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Krabi & Ao Nang Green Transport

Plan to Improve Public Transport, Walking and Cycling

IMT-GT Indonesia - Malaysia - Thailand Growth Triangle

ADB

Draft Report, May 2019

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Outline

Krabi Town and Ao Nang

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 Krabi started in April 2019. ITDP alongside with Guido Bruggeman and Willem Bouwer, hired also 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 come up with potential improvements.

The team also attended several meetings separately with the Krabi Government, land transport and marine department together with long-tail boat associations.

1.2 Work Objective and Scope

The objective of this report is to produce guidance of improvements that can be implemented in terms of efficient and clean mobility in Krabi. The improvements area in the area of the prioritization of walking, cycling and public transport.

In this assignment ITDP will focus on public transport improvement, ideas for prioritizing non-motorized transport (NMT), such as walking and cycling in both Krabi Town and Ao Nang.

1 Introduction

1.3 Context

Krabi Town is the provincial capital of Krabi province located on the southern Thailand's Andaman coast. Tourism is the main source of this province with at least 2.03 million visitors in 2016 based on total passenger arrival at Krabi International Airport. It is also reachable by ferry from Noppharat Thara pier or land journey by bus centralized at Krabi bus terminal. Krabi town is located at the center of these transport hubs, making it ideal as a place for transit between tourist attractions in the province.

Map of POI in Krabi

Creating Green City in Krabi

The Municipality of Krabi won the national environmental award in 2018. The city has 3.5 times more green space compared to other cities in Thailand, and is continuously looking for green approach to every measures, including public transport service.

Public transport is available within the area but with low service quality, making it not too popular amongst local residents and tourists. In a spirit of creating environmentally-friendly transport in Krabi, public transport service needs to be improved, with better information and cleaner fleet.

At the same time, there is also a need to create a more pedestrian-friendly environment to make walking safer and more comfortable both for the locals and tourists in Krabi Town and Ao Nang.

1.4 Summary of Issues and Objectives

Public Transport

Public transport in Krabi is served mostly by *Songthaews*, a modified pick-up which literally means two rows. The first major issue for public transport in Krabi town is the lack of reliable information. Krabi town is located between the airport and Ao Nang where most tourists go to.

Public transport passengers are prone to the air pollution from the Songthaews. According to the meeting with the government of Krabi, The Land Transport Authority has a plan to promote more vans/buses for tourists and maintain pick-up trucks for the locals that they have to carry on things.

Walking and Cycling

In Ao Nang, as a popular tourist destination, there is a potential and benefits to reduce the private vehicle use to make the are more sustainable. With hotels, guesthouses, bars and restaurants are located close to each others, walking and cycling could be enjoyable for tourist visiting Ao Nang, if it is provided with the right infrastructure.

Walking experience in Ao Nang and Krabi can be improved by prioritizing the right of way for people instead of cars. In both areas crossings should also be placed every required distance for safer environment.

Eco-friendly mobility is the approach for Krabi and Ao Nang to promote green transportation. The strategy consists of:

1. More people shift from private vehicles to use greener transport modes such as walking, cycling and public transport.
2. Public transport fleet electrification as a way to have better local air quality.
3. Boat management and long-tail boat electrification to reduce emissions and noise that will be discussed in different report.

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1.4 Summary of Issues and Objectives

List of issues, objectives and measures for Krabi

Issues	Objective	Measures
Krabi Town		
• People especially tourists are confused with no official and clear information of public transport network	• To have more people using public transport	• Route reorganization in town • Provide high quality bus stops • Provide clear route information
• Public transport passengers experience uncomfortable journey and exposed to vehicle exhaust due to poor public transport fleet quality	• More pleasant public transport journey • Better local air quality to improve livability of the people	• Fleet modernization to increase comfort with less air pollution
• Lack of pedestrian crossings in town, making it dangerous for people to cross	• Safer and more comfortable walking and crossing experience	• Street reconfiguration to promote walking and cycling
Ao Nang		
• No local public transport mode to get around and explore the area	• Reduce the use of cars and motorcycles trip • Promote cycling as one of the main transport modes	• Provide local shuttle service • Provision of bike lane and (electric) bike-share
• Inconvenience experience to access the long-tail boat from the beach	• Less hassle to access long-tail boat from the beach	• Provision of jetty at Ao Nang and Railay Beach

1.5 Report Objectives

Supporting Green Transport

This report provides guidance to move towards efficient and cleaner mobility specifically in Krabi Town and Ao Nang. The measures of green transportation are developed in this work and based on the perspective from walking, cycling and public transport as the most efficient and eco-friendly way of travel. To achieve the goal, some measures are as follow:

- Promoting the use of public transport for the locals and tourists as a reliable mode to get around.
- Introducing low-emissions public transport fleets to support better air quality.
- Enhance walking and cycling experience and improve its connectivity to public transport.
- Introducing bike share system in the tourist area.
- Providing strategy for better management of long-tail boat and shift towards cleaner and less noise boats.

Packages of Improvement

Public transport improvement is crucially urgent. The unclear public transport routes make people using private vehicles which cause inefficient mobility and leads to more air pollution. At the same time, the improvement package of walking and cycling shall be taken into account to ensure connectivity.

This report only acts as a guidance, more detail planning and design work shall be undertaken in the future prior the implementation to ensure it is fit with the proper needs.

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Public Transport

2 Public Transport

Passenger Information at Krabi Bus Terminal

2.1 Bus System in Krabi

The study focuses on local buses, and not so much on the interprovincial bus service. The only official information for bus routes is only found at Krabi bus terminal. According to that information, there are four local bus routes that serve the terminal. No similar official information observed in Krabi city center where tourists mostly stay and visit.

2.1.1 Bus Routes in Krabi

ITDP observed 10 different routes for local bus around Krabi. The average length of the total bus routes for one-way trip is 42.8 km. Route 1, 1822 and 8399 to Tesco Lotus, Krabi Airport and Ao Nang respectively are considered as reasonable distance routes for local journey while the rest are long-distance routes even to other districts.

Seven out of ten routes are using Songthaew as the fleet. It is a modified pick-up vehicle and used as the public transport in Krabi. Painted route information is placed in front and side of the vehicle, sometimes all in Thai, making it more difficult for foreigners to recognize. One Songthaew can occupy up to 11 passengers and it costs 20-90 THB depends on destination. Route 8415 from airport to Klong Muang is the only service that uses bus and minivan.

Bus Routes in Krabi Town

Route Number	From	To	One-Way Length (km)	Mode
1	Krabi Town	Tesco Lotus	13.3	Songthaew
1822	Krabi Town	Airport	13	Songthaew
1823	Krabi Town	Ao Luek	40.2	Songthaew
8256	Krabi Town	Ko Lanta	78.7	Songthaew
8308	Krabi Town	Khlong Tom	40.9	Songthaew
8317	Krabi Town	Lam Tap	68	Songthaew
8399	Krabi Town	Ao Nang	22.6	Songthaew
8415	Airport	Klong Muang	50	Blue Bus
	Airport	Klong Muang	50.8	White Bus
	Airport	Klong Muang	50.8	Van

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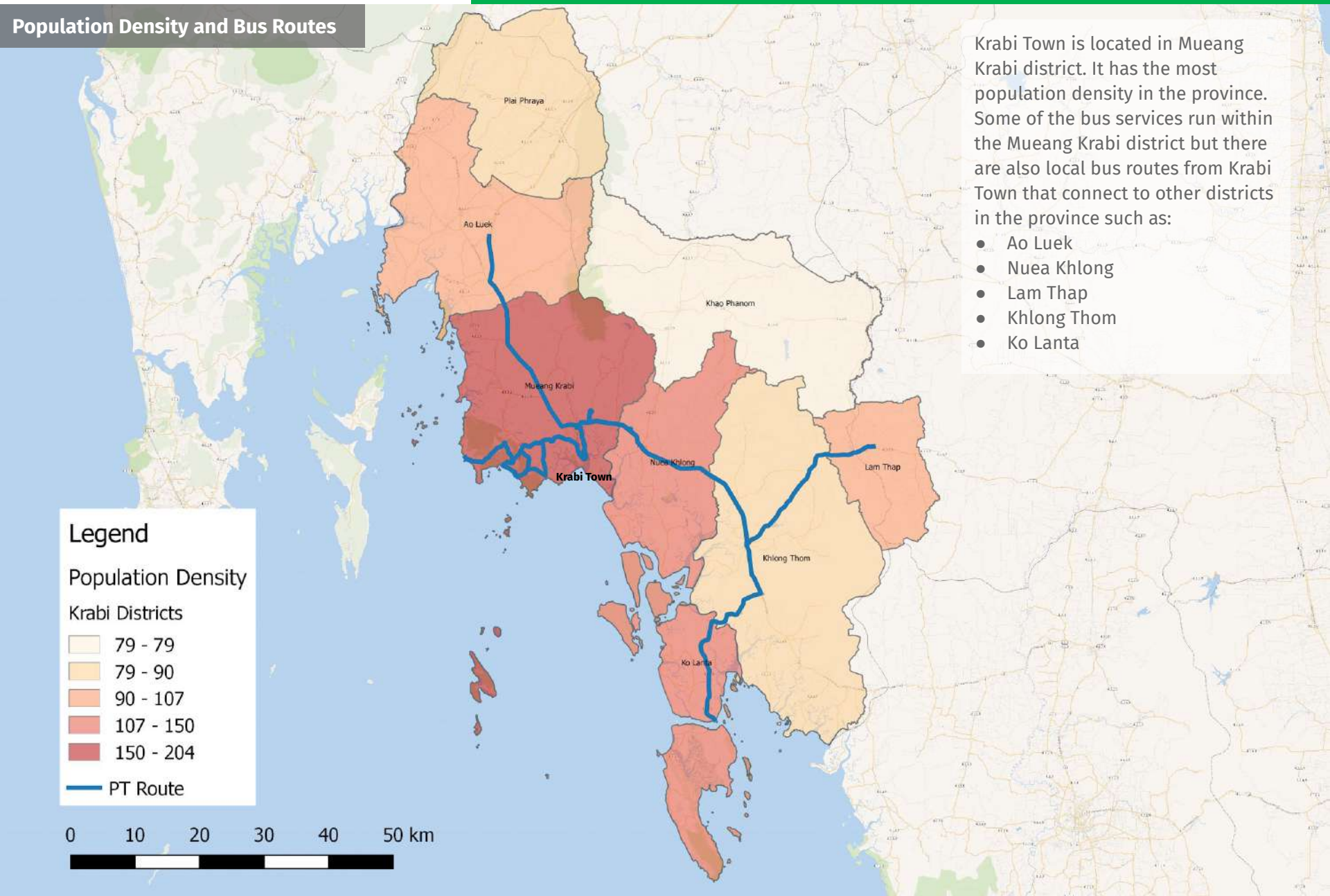
2.1 Bus System in Krabi

Population Density and Bus Routes



Krabi Town is located in Mueang Krabi district. It has the most population density in the province. Some of the bus services run within the Mueang Krabi district but there are also local bus routes from Krabi Town that connect to other districts in the province such as:

- Ao Luek
- Nuea Khlong
- Lam Thap
- Khlong Thom
- Ko Lanta

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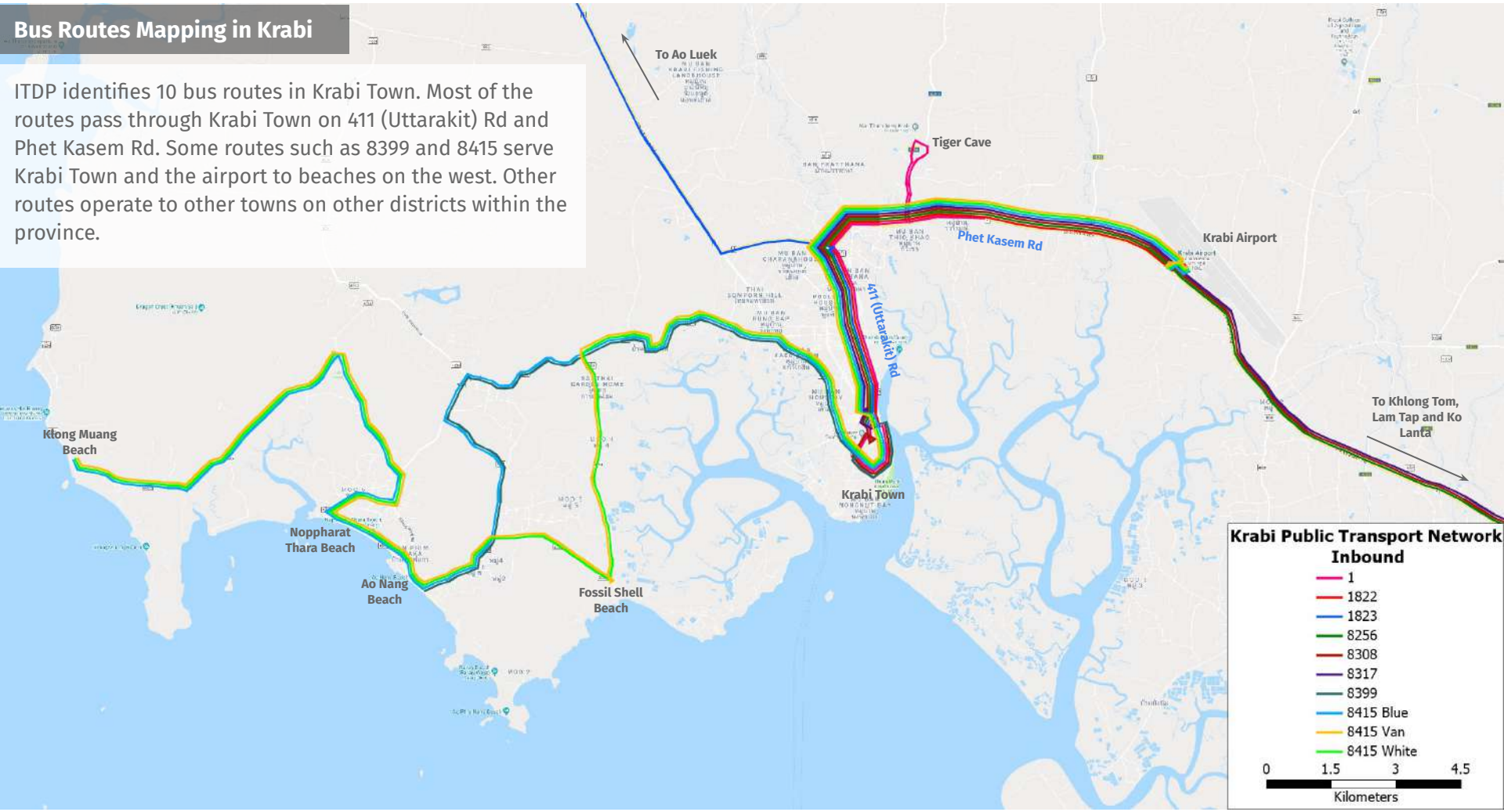
2.1 Bus System in Krabi

Bus Routes Mapping in Krabi

ITDP identifies 10 bus routes in Krabi Town. Most of the routes pass through Krabi Town on 411 (Uttarakit) Rd and Phet Kasem Rd. Some routes such as 8399 and 8415 serve Krabi Town and the airport to beaches on the west. Other routes operate to other towns on other districts within the province.



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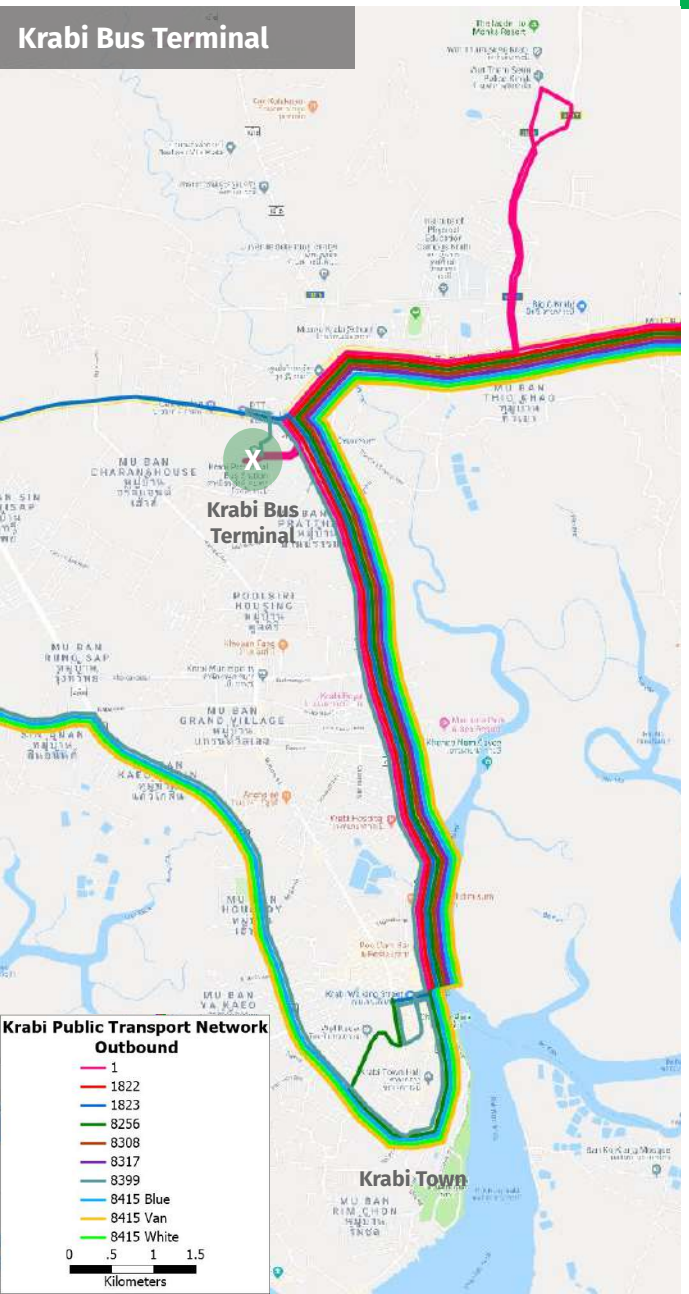
2.1 Bus System in Krabi

Krabi Bus Terminal



2.1.2 Krabi Bus Terminal

- Krabi Bus Terminal is located around 5 km on the north of Krabi Town.
- The terminal mostly acts as a hub for between provinces service, from Krabi to other city in Thailand such as Bangkok, Phuket, Hatyai, Surat Thani and Nakhon Si Thammarat.
- Based on the observation, there are two local routes that also go directly into the terminal to get passengers.
- The routes are 1 to Tesco Lotus and 8399 to Ao Nang using Songthaews.
- The rest of the local routes only pass through Utarakit Road and do not directly serve the terminal
- Unlike big buses and coaches that have dedicated bus bays, the local routes stops in front of the terminal entrance.
- The terminal lacks of distinctive signage for passengers transferring to the local services.


