	6,394	919	0.7
7	KAB. TAPANUL I UTARA													
34	SIBORONG BORONG - TARUTUNG	19.68	6.2	2/2 UD	3100	0.87	1	0.94	0.86	2,180	8,559	6,366	856	0.4
34.12	JLN. BALIGE (TARUTUNG)	5.23	6.2	2/2 UD	3100	0.87	1	0.94	0.86	2,180	7,549	6,006	755	0.3
34.13	JLN. BY PASS (TARUTUNG)	6.12	5.6	2/2 UD	3100	0.87	1	0.94	0.86	2,180	4,032	2,596	403	0.2
34.14	JLN. SISINGAMANGARAJA (TARUTUNG)	0.863	10.5	2/2 UD	3100	1.29	1	0.94	0.86	3,233	19,976	15,300	1,998	0.6
35	BTS. KOTA TARUTUNG - BTS. KAB. TAPANULI SELATAN	50.07	5.3	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,968	3,030	397	0.3
35.11	JLN. PANJAITAN (TARUTUNG)	1.46	7.3	2/2 UD	3100	1	1	0.94	0.86	2,506	20,639	13,919	2,064	0.8
35.12	JLN. RAYA YOHANES (TARUTUNG)	1.52	4.8	2/2 UD	3100	0.56	1	0.94	0.86	1,403	19,418	13,328	1,942	1.4
35.13	JLN. PAHAE (TARUTUNG)	0.62	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,184	4,692	618	0.4
69	BTS. KAB. TOBASA - SIBORONG BORONG	9.19	6.1	2/2 UD	3100	0.56	1	0.94	0.86	1,403	11,158	9,521	1,116	0.8
70	BTS. KOTA TARUTUNG - BTS. KAB. TAPANULI TENGAH	36.27	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,981	4,643	698	0.5
70.11	JLN. SISINGAMANGARAJA (TARUTUNG)	0.62	6.0	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,135	3,382	514	0.4
70.12	JLN. KE SIBOLGA (TARUTUNG)	1.58	4.6	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,991	2,538	399	0.3
97	SP. SILANGIT - BANDARA SILANGIT	1	10.0	2/2 UD	3100	1.29	1	0.94	0.86	3,233	3,913	2,600	391	0.1

TOLL ROAD DIVERSION AND CAPACITY

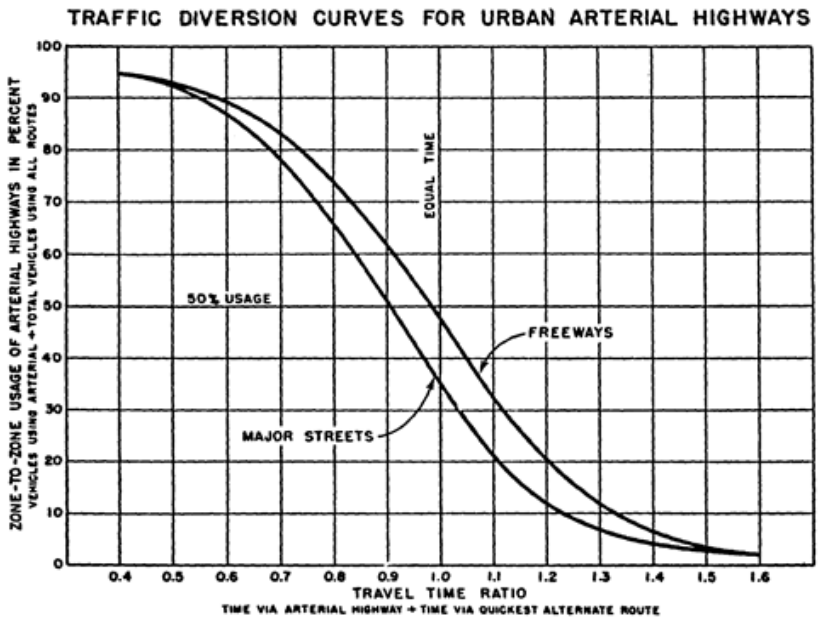
The toll road proposal would add capacity to carry about 9,200 vehicles per hour. Diversion curves method is used to analyze the adequacy of toll road. The method assumes the availability of zone-to-zone travel over the existing road network from an IRMS data (Inter urban road management system, PWD).

Travelling on the new toll-road from Medan to Tebing Tinggi at an average 75 kph would take 50 minutes, whilst Tebing-Tinggi to P. Siantar would take 30 minutes. 40 minutes time was added for Pem. Sinatar-Parapat, such that Medan - Parapat route travel time is 2 hours in total.

The probability of diversion can be represented graphically by a curve. When the cost of a trip is equal between two alternative routes then the probability is that traffic will split 50%-50%. When the cost comparison is unequal then traffic proportions move away from the 50%-50% split - not in a linear pattern but rather as shown in Figure 130.

The diversion rate method then is applied to estimate the proportion of traffic volumes diverted from the future ordinary road network to the newly developed toll roads. The factors having the greatest influence on the routes taken by drivers are the comparative travel time and distance. The BPR (bureau of public road) formula was utilized for the study (Figure 130).

FIGURE 130: DIVERSION CURVES



Source: American Association of State Highway Officials, a Basis for Estimating Traffic Diversion to New Highways in Urban Areas

The term user equilibrium (UE) in the context of transportation modelling is used to describe a route choice assumption formally proposed by Wardrop: "The journey times on all the routes actually used are equal and less than those which would be experienced by a single vehicle on any unused routes".

