ITDP | Institute for Transportation & Development Policy

Phuket Green Transport Plan

Recommendations to improve walking, cycling and public transport in Phuket

IMT-GT Indonesia - Malaysia - Thailand Growth Triangle

ADB

Draft Report, May 2019

1. Introduction

1.1 Background

Institute for Transportation and Development Policy (ITDP) is commissioned by the Asian Development Bank (ADB) to bring about new ideas and approach to urban transport improvement in few cities as part of the Indonesia Malaysia Thailand Growth Triangle or IMT-GT.

ITDP provides technical assistance under the contract to work in multiple cities starting from meetings with stakeholders to field data collection.

The field work in Phuket started in April 2019. ITDP alongside Guido Bruggeman and Willem Bouwer, also hired by ADB, as the team leader and parking specialist respectively. The team collected data and directly experienced the situation to have better understanding of the problems and to come up with potential improvements.

The team also attended several meetings separately with Phuket Provincial Government, Phuket Municipal Government, Patong Mayor as well as land transport and public transport association.

1.2 Work Objective and Scope

The objective of this report is to provide guidance and direction of improvements to achieve green transport and low-carbon mobility objective in Phuket. As one of the main tourist destinations in Thailand, eco-tourism should be the focus of the provincial government, which includes the choice of more sustainable and eco-friendly transport for both tourist and local residents.

Following that logic, the objective of the work is to provide a list of measures that can be applied to promote sustainable transport modes such as walking, cycling as well as public transport.

This report focuses on three main topics as follows:

1. Improving walking and access to public transport in Phuket City **(Chapter 2)**
2. Improving public transport services in Phuket **(Chapter 3)**
3. Improving walking, cycling and public transport in Patong City **(Chapter 4)**

2. Phuket City

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OUTLINE

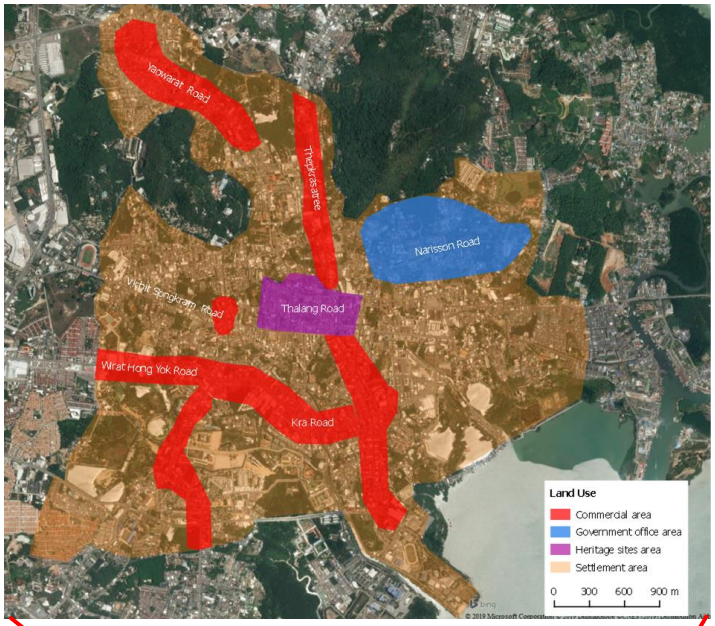
2.1 Project Overview and Current Situation

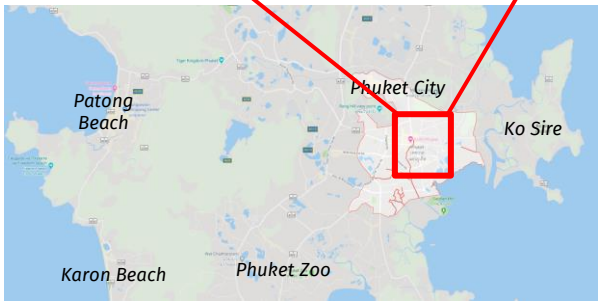
2.1.1 Overview

Phuket Island is famous for its beach destinations for tourist, in areas such as Patong, Kamala or Karon beach.

Other than the beach, another tourist destination area is the old town part of Phuket City, a capital of Phuket province with 80,000 inhabitants and is located south-east of Phuket Island.

It covers the sub-districts Talat Yai and Talat Nuea of Mueang Phuket district, covering a total of 12 square km area.



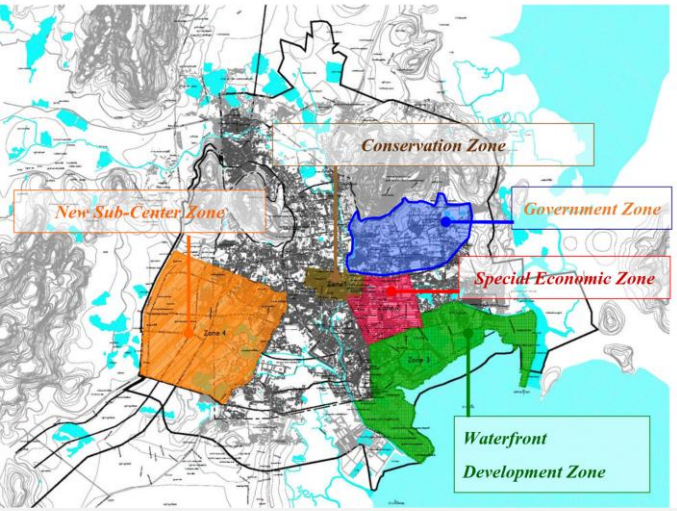


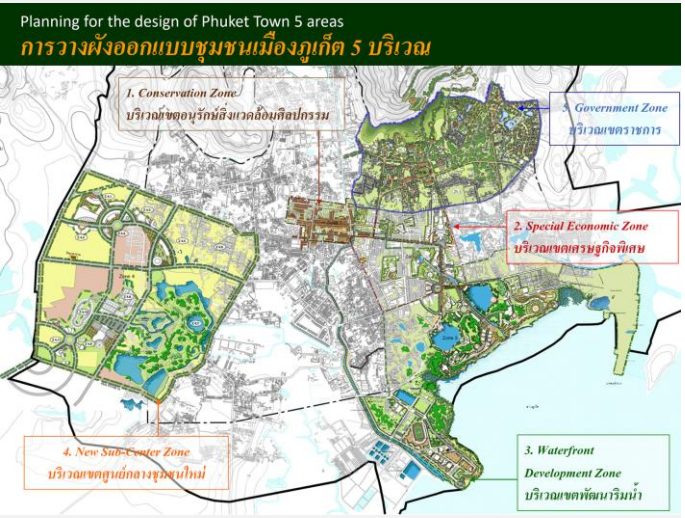
Phuket City is one of the oldest cities in Thailand. It was an important port on the west of the Malay Peninsula where Chinese immigrants first landed. The old buildings in Phuket town indicate its former prosperity. Some of the old buildings still exist and are maintained properly. This condition allows Phuket to have a heritage area in the heart of its city.

Not only the heritage area, Phuket City also features an exciting mix of old and modern building, simple and sophisticated, peaceful and pulsating situation. In the morning, regular activities by local residents such as trips to office, fresh markets, and schools are conducted. During the afternoon, tourism activities start to pick up on the old town area and later in the evening, night markets, which are opened in different locations on different days and are packed with both locals and tourists.

2.1 Project Overview and Current Situation

Detail development area in Phuket City Master Plan





Phuket City has a master plan to control the city development. The master plan lays out a detail area plan for Phuket City. The areas are divided into 5 zones:

- **Zone 1: Conservation Zone**
- **Zone 2: Special Economic Zone**
- **Zone 3: Waterfront Development Zone**
- **Zone 4: New Sub-Center Zone**
- **Zone 5: Government Zone**

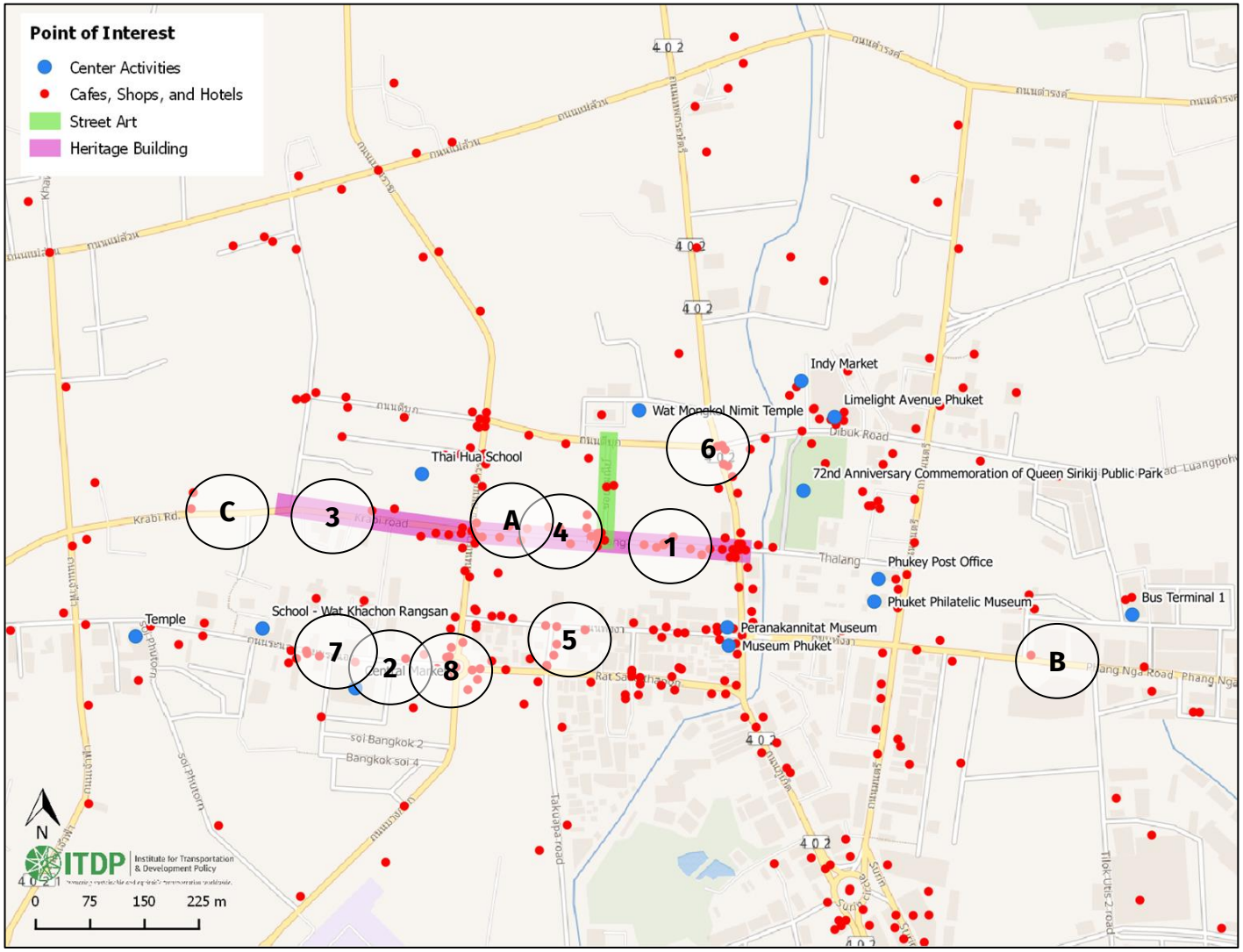
Based on the master plan, each zone has a different concept of improvement based on their need. For example, in the Conservation Zone, the improvement will focus on walking facility improvement and preservation of heritage buildings. A Special Economic Zone, planned in the centre of the city, will create some shopping streets and commercial buildings with good walking facility and public spaces to make visitors feel comfortable.

To support the master plan and to accommodate a high volume of tourists on the heritage area, a comprehensive plan of improvement should be done in Conservation Zone and the around the surrounded area so tourists can enjoy their walking experience. The improvement should not only focus on walking facility inside the Conservation Zone but it is also needed to improve the connecting facility in the surrounded area.

The combination of walking, cycling, and public transit is a quick-win solution which can bring more people and also environmentally friendly for the city. Moreover, car-free zones, pedestrian-friendly areas, and beautification can also conserve and protect the old heritage city and transform it into a livable, accessible, attractive and sustainable city.

2.1 Project Overview and Current Situation

2.1.2 Current Situation

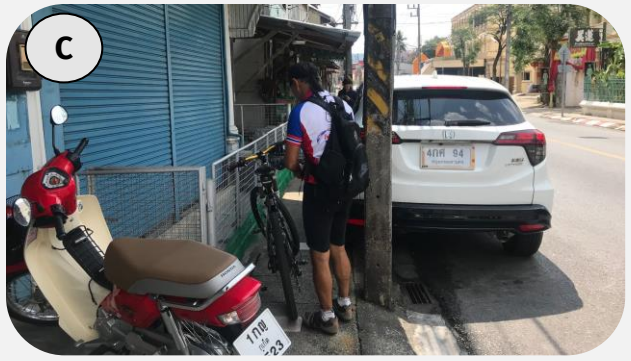


Point of Interest (POI) locations in the heritage area and surrounding

Many point of interests are centered on and around heritage area or also known as Conservation Zone in the Phuket City Masterplan. Not only heritage buildings and museums but also shops, cafes/ restaurants, and hotels are located on and near the heritage area.

Note:
Detail pictures of each circled number reference are shown in the following page.

2.1 Project Overview and Current Conditions



Current situation (general)

- With commercial and heritage buildings centralized in the city, most destination places in Phuket city are reachable within walking distance from one place to to another. However, the walking environment is unfriendly for pedestrians, such as narrow and fragmented sidewalks, as well as obstacles that sometimes block pedestrians from walking comfortably around Phuket City.
- In 2012, the government made an improvement for sidewalk along Thalang Road. While some of the good principles of design are applied, but there are still many parts of the sidewalk with such a narrow space, and unable to accommodate large number of pedestrians.
- The on-street parking arrangement in city centre, which allows parking on one side only on alternate days, as it turns out, only leaves little space for sidewalk. Parking demand is also very high, and parking occupancy is very high during business hour, which is understandable, since parking is practically free.
- In the central market area, many spaces that could have been used for pedestrians are occupied by on-street parking for cars and motorcycles, as well as for the buses. The market is also functioning as unofficial bus terminal, but without proper bus parking management, can make the area chaotic and cause difficulties for pedestrians to walk.
- No bicycle infrastructure is available in Phuket City which makes cycling unpopular for tourists and local residents. With relatively flat and compact, the old town is also perfect for cycling activities. Creating more bicycle-friendly infrastructure would help Phuket growing number of cyclists in the city.

2.1 Project Overview and Current Conditions

Sidewalk Conditions

- Many sidewalks are provided with less than 2.5 meter width, which includes utilities or any obstacle objects. This condition makes walking unpleasant and sometimes unsafe. Tourists cannot access easily to destinations such as Thalang Road, Rommani Road and Central Market due to the poor quality of sidewalk.
- Sidewalks are built in fragmented and non-continuous. For example sidewalk is always cut off when there is a driveway.
- Pedestrians cannot walk under the arcade of five-foot-way since the building owner often block the access by putting a wall, goods, or there is motorcycle parked illegally.

1 *Narrow sidewalks*

2 *Obstacles on sidewalks such as utilities, goods, motorcycle parking*

3 *Fragmented sidewalk*

4 *The five-foot-ways are blocked by wall and motorcycle parking*

2.1 Project Overview and Current Conditions

Crossing and Obstacles:

- Most crossing facilities are only located at the intersections, with approximately 300 meters between crossings.
- Some fences are installed at intersection, forbidding pedestrians to cross at minimum crossing distance at intersections.
- In the morning, streets around Central Market are partially clogged with on-street parking by motorcycles, loading activities, passenger drop off and bus parking.
- There are 3 dedicated on-street parking spots for buses to park around Central Market. However, these 3 spots are located relatively far from the market.

5 *No crossing facility*

6 *The pedestrian cannot cross directly at the intersection*

7 *Double motorcycle parking in front of Central market*

8 *Some buses parking on the street and wait for passengers*

2.2 NMT Scope and Objective

2.2.1 Focus Area

The scope for study focuses on the core heritage and conservation zone of Phuket City, where the highest volume of pedestrians are concentrated.

The selection of focus area includes the conservation zone as specified in the master plan, as well as some other area beyond the conservation zone such as central market and Bus Terminal 1. The main goals of improvement within the study area are as follows:

1. Connectivity improvement between point of interests
2. Improving safety and quality of pedestrian facility
3. Provision of cycling facility for Phuket City

2.2 NMT Scope and Objective

2.2.2 NMT Objective

As there are many tourists visiting Thalang and Rommani Road, The connections from Central Market, Bus Terminal 1, Dibuk Road and hotels around Phuket old town need to be improved. Within the area, many historical sites, shops, and cafes/restaurants can be reached within short walking distance.

However, the amount of private cars and motorcycle that are parked on-street, and sometimes on sidewalk, has made the situation quite unpleasant for walking in this tourist area.

To create better walking environment, improving non-motorized transport (NMT) connectivity should be prioritized in Phuket City. Providing bigger space for pedestrians, especially in the area with high pedestrians volume, is also needed to create safe and convenience walking environment in Phuket City.

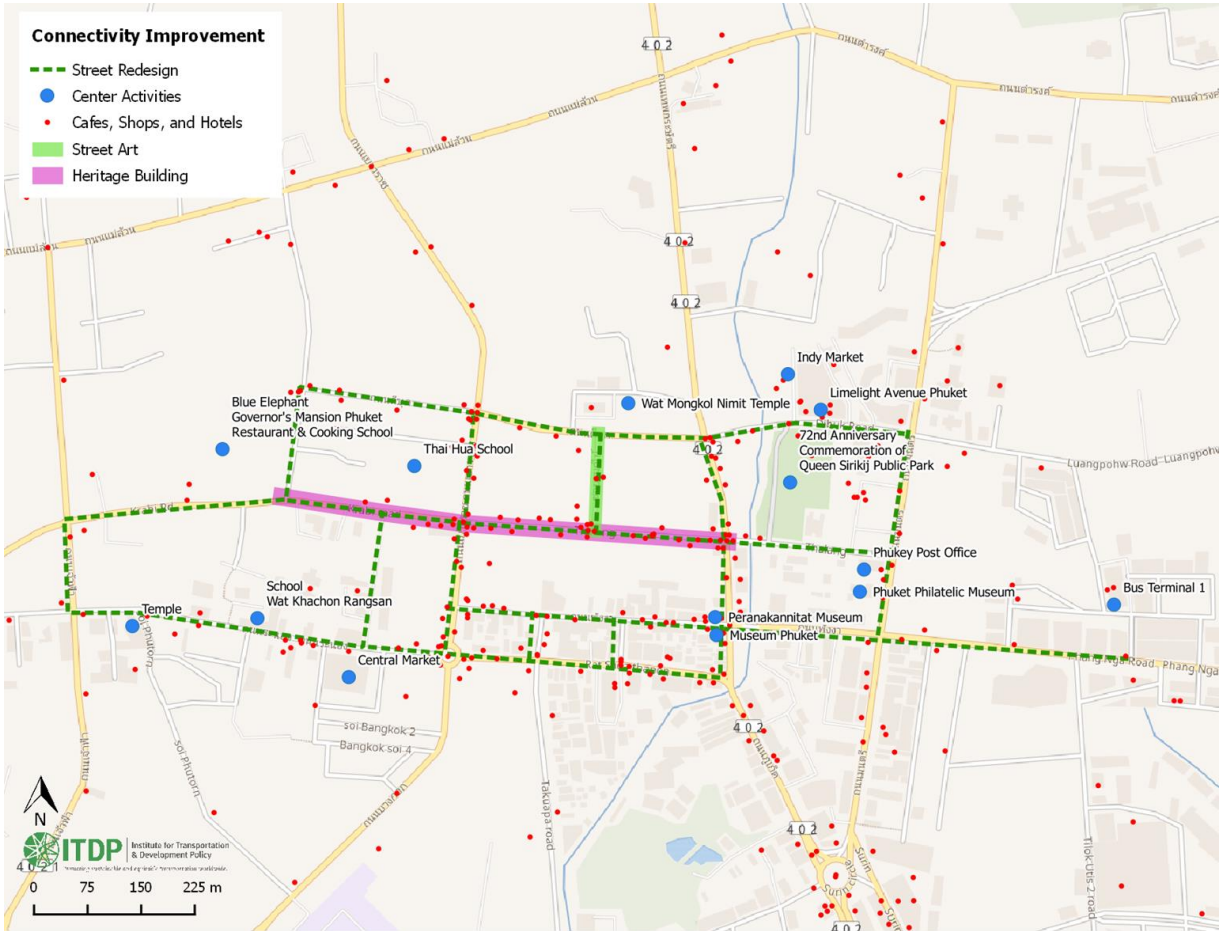


Figure X.X Connectivity improvement plan

2.2 NMT Scope and Objective

NMT Objectives

Issues	Objectives	Measures
Connectivity Improvement		
• Lack of connectivity between tourist arrival places (Central Market, Bus Terminal 1, and Dibuk Road) to tourist destination (heritage sites)	• To facilitate pedestrians with good and safe walking facilities and better connections to tourist destinations • Make tourists easy to reach the destination through better signage and way-findings	• Connectivity improvement through walking facilities improvement along the connection corridor • Provision of good signage for direction and information for tourists (way-findings)
• High pedestrian volume in heritage area is not followed by good sidewalk quality (narrow, blocked by utilities, non-continuous)		
• Lack of pedestrian crossing, making pedestrians unsafe to cross the road	• Create safe walking and crossing environment for tourists	• Provide safe crossing facilities around old town
• Poor arrangement of bus parking, motorcyle parking and pedestrians walkway, making it difficult for public transport passengers and pedestrians to walk.	• Better pedestrians and public transport circulations around central market and heritage site.	• Street redesign at Central Market
Cycling Facility Improvement		
• No cycling facility provided in Phuket City, despite the city is relatively flat and ideal for cycling.	• Promote cycling as one of the transportation modes in Phuket City.	• Provide safe cycling facilities in the Phuket Old town • Provide bike share system in greater area of heritage area

2.3 Focus of Improvement

Continuous and safe sidewalk

Safe cycling network even on intersection

Bike share system

2.3.1 Connectivity Improvement

The improvement will focus on re-allocating vehicle space to create a better walking environment along connectivity corridors, especially on the area with high pedestrian volume. Pedestrian safety should be the main priority in improving the connections between different point of interests.

Walking improvement in Phuket City area can be done through the following activities:

1. **Car-free zone in the Conservation Zone**
2. **Provide continuous sidewalk and remove on-street parking to create more space for pedestrian and cycling movement**
3. **Provision of good signage for direction and information for tourists (way-findings)**
4. **Provision of safe crossings facility**

2.3.2 Cycling Facility Improvement

While not many cyclists are seen in Phuket City, the heritage area of Phuket City is ideal for cycling. Many historical sites, shops, and cafes/restaurants are located close to each others. However, the current road conditions are unsafe for cyclists, without any dedicated lane provided. The bike share system, which currently does not exist, could be a good alternative for tourist to explore Phuket City.

To improve cycling facilities, the following activities shall be introduced :

1. **Safer cycling network and infrastructure**
2. **Bike-sharing implementation**

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2.4 Survey and and Finding

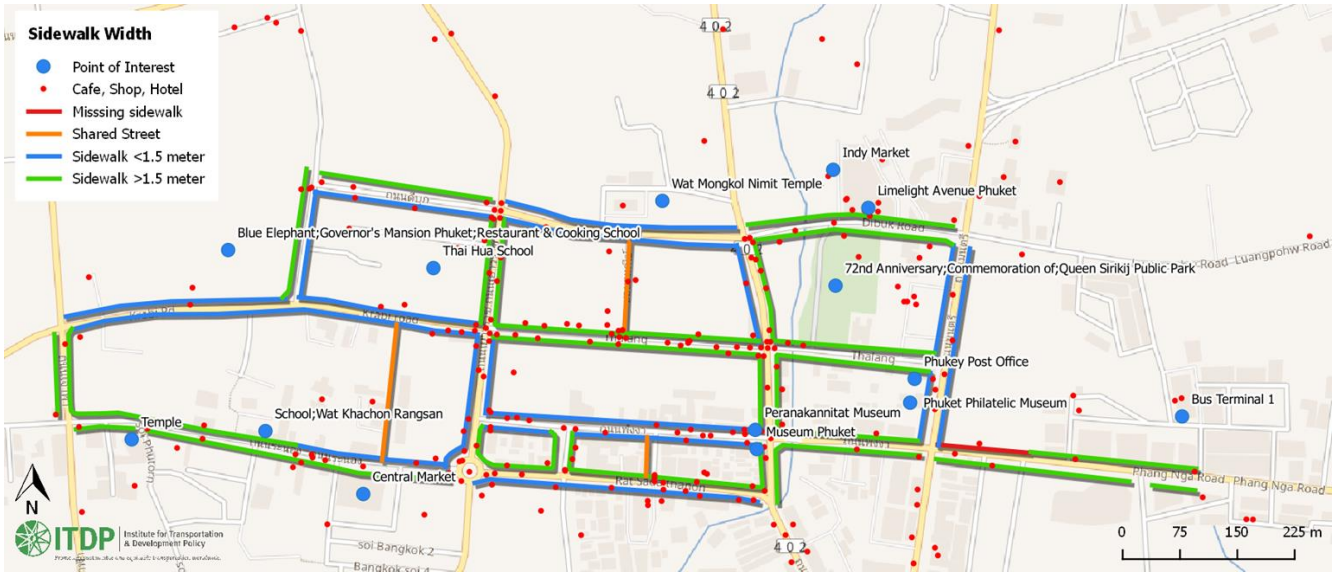
Survey activity		Objective	Methodology	Outcome
Traffic	Peak-hour pedestrian volume	To identify high-priority streets for pedestrian improvements.	Walking and counting the number of pedestrian passing by on every street within the scope area, during the peak hours.	Map of pedestrian volume on every street within the scope area.
	Pedestrian crossing movement	To identify the potential crossings to be improved and/or added.	Marking the locations where pedestrian crossing activities occur, on a map.	Map of pedestrian crossing locations within the scope area.
	Motorized traffic count	To identify motorized traffic volumes for potential reorganization of traffic lanes (number of lanes and directions).	Recording several videos of the traffic condition at the selected intersections, where the traffic reorganization is preferable.	Map of motorized traffic volume on the selected streets.
Infrastructure	Sidewalk	To identify the width of the sidewalks in the selected scoping area.	Documentation of the existing width of the sidewalks in the scope area, on a map.	Map of the sidewalk width improvements and recommendations, including the cross section designs of the corresponding streets.
	Junction location	To identify the junction for potential design improvements.	Recording several videos of the traffic condition at the selected intersections.	Information of the existing junction design.
	Active frontage	To identify the roads which have active frontage	Marking the active and no active frontage on GPS by walking stroll the focus area	Maps of active frontage on every street within the scope area.
Activities	Central Market	To improve public transport (bus) stop location and improve the sidewalk for pedestrian to access heritage site	Flying a drone to record a video and take some photos in Central Market area	Street redesign which accommodate bus bay and high quality sidewalk
	Public Space	To reactivate public space to get more visitors	Marking the public space location which need some improvements	Plan of activities on the public space which need activation improvement.

2.4.1 Findings: Sidewalk Width

Sidewalk Width and Quality

Survey Methodology: Conducting documentation of cross-section including the width of sidewalks.

Findings: Many streets in the heritage only have sidewalk with width less than 1.5 meter. Few streets such as Rommani Road, Phisai Sapphakit Street, and Pradit Street adopt shared street principle where pedestrians, cyclists, and vehicles sharing the road space. However, the shared concept cannot work optimal when pedestrian volume is high.



Shared Street on Rommani Road

Sidewalk width: > 1.5 meter on Ratsada Road

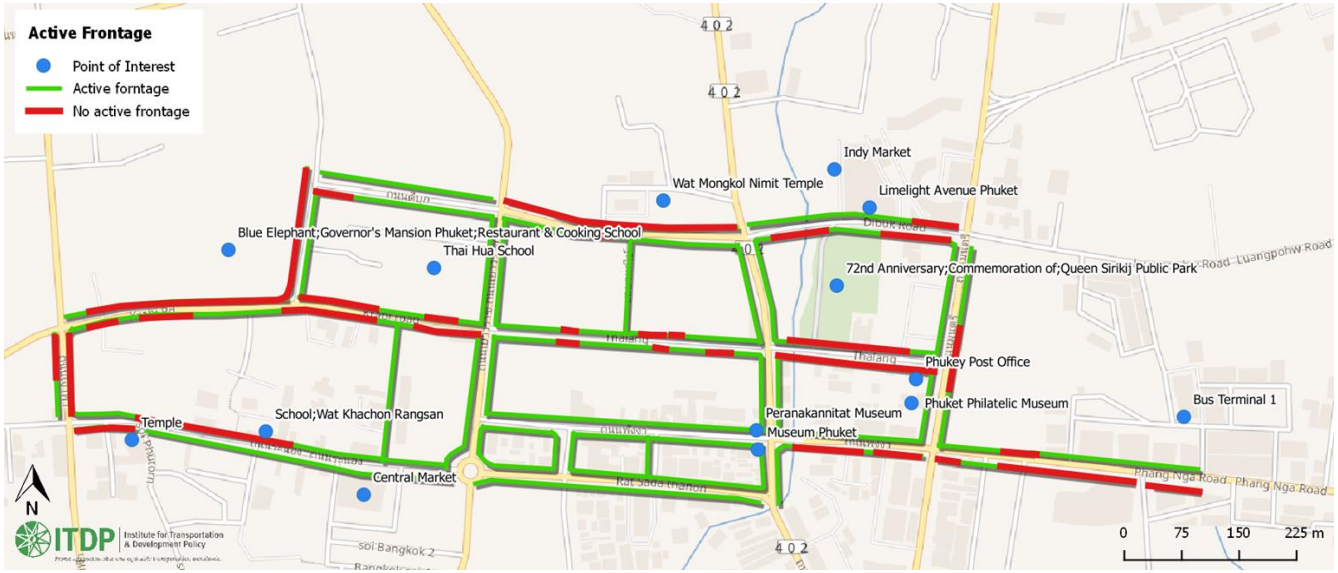
2.4.2 Findings: Frontage

Active Frontage

Survey Methodology: GPS marking of different frontage activity while walking.

Result: Outside the heritage area, there are not many streets that have a lot of active frontage, which is due to fences and walls from buildings. On west part of Thalang road, few buildings which are not occupied as residential have inactive frontage, instead of being used for commercials.

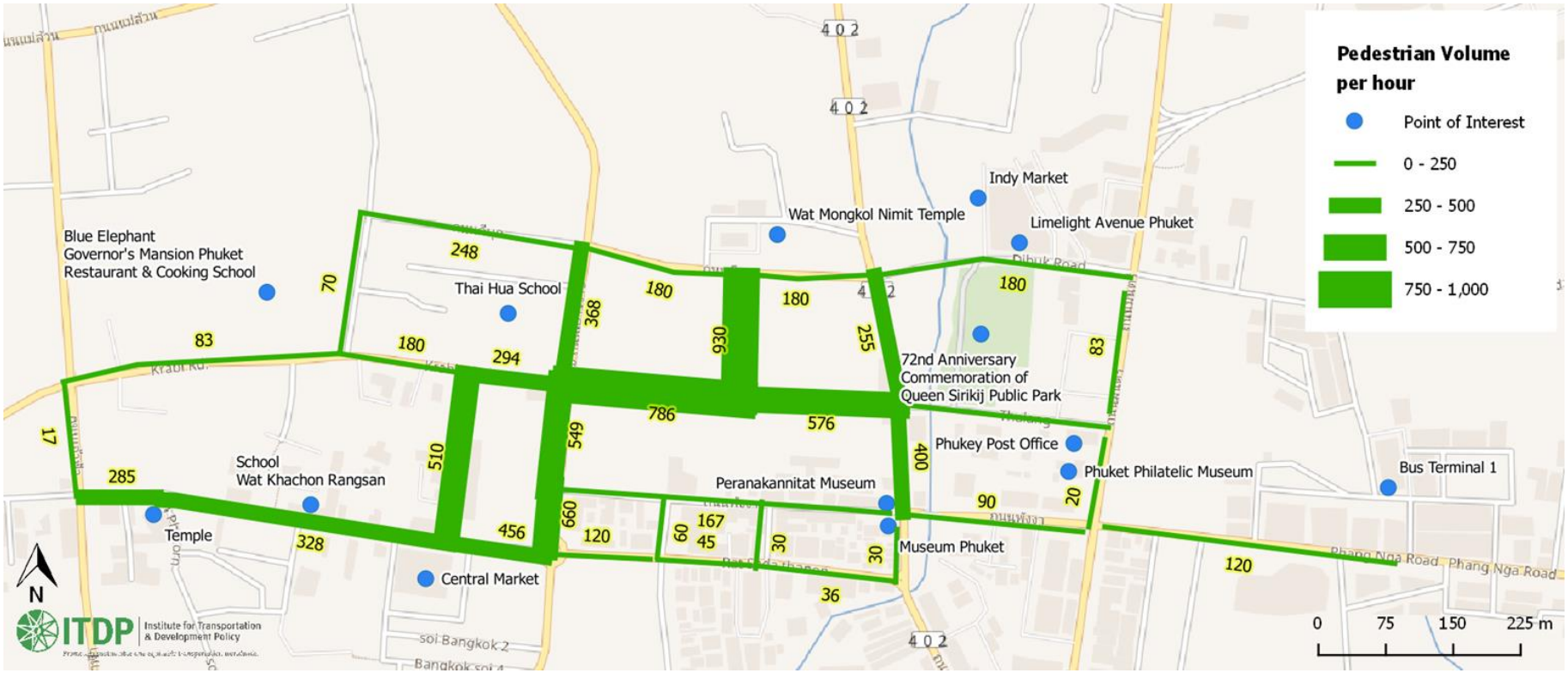
Active frontage, such as attractive shop front with glass window, or cafe with open-air seating, add positive vibe to walking environment, which makes walking more enjoyable.



No active frontage on Krabi Road

Active frontage along Thalang Road

2.4.3 Findings: Pedestrian Volume



Pedestrian Volume

Survey Methodology: Moving-observation method. Through this survey methodology, pedestrian volume on some streets can be covered in a short time.

Findings: During the day, pedestrians are concentrated at Rommani Road and Thalang Road where heritage buildings, shops, and cafes are located. Many pedestrians also walk from and to Central Market to access bus that goes to the beach areas.

The highest pedestrian volume was observed after lunch time until around evening. On Saturday and Sunday, Thalang Road has many visitors who visit Phuket Sunday Night Market.

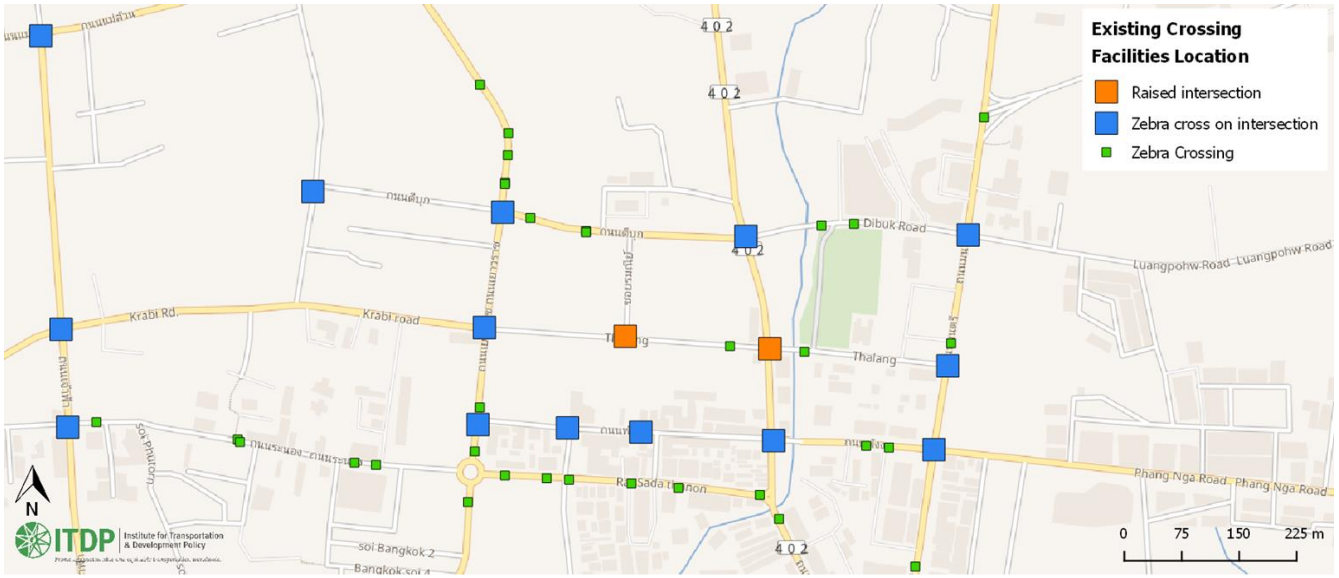
2.4.4 Findings: Crossing Locations

Pedestrian Crossing Locations

Methodology: Marking the the crossing facility on GPS

Findings: Inside the focus area, most of pedestrian level crossings are located at intersections, with 2 raised intersections were built.

The mid-block crossing, which can help to reduce distances between crossing locations, are only available at 1 location within the focus area.



Mobility-impaired person tries to cross the road without any safe crossing facility

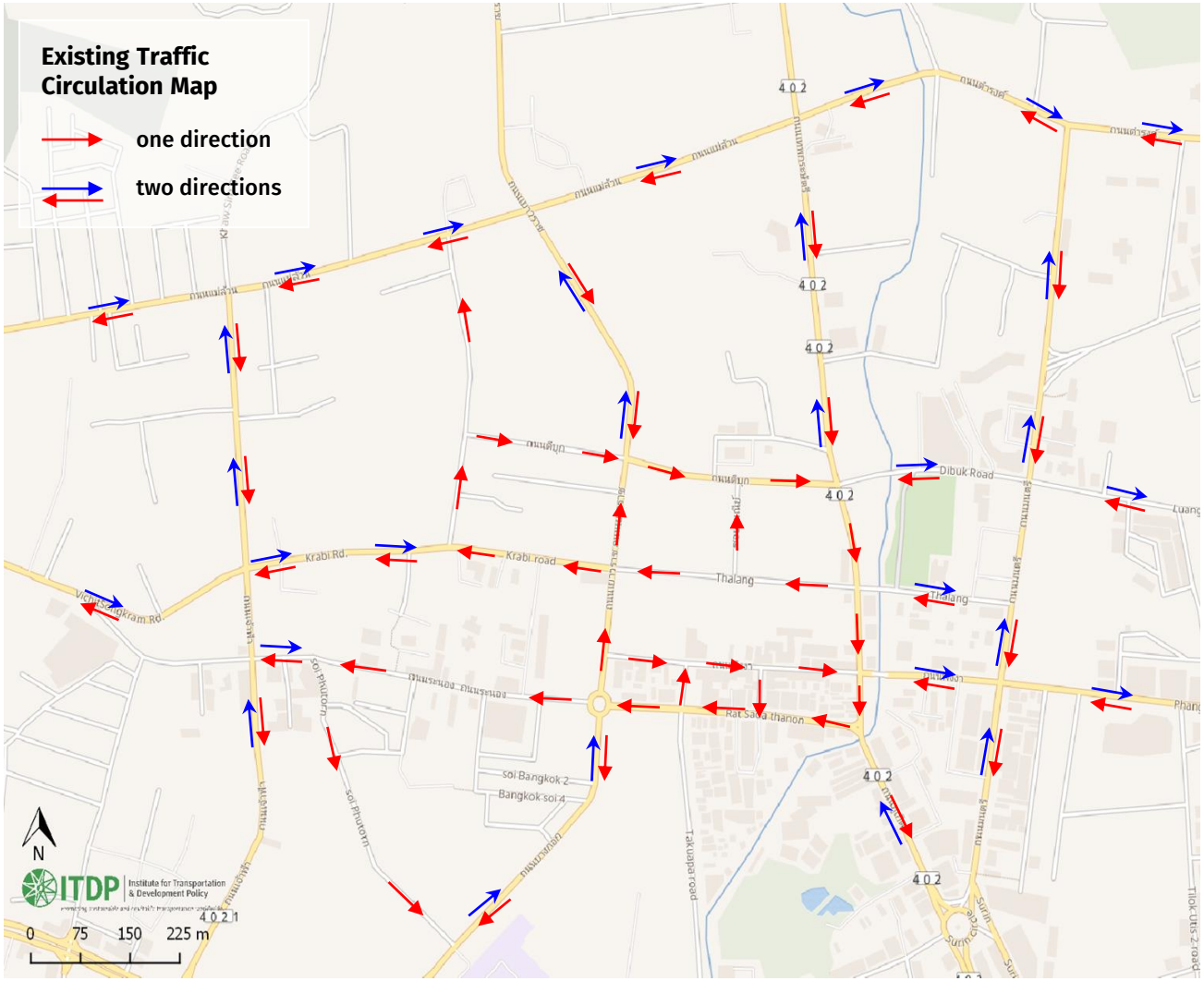
2.4.5 Findings: Traffic Circulation

Traffic Circulation

Survey Methodology: Validating the traffic circulation from Google maps by going around the roads in greater focus area.

Result: Most of the streets inside the focus area are one-way street, whereas streets outside the focus area are mostly two-directional streets with one lane for each direction. On-street parking is allowed on both sides of the road, hence sometimes in busy streets means creating congestion due to parking maneuver.

On Thalang Road, parking is allowed only on one side of the road and it depends on the dates of the day (odd or even).



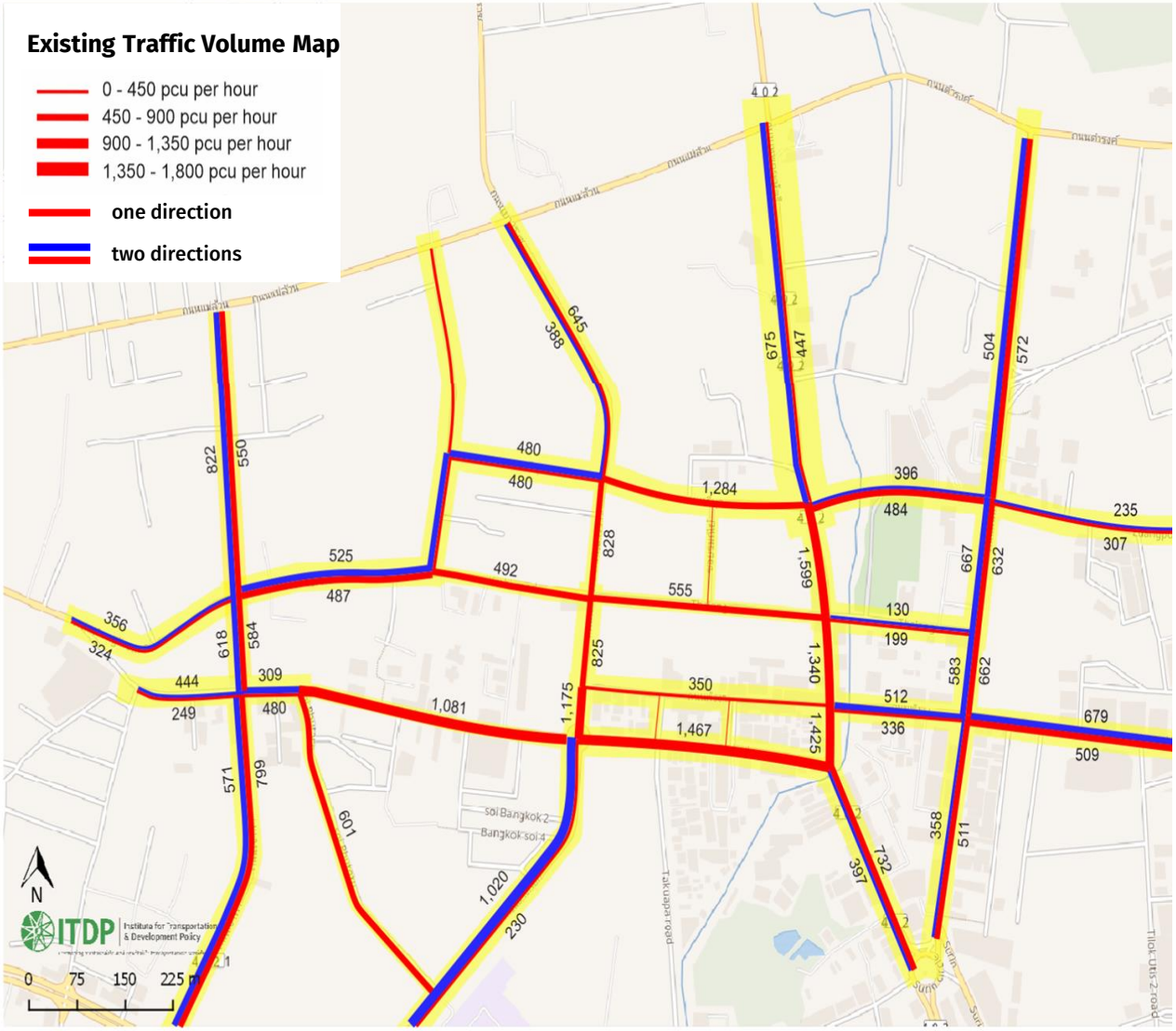
2.4.6 Findings: Traffic Volume

Traffic Volume

Survey Methodology: Recording some videos on selected intersections where traffic reorganization is preferred.

Findings: Motorized traffic volume on the core heritage area of Phuket is not so high and most of them are through traffic. The highest volume is along Phuket Road and south part of Yaowarat Road with 1,100 to 1,500 vehicles per hour. Both of the roads can accommodate up to 1,800 vehicles per hour or 3,600 vehicles per hour if the on-street parking is reduced so they can have 2 lanes.

With relatively low volume of traffic, especially on Thalang Road and Phangha Road, it might be feasible in the future to close this road for traffic, and only open for pedestrians and cyclists.



2.5 Connectivity Improvement

Goal of Improvement

The goal of the connectivity improvement is to create better walking facility, provide more accessible walkway, as well as create safe crossing facilities throughout the heritage area.

List of Improvement Projects

The following measures are proposed to improve the connectivity in Phuket city heritage area:

1. Car-free zone
2. Sidewalk enhancement
3. Intersection and crossing facility improvement
4. Wayfindings around heritage area
5. Circulation and arrangement around Central Market
6. Public space activation

Bikeshare

To further improve the coverage outside the study area, a bikeshare program is also proposed in Phuket City.

Car-free street

Intersection re-design

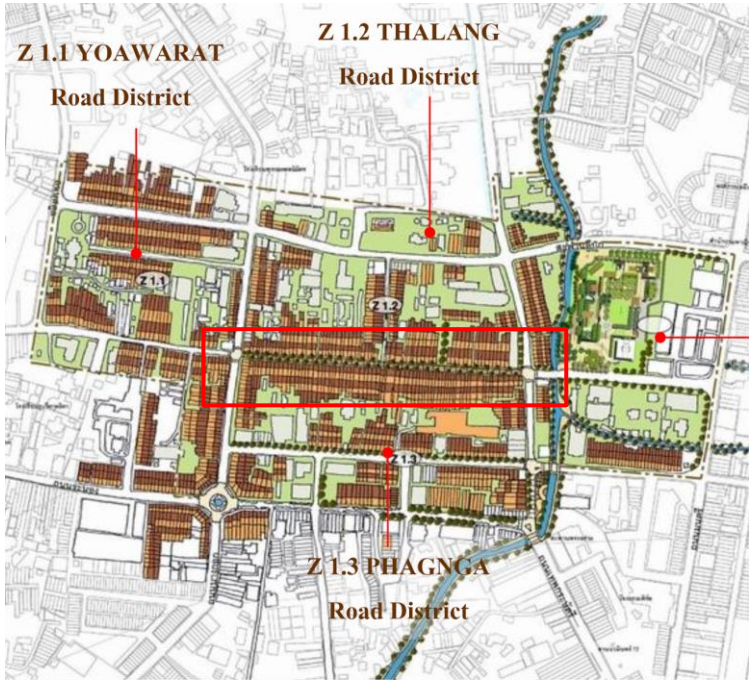
Street re-configuration

Bikeshare

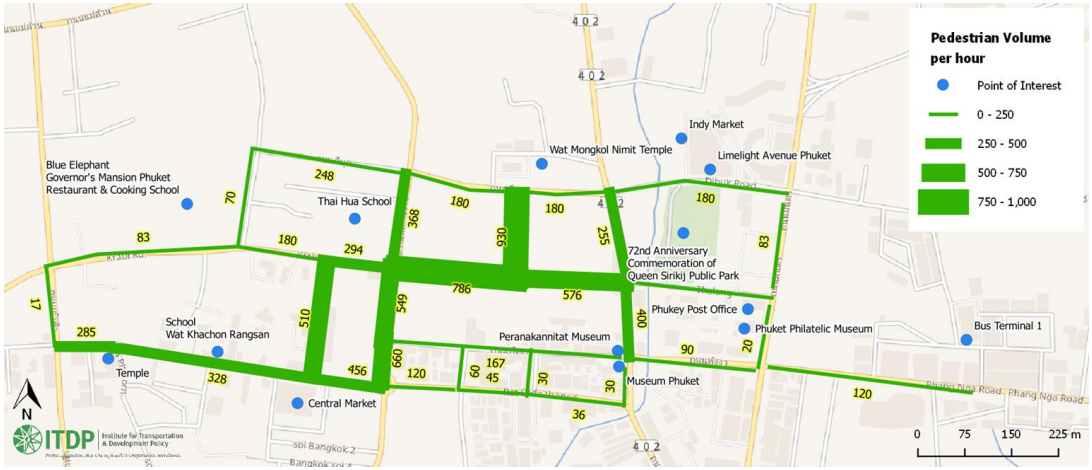
2.5.1 Car-free Zone

Plan and Rationale

Zone 1: Conservation Zone on Phuket Master Plan



Proposed design in Masterplan



Pedestrian volume in Phuket City

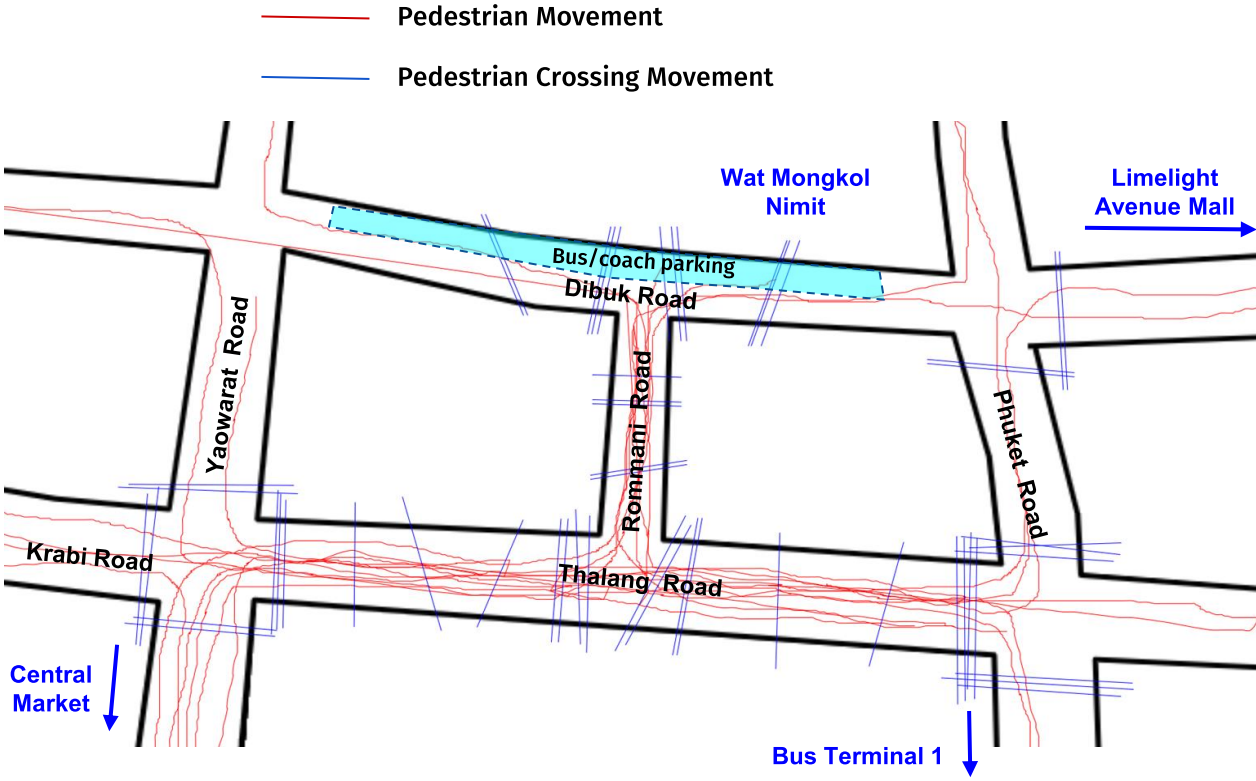
- **There is already a plan to make Thalang Road as pedestrianized street permanently, which is mentioned on Master Plan of Phuket City.**
- **Thalang Road and Rommani Road have high pedestrian volume and relatively low motorized traffic. Meanwhile, Phangnga Road, Takuapa Road, and Phadit Road do not have many pedestrians and motorized traffic.**
- **To support the plan on Phuket City Master Plan, having pedestrian-only street would help to create a good quality of Conservation Zone.**

2.5.1 Car-free Zone

Pedestrians Movement

Thalang Road during daytime

Sunday night market on Thalang Road

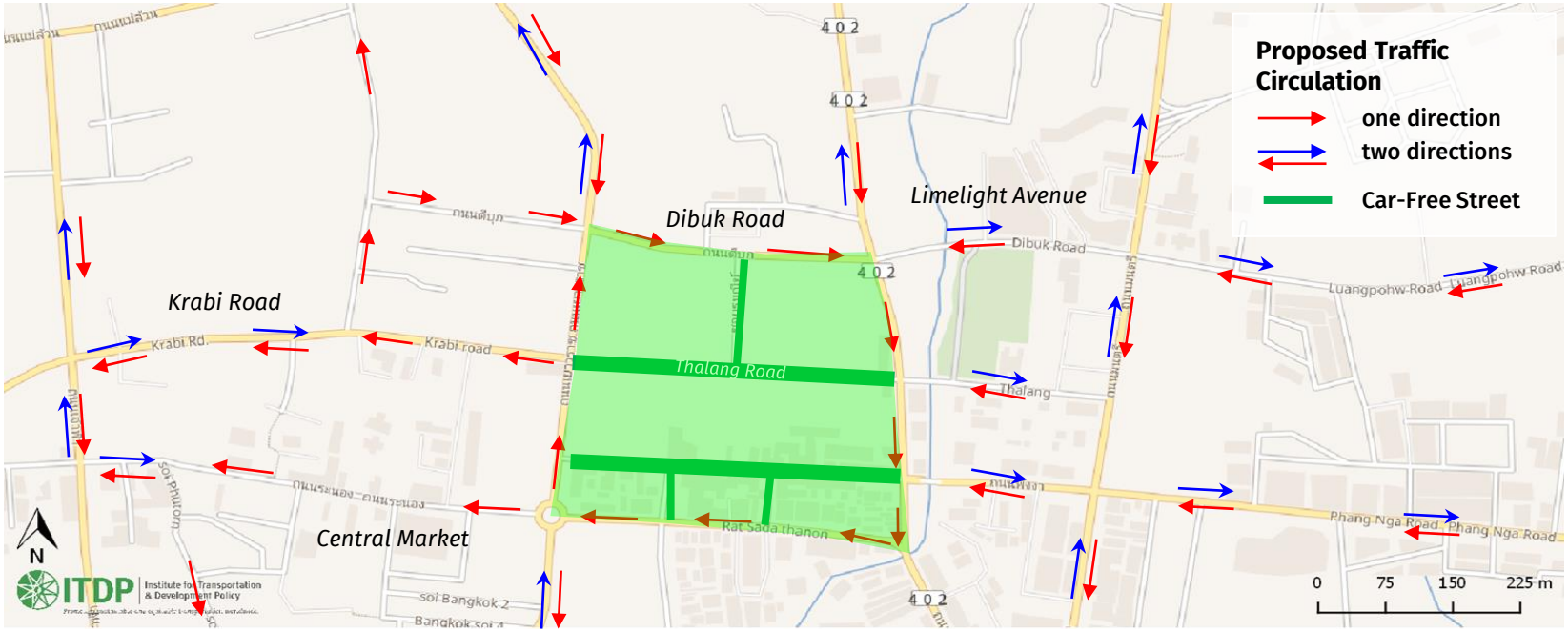


Pedestrian movement tracking around Thalang Road

- Currently, Thalang Road is open only for pedestrians during Sunday Night Market, held every Saturday and Sunday from 16:00 - 21:00.
- During daytime Thalang road and Soi Rommani have high pedestrian volume, which makes it necessary to provide more space for pedestrians.
- With so many activities along Thalang Road, people practically cross the road on many locations in Thalang Road and Rommani Road, as shown from the pedestrian movement tracking map above.

2.5.1 Car-free Zone

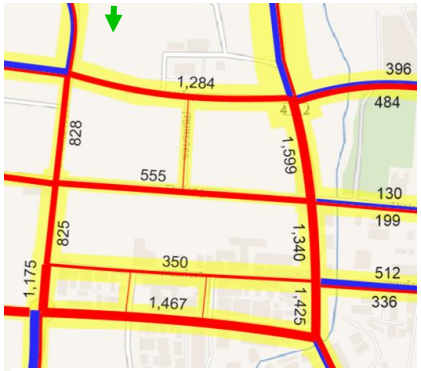
Proposed Zone and Traffic Diversion



The car-free zone is proposed for the following streets:

1. Thalang Road
2. Rommani Road
3. Phangnga Road
4. Phadit Road
5. Takuapa Road

As for traffic diversion, the traffic diverted from Thalang Road would still be able to be accommodated by surrounding roads, with capacity of 3,000 vehicles per hour.