8399 at the terminal entrance

Static route information that needs to be updated

Motorcycle taxi is available next to the main building


Waiting facility for van service outside the main building

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2.1 Bus System in Krabi

2.1.3 Bus Stops in Krabi Town

All bus routes except route 8415 have the terminus in the city center of Krabi. There are 3 bus stops on Maharaj Road and 1 bu stop on Uttarakit Road. All of the bus stops are located on one side of the road. However, there is no clear and distinctive signage of these bus stops. It makes harder for people to have better understanding of bus network in Krabi.

Existing Bus Terminus in Krabi Town

Bus Terminus	Routes	Destination
BS1	1823	Ao Luek
BS2	8256	Ko Lanta
BS3	8399	Ao Nang
BS4	1 1822 8308 8317	Tesco Lotus Airport Khlong Tom Lam Tap

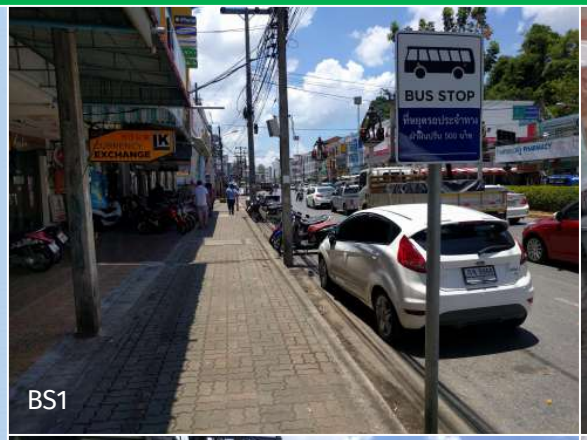
Route 8415 runs through Uttrakit Road but does not terminate in Krabi Town. The route starts at Krabi Airport to Klong Muang Beach.

2.1 Bus System in Krabi

Existing Bus Stop Locations

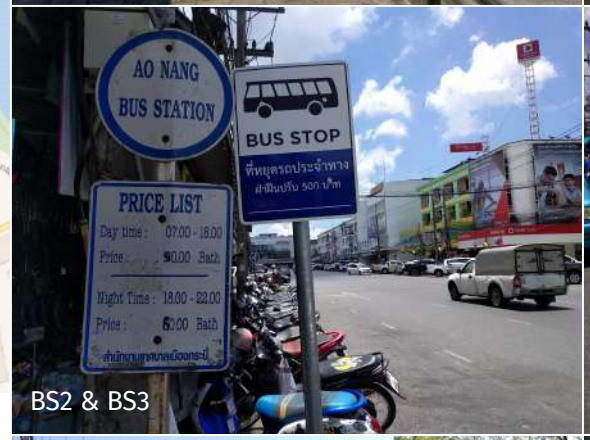
The bus stop infrastructure in Krabi Town lacks of features that can make the system clearer and better.

- Bus stop facilities are only located on one side of the road.
- Bus stop sign is not distinctive.
- No clear information of what routes stop and go where.
- No network and single map of the bus system.
- Songthaews wait for passengers with uncertain schedule.



BS1

BS1



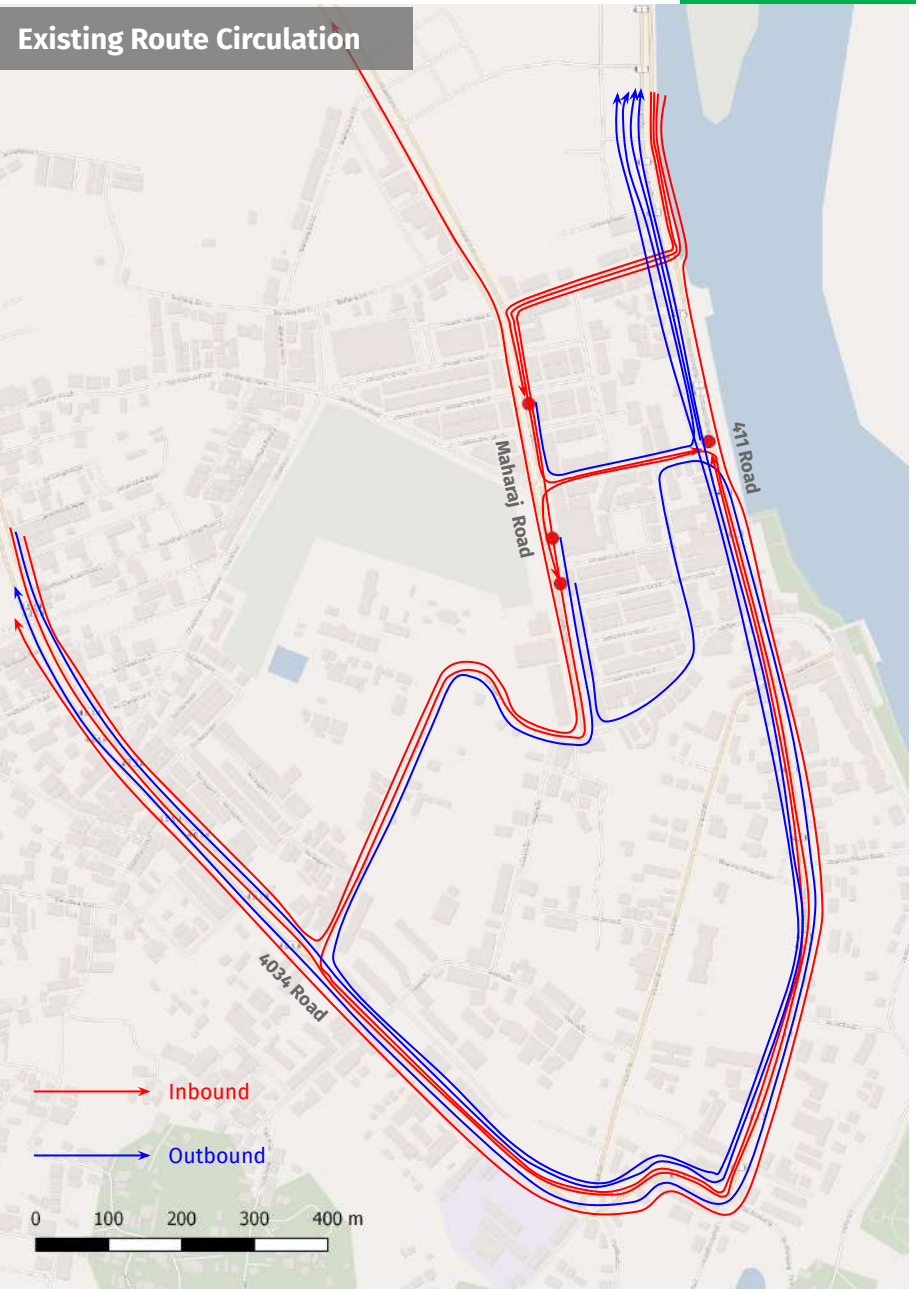
BS2 & BS3


BS2 & BS3

BS4

BS4

2.1 Bus System in Krabi



2.1.4 Bus Route Circulation in Krabi Town

- There are 3 bus stops and 7 routes that start and end in Krabi Town.
- In order to understand the circulation in town, ITDP mapped out the routes for both inbound and outbound direction.
- The map of the circulation shows disorganized route network in town.
- It is a crucial issue that inbound and outbound direction bump into each other from/to bus stops with the same direction on main road segments such as Maharaj Rd, 4034 Rd and 411 Rd.
- This existing situation leads to disorientation and generates confusion especially for tourists as the first-timer in Krabi Town.
- In addition, lack of passenger information system at the bus stop or fleets worsen the situation.

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2.1 Bus System in Krabi

Recommendations

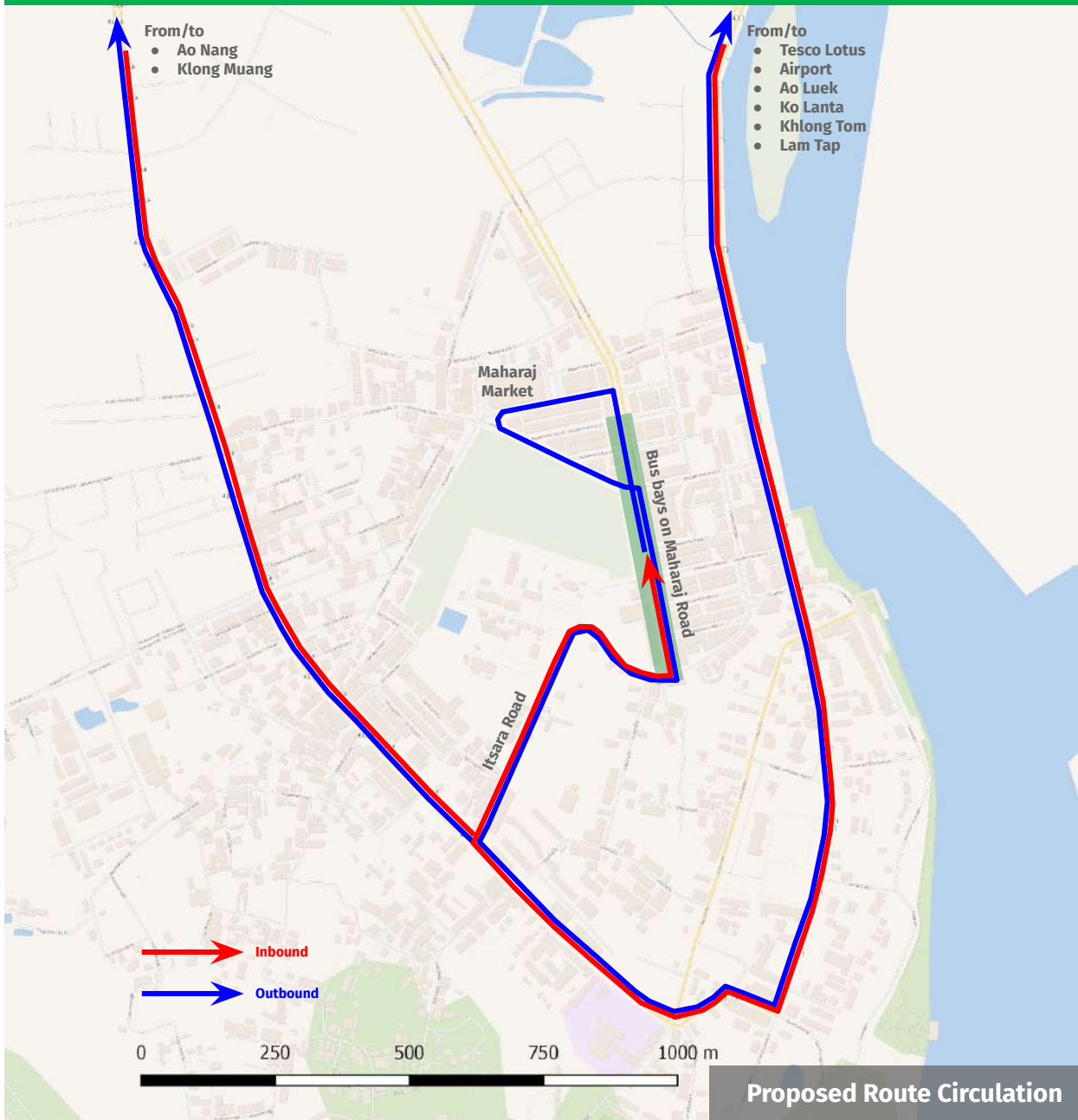
In order to make the bus network clearer and more organized, routes rearrangement in Krabi Town is proposed by creating simpler network.

All inbound routes (red line) entering Maharaj Road through Itsara Road.

When the bus wants to make outbound trip (blue line), it turns around at Maharaj Market and exiting the town also through Itsara Road.

Bus Stops on Maharaj Road

- Creating centralized bus stops on Maharaj road and concentrating the first and last bus journey on this road.
- All bus routes start and end on several bus bays on Maharaj Road.
- The bus bays are provided on both ways, unlike the existing condition that only have one side of the road.



Proposed Route Circulation

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2.1 Bus System in Krabi

Creating Centralized Bus Stops in City Centre

Route Allocation

BS1

1823 Ao Luek

BS2

8317 Lam Thap
8308 Khlong Tom
8256 Ko Lanta

BS3

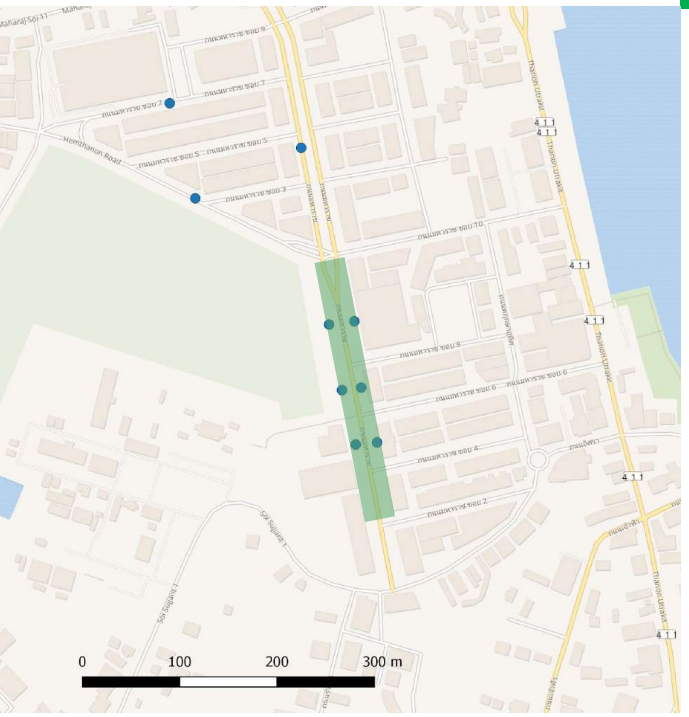
8399 Ao Nang

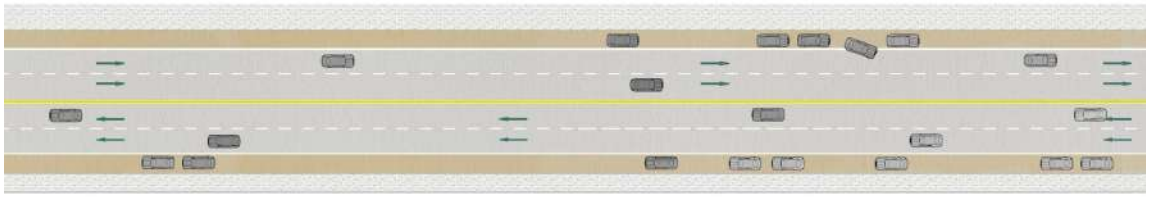
BS4

1 Tesco Lotus
1822 Krabi Airport

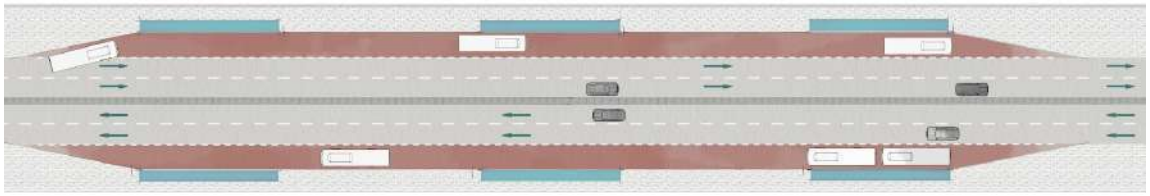
Additional bus stops near Maharaj Food Market and Hemthanon Street.

2.2 Centralized Bus Stop





Existing Top View



Proposed Top View

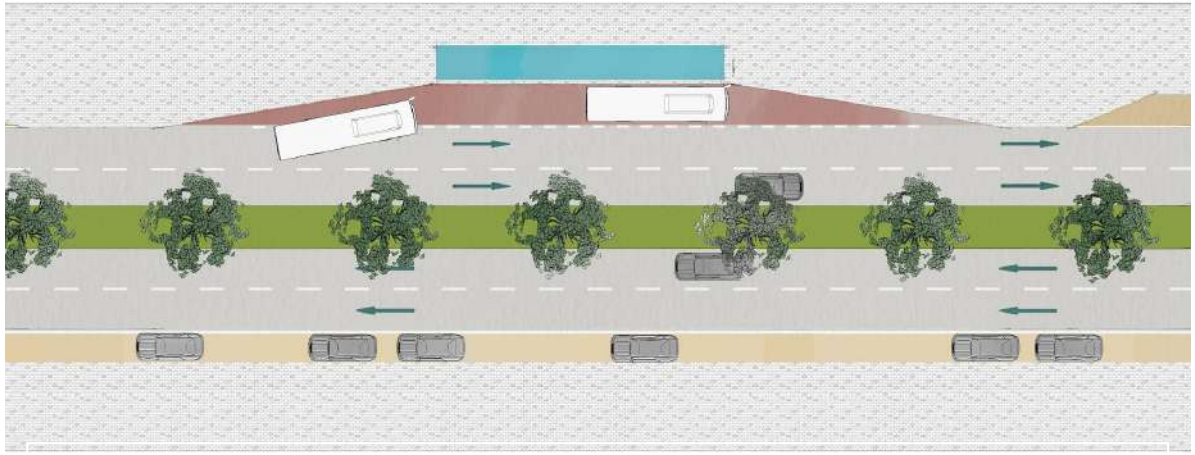
Recommendations

- Reduce the width of mixed-traffic lane from 4 m to 3 m to have wider sidewalk up to 5.6 m.
- Add median to separate different ways.
- Angled parking is prohibited, only parallel parking is allowed.
- Parallel parking is removed only when the space is required for bus bays.

- Maharaj Road is dedicated as centralized bus stop in Krabi Town.
- All bus routes board and alight at the dedicated stops.
- It will be easier for people to notice the bus stop and have better understanding about the bus network in Krabi.

2.2 Centralized Bus Stop

Existing Top View



Proposed Top View

Recommendations

- Reduce the width of mixed-traffic lane from 3.95 m and 3.55 m to 3 m to have wider sidewalk up to 6.7 m.
- Angled parking is prohibited, only parallel parking is allowed.
- Parallel parking is removed only when the space is required for bus bays.

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2.2.1 Centralized Bus Stop Best Practice

Centralized Bus Stop in Berlin

Centralized Bus Stop in Ho Chi Minh City

Passenger Information with Clear Route Map

The Site Map of Centralized Bus Stop

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2.3 Bus Stop Improvement

Bus stop design and location are essentials as part of the bus service quality. The whole journey experience implies all bus passengers are also pedestrians at the beginning and end of the bus trip so bus stop should be designed to create ease of access.

The typical existing bus stop in Krabi Town, as shown in the picture below, only uses a signed pole and lack of proper facility for passengers when waiting for the bus.