This condition of UE is used to estimate the proportion of vehicle traffic shifted to new toll road. Origin destination (OD) pair for each road segment (Medan-Tebing Tinggi) and (Tebing Tinggi - P. Siantar) is connected by two one-way links representing two different routes. Fixed characteristics of links utilized in the calculation are listed in the above table. Travel times on these links are estimated by using a typical Bureau of Public Roads volume delay function shown in equation above where travel time is an increasing function of flow. This type of flow dependent functions for estimating travel time are also called link cost function.

FIGURE 131: USER EQUILIBRIUM & CAPACITY RESTRAINT CONDITION MEDAN – TEBING TINGGI

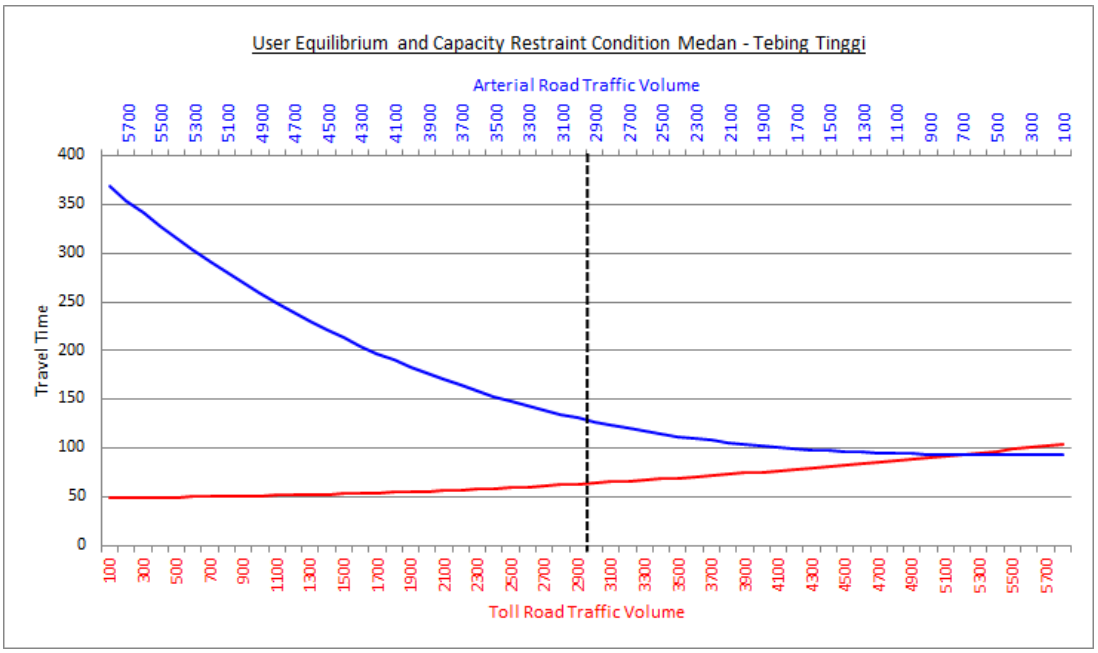
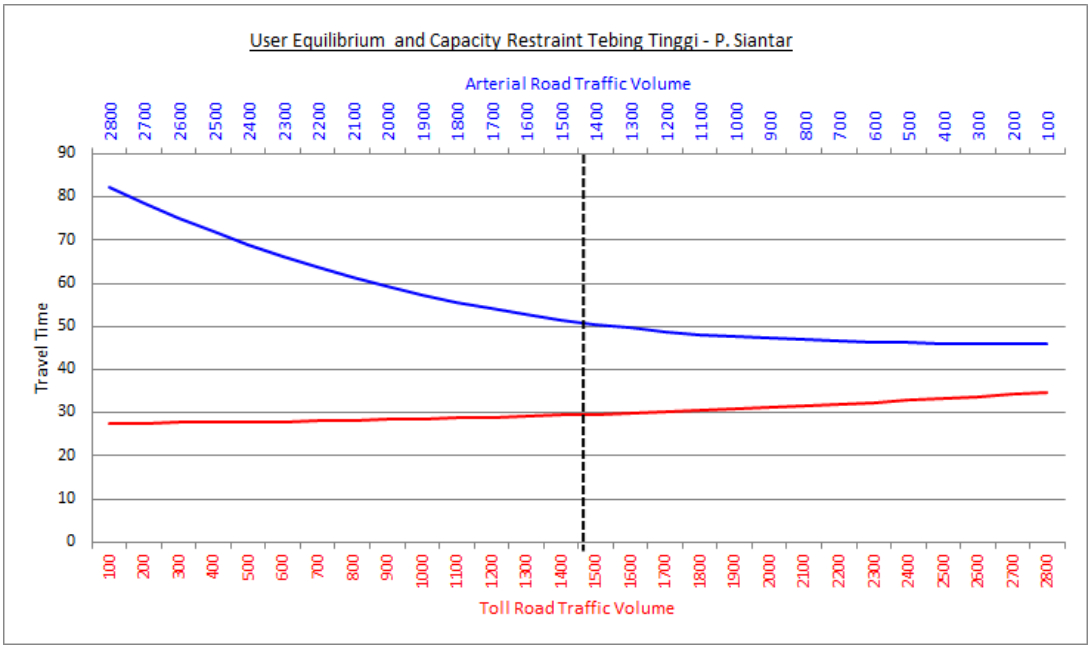


FIGURE 132: USER EQUILIBRIUM & CAPACITY RESTRAINT CONDITION TEBING TINGGI – P. SIANTAR



Based on the above parameters, the diversion rate to the new toll road (per direction) is estimated as follows.