Existing traffic volume

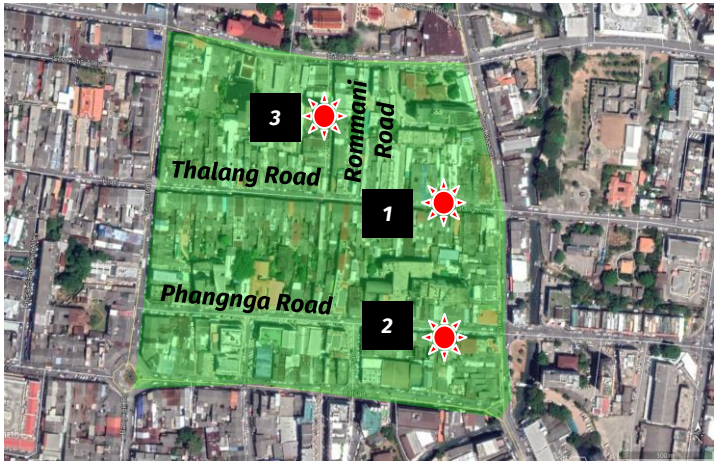
2.5.1 Car-free Zone

Street Design for Car-free Street

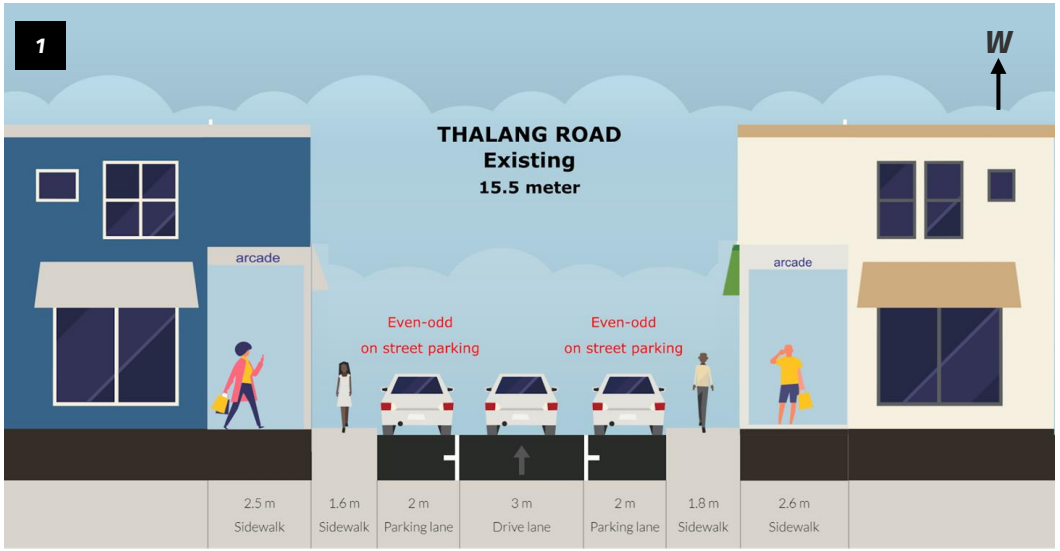
Type: Pedestrian/cyclist-only street

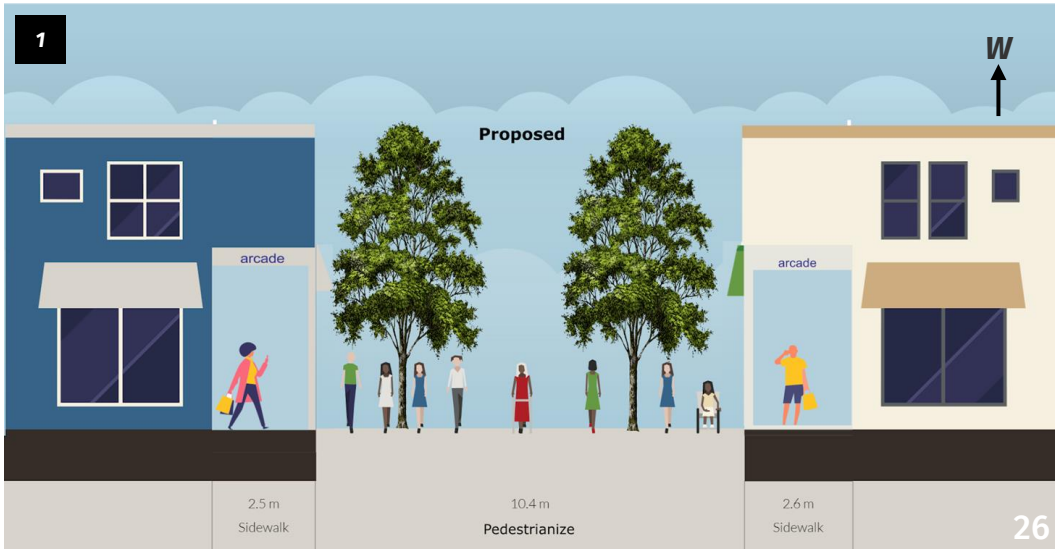
- Restricted access of motorized vehicle for a limited period
- Vehicle access only for residents and freight vehicle
- Add more activities such as commercial stalls, benches, trees

Sample of street redesign location



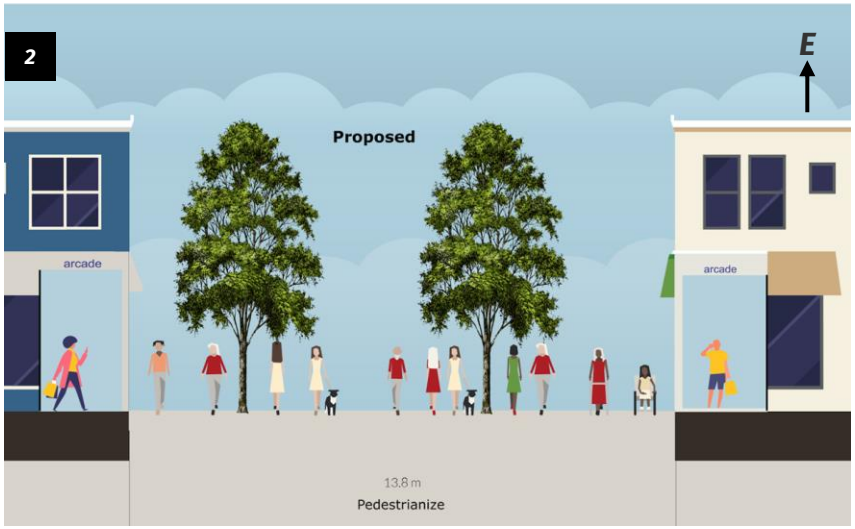
Street design for Thalang Road





2.5 Connectivity Improvement

Street design on Phangnga Road and Rommani Road



2.5.1 Car-free Zone

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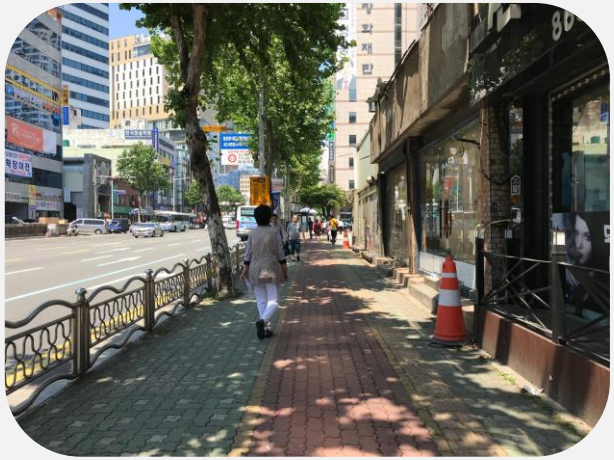
2.5.1 Car-free Zone

2.5.2 Sidewalk Enhancement

Best practice pictures from South Korea. Continuous sidewalk even on the driveway. The sidewalk also has buffer and/or bollards.



Principles in **Sidewalk Enhancement**

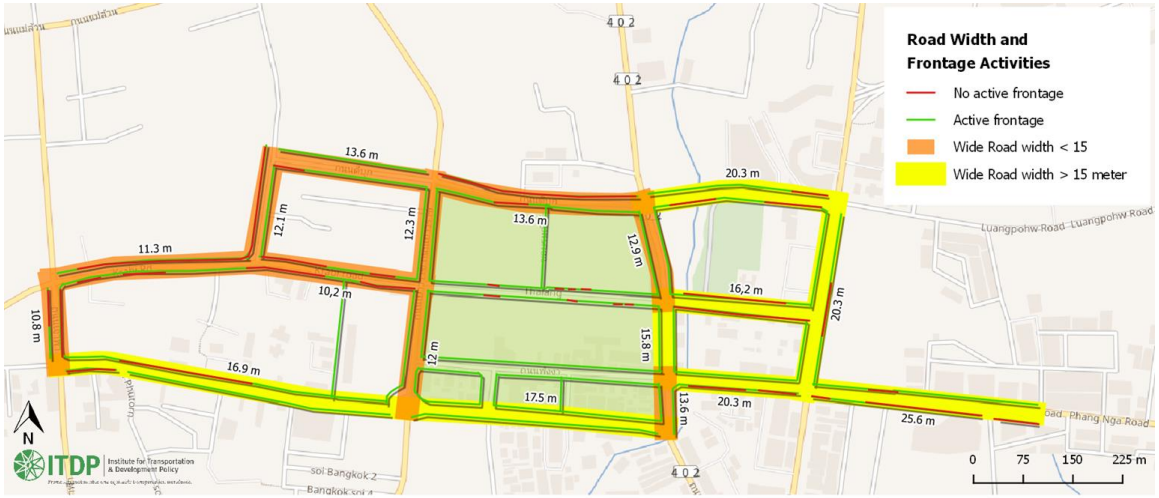
1. **Obstruction-free**
   Walkways need to be clear from any obstructions. Electrical pole, sign post, street lights, bench, hydrant, trees, pots, parking meter are all important but they all have to be aligned on a specific space to give pedestrians an exclusive space for walking.

2. **Separation from motorized vehicle (bollards/buffer zone)**
   On an exclusive sidewalk next to high volume motor vehicle streets, the safety of pedestrian is ensured by providing a clear separation between pedestrian and motorized vehicles. This can be done by lining up street furniture and utilities on the outer side of the sidewalk or using bollards to protect pedestrians from the vehicle. Bollards are also great tools to prevent the encroachment of sidewalk from cars and motorcycles parking.

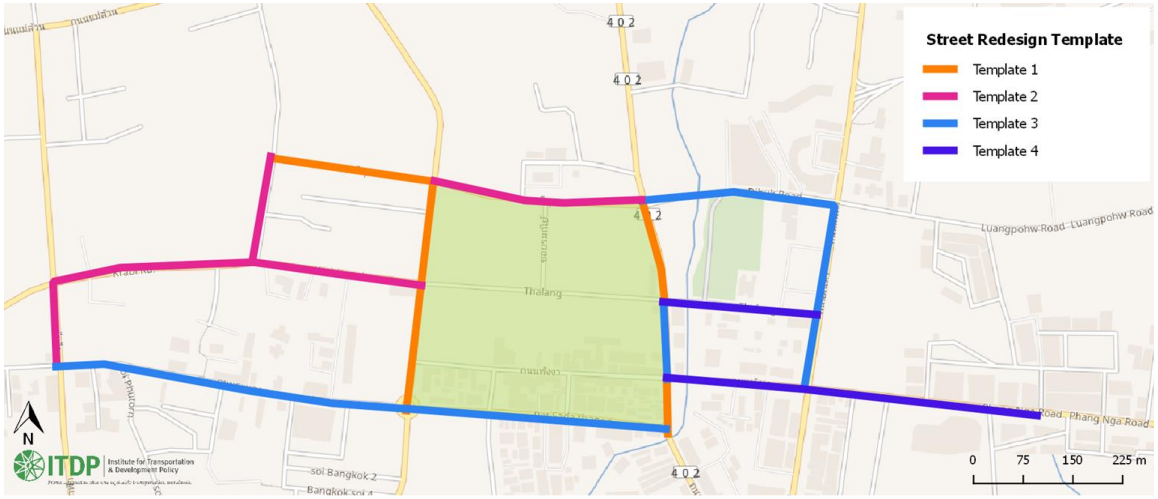
3. **Continuity over driveways and intersections**
   Giving priorities to the pedestrian can be done by raising walkways over intersections and driveways. Pedestrians need a continuous and leveled walkways more than cars and motorcycles need on the traffic lane. By raising the walkways, motorized vehicles are also forced to slow down their speed, which makes the pedestrian safer to cross the road.

2.5.2 Sidewalk Enhancement

Existing condition



Proposed street template

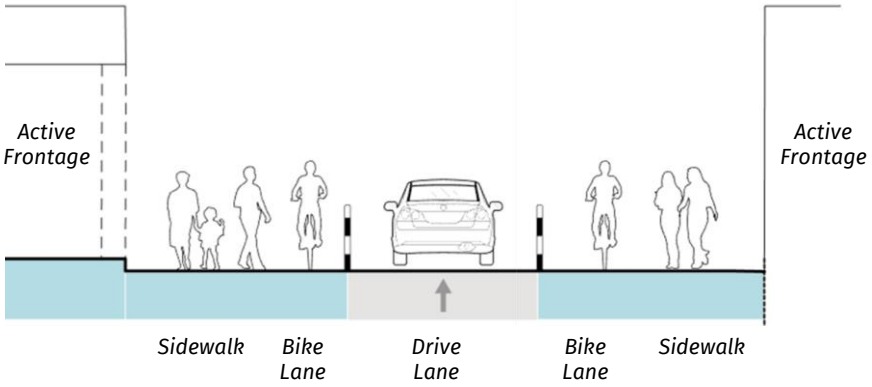


Street design template

- Street design template is needed as a guideline to create complete street. This template can be used not only in the focus area but also for the whole Phuket City area.
- For the study focus area, a set of different proposal design for street cross section is created.
- There are 4 design templates developed, which are based on sidewalk width and frontage activities.
- These templates are created for different street types, which are:
  - **Template 1**
    Road width less than 15 meter with active frontage
  - **Template 2**
    Road width less than 15 meter with no active frontage
  - **Template 3**
    Road width more than 15 meter with active frontage
  - **Template 4**
    Road width more than 15 meter with no active frontage

2.5.2 Sidewalk Enhancement

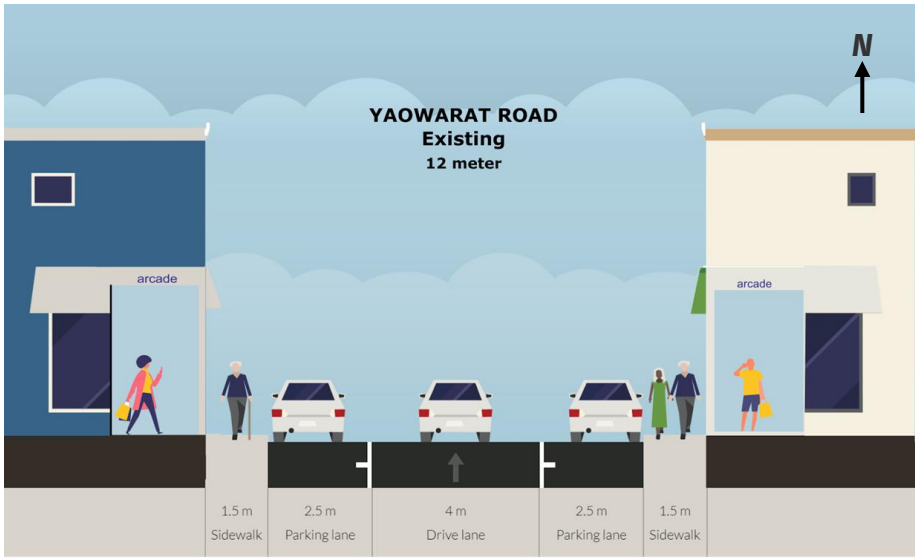
Design Template 1



Design features:

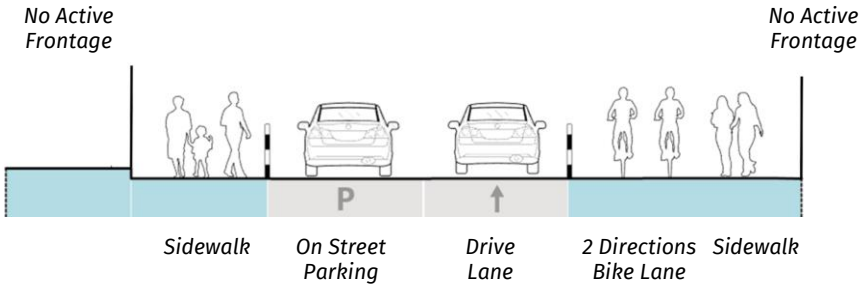
- Widen walkways area
- Add bike lane on both side
- On street parking restriction
- Establish 1 driving lane as existing

Sample: Yaowarat Road



2.5.2 Sidewalk Enhancement

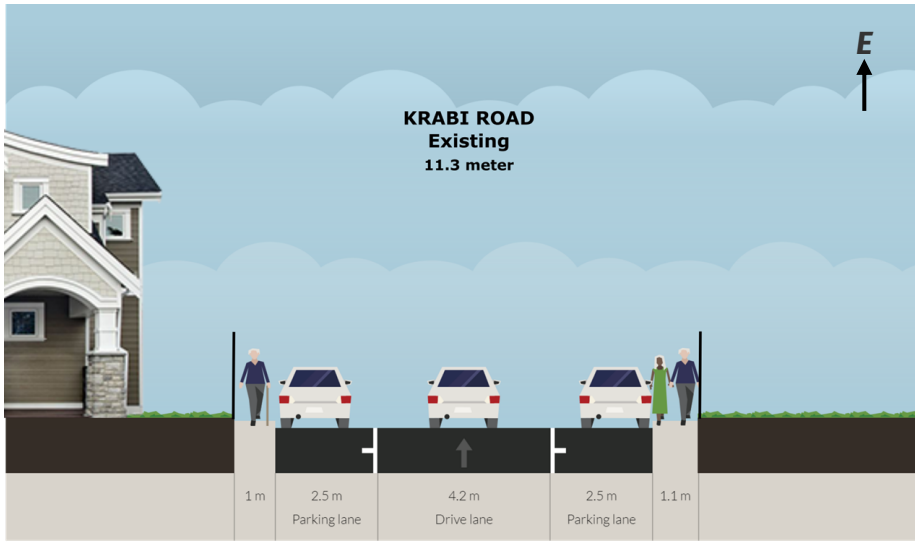
Design Template 2

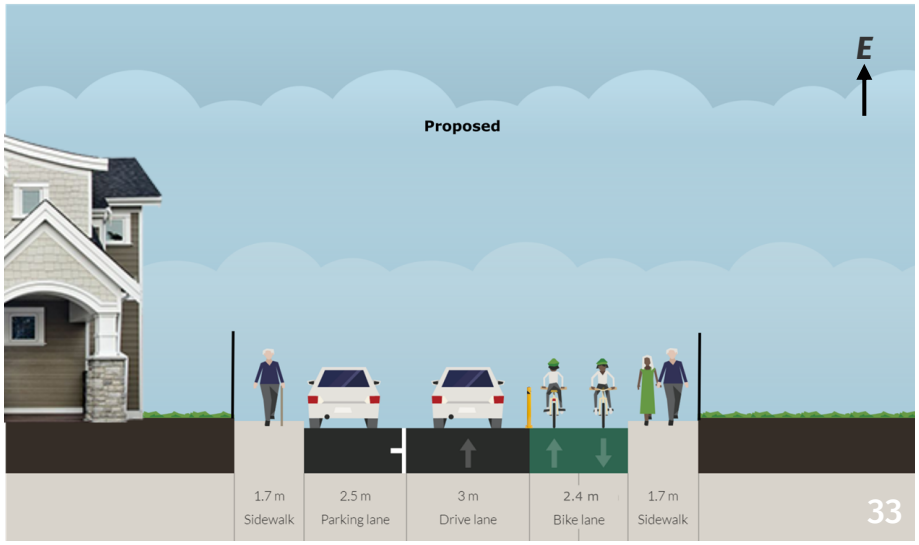


Design features:

- Widen walkways area
- Add bike lane on one side for 2 directions
- Formalize on-street parking to be one side only
- Establish 1 driving lane as existing

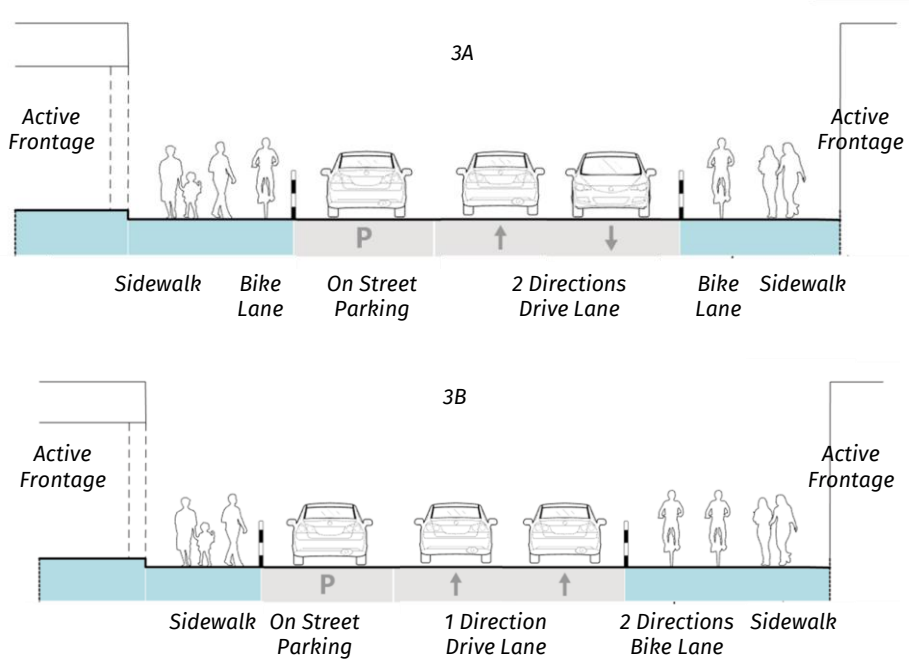
Sample: Krabi Road



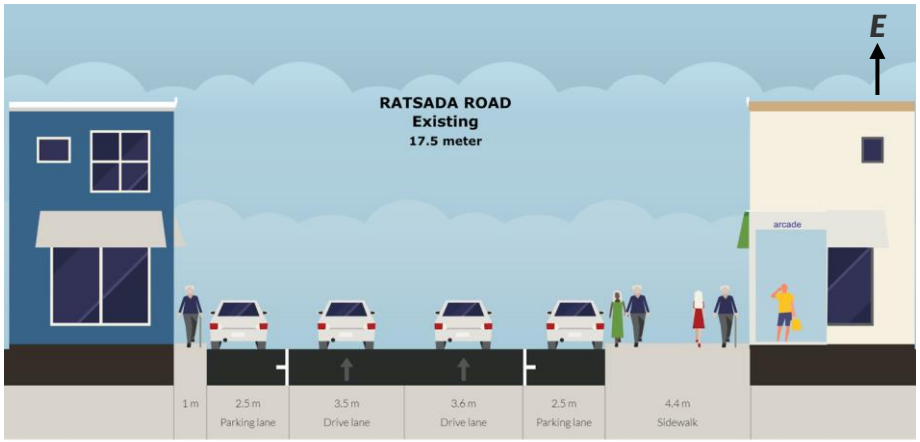


2.5.2 Sidewalk Enhancement

Design Template 3



Sample: Ratsada Road

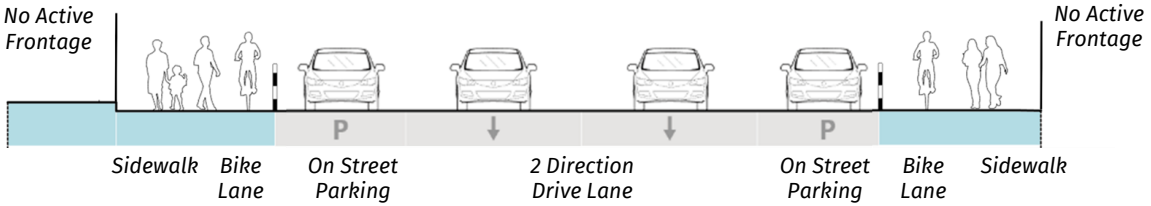


Design features:

- Widen walkways area
- Add bike lane
- Formalize on-street parking to be one side only
- Establish driving lane as existing

2.5.2 Sidewalk Enhancement

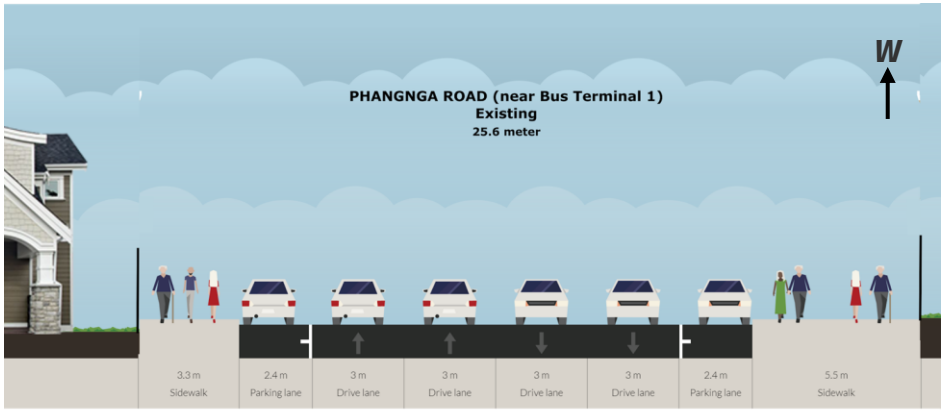
Design Template 4

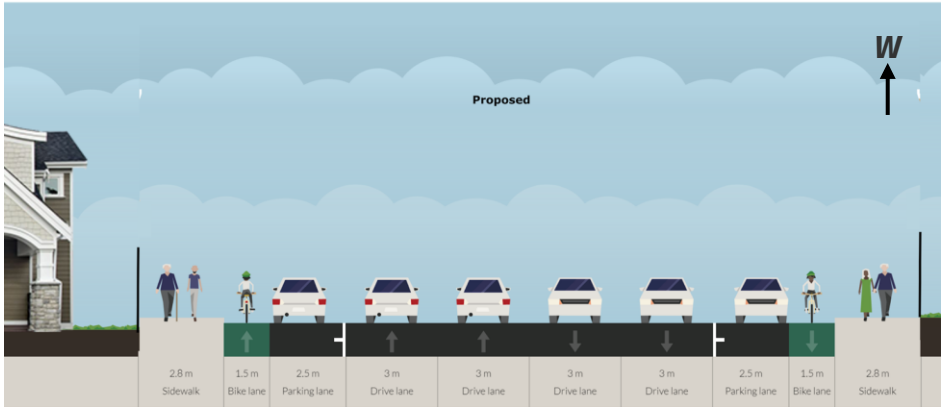


Design features:

- Widen walkways area
- Add bike lane on both side
- Establish on-street parking as existing
- Establish 1 driving lane as existing

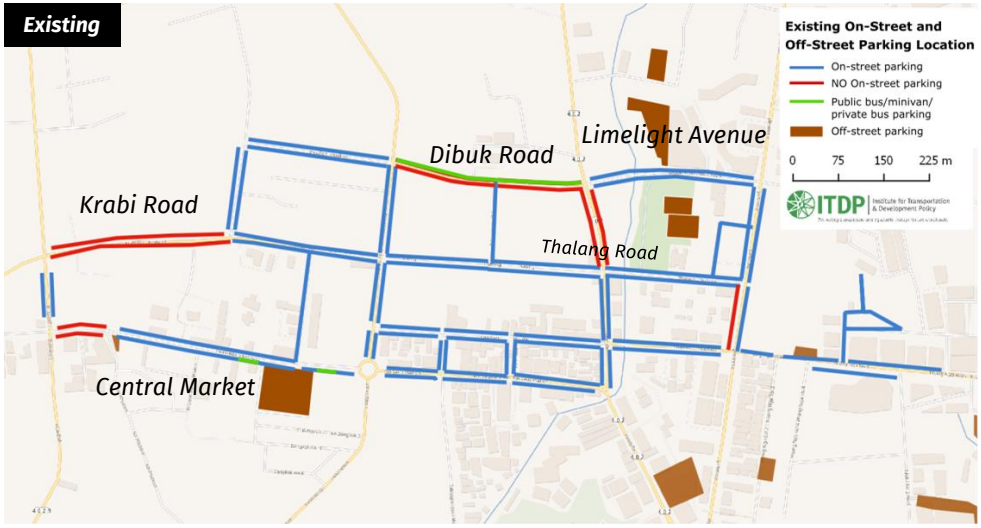
Sample: Phangnga Road near Bus Terminal 1

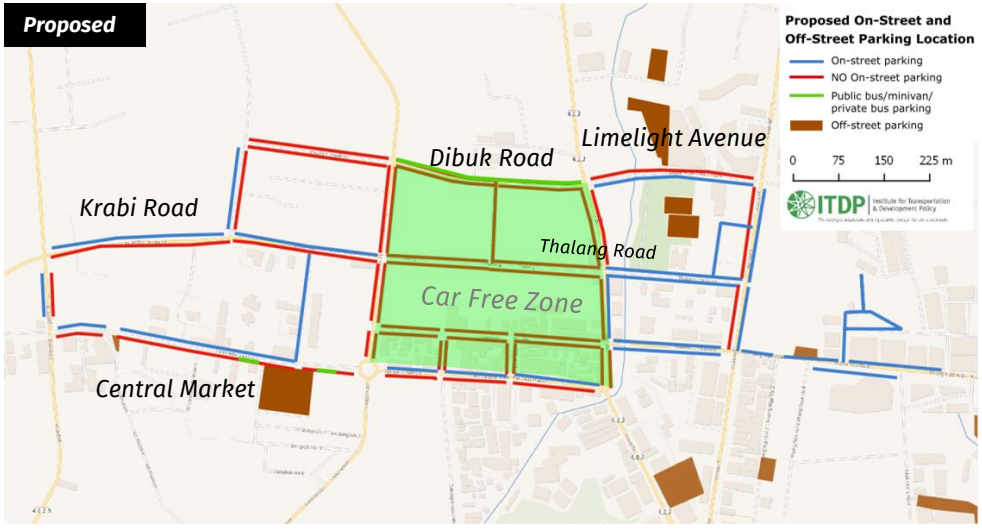




2.5.2 Sidewalk Enhancement

Removal of On-Street Parking Spaces





- As a result of creating car-free zone, sidewalk widening and the provision of bike lane, there will be many on-street parking spaces that need to be removed.
- The following streets Thalang Road (west), Phangnga Road (west), Yaowarat Road, and Dibuk Road, will have no on-street parking.
- Ratsada Road, Ranong Road, Krabi Road, Montri Road, and Dibuk Road will still be able to accommodate parking, but only on one side. Whereas for the remaining streets, no changes to the parking supply provided.
- Especially on Dibuk Road, the on-street parking will operate as existing as for the minivans and coaches parking.
- From the parking supply survey inside the study area, there will be 417 car spaces of on-street parking that need to be removed.
- With the proper parking management and fair pricing, the demand for parking in the city centre can be balanced to match the reduced supply. In addition to that, there are also also few off-street parking sites located around the heritage area, such as Central Market and near Limelight Avenue.
- Parking study, which is produced by another ADB consultant, discussed about the parking management for Phuket City with more detail.

2.5.3 Intersection and Crossing Facility Improvement

Yellow painted areas are claimed from inefficient intersection design

Principles in intersection re-design:

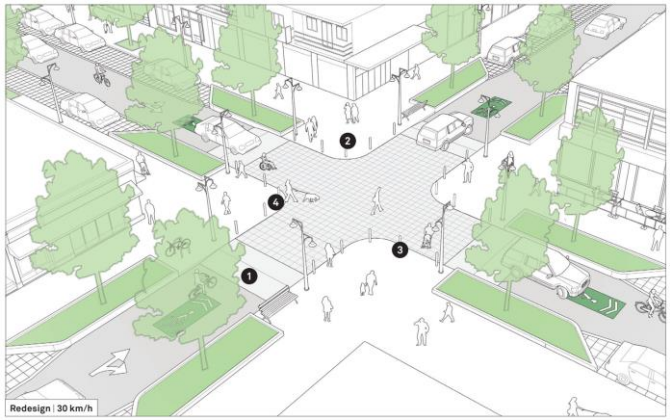
1. **Re-claim unused space for pedestrians**
   Many intersections in many countries are not efficiently designed, with too many spaces are given to motorized vehicles. These spaces can be re-claimed for pedestrians without reducing the capacity of the intersection.

2. **Shorten pedestrian crossing**
   By claiming unused space, pedestrian crossing distance can also be shortened. This way, pedestrians can cross the street faster and more direct.

3. **Narrowing turning radii for traffic calming**
   Turning movement in high speed is dangerous for both pedestrian and drivers. Designing a narrower turning radii can slow down turning speed and improve the awareness of drivers on crossing pedestrian.

4. **Providing pedestrian crossing phase**
   Every signalized intersection must ensure a dedicated signal phase for pedestrian crossing.

2.5.3 Intersection and Crossing Facility Improvement



Best practice: Raised intersection in Melaka, Malaysia

Raised Intersections

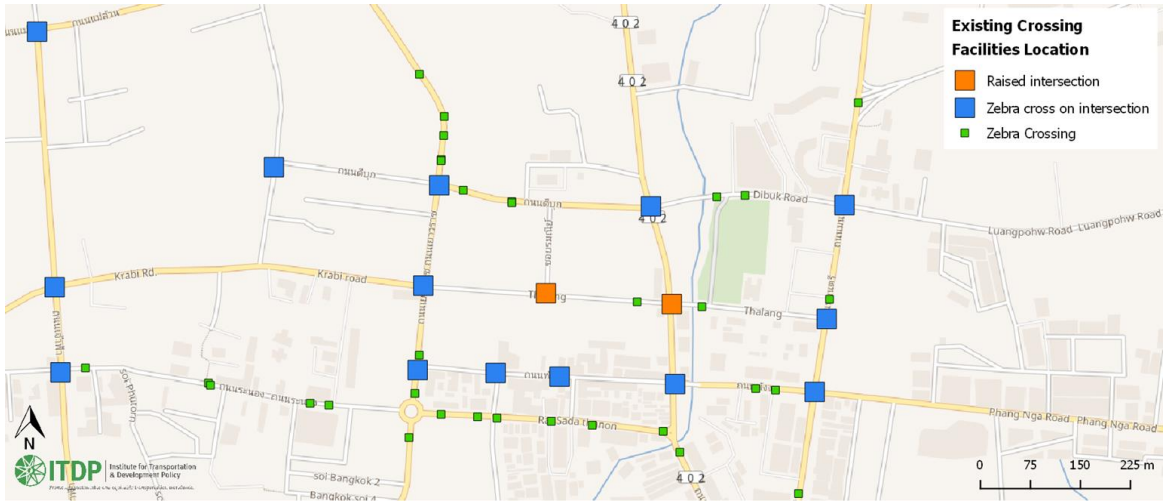
Raised intersections reinforce slow speeds and encourage motorists to yield to pedestrians at the crosswalk. Raised intersections are needed to make vehicles slowing down at intersections. This is as a way to prioritize pedestrians and cyclists in the conservation zone.

Principles:

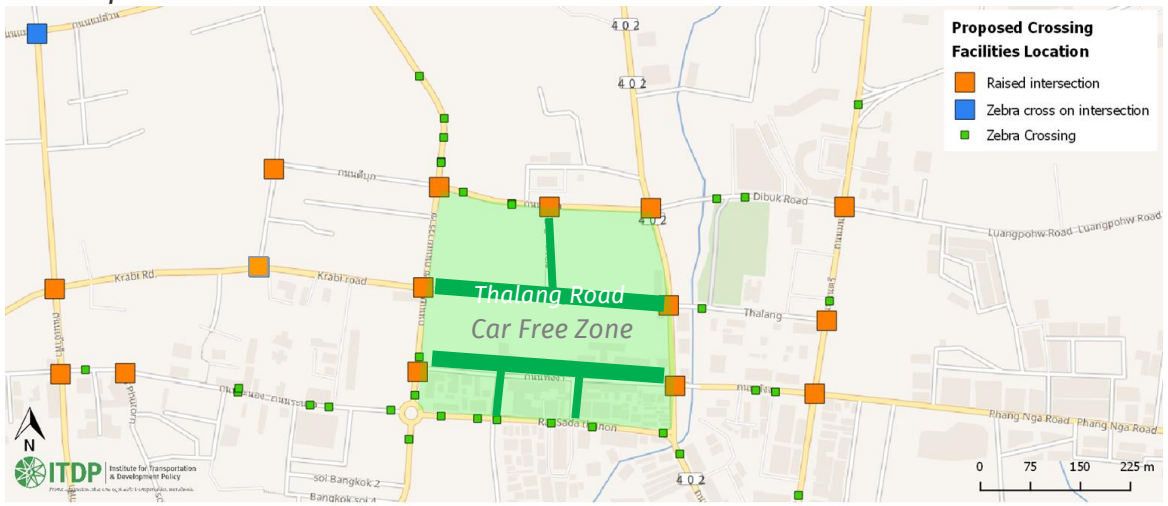
1. Raise the intersections to create a safe, slow-speed intersection. Provide speed humps and other vertical elements to reduce speeds and to signal the motorists that they must yield to pedestrians.
2. Add curb extensions to increase the pedestrian space, reduce the crossing distance, and prevent parking at the intersection corners. Use the extension of these spaces to also provide landscaping and street furniture
3. Where illegal parking on the sidewalks is a common problem, consider using bollards or street furniture to prevent vehicles from invading the pedestrian space.
4. Where vehicles are not turning, design corners with the smallest constructible radius, approximately 0.6 m.
5. Prioritize cycle traffic on low-speed corridors by treating them as cycle-priority streets with shared lane markings.
6. Consider removing one lane of parking to create a contraflow cycle lane. Raised intersections increase safety for cyclists riding contraflow and for performing turns across oncoming traffic.

2.5.3 Intersection and Crossing Facility Improvement

A. Existing



B. Proposed



Raised Intersection Locations

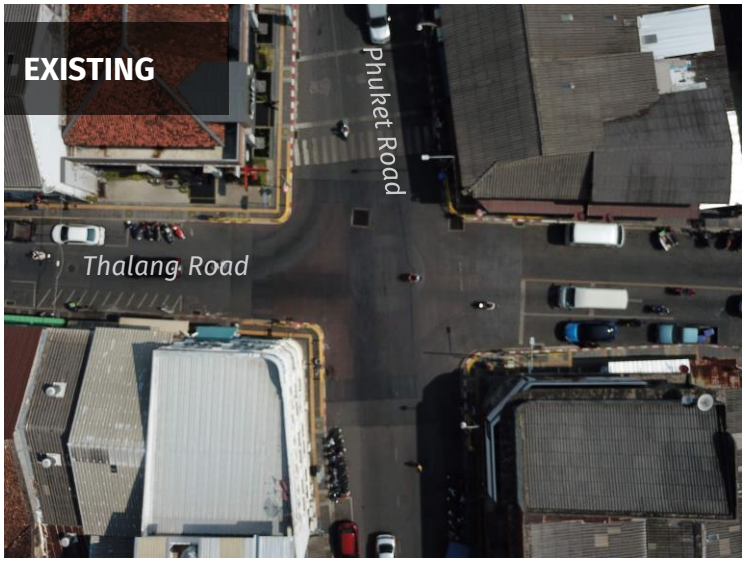
Some intersections around the heritage area need to be replaced with raised intersections, to achieve the following objectives:

- Reduce large corner radii and discourage drivers to turn at high speeds, which ultimately reduce conflict with pedestrians
- Create better visibility vehicles parked too close to the intersection reduce mutual visibility between motorists and pedestrians.
- Sidewalks contain obstacles and lack shade and street furniture.
- Pedestrian crossings have minimum markings and do not provide accessibility ramps for universal access.

The maps beside show existing and proposed crossing facility improvement in Phuket heritage area.

2.5.3 Intersection and Crossing Facility Improvement

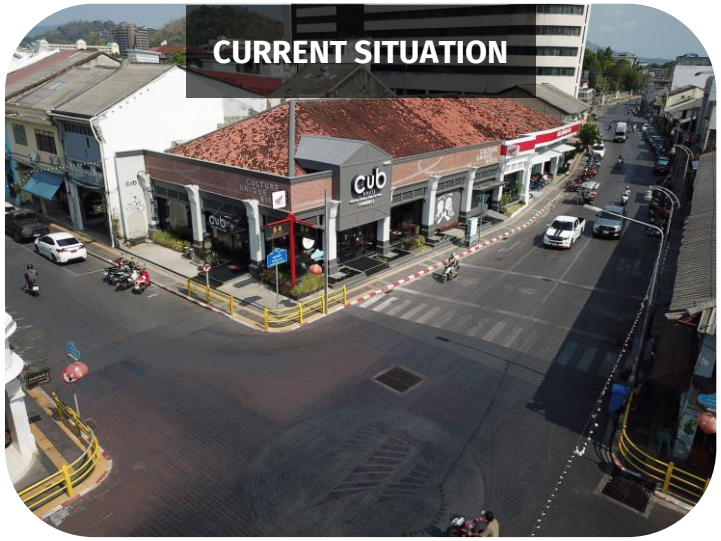
Intersection Between Thalang Road - Phuket Road



Raised Intersection Improvement

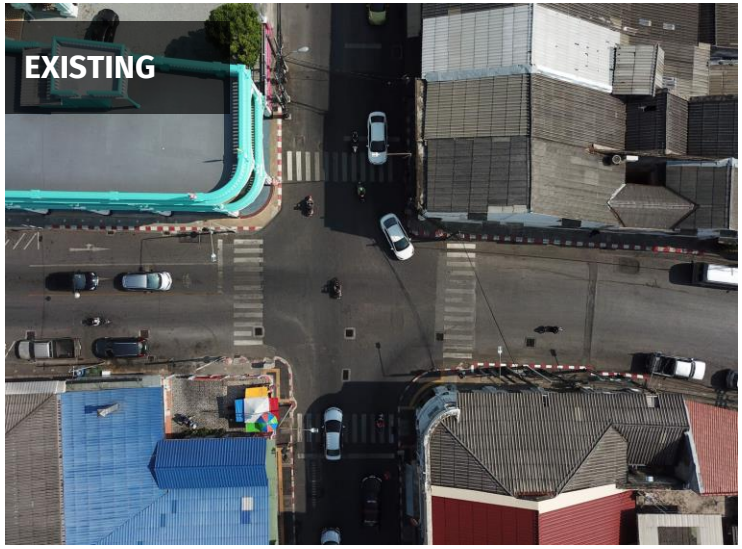
Improvements:

- Reduce motorized turning radius
- Add continuous bike lane
- Placed at-grade crossing for pedestrians and cyclists
- Install raised crossing to slow down vehicle speed
- Install bollards to prohibit cars/motorcycles parking on the sidewalk
- Formalize on-street parking
- Establish a driving lane and traffic direction as existing



2.5.3 Intersection and Crossing Facility Improvement

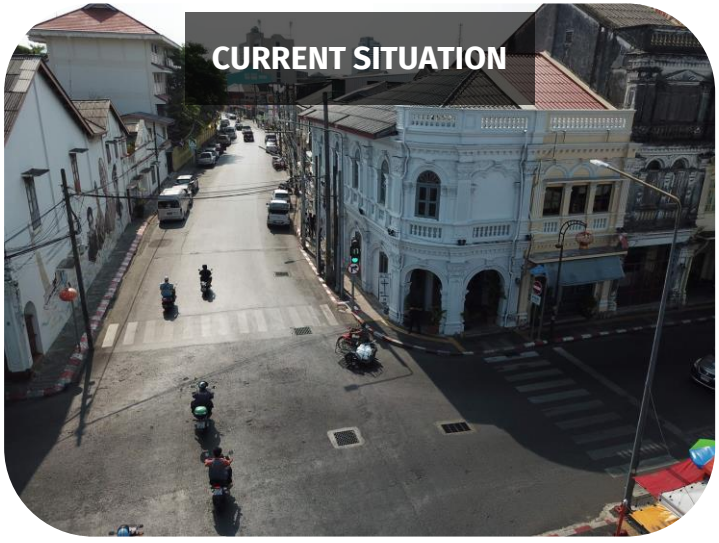
Intersection Between Dibuk Road - Yaowarat Road



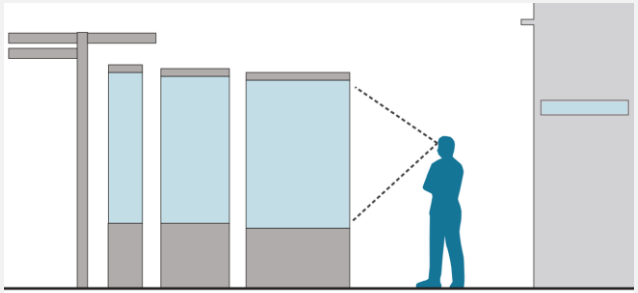
Raised Intersection Improvement

Improvements:

- Reduce motorized turning radius
- Add continuous bike lane
- Placed at-grade crossing for pedestrians and cyclists.
- Install raised crossing to slow down vehicle speed
- Install bollards to prohibit cars/motorcycles parking on the sidewalk
- Formalize on-street parking
- Establish driving lanes and traffic direction as existing



2.5.4 Wayfindings Inside and Around Heritage Area



Objectives

Wayfinding systems can encourage walking and transit usage by providing multimodal information and adopting the pedestrian perspective. Wayfinding works with other visual cues to help people orient themselves and provide confidence in navigating the geography of a city. Wayfinding also can increase people's comfort in choosing to walk when they understand a destination proximity

Wayfinding can be located near key destinations with high pedestrian volumes, such as transit stops, parks, public facilities, and markets. The wayfinding should indicate walking and cycling time with 5 and 10 minutes walking distances.

Principles

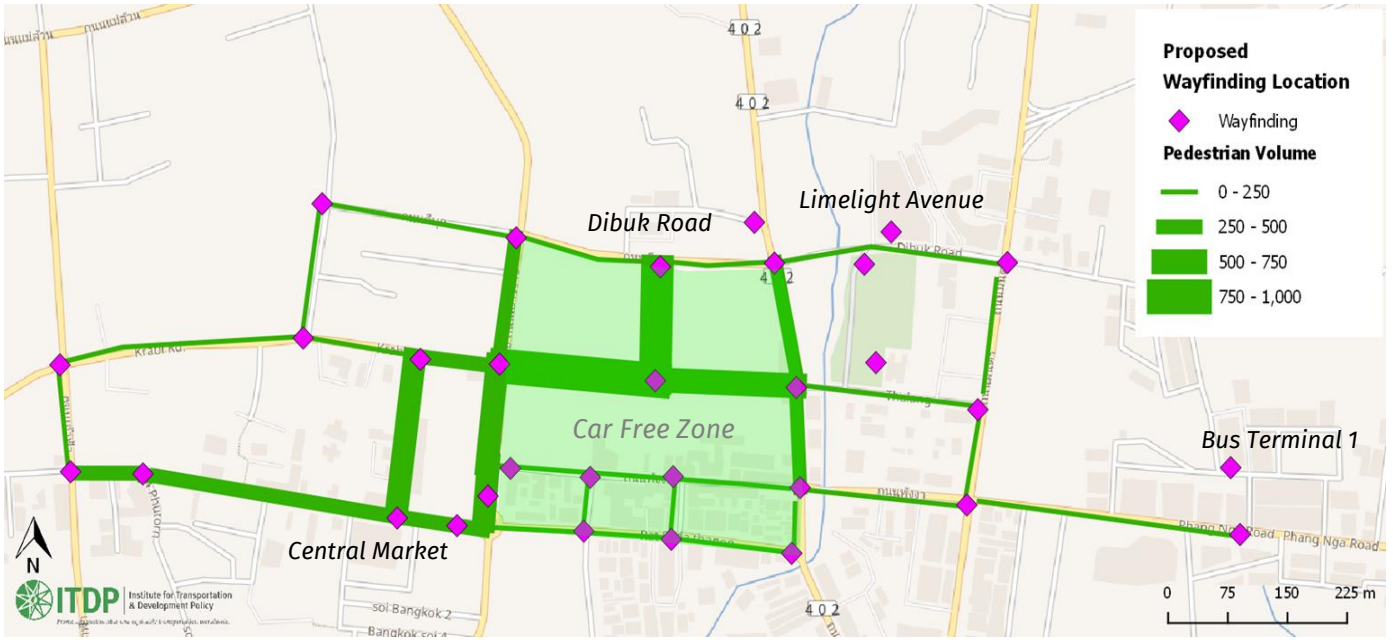
Wayfinding should be seen by people easily. The scale of wayfinding should consider the human body, eye, and height, including adults, children, and people using wheelchairs. Font type and size should be simple and big enough to be read by people with low vision or who are visually impaired.

Using a clear visual language, graphics standards, and maps can be universally understood. Inclusive signage and wayfinding should inform all type of users, from residents and workers to visitors and tourists

2.5.4 Wayfindings Inside and Around Heritage Area

Wayfinding Locations

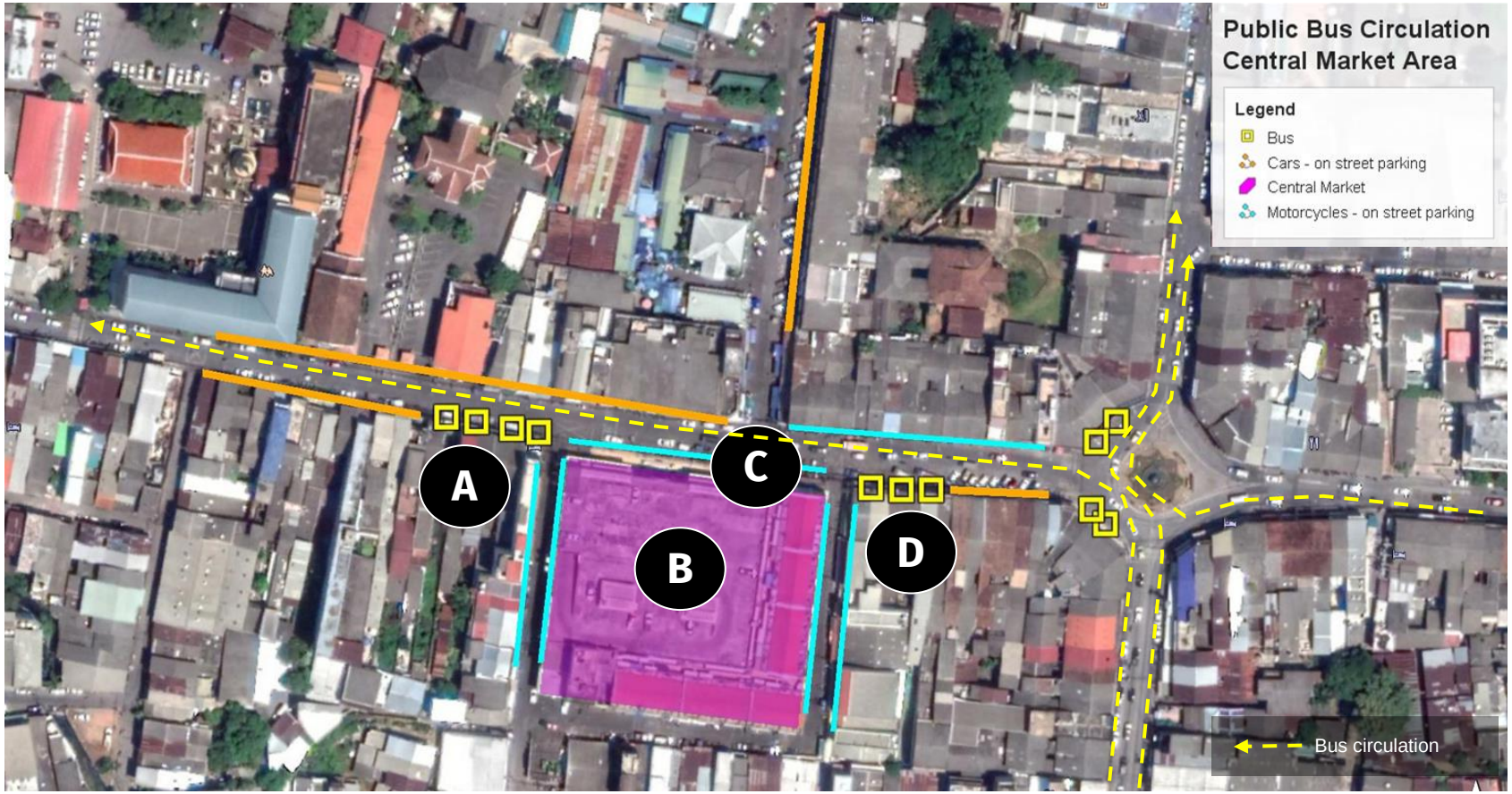
The quality of wayfinding systems should indicate walking and cycling time with 5- and 10-minute walking distances.



- **Currently, some tourists are getting lost when they arrived in Phuket City because there is no signage or tourist information in either the bus terminal, bus stops, or inside the heritage area.**
- **Wayfinding can be placed in the bus terminal, bus stops, every intersection and nearby public spaces. The proposed location of wayfinding shows on the map above.**
- **The wayfinding should inform all of the locations which can be accessed by walking and cycling within 5 min to 10 min.**
- **Many heritage areas around the world put many signage to facilitate the tourists, such as a UNESCO heritage site in Melaka, a heritage site in Victoria, etc.**

2.5.5 Public Transport Circulation Improvement on Central Market

Current Situation in Central Market Area



A

Informal bus stop location by Blue Bus routes:
1811
1813
1812
1815

B

Central Market building has cars and motorcycles parking space on 2nd and 3rd floor.

C

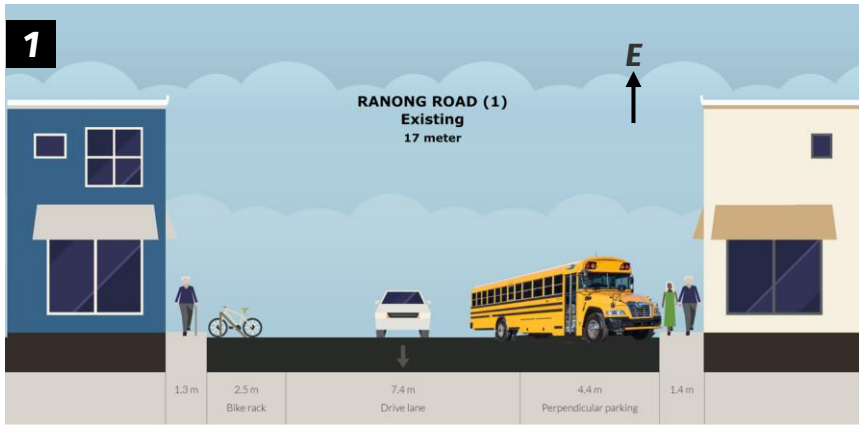
Double motorcycles parking on the street every morning because of fresh market activities.

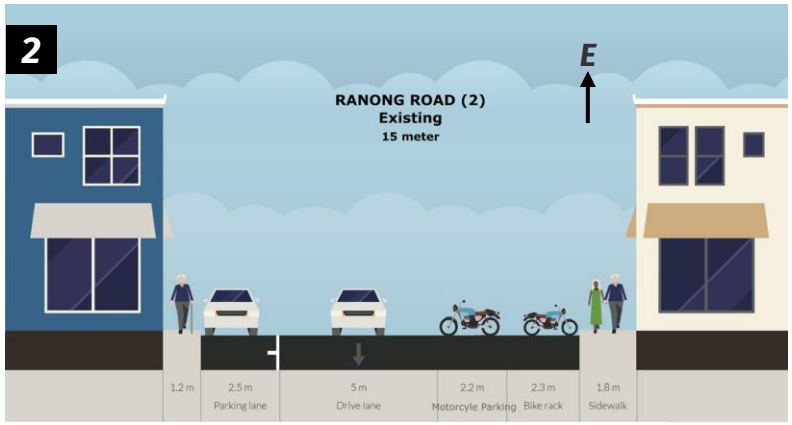
D

Informal bus stop location by Blue Bus routes:
1814
8359
1818
8360

2.5.5 Public Transport Circulation Improvement on Central Market

Street Redesign for Central Market Area

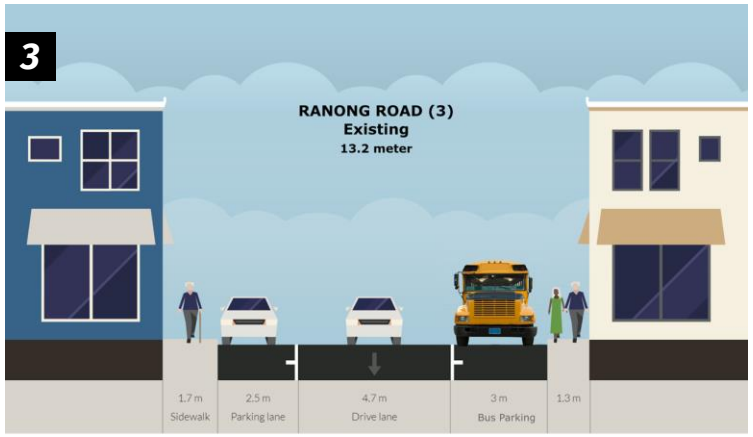


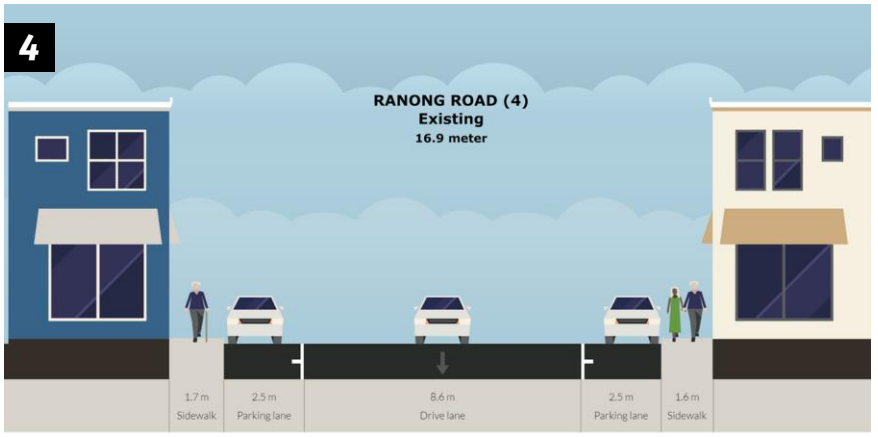


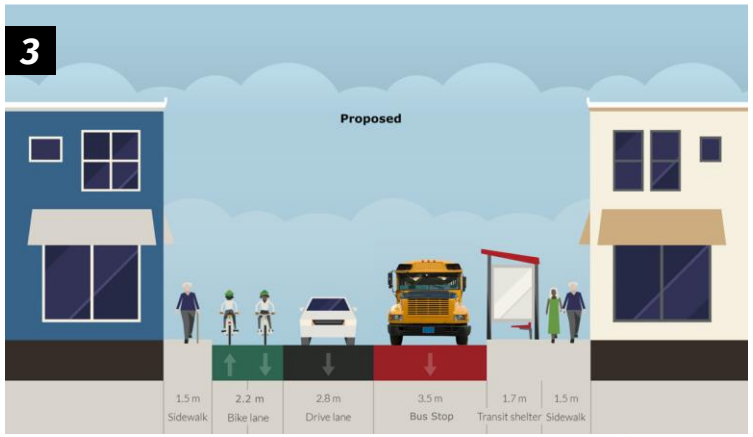
Improvements:

- The street is designed as Template 3.
- Especially on a bus stop irregularly in existing, in the proposed design the bus stops are established. On the other hand, the on-street parking is reduced.