The convenience and comfort of bus stops must not be disregarded. Bus stops have number of features that need to be considered as illustrated in the figure on the right.

Typical of Bus Stop in Krabi Town


Amsterdam

1. Bus Stop Sign

Distinctive and includes route numbers

More detail information on high demand locations.


Berlin

2. Shelter

Protection from sun and rain.

Straight unobstructed path of at least 1 m between the shelter and the curb and a minimum clear path of 2 m in width.


Brisbane

3. Bench

Avoid materials that retain heat in hot and sunny climate.

Seat and armrest should be ergonomics, fit various body shapes.


London

4. Passenger Information

Clear and prominent design of maps, routes and wayfinding.

Clear, universal, understandable and accurate.

Prior to dynamic and real-time, it can be started with static information.


Singapore

5. Street Lighting

To lit the bus stops and provide safer ambience especially during the night.

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2.4 Fleet Modernization

The Need

- Krabi was awarded the "Global Low-Carbon Ecological Scenic Spot" by UNESCAP in October 2018.
- Fleet modernization is another area that can be explored to promote green transport in the region.
- Public transport in Krabi is still dominated by old fleet songthaews.
- Passengers of songthaew are more exposed to exhaust fumes along the journey.
- The existing songthaews are also less comfortable and safe to cater both the locals and tourists demand.
- It appears to be no standards in the existing songthaews as modifications are applied.
- Public transport especially songthaew or tuktuk should be the first target for conversion to low emission transport and conform to the national standard.

Approach on EV Introduction

- Establish regular and consistent communication with the association and the owners.
- Slowly introduce the need of conversion to replace songthaew with safer and modern transport mode.
- Preparation to provide soft-loan financing facility which partially include subsidy through the songthaew associations.
- Provide tax reduction and necessary support.

The Benefits

- Improvement of environment including better local air quality and reduce CO_2 emissions globally.
- Better energy consumption by fossil fuel savings.
- Less urban noise.
- Economic benefit to bring new business opportunities.

Existing Songthaew in Krabi

Electric-Powered Microbus (Motor India Online)

2.4 Fleet Modernization

The Pilot

Fleet modernization can be started with three initial routes in the first stage.

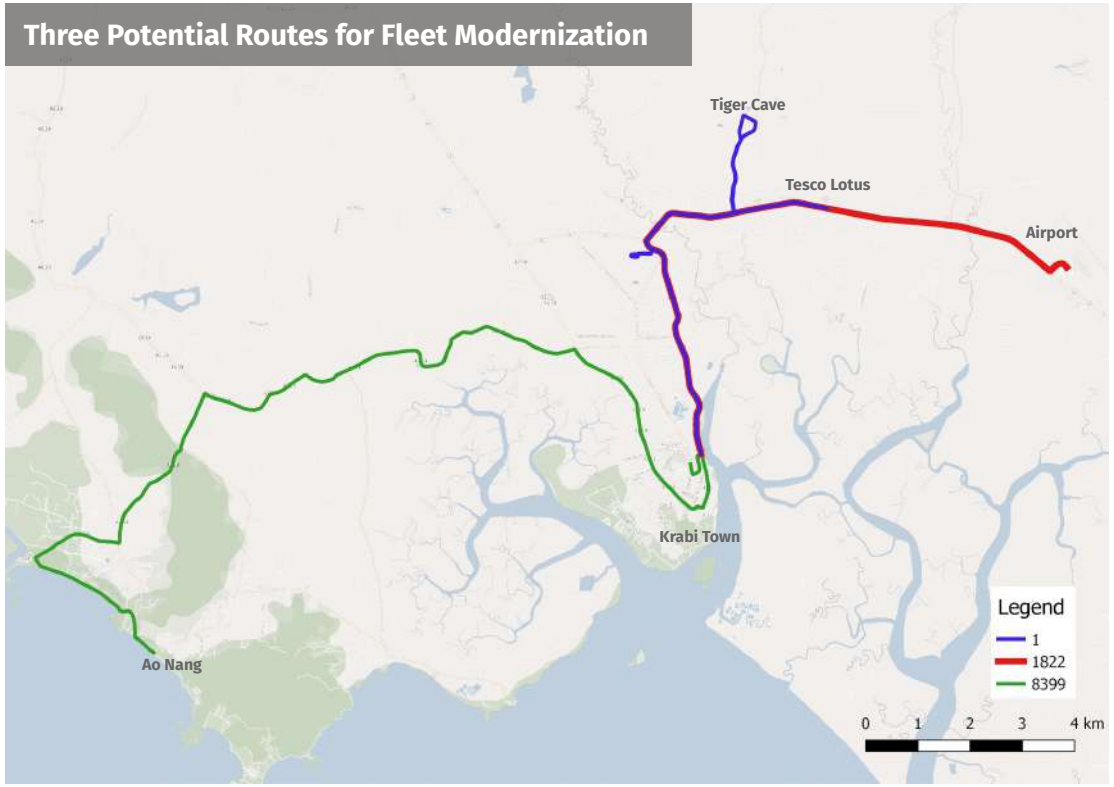
Route 1, 1822 and 8399 from Krabi Town to Tesco Lotus, airport and Ao Nang are the perfect routes to start with.

The distance of these routes is relatively moderate when considering daily mileage and the location of charging facility.

These routes are also popular, serving people from airport and Ao Nang will create good impression that Krabi is fastly shifting to more eco-friendly transport.

The charging facility can be placed in Krabi Town, Tesco Lotus, airport and Ao Nang.

Three Potential Routes for Fleet Modernization



Route Number	From	To	One-Way Length (km)	Existing Mode	Daily Bus km	Fleet Requirement
1	Krabi Town	Tesco Lotus	13.3	Songthaew	160	10
1822	Krabi Town	Airport	13	Songthaew	182	10
8399	Krabi Town	Ao Nang	22.6	Songthaew	181	16

- 10 minutes headway
- 22 km/h average speed
- Fleet requirement includes 10% spare

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Krabi Town
Street Reconfiguration

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3 Krabi Town Street Reconfiguration

Non-Motorized Transport Objectives

Issues	Objective	Target
Walking		
• The use of road space is still dominated by motorized mobility	• Promote equality and prioritization to pedestrian infrastructure	• Wider sidewalk infrastructure for more convenient walking
• Lack of pedestrian crossings in town, making it dangerous for people to cross	• Create safer crossing experience	• Addition of crossings facility are placed every 100 - 200 m
• Hot climate in Krabi sometimes makes walking less preferable	• Create more comfortable walking experience even in hot day	• Cooler and less sweaty with the provision of shades element such as trees or canopies
Cycling		
• The existing bike lane is not safe and full of obstacles to cycle with	• Create a continuous and dedicated bike lane	• Safer and more convenient bicycle riding


Road space are mostly dedicated for cars and parking


No crossing facility

Existing bike lane


Hot walking condition

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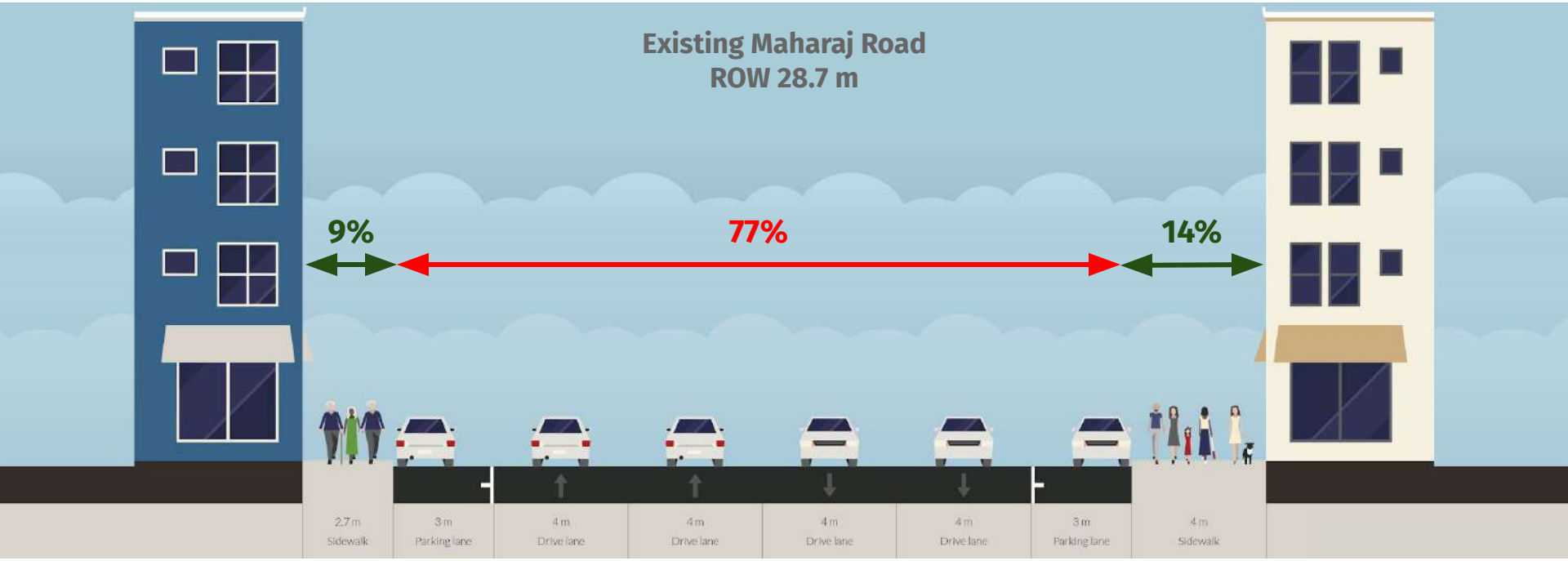
3 Krabi Town Street Reconfiguration



Existing Maharaj Road

The Equality of Space Usage

- ITDP measured 17 cross sections in Krabi Town and found that in average 75% of the road space is allocated for car mobility and parking.
- In Maharaj Road only 23% of the space is given to non-motorized transport.
- Pedestrians even still struggling to reclaim the sidewalk from street vendors and motorcycles.
- Street reconfiguration in Krabi Town is needed to prioritize and promote walking, cycling and public transport.

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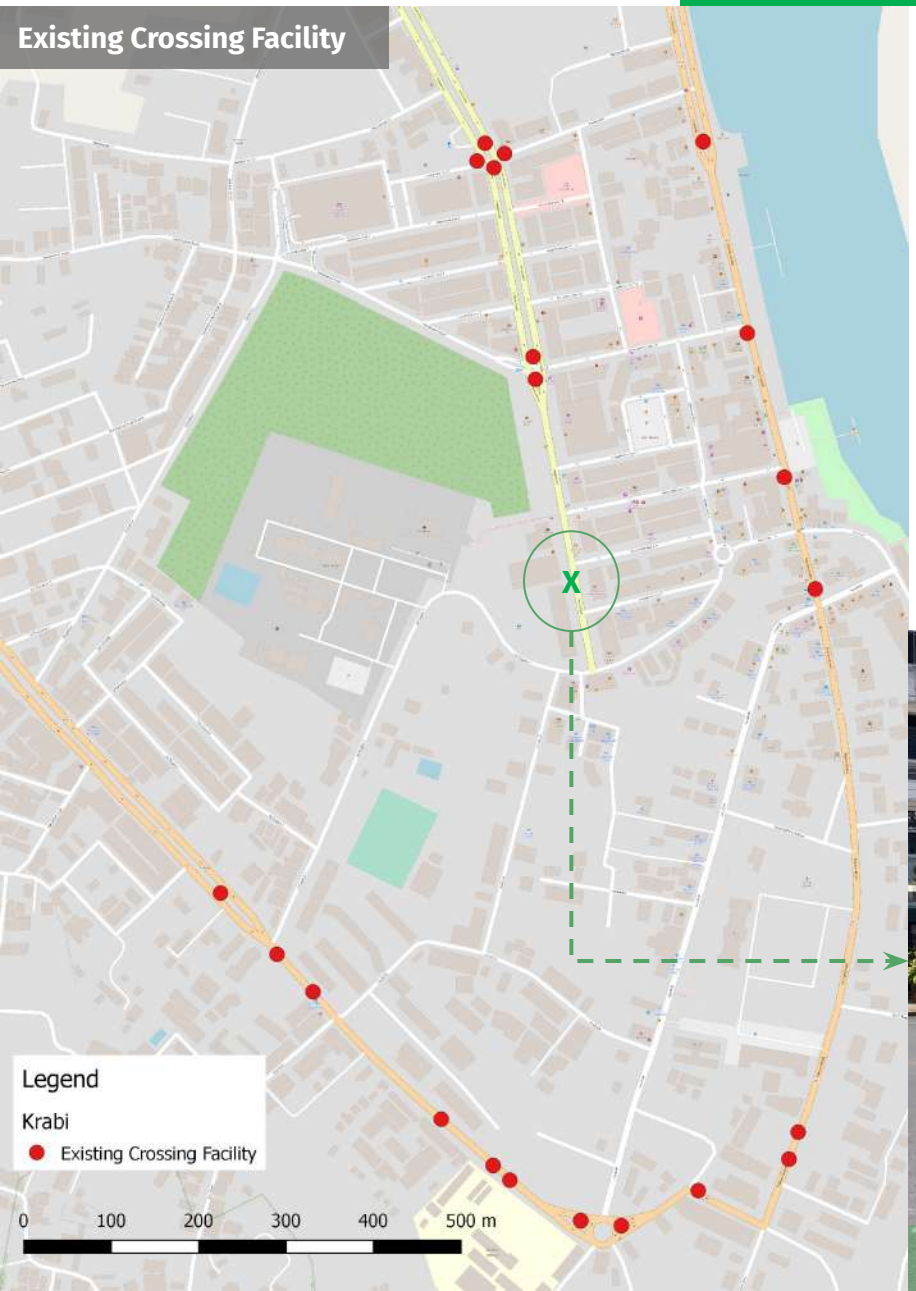
3 Krabi Town Street Reconfiguration

Existing Crossing Facility



The Need of Crossings

- Krabi Town is extremely lack of safe pedestrian crossings.
- Not all intersections provide adequate crossings.
- Crossing is only available at the intersection at Maharaj Road, there is no mid-block crossing along the street.
- Distance between mid-block crossings can be more than 200 m, which is should be avoided.
- It becomes difficult and dangerous for people just to cross the streets.
- Safe and frequent pedestrian crossings will highly support a walkable environment in Krabi.

Students are dangerously crossing the street with no facility on Maharaj Road.

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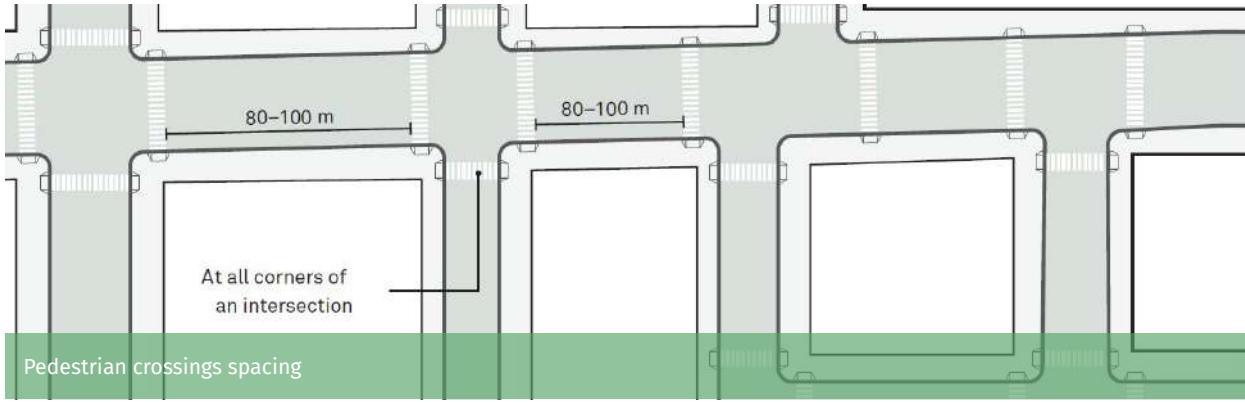
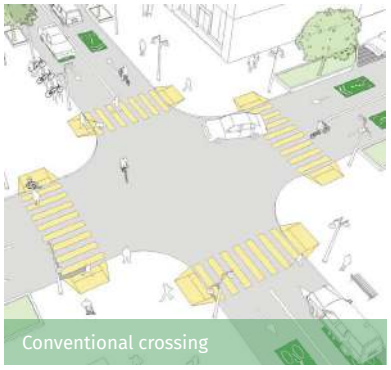
3 Krabi Town Street Reconfiguration

Recommendations for Crossings

- Provide safe and accessible crossings every 80 - 100 m and at all legs of intersections in order to ensure a connected walkable network.
- Spacing of more than 200 m of pedestrian crossings should be avoided.
- Put pedestrian crossings where there is a significant pedestrian desire line.
- At-grade crossings always preferable than pedestrian bridge unless unavoidable circumstances such as limited-access highway or natural environment such as rivers.
- Reducing the turning radius at intersection can give more space to pedestrians and cut the crossing distance.