FIGURE 133: DIVERSION RATE TO THE NEW TOLL ROAD

Section	Length	Carriageway	C	2016	2017	2018	2019	2020	2021
Medan - Tebing Tinggi Toll Road Perbaungan Exit	21.16	14	4,600				3,279	3,440	3,608
Medan - Tebing Tinggi Toll Road Tebing Tinggi Exit	39.9	14	4,600				3,193	3,350	3,514
National Road 7,10, 11 Medan - Perbaungan	21.16	14.3	3,566	5,129	5,381	5,644	2,642	2,771	2,907
Corridor 12,13,14 Perbaungan - Tebing Tinggi	39.9	7.2	1,515	5,181	5,435	5,701	2,788	2,924	3,068
Tebing Tinggi - P.Siantar Toll Road	34.5	14	4,600						2,677
National Road 63,64 Tebing Tinggi - P. Siantar	34.51	6.9	1,442	2,482	2,603	2,731	2,865	3,005	475
Section	**Length**	**Carriageway**	**C**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Medan - Tebing Tinggi Toll Road Perbaungan Exit	21.16	14	4,600	3,711	3,816	3,924	4,035	4,149	4,266
Medan - Tebing Tinggi Toll Road Tebing Tinggi Exit	39.9	14	4,600	3,613	3,715	3,821	3,929	4,040	4,155
National Road 7,10, 11 Medan - Perbaungan	21.16	14.3	3,566	2,989	3,074	3,161	3,250	3,342	3,437
Corridor 12,13,14 Perbaungan - Tebing Tinggi	39.9	7.2	1,515	3,154	3,244	3,336	3,430	3,527	3,627
Tebing Tinggi - P.Siantar Toll Road	34.5	14	4,600	2,753	2,831	2,911	2,993	3,078	3,165
National Road 63,64 Tebing Tinggi - P. Siantar	34.51	6.9	1,442	489	502	517	531	546	562
Section	**Length**	**Carriageway**	**C**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**
Medan - Tebing Tinggi Toll Road Perbaungan Exit	21.16	14	4,600	4,387	4,512	4,639	4,771	4,906	5,045
Medan - Tebing Tinggi Toll Road Tebing Tinggi Exit	39.9	14	4,600	4,272	4,393	4,518	4,645	4,777	4,912
National Road 7,10, 11 Medan - Perbaungan	21.16	14.3	3,566	3,534	3,634	3,737	3,843	3,952	4,064
Corridor 12,13,14 Perbaungan - Tebing Tinggi	39.9	7.2	1,515	3,730	3,835	3,944	4,056	4,171	4,289
Tebing Tinggi - P.Siantar Toll Road	34.5	14	4,600	3,255	3,347	3,442	3,539	3,639	3,743
National Road 63,64 Tebing Tinggi - P. Siantar	34.51	6.9	1,442	578	594	611	628	646	664

Section	Length	Carriageway	C	2034	2035	2036	2037	2038	2039	2040	2041
Medan - Tebing Tinggi Toll Road Perbaungan Exit	21.16	14	4,600	5,187	5,334	5,485	5,641	5,800	5,965	6,134	6,307
Medan - Tebing Tinggi Toll Road Tebing Tinggi Exit	39.9	14	4,600	5,051	5,194	5,341	5,493	5,648	5,808	5,973	6,142
National Road 7,10, 11 Medan - Perbaungan	21.16	14.3	3,566	4,179	4,297	4,419	4,544	4,673	4,805	4,941	5,081
Corridor 12,13,14 Perbaungan - Tebing Tinggi	39.9	7.2	1,515	4,410	4,535	4,663	4,795	4,931	5,071	5,214	5,362
Tebing Tinggi - P.Siantar Toll Road	34.5	14	4,600	3,848	3,957	4,070	4,185	4,303	4,425	4,550	4,679
National Road 63,64 Tebing Tinggi - P. Siantar	34.51	6.9	1,442	683	702	722	743	764	785	808	831

In summary, the Volume Capacity Ratio of future road is shown in Figure 134 (highlighted yellow is the national road section which will be affected by the toll road operation).