2.5.5 Public Transport Circulation Improvement on Central Market



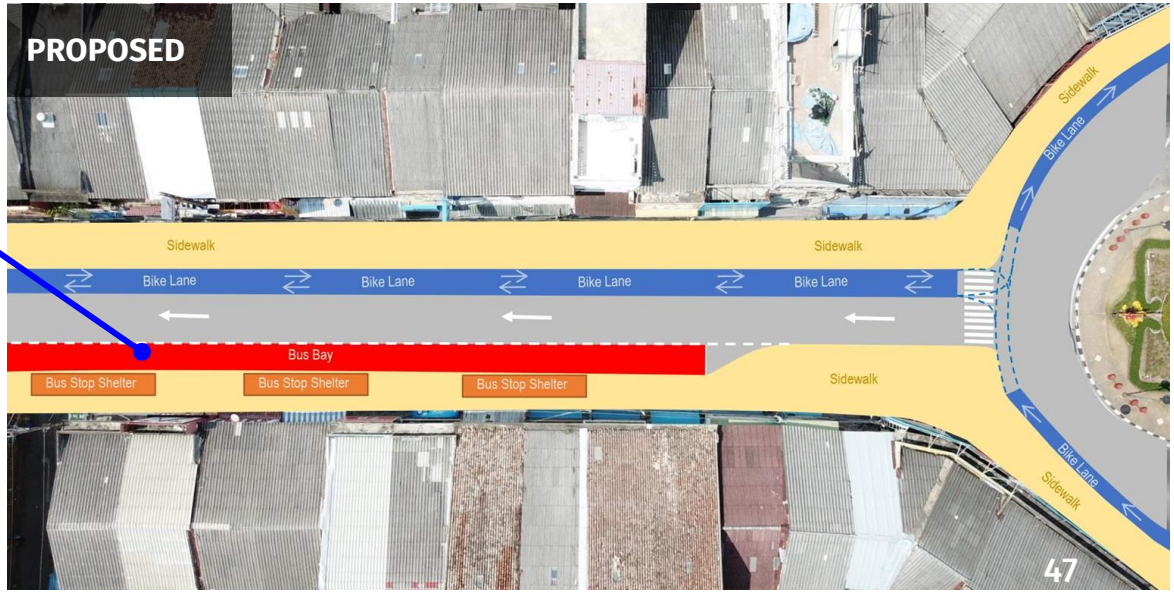




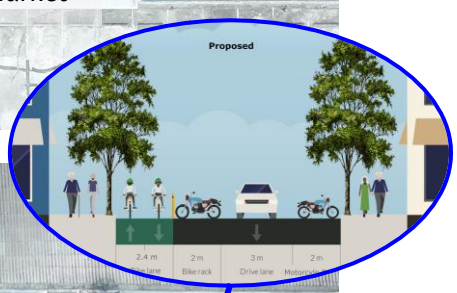
Improvements:

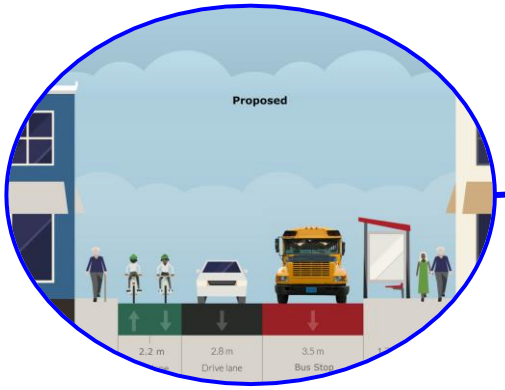
- The street is designed as Template 3.
- Relocation of on-street parking.
- Especially on a bus stop irregularly in existing, in the proposed design the bus stop is established. On the other hand, the on-street parking is reduced.

2.5.5 Public Transport Circulation Improvement on Central Market



2.5.5 Public Transport Circulation Improvement on Central Market

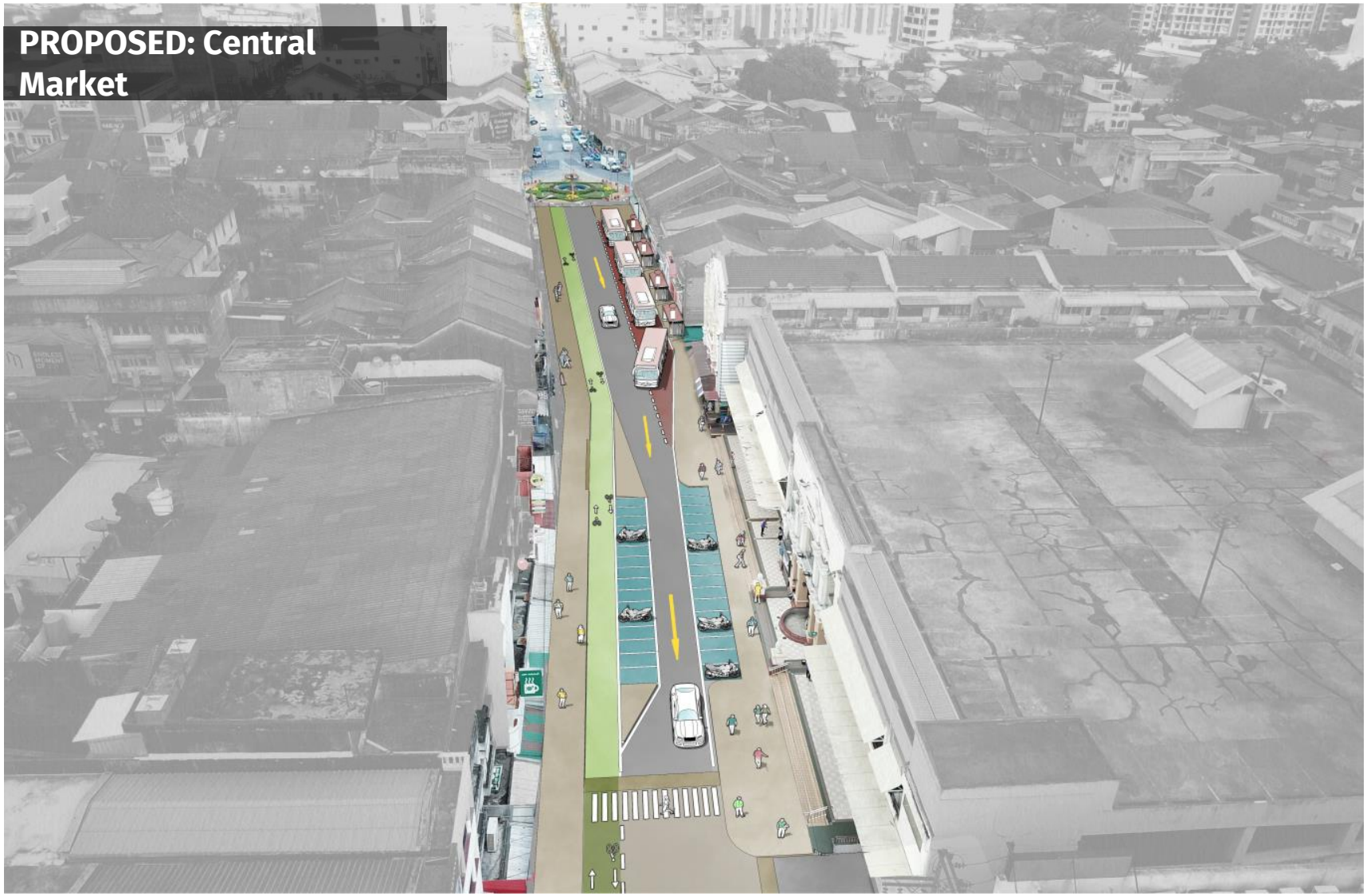




2.5.5 Public Transport Circulation Improvement on Central Market

Street Redesign on Central Market Area

2.5.5 Public Transport Circulation Improvement on Central Market



2.5.5 Public Transport Circulation Improvement on Central Market


Kyoto, Japan


Busan, South Korea

Shelter and Passenger Information

- Shelter is needed to provide a better environment as the protection from sun and rain;
- Shelters can be built in multiple sizes to adjust to the local volumes. The regular bus shelter is 1.5 m x 4 m
- Shelters should allow a straight unobstructed path of at least 1 m between the shelter and the curb and a minimum clear path of 2 m in width.
- Provision of comfortable shelter and seating can significantly improve the perception of wait time and rider satisfaction.
- Maps, routes, and other wayfinding should be prominent at bus stops, especially high-volume, high-activity, or transfer stops.
- System information may include strip maps of single routes, fixed schedules or frequencies, full system maps, and pertinent transfer maps or schedules.
- Information can be shown on hanging signs or signage integrated into the shelter. Temporary posted information should be protected from weather behind placards.
- Providing route information that is clear, understandable, and accurate makes it easier for passengers to understand their travel options.
- Alerting riders about nearby, transit-accessible destinations enables them to make more informed decisions about their travel options.

2.6 Bike Share Initial Plan

2.6.1 Bike Share System

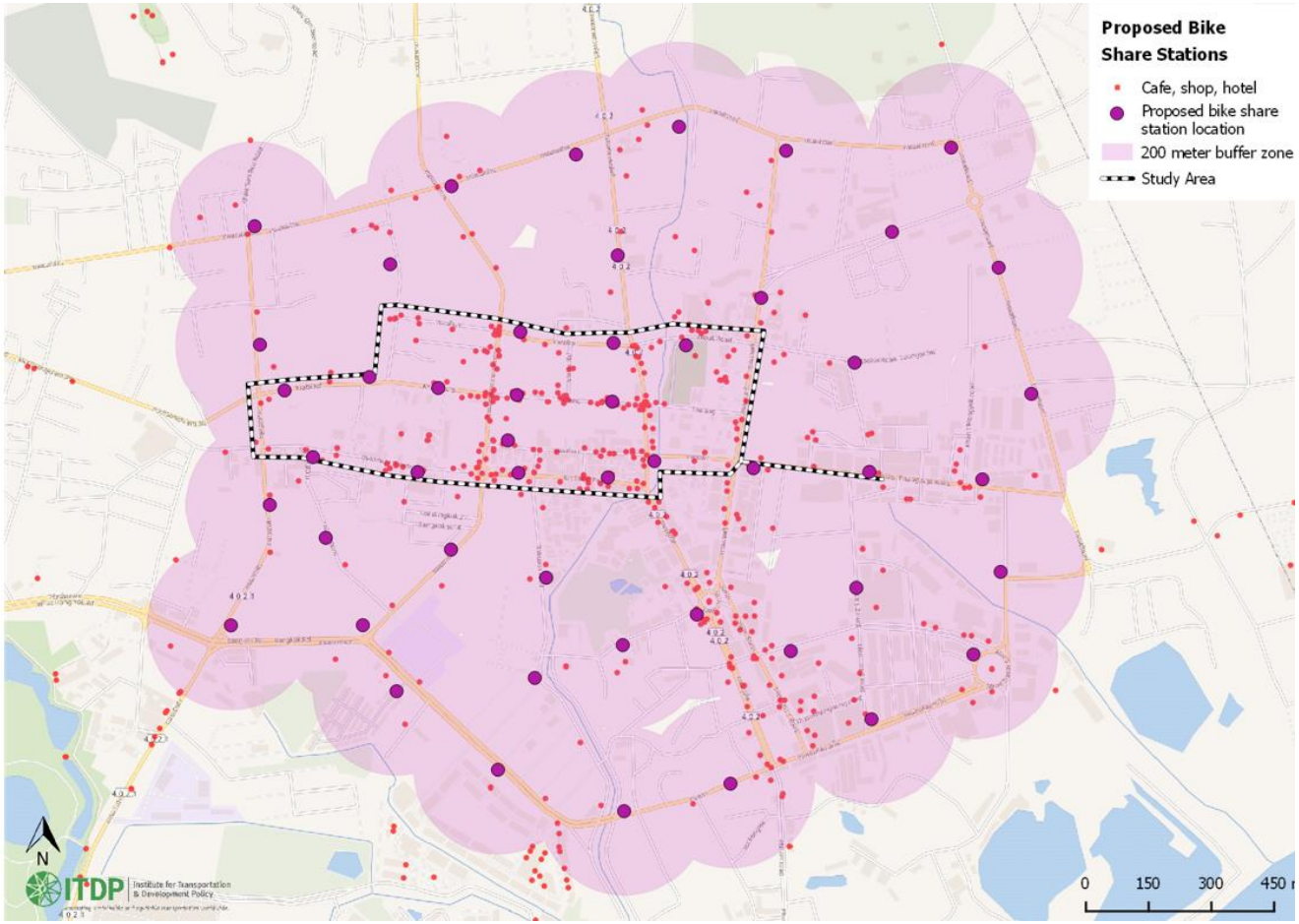
A bike-sharing system is a type of ride-sharing service, in which bicycles are made available for shared use on a short term basis. The bike-sharing scheme allows people to borrow a bike for short trips, with bike available to grab and be returned at different stations and locations.

As part of the public transport system, the bike-sharing system solves not only the 'last mile' issue of longer public transport trips, but it also creates a new way of travel, especially for shorter trips.

LinkBike
Penang, Malaysia

2.6 Bike Share Initial Plan

2.6.2 Proposed Bike Share Station Location



- A good planning for station location is the key of the success bike share system. The planning of bike share shall be determined based on the density, position and scale of bike parking locations.
- The stations should be located close to demand, such as tourist attractions restaurants, central business districts and residential areas.
- Because of spaces limitation in the greater conservation zone of Phuket City, stations for bike share system should be combined with on-street parking for vehicles.

2.6 Bike Share Initial Plan

2.6.3 Bike Share Station Arrangements

Form 1: Combine bike-sharing with sidewalk

Best practice: Penang, Malaysia

Proposed bike share station on sidewalk in Phangnga Road, Phuket:

Form 2: Combine bike-sharing with on-street parking space

Best practice: Penang, Malaysia

Proposed bike share station combined with on-street parking on Ratsada Road, Phuket:

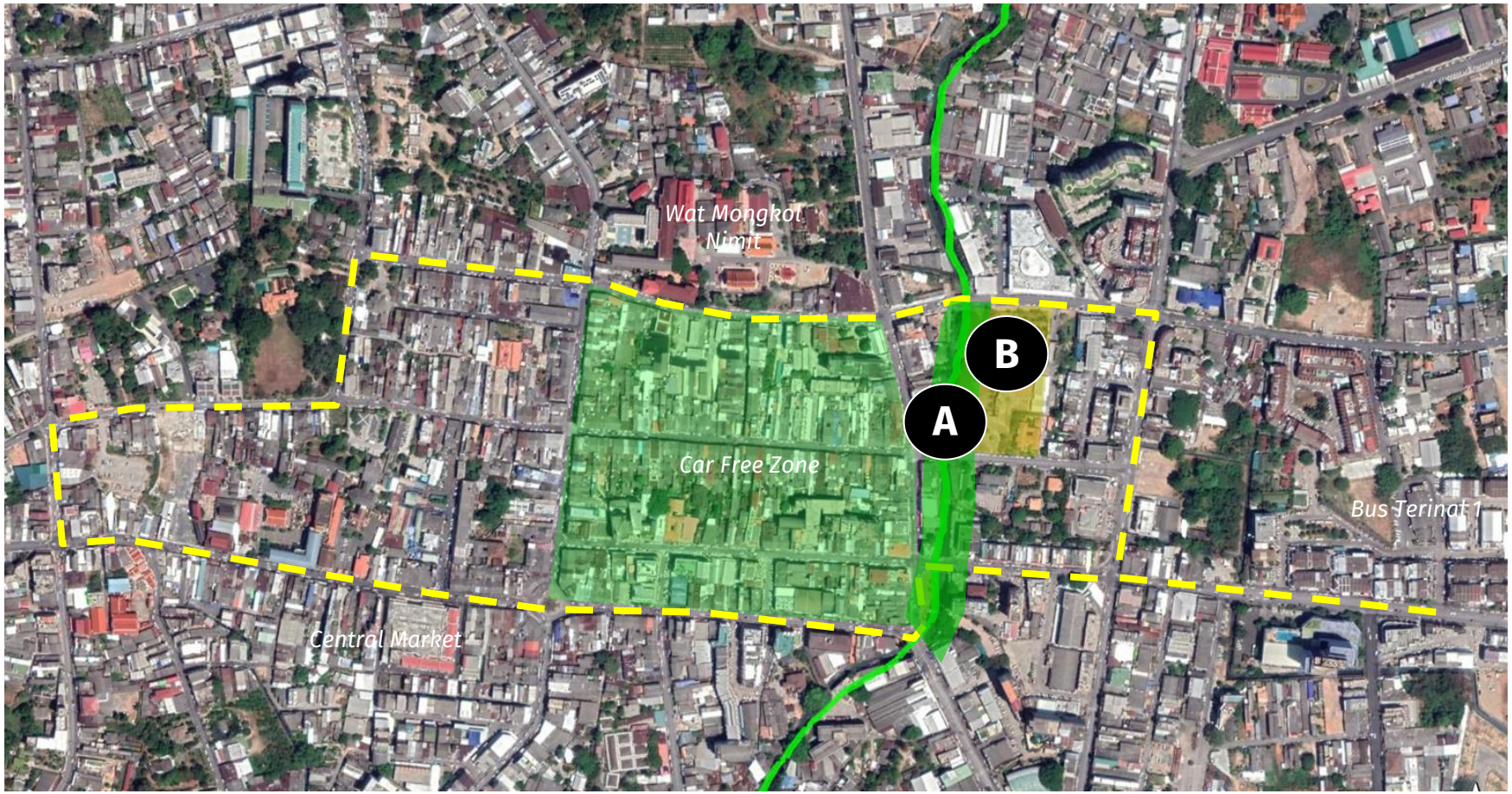
Form 3: Bike-sharing station based on field condition

Best practice: Shanghai, China

Proposed bike share station based on field condition on 72nd Anniversary Queen Sirikit Park, Phuket:

2.7 Public Space Activation

2.7.1 Current Situation in 72nd Anniversary Queen Sirikit Park



A

- Along the river is a slum area.
- The river is potentially to be a greenway which can attract many visitors.

B

- An unattractive park across the Limelight Avenue Mall with Hai Leng Ong Statue.
- In Phuket City Masterplan, in this park, government will do Commemoration of the Queen's 72nd Birthday Anniversary Project

2.7.1 Current Situation in 72nd Anniversary Queen Sirikit Park

Commemoration of the Queen's 72nd Birthday Anniversary Project in Phuket City Masterplan

Current situation:

- The river and the park are unattractive.
- Both of this location is potentially to be a tourist destination or shortcut path for the pedestrian because they are located near Thalang Road, Limelight, and Bus Terminal 1.
- During the preparation of Commemoration of the Queen's 72nd Birthday Anniversary Project, the government can activate the park through organizing night market like Indy Night Market in Limelight Avenue.

2.7.2 Ideas for Activation

A. Night Market on 72nd Anniversary Queen Sirikit Park

Create a night market in 72nd Anniversary Queen Sirikit Park. The activities not only attract visitors but also can create a good impact on the local economy.

B. Greenways plan along the canal

Improving the greenways can be done through making a continuous sidewalk and put the greeneries along the river.

If possible, bike lane can also be put beside the side walk so the river can only be accessed by pedestrians and cyclists.

Improving access to the greenways are also needed. The street surrounding the river can implement street beautifications, providing signage and wayfinding on the streets that lead to the riverwalk.

To support the heritage site and for the short term project, the greenways can be built from Ratsada Road intersection to Dibuk Road.

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2.8 Project Cost Estimate for Phuket City

Improvement	Units	Unit Price	Cost (USD)	Total Cost
Street Design - Phuket City Heritage Area				**10,364,710 USD**
Sidewalk Improvement	21,475 m^2	200	4,295,000	
Bike Lane	11,167 m^2	300	3,350,000	
Pedestrian only street (car-free zone)	13,494 m^2	200	2,698,760	
Greenways along the Canal	1,101 m^2	250	275,250	
Bike Share System				**10,619,110 USD**
New Stations	49 stations	3,200	156,800	
New Bikes	343 bikes	250	62,500	
Intersections				**2,025,000 USD**
New Raised Crossing	15 intersections	135,000	2,025,000	
TOTAL				**12,644,110 USD**

3. Phuket Public Transport

Outline

3.1 Project Overview and Objective

Poor Bus Terminal facilities at Phuket Town, which became less attractive for some locals and tourists

3.1.1 Project overview

High tourism activities have caused long term impacts towards the city, such as poor traffic, high accident rates and environmental damages. Based on the data, there were approximately 180 deaths per year caused by road accident alone in Phuket.

The public transport mode share in Phuket is relatively low because of poor quality of service and lack of access on the public transport. Thus, in order to accommodate future growth and sustainable mobility in Phuket, the provision of good quality public transport is needed.

3.1.2 Scope and Objective

This chapter only covers the public transport improvement for Phuket Island, examines existing public transport condition and provides guidances of possible improvements and policies that can be implemented to provide accessible, reliable and safe public transport in Phuket.

The work for this study were conducted between March to April 2019 to collect data, field observation and meeting with relevant stakeholders.

3.2 Current Conditions

Blue bus or Phothong

Pink bus

Airport bus

3.2.1 Local Public Transport

Public transport in Phuket is served by blue bus, pink bus and airport bus. The blue bus, commonly known as Phothong, is individually owned and serves various destinations from Phuket. The pink bus is a more organized service under an association and caters the network for local residence in within town of Phuket. The airport bus has three routes and in which serves in buses or minivans.

The existing service and the condition of the infrastructure are still below the standard. On average, bus frequency of all routes is extremely low, in which only less than 3 buses per hour or more than 20 minutes headway. The situation is worsen by the lack of clear official information system that is able to inform passengers, especially tourists, about the bus route and schedule. Based on the experience, there is no minimum standard of service in which the bus driver can be of speed or very slow. It happens particularly on Phothong as they still retain revenue directly from the passengers. The government has no service contract with the Phothongs yet in order to properly regulate them.

In terms of the condition of the fleet, both blue and pink buses are using modified truck to carry the passengers. The fleet is using Euro 2 engine and passengers are considerably exposed to the exhaust gas which is harmful for long-term health. Accessing the fleet is also an issue due to high vertical gap and makes the fleet not inclusive.

All the bus services require passengers to pay by cash, except for Phuket Smart Bus (airport bus). The bus fare is given either to the driver or the conductor with no proof of payment except for the pink bus. Bus services in Phuket need massive improvements to be reliable and safe for both locals and tourists.

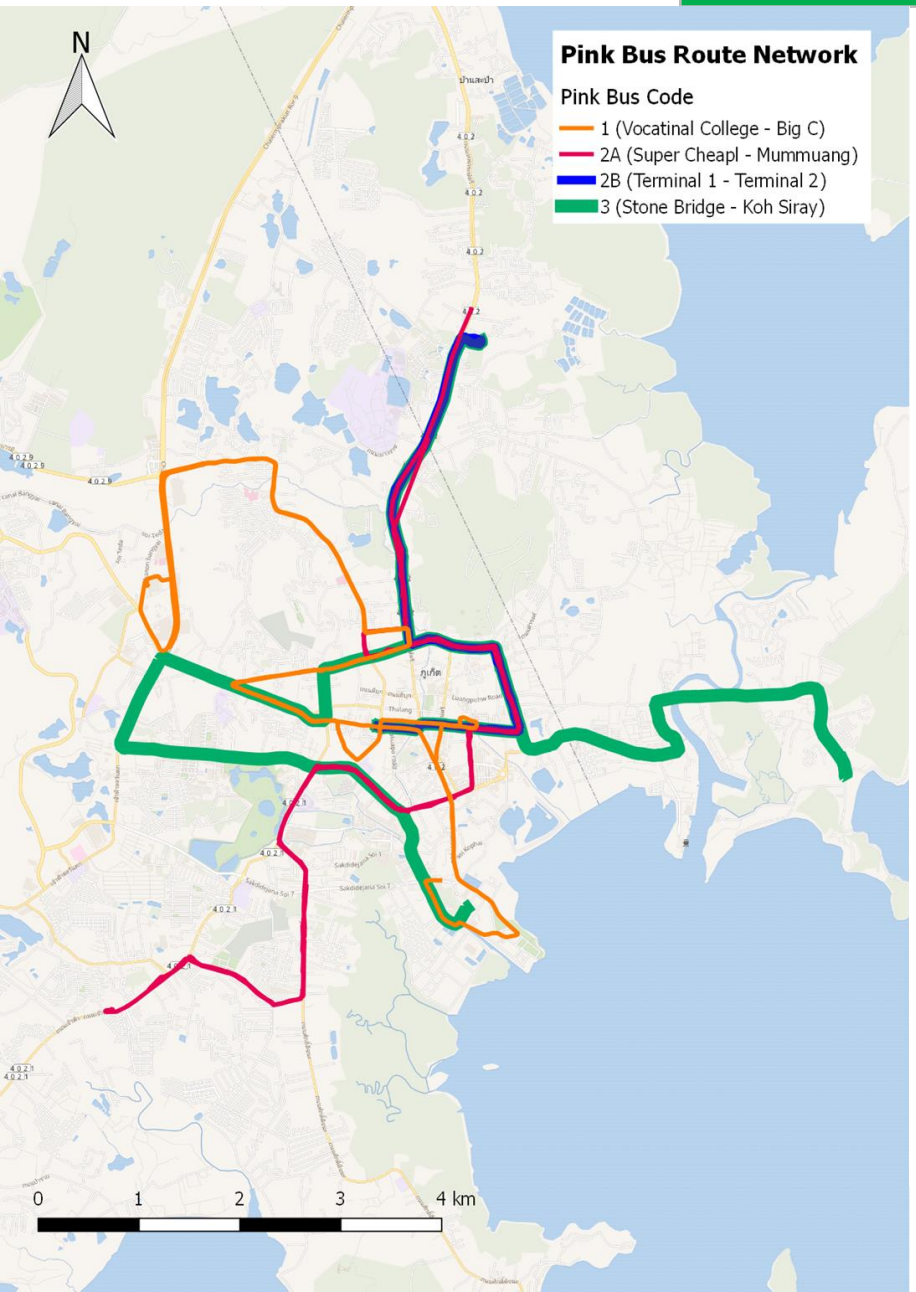
3.2 Current Conditions

Blue Bus

- End to end route type in which Phuket town as the central transit place.
- Has limited service time, low frequency, inconsistent headway and long waiting time.
- No service available for some destinations, consequently additional service is needed.
- Poor quality of fleet and infrastructure

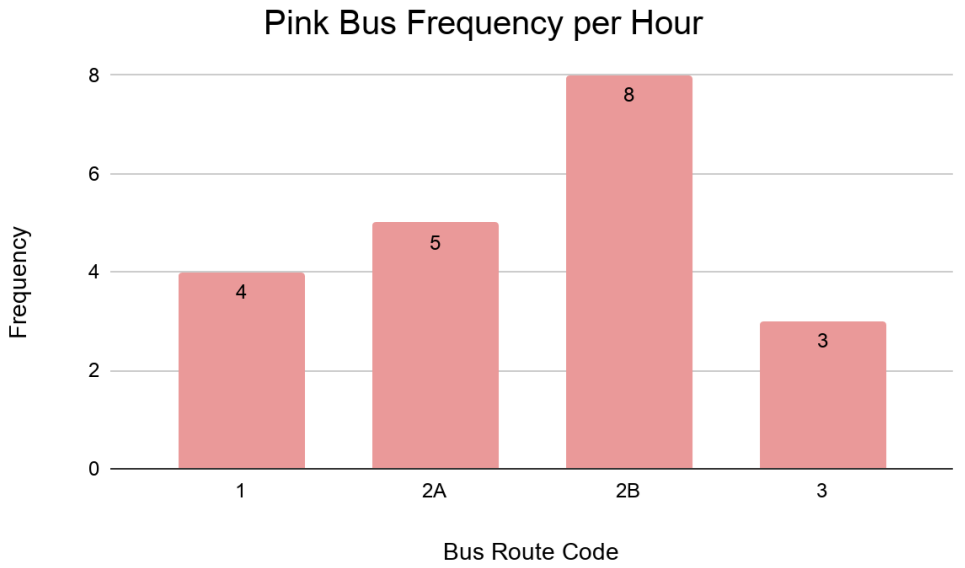
Type Bus	Route Code	Origin	Destination
Blue Bus	1811	Phuket Town	Sarasin
Blue Bus	1812	Phuket Town	Kamala
Blue Bus	1813	Phuket Town	Bang Rong Pier
Blue Bus	1814	Phuket Town	Patong
Blue Bus	1815	Phuket Town	Naiharn
Blue Bus	1818	Phuket Town	Ao Makham
Blue Bus	8359	Phuket Town	Karon
Blue Bus	8360	Phuket Town	Chalong Pier

3.2 Current Conditions



Pink Bus

- Limited service time, similar to the Blue Bus.
- Poor fleet condition and infrastructure, some stops do not have any bus pole or sign
- Low bus frequency; even though it has fixed time schedule yet the waiting time can be more than an hour.
- Some fleets do not have a clear route code which will confuse some passengers, especially tourists.



3.2 Current Conditions

High tourism activity in Phuket

Lack of wayfinding and public transport service at the airport makes less appealing for the commuters

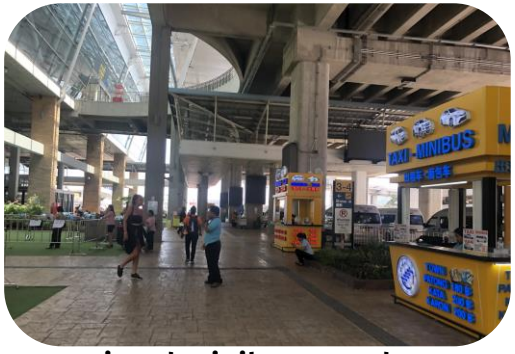
3.2.2 Airport Public Transport Access

According to Phuket International Airport Statistic, the number of tourists in Phuket have reached to almost 9 millions in 2018 with 8% expected annual growth.

The provision for good, reliable and affordable public transport system is crucial as to the fact that most of the tourists are highly relying on public transport to commute between the cities and tourist destinations.

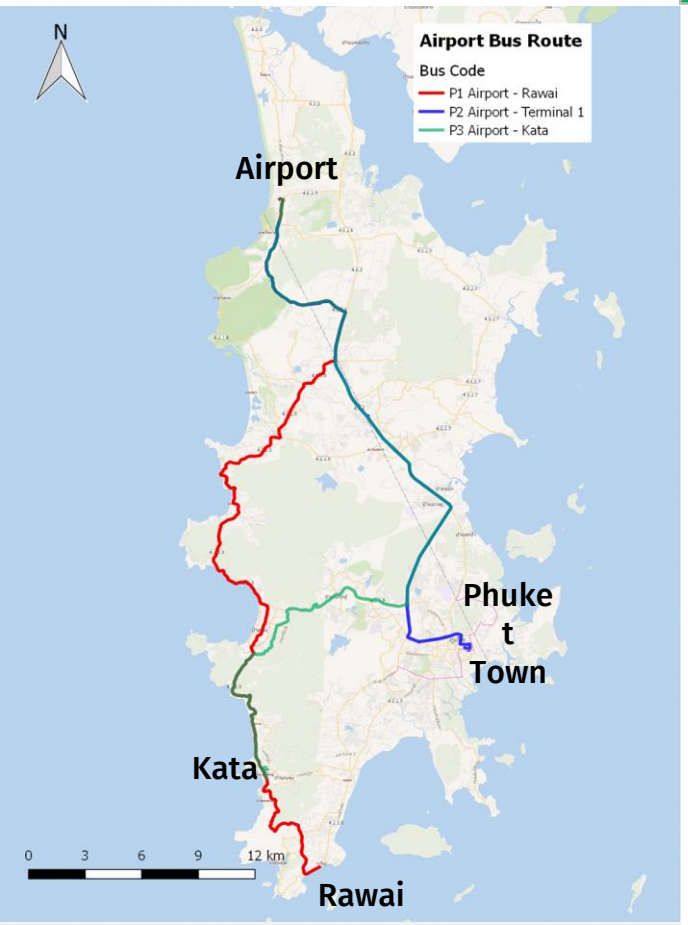
However, based on the observation, the public transport accessibility from the airport is still difficult and limited. This situation has forced a lot of passengers to use alternate transport modes such as local taxis and minivans to reach the city.

Minivan pick-up passenger on the arrival hall



Taxi and minibus stands are located right in front of the arrival hall

3.2 Current Conditions



Airport Bus

- Lack of destinations from the airport compared to local taxi or minivan
- P1 / Phuket Smart Bus is the only bus system that serves west coast of the island
- All routes (P1, P2 and P3) have low frequency bus (1 bus/hour) and also create long waiting time for the passengers
- The P1 fare is more expensive than the local bus, which is unattractive for the locals
- Lack of information about ticket sale and top up point for the Smart Bus
- Most of the locals use P2 because it covers the commercial and residential area which terminate at Phuket city center
- The P3 has low demand of passengers because it is still expensive compared to the local taxis (it costs 200 THB compared to 70 THB for minivan taxis)
- Poor bus stop infrastructures (small bus pole and infrequent)

Type Bus	Route Code	Origin	Destination
Airport Bus	P1	Airport	Rawai
Airport Bus	P2	Airport	Terminal 1
Minivan	P3	Airport	Kata

Bus P1 - Smart Bus

Bus P2 - Local Bus

Bus P3 - Minivan

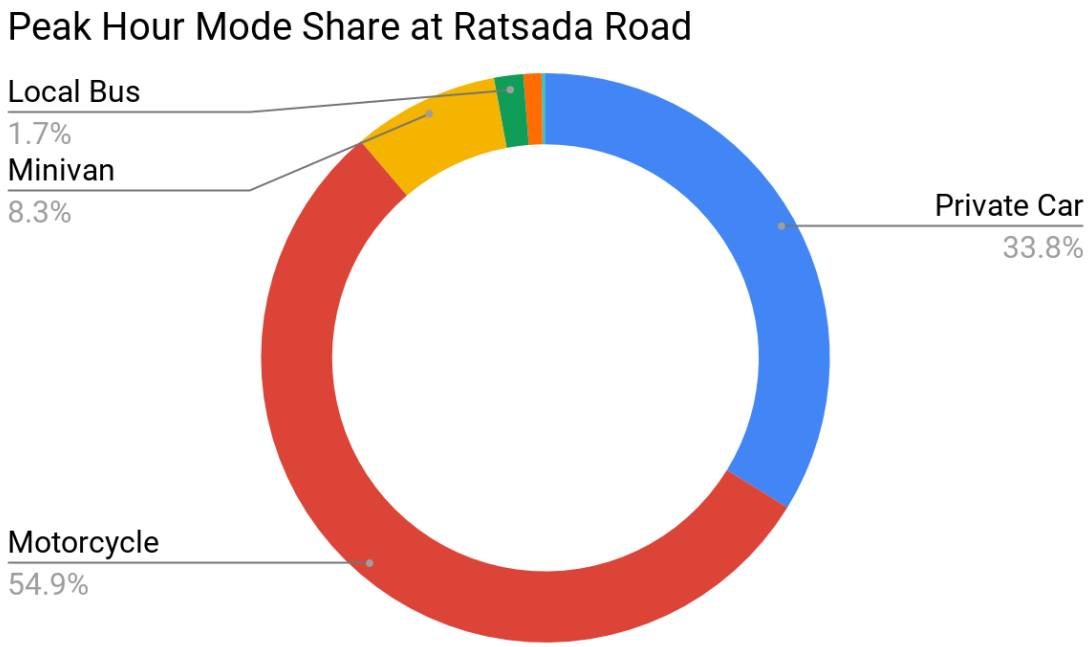
3.2 Current Conditions

3.2.3 Mode Share

Based on the traffic survey conducted during peak hour at few locations in Phuket, the proportion of the private vehicles is higher than public transport.

With 54.9% of the motorized trips are made with motorcycles for both locals and tourists, this shows that access to motorcycle is very easy. For tourists, the amount of motorcycle rent kiosks in tourist destinations make it very easy for them to rent motorcycles, even without the proof of valid driving license.

Mode share of regular bus service is very low, with only 1.7% of the total trips. This condition shows there is an urgent need to improve the quality of public transport service in Phuket.

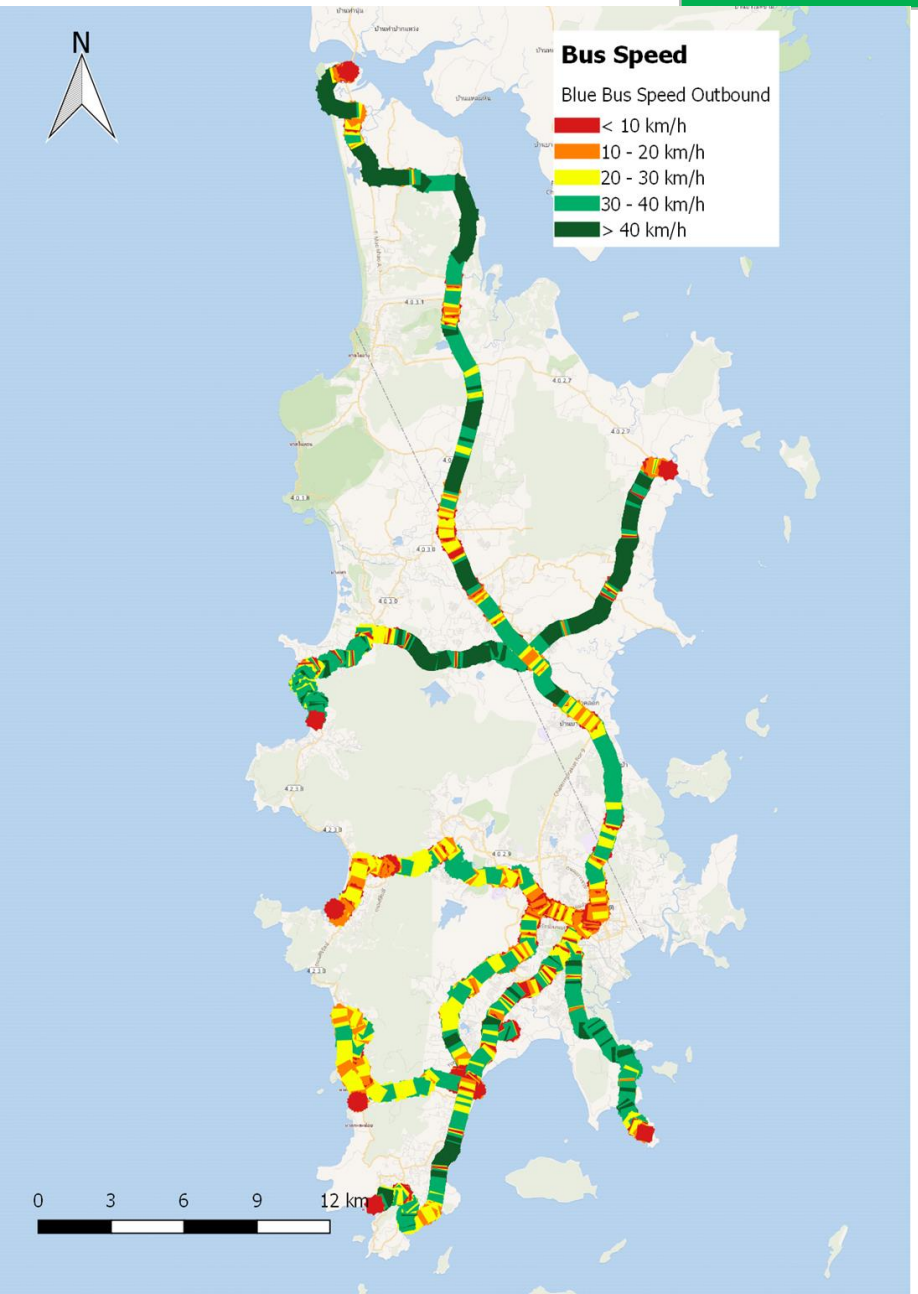


3.2 Current Conditions

3.2.4 Existing Ticketing System

- The typical payment for the Blue Bus is by cash, which collected by the bus conductor before the journey. If there is no conductor, the passenger has to pay the fare to the bus driver at their journey's end.
- The tariff can be varied 30, 40 and 50 THB. However, most of the bus did not displayed tariff information, which can be a baffle for the tourist
- There is no proof of payments or paper tickets and sometimes the bus driver calls for the tariff directly to the passenger, which indicates inconsistencies on the bus tariff.
- However, Pink Bus is the only service that issued a paper ticket for each passenger with a fixed tariff rate of 15 THB.
- The PKSB is the only bus service which requires a card to make a payment, although the passenger can use cash instead. However, it costs 170 THB for a single journey from and to any destination.
- Although the information says that the card can be purchased on the bus, yet many tourists are still confused and questioning on the whereabouts of purchasing the car. This is due to the lack of clear communication with the bus driver and the tourists are forced to buy the single trip ticket.

3.2 Current Conditions

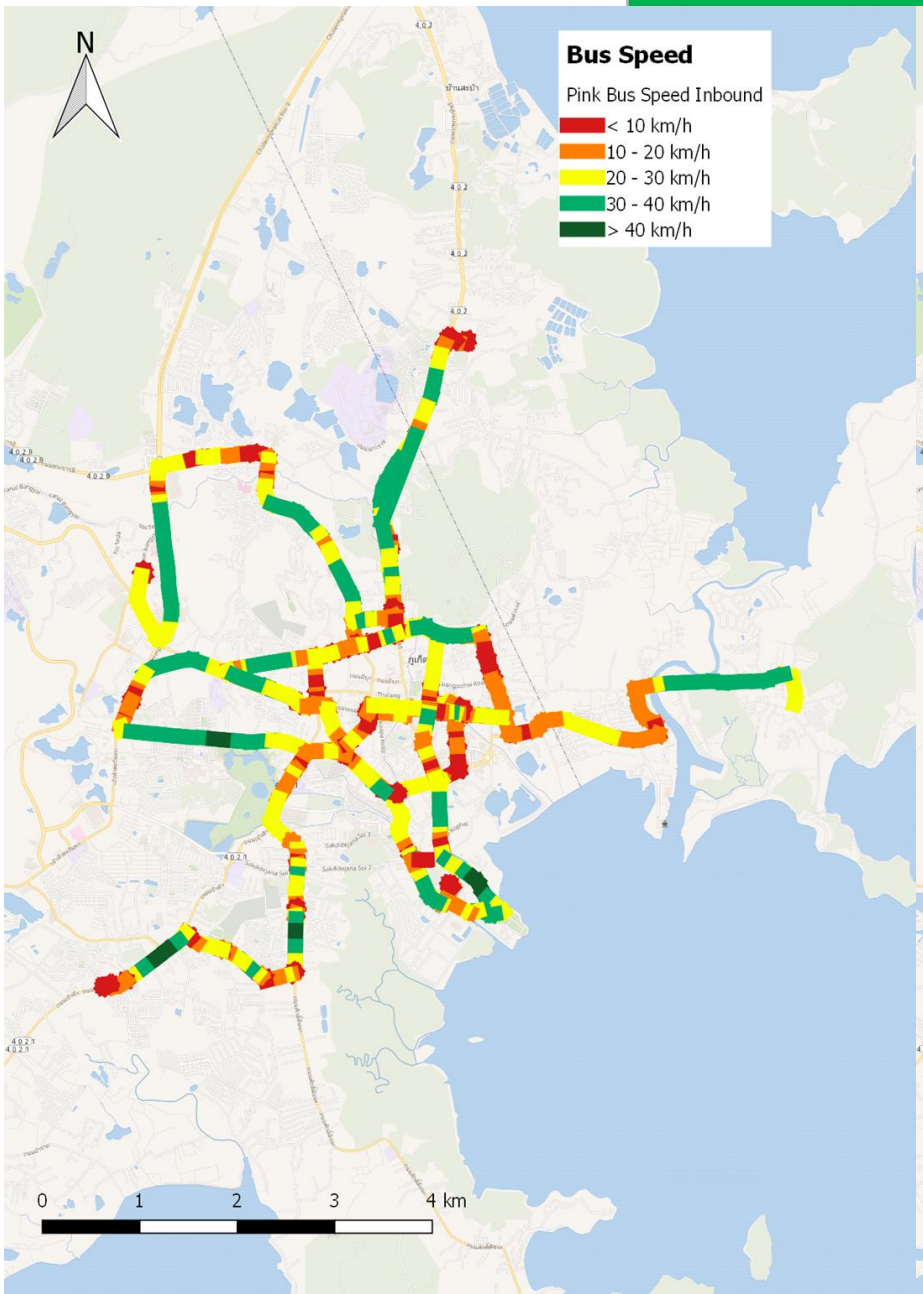


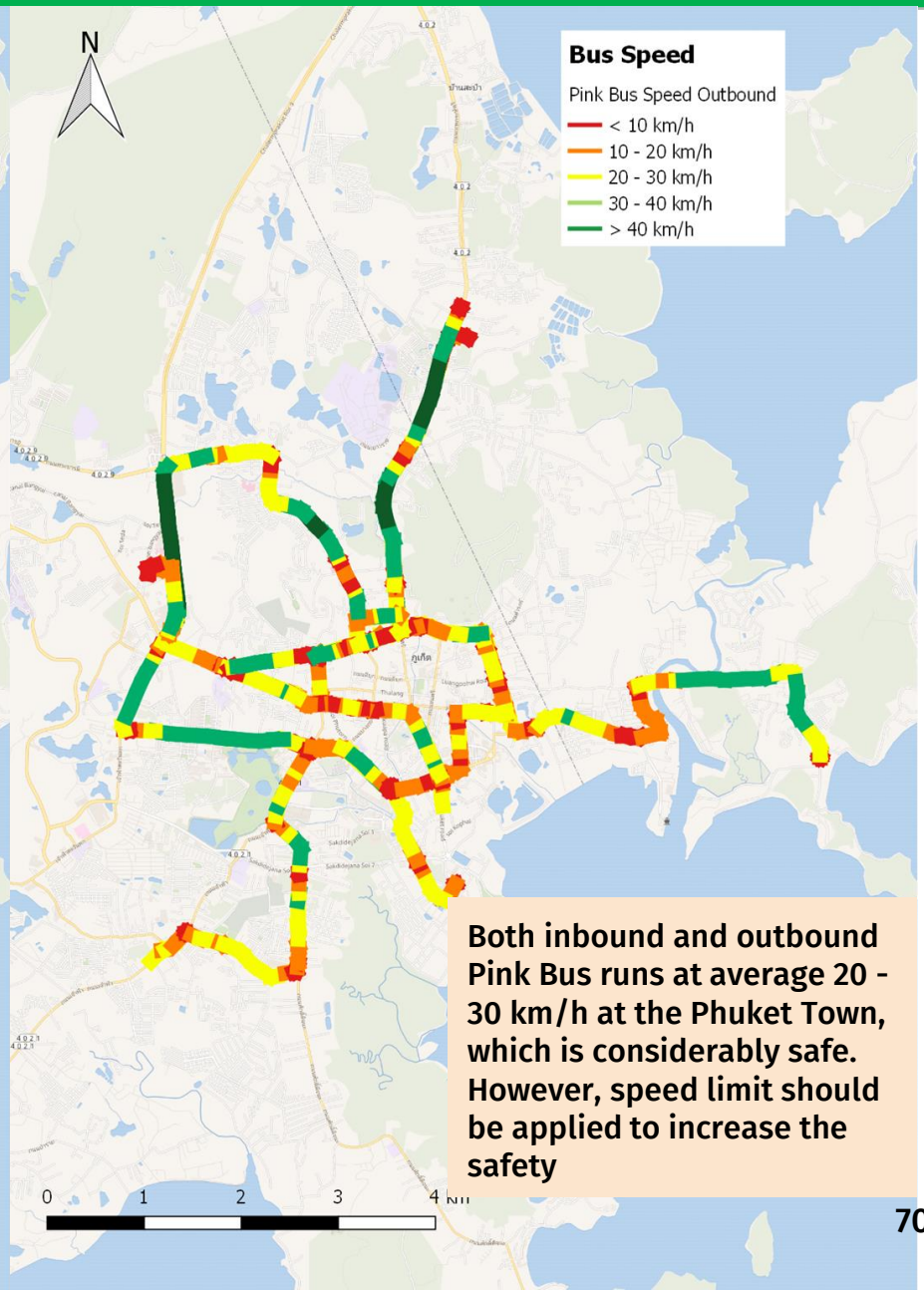
3.2.5 Existing Bus Speed

- For the local bus, particularly the Songthaew bus, which has speed more than 40 km/h and can be very dangerous for some passengers
- The figure below shows the example of bus fleet with no reliable safety system, which can caused an issue when the bus is speeding
- The speed limit policy should be applied to increase the safety

Route 1818 Phuket - Ao Makham

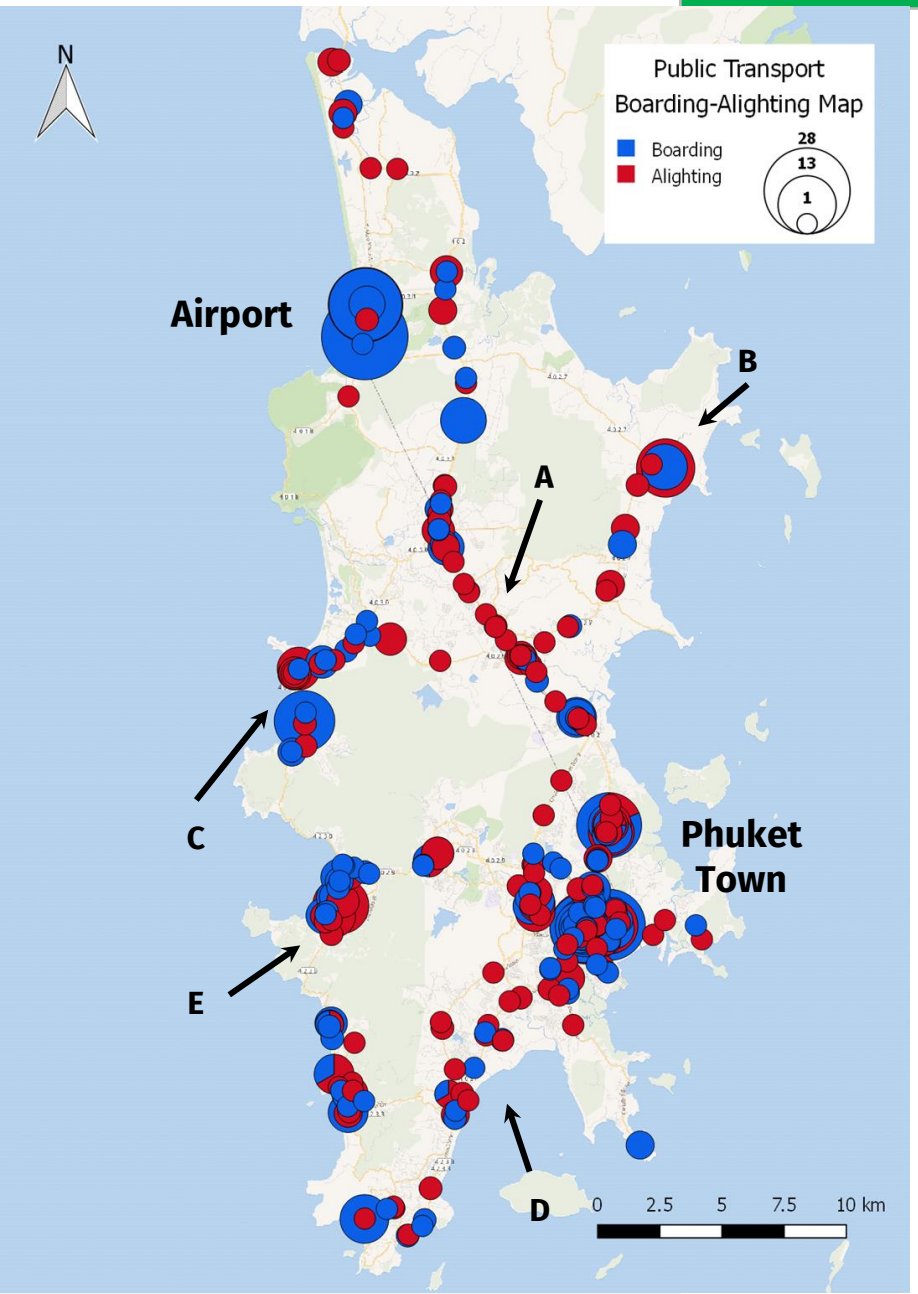
3.2 Current Conditions





Both inbound and outbound Pink Bus runs at average 20 - 30 km/h at the Phuket Town, which is considerably safe. However, speed limit should be applied to increase the safety

3.2 Current Conditions



3.2.6 Existing Boarding and Alighting

- A: High commercial area and dense residential area, many tourists and locals also makes a transit at Terminal 2
- B: Bang Rong Pier, one of the transit place for tourist to cross into another island, along the journey, most of the area are residential
- C: High demand for tourist and locals, most of the tourist alight at the halfway to access beaches at the north Kamala
- D: Transit place to access Chalong Pier, high demand area for tourist to cross into another island
- E: Patong Beach, second biggest tourist destination in Phuket

3.2 Current Conditions

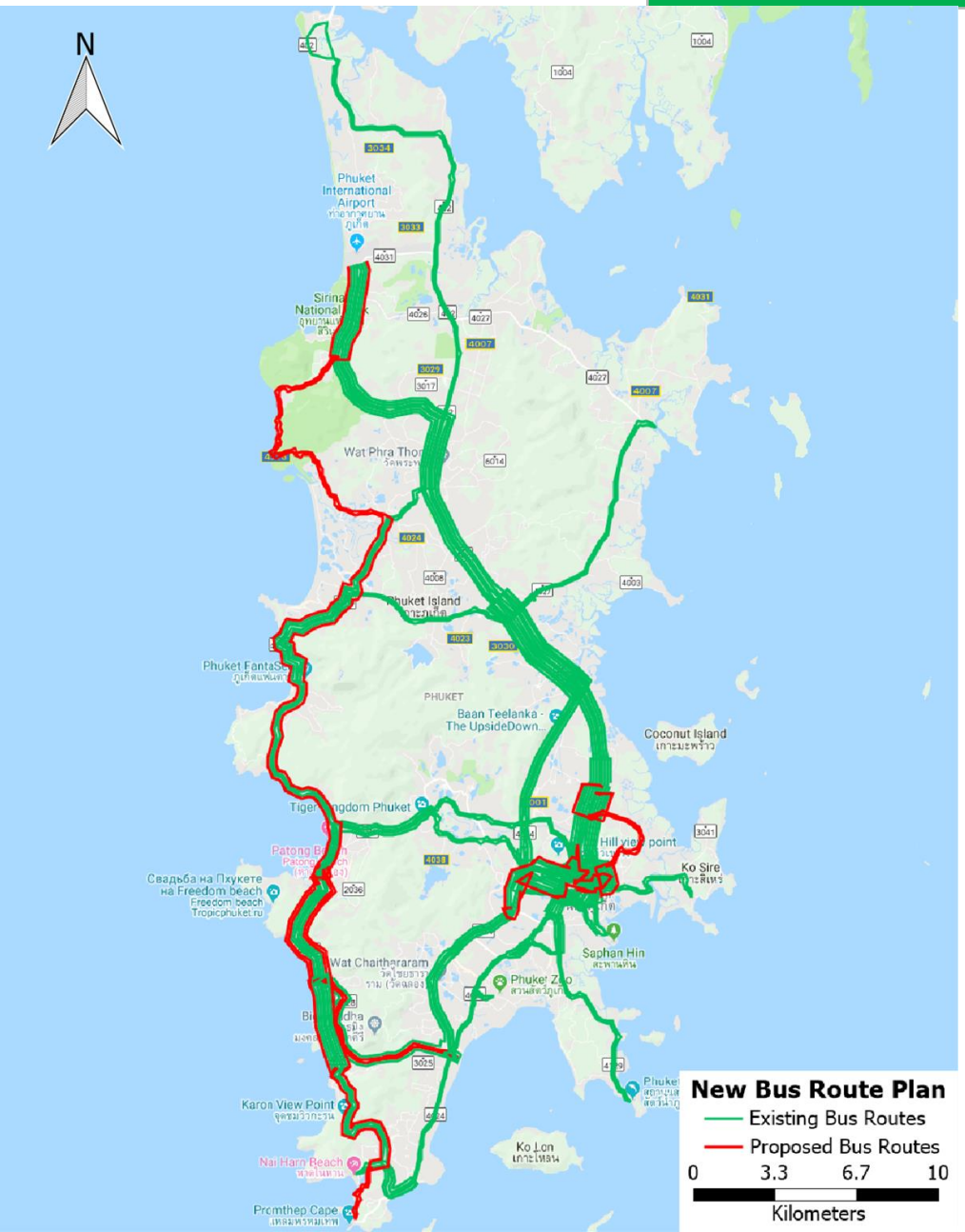
3.2.7 Existing Bus Coverage

- There are only 15 bus routes currently in operation in Phuket Island. Most routes connect cities between the east and west part of the island.
- Most routes run on arterial roads that go along North-South corridor. This corridor is quite active with passengers activity from commercial and residential area around the corridor.
- Most bus routes terminate in Phuket Town, either in Bus Terminal 1 or the central market. The tourist destinations along the west coast are only served by airport buses route P1 and P3.

3.3 Summary of Issues, Goals and Measures

Issues	Objective	Measures
1. Some areas are still not served by public transport. In general, one destination only has one public transport route. This lack of option makes some passengers taking additional transfer. Moreover, Patong as the second tourist attraction, has no reliable public transport option available to accommodate the tourist destinations.	Creates more direct public transport route which means more destination accessed by the public transport and increases its attractiveness.	Providing new bus routes to minimize transfer, especially from the west side of the island from the lack of public transport access.
2. All public transport in Phuket has low frequency in general whether is scheduled or not. Consequently, long waiting time for the passenger that can be more than 30 or 60 minutes	Enhances public transport service quality and create reliable public transport system.	Making adjustment on bus fleet and frequency in order to shorten waiting time and more frequent bus operations.
3. No proper bus stops infrastructure along bus routes, no shelter and no clear visibility which are unattractive for users of the public transport.	Increases the convenience of passengers and the safety for accessing public transport and waiting for the bus at the bus stop.	Improving bus stops to provide better infrastructure and bus information.
4. Poor condition of bus fleet, lack of convenience and production of polluted gas emission from the aging bus fleet.	Provides convenience and safety for passengers when using the bus and for having a cleaner public transport system.	Making provision for new bus fleet with a cleaner engine standard.

3.4 Level of Service Improvement



3.4.1 New Public Transport Routes Plan

On determining the new public transport route option, the following considerations are taken into account:

- Street Right-of-Way, the road alignment should be adequate to accommodate the bus movement
- Existing demand and attraction
- Impact on the area

Proposed new public transport routes:

1. Patong - Airport : to increase more destination area from the airport and to support airport public transport mobility
2. Patong - Promthep : to increase public transport route at the west coast of the island
3. Patong - Chalong Pier : to create more direct and support tourist mobility to another destinations
4. Terminal 2 - King Power : to increase Pink Bus coverage mobility in Phuket Town

3.4 Level of Service Improvement

New Blue Bus Route (Patong - Airport)

- Route 1812 **Phuket Town - Kamala**
- P1 and P3 are the only public transport routes that serve from Patong to Airport.
- It has low frequency, indirect route and lack of access, hence many people prefer to use taxi and minivan instead.
- The new additional route from Patong to Airport will give access to the new tourist attractions on the west coast and an access for the locals from Kamala to Patong.