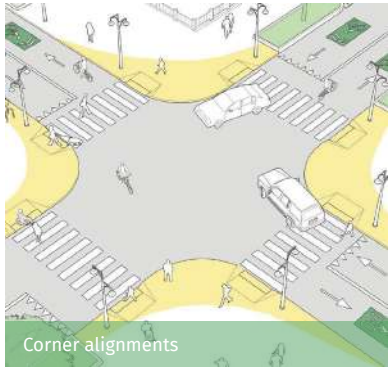
Pedestrian crossings spacing


Conventional crossing


Raised crossing


Yield crossing


Median cut-through

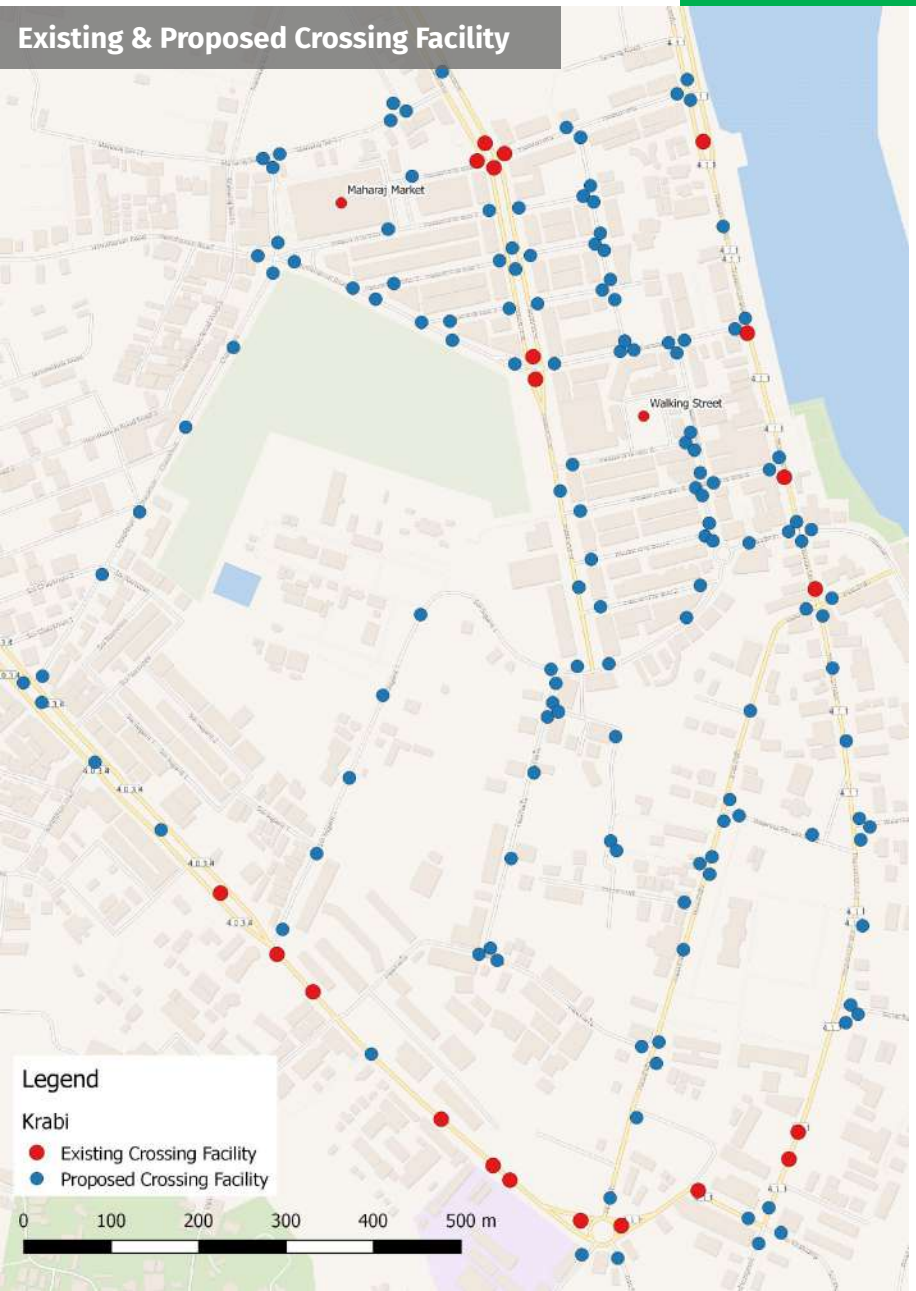

Corner alignments


Slip lane removal

Images by NACTO - Global Street Design Guide

3 Krabi Town Street Reconfiguration

Existing & Proposed Crossing Facility



Proposed Crossing

- According to the crossing proposal, Krabi Town highly needs more crossing facility.
- Crossing is obligatory on every leg of the intersection.
- Mid-block crossing is placed every 100 m on a road segment.
- Crossing is a quick win that can be implemented immediately by the government.
- It also shows tendency to prioritize people over cars and motorcycles in a city.

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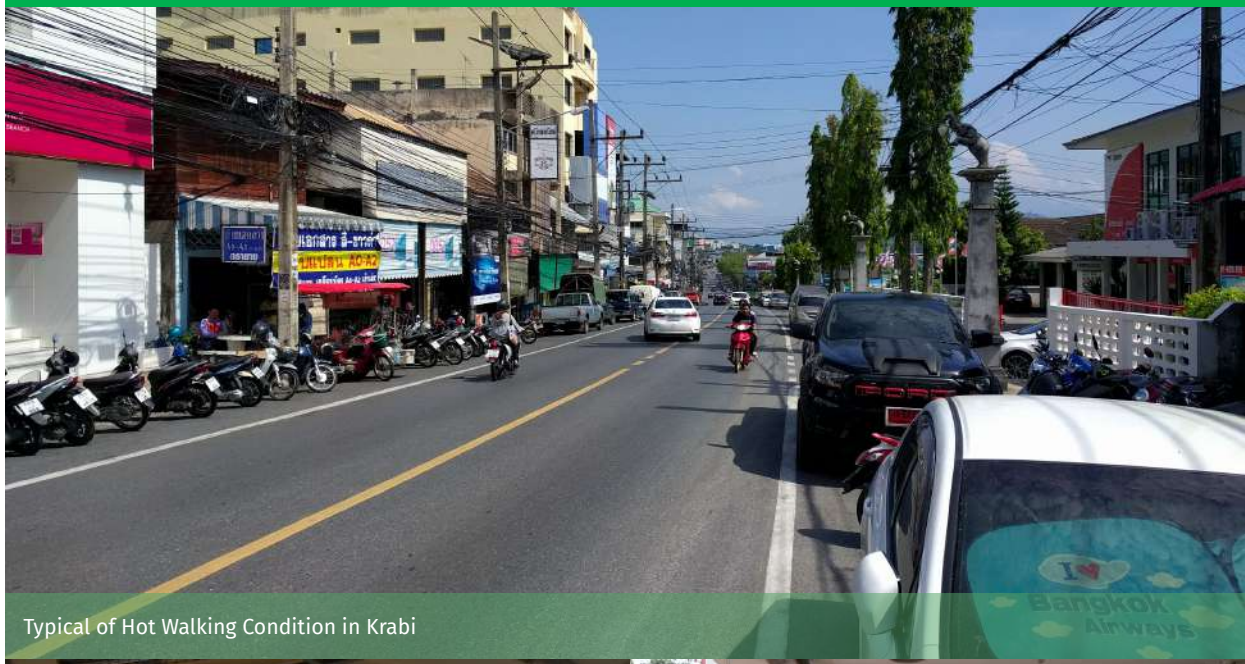
3 Krabi Town Street Reconfiguration

Shades Element

- Walking experience in tropical country can be enhanced with shades.
- Shades can be artificial or natural such as canopy or trees.
- It has the function to protect the pedestrian from direct sunlight or rain.
- Some streets in Krabi such as Maharaj Road already implement arcade design.
- Similar approach to cover the pedestrian should be replicated on other streets in Krabi Town.



Typical of Hot Walking Condition in Krabi

Implementation of Canopy and Arcade in Kuala Lumpur

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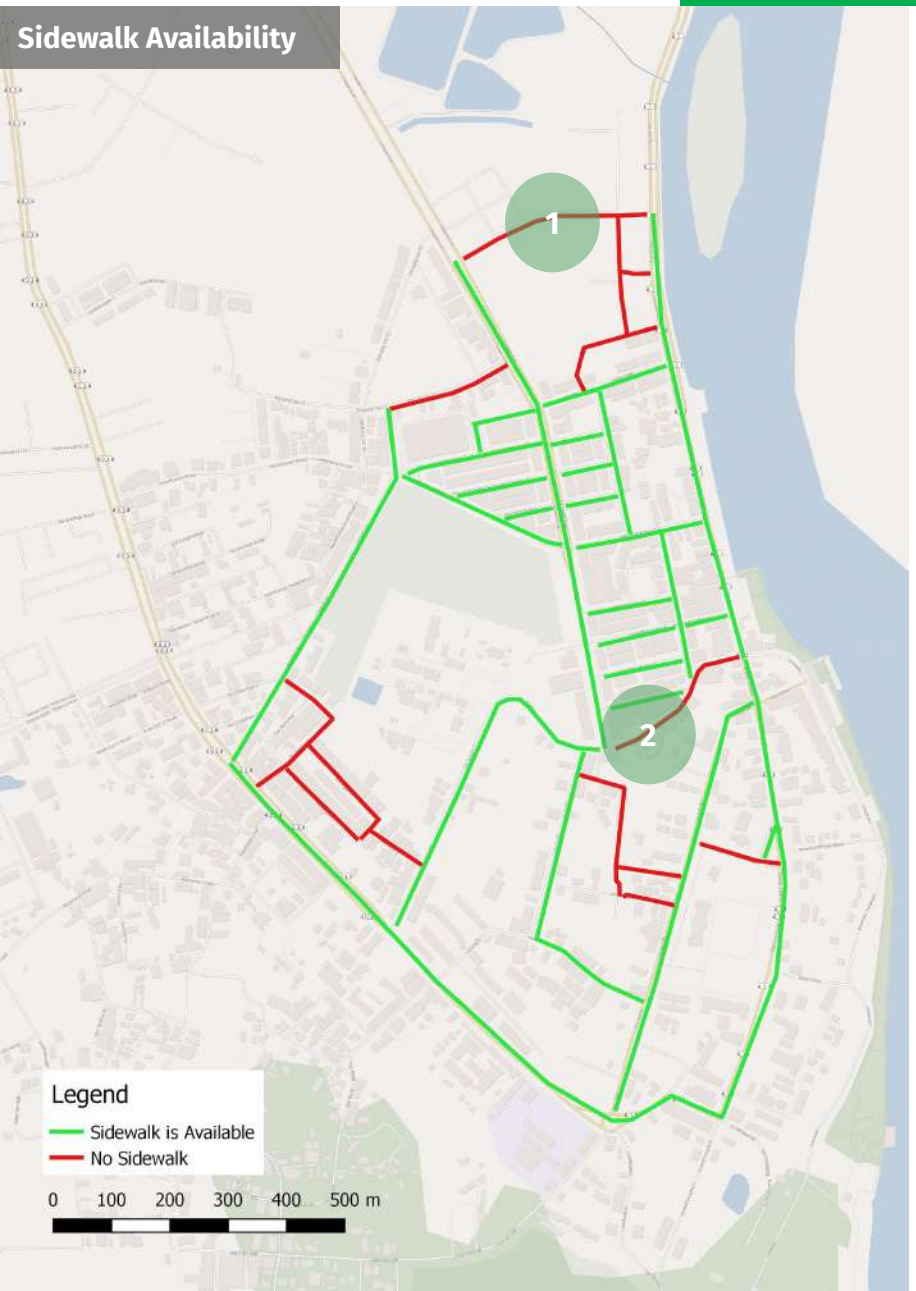
3 Krabi Town Street Reconfiguration



Existing Street Condition

- There are still some road segments in Krabi Town that have no sidewalk facility or with poor condition.
- At the same time not all road segments that have sidewalk are in good condition.
- Typical of road in Krabi town is still heavily accommodating the motorized transport, shown by wide road lane and plenty on-street parking, neglecting the basic need of human to walk.
- Street reconfiguration is needed to reclaim and prioritize pedestrian over private vehicles.

1. Wide street with no sidewalk at all

2. Sidewalk only on one side

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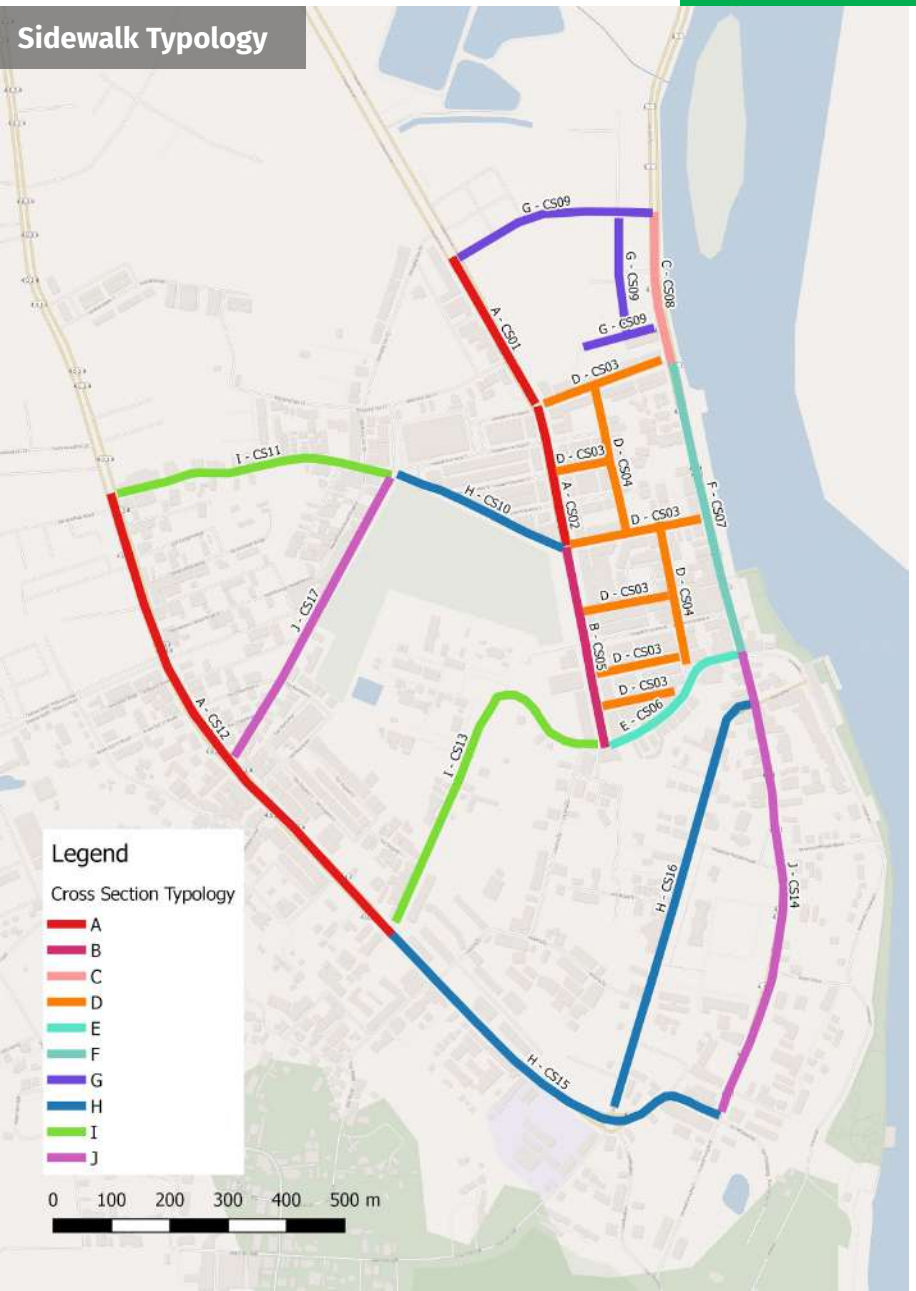
3 Krabi Town Street Reconfiguration

Sidewalk Typology



Cross section survey was conducted in Krabi Town to see the typical street dimension and adjust the existing right of way to prioritize pedestrians and people on bike.

- In general there are 10 street typologies.
- The existing range for one mixed-traffic lane is around 3.2 m to 4 m.
- Most of the streets are available for on-street parking for cars and motorcycles. The existing width of on-street parking space can be more than 3 m.

Recommendations

- Reduce the width of one mixed-traffic lane to 3 m.
- Angled on-street parking is prohibited, only parallel is allowed.
- The width of on-street parking can be squeezed to 2.1 m to 2.5 m.
- The width reduction of mixed-traffic and on-street parking is converted to more space for sidewalk.
- Along the waterfront, switch the bike lane position to the outer side next to the sidewalk with addition of buffer for protection and exclusivity.
- Provision of sidewalk when the existing is unavailable and prioritization over on-street parking.
- Add trees or canopy for shading to make walking more convenient.

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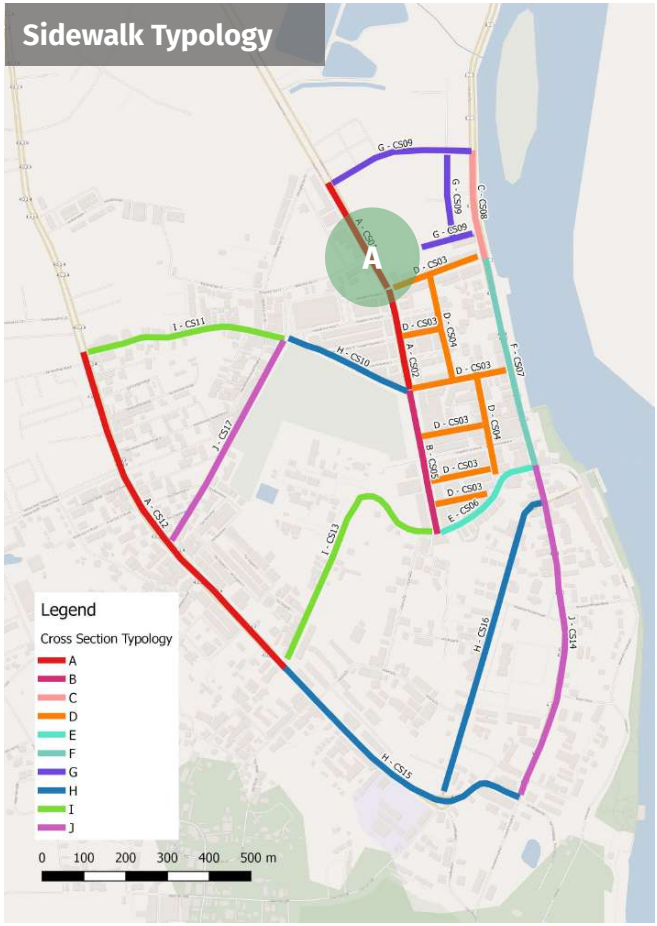
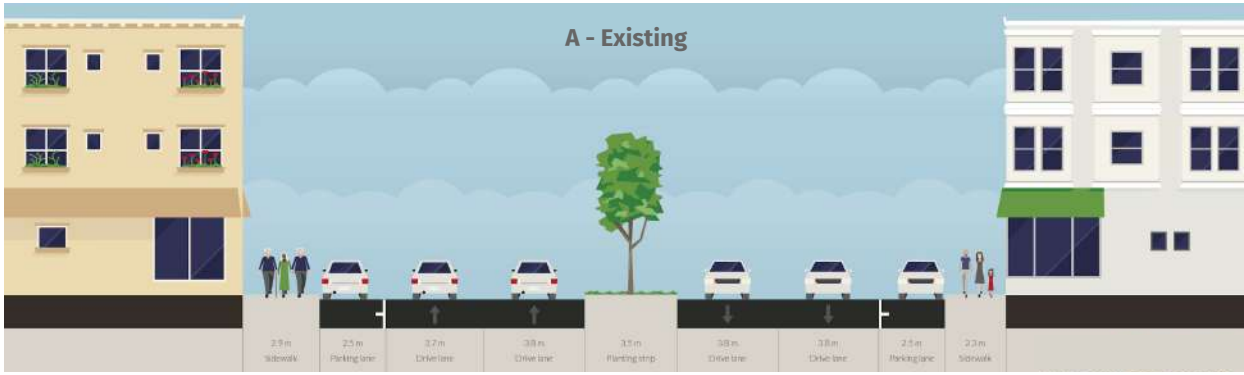
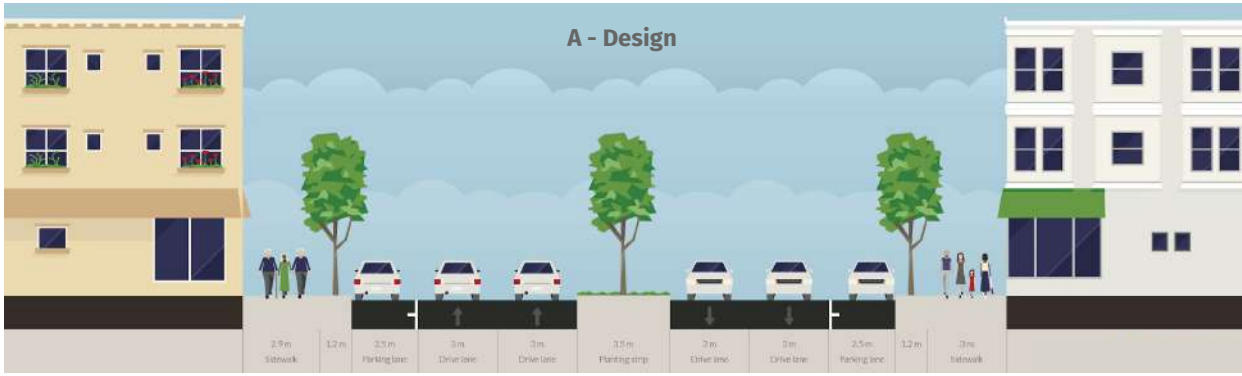
3 Krabi Town Street Reconfiguration