FIGURE 134: ROAD CAPACITY

											2021				2041			
Section	National Road	Length	Carriageway	Type	Co	Fcw	FCsp	FCsf	FCcs	C	ADT	PCU	Peak	VCR	ADT	PCU	Peak	VCR
7	BTS. KOTA MEDAN - BTS. KOTA LUBUK PAKAM	14.032	14.9	4/2 D	7600	0.96	1	0.94	1.04	7,133	100,105	72,183	7,218	1.0	174,979	126,172	12,617	1.8
10	TUGU KOTA LUBUK PAKAM - BTS. KAB. SERDAN	6.16	14.0	4/2 D	7600	0.96	1	0.94	1.04	7,133	77,019	53,484	5,348	0.7	134,626	93,488	9,349	1.3
11	BTS. KAB. DELI SERDANG - PERBAUNGAN	1.8	14.0	4/2 D	7600	0.96	1	0.94	1.04	7,133	68,209	48,748	4,875	0.7	119,226	85,208	8,521	1.2
12	PERBAUNGAN - BTS. KAB. DELI SERDANG/SEI	13.2	7.3	2/2 UD	3100	1	1	0.94	1.04	3,031	71,743	60,095	6,009	2.0	125,403	105,043	10,504	3.5
13	BTS. KAB. DELI SERDANG/SEI BULUH - SEI R	13.2	7.3	2/2 UD	3100	1	1	0.94	1.04	3,031	92,793	65,233	6,523	2.2	162,197	114,023	11,402	3.8
14	SEI RAMPAH - BTS. KOTA TEBING TINGGI	13.5	7.2	2/2 UD	3100	1	1	0.94	1.04	3,031	84,444	58,729	5,873	1.9	147,603	102,654	10,265	3.4
63	BTS. KOTA TEBING TINGGI - BTS. KAB. SIMA	19.5	7.0	2/2 UD	3100	1	1	0.94	1.04	3,031	35,158	6,347	635	0.2	61,454	11,094	1,109	0.4
1	KAB. KARO																	
53.1	BTS. DELI SERDANG - SP. UJUNG AJI	12.7	6.2	2/2 UD	3100	0.87	1	0.94	0.94	2,383	57,909	83,699	8,370	3.5	101,222	146,302	14,630	6.1
53.21	JLN. J.M. GINTING (KABANJAHE)	1.24	11.6	4/2 UD	6800	0.91	1	0.94	0.94	5,468	49,737	64,829	6,483	1.2	86,938	113,317	11,332	2.1
53.22	JLN. VETERAN (KABANJAHE)	1.14	13.8	4/2 UD	6800	0.95	1	0.94	0.94	5,708	53,468	64,095	6,409	1.1	93,460	112,034	11,203	2.0
53.23	JLN. MARIAM GINTING (KABANJAHE)	1.83	7.0	2/2 UD	3100	1	1	0.94	0.94	2,739	37,767	58,373	5,837	2.1	66,014	102,033	10,203	3.7
54	JLN. KUTACANE - BTS. KOTA KABANJAHE - KUTA BULUH	58.5	5.0	2/2 UD	3100	0.56	1	0.94	0.94	1,534	12,898	19,440	1,944	1.3	22,545	33,980	3,398	2.2
54.11	JLN. KAP. BANGSI SEMBIRING (KABANJAHE)	0.53	13.3	4/2 UD	6800	0.95	1	0.94	0.94	5,708	11,396	15,257	1,526	0.3	19,920	26,668	2,667	0.5
55	KABANJAHE - MEREK	21.98	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	15,909	18,565	1,857	0.8	27,809	32,451	3,245	1.4
55.11	JLN. PALABANGUN (KABANJAHE)	1.1	8.2	2/2 UD	3100	1.14	1	0.94	0.94	3,123	15,887	20,589	2,059	0.7	27,769	35,989	3,599	1.2
56	MEREK - BTS. KAB. DAIRI	14.06	5.6	2/2 UD	3100	0.87	1	0.94	0.94	2,383	6,843	9,165	917	0.4	11,962	16,020	1,602	0.7
59	MEREK - BTS. KAB. SIMALUNGUN	2.668	6.0	2/2 UD	3100	0.87	1	0.94	0.94	2,383	5,687	8,431	843	0.4	9,940	14,737	1,474	0.6
2	KAB. SIMALUNGUN																	
60	BTS. KAB. KARO - SERIBU DOLOK	8.59	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	4,642	6,854	685	0.3	8,114	11,980	1,198	0.5
61	SERIBU DOLOK - TIGA RUNGGU	14.95	5.6	2/2 UD	3100	0.87	1	0.94	0.94	2,383	5,868	8,233	823	0.3	5,667	14,391	1,439	0.6
62	TIGA RUNGGU - TANJUNG DOLOK	42.29	4.8	2/2 UD	3100	0.57	1	0.94	0.94	1,561	8,762	11,212	1,121	0.7	15,316	19,599	1,960	1.3
64	BTS. KAB. SERDANG BEDAGAI - BTS. KOTA PEMATANG SIANTAR	15.01	6.9	2/2 UD	3100	1	1	0.94	0.94	2,739	49,756	12,660	1,266	0.5	86,971	22,129	2,213	0.8
65	BTS. KOTA PEMATANG SIANTAR - PARAPAT	37.92	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	9,611	13,484	1,348	0.6	16,799	23,569	2,357	1.0
66	PARAPAT - BTS. KAB. TOBASA	10.47	5.9	2/2 UD	3100	0.87	1	0.94	0.94	2,383	8,324	10,081	1,008	0.4	14,550	17,622	1,762	0.7
90	BTS. KAB. SIMALUNGUN/BTS. KAB. BATU BARA - SP. MAYANG	3.65	6.5	2/2 UD	3100	0.87	1	0.94	0.94	2,383	7,490	15,203	1,520	0.6	13,092	26,574	2,657	1.1
96	JLN . LINGKAR LUAR PARAPAT	19.85	6.0	2/2 UD	3100	0.87	1	0.94	0.94	2,383	537	774	77	0.0	939	1,353	135	0.1
91	SP. MAYANG - SEI MANGKEI	2.5	5.3	2/2 UD	3100	0.56	1	0.94	0.94	1,534	4,080	10,444	1,044	0.7	7,132	18,256	1,826	1.2
3	KAB. DAIRI																	
28	LAWE PAKAM (BTS. PROV. ACEH) - KUTA BULUH	42.64	5.1	2/2 UD	3100	0.56	1	0.94	0.86	1,403	1,600	2,555	256	0.2	2,797	4,467	447	0.3
29	KUTA BULUH - BTS. KOTA SIDIKALANG	54.4	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	861	1,455	146	0.1	1,505	2,544	254	0.2
29.11	JLN. AHMAD YANI (SIDIKALANG)	1.073	12.6	4/2 UD	6800	0.91	1	0.94	0.86	5,002	12,556	16,741	1,674	0.3	21,947	29,262	2,926	0.6
29.12	JLN. SISINGAMANGARAJA (SIDIKALANG)	2.65	10.7	4/2 UD	6800	0.91	1	0.94	0.86	5,002	15,316	21,745	2,174	0.4	26,772	38,008	3,801	0.8
29.13	JLN. TIGA LINGGA (SIDIKALANG)	0.72	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,061	4,594	459	0.3	5,350	8,030	803	0.6
30	BTS. KOTA SIDIKALANG - PANJI	3.62	5.0	2/2 UD	3100	0.56	1	0.94	0.86	1,403	8,273	11,501	1,150	0.8	14,461	20,103	2,010	1.4
30.12	JLN. PAHLAWAN (SIDIKALANG)	2.67	6.6	2/2 UD	3100	0.87	1	0.94	0.86	2,180	12,823	16,775	1,678	0.8	22,415	29,323	2,932	1.3
31	PANJI - BTS. KAB. SAMOSIR	29.38	4.8	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,668	7,731	773	0.6	9,908	13,513	1,351	1.0
57	BTS. KAB. KARO - PANJI	29.81	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,831	8,069	807	0.6	10,192	14,105	1,410	1.0
58.11	JLN. RUNDING (SIDIKALANG)	5.437	5.4	2/2 UD	3100	0.56	1	0.94	0.86	1,403	7,913	10,521	1,052	0.7	13,832	18,391	1,839	1.3