A Section - The road width on proposed new route is adequate to accommodate bus operation

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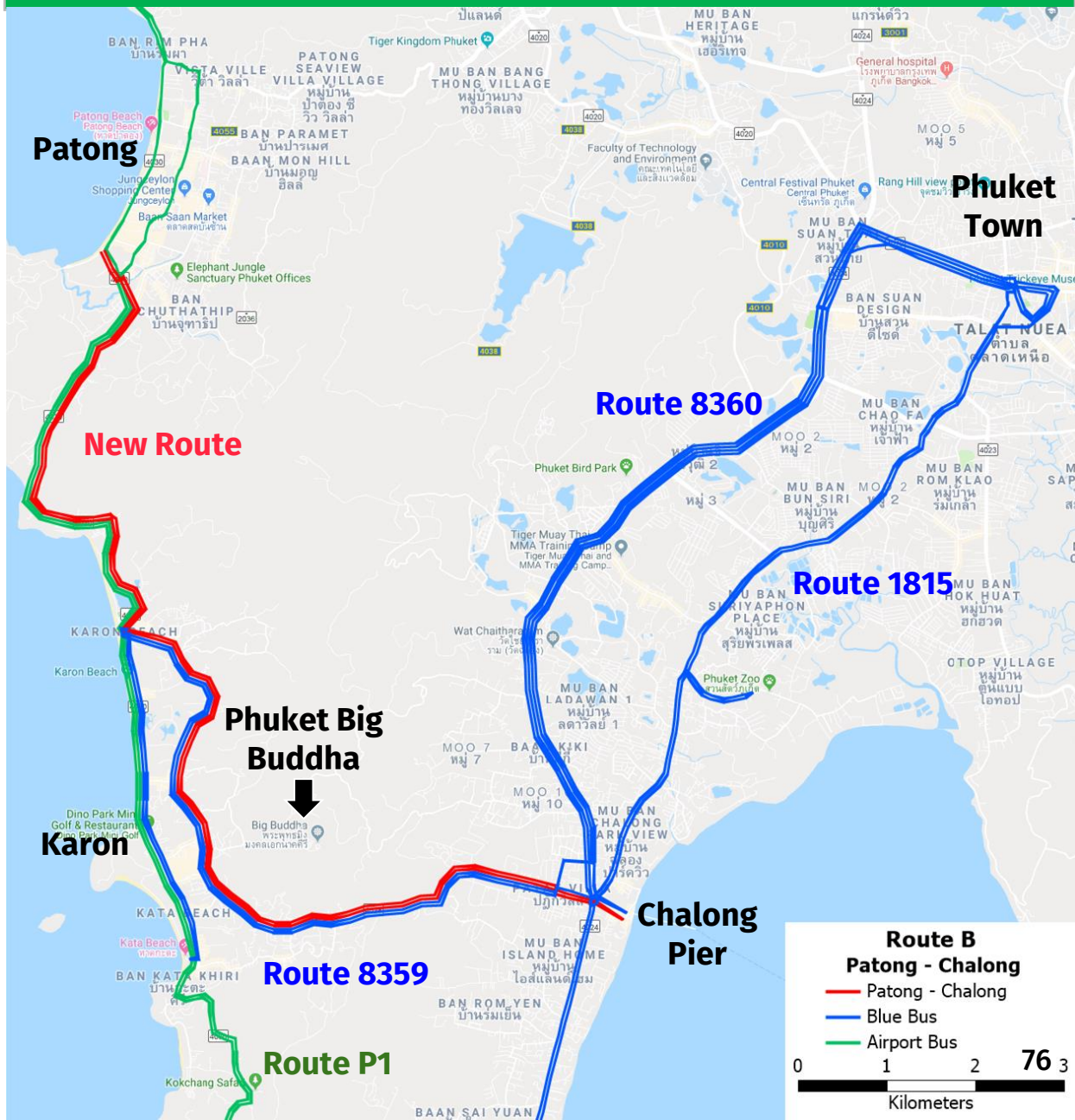
3.4 Level of Service Improvement

New Blue Bus Route (Patong - Chalong Pier)

- Route 8359 **Phuket Town - Karon**
- Route 8360 **Phuket Town - Chalong Pier**
- Route 115 **Phuket Town - Naiharn**
- No direct access from Patong to Chalong Pier, people needs to take a transit at Phuket Town and use route 8360
- Another routes to Chalong Pier are The 8359 and 1815 route, however, the passenger needs to walk additional 600m to chalong Pier
- No direct access from Patong to Karon except the P1 route
- The new route will gives access from Patong direct to Chalong Pier trough additional access for tourist destination such as Karon Beach and Phuket Big Buddha



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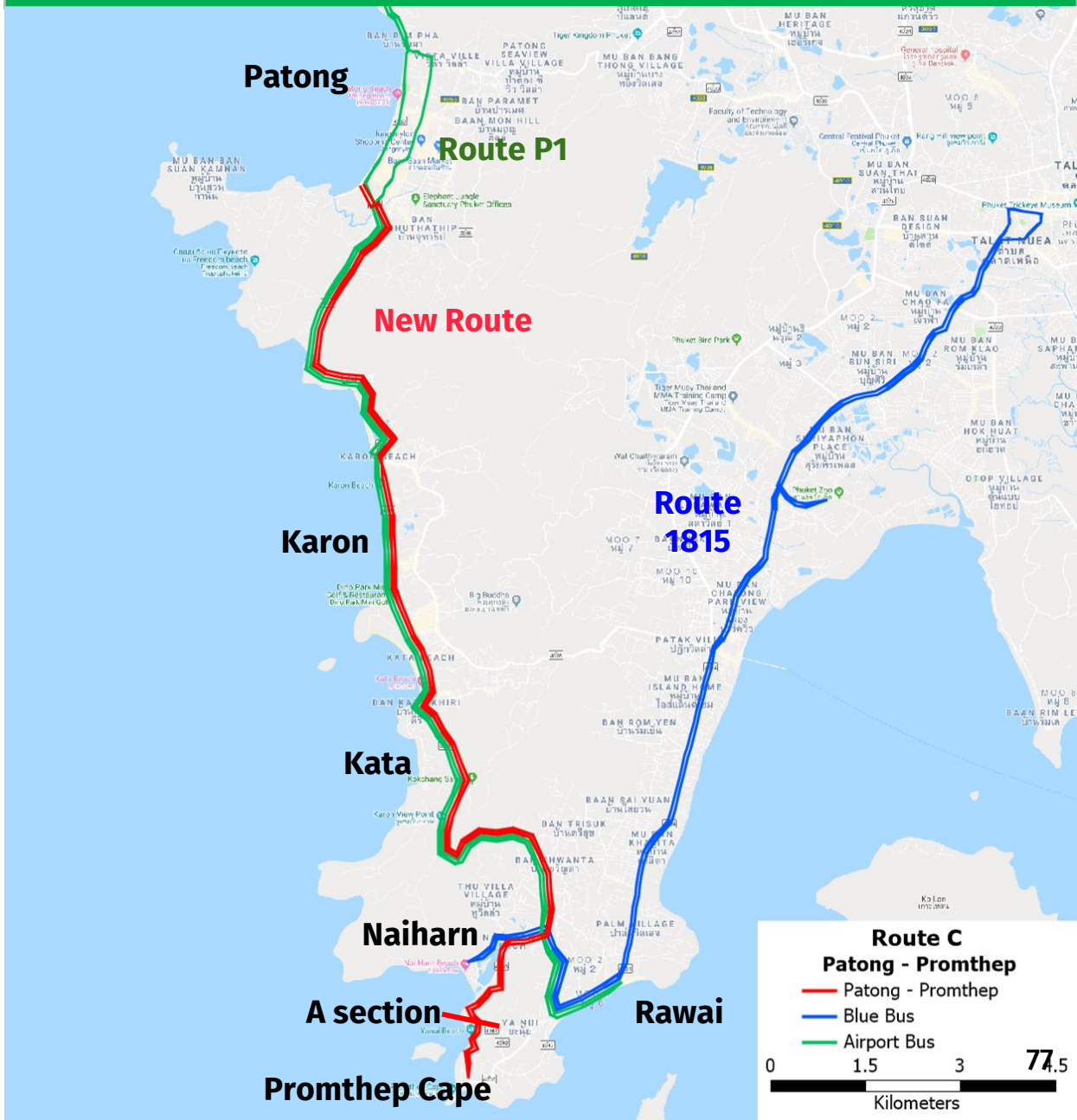
3.4 Level of Service Improvement

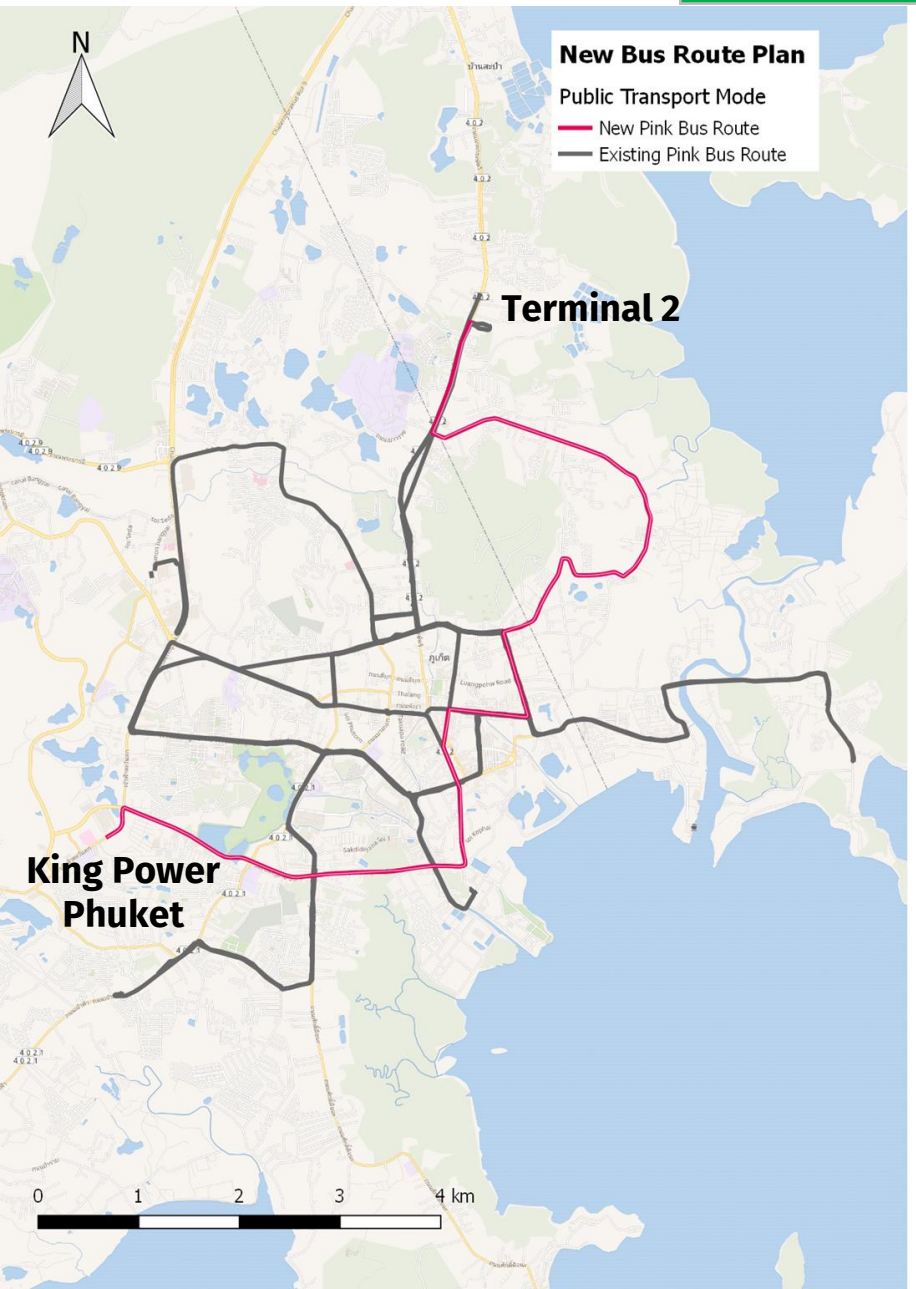
New Blue Bus Route (Patong - Promthep Cape)

- P1 route serves from airport to Rawai through Patong, Karon and Kata beach.
- Direct access to Naiharn beach is only served by route 1815, which can only be accessed from Phuket town.
- The new route gives direct access to Karon, Kata, Naiharn and end at Promthep Cape, which is one of the tourist attraction in Phuket.

A Section - The road width on proposed new route is adequate to accommodate thebus operation



3.4 Level of Service Improvement



New Pink Bus Route (Terminal 2 - King Power Phuket)

- The additional route for Pink Bus is suggested from Terminal 2 to King Power, which covers more greater area, residential and commercial destination
- The yellow lines indicates existing of Pink Bus route in the city center
- 2B is the only existing route that transfer from Terminal 2 into Terminal 1
- The new route gives additional direct access option, which can eliminate the number of transfer

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3.4 Level of Service Improvement

10 hour bus frequency per route

Bus Code	Time Period											
	7:30 - 8:30	8:30 - 9:30	9:30 - 10:30	10:30 - 11:30	11:30 - 12:30	12:30 - 13:30	13:30 - 14:30	14:30 - 15:30	15:30 - 16:30	16: 30 - 17:30	17:30 - 18:30	18:30 - 19:30
1811	4	1	4	3	1	4	2	3	4	2	n/a	n/a
1812	4	4	3	3	2	1	3	2	1	1	n/a	n/a
1813	1	1	1	1	0	0	0	1	0	0	n/a	n/a
1814	2	3	3	2	3	2	2	4	1	1	n/a	n/a
1815	2	4	3	2	3	1	1	3	2	3	n/a	n/a
1818	0	0	1	0	0	1	1	0	1	0	n/a	n/a
8359	1	2	2	3	3	4	1	1	3	4	n/a	n/a
8360	1	1	1	1	0	1	1	0	0	1	n/a	n/a
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1	4	2
2A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	5	0
2B	5	7	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	2	2	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

The table shows the 12 hour frequency for the Public Transport system in Phuket. The frequency of the Blue Bus are relatively low, only several routes that has high frequency (4 bus/hour), those are 1811, 1812, 1814, 1815 and 8359. Meanwhile other route, such as 1813, has inconsistent frequency and headway, which can be an issue for the users.

The n/a indicates no data are available at that time, because of the survey only has 2 hour periods rather than 10 hour periods.

3.4 Level of Service Improvement

10 hour bus occupancy per route

	Time Period											
Bus Code	7:30 - 8:30	8:30 - 9:30	9:30 - 10:30	10:30 - 11:30	11:30 - 12:30	12:30 - 13:30	13:30 - 14:30	14:30 - 15:30	15:30 - 16:30	16: 30 - 17:30	17:30 - 18:30	18:30 - 19:30
1811	19	4	24	13	9	23	16	7	12	13	n/a	n/a
1812	7	37	41	20	10	7	15	13	15	24	n/a	n/a
1813	0	0	0	12	0	0	0	4	0	0	n/a	n/a
1814	19	26	40	30	30	31	28	42	11	18	n/a	n/a
1815	1	27	11	13	11	10	9	15	11	8	n/a	n/a
1818	0	0	2	0	0	2	2	0	3	0	n/a	n/a
8359	7	10	7	13	14	42	10	15	15	51	n/a	n/a
8360	2	5	0	7	0	6	6	0	0	4	n/a	n/a
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	14	3
2A	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	12	26	0
2B	29	25	19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	4	1	3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

For the occupancy, route 1814 (Phuket - Patong) has total 275 passenger in 10 hour, which also become the highest among all routes. The route 1818 (Phuket - Ao Makham) become the lowest demand in the system, however, from the district population map, indicates that Ao Makham has population in range (1,500 - 2,000), this can suggest that there are still many private vehicle users.

The n/a indicates no data are available at that time, because of the survey only has 2 hour periods rather than 10 hour periods.

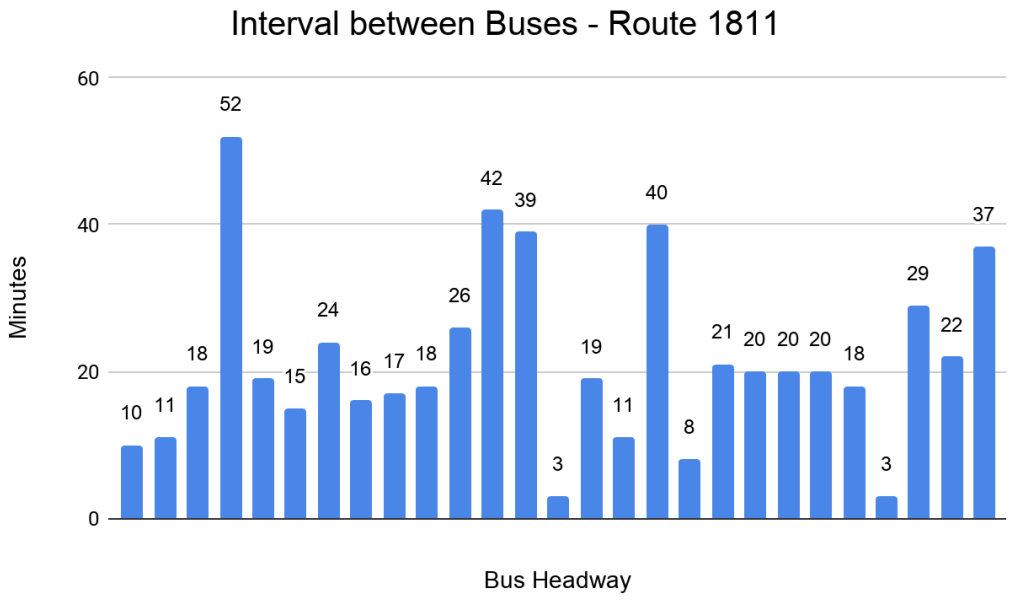
3.4 Level of Service Improvement

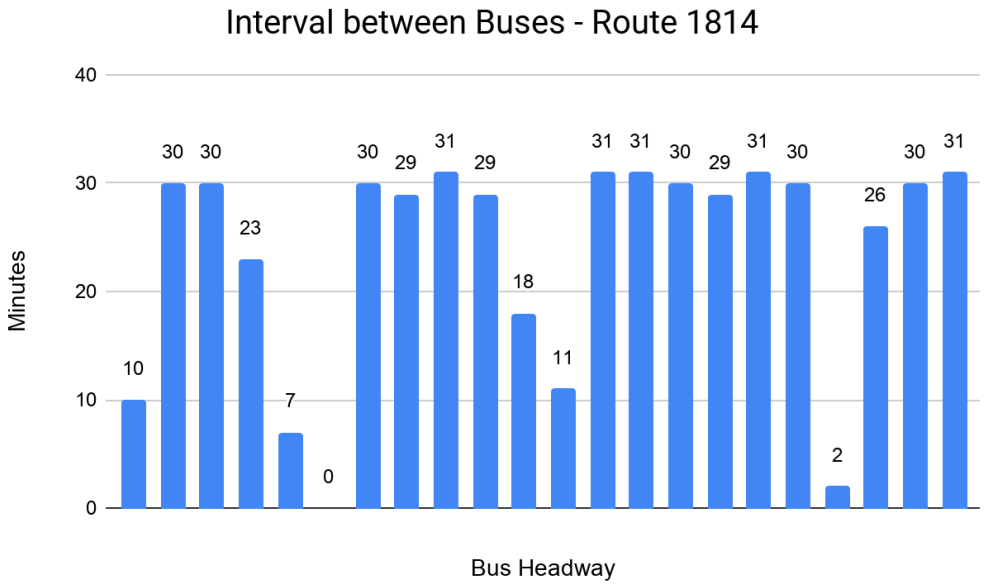
3.4.2 Bus Frequency Adjustment

- The following Figures show bus headway from route 1811, which is one of the bus route that has the highest frequency. The average bus headways are varied between 15-20 minutes.

- However, some of the headways can reach up to 40 and 52 minutes at maximum. This indicates some buses are waiting at the terminal to collect the passengers which create uncertain waiting time.

- In case of route 1814, the average waiting time can reach 30 minutes on average.





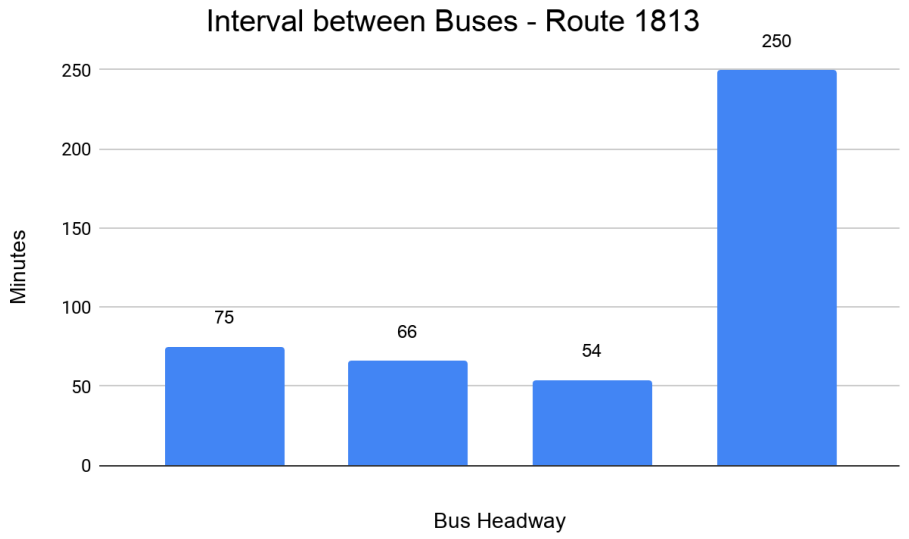
3.4 Level of Service Improvement

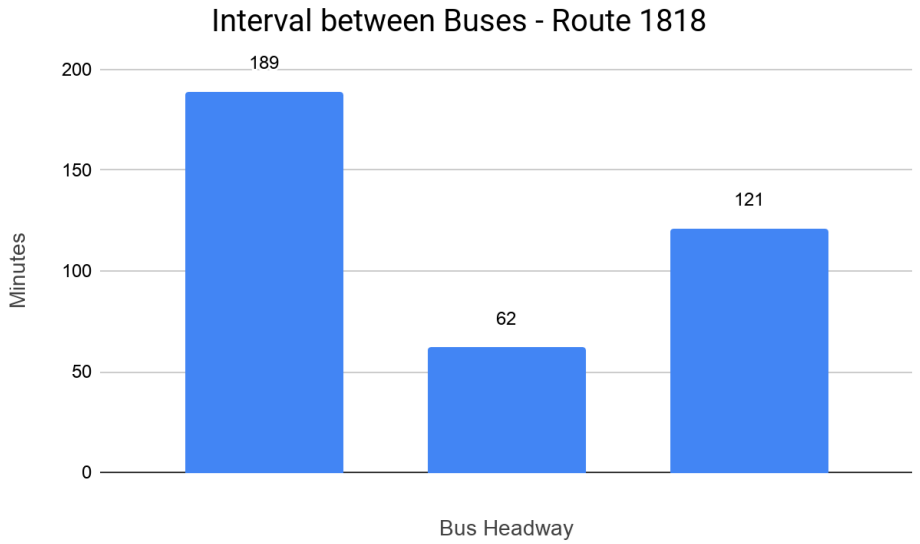
3.4.2 Bus Frequency Adjustment

- Route 1813 has a low demand and bus frequency. The local informed that the bus only serves five or four times a day. They even find it difficult to know the exact time schedule for the bus.

- Long waiting time forces tourists and locals to use taxi or private vehicle service to go back to Phuket town.

- While route 1818 has the lowest frequency compared to other routes, the headway can be more than one or two hours.





3.4 Level of Service Improvement

3.4.2 Bus Frequency Adjustment

- The higher bus frequency means shorter waiting time for the passenger
- The existing bus frequencies are too low and need to be raised to improve the convenience of the service
- The table shows existing bus frequency compared to new proposed bus frequency for the peak hour
- The new proposed bus frequency is also applied to the three newly proposed bus routes.

Route Code	Origin	Destination	Existing Max Frequency / hour	Proposed Peak Hour Frequency
1811	Phuket Town	Sarasin	4	6
1812	Phuket Town	Kamala	4	6
1813	Phuket Town	Bang Rong	1	6
1814	Phuket Town	Patong	4	6
1815	Phuket Town	Naiham	4	6
1818	Phuket Town	Ao Makham	1	6
8359	Phuket Town	Kaorn	4	6
8360	Phuket Town	Chalong	1	6
A	Patong	Airport	New route	6
B	Patong	Chalong	New route	6
C	Patong	Promthep	New route	6

3.4 Level of Service Improvement

3.4.2 Bus Frequency Adjustment

- Beside the Blue Bus, the adjustment of bus frequency is also given to the Pink Bus and Airport Bus.

Route Code	Origin	Destination	Existing Max Frequency / hour	Proposed Peak Hour Frequency
1	Big C	Vocational	4	6
2A	Super Cheap	Mummuang	5	6
2B	Terminal 1	Terminal 2	7	6
3	Stone Bridge	Koh Siray	2	6
4	Terminal 2	King Power	New route	6
P1	Airport	Rawai	1	6
P2	Airport	Terminal 1	1	6
P3	Airport	Kata	1	6

- At the peak hour, 10 minutes headway is recommended for all public transport route
- At the off peak hour, 15 minutes headway is recommended for all public transport route

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3.4 Level of Service Improvement

3.4 Level of Service Improvement

3.4.3 Fleet Requirement

Route Code	Journey Time (hr)	Proposed Peak Hour Frequency	Proposed Average Speed (kph)	Fleet Requirement
1811	2.00	6	25	25
1812	1.34	6	25	17
1813	1.26	6	25	16
1814	0.81	6	25	10
1815	1.02	6	25	13
1818	0.66	6	25	8
8359	1.17	6	25	14
8360	0.68	6	25	9
A	1.64	6	25	20
B	0.89	6	25	11
C	1.10	6	25	14
1	0.82	6	25	10
2A	0.76	6	25	10
2B	0.44	6	25	6
3	0.88	6	25	10
4	0.73	6	25	9
P1	2.43	6	25	30
P2	1.63	6	25	20
P3	2.21	6	25	27
			Total Fleet with 10% spare	307

3.4 Level of Service Improvement

3.4.4 Bus Stop Improvement
Existing Bus Stop Condition

- Typical bus stops in Phuket lack of comfort, convenience and accessibility. It only uses a simple small signage without any shelters, seats and lightings.
- At some places, many bus stops are not visible during the night or blocked with street utilities such as signs, electricity cables and trees
- There are no fixed bus stop can be seen around suburban or rural areas. Fixed bus stops are only available in the city.

Pink Bus Stop at Phuket Town


No bus stop available at rural area

The figure above shows no bus stops are available in the area and force the passengers to get off at the side of the road which is unsafe and inconvenient.

- The provisions of proper bus stops are necessary, especially in high boarding and alighting area.
- The bus stop location also needs to be assessed carefully which means less conflict for the road users and the traffic.

3.4 Level of Service Improvement

3.4.4 Bus Stop Improvement

- In general, the passenger can Hail and Ride the bus from any places, as long there is a possible place for bus to docking and not blocking the traffic on the street

- Meanwhile in the city, hail and ride buses can not be done at random. There are designated spaces privileged for any public transport to board and alight the passengers (on the yellow marking space or along the white yellow curb marking).

- Most of the tourists and locals prefer to wait the bus at the assigned stops. However, they still choose to get off on any safe section along the road.

Typical Bus stop at Phuket

3.4 Level of Service Improvement

3.4.4 Bus Stop Improvement

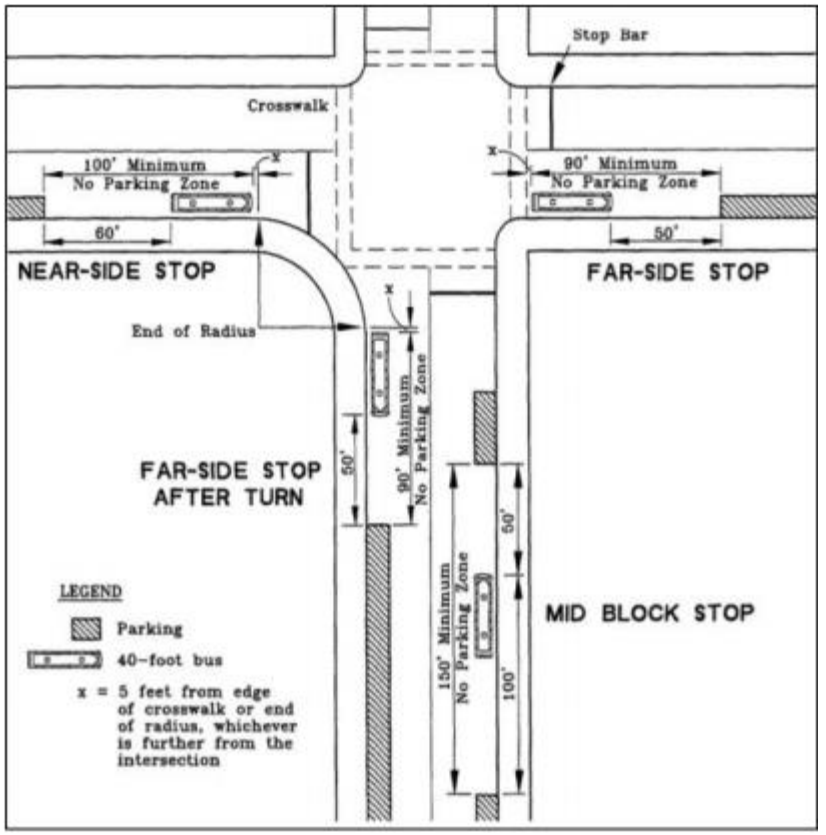
Bus stop recommendation

Bus Stop Location

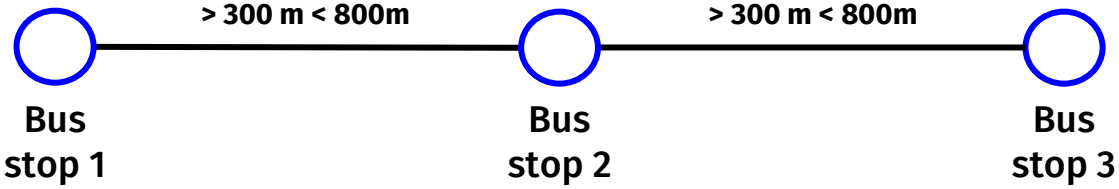
- Based on TCRP there are three recommended bus stop location (near-side, far-side and far-side stop after turn)
- The location should be adjusted based on the most safety and possible reasoning depend on city streets configuration

Bus Stop Distance

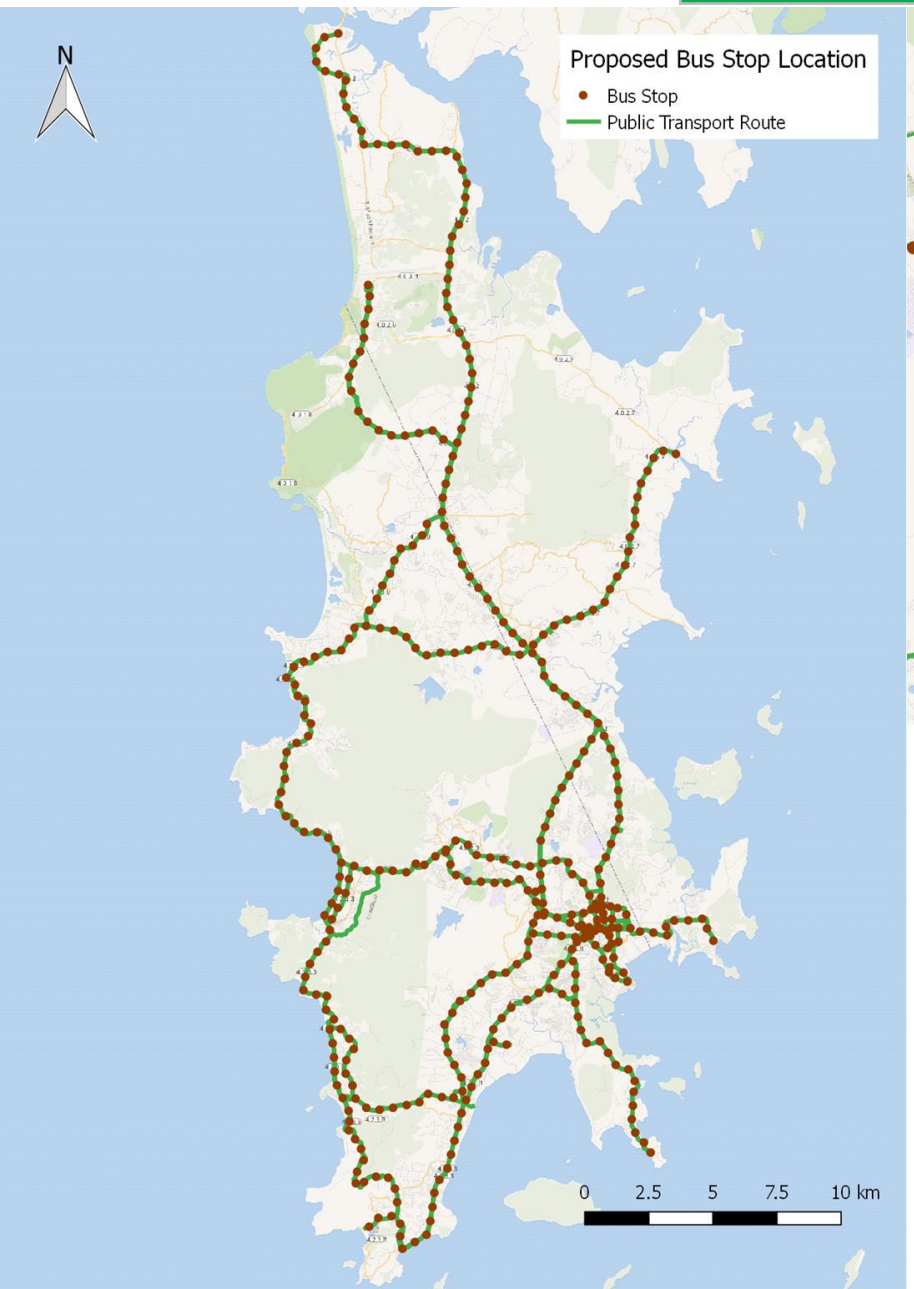
- In a dense land use area, the bus stop distance should be at range between 300m - 800m for the optimum distance
- Meanwhile for the low dense area can be placed at max

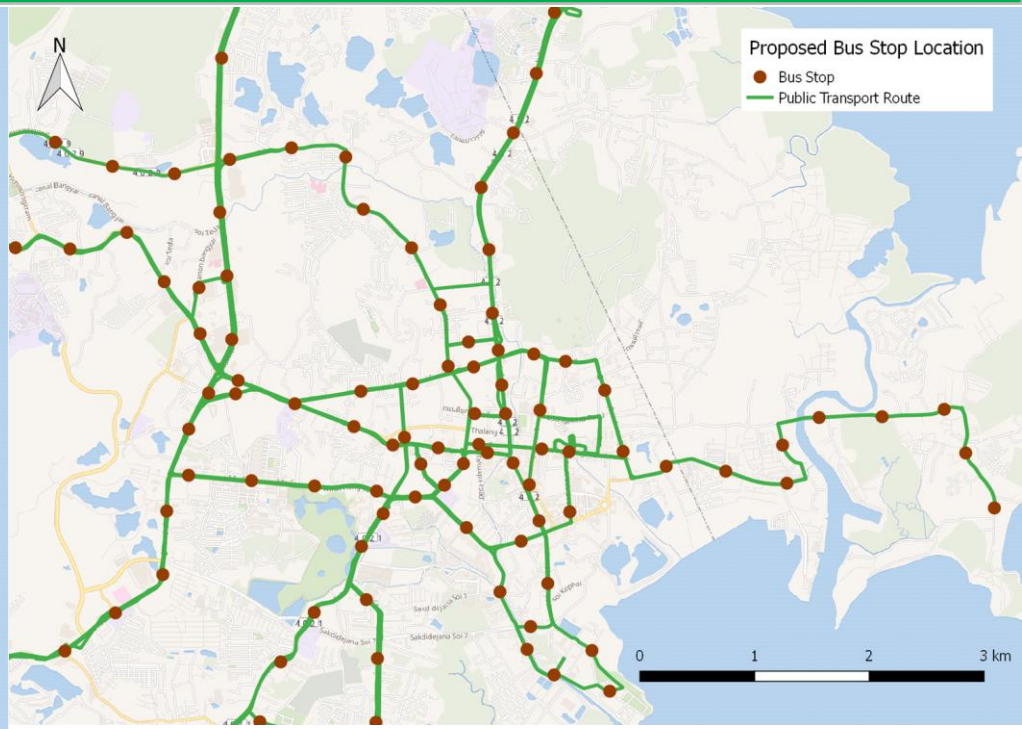


Source: TCRP Report 19 Guidelines for the Location and Design of Bus Stops



3.4 Level of Service Improvement





3.4.4 Bus Stop Improvement

The figures show the proposed bus stops location along the public transport routes. The bus stops were designed with 500 meter distance.

3.4 Level of Service Improvement

3.4.4 Bus Stop Improvement

Bus stop recommendation

London

London

London

Bus Stop Sign

- The bus stop sign should be clear from any obstacles and visible during day and night
- All bus stop sign should be equipped with designated code to ease the user find the right place and bus route

Shelters

- Bus shelters will provide convenience for the passengers who are waiting for the bus
- It should be designed weatherproof and clear for visibility and security.

Passenger Information System

- The information of route and time table should be provided at the bus stop
- The information can be a schedule holder or a display panel type as long as it is weatherproof and permanent.

3.4 Level of Service Improvement

3.4.4 Bus Stop Improvement

Bus stop recommendation

Kuala Lumpur

Amsterdam

Amsterdam

Benches

- Benches should be installed either under the shelter or places with shades.
- The placement of the benches should be far away from the roadside and at the back side of the sidewalk so not to disrupt pedestrian flow.

Lighting

- Lighting is an important element to increase safety and security especially during the night
- Lights should enhance the bus driver's vision and eliminate dark area around the bus stop.

Trash bin

- The presence of trash bin will help the people to prevent littering
- The trash bin should be weatherproof and placed in a proper place to minimize poor scent issue

3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement

The fleet condition of buses in Phuket are quite the same. The local bus or usually known as Photong is a modified diesel truck with an added side facing seat that can be filled up until 20 to 25 passengers at the peak hour. In addition, some of the buses are still use 10-seater capacity which is commonly used for low demand destination.

However, it has poor quality in general. It has no air conditioning system, uncomfortable seats which usually made from hard materials, traditional windows cover (only used when it rains) and not inclusive, which lack of safety access particularly for vulnerable group of passengers.

Blue Bus fleet condition

Non-universal access

3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement

The smart bus or PKSB (Phuket Smart Bus) is the only bus system that has proper quality conditions. The bus has modern facilities (air-con and wi-fi), e-ticketing system and live information system that can be accessed from mobile apps. Although the bus equipped with a GPS, the live information system from the website or app is still not reliable and accurate. The user still have to wait at the bus stops and hail to make the bus stop

Moreover, the bus only serves the west coast of the island, starts from airport to the beaches that usually become tourist destinations. The tariff is also two or three times more expensive compared to the local bus and there is no direct connection to Phuket town. Consequently, the passengers have to make a transfer with a local bus, which makes additional external cost.

Smart Bus at the Airport

Smart Bus fleet condition

3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement
Existing condition

Old Fleet Photong Bus

Emission types	Local Pollutants	GHG Pollutants
Carbon Monoxide (CO)	x	
Carbon Dioxide (CO_2)	x	x
Nitrogen Oxides (NOx)	x	x
Particle Matter (PM)	x	

Gases impact on GHG

Public Transports in Phuket are dominated by old diesel trucks that still produce high level of black soot.

Majority vehicles owners tend to keep from renewing their fleet from the old fleet chassis to the new ones because of the fact of rebuilding old bus is cheaper than investing in buying new buses.

The age limit policy of replacing the old fleet with more modern and fuel efficient fleet can be away of improving bus performance and efficiency and prevent the vehicle owners to renew their buses

The table shows the tailpipe transportation emissions from Heavy-Duty vehicles, some of the gases such as CO2 and NOx are accounts to global greenhouse gases. *Source: Exhaust Emissions of Transit Buses, Embarq 2012*

Moreover, the vision of having cleaner bus fleet has already become a major focus in Thailand, such as Bangkok. The city Mass Transit Authority has planned to eliminate all non-aircon buses off the road by 2022 and replace them with Natural gas and hybrid diesel vehicles.

To achieve cleaner air quality and greener sustainable transport system, the implementation of soot free technologies in new bus fleet is recommended

For long term, the soot free buses provide a lot of health benefit impacts for city residents as similar to eliminate the black carbon emissions and reduce the GHG emission.

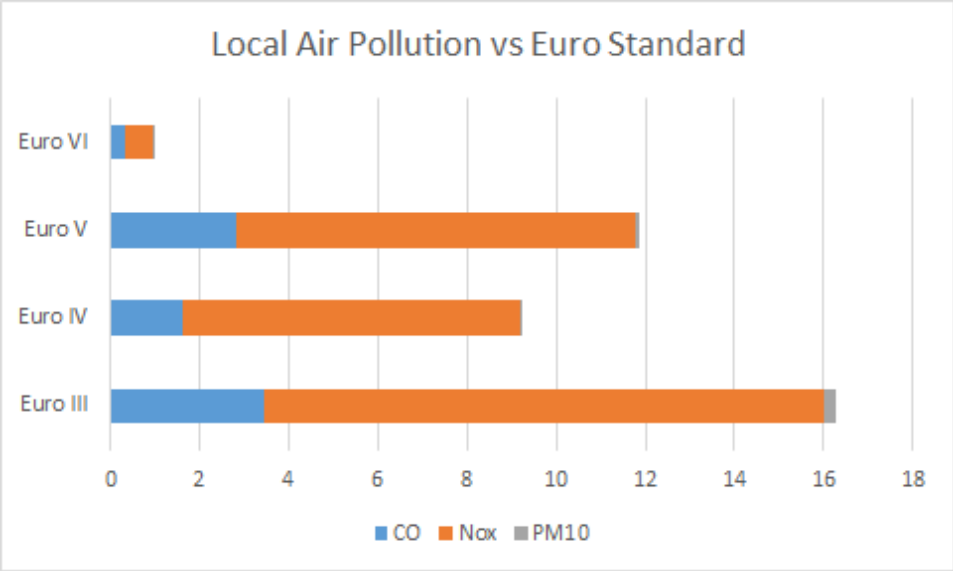
3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement
Fleet modernization

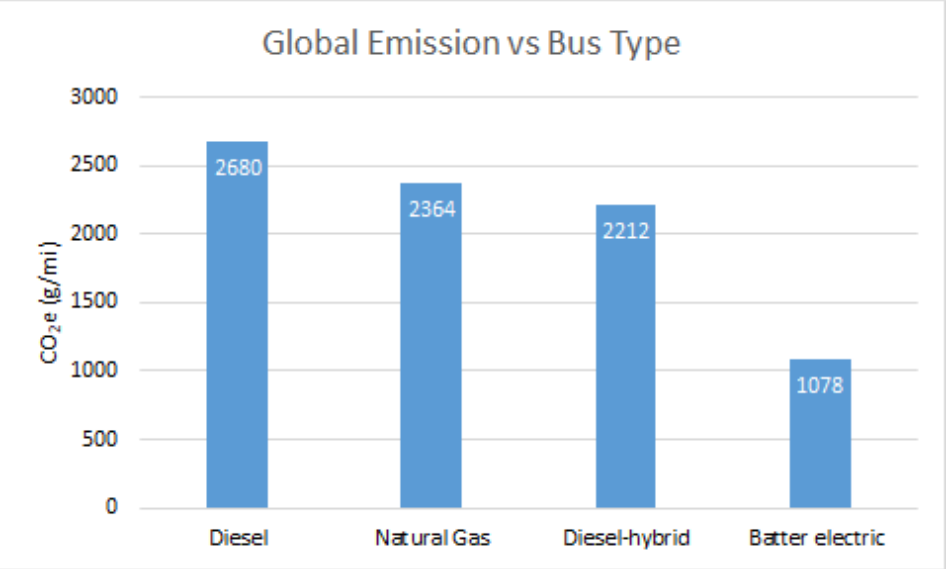
The provision for gas and electric buses are far better compared with diesel engine on the local air pollution matter. However, the gas and electricity infrastructure supply can be quite challenging for Phuket.

Therefore, the option by replacing current fleet with engines that meets the EURO VI emission standard can be a starting point to achieve low emission buses in the future

Source:
Andrew C, 2017, CASANZ TSIG and TEKH-EG Workshop
Jimmy O, 2018, Union of Concerned Scientists



Local air pollution comparison based on the Euro standard



Global emission comparison based on the bus type technology

3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement

Fleet modernization

Bus Route	Fleet Estimate	Current Fleet Type	Proposed Fleet Type	Estimate annual VKT (km/year)	CO reduction	NOx reduction	PM reduction	CO2 reduction
1811	25	EURO II Diesel	9-m EURO 6 Diesel	1,646,150	7.41	19.56	0.41	202
1812	17	EURO II Diesel	9-m EURO 6 Diesel	1,061,055	4.77	12.61	0.27	131
1813	16	EURO II Diesel	9-m EURO 6 Diesel	932,064	4.19	11.07	0.23	115
1814	10	EURO II Diesel	9-m EURO 6 Diesel	554,800	2.50	6.59	0.14	68
1815	13	EURO II Diesel	9-m EURO 6 Diesel	781,976	3.52	9.29	0.20	96
1818	8	EURO II Diesel	9-m EURO 6 Diesel	466,032	2.10	5.54	0.12	57
8359	14	EURO II Diesel	9-m EURO 6 Diesel	863,846	3.89	10.26	0.22	106
8360	9	EURO II Diesel	9-m EURO 6 Diesel	516,731	2.33	6.14	0.13	64
A	20	EURO II Diesel	9-m EURO 6 Diesel	1,051,200	4.73	12.49	0.26	129
B	11	EURO II Diesel	9-m EURO 6 Diesel	486,217	2.19	5.78	0.12	60
C	14	EURO II Diesel	9-m EURO 6 Diesel	689,850	3.10	8.20	0.17	85
1	10	EURO II Diesel	9-m EURO 6 Diesel	565,750	2.55	6.72	0.14	70
2A	10	EURO II Diesel	9-m EURO 6 Diesel	566,115	2.55	6.73	0.14	70
2B	6	EURO II Diesel	9-m EURO 6 Diesel	330,143	1.49	3.92	0.08	41
3	10	EURO II Diesel	9-m EURO 6 Diesel	551,698	2.48	6.55	0.14	68
4	9	EURO II Diesel	9-m EURO 6 Diesel	387,302	1.74	4.60	0.10	48
P1	20	EURO II Diesel	9-m EURO 6 Diesel	1,222,020	5.50	14.52	0.31	150
P2	14	EURO II Diesel	9-m EURO 6 Diesel	914,690	4.12	10.87	0.23	113
P3	18	EURO II Diesel	9-m EURO 6 Diesel	989,639	4.45	11.76	0.25	122
			Total emissions reduction (ton/year)		65.60	173.18	3.67	1,793

3.4 Level of Service Improvement

3.4.5 Bus Fleet Improvement

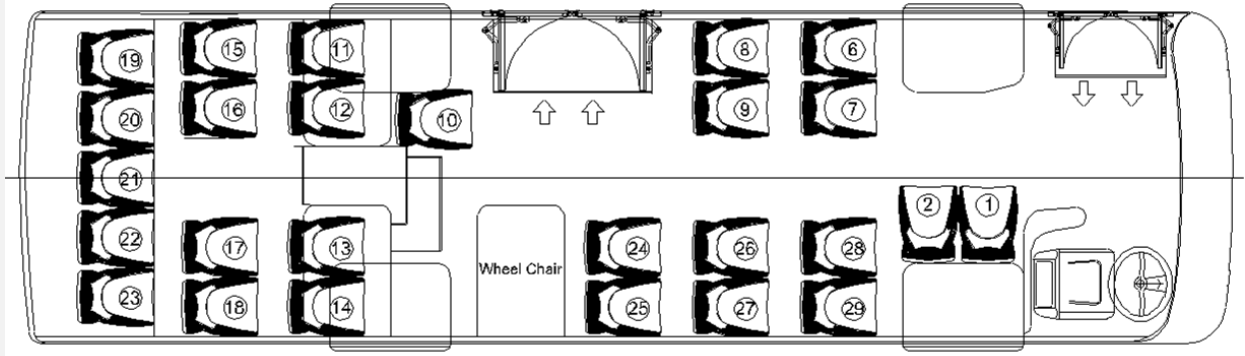
Fleet Recommendation

To increase the passenger comfort, upgrading bus fleet to the modern type is recommended

- Replacement to 7.7 m or 9 m bus is suitable for typical road alignment in Phuket (2.4 m to 2.5 m width)
- It carries more passenger capacity (40 - 48 passenger)
- The front facing seat configuration is suggested because dense and face-to-face seats is not compelling
- Quieter engine also can reduce noise pollution, which is more convenience for the journey

7.7 m Electric Bus from Mudan Auto, China

Face-to-face seat configuration



Example of Front Facing Bus Seat Configuration

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3.5 Summary of Improvement

Improvement	Proposed Plan	Notes
1. New public transport plan	• Patong - Airport • Patong - Chalong Pier • Patong - Promthep Cape • Terminal 2 - King Power	Route improvement to cover new destination area, more direct route, and less transfers
2. Bus frequency	• All public transport route frequency were increased	Bus frequency is adjusted to decrease waiting time, more consistent headway and reliable schedule time
3. Bus fleet requirement	• New public transport fleet requirement to accommodate proposed bus frequency	The bus fleet is also adjusted to have more reliable service system with the new proposed bus frequency
4. Bus stop improvement	• Improved bus shelter with proposed location and distance	Bus stop improvement to enhance passenger convenient and safety while boarding and alighting the public transport
5. Bus fleet improvement	• New proposed modern bus, with 9 meter dimension • New proposed diesel engine standard	Bus fleet improvement to enhance passenger convenient and safety while commuting and also to achieve cleaner bus emission

3.5 Costing

3.5.1 Bus Stop Requirement Cost Estimation

Bus Stops Requirement	Total cost for bus shelter ($)	Total cost for bus pole ($)	Total cost ($)
770	435,555	29,276	464,831

Based on the analysis there were total of 770 bus stops are needed to accomodate all the bus routes with 500 meter distance between the bus stop. The shelter type bus stop will used for the inbound direction as many 389 bus shelters. Meanwhile for the outbound direction will used ordinary bus pole as many 381 bus poles, with the assumption, there will be no passenger waiting at the bus stop after they alight from the bus.

Moreover, the pink bus will be used bus shelter type for both direction (inbound and outbound) because is located at the city center or high-density area, which mean always needs a proper bus stop along side the corridor.

3.6 Costing

3.6.2 New Bus Fleet
Cost Estimation

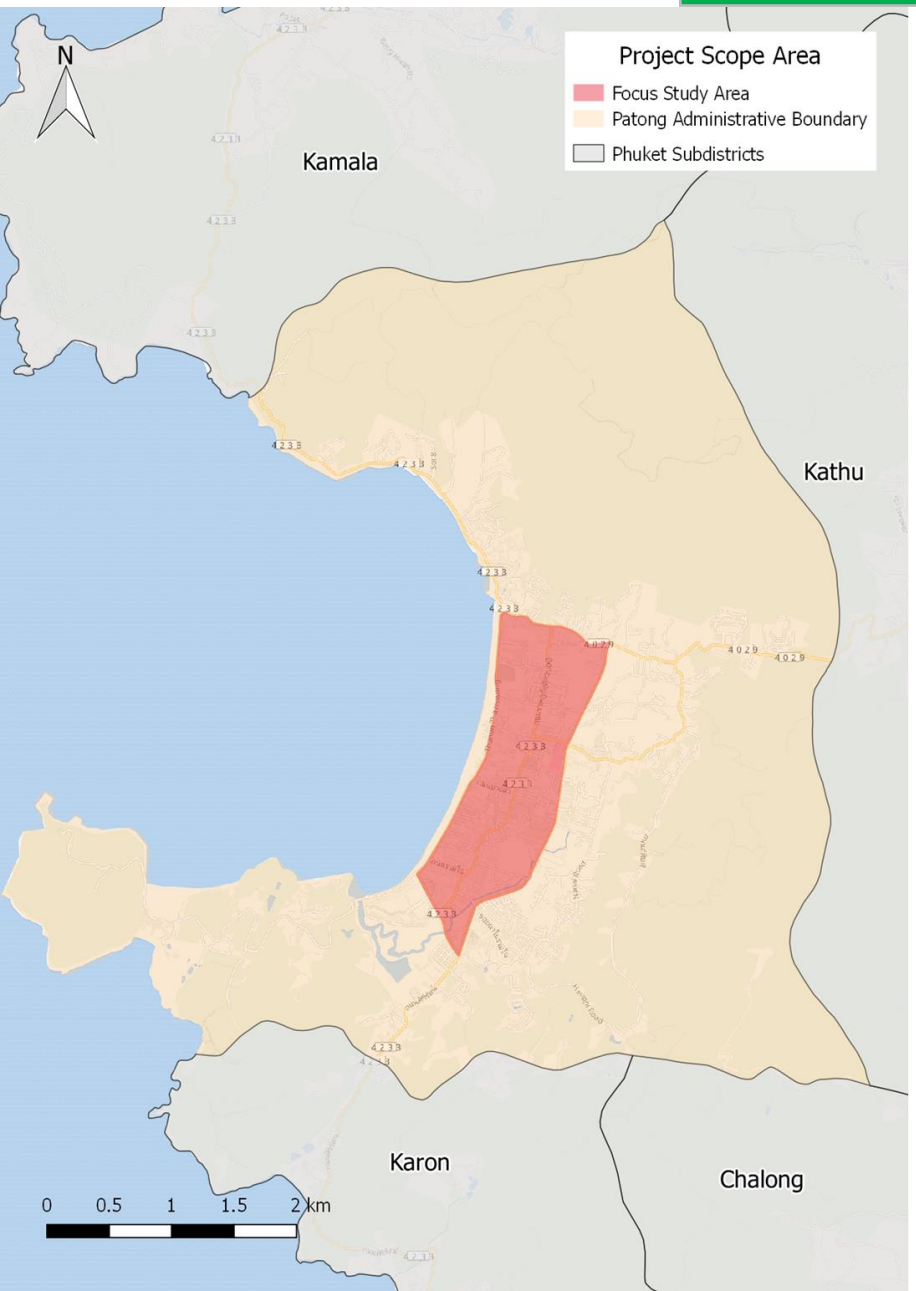
Route Code	Proposed Bus Fleet	Bus Fleet Requirement	Price per Unit (USD)	Estimated Price (USD)
1811	9 meter std bus	25	25,000	625,000
1812	9 meter std bus	17	25,000	425,000
1813	9 meter std bus	16	25,000	400,000
1814	9 meter std bus	10	25,000	250,000
1815	9 meter std bus	13	25,000	325,000
1818	9 meter std bus	8	25,000	200,000
8359	9 meter std bus	14	25,000	350,000
8360	9 meter std bus	9	25,000	225,000
A	9 meter std bus	20	25,000	500,000
B	9 meter std bus	11	25,000	275,000
C	9 meter std bus	14	25,000	350,000
1	9 meter std bus	10	25,000	250,000
2A	9 meter std bus	10	25,000	250,000
2B	9 meter std bus	6	25,000	150,000
3	9 meter std bus	10	25,000	250,000
4	9 meter std bus	9	25,000	225,000
P1	9 meter std bus	30	25,000	750,000
P2	9 meter std bus	20	25,000	500,000
P3	9 meter std bus	27	25,000	675,000
Spare	9 meter std bus	28	25,000	700,000
			Estimate Cost for New Bus Fleet	**7,675,000**

4. Patong

ITDP Institute for Transportation & Development Policy

Outline

4.1 Overview



Patong is the most popular beach resort in Phuket, located in the west coast of Phuket. It is known to be the busiest 2.5 km of coastline with hundreds of attractions. The nightlife is centered around Bangla Road, which becomes a pedestrian-only street from 6 pm to 4 am every day.

As a tourist destination, the economy in Patong is driven by tourist industries such as hotels, restaurants, shops and other services. Therefore to increase the visitors, the government plans to improve the facilities provided for tourists.

However, the city government understands that good and livable environment as one of the assets of Patong. Therefore, in order to preserve the environment, those improvements should be made toward sustainable developments.

Getting support from the national government, Patong aims to be not only the greenest tourist destination which will be implemented toward environment friendly development but also as a MICE (Meetings, Incentives, Conventions, and Exhibitions) city. The government believes that in becoming a MICE city, it will increase visitors and economic performance, because contrary to meeting and event that have no special season, tourists are constant throughout the year. Having this will increase the economy of Patong.

4.2 Context

4.2.1 Patong as MICE and Green City

Thailand National Government and the City of Patong Government have defined a ten-year development plan for Patong. Other than becoming a MICE special district, Patong Government also has a vision to make Patong as an innovative, green, and walkable city in ten years time, with a positive impact towards the environment.

From Patong Charter MICE and Greenest City workshop held on April 5th 2019 by Patong city government, in order to achieve these goals, the government has defined these following focus developments:

1. Patong as a MICE City
2. Development of green infrastructure
3. Development of green economy
4. Provision of public parks and green spaces
5. Provision of green transportation
6. Development of housing and real estates
7. Patong urban revitalisation

On the transportation sector, the government focuses to improve the current conditions of mobility which is highly dependent on private vehicle usage such as motorcycles and minivans. The government has identified that public transport services and pedestrian facilities are still limited in Patong.. Therefore the improvement aims to improve facilities for walking, cycling and public transport which are more sustainable mode of transport for Patong.

Opening speech from the Mayor for Patong MICE and Green City Workshop

4.2 Context

To shift the mobility into more sustainable mobility, from the workshop, the transportation division developed plans for improvement as follows:

- Focus of improvements will be done at Thawewong Road and Ratuthit Songroipi Road
- Give priority for pedestrians by improving walkways quality and facilities
- Provide bicycle lanes
- Provide good quality public transport with frequent service
- Build collaboration and cooperation with local taxis

Group discussion to improve public transport during the workshop

With those proposed improvements, the government aims to create Patong as a nice walking and cycling area for tourists, and reduce the private vehicle usage by providing new service of public transport system in Patong.

4.2.2 Goal of the Report

This report will provide guidance and detailed plans to improve walking and cycling facilities in creating Patong as walkable city. The walkways in Patong would be universally accessible and connected.

To reduce high dependency on private vehicles such as motorcycle and taxi, guidance on series of measures to provide good and reliable public transport and managing parking will be analysed in this report. Therefore the mobility in Patong will be mainly walking, cycling and using public transport.

This report could support the ten-year plan from the government as it shares the same goals and objectives.

4.3 Project Scope Area

The focus area of this study is located at the two closest main roads to the beachfront area, Thawewong Road and Ratuthit Songroipi Road, and the small road connections between those roads. The third closest main road to the beach, Phangmueang Soi Kar Road, is allocated for through-traffic, where vehicles that pass Patong without going to the city center should take this road.