Maharaj Road
ROW 28.8 m







Improvements

- Widen sidewalk area
- Reduce the width of car lane and on-street parking

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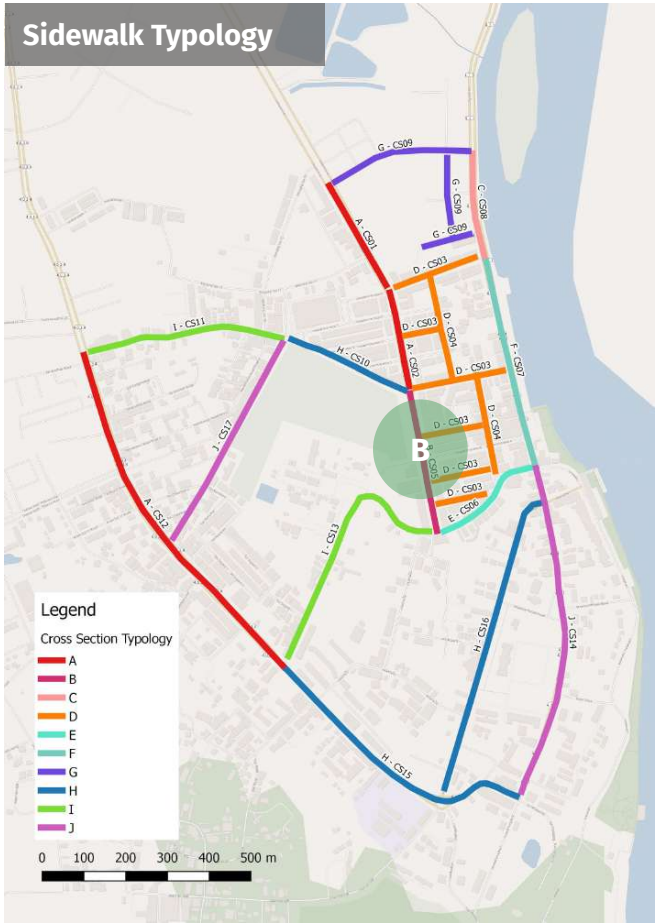
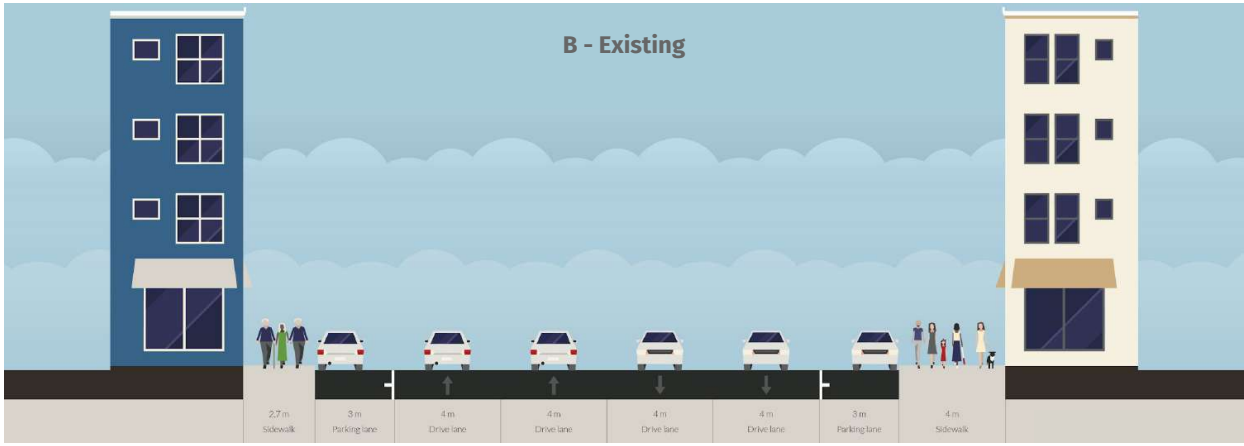
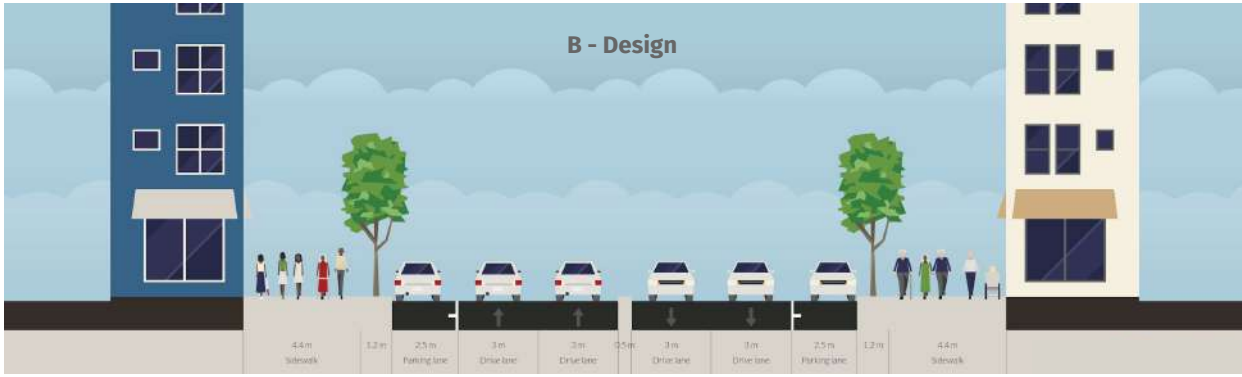
3 Krabi Town Street Reconfiguration

Maharaj Road
ROW 28.7 m







Improvements

- Widen sidewalk area
- Reduce the width of car lane and on-street parking
- Add separator as road median

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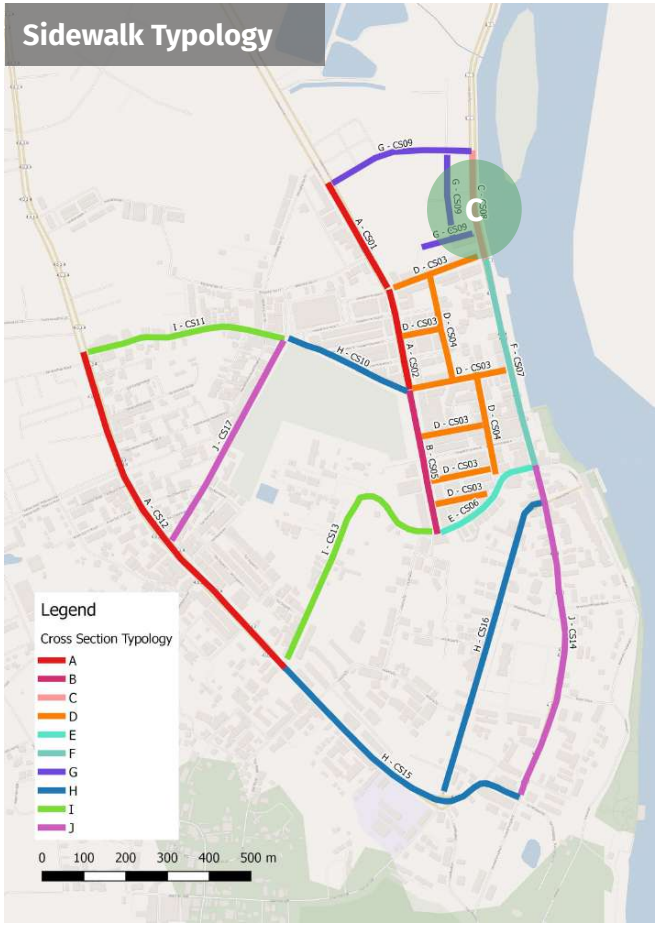
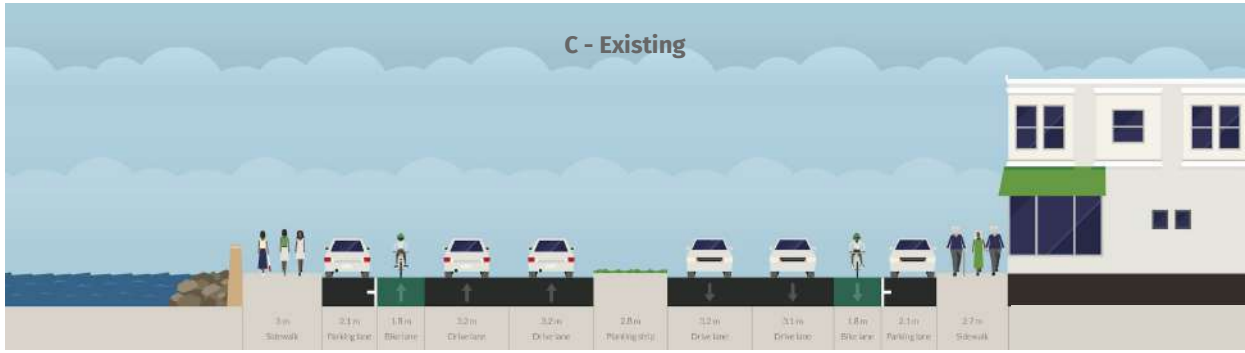
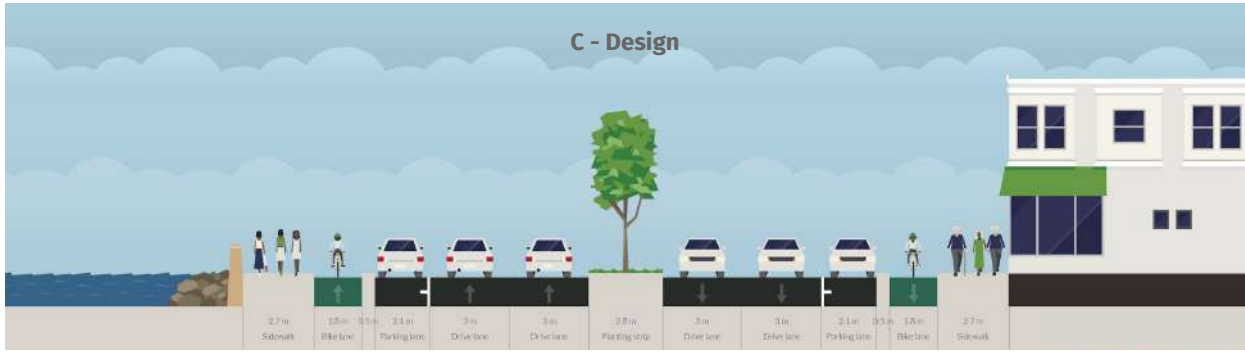
3 Krabi Town Street Reconfiguration

Thanon Utarakit Road
ROW 29 m







Improvements

- Reduce the width of car lane and on-street parking
- Switch bike lane position to the outer side of the street
- Add separator for bike lane

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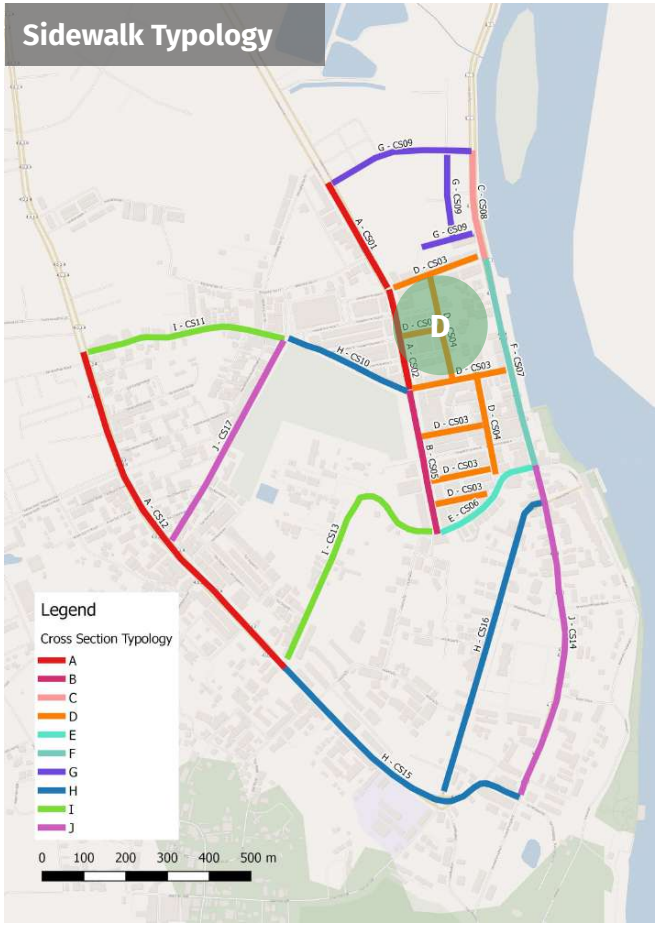
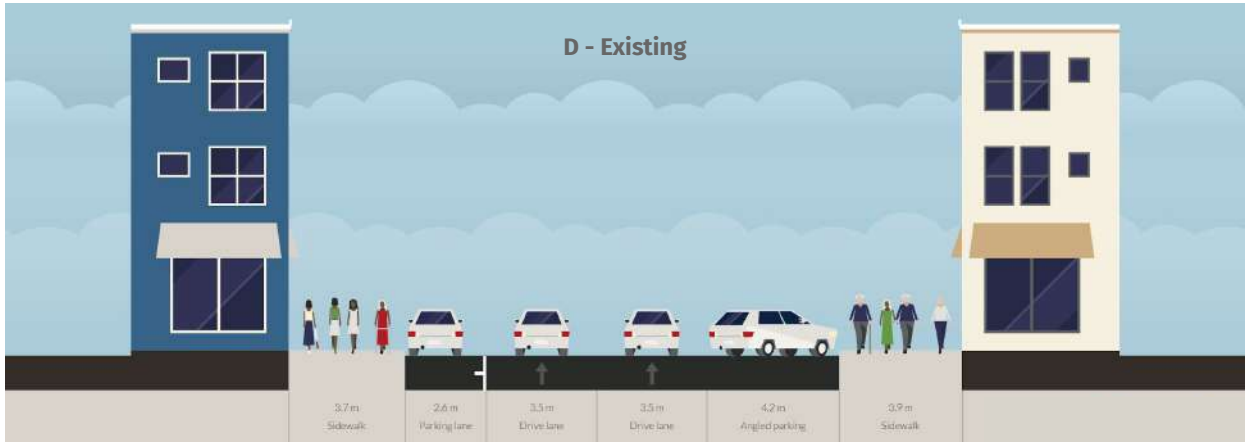
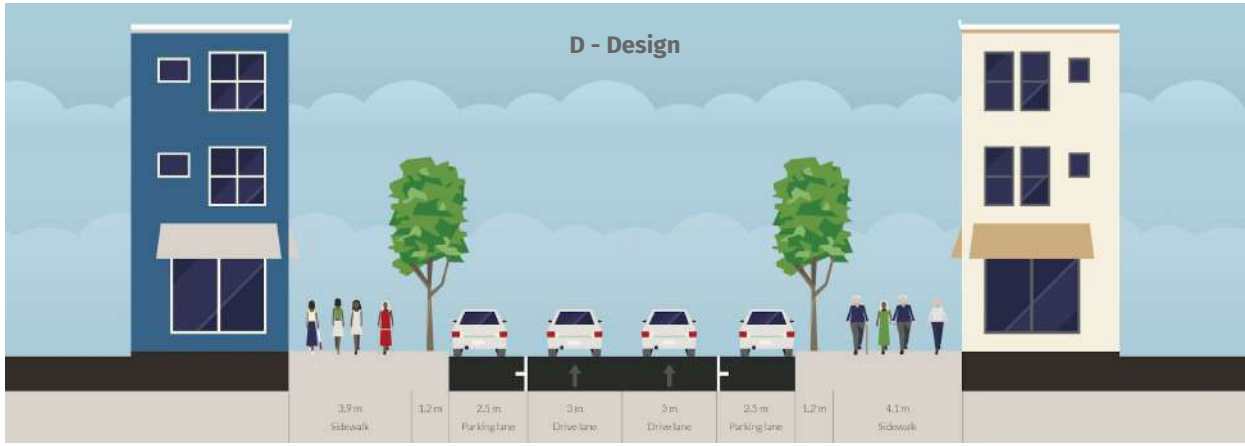
3 Krabi Town Street Reconfiguration

Vicar Road
ROW 21.4 m







Improvements

- Widen sidewalk area
- Reduce the width of car lane and on-street parking
- Only parallel parking is allowed, angled is prohibited