											2021				2041			
Section	National Road	Length	Carriageway	Type	Co	Fcw	FCsp	FCsf	FCcs	C	ADT	PCU	Peak	VCR	ADT	PCU	Peak	VCR
4	KAB. SAMOSIR																	
93	TOMOK - AMBARITA	5.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	5,058	7,815	781	0.6	8,841	13,660	1,366	1.0
94	AMBARITA - SIMANINDO	18.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	4,618	7,218	722	0.5	8,072	12,616	1,262	0.9
95	SIMANINDO - PANGURURAN	19.3	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,400	10,669	1,067	0.8	11,186	18,649	1,865	1.3
96	PANGURURAN - NAINGGOLAN	40	6.0	2/2 UD	3100	0.87	1	0.94	0.86	2,180	537	774	77	0.0	939	1,353	135	0.1
98	TELE - PANGURURAN	22	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	4,352	7,360	736	0.5	7,607	12,865	1,286	0.9
100	NAINGGOLAN - ONAN RUNGGU	7	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	216	435	44	0.0	377	761	76	0.1
101	ONAN RUNGGU - TOMOK	34	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	2,766	4,937	494	0.4	4,835	8,629	863	0.6
5	KAB. HUMBANGHASUNDUTAN																	
32	BTS. KAB. DAIRI - DOLOK SANGGUL	49.41	5.3	2/2 UD	3100	0.56	1	0.94	0.86	1,403	2,866	4,448	445	0.3	5,010	7,776	778	0.6
33	DOLOK SANGGUL - SIBORONG BORONG	28.48	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	11,777	16,912	1,691	1.2	20,586	29,562	2,956	2.1
6	KAB. TOBA SAMOSIR																	
67	BTS. KAB. SIMALUNGUN - SILIMBAT	34.74	5.9	2/2 UD	3100	0.87	1	0.94	0.86	2,180	11,656	17,704	1,770	0.8	20,374	30,946	3,095	1.4
68	SILIMBAT - BTS. KAB. TAPANULI UTARA	26.65	6.8	2/2 UD	3100	1	1	0.94	0.86	2,506	8,955	11,470	1,147	0.5	15,653	20,048	2,005	0.8
92	PARAPAT - PELABUHAN AJIBATA	2.8	5.2	2/2 UD	3100	0.56	1	0.94	0.86	1,403	8,520	12,251	1,225	0.9	14,892	21,414	2,141	1.5
7	KAB. TAPANUL I UTARA																	
34	SIBORONG BORONG - TARUTUNG	19.68	6.2	2/2 UD	3100	0.87	1	0.94	0.86	2,180	8,482	11,404	1,140	0.5	14,827	19,934	1,993	0.9
34.12	JLN. BALIGE (TARUTUNG)	5.23	6.2	2/2 UD	3100	0.87	1	0.94	0.86	2,180	8,003	10,059	1,006	0.5	13,988	17,583	1,758	0.8
34.13	JLN. BY PASS (TARUTUNG)	6.12	5.6	2/2 UD	3100	0.87	1	0.94	0.86	2,180	3,459	5,373	537	0.2	6,046	9,392	939	0.4
34.14	JLN. SISINGAMANGARAJA (TARUTUNG)	0.863	10.5	2/2 UD	3100	1.29	1	0.94	0.86	3,233	20,386	26,616	2,662	0.8	35,634	46,524	4,652	1.4
35	BTS. KOTA TARUTUNG - BTS. KAB. TAPANULI SELATAN	50.07	5.3	2/2 UD	3100	0.56	1	0.94	0.86	1,403	4,037	5,287	529	0.4	7,057	9,241	924	0.7
35.11	JLN. PANJAITAN (TARUTUNG)	1.46	7.3	2/2 UD	3100	1	1	0.94	0.86	2,506	18,546	27,501	2,750	1.1	32,418	48,070	4,807	1.9
35.12	JLN. RAYA YOHANES (TARUTUNG)	1.52	4.8	2/2 UD	3100	0.56	1	0.94	0.86	1,403	17,759	25,873	2,587	1.8	31,041	45,225	4,522	3.2
35.13	JLN. PAHAE (TARUTUNG)	0.62	4.5	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,252	8,239	824	0.6	10,928	14,402	1,440	1.0
69	BTS. KAB. TOBASA - SIBORONG BORONG	9.19	6.1	2/2 UD	3100	0.56	1	0.94	0.86	1,403	12,686	14,867	1,487	1.1	22,175	25,987	2,599	1.9
70	BTS. KOTA TARUTUNG - BTS. KAB. TAPANULI TENGAH	36.27	4.7	2/2 UD	3100	0.56	1	0.94	0.86	1,403	6,187	9,302	930	0.7	10,814	16,260	1,626	1.2
70.11	JLN. SISINGAMANGARAJA (TARUTUNG)	0.62	6.0	2/2 UD	3100	0.56	1	0.94	0.86	1,403	4,506	6,843	684	0.5	7,877	11,961	1,196	0.9
70.12	JLN. KE SIBOLGA (TARUTUNG)	1.58	4.6	2/2 UD	3100	0.56	1	0.94	0.86	1,403	3,382	5,318	532	0.4	5,911	9,295	930	0.7
97	SP. SILANGIT - BANDARA SILANGIT	1	10.0	2/2 UD	3100	1.29	1	0.94	0.86	3,233	3,464	5,214	521	0.2	6,056	9,113	911	0.3