Thawewong Road, Ratuthit Songroipi Road, and the surrounding areas are the main roads in Patong which pass through many tourist destinations, such as hotels, restaurants, and shopping centers. These roads have high pedestrian and traffic volume. Phangmueang Soi Kar Road has wider road space and less tourist activities, and connects the city center with other places outside Patong.

Given the touristic importance of Patong, it is necessary to have a more walking-friendly city as Patong is best explored by walking. It is also important to make destinations in Patong more accessible by improving connectivity and public transport service. Therefore, walking-friendly streets and reliable public transport service should be implemented in transforming Patong to become more attractive, accessible, and walkable city.

4.4 Non-Motorized Transport (NMT)

4.4.1 NMT Overview and Current Situation

With relatively short walking distance from the beachfront, most visitors explore Patong by walking. However, motorcycles and cars still occupy most of the road spaces, making it unpleasant for people to walk.

Non-motorized transport facilities for pedestrians and cyclists in Patong should be improved to create better walking environment, especially for tourists. Pedestrians and cyclists should get more priority, which means providing bigger space on the road, so it will be safer and more comfortable for them to explore Patong.

Despite those three main roads in Patong, the priority of improvements should be implemented throughout all of the roads including secondary roads, small alleys and pedestrian only roads to create good road network which gives priority to pedestrians and cyclists. Therefore, adequate walkways and cycling facilities should also be provided in all roads across the city.

Most of the road space occupied by motor vehicles, leaving no space for pedestrian

Best practice at Bangla walking street while closed for traffic

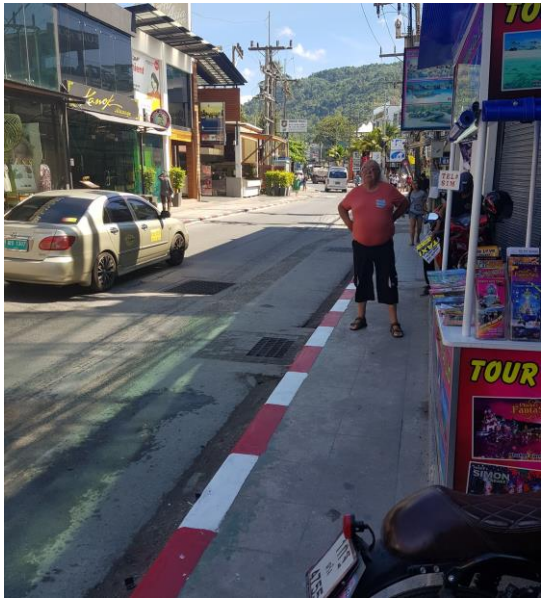
4.4.2 Current NMT Issues

Sidewalk Facilities

With many people visiting Patong as tourist destination, Patong is expected to be walkable. However, Patong is still lacking of good pedestrian facility, such as sidewalk and crossing, making walking unpleasant and often dangerous on some roads.

No sidewalk at main road

Sidewalk occupied by street vendors

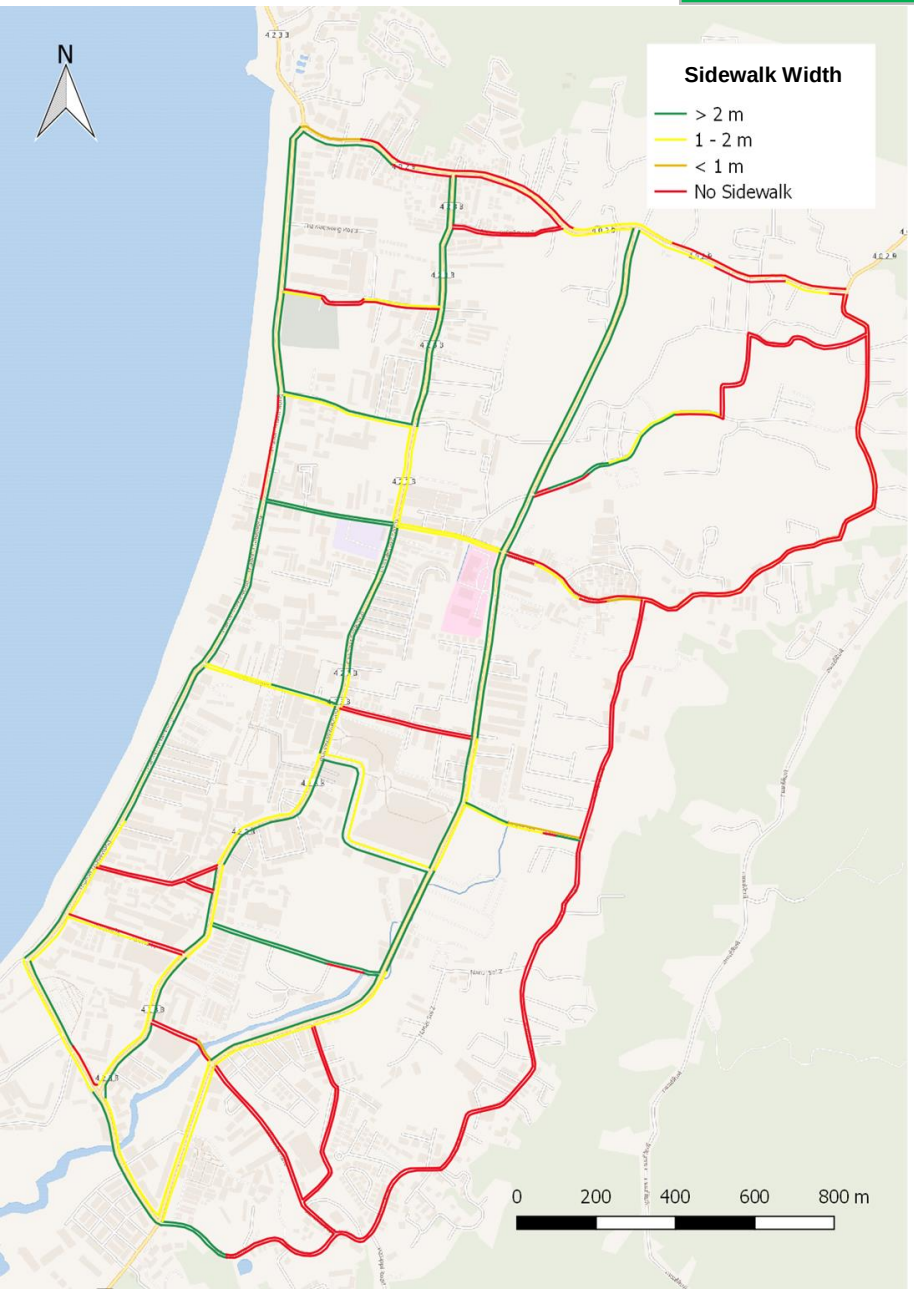


Narrow sidewalk

Noncontinuous walkways

Sidewalk occupied by utilities

4.4.2 Current NMT Issues



Size of the Sidewalks

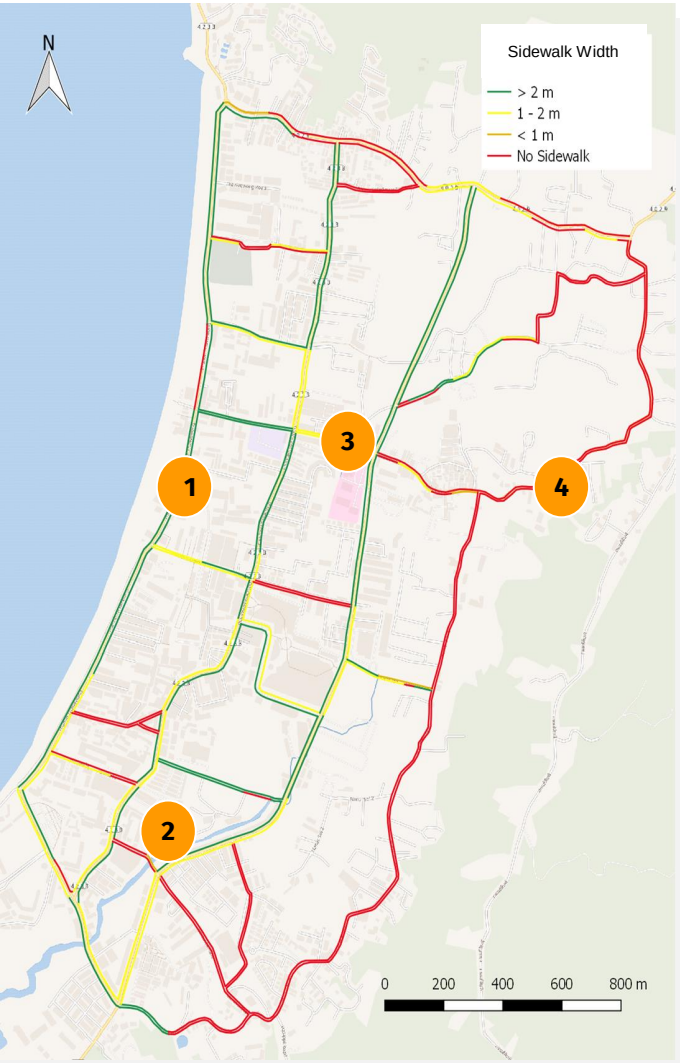
Sidewalks in Patong should be wide enough to accommodate high pedestrian volume, especially on few streets near the beach. From the sidewalk mapping conducted by ITDP, many sidewalks are found to be below 2 meters-wide or no sidewalk at all.

Sidewalks on small streets to access main roads are also narrow and not continuous. Outside the beach area, towards the Patong Hill, most streets do not even have sidewalks.

One particular street in Patong beach, Bangla Road, is closed during the evening from 6PM to 4AM, making it a pedestrian-only street.

Bangla walking street while closed for traffic

4.4.2 Current NMT Issues



Streets with different sidewalk width

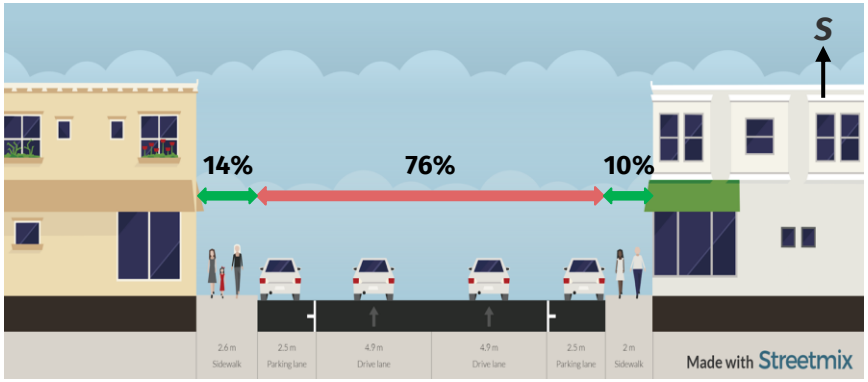
Street with sidewalk width > 2 m

Street with sidewalk width 1 - 2 m

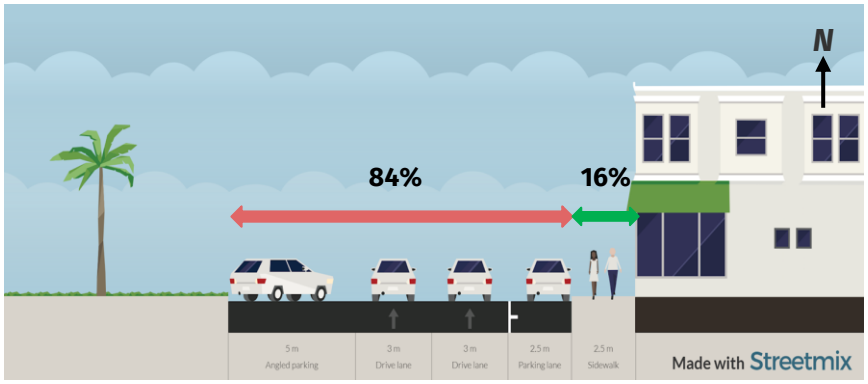
Street with sidewalk width < 1 m

Street with no sidewalk

4.4.2 Current NMT Issues



Existing street configuration at Ratuthit Songroipi Road



Existing street configuration at Thawewong Road

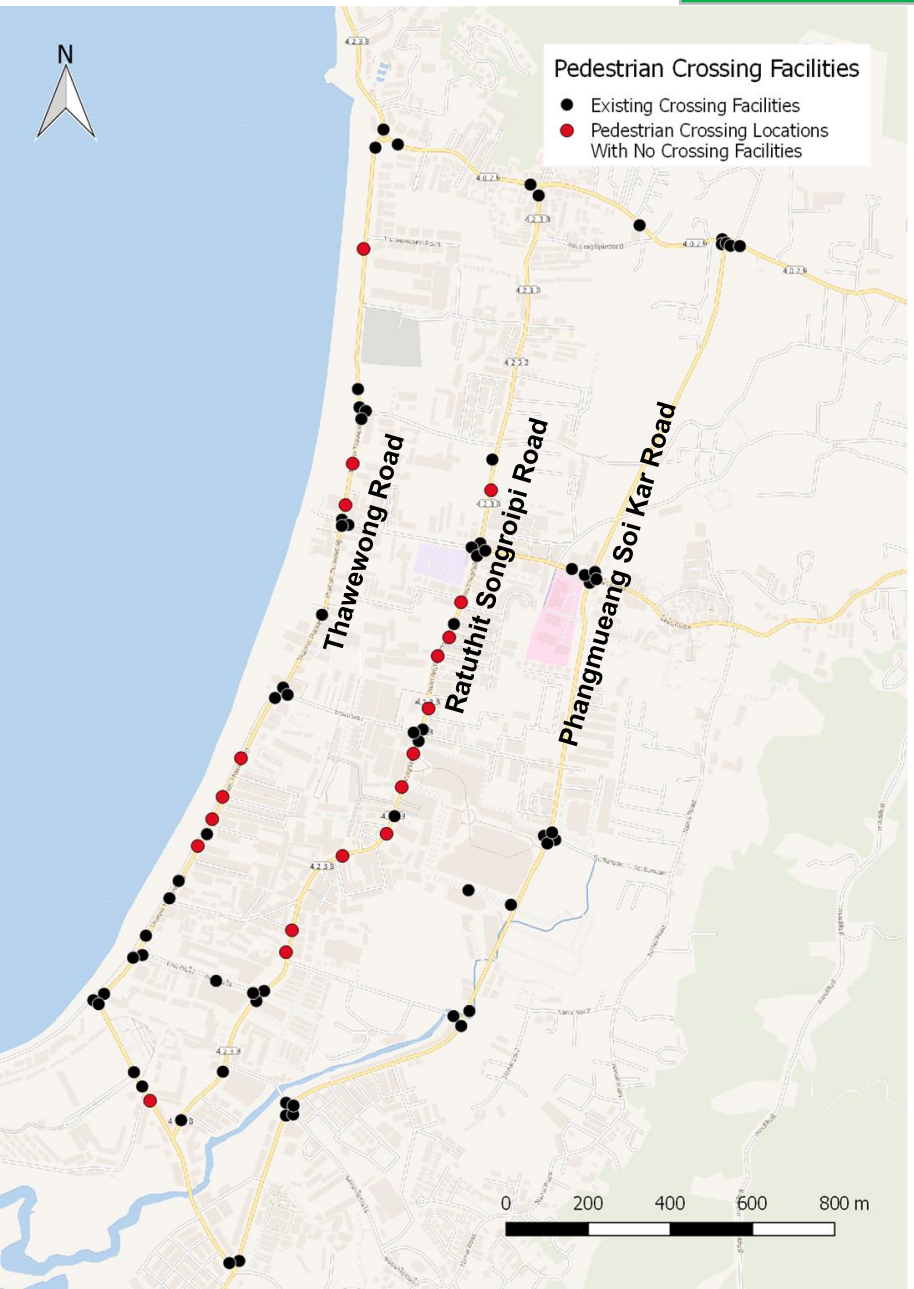
Equal space allocation between different users

The street configuration in Patong not only gives the least priority for pedestrians, but also for non-motorized transport and transit system in general.

In average, 76% of the road spaces in Patong are dedicated for motorized transport and only 24% of space is allocated for pedestrians for sidewalks, despite the high pedestrian volume in the area. The space allocated for motorized traffic also includes the space for on- street parking.

On-street parking and drive lane occupy the majority of the road space

4.4.2 Current NMT Issues



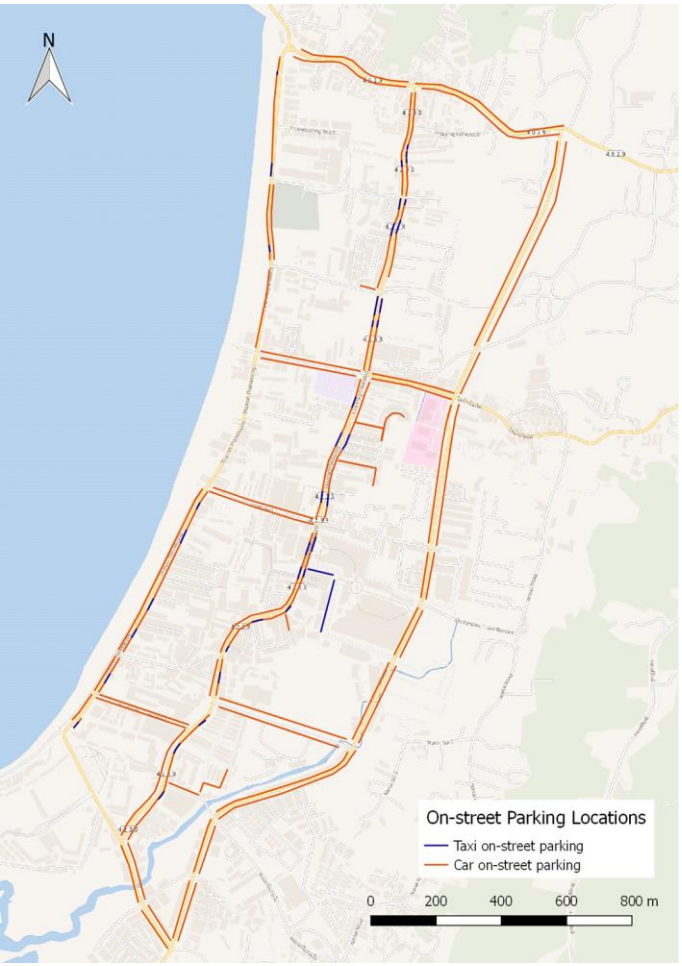
Crossing Facilities

Existing crossing facilities in Patong are mostly located at intersections. However, from crossing locations survey, many people cross the road without any crossing facilities such as zebra cross or pelican crossing, along the streets with busy shopping and leisure activities such as on Thawewong Road and Ratuhit Songroipi Road.

Provision of safe crossing facility can be done through putting pelican crossings and raised crossings every 200 meters along those roads, especially near the location where people cross.

Some locations with high volume of pedestrians crossing still have no crossing facilities

4.4.2 Current NMT Issues



Space taken for on-street parking

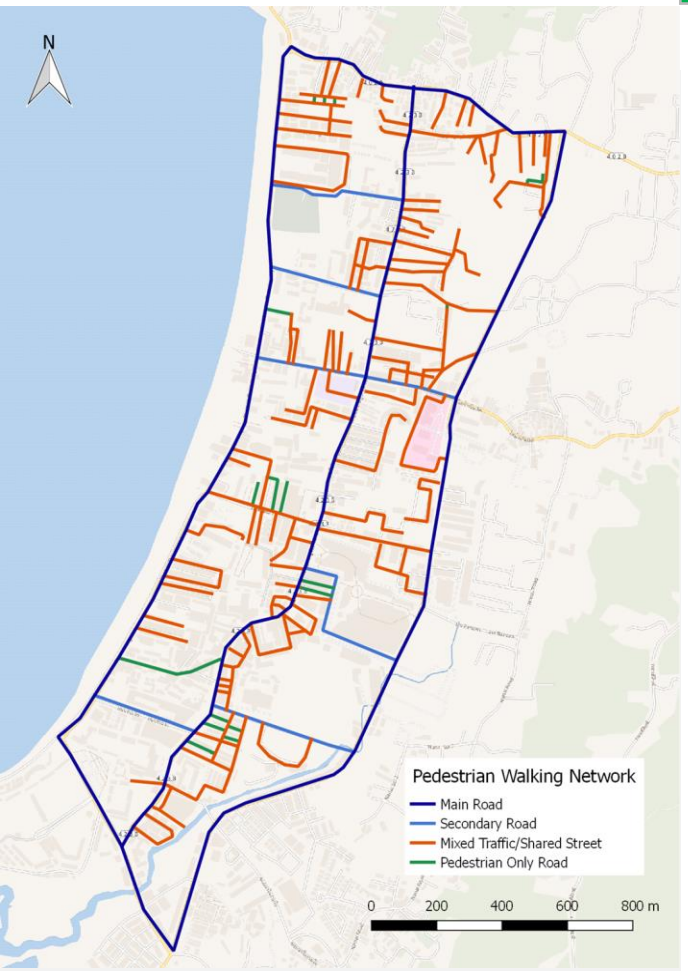
With the high volume of private vehicle use, on-street parking is practically available at most roads in Patong, with the exception of small sections of Prachanukhro Road (west part), Thawewong Road (middle part), dan Sawatdirak Road, Hatpatong Road, and street beside Jungceylon Shopping Center. The popularity of motorcycle and car rent and taxi among tourists also contribute to the high number of vehicles that occupy road spaces.

On-street parking in Patong are often found blocking pedestrian movement and causes congestion where it occupies too much of road spaces.

On-street parking blocks pedestrian movement

Space for taxi parking (left)

4.4.2 Current NMT Issues



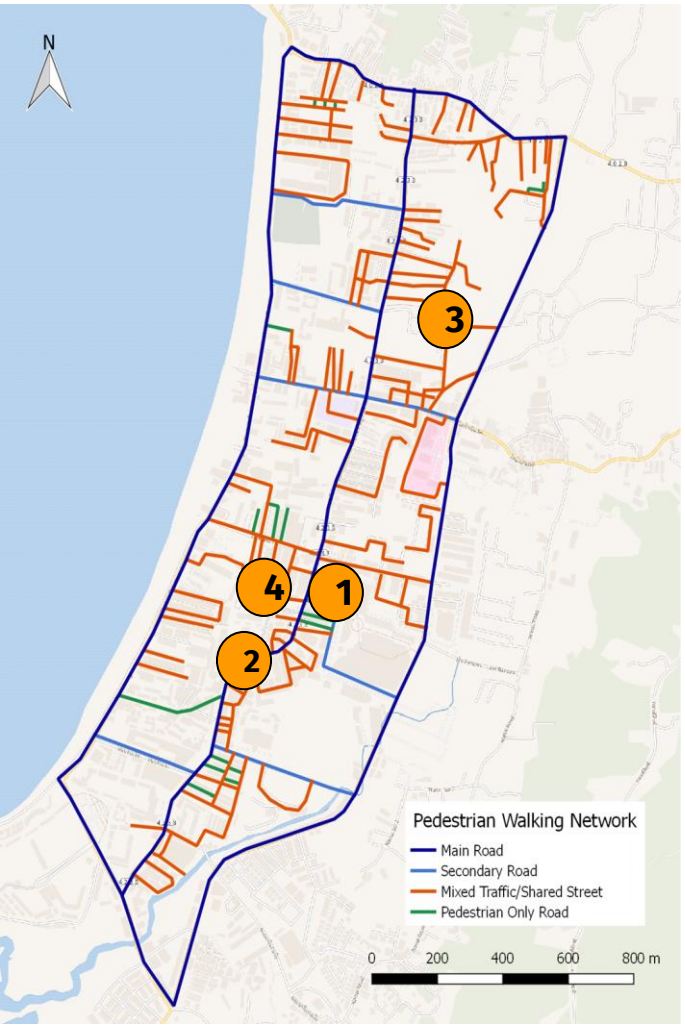
Shorter pedestrian connections

To reach the beach and city center, besides using main and secondary roads, pedestrians can also walk through small pathways as shortcuts to reduce the walking distance. Unfortunately, some of them are located within private properties which are not accessible for public. There are also almost no wayfindings available for pedestrians, therefore it is not easy to find the paths unless for locals.

If these small streets and alleys are opened for pedestrians at all times, it could reduce the walking distance for pedestrians to reach different places in Patong.

Shared street with less priority for pedestrians

4.4.2 Current NMT Issues



Shorter pedestrian connections

Pedestrian access amongst the shops

Pedestrian path blocked by wall

Stairs accessible only for pedestrians

Access only for hotel guests and restricted for public

4.4.2 Current NMT Issues

Lack of Cycling Activities and Facilities

In order to improve the environment in Patong and promote more sustainable mobility, the government should give more support and facilities for bicycles. It is well known that cycling can improve the environment and reduce emissions of CO_2 as well as hazardous gasses like particles and NOx.

However, compared to motorcycle, bicycle is not popular in Paatong. Bicycle facilities such as bicycle lane, bicycle parking places or priority for cyclist at junctions are not available. These conditions create lack of safety and convenience for cyclists. Despite the lack of infrastructure facilities for bicycle, motorcycle renting places are easier to find compared to bicycle, which makes motorcycle more accessible for tourists.

Moreover, according to the geographic condition in Patong, although the east side of the city is more hilly, but the city center area closer to the beachfront could be a nice area for cycling. The size of the area in the city center can also be easily reached by bicycle.

For smaller roads, instead of giving access priority and parking places for motorcycles, these could be bicycle priority access connected those main roads which will create a good shorter cycling network in Patong.

Compare with motorcycle riders, cyclist is barely seen in Patong

Priority road for motorcycles

4.4.3 NMT Survey and Data Collection

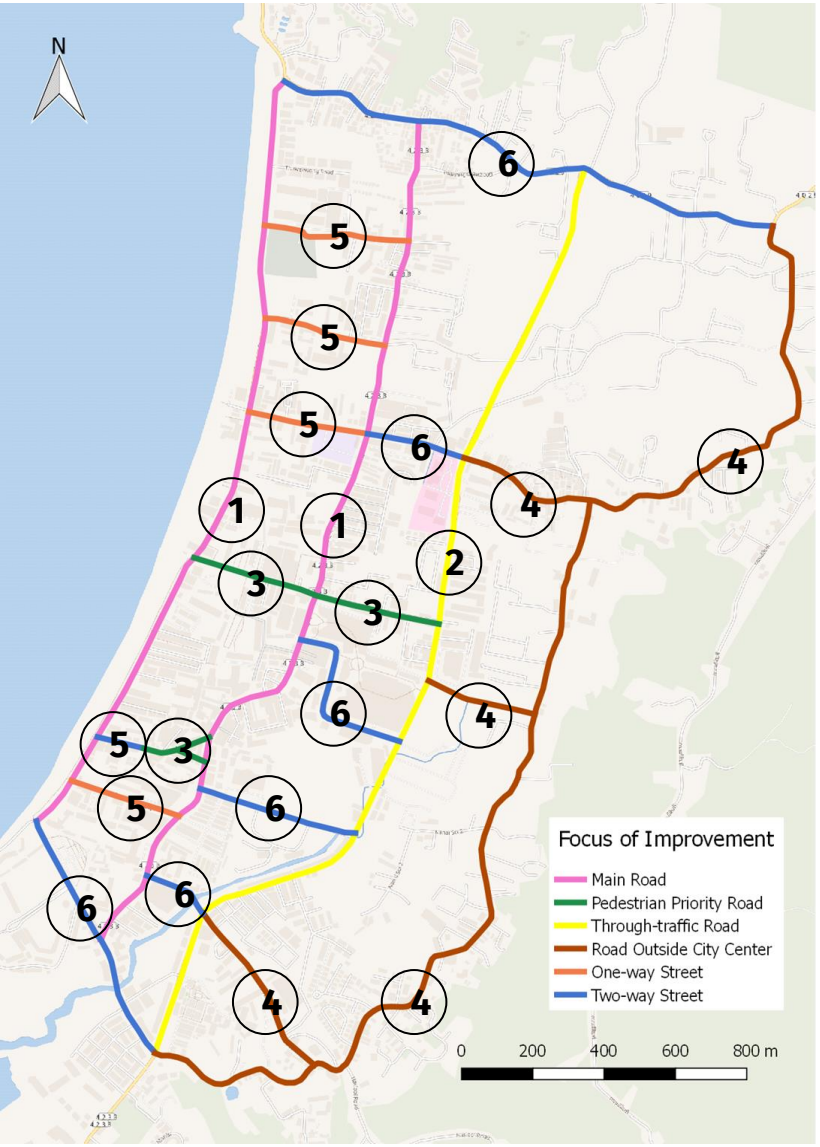
The following table summarizes traffic, infrastructure, and parking surveys which were conducted in Patong.

Survey Activity		Objective	Methodology	Outcome
Traffic	Peak-hour pedestrian volume	To identify high-priority streets for pedestrian improvements.	Walking and counting the number of pedestrian passing by on every street within the scope area, during the peak hours.	Map of pedestrian volume on every street within the scope area.
	Pedestrian crossing location	To identify the potential crossings to be improved and/or added.	Marking the locations where pedestrian crossing activities occur, on a map.	Map of pedestrian crossing locations within the scope area.
	Motorized traffic count	To identify motorized traffic volumes for potential reorganization of traffic lanes (number of lanes and directions).	Recording several videos of the traffic condition at the selected intersections, where the traffic reorganization is preferable.	Map of motorized traffic volume on the selected streets.
Infrastructure	Sidewalk	To identify the width of the sidewalks in the selected scoping area.	Documentation of the existing width of the sidewalks in the scope area, on a map.	Map of the sidewalk width improvements and recommendations, including the cross section designs of the corresponding streets.
	Junction design	To identify the junction for potential design improvements.	Recording several videos of the traffic condition at the selected intersections.	Information of the existing junction design.
	Pedestrian pathways	To identify the possible shortways to build and/or to recommend for the pedestrians.	Walking across the streets within the scope area to identify its connection to the other streets.	Map of the information of the connected and dead-end streets.
Parking	On-street parking locations	To identify the on-street parking location and capacity.	Observing the parking locations along the streets and estimating its capacity.	Map of on-street locations for car and/or motorcycle.
	Taxi stand locations	To identify the taxi parking location and capacity.	Observing the parking locations along the streets and estimating its capacity.	Map of on-street locations for car and/or motorcycle.

4.4.4 NMT Objectives

Issues	Objectives	Measures
Walking Improvement		
Low quality of sidewalk facilities in several tourist areas (e.g. Bangla Road) despite the high pedestrian volume walking across these areas.	To create better and safer walking environment in Patong area by giving higher priority for the pedestrians in terms of space and continuity of the walkways.	Provide safe and continuous walkways by reallocating the space of the streets.
Insufficient crossing facilities in high pedestrian crossing locations (e.g. Ratuthit Songroipi Road), which creates unsafe conditions for them to cross the streets.	To provide safe crossing facilities for pedestrians.	Provision of safe crossing facilities at junctions and other crossing locations.
On-street parking dominates the space of the streets within the scope area and in some streets with a nonexistence/low quality of sidewalks, it blocks the pedestrian movement.	To provide more comfortable walking environment for the pedestrians.	Management of on-street parking locations and street reconfiguration.
There are several potential short paths for the pedestrians, however, no information are provided and in some locations the paths end in cul-de-sacs, also occupied by motorcycle parking.	To create a more connected pedestrian network paths and provide sufficient information for pedestrians to walk around Patong.	Extension of the closed-end paths to the nearby streets and provision of wayfindings and signages.
Less priority for pedestrian at the junctions.	To provide junction facilities that prioritize pedestrians first, in particular when heavy pedestrian volumes occur.	Redesigning the important junctions.
Cycling Facility Proposal		
Nonexistence of cycling facilities in Patong.	To promote cycling as one of transportation modes in Patong.	• Provision of safe cycling facilities in Patong, especially at roads with high volume of traffic. • Establishment of bike-sharing system in Patong.

4.4.5 Focus of Improvement



Street Improvement Measures

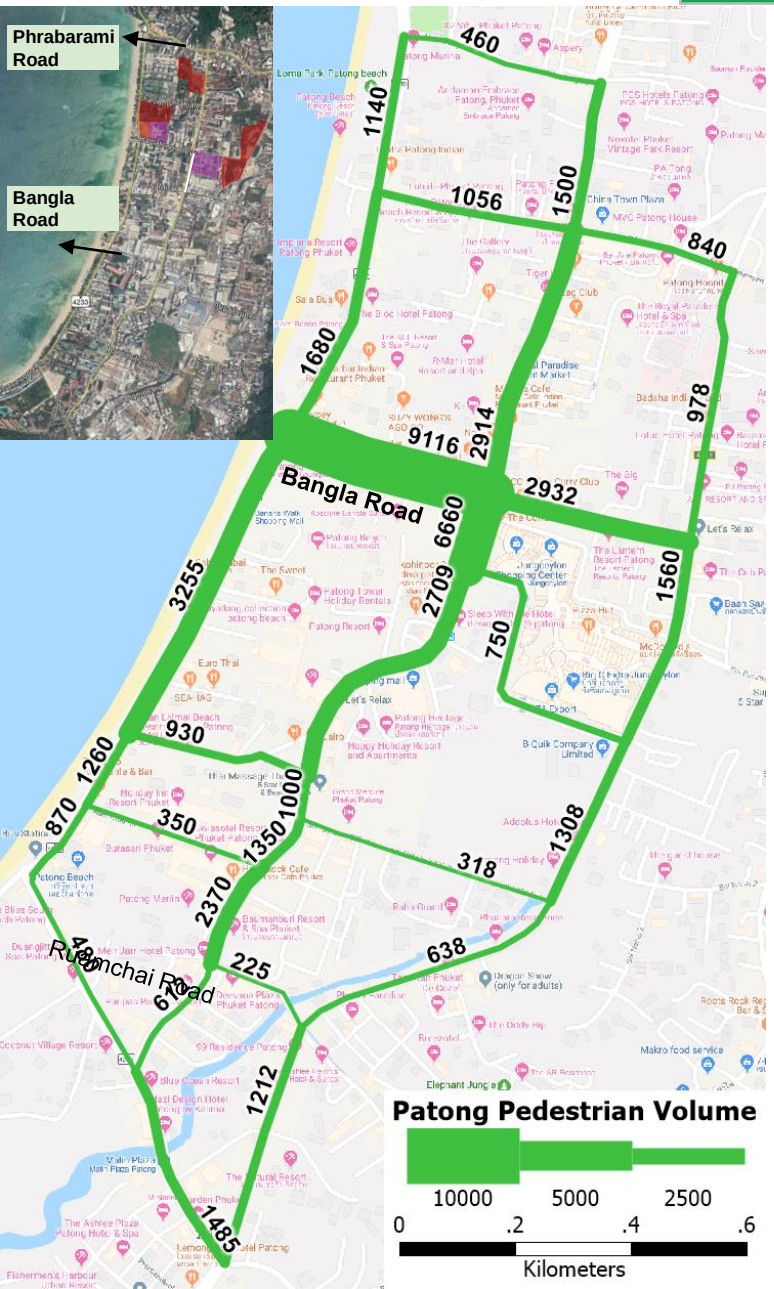
In general, the proposed improvement of walking facilities in Patong are clustered into these six categories as follows:

1. Complete street with universal access at main roads
2. Provide consistent number of lanes at through-traffic road with safe and continuous walking facilities for pedestrian. To reclaim some road segments for pedestrian, on-street parking management is needed
3. Implementation of pedestrian priority road
4. Provision of walking facilities at roads outside city center
5. Provision of convenient and continuous sidewalk, and on-street parking management
6. Provision of continuous sidewalk and on-street parking. These roads are less attractive with less number of pedestrian on the roads. Therefore, on-street parking could be located along the roads

To support walking facilities improvements mentioned, these following improvements are also proposed:

- Crossing facilities improvement
- Pedestrian access improvement
- Provision of bike-sharing and bike lane network
- Junction improvement

4.4.5 Focus of Improvement



Focus of Improvement at High Pedestrian Volume Locations

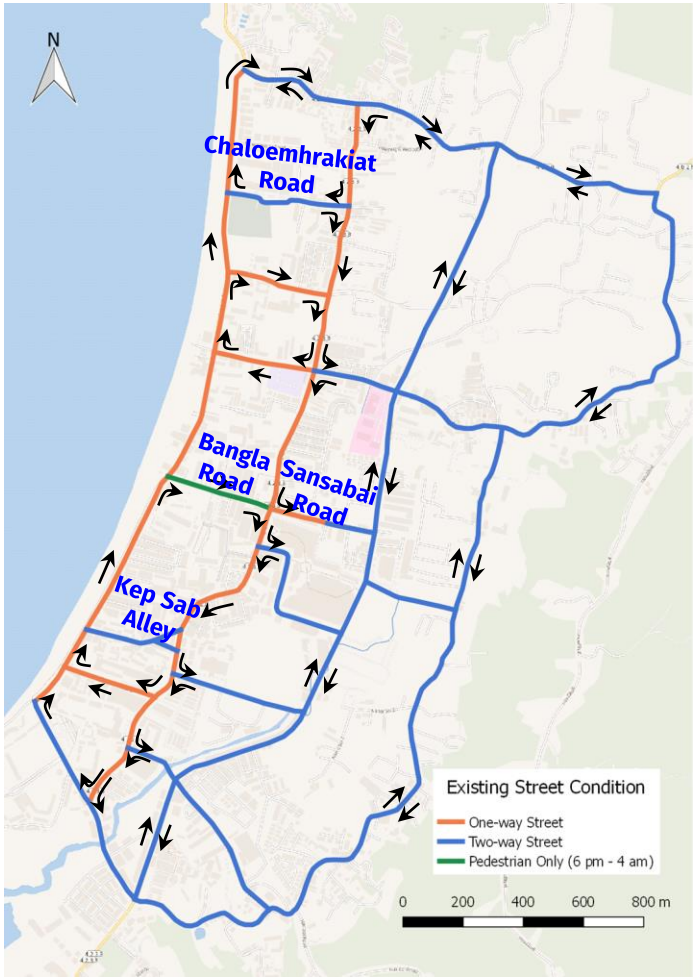
Detailed designs of this study will be focused at high pedestrian volume locations. From pedestrian volume mapping resulted from the survey, pedestrian volumes were counted as high as 9,116 pedestrians per hour. These high pedestrian volume locations are centered around Bangla Road, beachfront area, and the road in front of Jungceylon Shopping Mall.

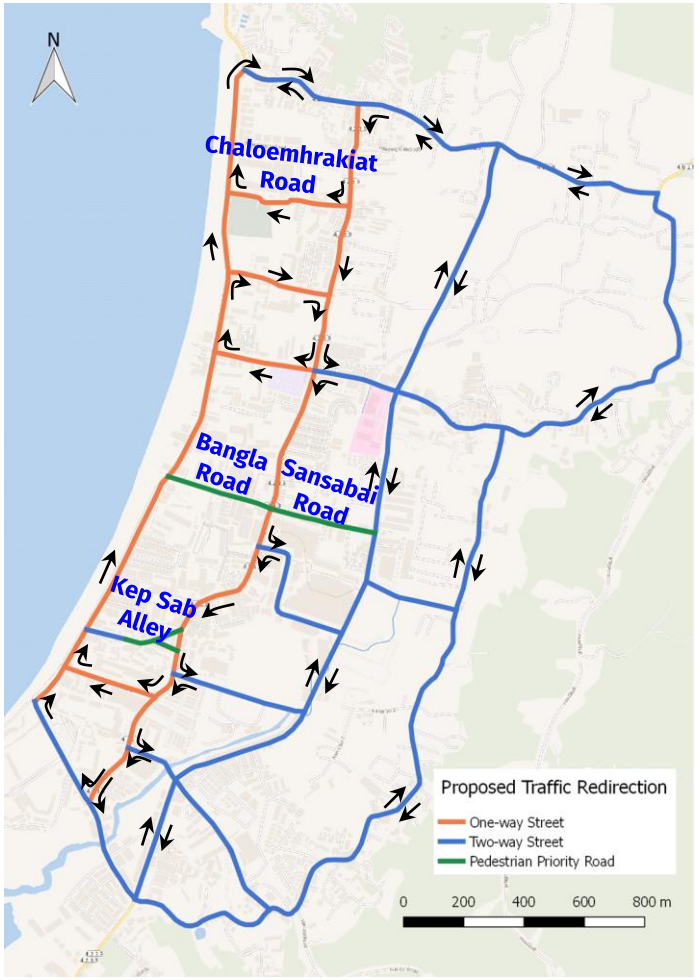
At the north side of Patong up to Phrabarami Road, there are some empty places found at that area. The areas highlighted in red are empty areas, while the areas highlighted in purple are where the buildings have side back which makes it less attractive because there are no connection between private properties and public spaces. The south side is more attractive. Shops, night markets, bars, and hotels are mostly located at the south side.

Night food market located at the south side of Patong

4.4.5 Focus of Improvement

Pedestrian-only Streets





To improve pedestrian connectivity to the city center and beachfront area, few roads such as Bangla Road, Sansabai Road and Kep Sab Alley are proposed to be pedestrian-only road at all times. Traffic redirection is proposed at Chaloemhrakiat Road, to become one-way street heading west.

4.4.6 Road and Connectivity Improvement

Thawewong Road

As the nearest road to the beach, Thawewong Road is the busiest street in Patong. The proposed road improvement plan for Thawewong Road is to create walking-friendly street with universal access.

Walking-friendly street and pedestrian priority:

- Good, safe, accessible walkways
- Sufficient clear path
- Lighting to ensure safety
- Adequate crossing facilities to facilitate busy pedestrian traffic
- Good information system through wayfindings and other relevant signages
- On-street parking removal and place utilities underground

Universal access:

- Guidance for people with visual impairments
- Ramps on crossings

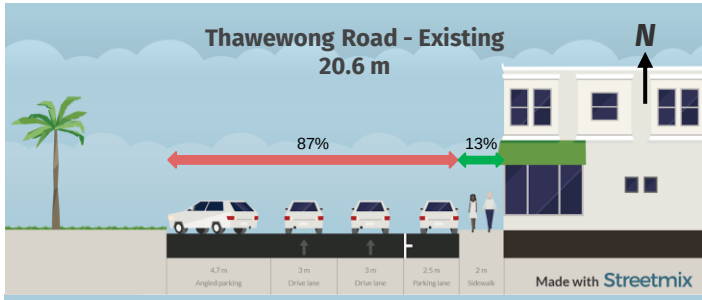
Provision of alternative transportation modes:

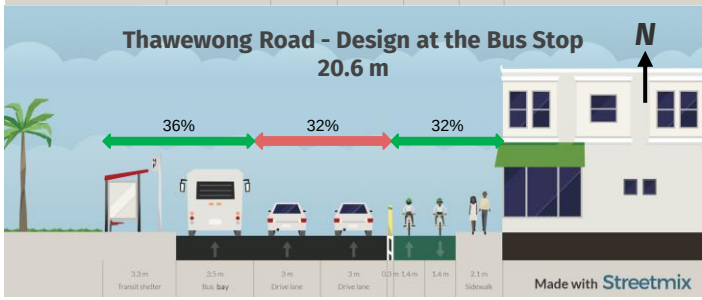
- Dedicated cycle lanes
- Public transport facilities

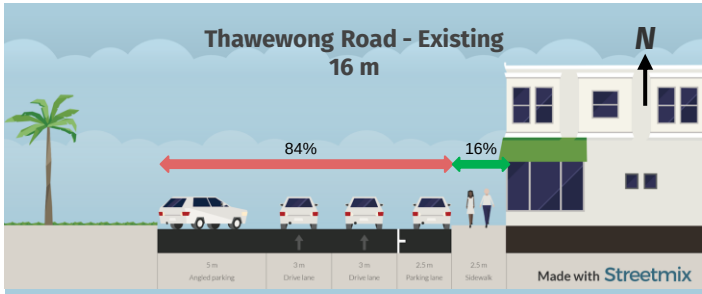
4.4.6 Road and Connectivity Improvement

Proposed plan for improvement at Thawewong Road

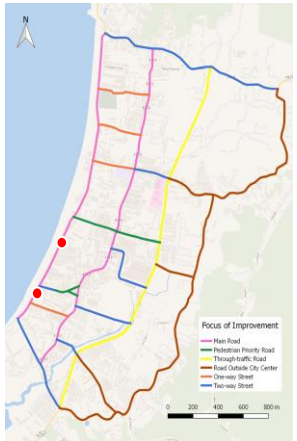
- Widening the space towards the west direction to allow better reconfiguration of the space.
- Sidewalks widening.
- Provision of bike lanes.
- Provision of public transport facilities. Bus stop and bus bay are required to create safer and more convenient boarding-alighting activities for potential high passenger volume coming to this street.
- Boarding island to avoid conflict between cyclists and passenger activities. Additional facility to cross the cycle lane while accessing the boarding island is required (i.e. crossing and ramp).
- Reduction of drive lane width to increase safety.
- Removal of the on-street parking. The vehicles can park in the northern part of this road and in the off-street parking area.
- Placing the wayfindings and signage.
- Provision of sufficient lighting, especially on the left side (facing the North direction).





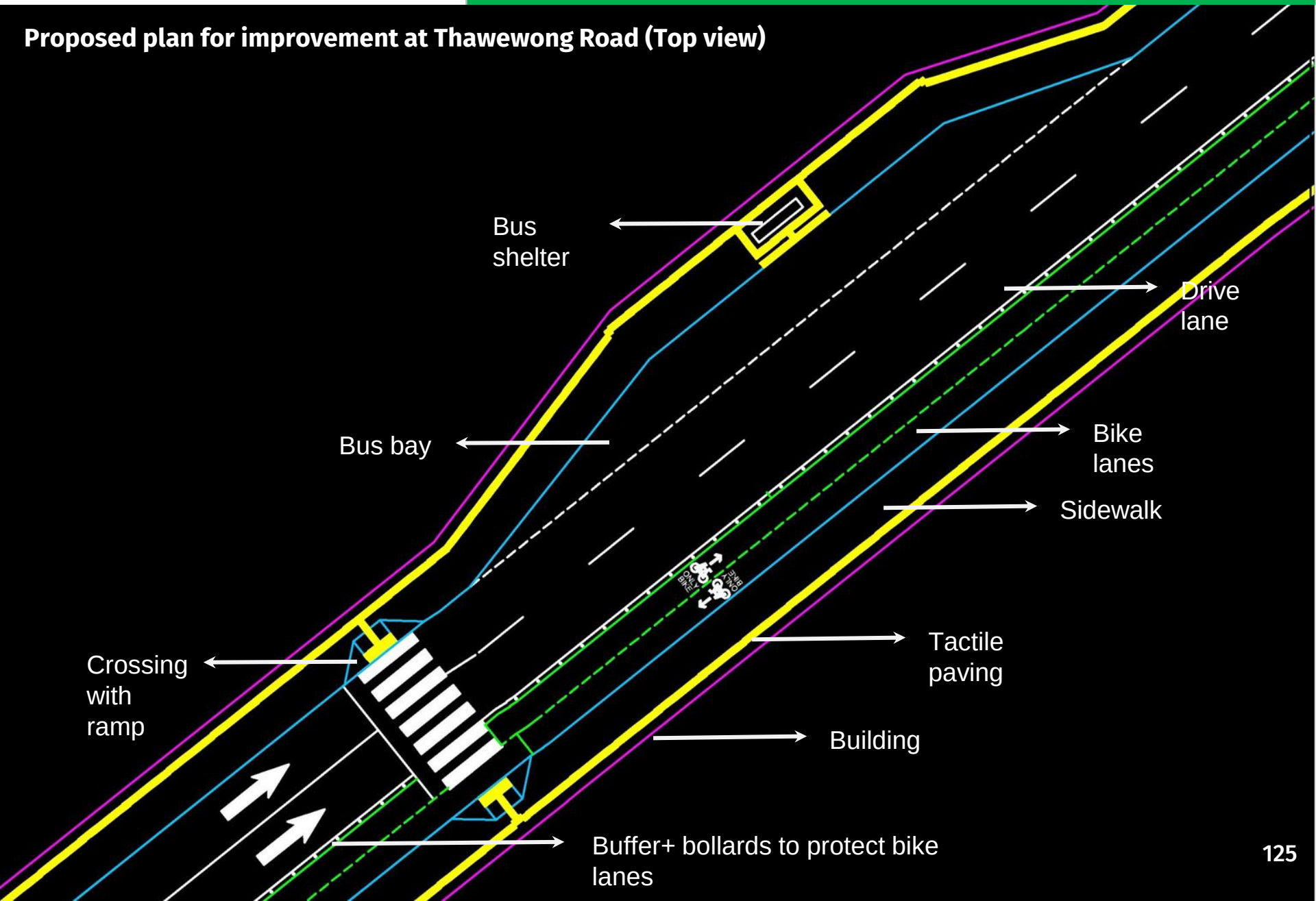


Current situation at Thawewong Road



4.4.6 Road and Connectivity Improvement

Proposed plan for improvement at Thawewong Road (Top view)



4.4.6 Road and Connectivity Improvement

Ratuthit Songroipi Road

Ratuthit Songroipi Road runs parallel to Thawewong Road. It is also a one-way street that can only be driven from north to south, which creates a looping driving pattern between both roads. There are many activities along the road as much as Thawewong Road, therefore the proposed road improvement plan for Ratuthit Songroipi Road is also to create walking-friendly street with universal access.

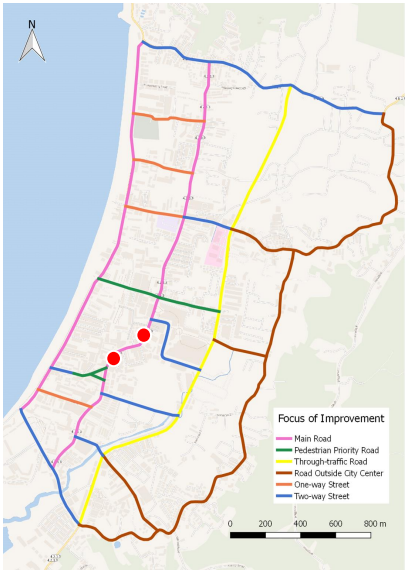
The same features as Thawewong Road are also applied on this road improvement plan. However, since the motorized traffic there is twice heavier than in Thawewong Road, on-street parking is still provided on only some segments of this street, but is proposed to be reduced to one side only.

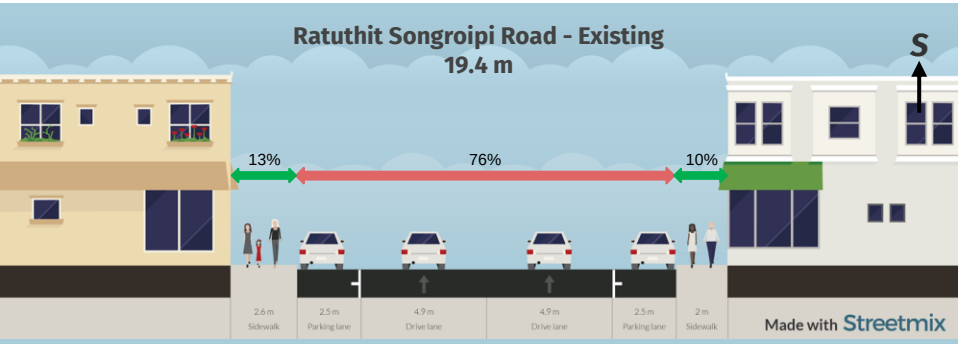
Design illustration for complete street (Source: NACTO)

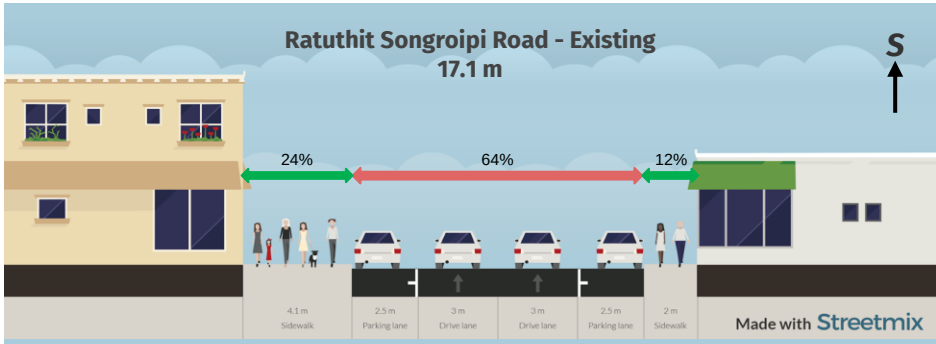
4.4.6 Road and Connectivity Improvement

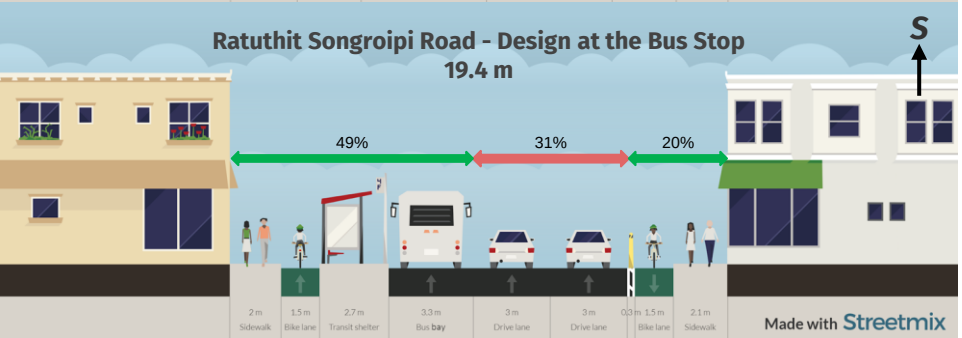
Proposed plan for improvement at Ratuthit Songroipi Road

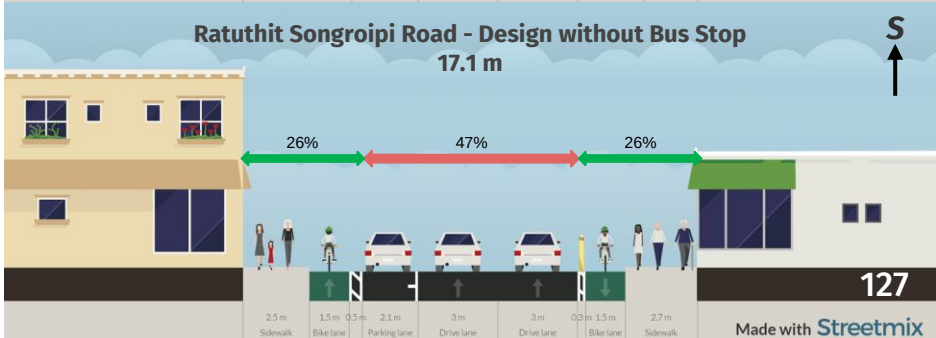
- Similar measures as Thawewong Road, with an exception in the parking recommendation.
- Reduction of the on-street parking to the left side-only (facing the South direction). In addition to this, the vehicle can park in the northern side and in the off-street parking area.
- Dedicated parking areas are provided to prevent obstructions of the clear path for the pedestrians. Furthermore, the parking does not need to be continuous. It can be interspaced by the other facilities, for instance, the boarding island and bus bay area.





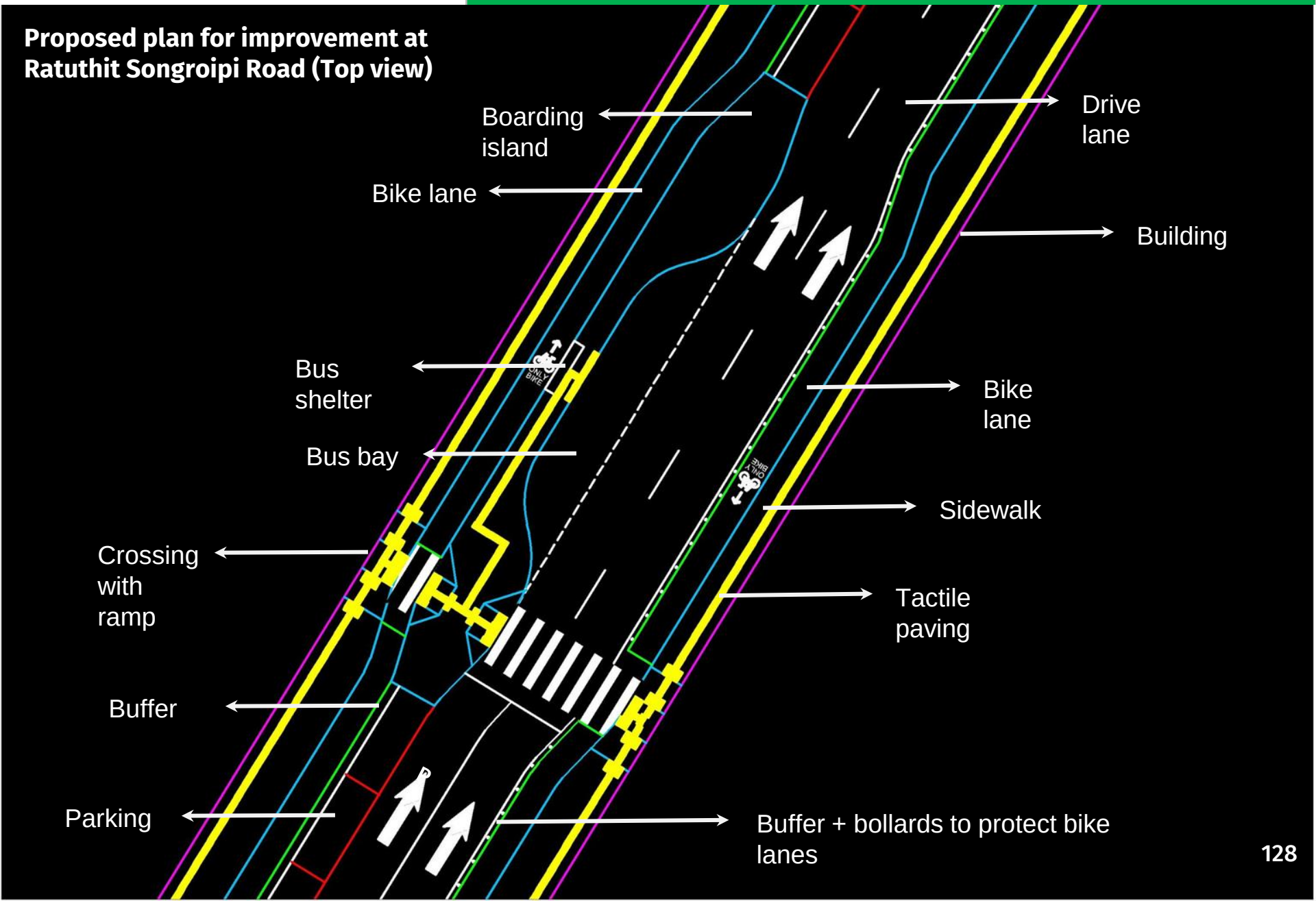






4.4.6 Road and Connectivity Improvement

Proposed plan for improvement at Ratuthit Songroipi Road (Top view)



4.4.6 Road and Connectivity Improvement

Phangmueang Soi Kar Road

Phangmueang Soi Kar Road is a two-way street that also runs parallel to both Thawewong Road and Rathutit Songroipi Road. As the traffic passing through this road is mainly going to other areas of Phuket which implicates higher vehicle speed. The proposed road improvement for Phangmueang Soi Kar Road is to create safe walking and crossing facilities for pedestrians.