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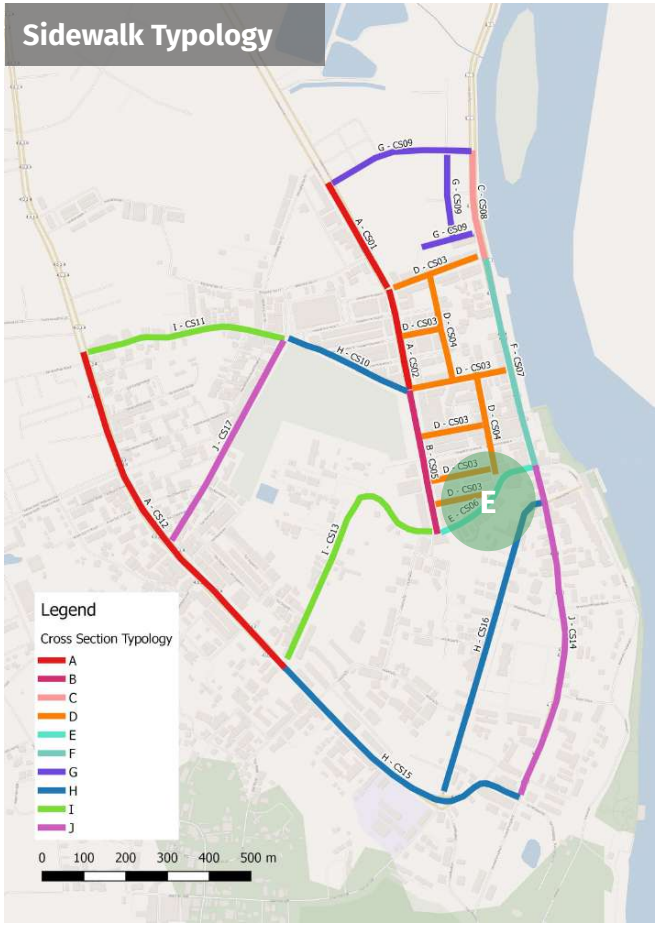
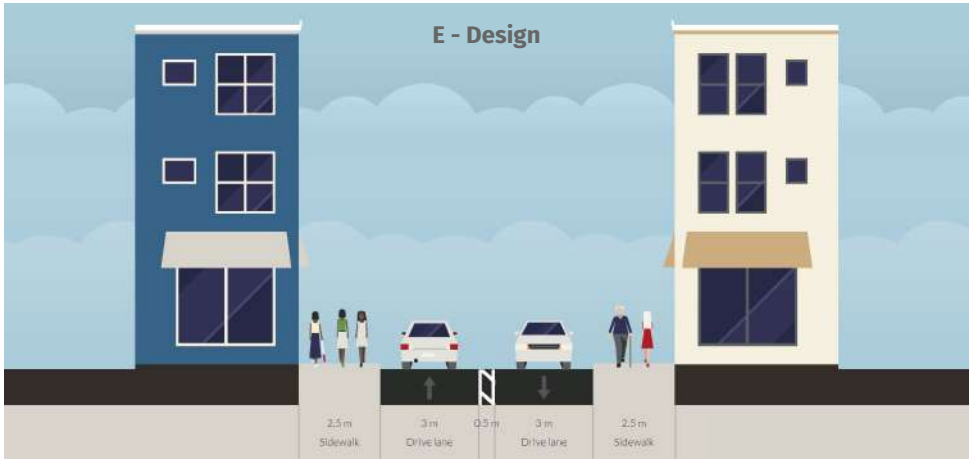
3 Krabi Town Street Reconfiguration

Ruamjit Road
ROW 11.5 m





Improvements

- Widen sidewalk area
- Remove on-street parking
- Add sidewalk towards East
- Add painted road median

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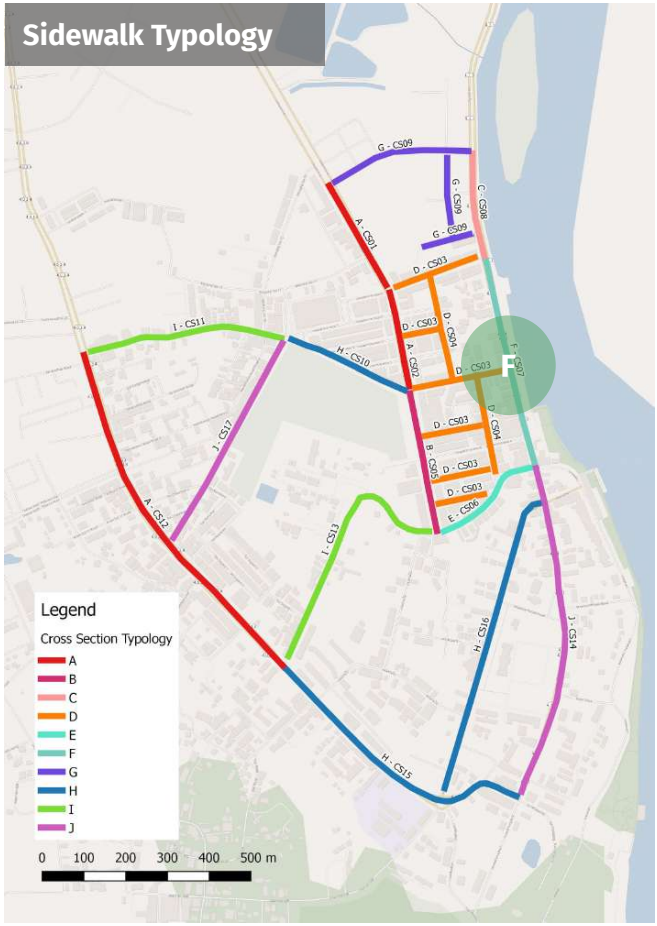
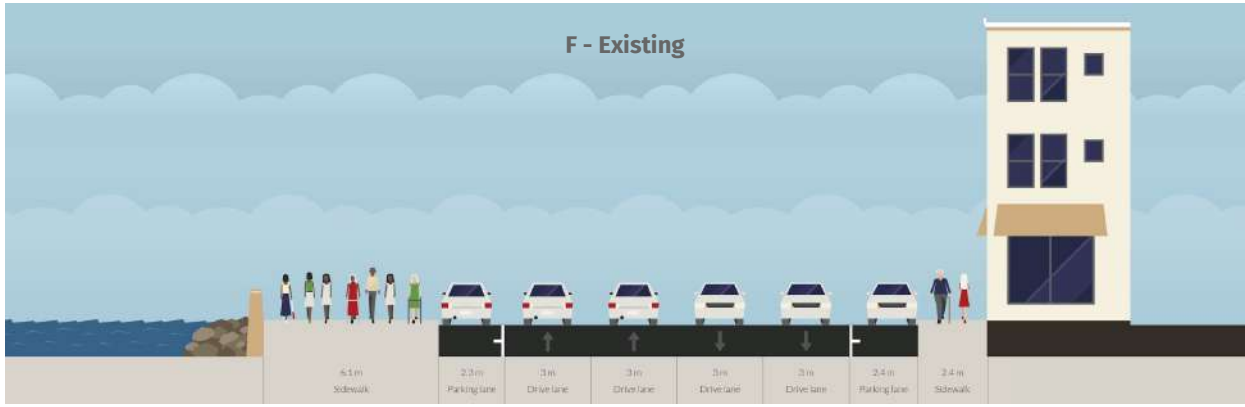
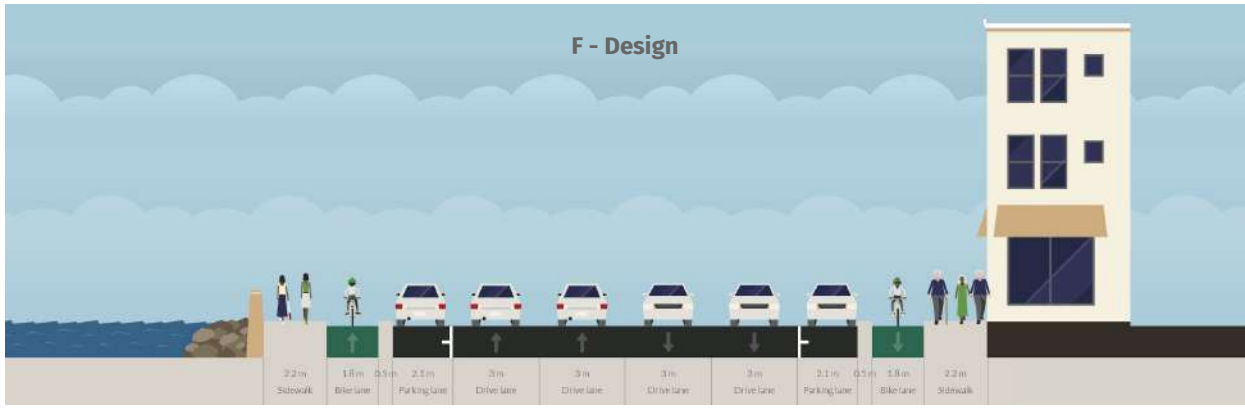
3 Krabi Town Street Reconfiguration

Utarakit Road
ROW 25.2 m







Improvements

- Add protected bike lane on both sides
- Reduce the width of on-street parking

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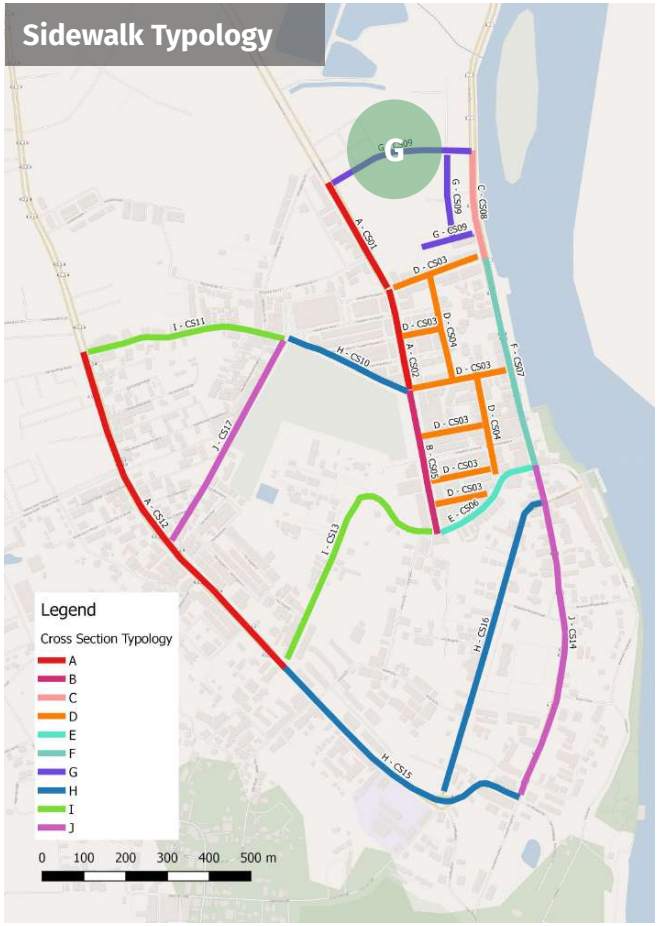
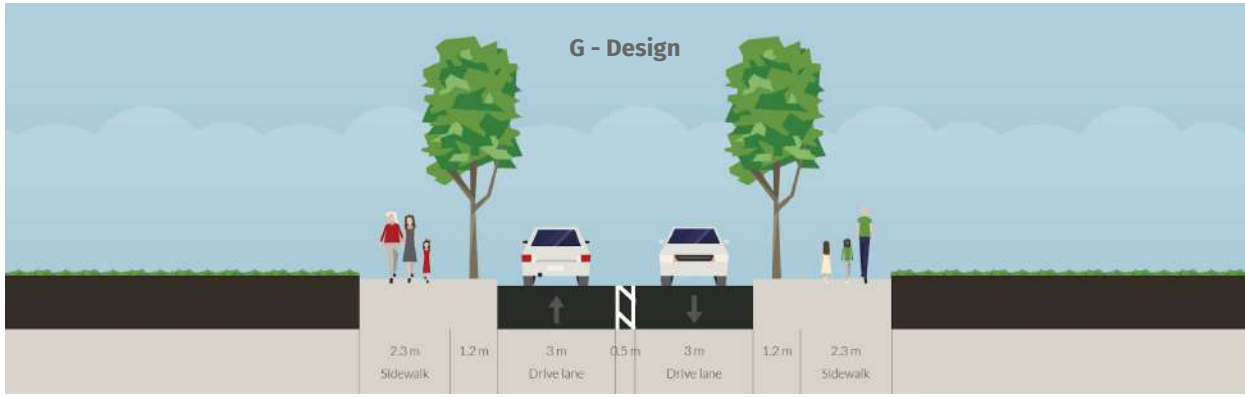
3 Krabi Town Street Reconfiguration

Taguathung Road
ROW 13.5 m





Improvements

- Add sidewalk on both sides
- Reduce the width of car lane
- Remove on-street parking
- Add painted road median

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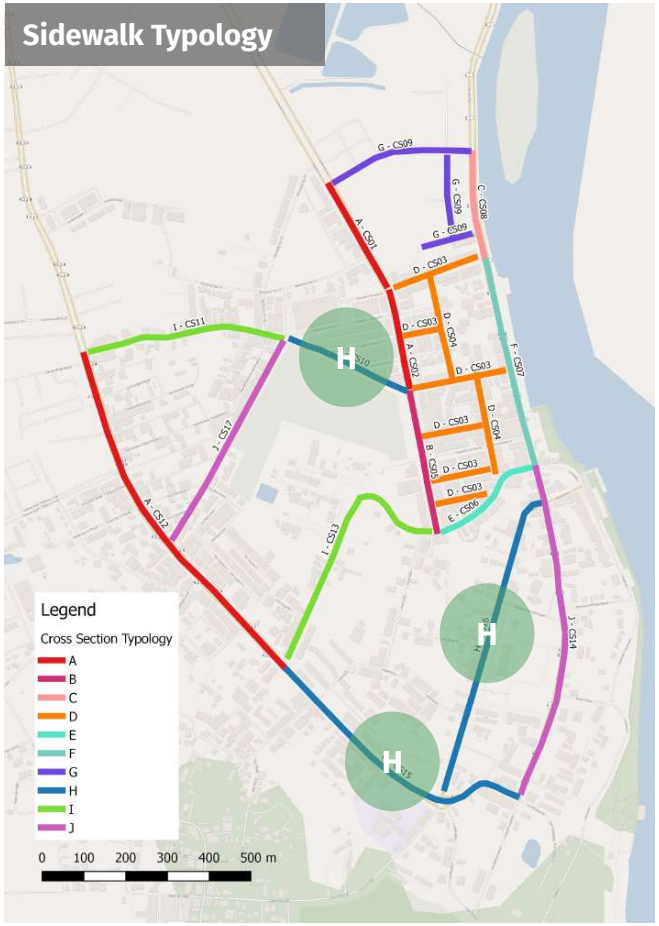
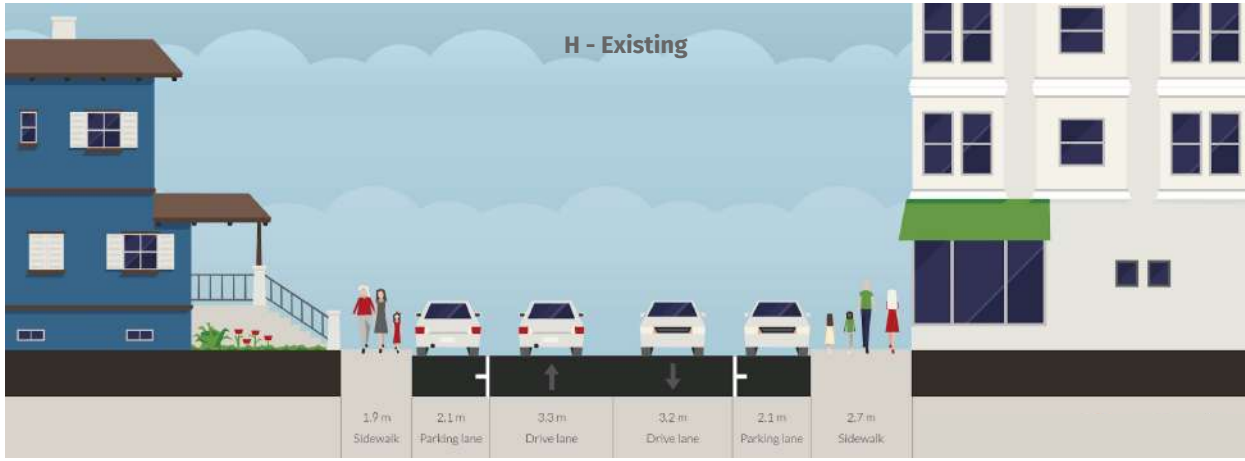
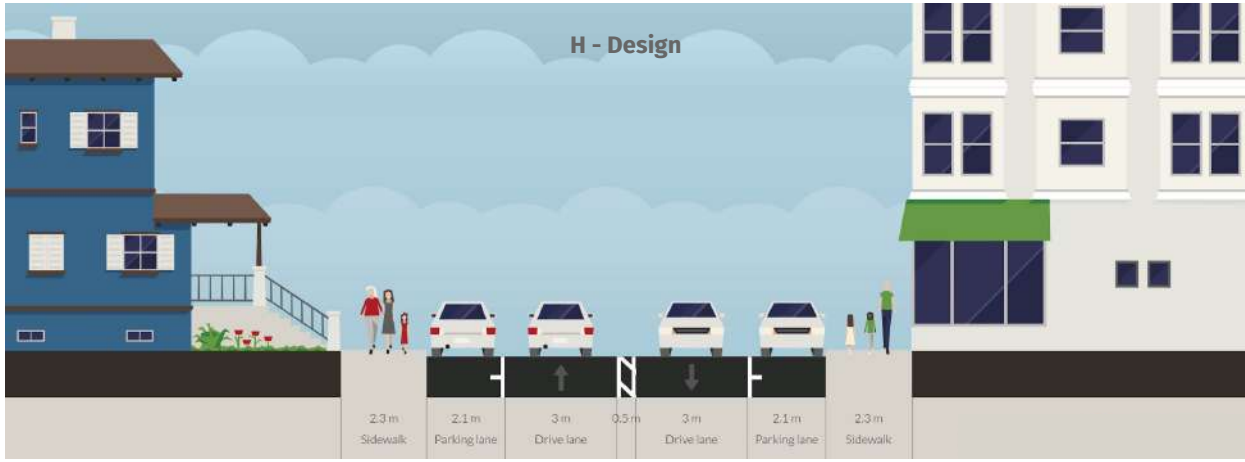
3 Krabi Town Street Reconfiguration