Following formula (left) has been used to assess the toll road capacity. Using BPR Formula (right), the new toll road and existing road are assessed.

$$C = C_0 \; x \; FC_{sp} \; x \; FC_w$$

C	capacity (PCU/hour)
C_o	free flow capacity (PCU/hour)
FC_w	link width capacity factor
FC_{SP}	link separated capacity factor

$$T_f = To \times (1 + \alpha \times [v/c]^{\beta})$$

Where:

T_f = Final/Congested Travel Time (minutes)

To = Free Flow Travel Time (minutes)

α= 0.15 (parameter)

β= 4 (parameter)

V = Estimated Volume (vehicle per hour/vph)

C = Flow Capacity (vph)

APPENDIX IV: AIRPORT CAPACITY ASSESSMENT

KUALANAMU AIRPORT AIRCRAFT MOVEMENT AND RUNWAY CAPACITY

Possible Hourly Aircraft Movements

Currently, the Kualanamu airport runway utilization has runway 05/23 (direction) as the primary departure and arrival runway. In determining the runway capacity all associated comments are made without considering airspace design and airspace structure within the Indonesia FIR (Flight Information Region).

If the airspace or operational procedures used by the Air Traffic Control are the limiting factors, as such, for the purpose of obtaining maximum capacity the following information will address a runway capacity as an independent runway operation.

According to the ICAO Doc 9164, the single runway system could have a capacity of more than 50 peak hour aircraft movements under ideal conditions, i.e. considering fully independent mixed mode operations, proper management of flight schedules, reduction of arrival aircraft in-trail spacing, and addition of more aircraft parking stands.

Based on the information reviewed as part of this study, it is not possible to validate this estimate, as this often does everything perfectly – i.e. allowing departures when arrivals are nearly 2.8 Nautical Miles (NM) away every time. A human controller may not allow this behaviour.

Therefore, as part of this study, theoretical runway capacity estimates were developed based on the following assumptions:

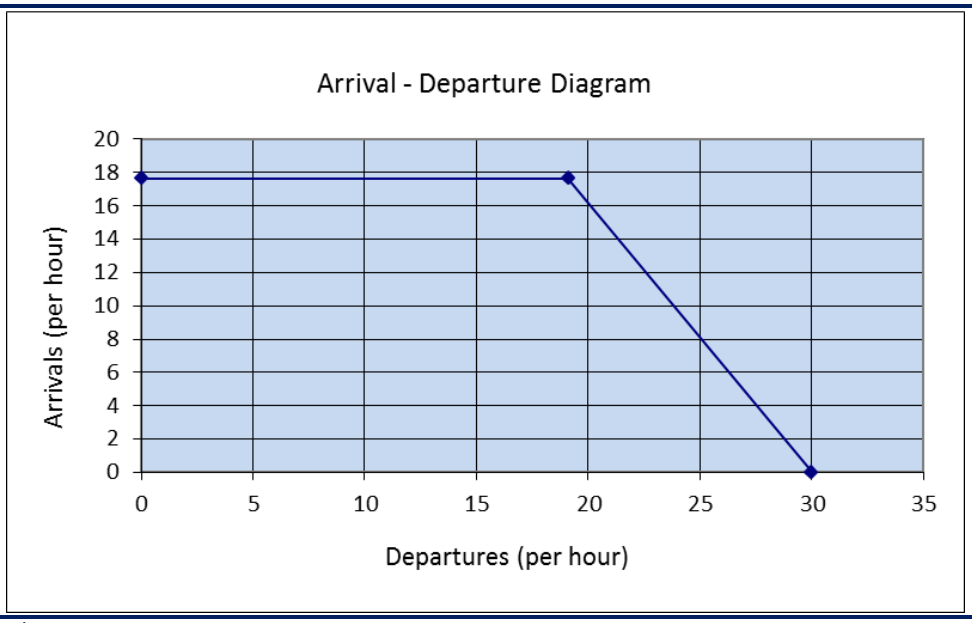
- Balanced peak, which consists of 50% arriving and 50% departing aircraft in the peak hour;
- Flying based on Instrumental Flight Rules (IFR);
- Wake Vortex distance between landing aircraft is 4 nm;
- No airspace and communication navigation systems and air traffic management (CNS-ATM) system limitations;
- Declare capacity will be 80% of full capacity.[34]

[34] *Declare runway capacity is arranged in the DOC.9426 (ATS Planning Manual —Appendix C Techniques for ATC Sector/Position Capacity Estimation) —an ATC unit cannot operate at full* capacity throughout the whole operating shift, since there are several variables that significantly reduce capacity at certain times. Therefore, it is advisable to adopt percentages between 80% and 90%, thus giving more flexibility to capacity values, that is, an ideal interval that preserves the safety of air operations.