Being the road that connects Patong to the other areas of Phuket, another improvement plan for Phangmueang Soi Kar Road is to have consistency of number of lanes by on-street parking management.

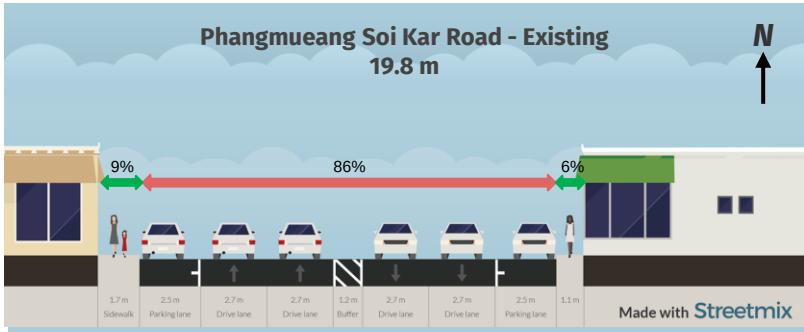
Provide pedestrian refuge island at zebra crossings (Source: fareastbrt.com)

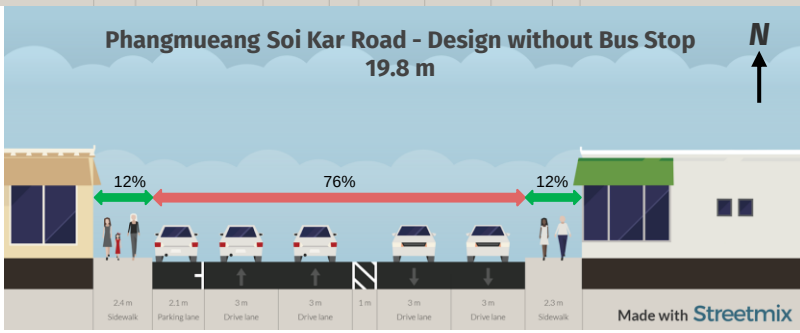
4.4.6 Road and Connectivity Improvement

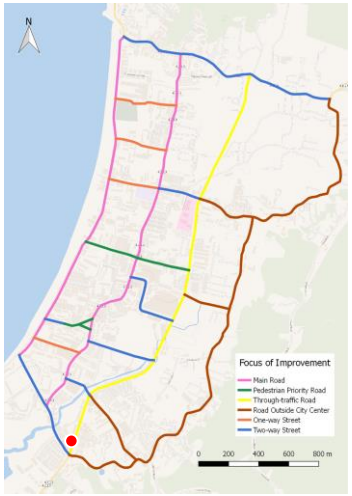
Proposed plan for improvement at Phangmueang Soi Kar Road

Design for cross section between bus stops:

- Provision of pedestrian crossing improvement
- Reduction of the on-street parking to the left side only (facing the North direction), to allow space reconfiguration and consistency of the number of lanes
- Widening the sidewalk, with utilities underground
- Provision of wayfinding and signage





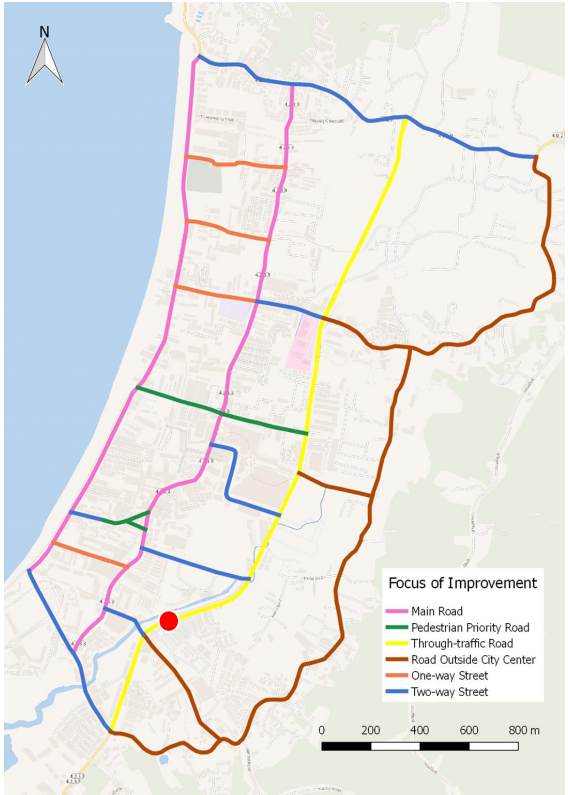


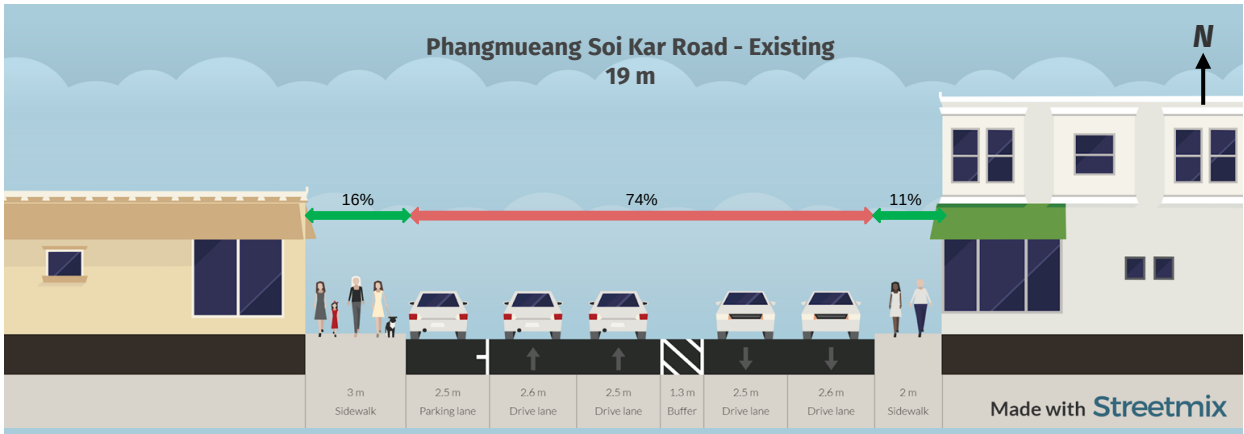
Current situation at Phangmueang Soi Kar Road

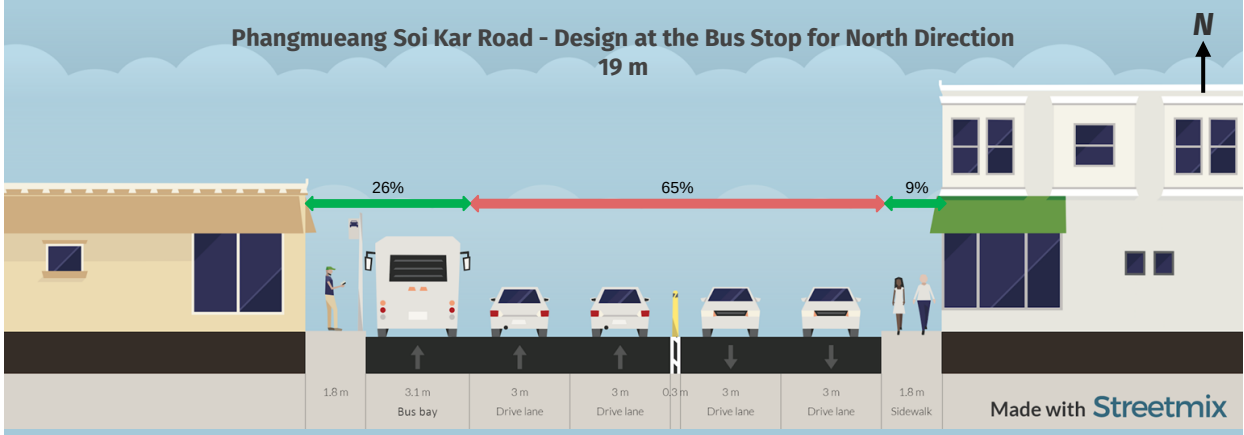
4.4.6 Road and Connectivity Improvement

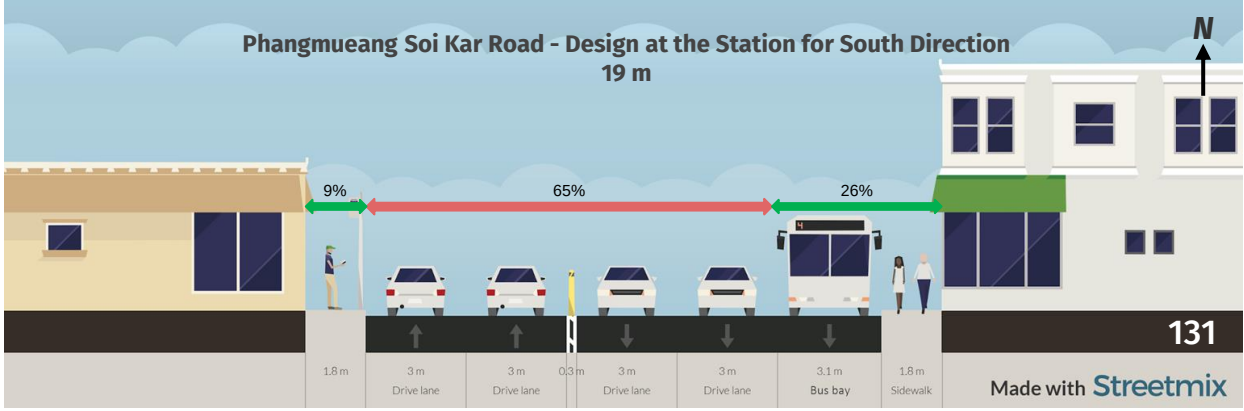
Design for cross section at the bus stop:

- **Road curve to add bus stop and bus bay on the both sides of the street.**
- **Other features are similar to the design for section between the bus stops.**









4.4.6 Road and Connectivity Improvement

Pisitkoraneee - Nanai Road

Pisitkoraneee Road and Nanai Road are two-way streets located near mountains of Patong Beach. Many accommodations are available along the road, but the lack of walking facilities makes people hesitant to walk and rent motorcycle instead.

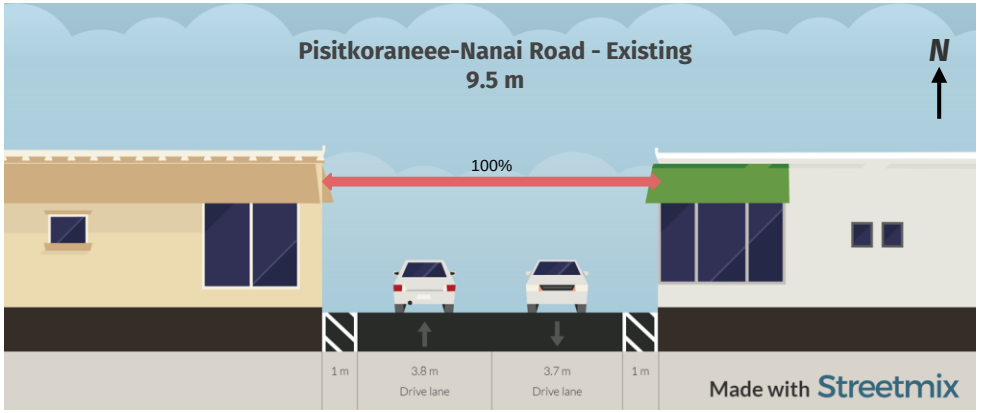
Although it is not located in city center, some hotels, shops and restaurants are located in this area. Therefore, good sidewalks are necessary to connect places and make it more accessible by walking. The proposed road improvement plan for Pisitkoraneee Road and Nanai Road is to provide good and continuous sidewalk.

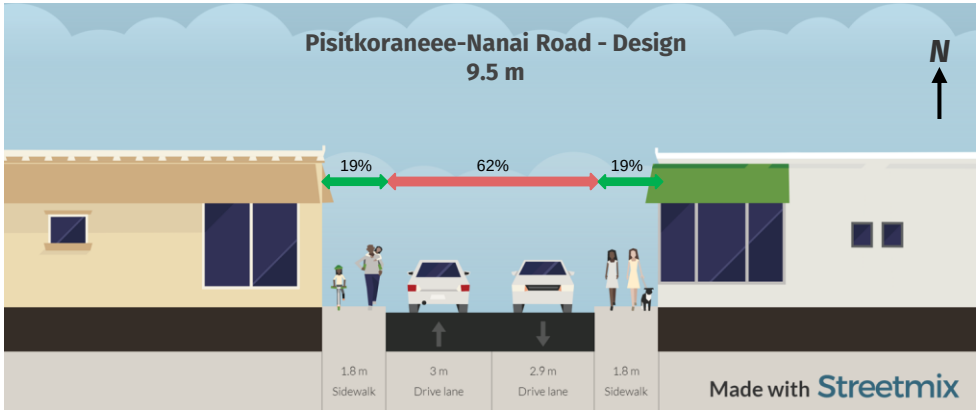
Provide continuous sidewalks for pedestrians

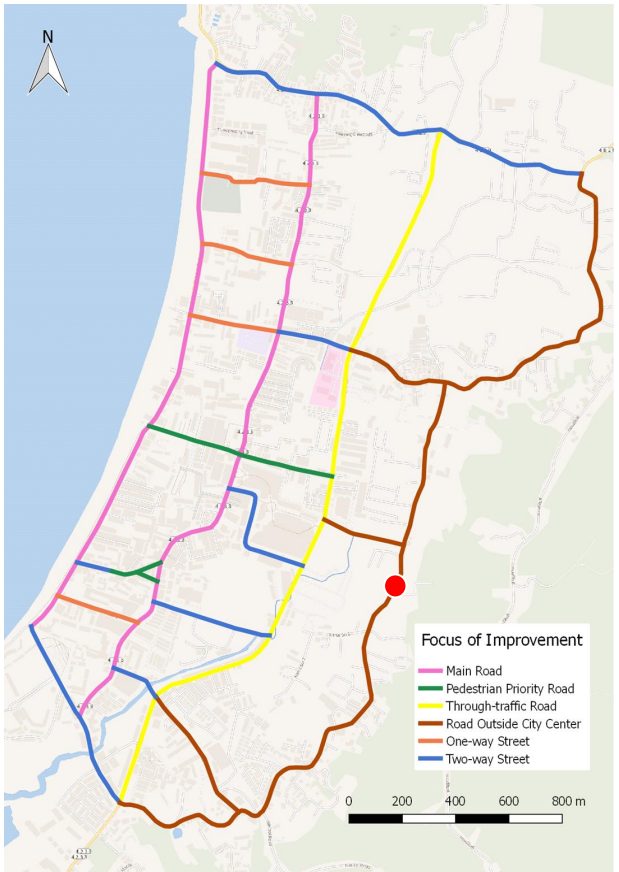
4.4.6 Road and Connectivity Improvement

Proposed plan for improvement at Pisitkoraneee - Nanai Road

- Reconfiguration of space, especially the width of the driving lanes.
- Provision of sidewalks to accommodate the pedestrians with safe walking environment. At minimum, a clear path of 1.8 meter width on sidewalks is required.
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.







4.4.6 Road and Connectivity Improvement

Bangla - Sansabai Road

Bangla Road is famous for its pedestrian only street that starts from 6 pm to 4 am every day. It connects the two closest main roads to the beach and is always busy at night. The proposed road improvement plan for Bangla Road is to close the road for traffic at all time, so the space can be only used by pedestrians and cyclists.

Located just across Bangla Road, Sansabai Road is also proposed to be closed for traffic at all time. It connects Ratuthit Songroipi Road and Phangmueang Soi Kar Road, so pedestrians can reach the coastline more easily with a pleasant walking experience.

Key design improvements:

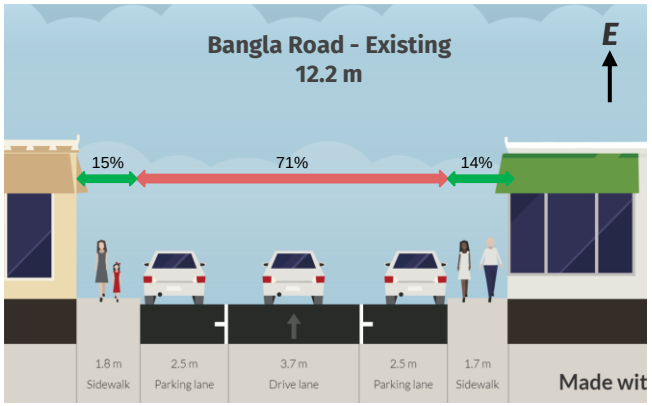
- Transforming the pedestrian only streets into attractive area with active frontage.
- Using visually interesting pavement such as pre-case two-toned concrete pavers.
- Leveling the street to achieve busy pedestrian area. Consider to remove the curbs.
- Other street furnitures (e.g. benches) to support pedestrian activities.

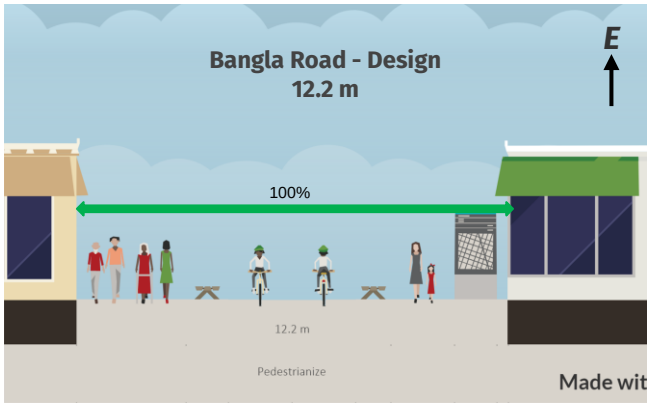
4.4.6 Road and Connectivity Improvement

Pedestrian Priority Road

1. Bangla Road
2. Sansabai Road
3. Kepsub Alley Road

Current situation at Bangla Road during the day





Proposed plan for improvement

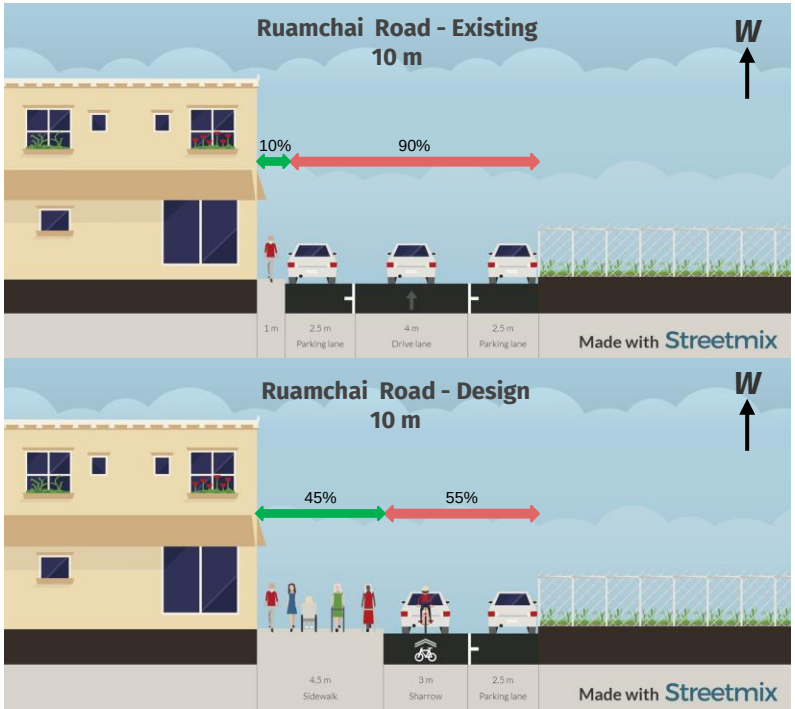
- Redesign the area to be more attractive.
- Limited traffic zones. Only pedestrians and cyclists are allowed to access these streets.
- Changing the pavement into precast two-toned concrete pavers.
- Removal of the obstacles from the streets. When necessary, remove the curb to level the street entirely. The space then can be filled by other pedestrian-attracting elements to create the overall pleasant walking experience.
- Provision of other supporting elements and furnitures to facilitate pleasant walking environment.

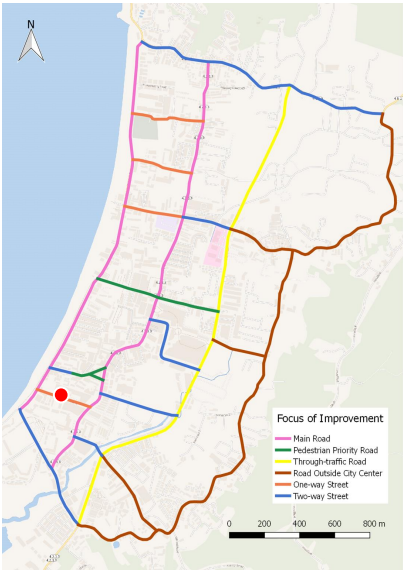
4.4.6 Road and Connectivity Improvement
One-way Street Design

Ruamchai Road is one of the streets that connect Ratuthit Songroipi Road and Thawewong Road. Currently, there are only a few interesting activities exist on this street.

Proposed plan for improvement at Ruamchai Road:

- Widening sidewalks on the left side (facing the West direction). This road can serve as a short path from people from Ratuthit Songroipi Road to Thawewong Road or vice versa, thus, providing better sidewalks is essential.
- Reducing the driving lane space into 3 meters wide.
- Locating on-street parking on the right side (facing the West direction) since this area is less interesting, to accommodate people parking from the Ratuthit Songroipi Road.
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.

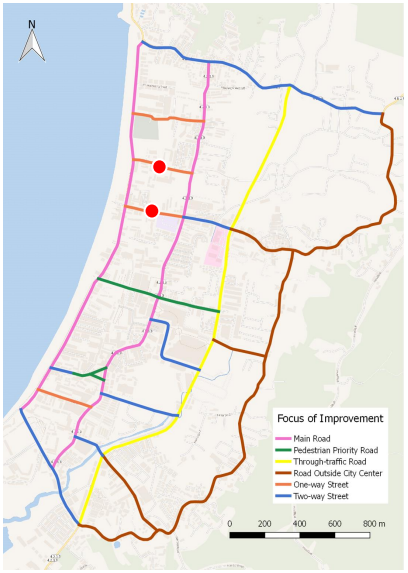




Current situation at Ruamchai Road

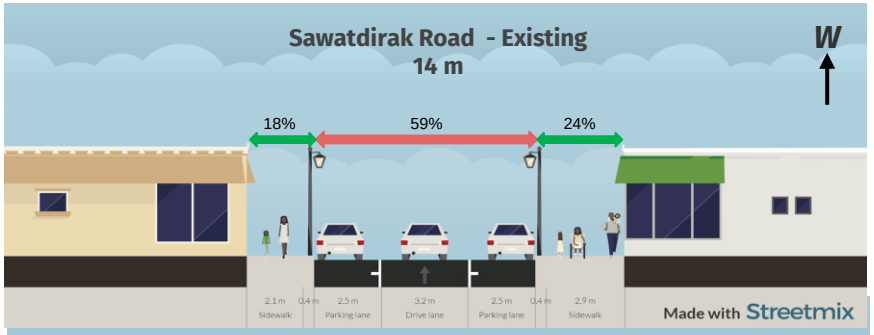
4.4.6 Road and Connectivity Improvement
One-way Street Design

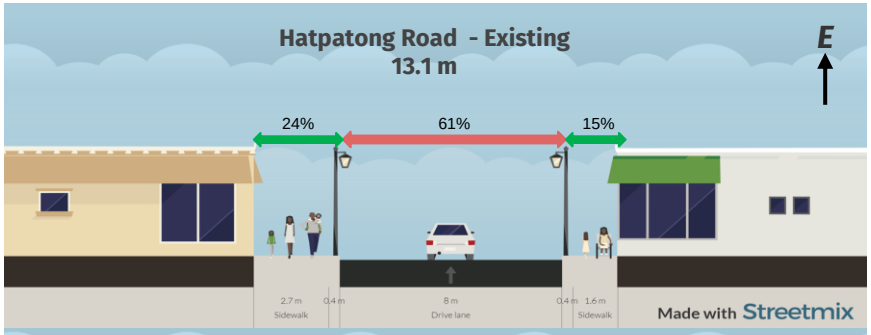
Sawatdirak Road and Hatpatong Road connect Ratuthit Songroipi Road and Thawewong Road. These streets are located close to Bangla Road, one of the tourist attractions.

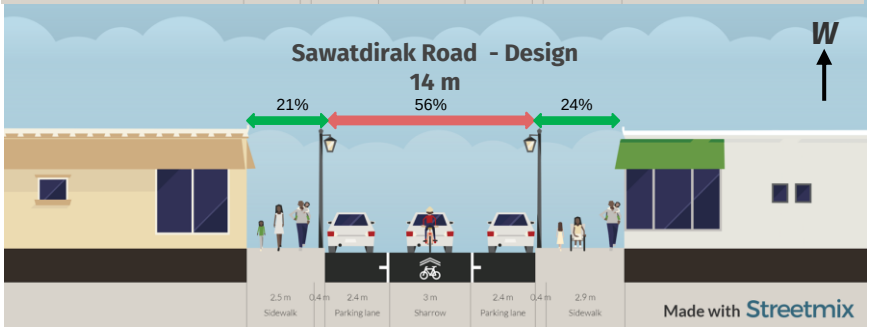


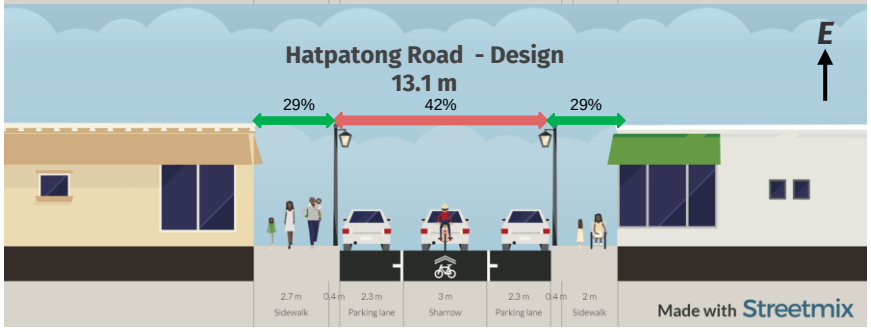
Proposed plan for improvement at Sawatdirak and Hatpatong Road:

- Widening the space for sidewalks while limiting the driving lane to 3 meters wide.
- Concerning their locations, on-street parking can be provided on these streets to accommodate people from Thawewong Road and Ratuthit Road.









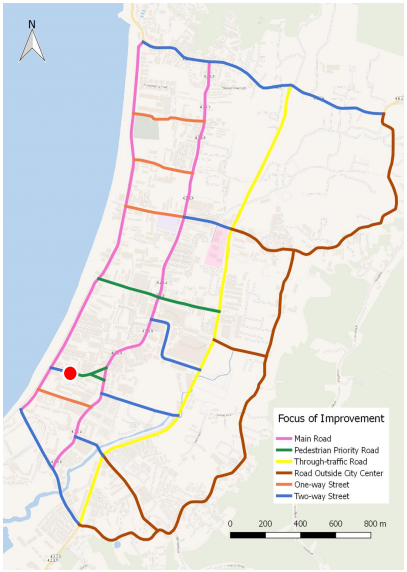
4.4.6 Road and Connectivity Improvement
One-way Street Design

Kep Sab Alley is an alley, which currently functions as a shared street.

Key important aspects to improve the existing shared-street:

- Street is prioritized for pedestrian and only for private vehicles resident access and emergency vehicles.
- No physical distinctions between different road users.
- Low speed area (maximum 10 km/h).
- Provision of signage to inform the motorists of the low speed limit.
- No parking allowed.
- Make it attractive for pedestrians as shared street itself could improve vibrancy of the area.
- Wayfinding placement as it is potential to serve as a short path for pedestrians from Ratuthit Songroipi Road to Thawewong Road or vice versa.
- Provision of other supporting elements and furnitures to facilitate pleasant walking environment such as lighting, wayfindings, and benches.

Current situation at Kep Sab Alley Road

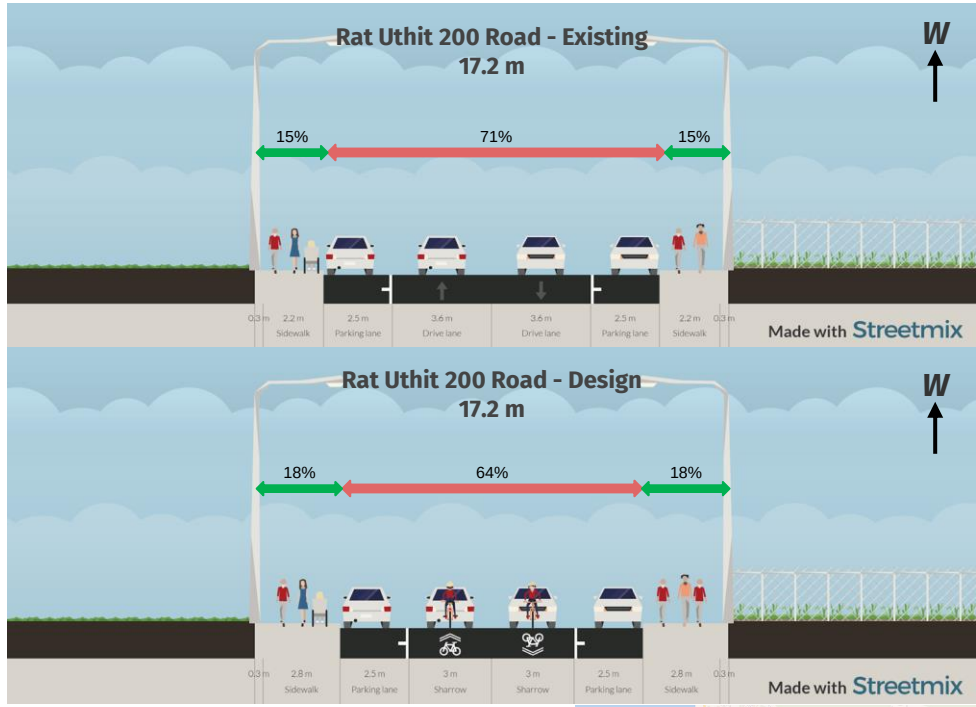


4.4.6 Road and Connectivity Improvement
Two-directional street design

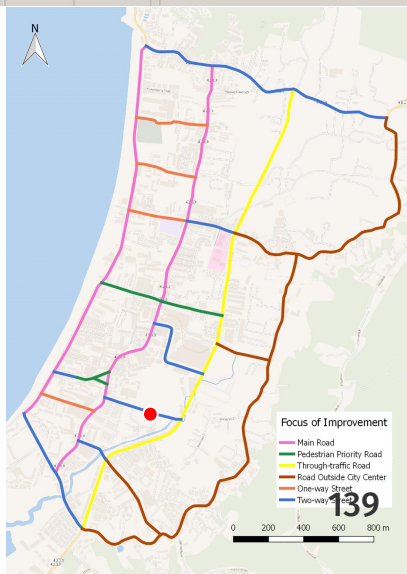
Rat Uthit 200 Road connects Ratuthit Songroipi Road and Phangmueang Soi Kar Road. Low pedestrian volume related to the other streets is found in this segment and there are not many interesting activities in this area.

Proposed plan for improvement at Rat Uthit 200 Road:

- Utilization of this street to become on-street parking area for people from Ratuthit Songroipi Road and Phangmueang Soi Kar Road.
- Reconfiguration of the space to maximize it for sidewalks and limiting the driving lane into 3 meters width to avoid unexpected speeding.
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.



Current situation at Rat Uthit 200 Road



4.4.6 Road and Connectivity Improvement
Two-directional street design

Jungceylon Road provides an access to the Jungceylon Shopping Center. The pedestrian traffic in this area is not as high as the other segments.

Proposed plan for improvement at Jungceylon Road:

Design between stations:

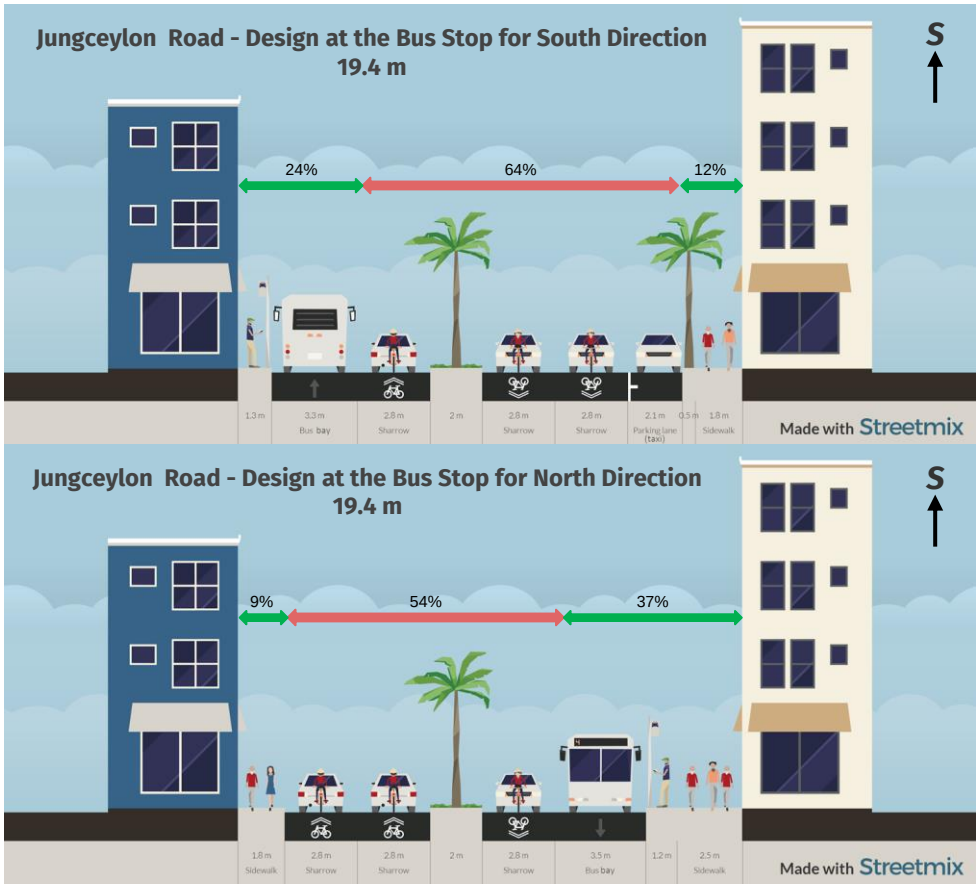
- On-street parking remains at this road.
- Widening sidewalks by reconfiguring the parking space and the driving lanes.
- Speed limit for the motorized vehicle up to 30 km/h.

4.4.6 Road and Connectivity Improvement
Two-directional street design

Design at the station:

- Provision of bus stop facilities and bus bay.
- In-line stop considering the limited space and low speed traffic.
- Interspace the on-street parking with the bus waiting area.

Current situation at Jungceylon Road



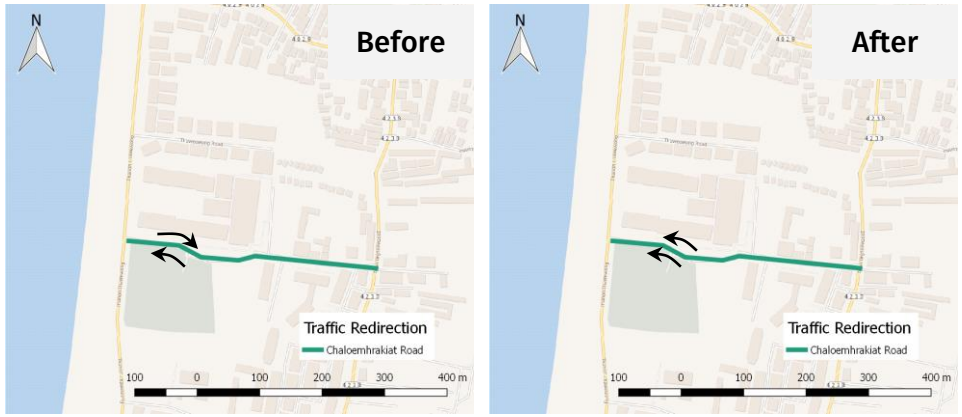
4.4.6 Road and Connectivity Improvement
Two-directional street design

Chaloemhrakiat Road is a two-way street, which connects Thawewong Road and Ratuthit Songroipi Road at the Northern part. It is a narrow street with a width varies between 5-8 meters.

Proposed plan for improvement at Chaloemhrakiat Road:

- Traffic redirection, transform the street into a one-way street. This street has only few interesting activities and does not have enough space for both two-way motorized traffic and pedestrians.
- Direction from East to West. It serves the contra flow of its parallel road (i.e. Hatpatong Road).
- Allocation of space for on-street parking for people coming from Ratuthit Songroipi Road.
- Provision of sidewalks along the street.
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.

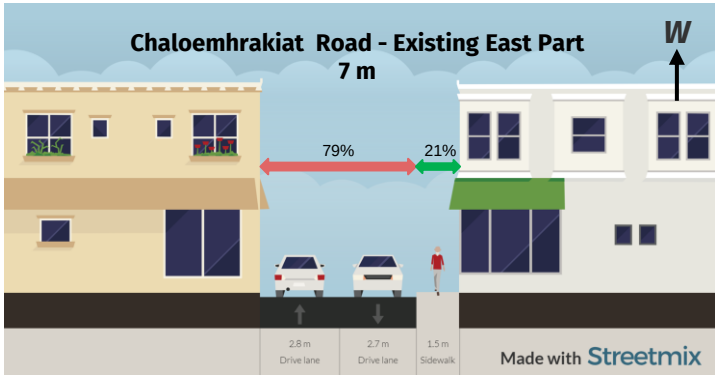
Current situation at Chaloemhrakiat Road

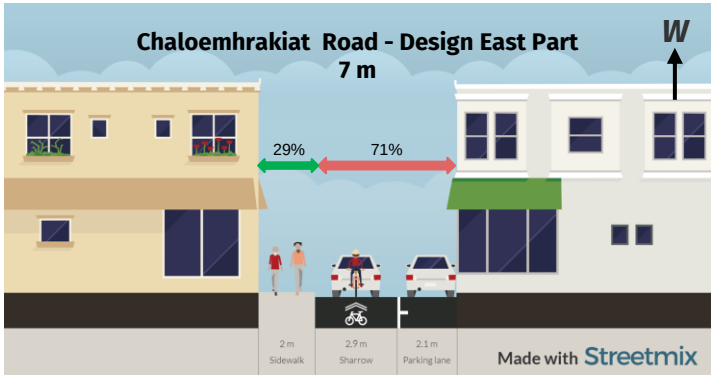


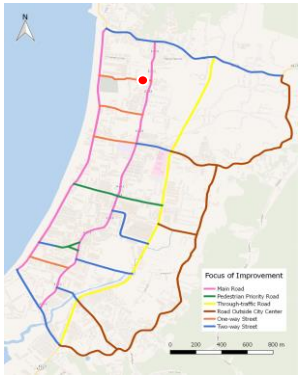
Traffic redirection at Chaloemhrakiat Road

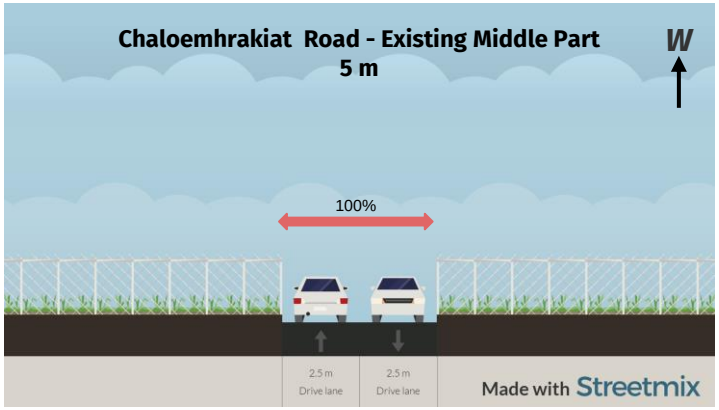
4.4.6 Road and Connectivity Improvement
Two-directional street design

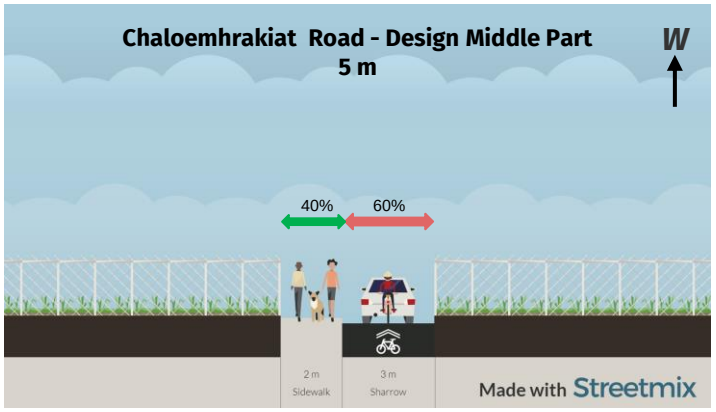
Proposed plan for improvement at Chaloemhrakiat Road

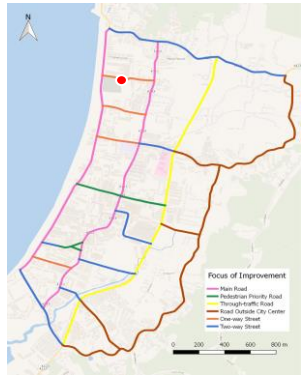


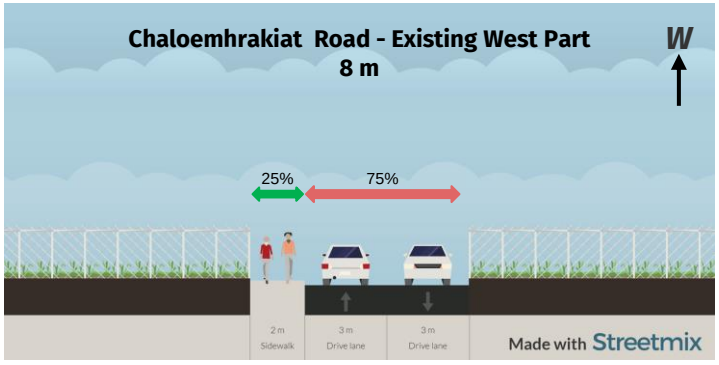


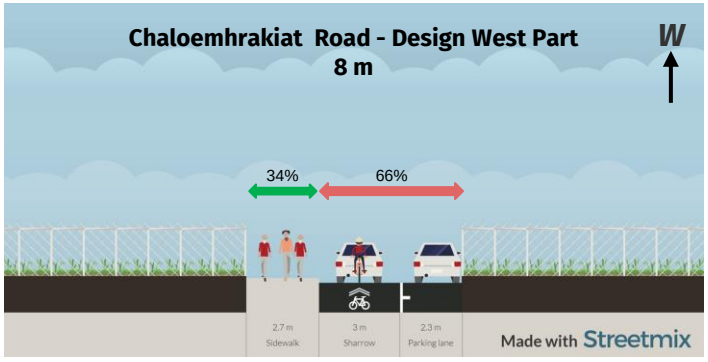


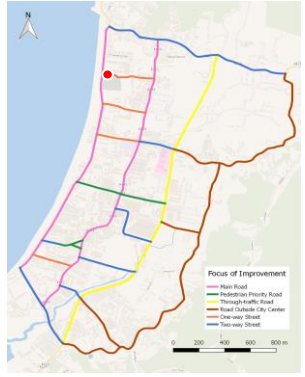






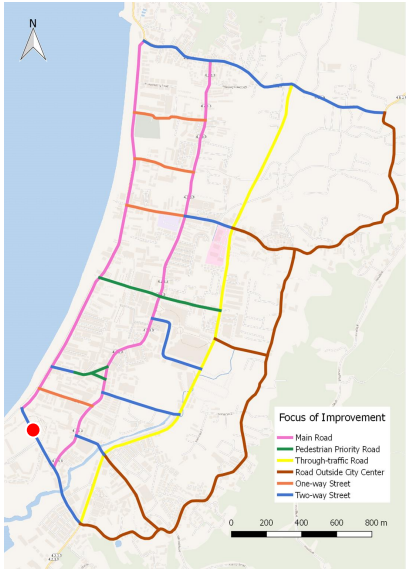






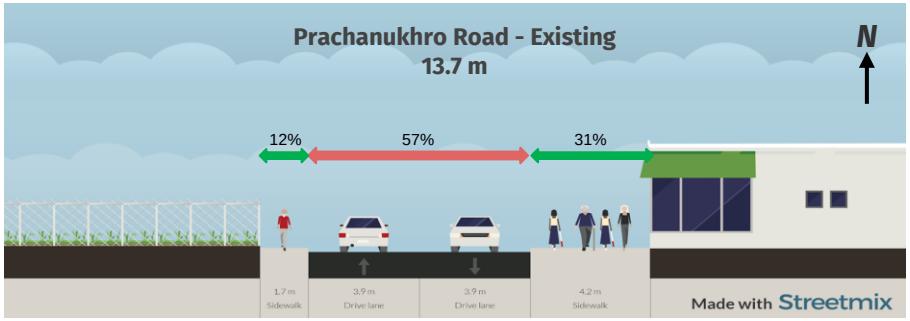
4.4.6 Road and Connectivity Improvement
Two-directional street design

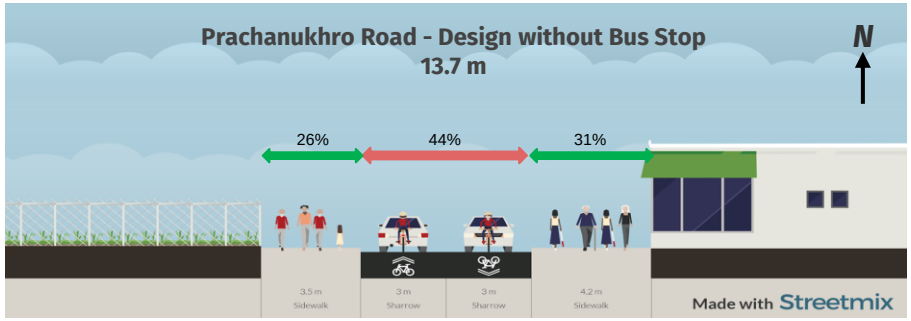
Prachanukhro Road connects the south end of the main roads in Patong.

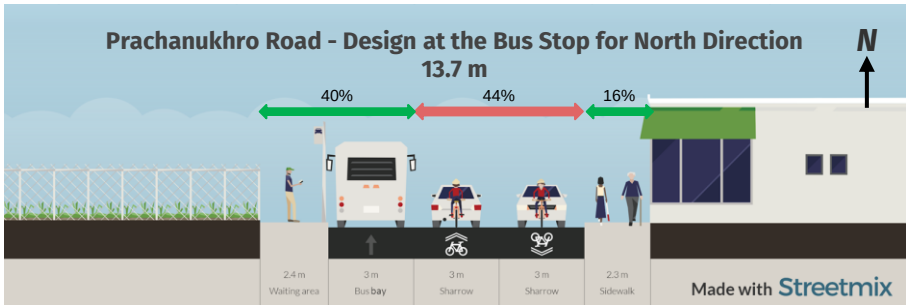


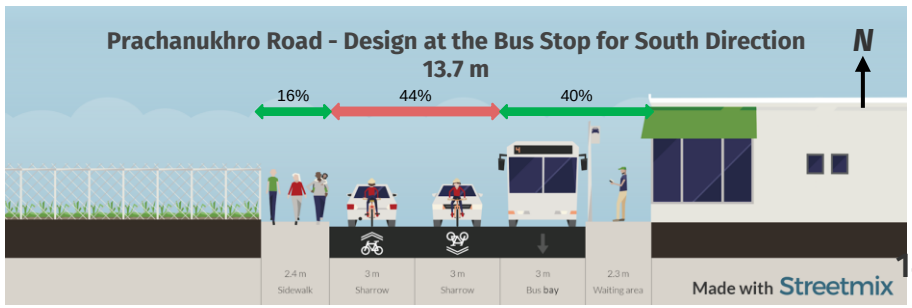
Proposed plan for improvement at Prachanukhro Road:

- Reconfigure the space to allow sidewalks widening.
- Provision of public transport facility in this area, with a bus bay to allow other vehicle to pass.
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.







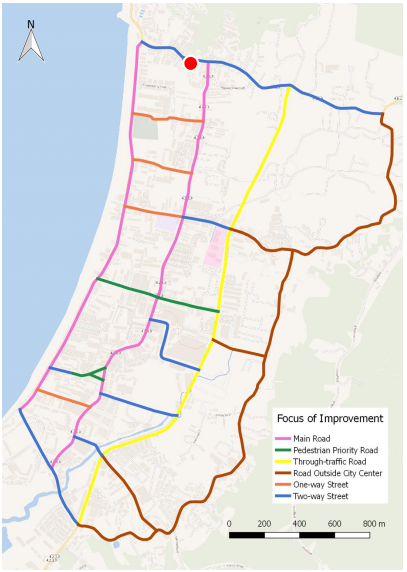


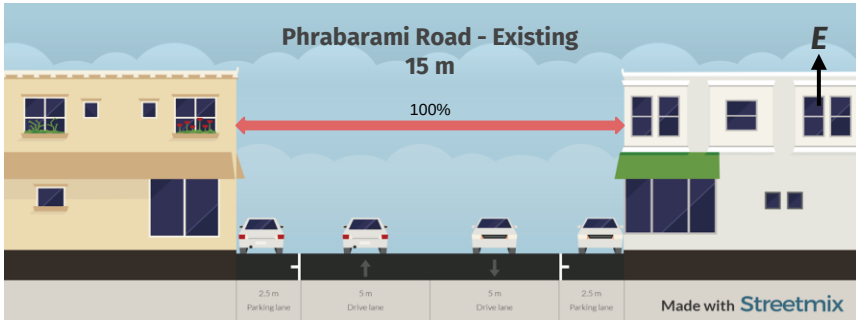
4.4.6 Road and Connectivity Improvement
Two-directional street design

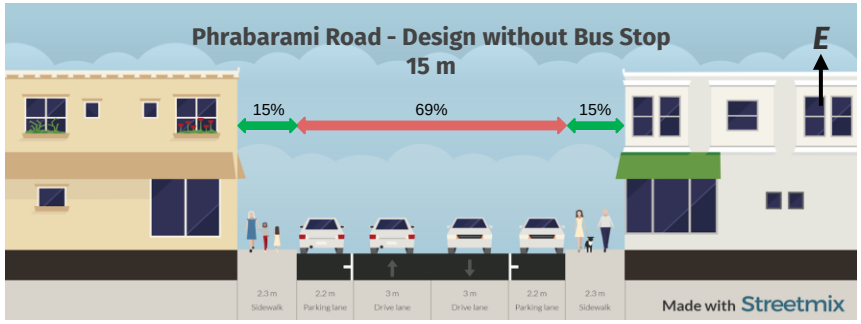
Phrabarami Road is the road that connects the two main roads at the North end. In the current situation, sidewalks do not exist in the most part of the road.

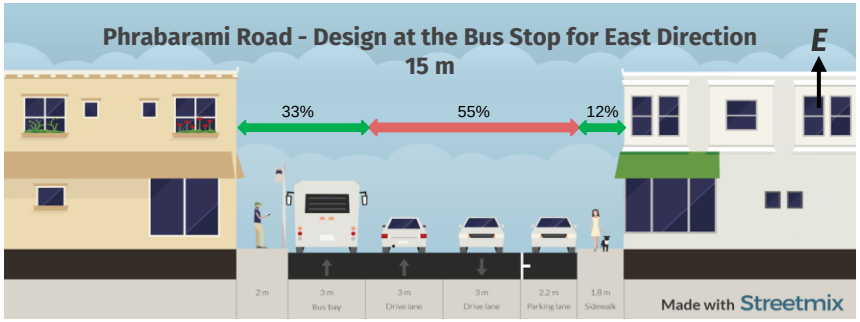
Proposed plan for improvement at Phrabarami Road:

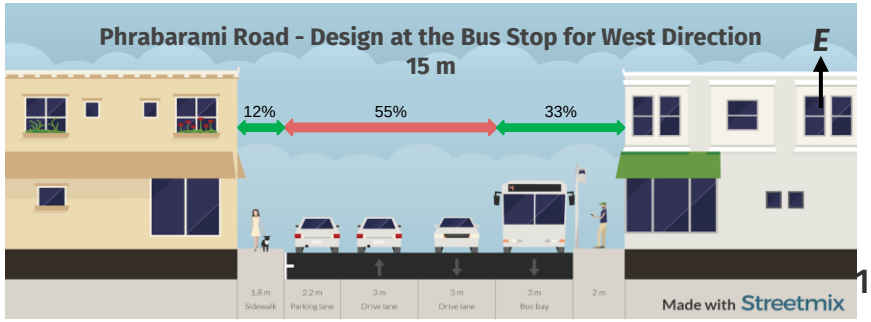
- Reconfigure the space and provide sidewalks for pedestrian.
- On-street parking remains available with 2.2 m width.
- Provision of bus stop and bus bay to accommodate the passengers served by the transit system





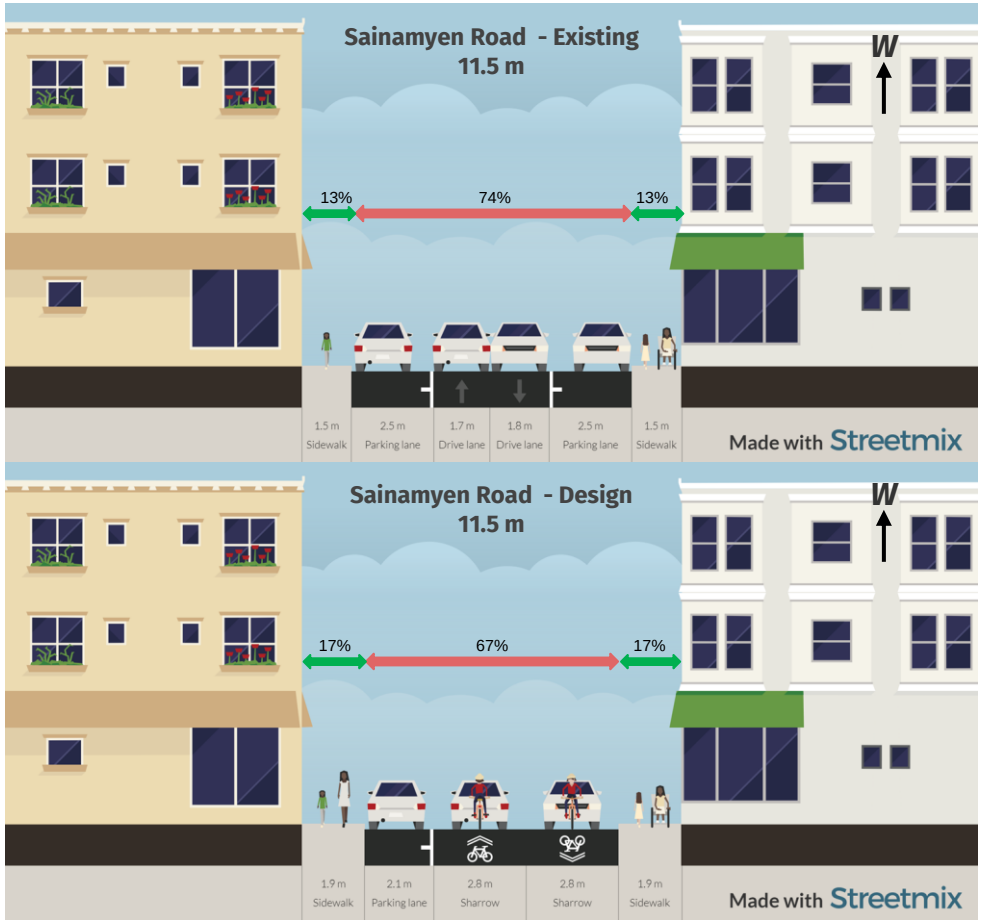






4.4.6 Road and Connectivity Improvement
Two-directional street design

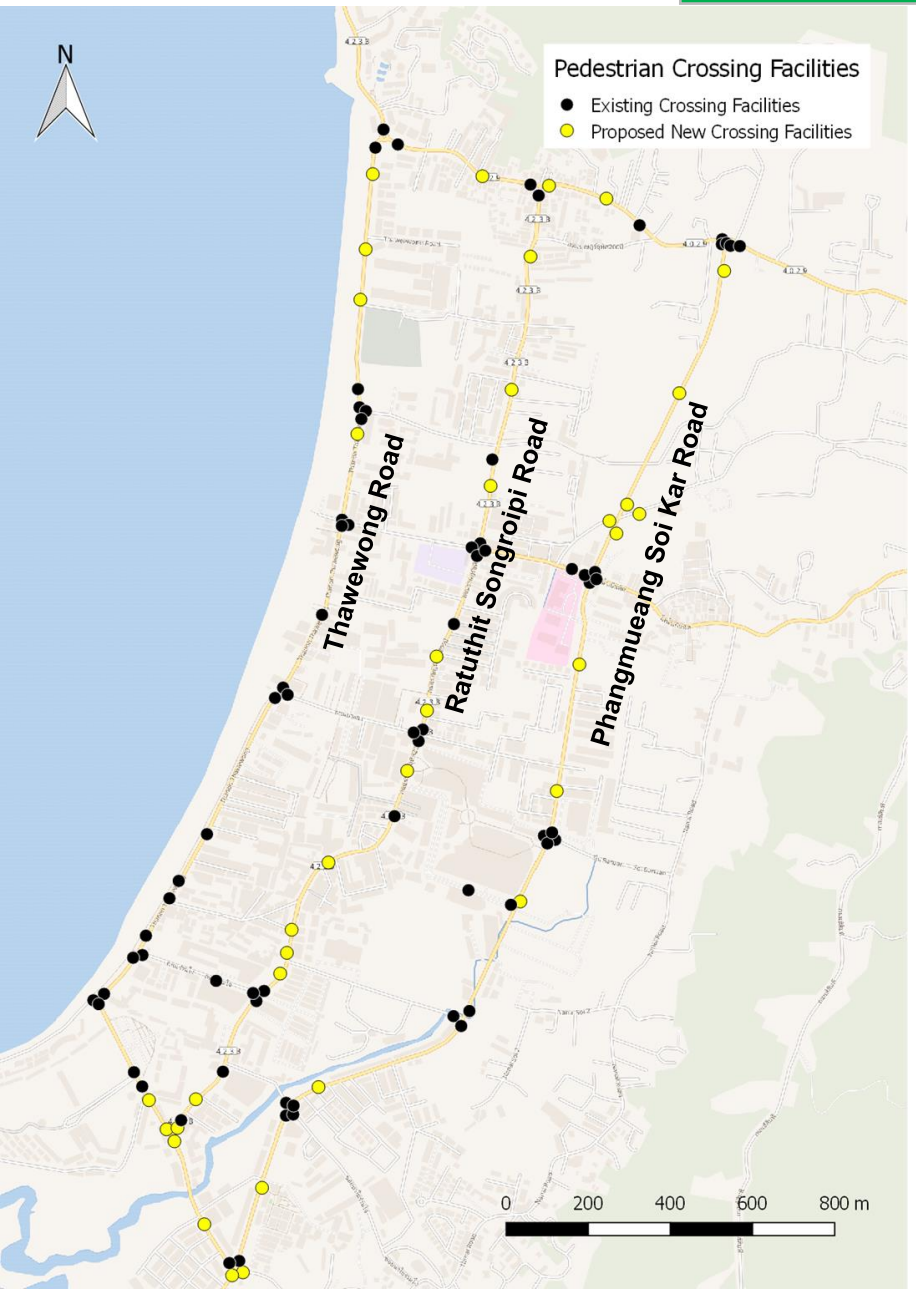
Sainamyen Road connects Phangmueang Road and Ratuthit Songroipi Road. Currently, it has a limited space for sidewalks as well as driving lanes due to provision of the on-street parking.