Hemthanon Road
ROW 15.8 m







Improvements

- Widen sidewalk area
- Reduce the width of car lane
- Add painted road median

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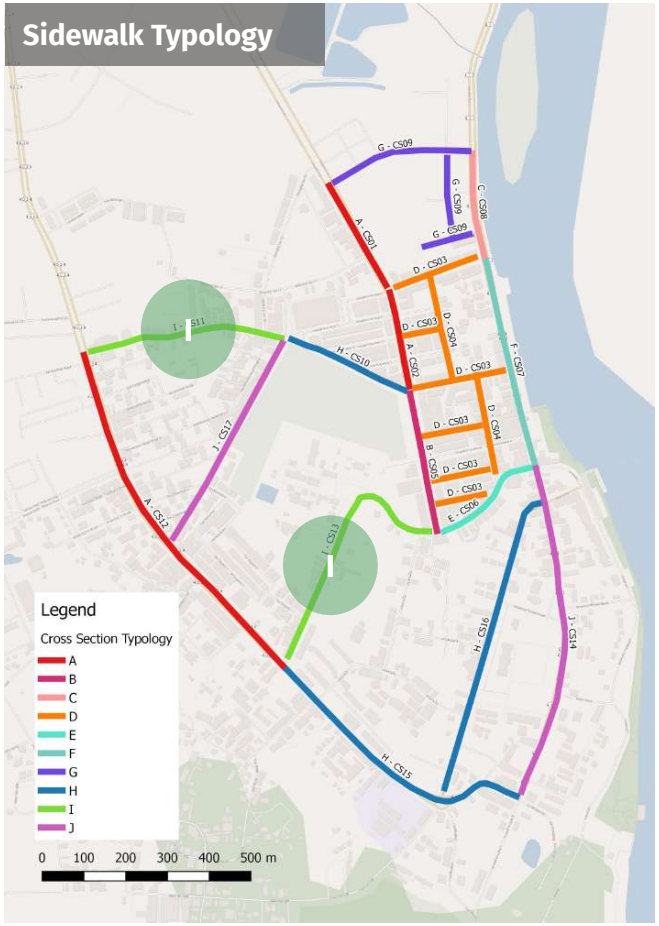
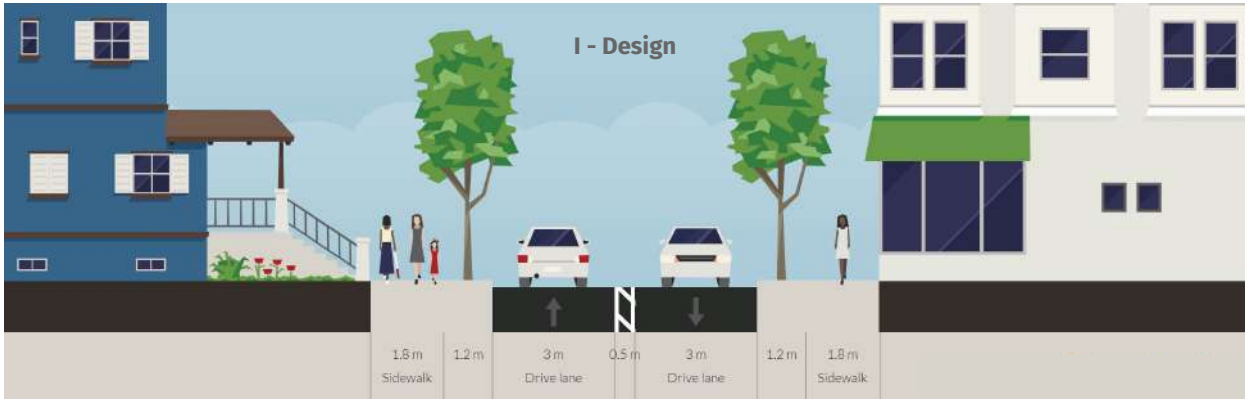
3 Krabi Town Street Reconfiguration

Itsara Road
ROW 12.5 m





Improvements

- Widen sidewalk area
- Reduce the width of car lane
- Remove on-street parking
- Add painted road median

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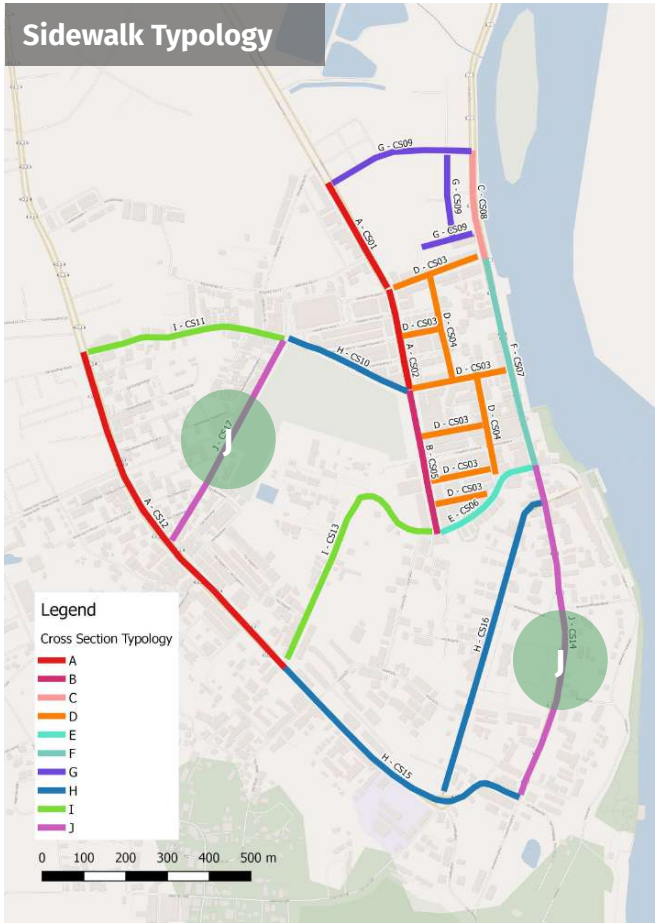
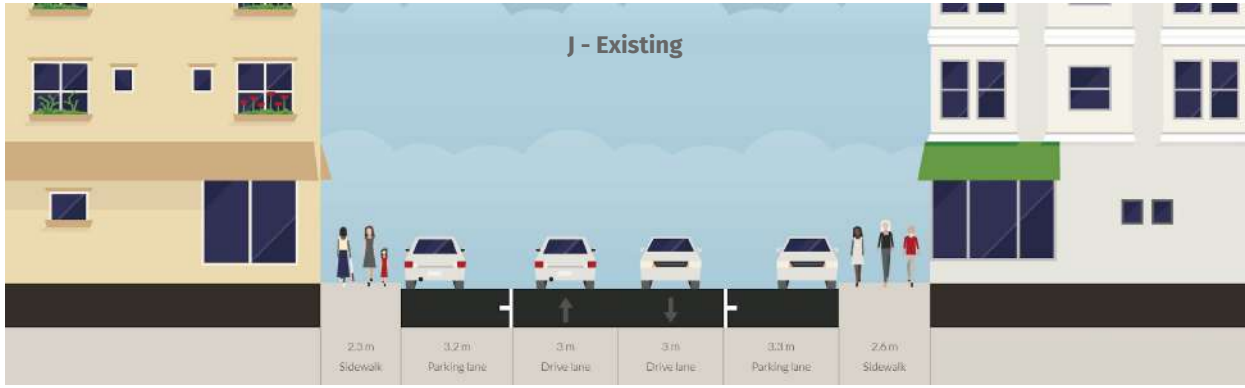
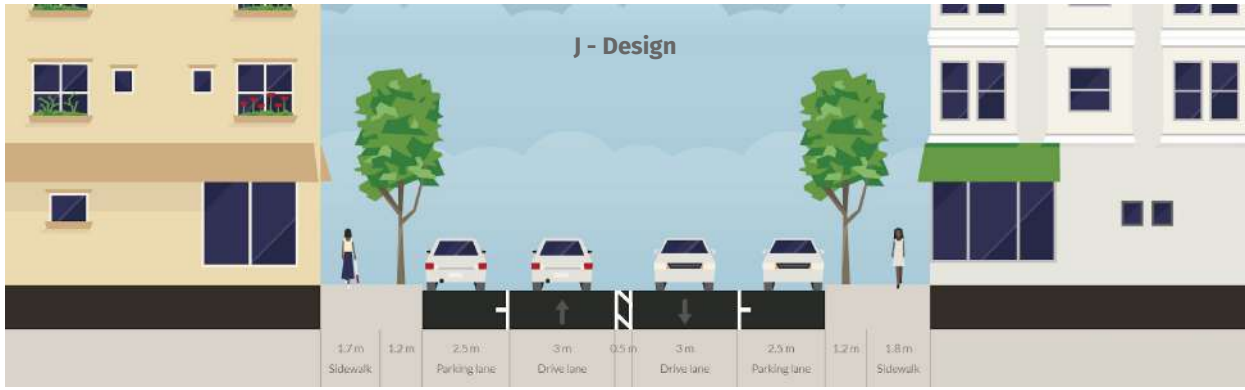
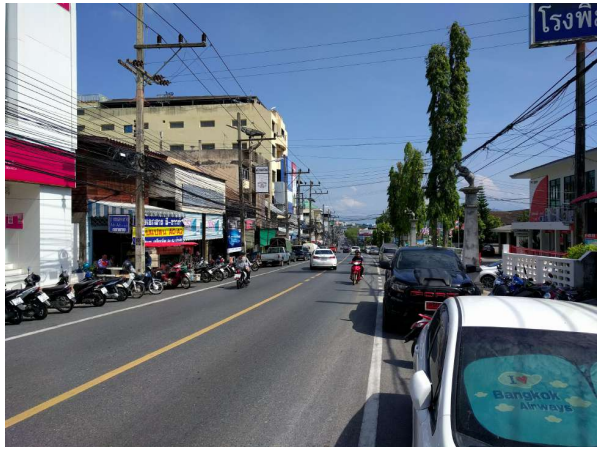
3 Krabi Town Street Reconfiguration

Uttarakit Road
ROW 17.4 m









Improvements

- Widen sidewalk area
- Reduce the width of on-street parking
- Add painted road median

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Ao Nang

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4. Ao Nang

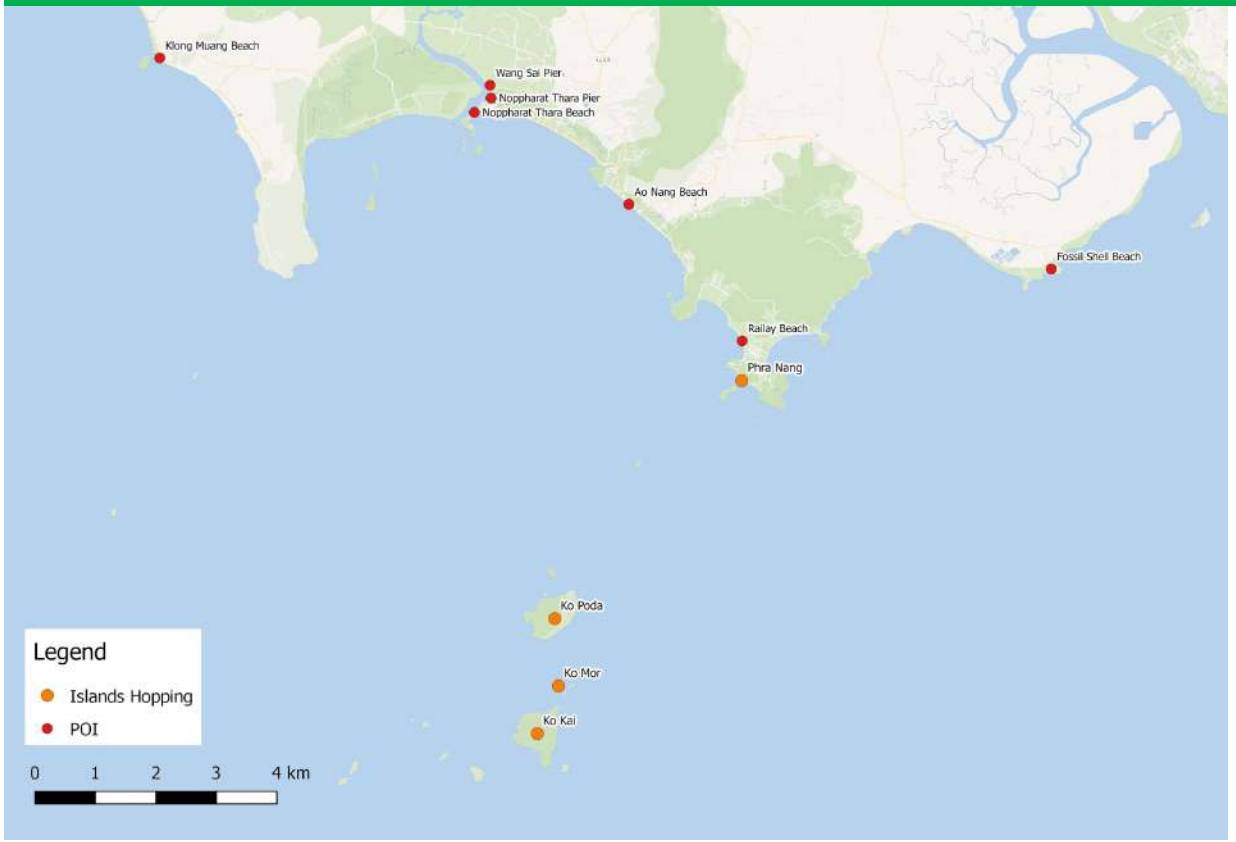
Overview

Ao Nang is a resort town located 18 km on south-west of Krabi Town. It is famously known for a long coast beachfront and acts as a hub to dive locations off the surrounding islands.

Long-tail boat

Ao Nang is also well-known as the center of long-tail boat tours to other beaches on other islands nearby such as Ko Poda, Ko Mor and Ko Gai (Chicken Island). Another exclusive journey with long-tail boat can also make trip to Railay beach, a secluded beach around 3 km on the south of Ao Nang beach.

On those two beaches, the lack of jetty makes the visitors have slight difficulty when accessing the boat, especially for for people carrying big luggages and suitcases in Railay.




Long-Tail Boat


Ao Nang Beach

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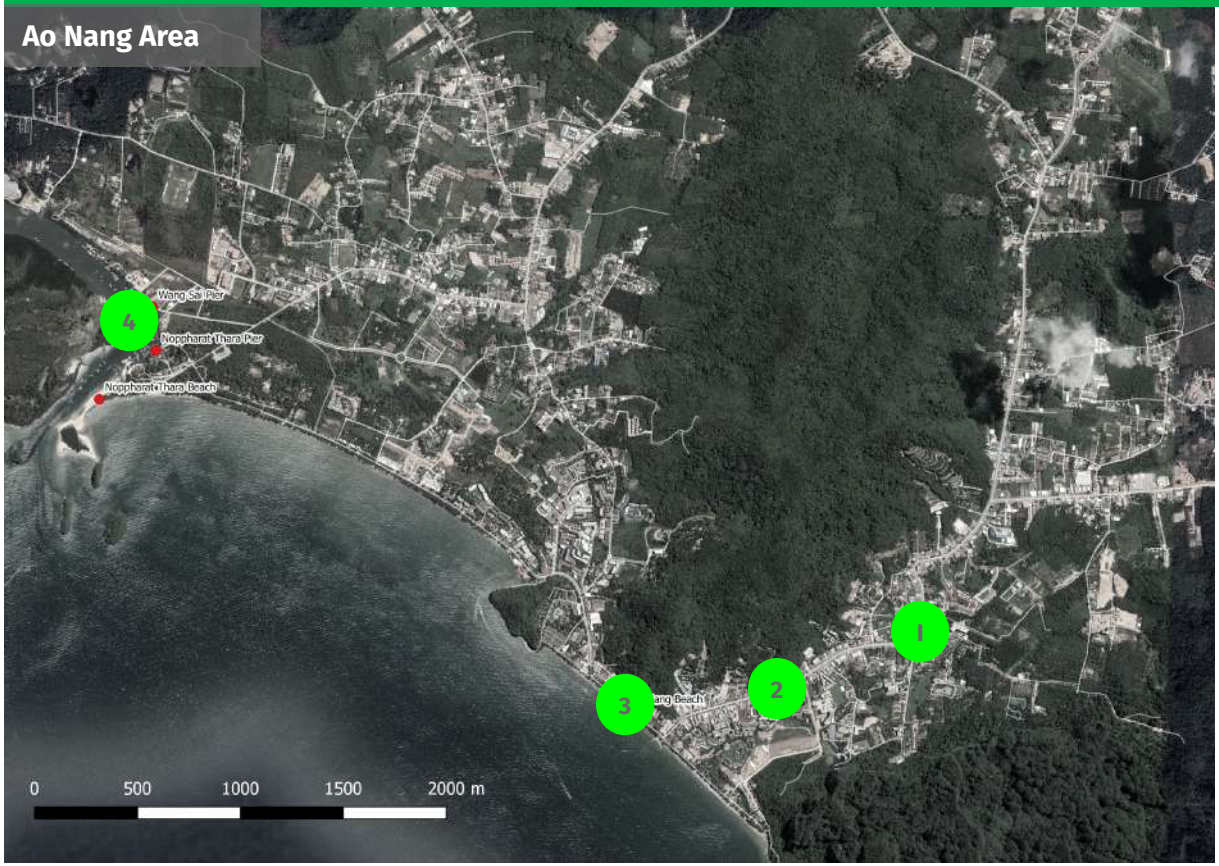
4. Ao Nang

Existing Conditions

- The main road and beachfront are concentrated with accommodations, bars, restaurants and souvenir shops.
- Wide and good quality sidewalk.
- On-street parking occupies one lane of the road everywhere.
- Available public transport is a long-distance service from Krabi and only along the main road, no frequent local service within the area.
- Poor connectivity and disorganized boat management at Wang Sai Pier.




1. Wide sidewalk with active frontage


2. On-street parking occupies the road


3. Souvenirs shops


4. Wang Sai Pier

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4. Ao Nang

Public Transport

Public transport only serves from/to Krabi town, with route 8399 and 8415 connecting Krabi town and airport to Ao Nang. There is no local shuttle service typically for tourists to move around Ao Nang.

While walking and cycling are perfect for Ao Nang, lack of bicycle infrastructure such as bike lane, bike parking as well as bike-share making cycling activity is very limited in Ao Nang.

Public transport in Ao Nang

Cyclist in Ao Nang

Waterfront Road along Ao Nang Beach

Street on Noppharat Thara Beach

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4.1. Bike Lane and Bike-Share

The Need of Bike Lane

- The quality of sidewalk in Ao Nang is decent.
- In addition to that, cycling is another sustainable tool to extend the explore range for local short trips within Ao Nang.
- In order to promote cycling, the facility should ensure the safety and comfort for people on bike.
- Bike lane as the dedicated place for cycling should come in first hand.
- In terms of design, protected and continuous bike lane is compulsory on the main road.
- ITDP recommends a network of bike lane in the area and grouped into three types.

1. One Side Bike Lane

To be implemented along the beachfront side by side with the sidewalk and the commercials.

One Side Bike Lane in Guangzhou, China

2. Two Sides Bike Lane

To be implemented along 4203 road where commercials are located on both side of the road.

Two Sides Bike Lane in Delft, Netherlands

3. Shared Bike Lane

To be implemented along Khlong Hang Road. This road is also packed with hotels and can be the way through to beachfront.