Runway Capacity

Based on the above assumptions and parameters, the theoretical capacity for the Kualanamu airport runway is 30 movements per hour in all-departure, or 37 movements per hour in mixed-mode operations and 18 movements per hour in all-arrivals. Figure 135 shows the resulting theoretical airport capacity based on mixed-mode operations.

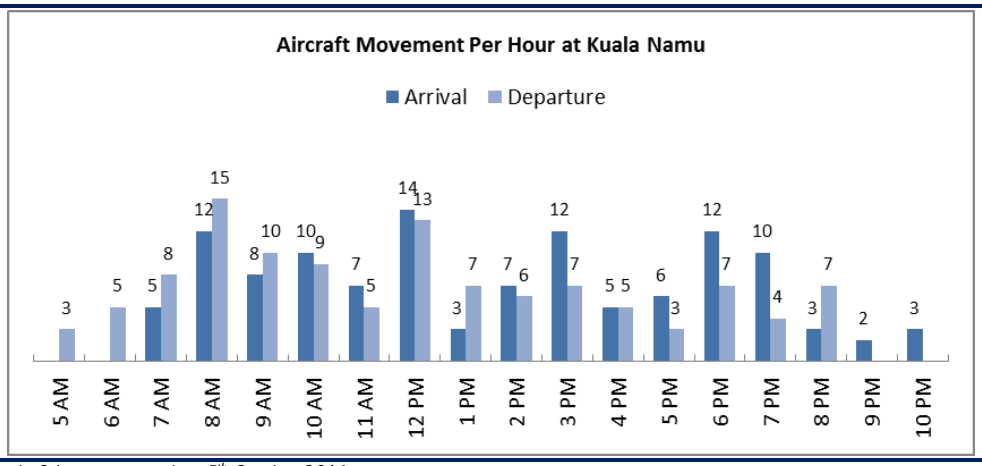
FIGURE 135: MIXED MODE OPERATIONS OF KUALANAMU AIRPORT



Source: Surbana Jurong

Therefore, the estimated capacity is approximately 29 movements (80% of full capacity). This indicated that the existing runway capacity near to its capacity based on the available of airport slot (see Figure 136).

FIGURE 136: HOURLY AIRCRAFT MOVEMENT DISTRIBUTION



Source: Flightradar24.com accessed on 5th October 2016

As seen from the above figure, the peak movement (>10) accounts for 77.6% of the day. Considering the typical airline slot movement, hourly runway capacity is converted to daily runway capacity in multiples of 10. With this consideration and the existing runway capacity for 29 aircraft movement, annual capacity for aircraft movement is estimated to be 105,850 aircrafts.

Supporting Information

Benchmark of Single Runway Capacity

The runway capacity of the runway with adequate exit taxiway system can handle the following number of aircraft movements during peak hour according to AP-II, ICAO and other major international airports in Asia.

Runway Configuration	Hourly IFR Runway Capacity (Movements/Hour)		
	Estimate by AP-II	ICAO Airport Planning Manual (Doc9184)	Major Airports in Asia
Single Runway (1):	38	50 - 59	
Independent Parallel Runways (1+1):	74	99 - 119	78* - 90**
Independent Semi-Dual Parallel Runways (2+1):	93		95* - 102**
Independent Dual Parallel Runways (2+2):	111		112*

Following section shows detailed calculation of theoretical of runway capacity.

Theoretical of Runway Capacity

Technical Parameters (inputs)	Parameter	Values
Dep-Arrival Separation (nm)	☐	4
Common Approach Length (nm)	☐	7
Standard deviation of Position Delivery Error (s)	☐	20
Probability of Violation	Pv	5
Cumulative Normal at Pv	qv	1.65

	Small	Narrow	Wide
ROT (s)	42	48	55
Percent Mix	18	80	2
Vapproach (knots)	100	140	150

Minimum Separation Matrix (nm) Arrivals-Arrivals

	Trailing		
Lead	Small	Narrow	Wide
Small	6	6	6
Narrow	6	6	6
Wide	6	6	6

Error Free Separation Matrix

	Trailing		
Lead	Small	Narrow	Wide
Small	216.00	154.29	144.00
Narrow	288.00	154.29	144.00
Wide	300.00	166.29	144.00

Pij Matrix

	Trailing		
Lead	Small	Narrow	Wide
Small	0.032	0.144	0.004
Narrow	0.144	0.640	0.016
Wide	0.004	0.016	0.000

Buffer Matrix

	Trailing		
Lead	Small	Narrow	Wide
Small	33.00	33.00	33.00
Narrow	0.00	33.00	33.00
Wide	0.00	22.71	33.00

Augmented Matrix

	Trailing		
Lead	Small	Narrow	Wide
Small	249.00	187.29	177.00
Narrow	288.00	187.29	177.00
Wide	300.00	189.00	177.00