Proposed plan for improvement at Sainamyen Road:

- Reconfigure the space to allow sidewalks widening.
- On-street parking remains available but only on the left side (facing the West direction).
- Provision of other street elements such as lighting, wayfindings, anti-slip sidewalks paving material, to ensure convenience of the pedestrians.

4.4.7 Crossing Facilities Improvement



Additional Pedestrian crossing locations

The existing crossing facilities have not accommodated the pedestrian crossing activities well. Therefore, several new crossing locations are proposed as shown in the picture on the left.

It is recommended to place the pedestrian crossing facilities at the following locations:

- Intersections
- Near bus stop
- High pedestrian crossing area (mid block crossing)

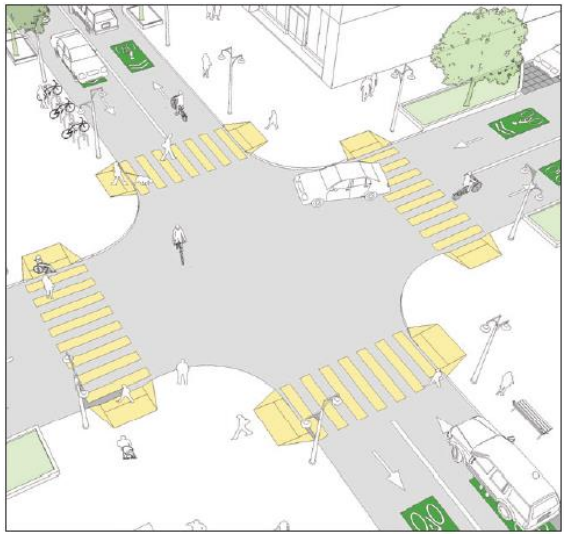


Illustration of pedestrian crossing design at intersection (Source: NACTO)

4.4.7 Crossing Facilities Improvement

Mid-block crossing design

In particular for roads with heavier traffic volume such as ,Phangmueang Soi Kar Road, it is recommended to place refuge island at the pedestrian crossing to protect the pedestrian and shorten the crossing distance.

Existing condition at Phangmueang Soi Kar Road

Pedestrian crossing design with refuge island at intersection (Source: NACTO)

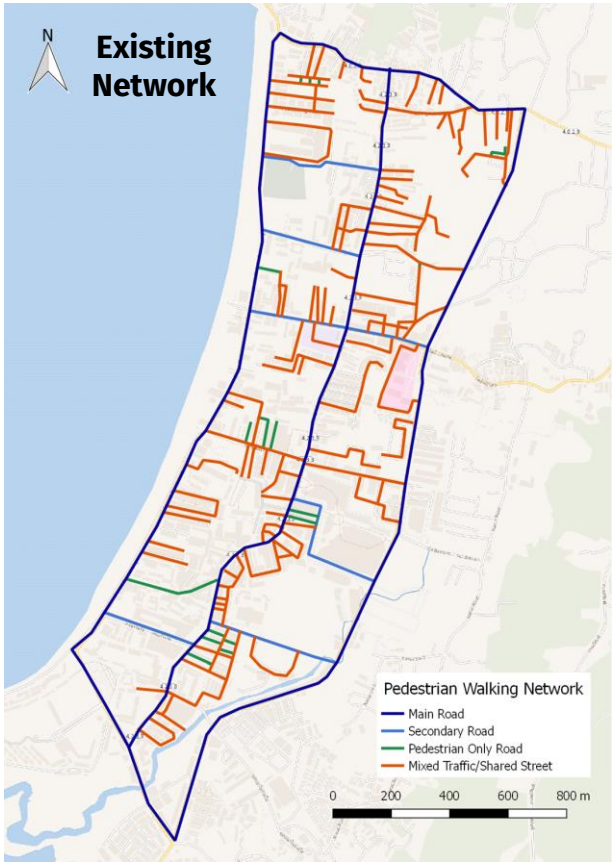
4.4.8 Creating Shorter Pedestrian Access

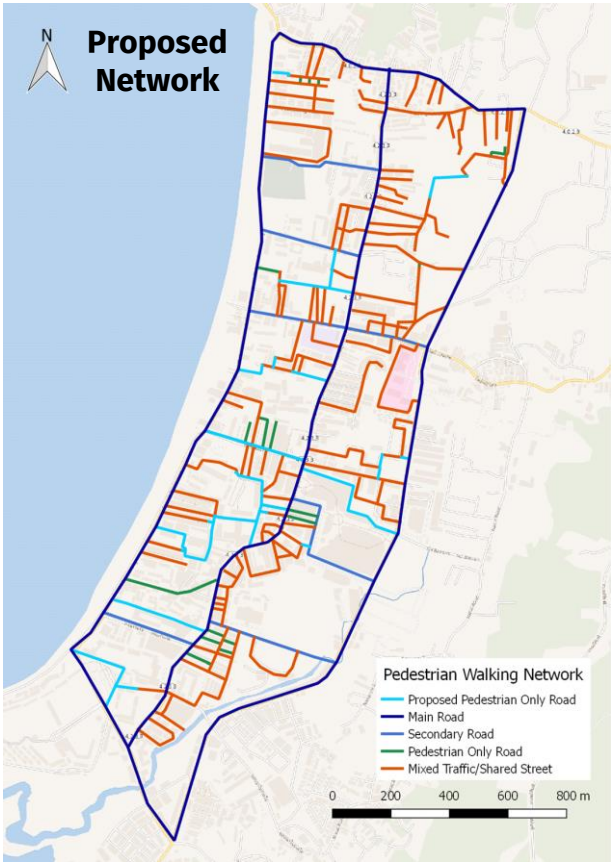
Pedestrian access and wayfindings

To improve pedestrian access to the city center and beachfront area, it is proposed to open pedestrian paths on private properties that can reduce walking distance in between roads.

Wayfindings also need to be provided on those paths, therefore tourists will be well-informed about shortcuts to reach the destinations and give priority for pedestrians as well.

By providing these connections, pedestrians are not only able to walk shorter but also with less vehicles passing on those streets which can ensure more safety and comfortable walking experience for pedestrians.





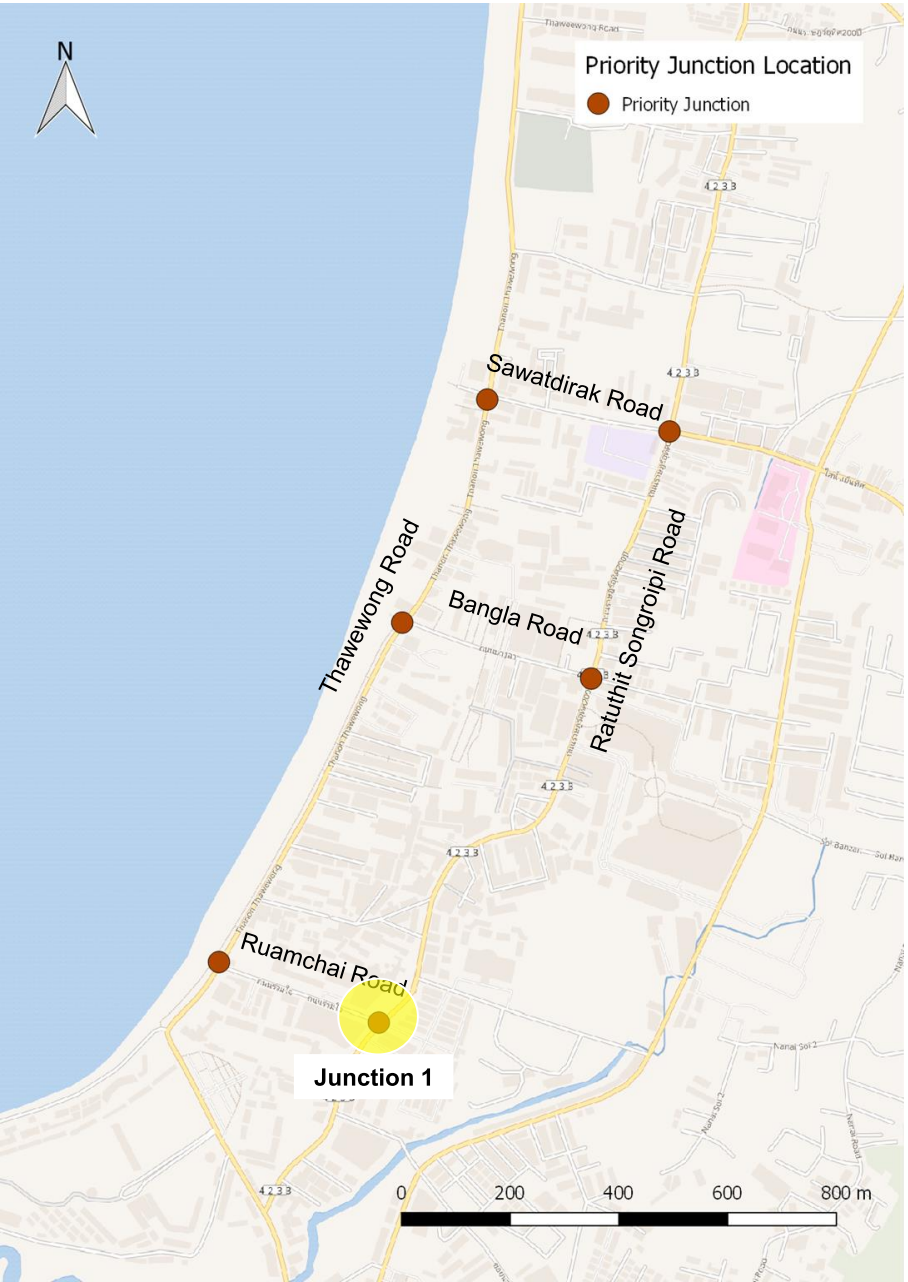
4.4.9 On-street Parking Management

Reclaiming parking space for pedestrians

While prioritizing the space for the pedestrian, the proposed street reconfiguration in the previous chapter suggest to modify the on-street parking, which can be summarized by this figure.

With this proposal, **758 parking spots** are removed to provide more space for the non-motorized vehicle.
At the same time, **53 parking spots** are added at the locations where the traffic volume and pedestrians activities are low.

4.4.10 Junction Design Improvement

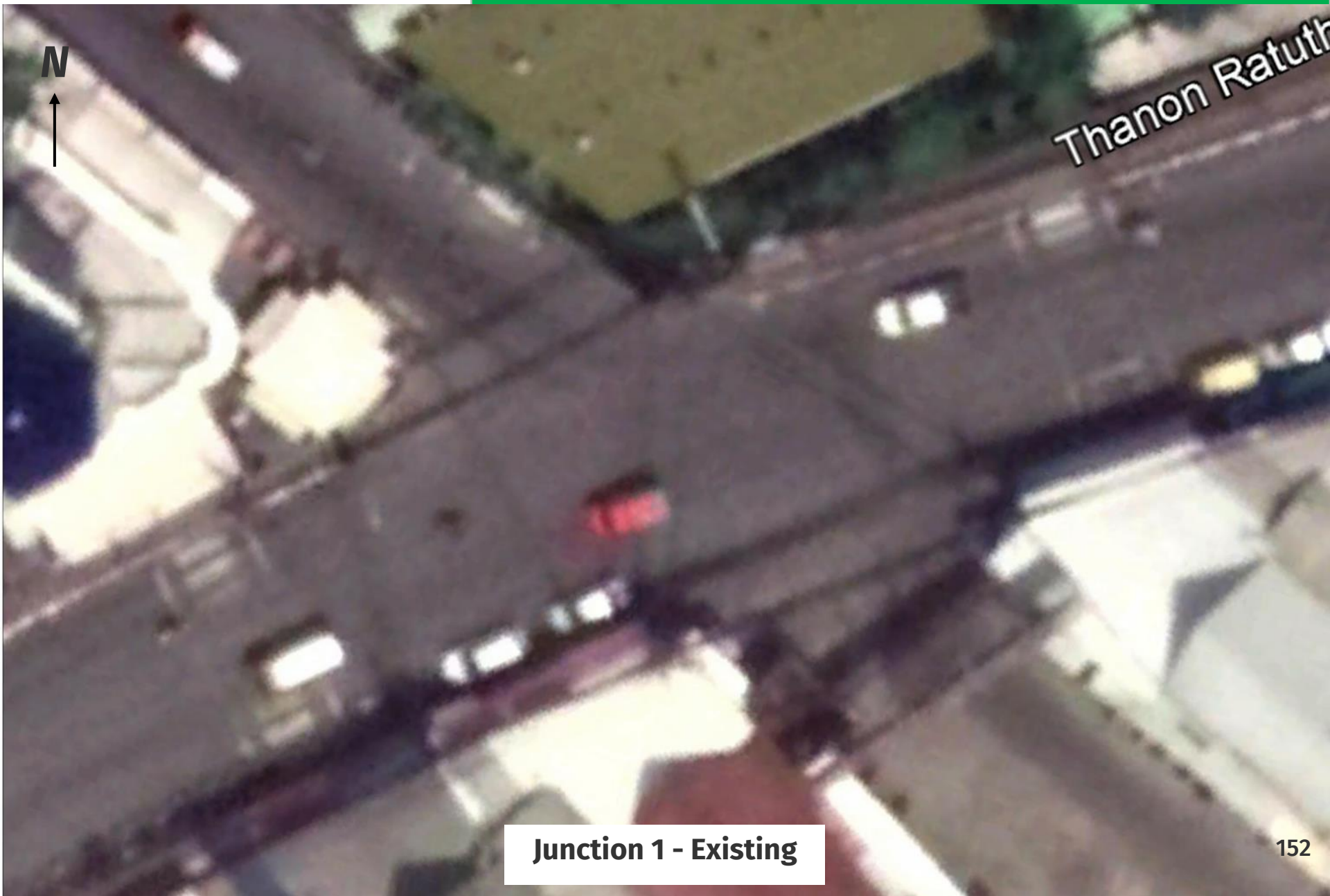


Junction 1

Proposed plan for improvement:

- Adding curb extensions to reduce motorized turning radius
- At-grade crossing for the pedestrians and cyclists
- Protection of bike crossings when there is potential conflict with the turning vehicles and provision of queue box for turn-right bikes
- Buffers for protecting the bike lanes
- Ramps and tactile pavings on pedestrian crossings for universal access
- Pedestrian refuge island in line with parking lane

4.4.10 Junction Design Improvement



Junction 1 - Existing

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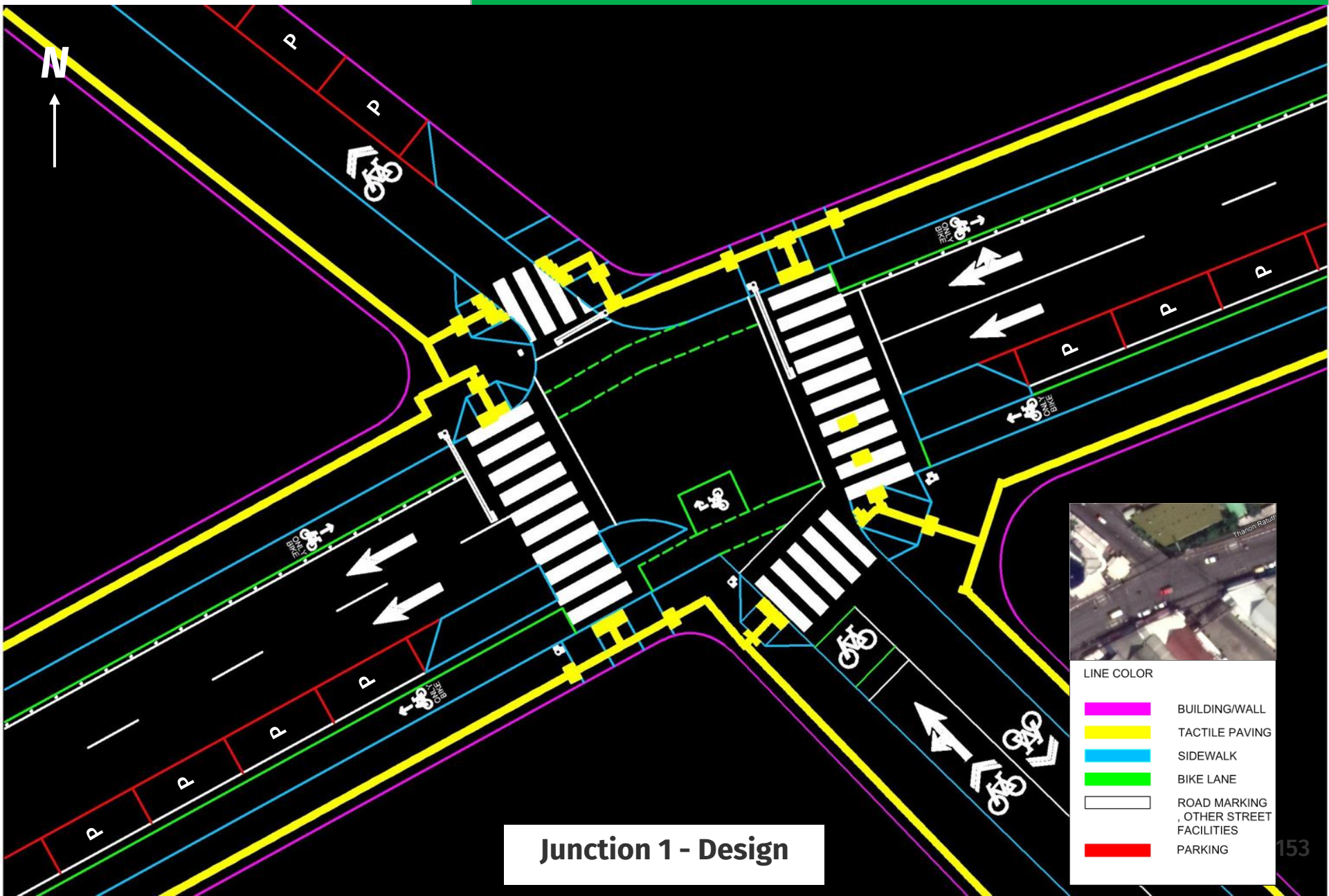
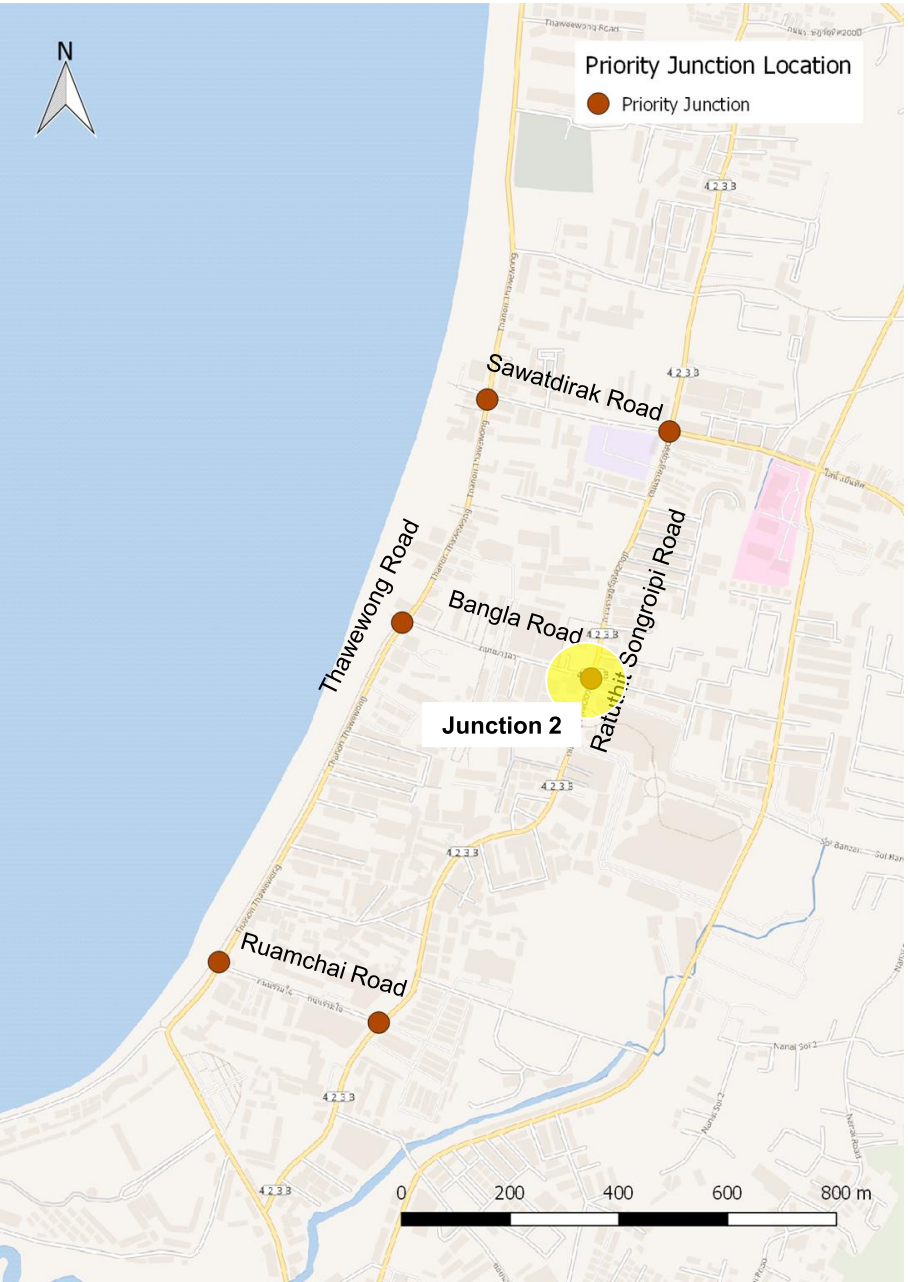
4.4.10 Junction Design Improvement



Junction 1 - Design

4.4.10 Junction Design Improvement



Junction 2

Proposed plan for improvement:

- Buffers for protecting the bike lanes
- Bollards to prevent vehicles entering the pedestrian-only streets
- Adding curb extensions to reduce motorized turning radius.
- At-grade crossing for the pedestrians and cyclists
- Ramps and tactile pavings on pedestrian crossings for universal access
- Pedestrian refuge island in line with parking lane

4.4.10 Junction Design Improvement

Junction 2 - Existing

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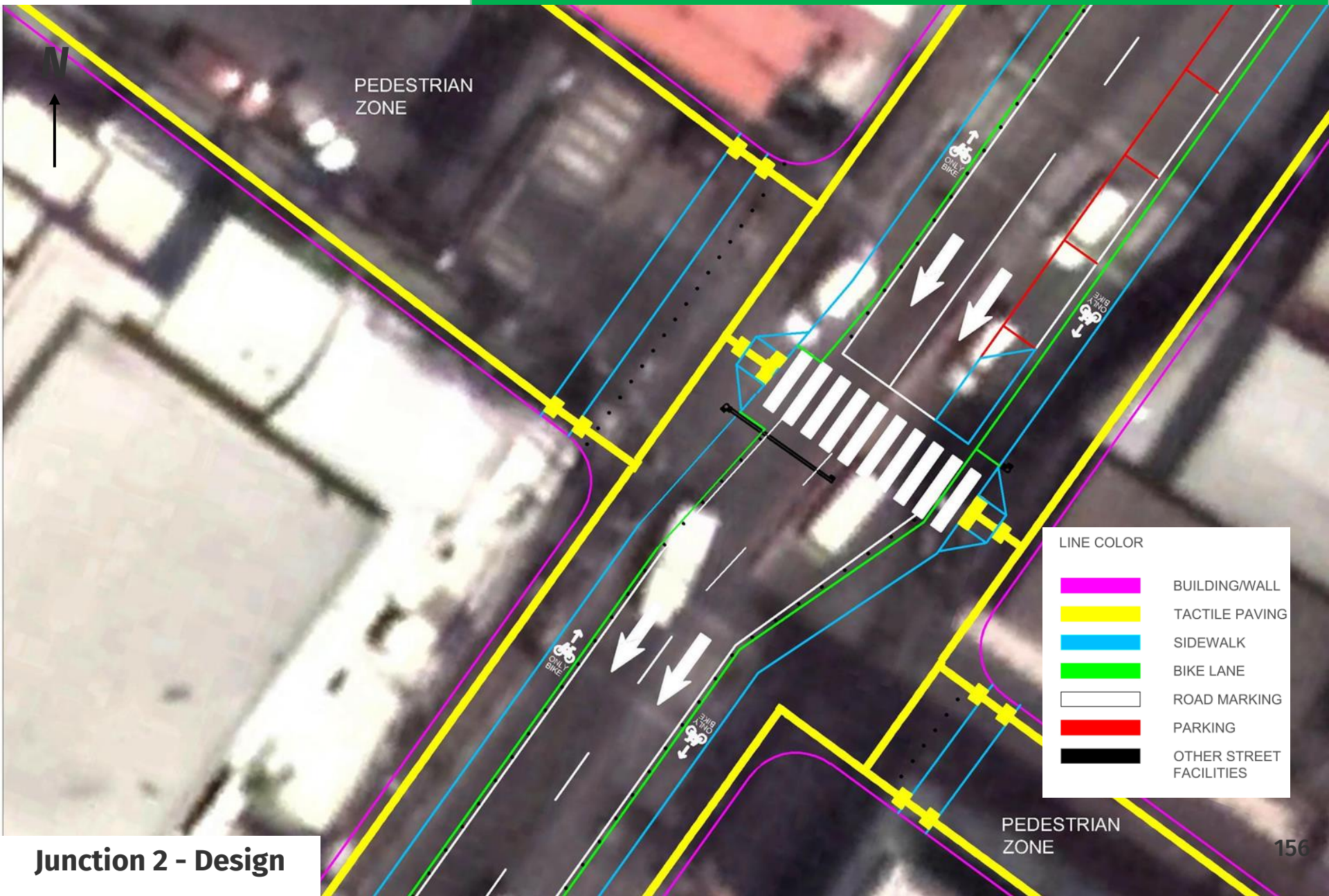
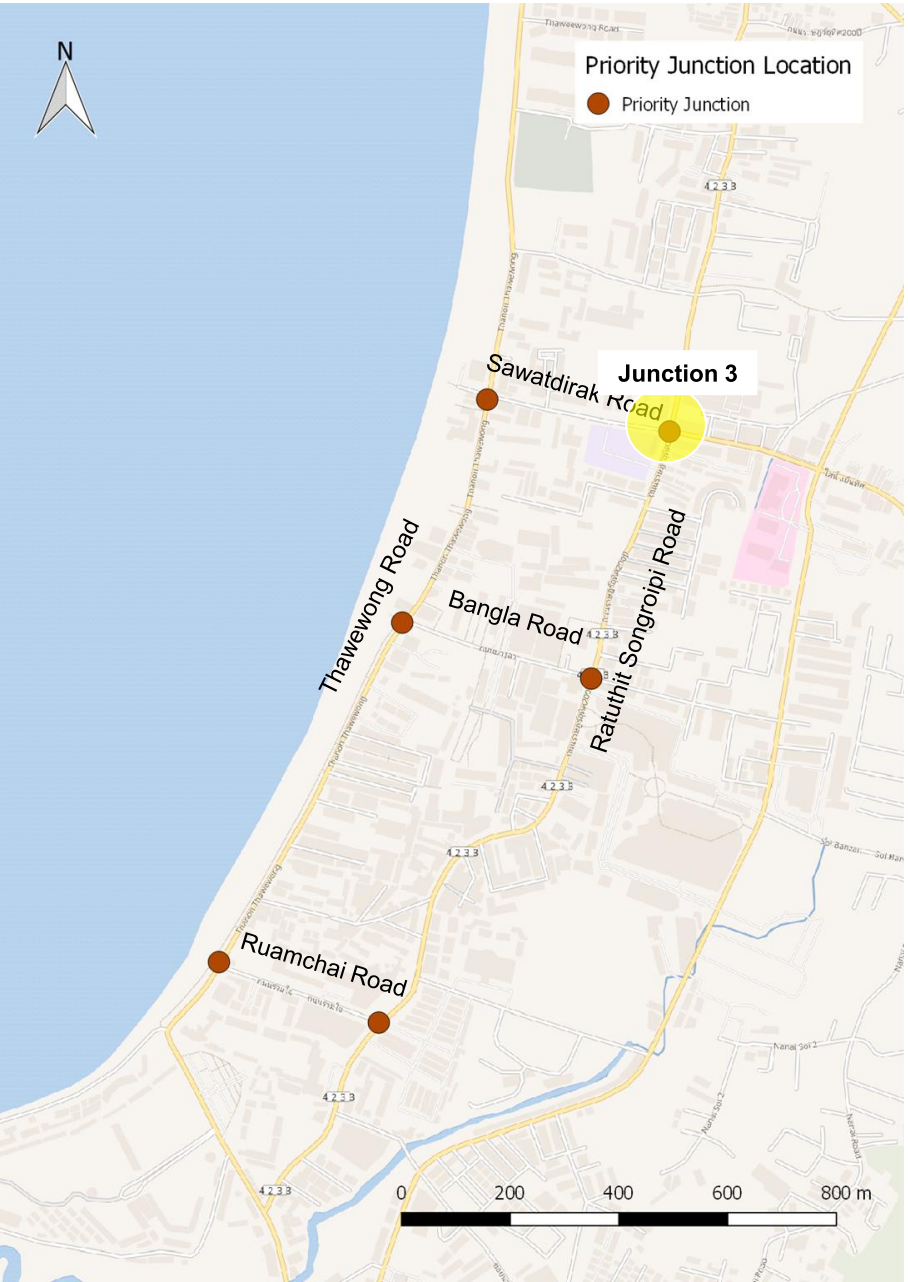
4.4.10 Junction Design Improvement



Junction 2 - Design

4.4.10 Junction Design Improvement

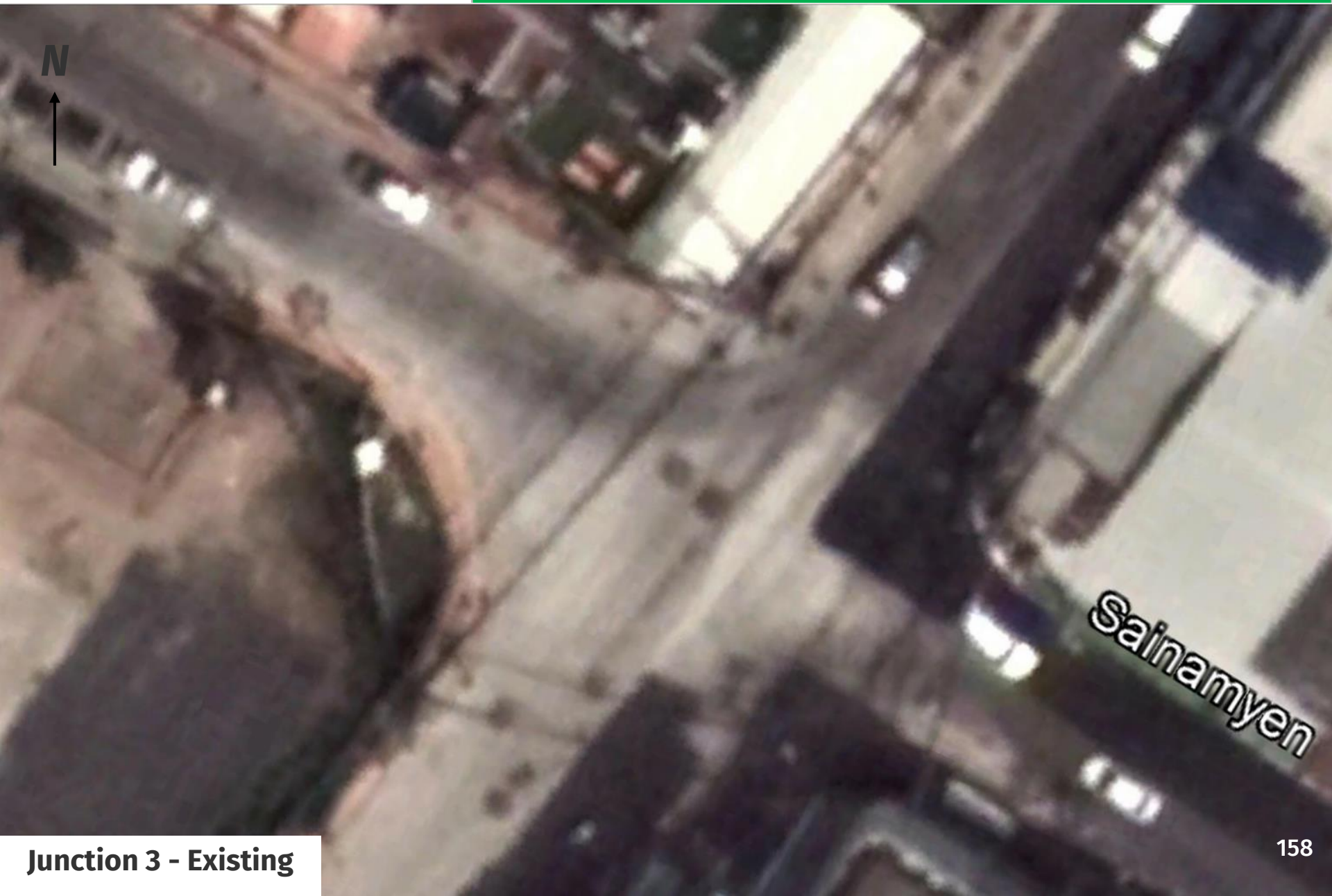


Junction 3

Proposed plan for improvement:

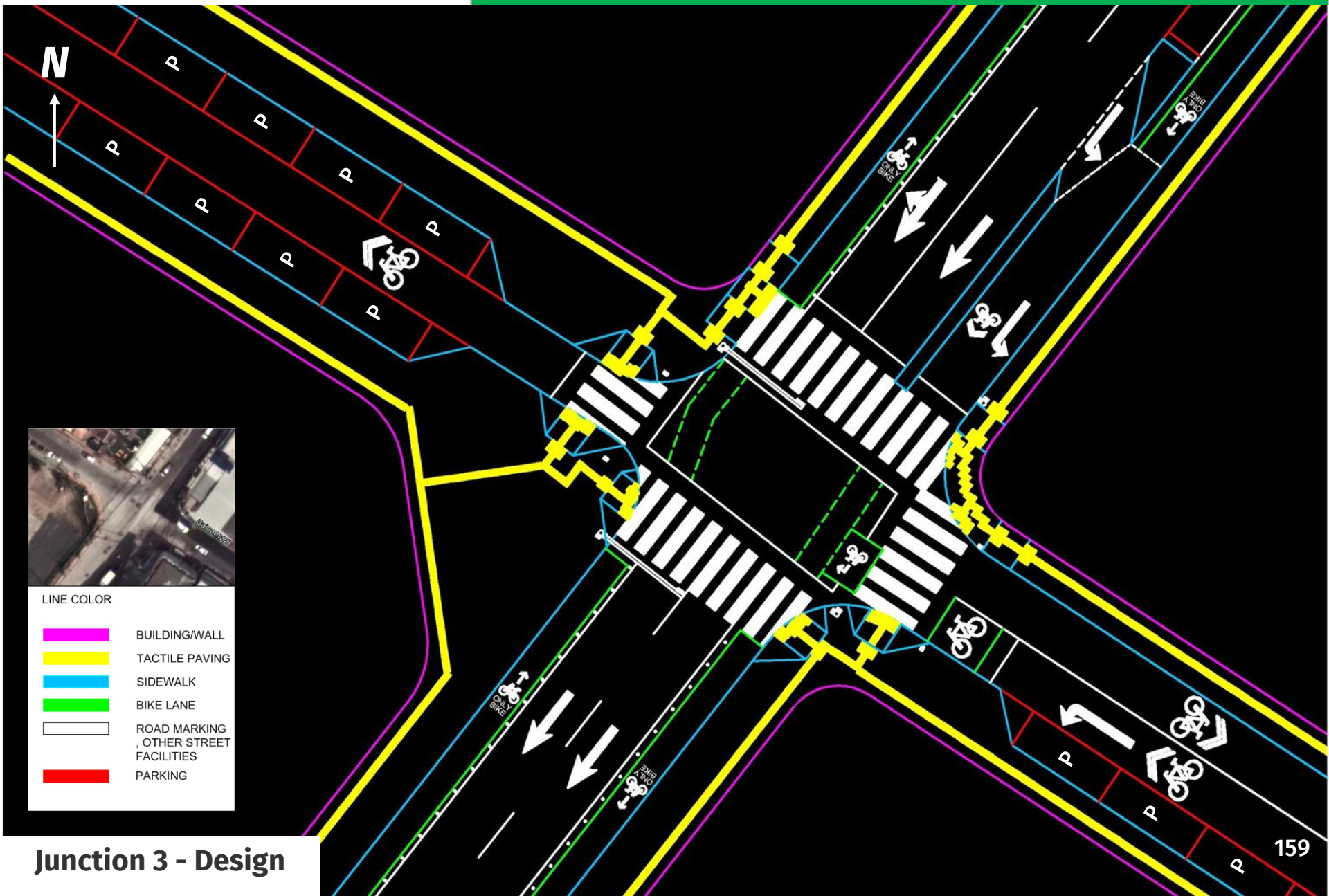
- Adding curb extension to reduce motorized turning radius
- Buffers for protecting the bike lanes
- At-grade crossing for the pedestrians and cyclists
- Ramps and tactile pavings on pedestrian crossings for universal access
- Bike box before the intersection to prevent conflict with turning-left vehicles
- Queue box for turning-right bikes
- Mixing zone to ease turning-left bikes and vehicles

4.4.10 Junction Design Improvement



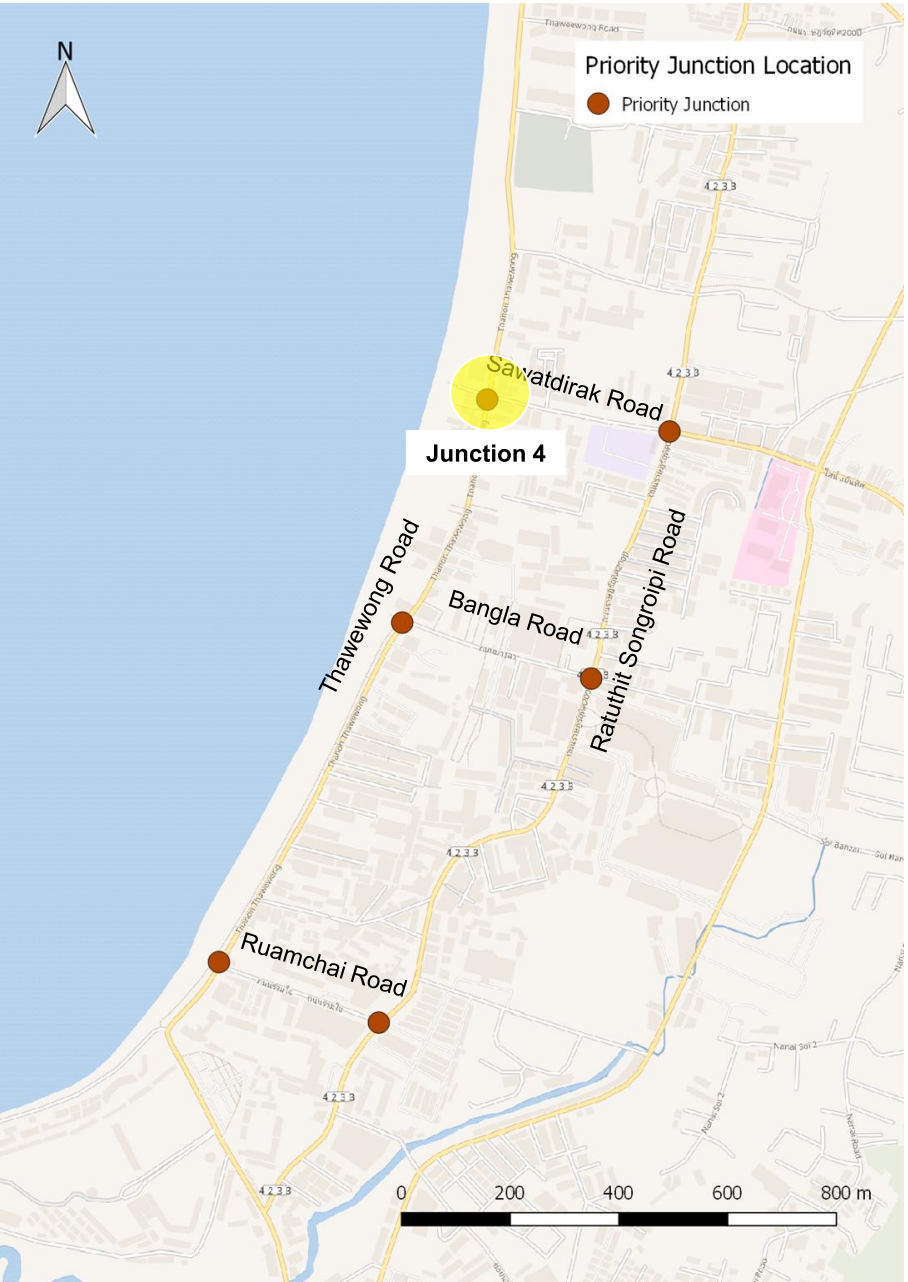
Junction 3 - Existing

4.4.10 Junction Design Improvement



Junction 3 - Design

4.4.10 Junction Design Improvement

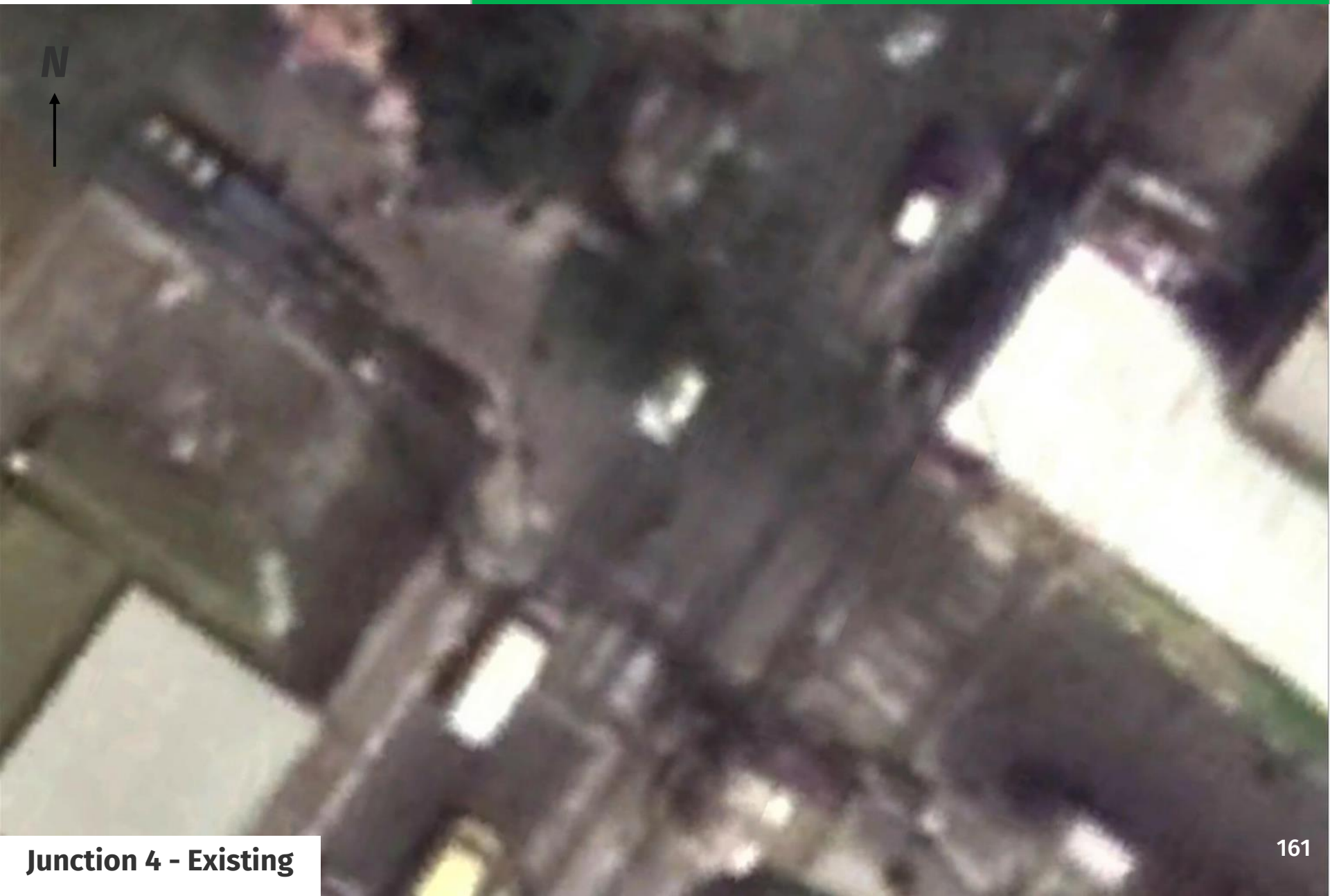


Junction 4

Proposed plan for improvement:

- Bollards to prevent vehicles entering the pedestrian-only streets
- Adding curb extension to reduce motorized turning radius
- At-grade crossing for the pedestrians and cyclists
- Ramps and tactile pavings on pedestrian crossings for universal access
- Bike box before the intersection to prioritize the bike to enter the dedicated bike lanes and prevent conflict with the turning vehicles

4.4.10 Junction Design Improvement

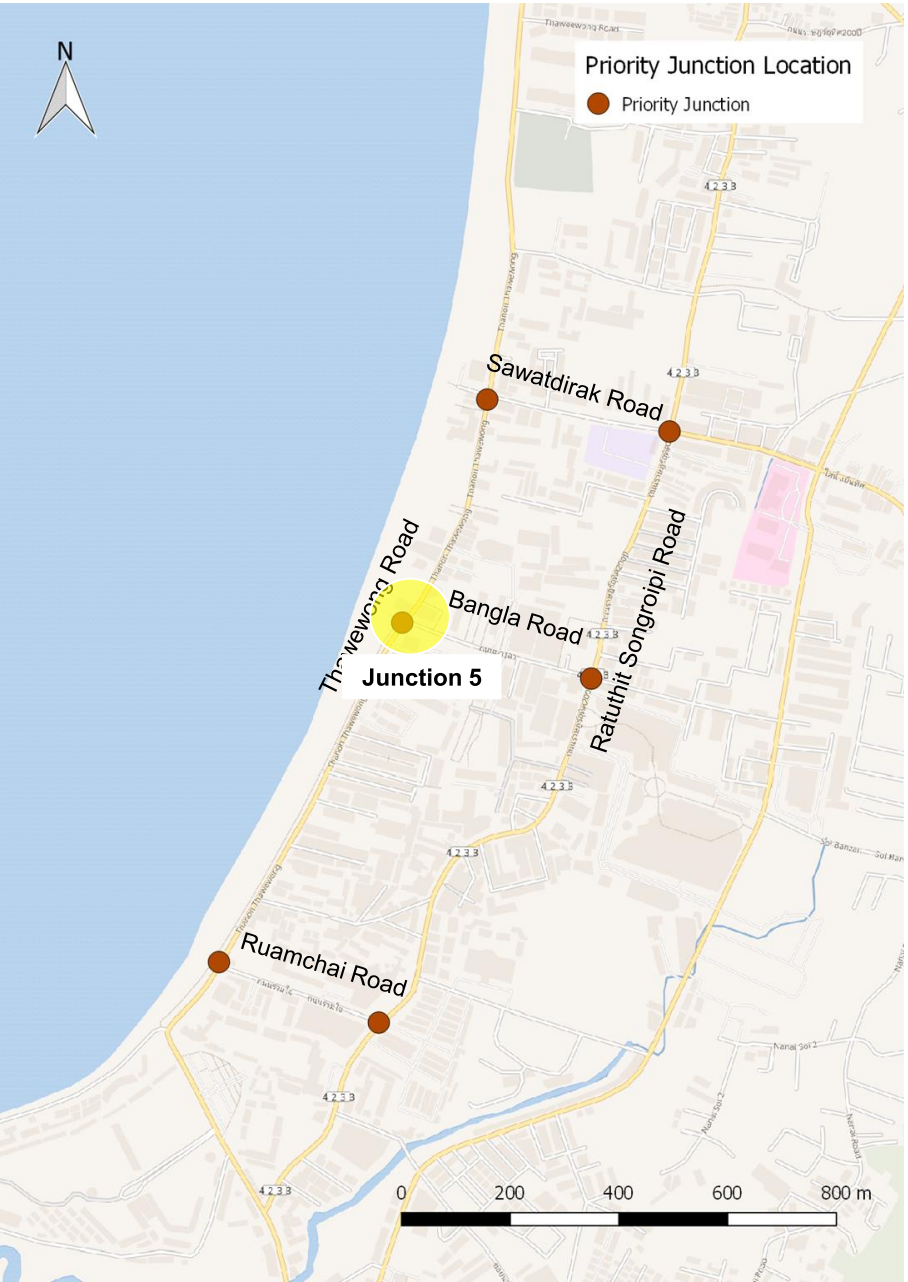


Junction 4 - Existing

4.4.10 Junction Design Improvement

Junction 4 - Design

4.4.10 Junction Design Improvement

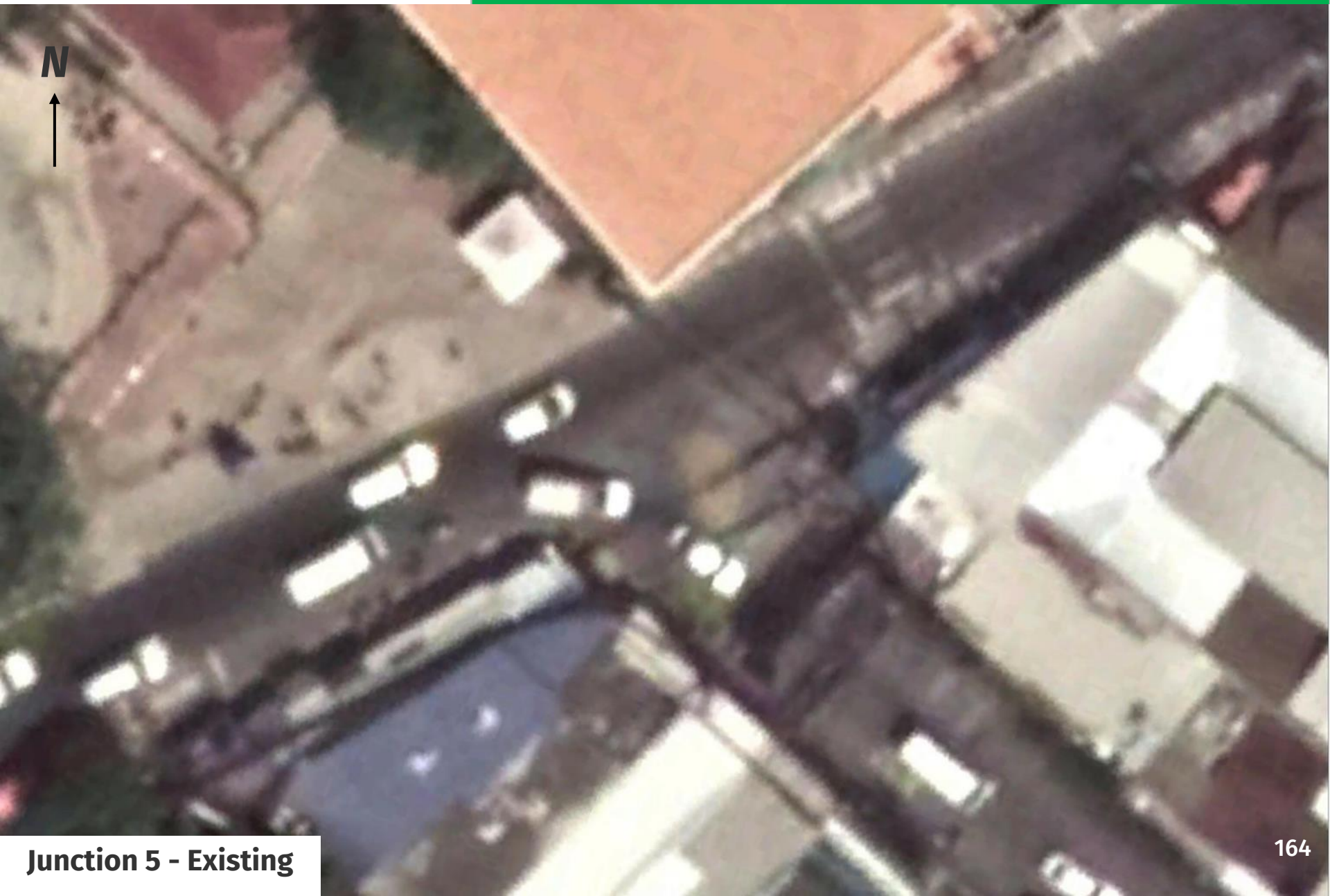


Junction 5

Proposed plan for improvement:

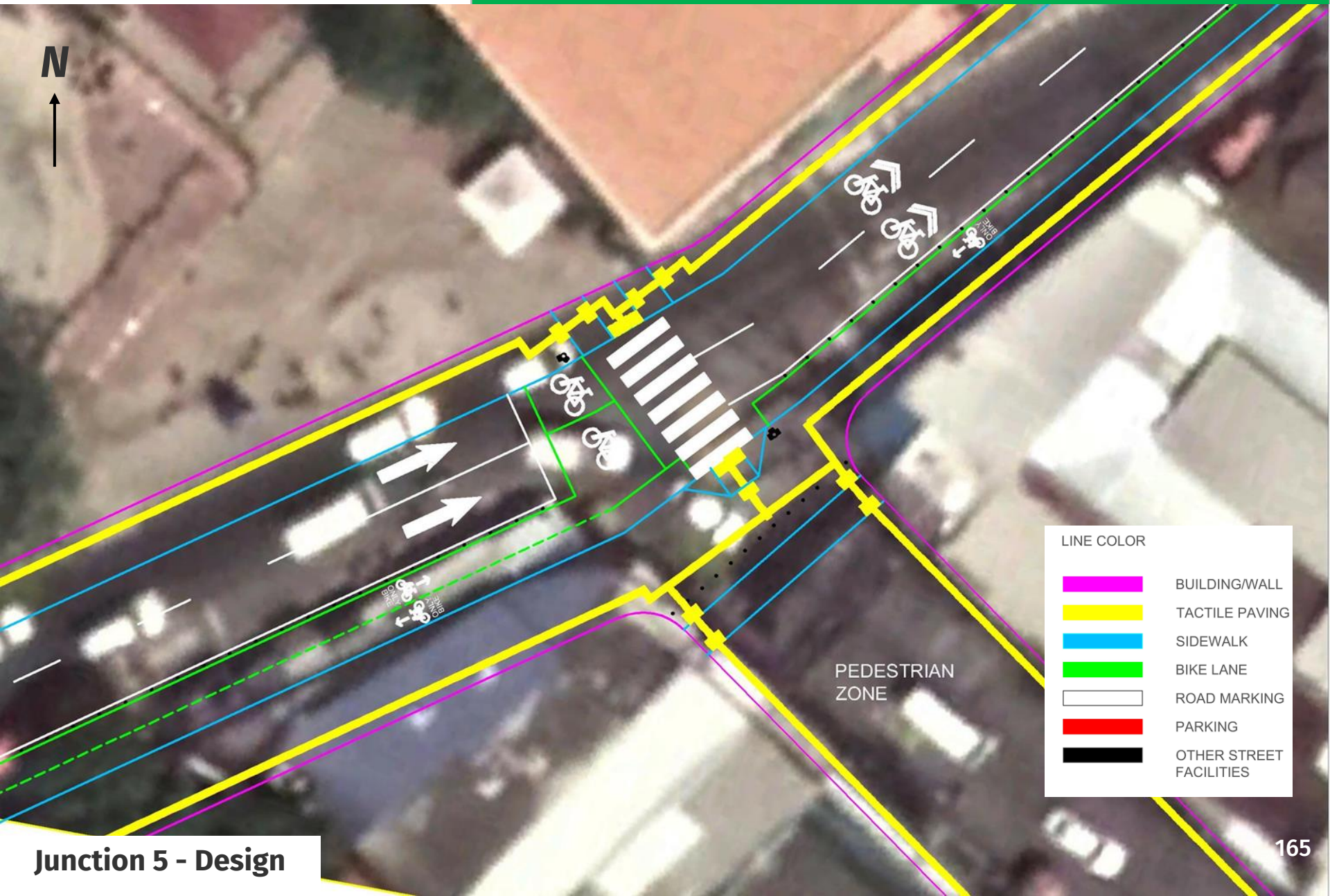
- Bollards to prevent vehicles entering the pedestrian-only streets
- Adding curb extension to reduce motorized turning radius
- At-grade crossing for the pedestrians and cyclists.
- Ramps and tactile pavings on pedestrian crossings for universal access
- Bike box before the intersection to ease the bikes entering the sharrow area