Arrivals Only Capacity (per hour)	17.65

Departure-Departure Separation Matrix (nm)

		Trailing	
Lead	Small	Narrow	Wide
Small	120	120	120
Narrow	120	120	120
Wide	120	120	120

Departures Only Capacity (per hour)	30.00

Estimation of Critical Departure Gaps

Departures	Gap (EDTij)
1	167.09
2	287.09
3	407.09
4	527.09
5	647.09
6	767.09
7	887.09
8	1007.09
9	1127.09
10	1247.09
11	1367.09
12	1487.09

Departures per Gap

		Trailing	
Lead	Small	Narrow	Wide
Small	1.00	1.00	1.00
Narrow	2.00	1.00	1.00
Wide	2.00	1.00	1.00

Departures per hour with 100% Arrival Priority

		Trailing	
Lead	Small	Narrow	Wide
Small	0.54	2.40	0.06
Narrow	4.79	10.65	0.27
Wide	0.12	0.27	0.01

Summary for Arrival - Departure Diagram

Arrivals	Departures	Operation Pattern
17.65	0	Arrivals Only
17.65	19.10	100% Arrivals + Departures
0	30.00	Departures Only

Kualanamu Airport Aircraft Movement Projection

FIGURE 137: YEARLY PROJECTION

Regression Statistics	
Multiple R	0.7855339
R Square	0.6170635
Adjusted R S	0.4894181
Standard Err	2377.6226
Observation	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	27328152	27328152	4.834198	0.115314
Residual	3	16959267.2	5653089.06		
Total	4	44287419.2			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	18484.35	21249.9124	0.86985534	0.4483862	-49142.356	86111.055	-49142.356	86111.055
X Variable 1	0.005894	0.0026807	2.19868098	0.115314	-0.0026372	0.0144252	-0.0026372	0.0144252

Source: Surbana Jurong, X variable 1 = Passengers movement, Hourly Projection, Aircraft peak hour factor 0.042% of yearly movement.

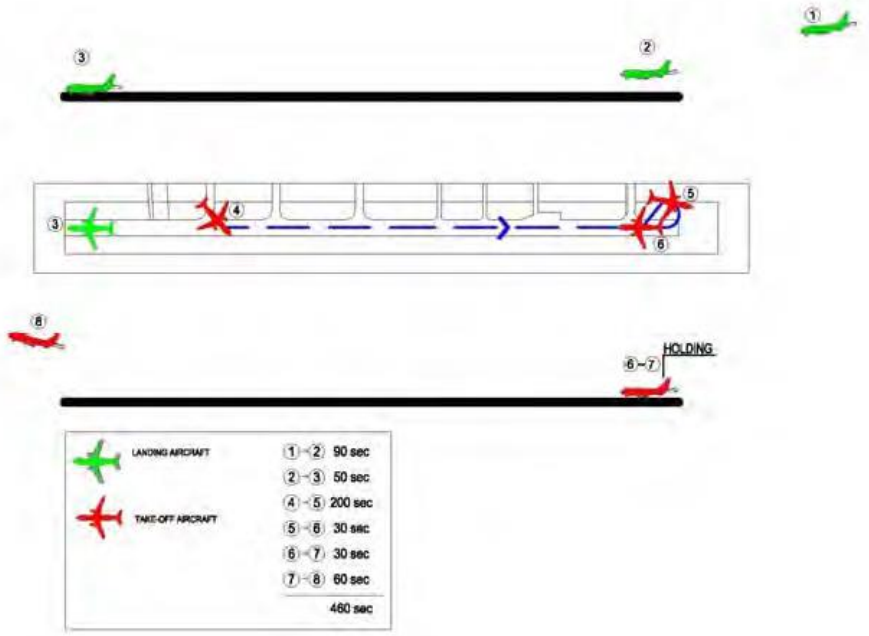
SILANGIT AIRPORT

Possible Hourly Aircraft Movements

Since the Silangit airport does not have a parallel taxiway similar to the Halim Airport in Jakarta, landing aircrafts need to run up to the end of the runway, turn at the turn pad and taxi along the runway up to the exit taxiway. Similarly, departing aircrafts will taxi along the runway, turn at the turn pad and start for take-off. Since departing and landing aircrafts occupy the runway for a long time, the runway capacity decreases.

As shown in Figure 138, the runway occupancy time by landing and departing aircrafts is calculated at approximately 460 seconds. As a result, assuming that the situation in which a departing aircraft follows a landing aircraft is continuous, the hourly runway capacity is calculated at approximately 16 movements.

FIGURE 138: SINGLE RUNWAY OCCUPANCY TIME



Source: Survey from Halim Airport Runway Occupancy Time (JICA, 2012)

Silangit Airport Aircraft Movement Projection

FIGURE 139: YEARLY PROJECTION

Regression Statistics	
Multiple R	0.72524578
R Square	0.52598144
Adjusted R Sq	0.36797525
Standard Errc	155.718939
Observations	5

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	80719.6363	80719.6363	3.32886609	0.16557239
Residual	3	72745.1637	24248.3879		
Total	4	153464.8			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	778.010749	160.67534	4.84212917	0.01680337	266.670108	1289.35139	266.670108	1289.35139
X Variable 1	0.01935027	0.01060569	1.82451804	0.16557239	-0.0144018	0.05310231	-0.0144018	0.05310231

Source: Surbana Jurong, Hourly Projection, Aircraft peak hour factor 0.209% of yearly movement.