4.4.10 Junction Design Improvement



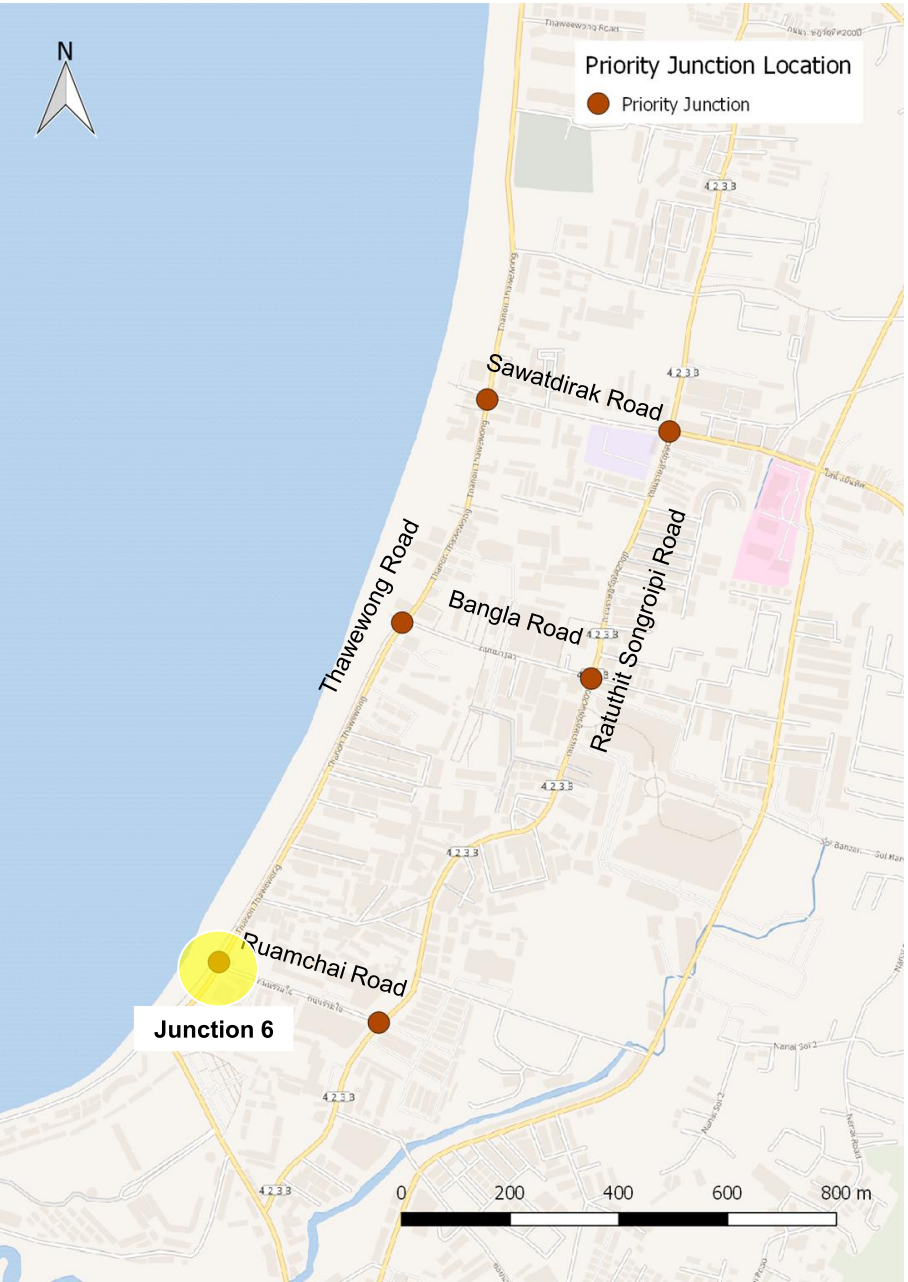
Junction 5 - Existing

4.4.10 Junction Design Improvement



Junction 5 - Design

4.4.10 Junction Design Improvement

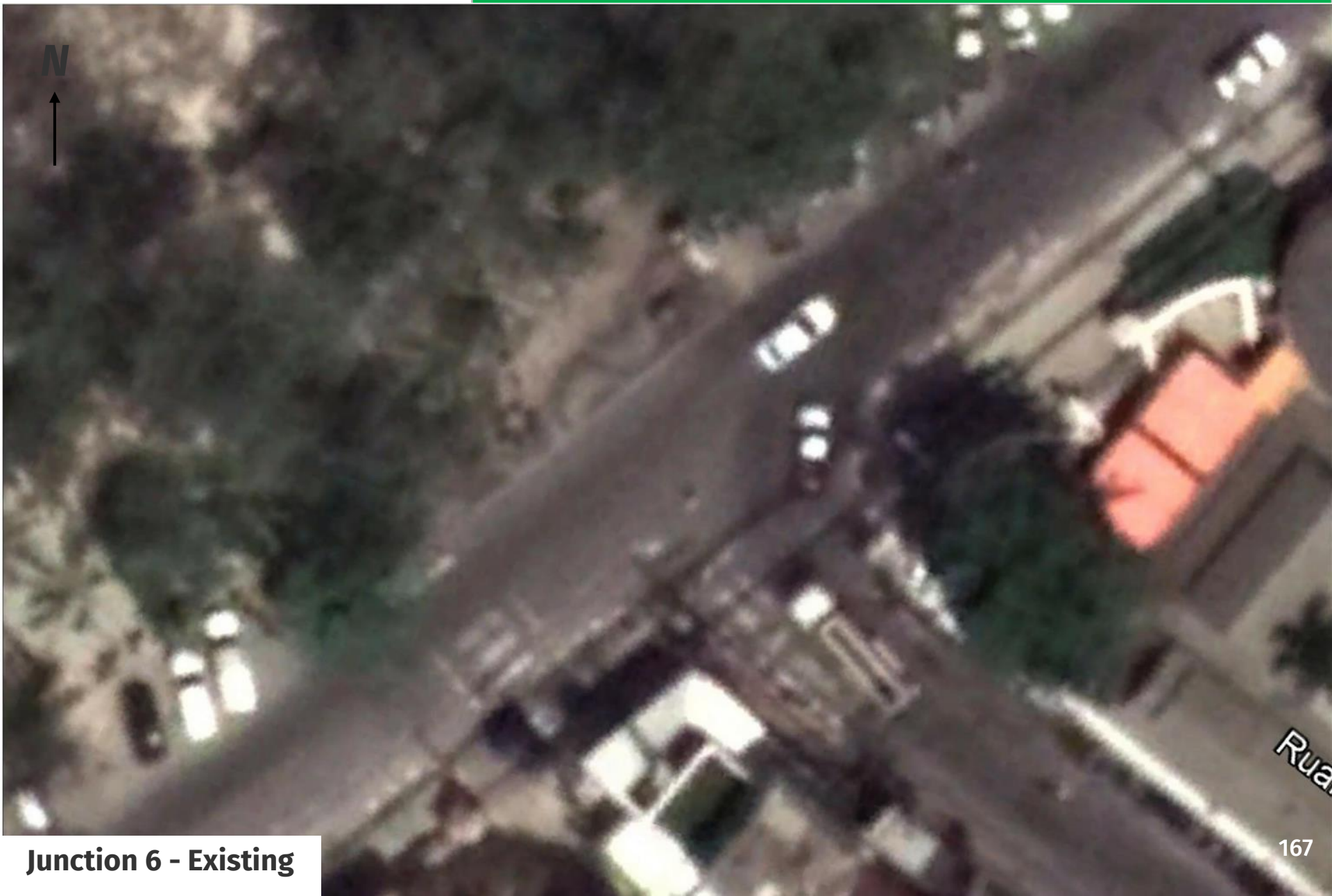


Junction 6

Proposed plan for improvement:

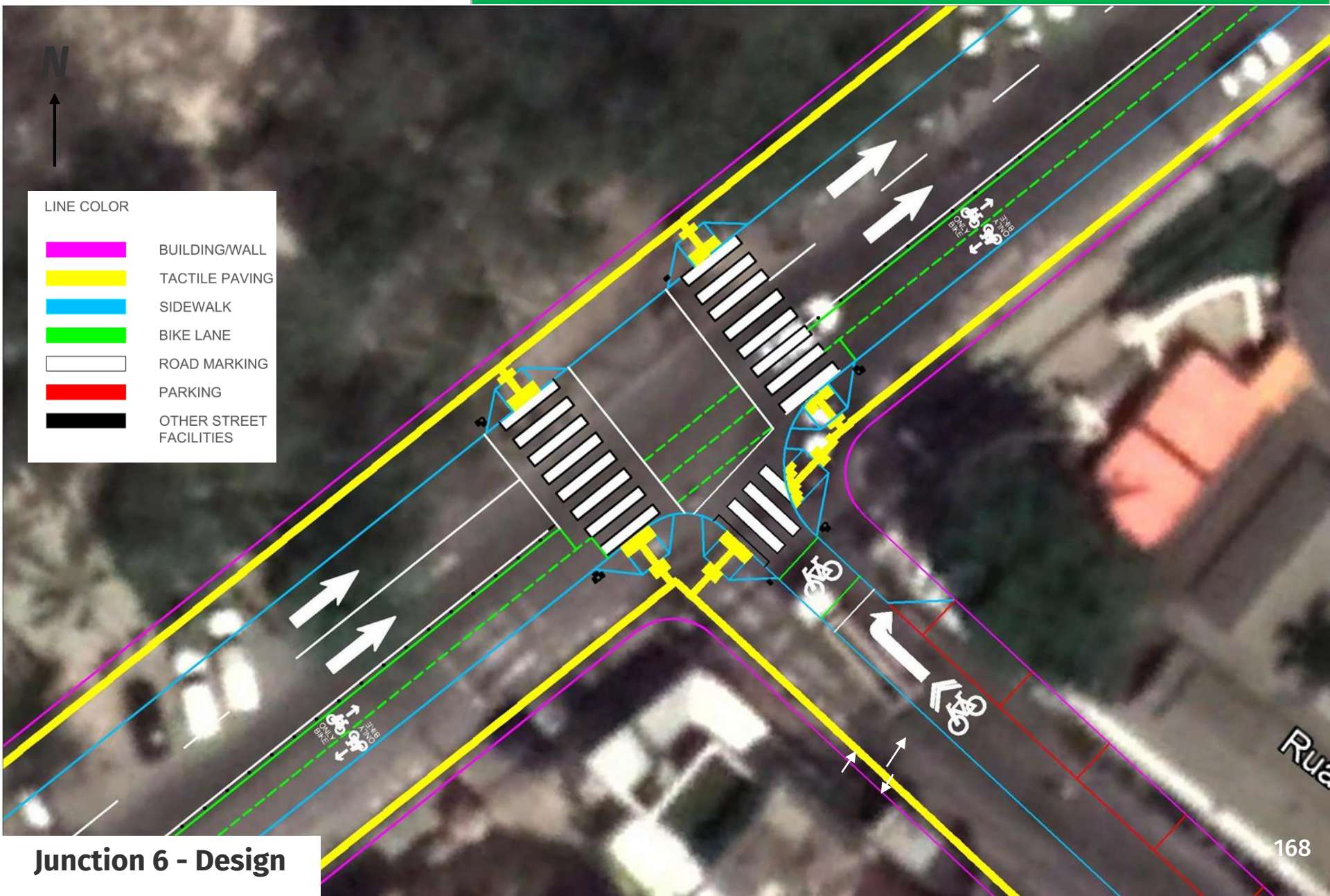
- Adding curb extension to reduce motorized turning radius
- At-grade crossing for the pedestrians and cyclists
- Ramps and tactile pavings on pedestrian crossings for universal access
- Protection of bike crossings when there is potential conflict with the turning vehicle
- Bike box to prevent conflict with the turning vehicles

4.4.10 Junction Design Improvement



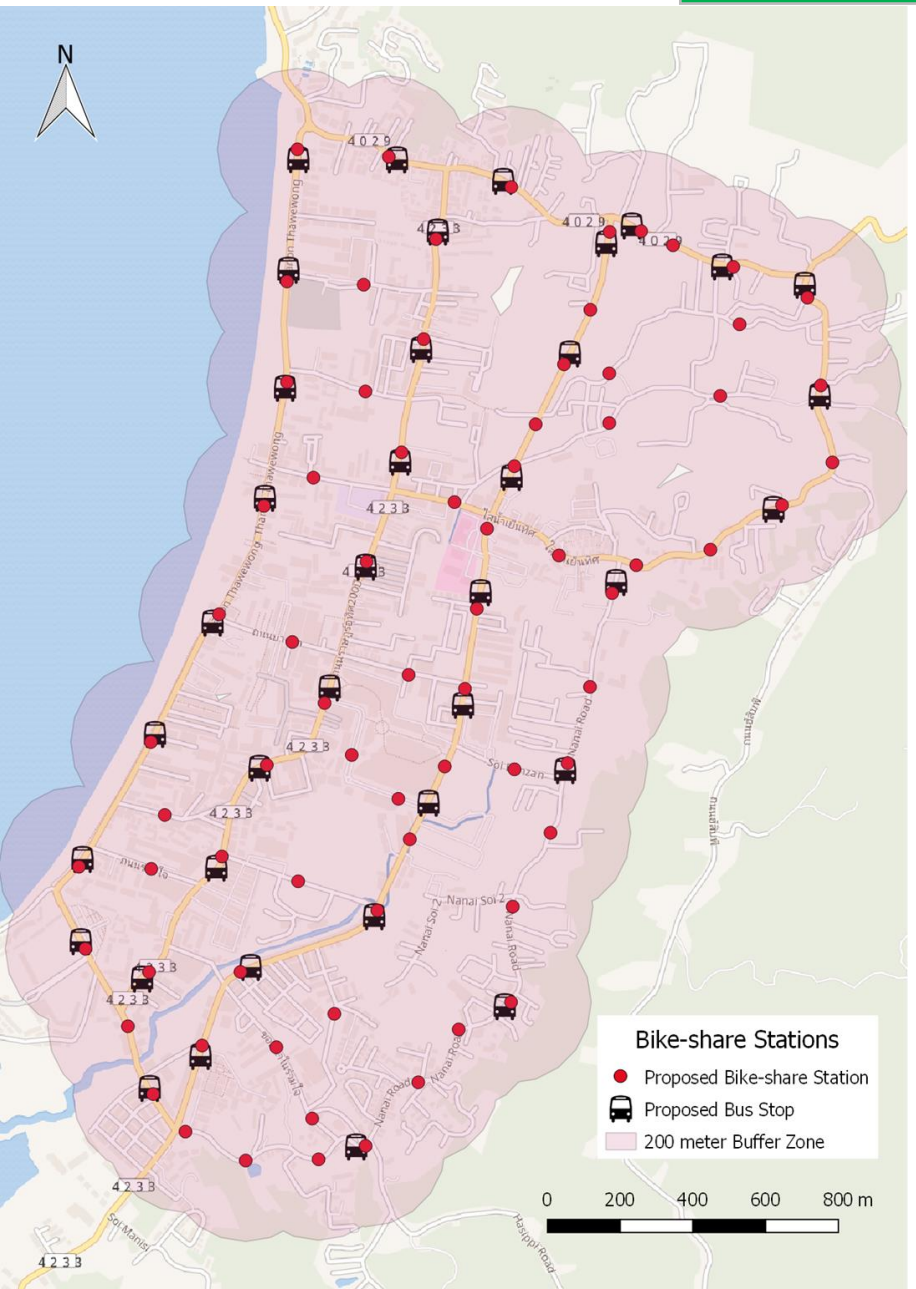
Junction 6 - Existing

4.4.10 Junction Design Improvement



Junction 6 - Design

4.4.11 Bike-sharing and Bike Network Plan



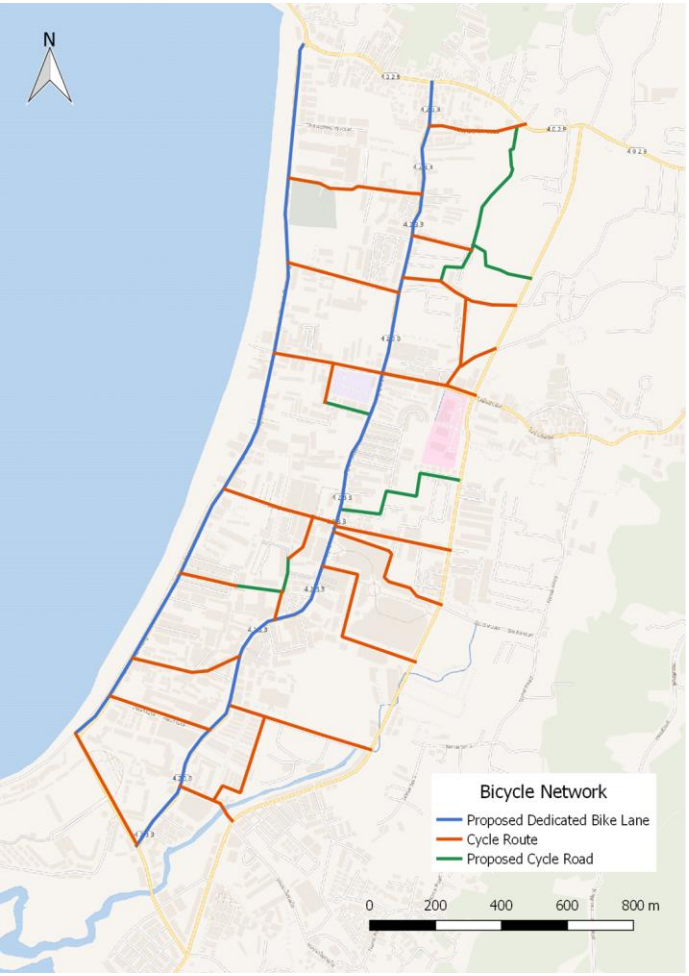
Bike-sharing

In order to promote cycling as one of the transportation modes in Patong, bike-sharing system is proposed to be implemented on all areas of the city. Bike-share allows people to borrow bikes from the nearest bike-share stations available for short trips around the city. It is also a part of public transport as the system is connected to the public transport network.

Bike-share stations should be located at bus stops, high density areas such as residential areas, and high demand areas such as shopping centers, hotels, restaurants, and other tourist attractions. Distances between stations should not exceed the walking distance so that people will be more encouraged to cycle.

Number of Bike-share Stations	Estimated Number of Bicycles at Stations	Total
54 (main roads)	20	1,365
19 (other roads)	15	

4.4.11 Bike-sharing and Bike Network Plan



Bike Network Plan at City Center

To ensure safety and comfortable cycling environment, dedicated bike lanes are proposed to be implemented at Thawewong Road and Ratuthit Songroipi Road.

However, other roads can be used as cycle roads to form a cycle network in Patong. At this network, priority should be given to cyclists than to private vehicles. Signage and other cycle facilities, especially at junctions, are to be provided along the network.

A cyclist in Patong

Example of bicycle route at shared street

4.5 Local Public Transport for Patong

4.5.1 Public Transport Overview

Most visitors in Patong are tourists, both domestic and foreign, where most of them come with minivans, private cars, and only a few with buses. Motorcycle rent is also popular since there are limited numbers of public transport available within the city.

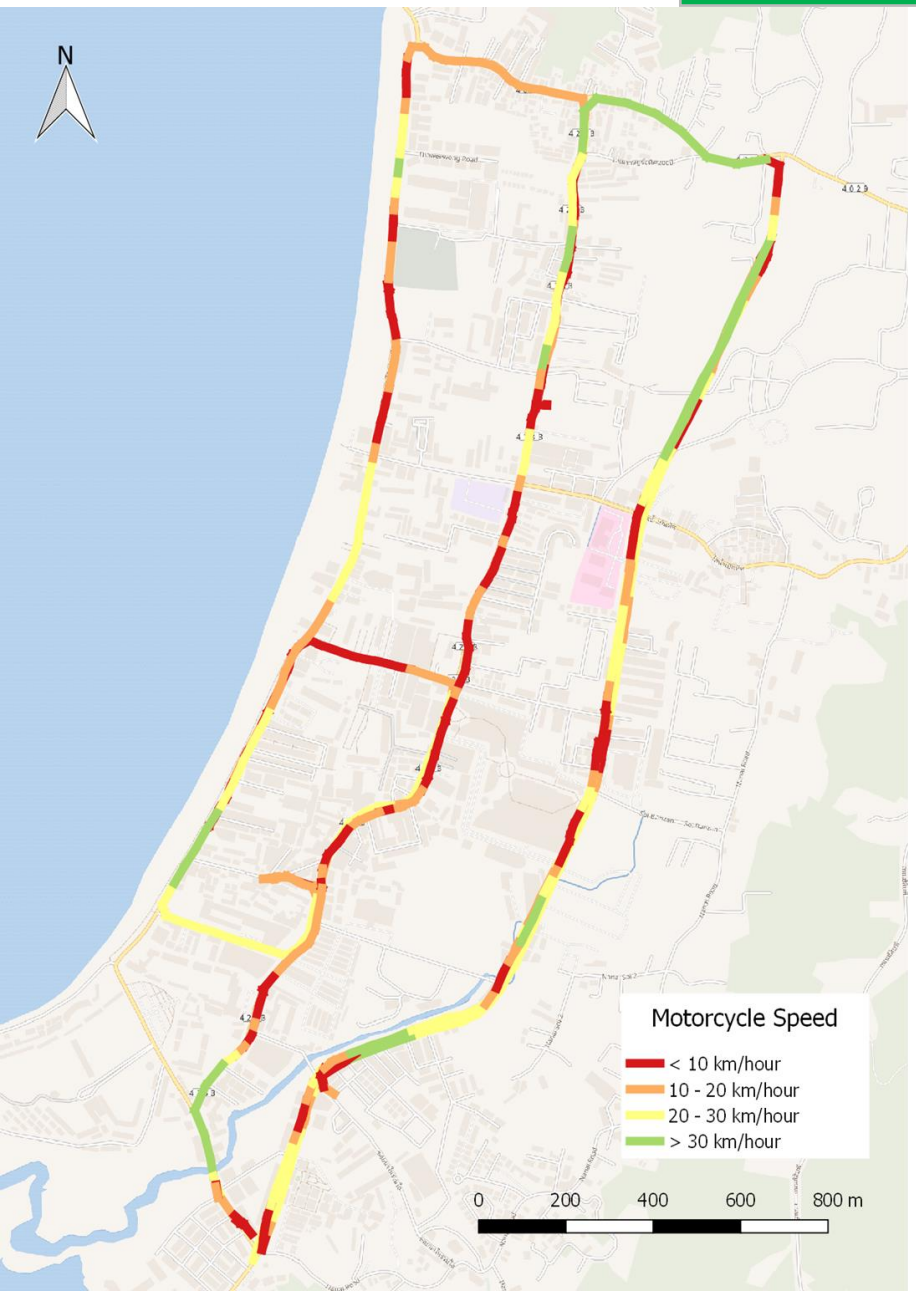
Public transport network are very limited in Patong. There are only buses that go to airport and Phuket Town, with no local routes available. Other than private vehicles, tourists move around using hotel shuttle bus and taxis, which also offer tours to surrounding beaches and attraction places.

Hotel shuttle service in Patong

Bus from Phuket Town to Patong

Patong taxis in a form of minibus with 4 seater capacity

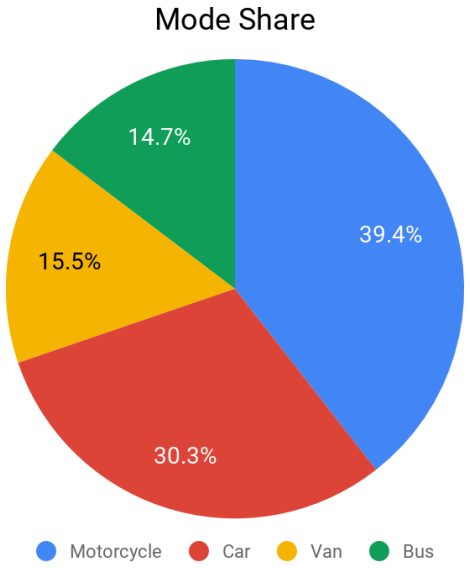
4.5.2 Current Public Transport Conditions



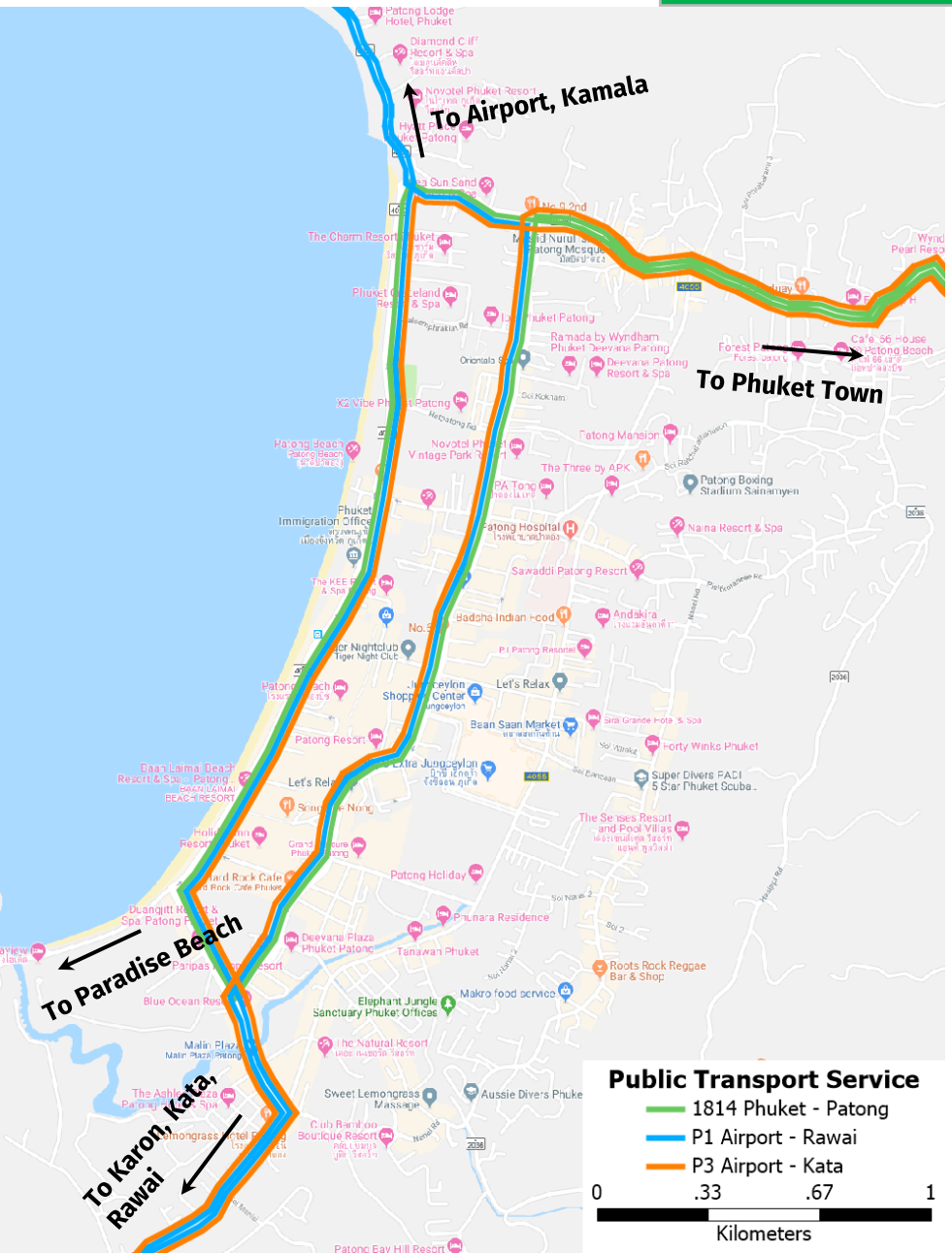
Low share of Public Transport

The great amount of private vehicles make travel inefficient as travel speed is very low during peak hours in Patong. For example, average motorcycle speed was observed below 20 km/hour, this is due to high pedestrians activity, as well as on-street parking which reduces the road capacity.

Cars and motorcycles contribute 70% of transportation mode share in Patong, while minivans and buses have a mode share of 30%.



4.5.2 Current Public Transport Conditions



Bus Routes and Services

Public transport system in Phuket currently has 15 bus routes, where three of them stop at Patong. Although the bus fares is very cheap compared to motorcycle and car rent, taking the bus in Patong is quite challenging especially for tourists since there are no information about routes and schedule provided at public areas.

Photong bus from Phuket Town to Patong

Phuket Smart Bus from Airport to Rawai

4.5.2 Current Public Transport Conditions

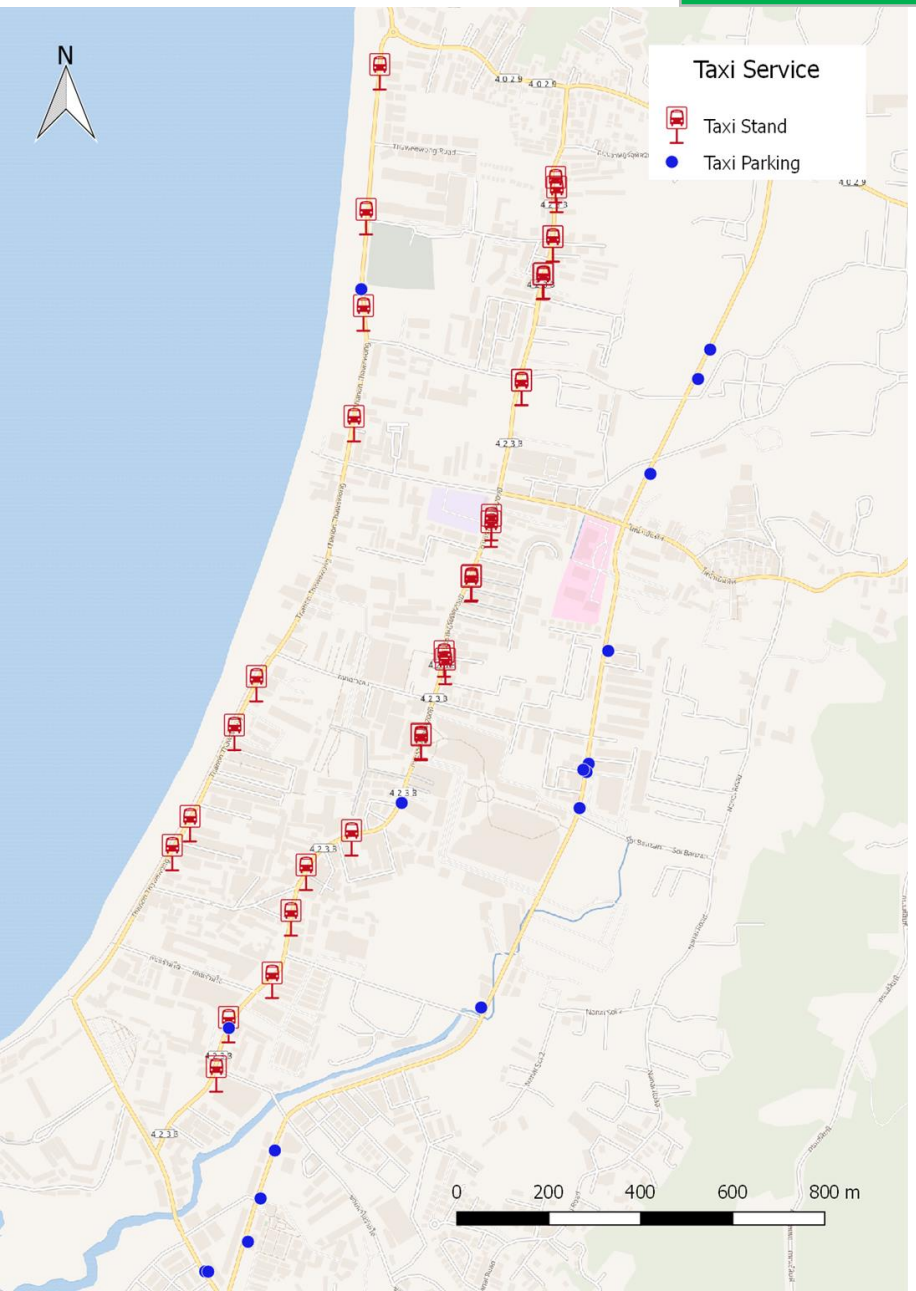
Different Modes of Public Transport in Patong

Taxi services

Public transport bus connected to other areas in Phuket

Private bus and minivan service provided by hotels and transportation company

4.5.2 Current Public Transport Conditions



Taxi Service and Motorcycle Rent

With low frequency and unreliable public transport service, taxi and motorcycle become the most popular transport services to get around Patong and other tourist attractions nearby.

Getting a taxi in Patong is also easy since there are a lot of taxi pick-up points along the main roads with a capacity up to 12 taxis. Therefore, taxi becomes the main choice for group trips. As for motorcycle, it is considered to be the best choice for solo and couple travelers because the rent price is relatively cheap, about THB 300 - 500 (USD 9.5 - 15.8) per day.

Taxi service

Motorcycles for rent

4.5.3 Public Transport Issues

Service Coverage

The existing bus routes in Phuket focus on serving passengers from Phuket Town and Phuket International Airport to tourist destinations, including the three bus routes that stop at Patong. There are no local routes in Patong to accommodate short distance trips. Currently, only two out of four main roads in Patong that are served by public transport.

4.5.3 Public Transport Issues

Information and operational issues

Although the bus fare is very cheap for such long routes, the low bus frequency makes it unreliable for getting around Patong and tourist attractions nearby.

For instance, route P1 and P3 from airport are scheduled to depart every 60 to 75 minutes. From the survey, route 1814 was identified with the most frequent service, due to high demand. However, without any fixed timetable or headway, the drivers sometimes only depart when there are enough passengers to carry.

Lack of information about route, fare as well as schedule on bus stops and public areas also make it difficult to attract people using public transport around Patong, despite the potential demand available from tourist.

Route	Route Length	Fleet	Fare	Frequency
1814 Phuket Central Market - Patong	15.2 km	Songtheaw	THB 10 - 50 (USD 0.3 - 1.6)	10 - 30 minutes
P1 Airport - Rawai	55.8 km	Bus	THB 50 - 170 (USD 1.6 - 5.4)	60 minutes
P3 Airport - Kata	50.2 km	Van	THB 200 (USD 6.3)	60 - 75 minutes

No fixed schedule and route information at Patong Bus Stop

Bus schedule information at Phuket Airport

4.5.3 Public Transport Issues

Parking for Minibus Taxis

While waiting for passengers, taxis are allowed to park at taxi pick-up points that can be easily found on main roads in Patong. The parking space on each taxi stands can accommodate up to 12 taxis.

Although this makes getting a taxi easier, the on-street parking system for taxi occupies road space and causes congestion at peak hours.

Despite many taxi stands available, a lot of taxis are still found parking on no-dedicated taxi stand as to make them more visible to visitors near shopping malls or restaurants.

On-street parking for taxi occupies road space and causes congestion

A taxi parks outside taxi stand

Pedestrian crossing and movement are blocked by on-street parking for taxi

4.5.4 Focus of Improvement

Public Transport Improvement

As an efficient and reliable transportation mode, public transport has to be provided for tourists and people in Patong, which will also reduce private vehicles usage.

This goal can be achieved by regulating the taxi industry to become operator of public transport in Patong.

The Importance of Regulating Current Taxi Industry in Patong

In Patong, along the walkways, it is very common to find taxi drivers offering their services to bring tourists around destinations in Patong. Although it is easy to find, there are no standard pricing and operation system for these taxis. These informal service operations are a breeding potential for problems such as scamming, speeding and safety issues especially for tourists.

Therefore, since this service has currently existed to serve mobility for tourist in Patong, an improvement of quality of service should be made. The government should regulate taxi operation system due to these following reasons:

- Regulate the existing taxi industry in Patong will also solve the problem of inefficient service. Based on the survey done on April 3th 2019 at peak hour located in front of Jungceylon, taxi frequency reached **150 taxis per hour** while the occupancy is very low, approximately 0.84 passenger per taxi. Therefore, on-street parking on Patong is mostly occupied by taxis waiting for passengers.
- The great amount of taxis will serve current routes which have been assigned to them and also covers the areas where public transports are not available but with a better operational system.
- Minimizing the resisting and rejection from existing taxi operators due to the introduction of new public transport system provided by the government.

4.5.5. Public Transport Implementation Process

Public Transport Implementation Process

- ❑ Business Plan
- ❑ Infrastructure and Fleet
- ❑ Regulation and Institutional Set-up
- ❑ Business Model, Financial and Operational
- ❑ Taxi Industry Transition Scheme

Taxi Transitional Process

- ❑ Formulate the Business Plan
- ❑ Building Communication and Consensus with Taxi Operators
- ❑ Capacity Building
- ❑ Negotiation Process
- ❑ Implementation

4.5.5. Public Transport Implementation Process

A. Formulate the Business Plan

- ❑ Demand analysis
- ❑ Route coverage
- ❑ Operational planning
- ❑ Tariff

B. Infrastructure and Fleet

- ❑ Bus stops
- ❑ Public transport fleet
- ❑ Technology (including payment system)

C. Business, Financial and Operational Model

- ❑ Cooperation model
- ❑ Tariff scheme and subsidy
- ❑ Financial model

D. Regulatory Framework and Institutional Design

- ❑ Formulation of policies and regulations for the operation of public transport
- ❑ Institution formation and capacity building to manage public transport

E. Transition Model of Taxi Industry

- ❑ Contract framework for new system
- ❑ Design implementation strategies which include operator on the discussion
- ❑ Collaboration consensus with taxi operators
- ❑ Social impact mitigation

4.5.5 Public Transport Implementation Process

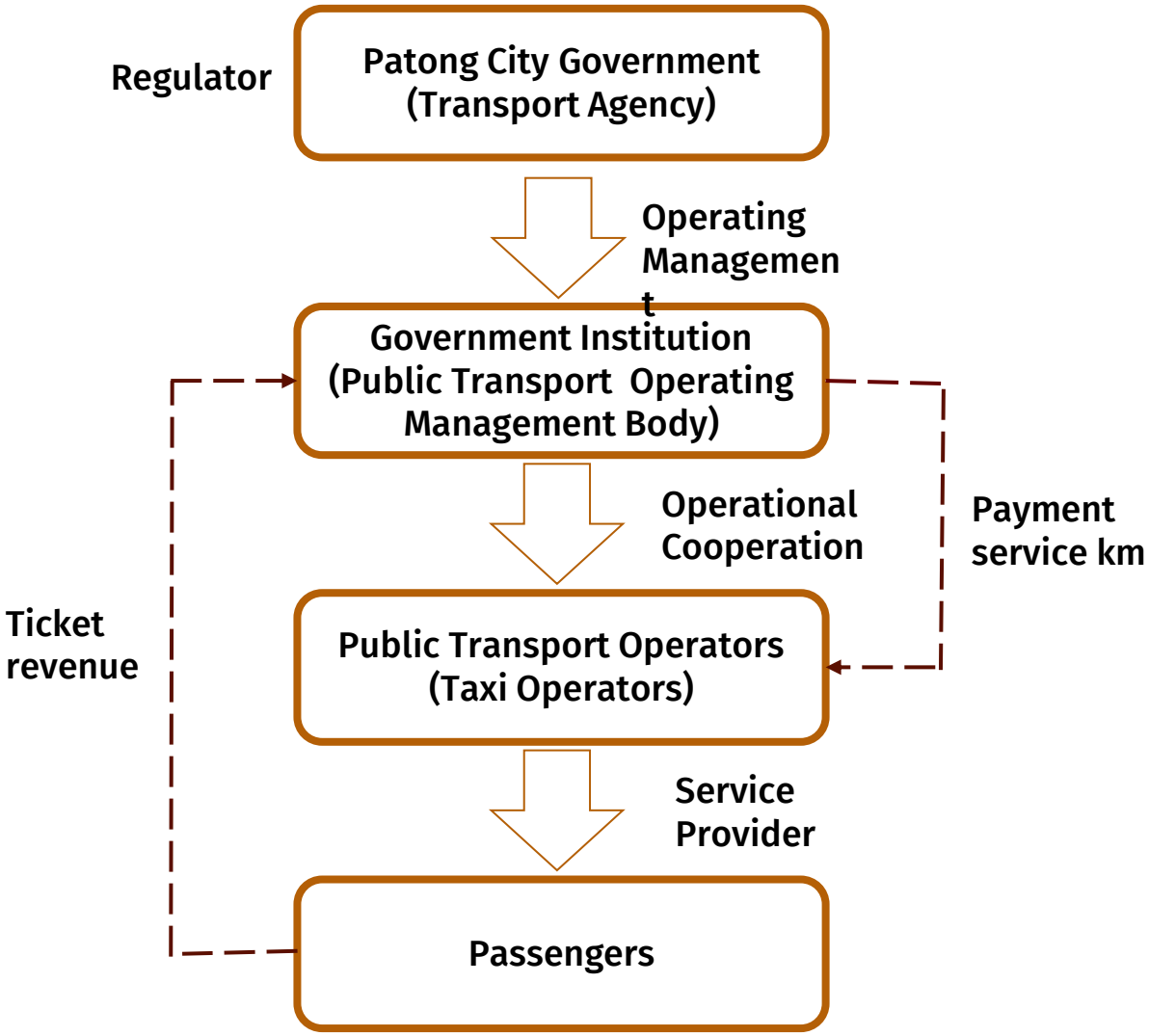
Basic Principles of Public Transport Implementation

Build Institution to Manage Public Transport System	Build government agency or institution to manage the new public transportation system in general.
Set Public Transport Tariff and Integration	The government set the tariff. The integrated payment structure for all public transport systems will be able to provide convenience transfers for users and increase efficiency.
Provide Efficient Network Coverage	Optimizing public transport network coverage by providing public transport service routes that are easier to access, simple, and connected. It will create efficient travel, saves time, and ensure more affordable costs.
Provide Good Quality Public Transport	Public transport fleet (taxi) operation should meet the minimum operational standards set by the government. Punctuality in operation, good fleet conditions, and training for drivers are needed in order to provide reliable public transport system.
Create Professional Public Transport Industry	Create public transport industry that meets the minimum service standard operation. The industry should give insurances, continuity of work, and ensure profits for its stakeholders (operators and drivers).

4.5.5 Public Transport Implementation Process
Contract System Between Operators & Government

The goal of Patong City Government is providing good public transport services. Therefore, the government is setting the public transport tariff (and also providing the subsidies) and creating the management operational institution to ensure that the service is convenient, accessible and affordable for all under the Transport Agency as the regulator.

To provide the services, there are contracts for operating the public transport (per km) between the government institution and taxi operators. Tickets and revenue are managed directly by the institution while operators only operate the public transport fleets (taxis).



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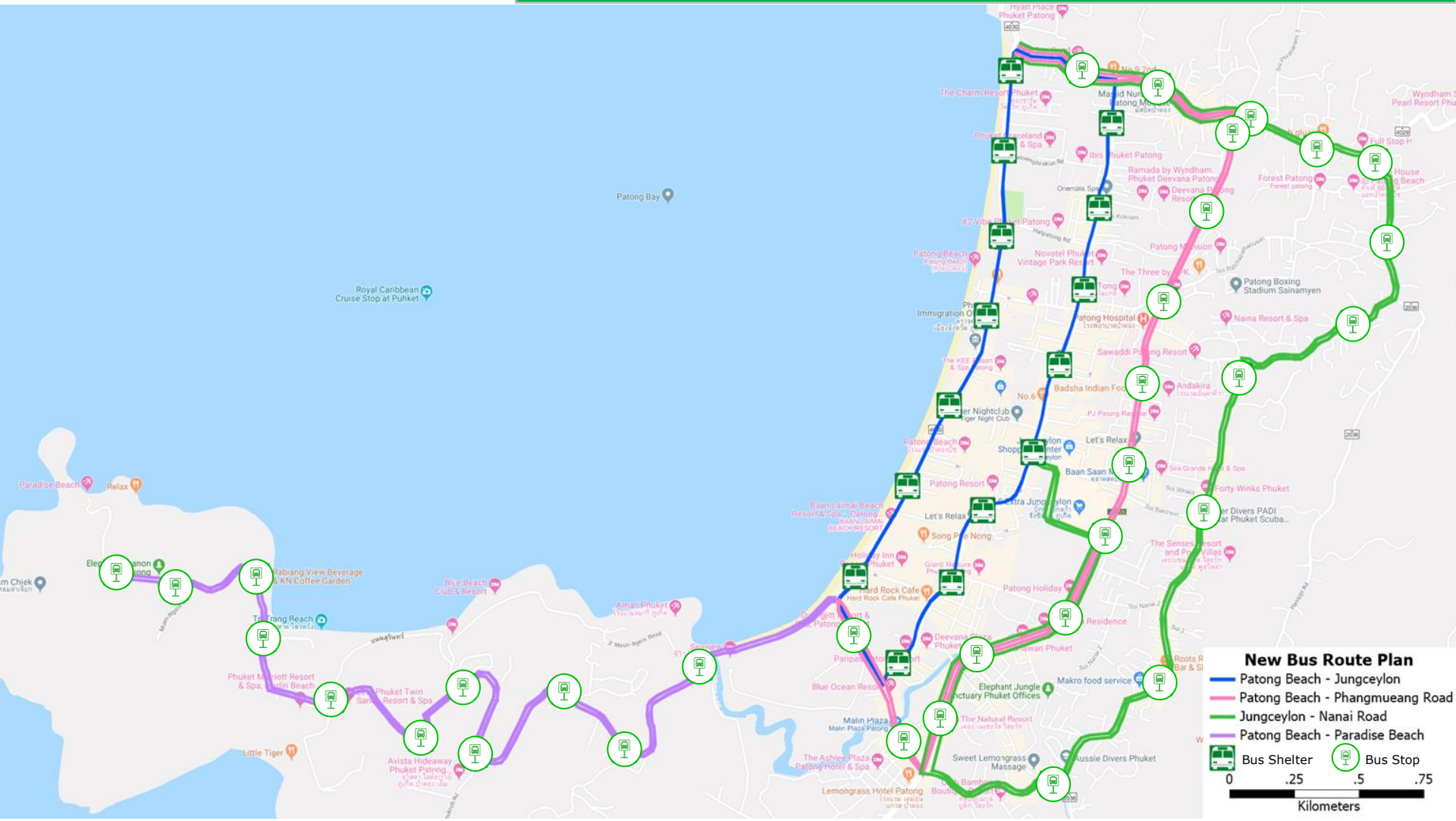
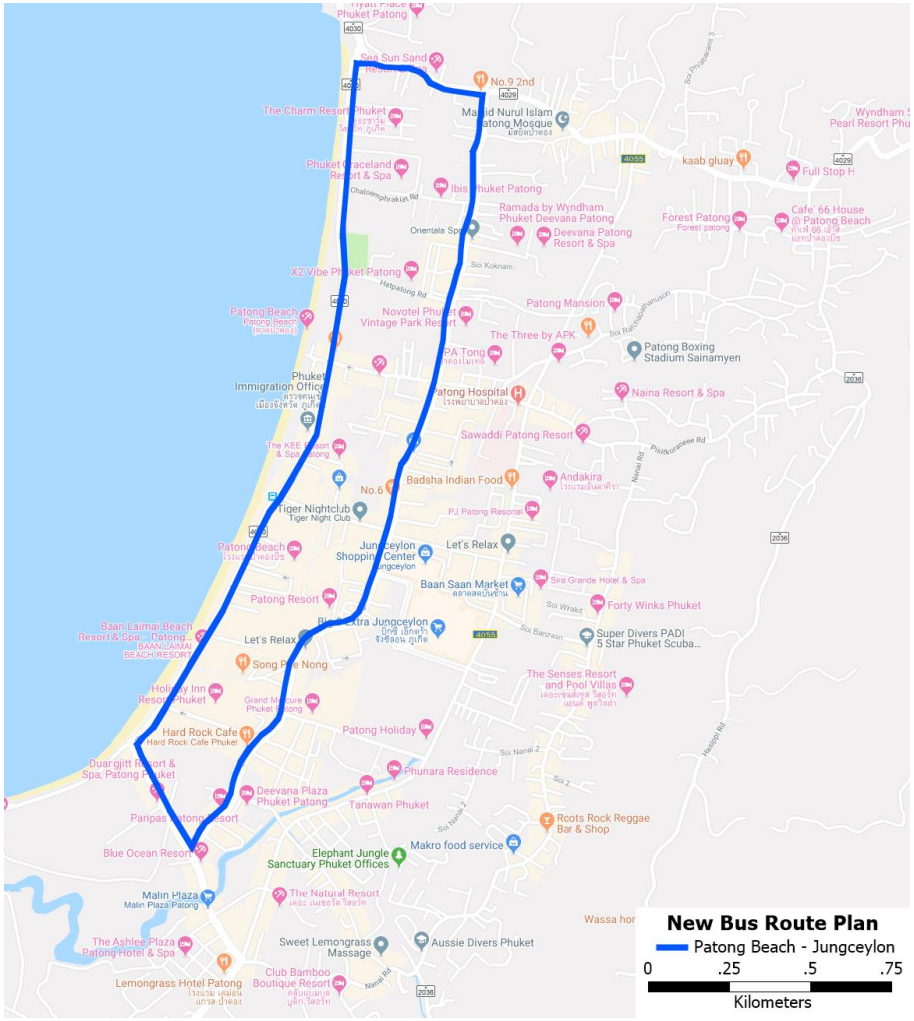
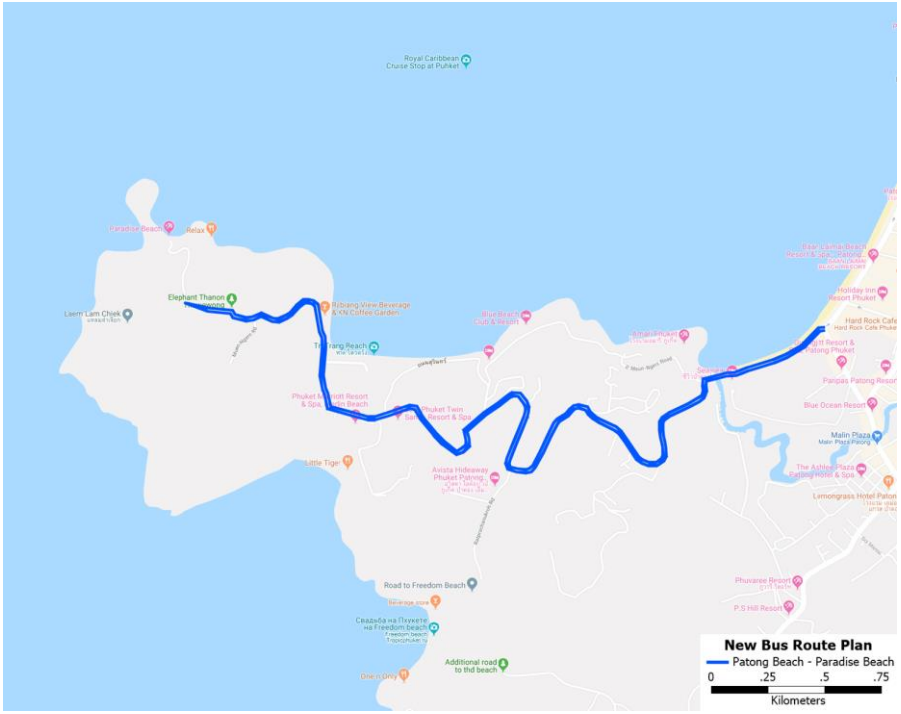
4.5.6 New Public Transport Route Plan



Four new public transport routes are proposed to accommodate short distance trips within Patong. These proposed routes should provide more transit coverage and facilitate people from all around Patong to reach the city center. Bus stops are to be located at high demand areas and have 300 to 500 meters in distances between stations.

4.5.6 New Public Transport Route Plan





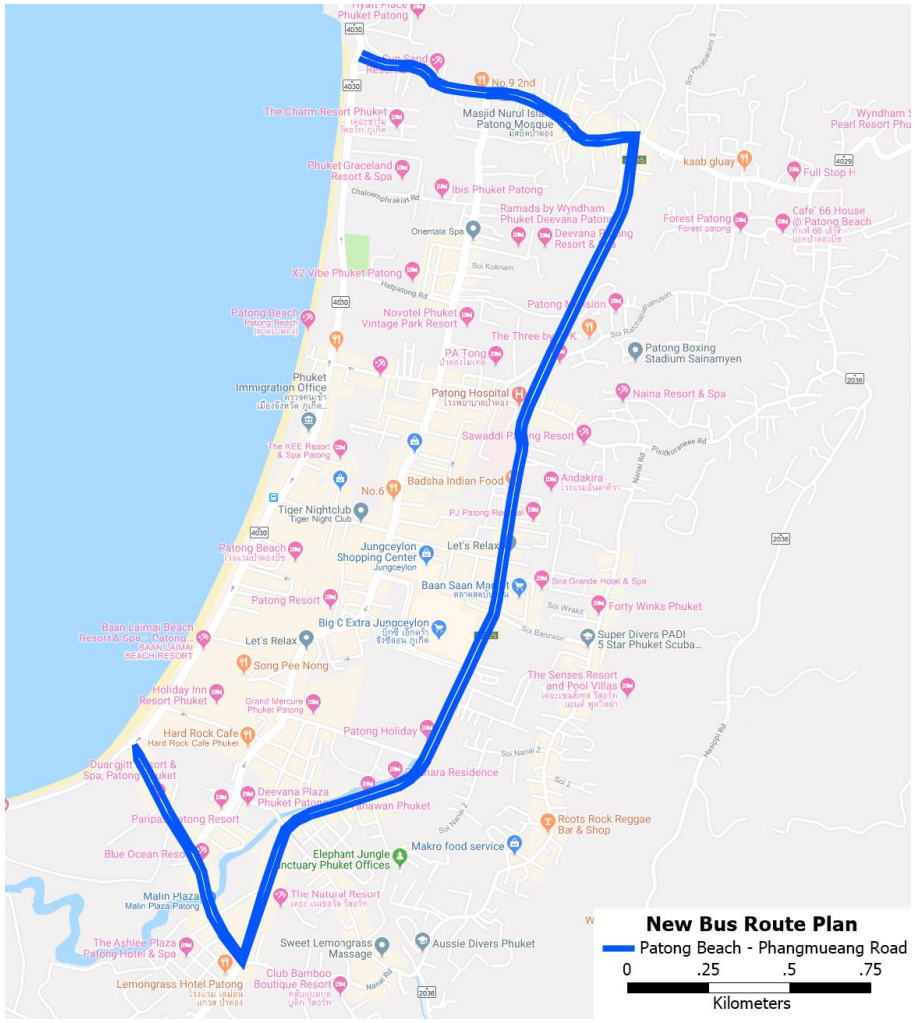
Patong Beach - Paradise Beach

This route goes to Paradise Beach, a tourist destination near Patong. There are several attractions and accommodations along the road as well.

Patong Beach - Jungceylon

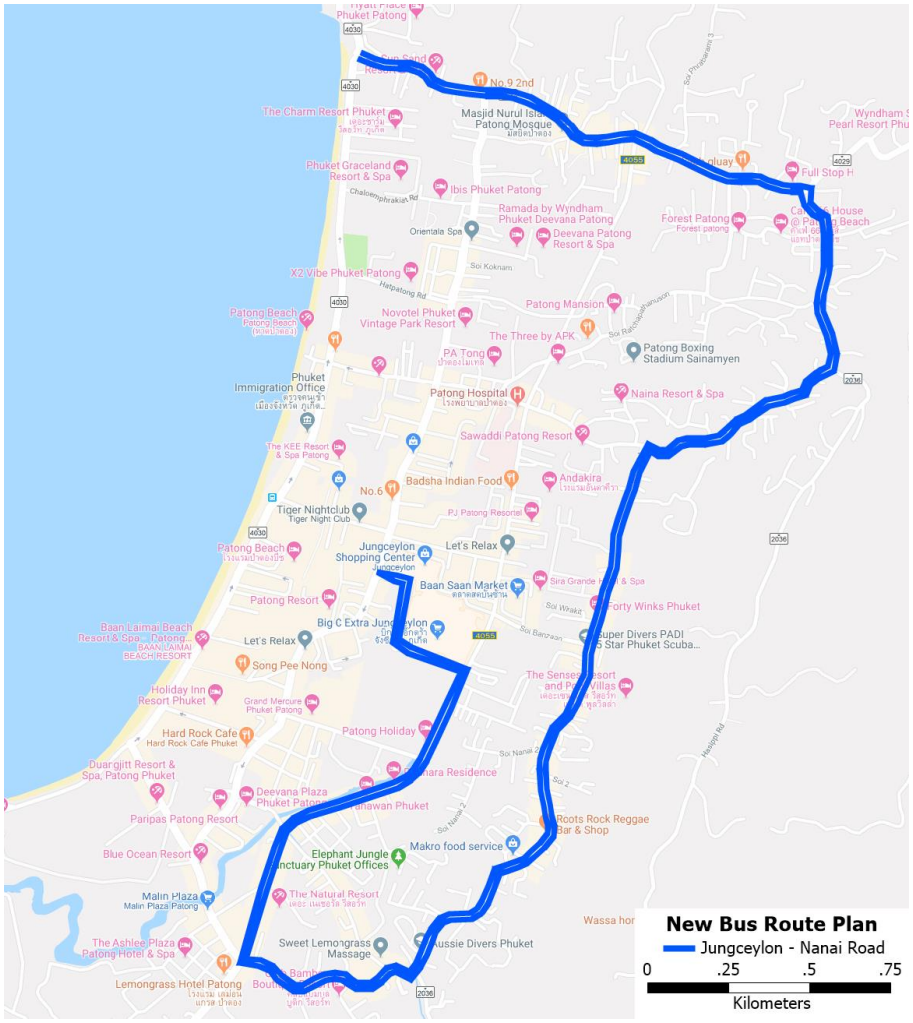
This route goes along Thawewong Road and Ratuthit Songroipi Road, the two closest main roads to the beachfront area. With many attractions and accommodations around these roads, this route should facilitate trips between destinations beyond walking distance, therefore motorized vehicle trips will be reduced.

4.5.6 New Public Transport Route Plan



Patong Beach - Phangmueang Road

This route connects other main road in Patong, Phangmueang Road, to the beachfront area.



Jungceylon - Nanai Road

This route provides access from the area outside the city to the city center.

4.5.7 Operation Plan

Operation Plan

To ensure reliable public transport service and comfortable journey, the operation plan of local public transport in Patong is proposed to have peak hour frequency of every 4 minutes due to the high demand and limited passenger capacity for taxi. Higher frequency will create a result in a shorter waiting time for passengers.

Fleet Design and Modernization

The service will operate existing local taxis. However, as the demand increases over time, fleets with bigger capacity should be operated in the future.

The current taxis being used as public transport mode in the future should be improved with better standard and better quality bus. This could be achieved by shifting to the electric bus.

Fleet Requirement Calculation

Based on calculation, a total of 54 taxis and 22 buses are needed with several assumptions as follows:

- Proposed average speed: 25 km/hour
- 10 minutes layover time per trip
- 10% spare fleet

Route	One-way Journey Time (hour)	Proposed Peak Hour Frequency	Proposed Average Speed (kph)	Fleet Requirement (Local Taxi)	Fleet Requirement (Bus)
Patong Beach - Jungceylon	0.32	15	25	10	4
Patong Beach - Phangmueang Road	0.39	15	25	12	5
Jungceylon - Nanai Road	0.48	15	25	15	6
Patong Beach - Paradise Beach	0.39	15	25	12	5
Total fleets required with 10% spare				**54**	**22**

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4.6 Project Cost Estimates for Patong

Improvement	Unit	Price per unit (USD)	Cost (USD)	Total Cost (USD)
Street Design				**26,050,210**
Sidewalk improvement	91,852 m^2	200	18,370,400	
New pedestrian zebra crossing	36 crossings	360	12,960	
Bike lane	16,867 m^2	300	5,060,100	
Pedestrianization area	12,133 m^2	200	2,426,600	
On-street parking removal	758 parking spaces	50	37,900	
New on-street parking	53 parking spaces	50	2,650	
Bike Sharing System				**574,850**
New stations	73 stations	3,200	233,600	
New bikes	1,365 bikes	250	341,250	
Public Transport System				**315,000**
Bus stop with bus bay	15 transit shelters	10,000	150,000	
Bus pole	33 bus stops	5,000	165,000	
TOTAL				**26,800,560**