Shared bike lane in New York, U.S. (NACTO)

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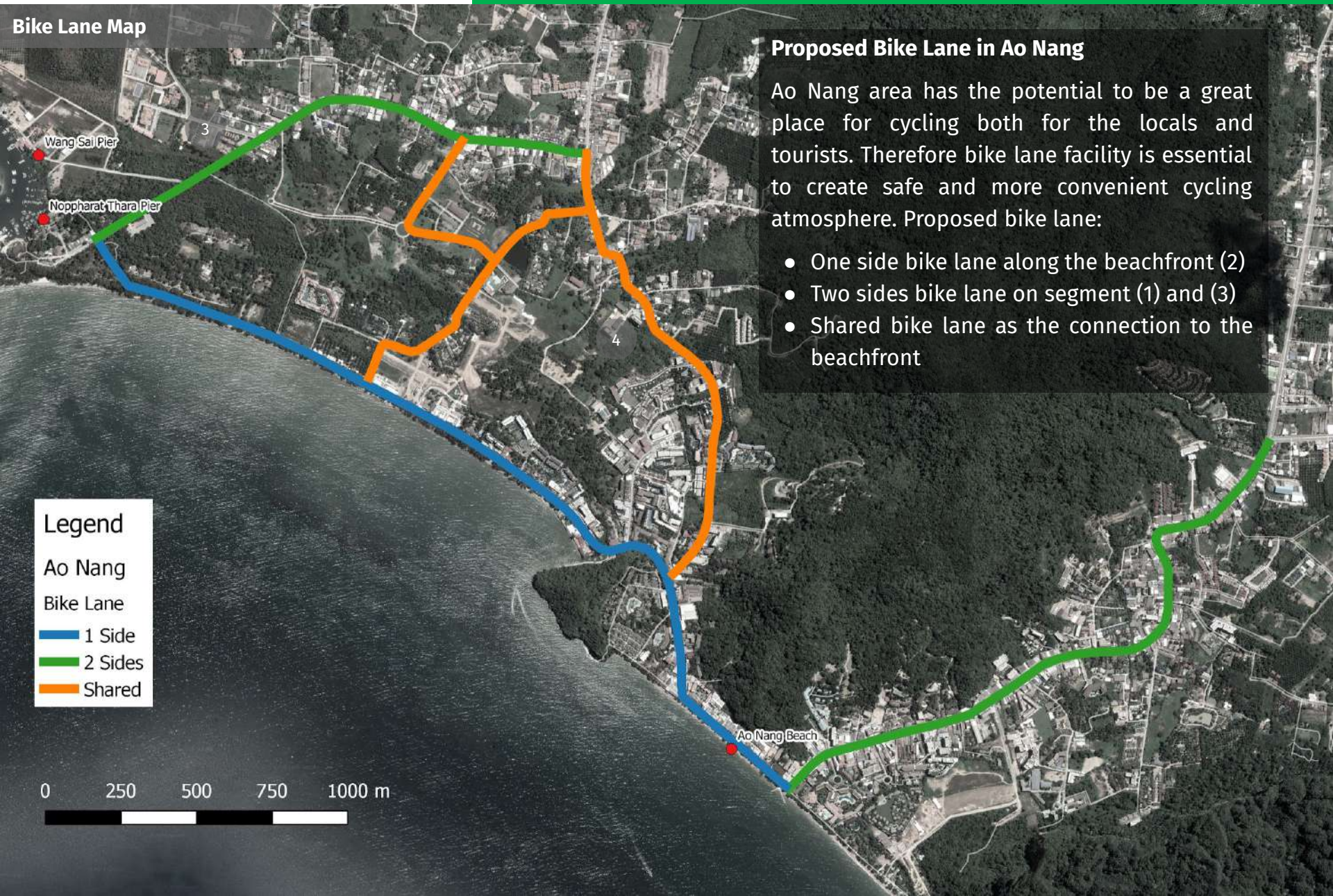
4.1. Bike Lane and Bike-Share

Bike Lane Map



Proposed Bike Lane in Ao Nang

Ao Nang area has the potential to be a great place for cycling both for the locals and tourists. Therefore bike lane facility is essential to create safe and more convenient cycling atmosphere. Proposed bike lane:

- One side bike lane along the beachfront (2)
- Two sides bike lane on segment (1) and (3)
- Shared bike lane as the connection to the beachfront

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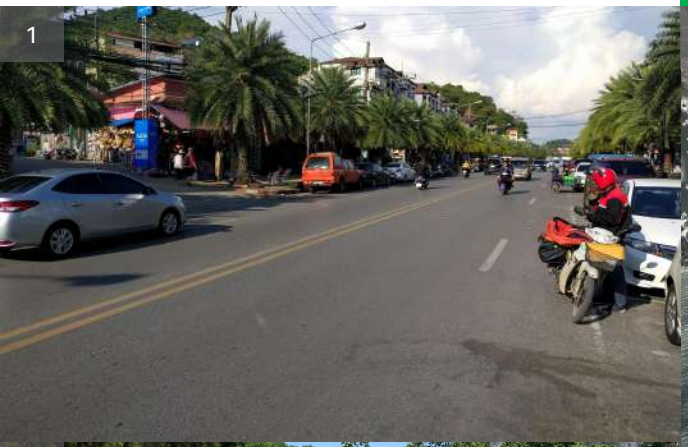
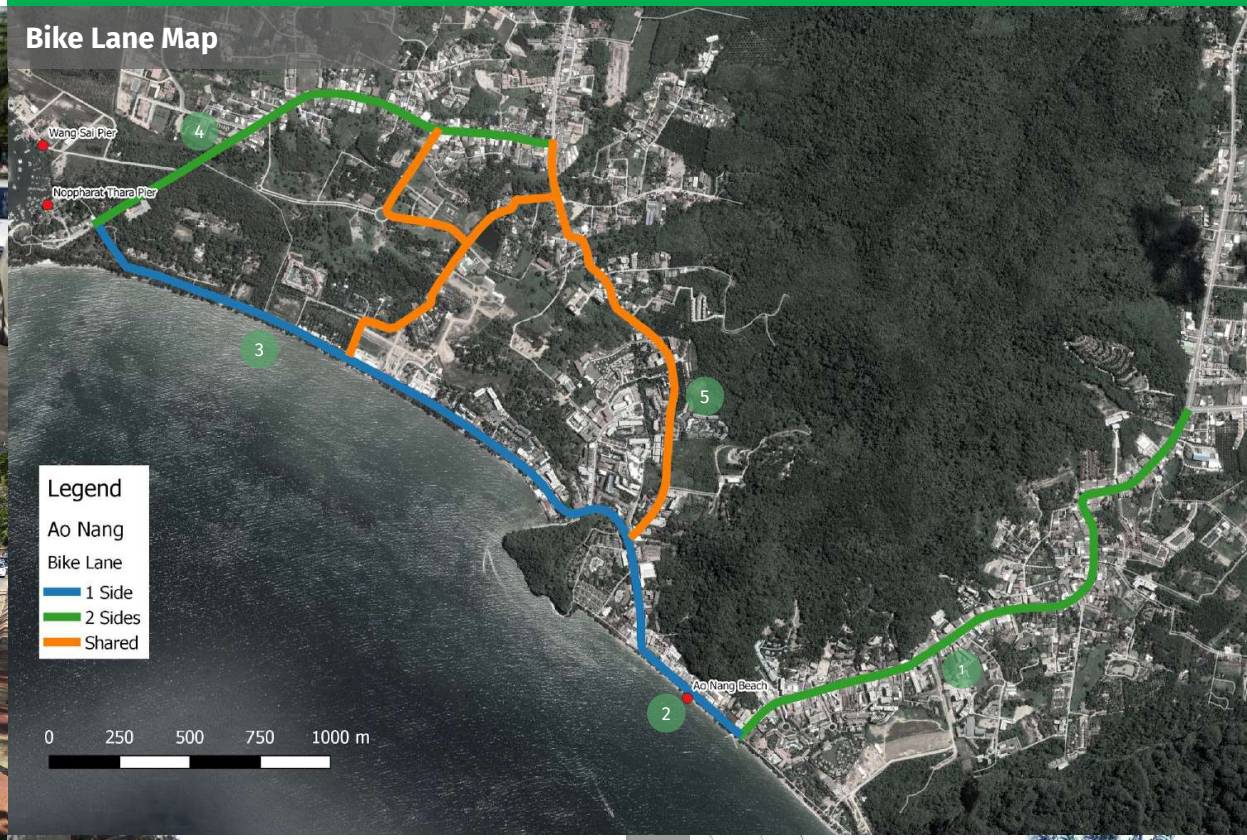
4.1. Bike Lane and Bike-Share (Existing Images)





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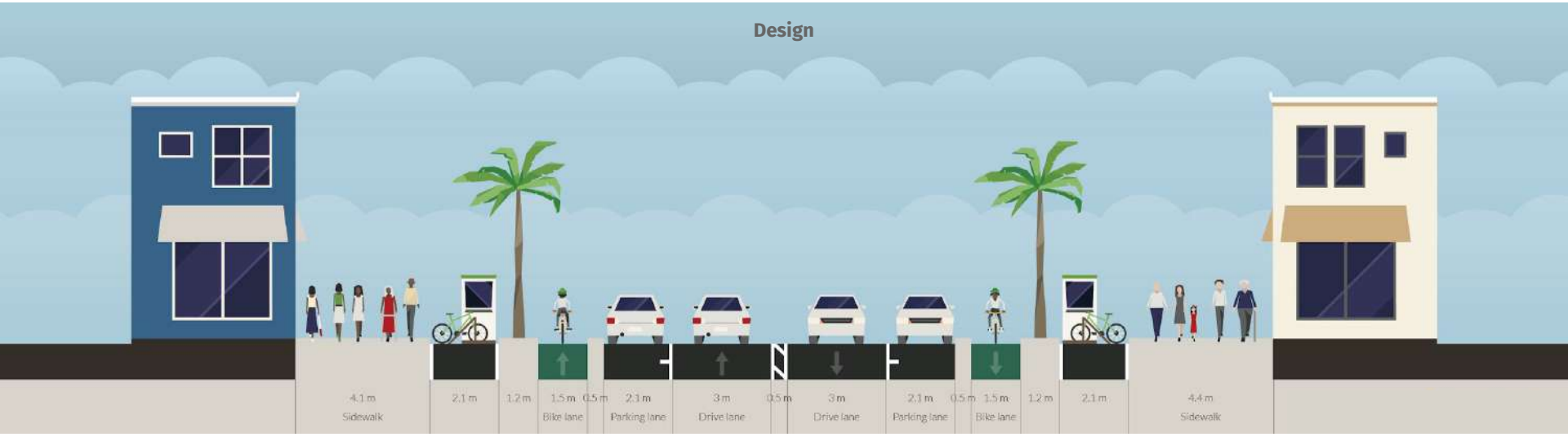
4.1. Bike Lane and Bike-Share



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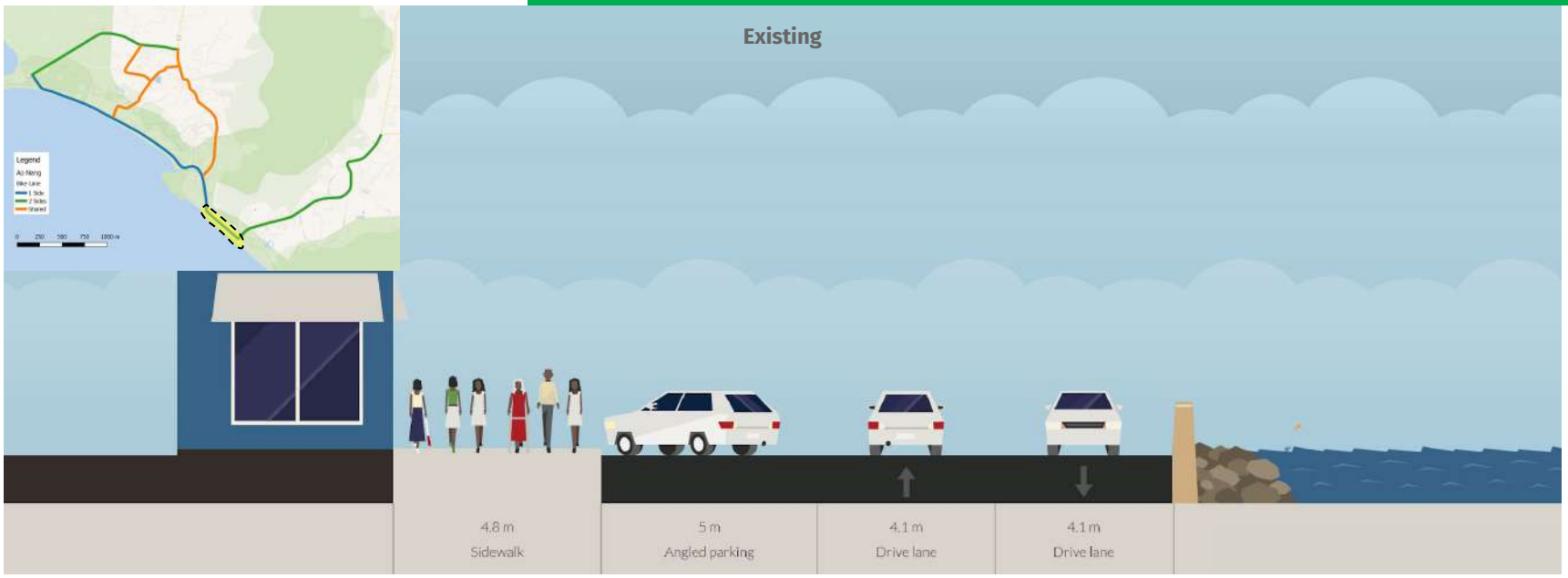
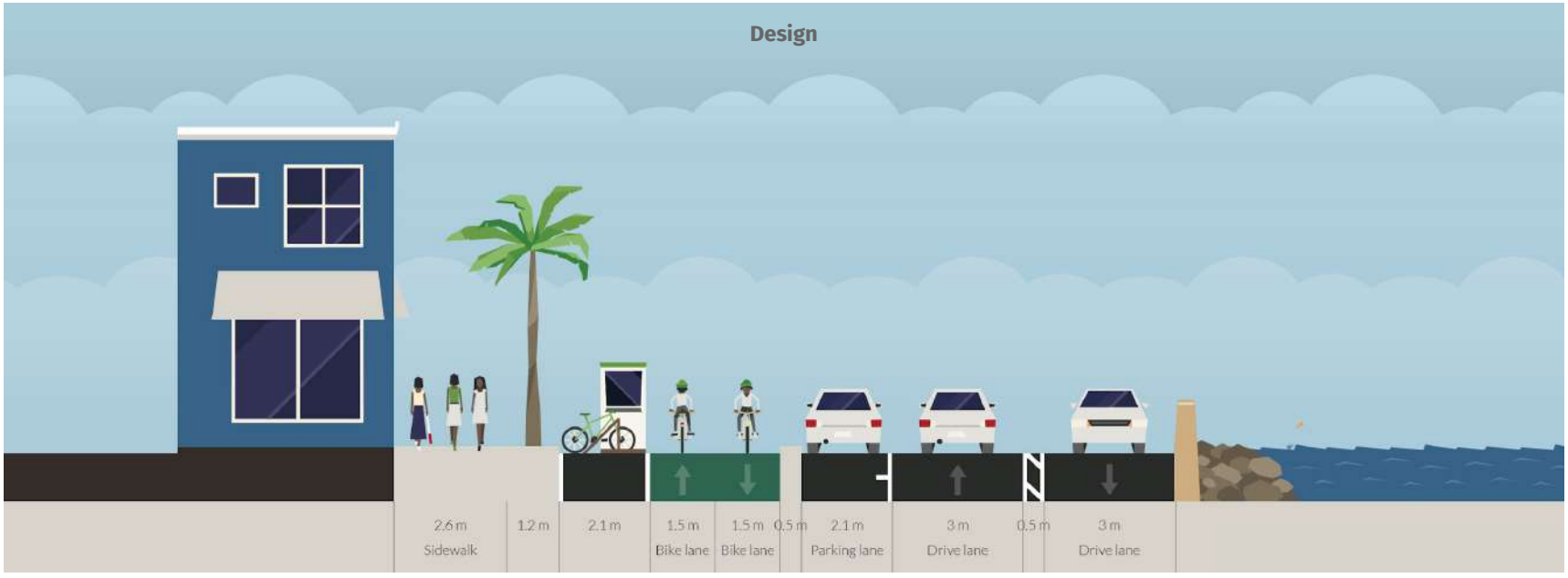
4.1. Bike Lane and Bike-Share





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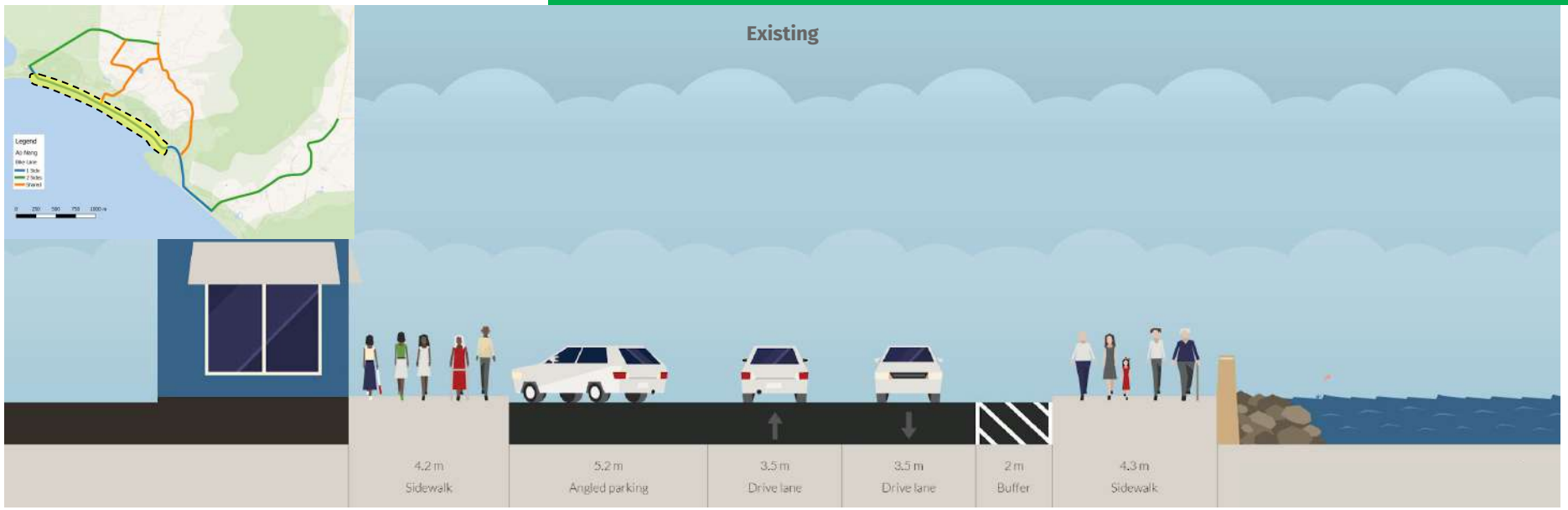
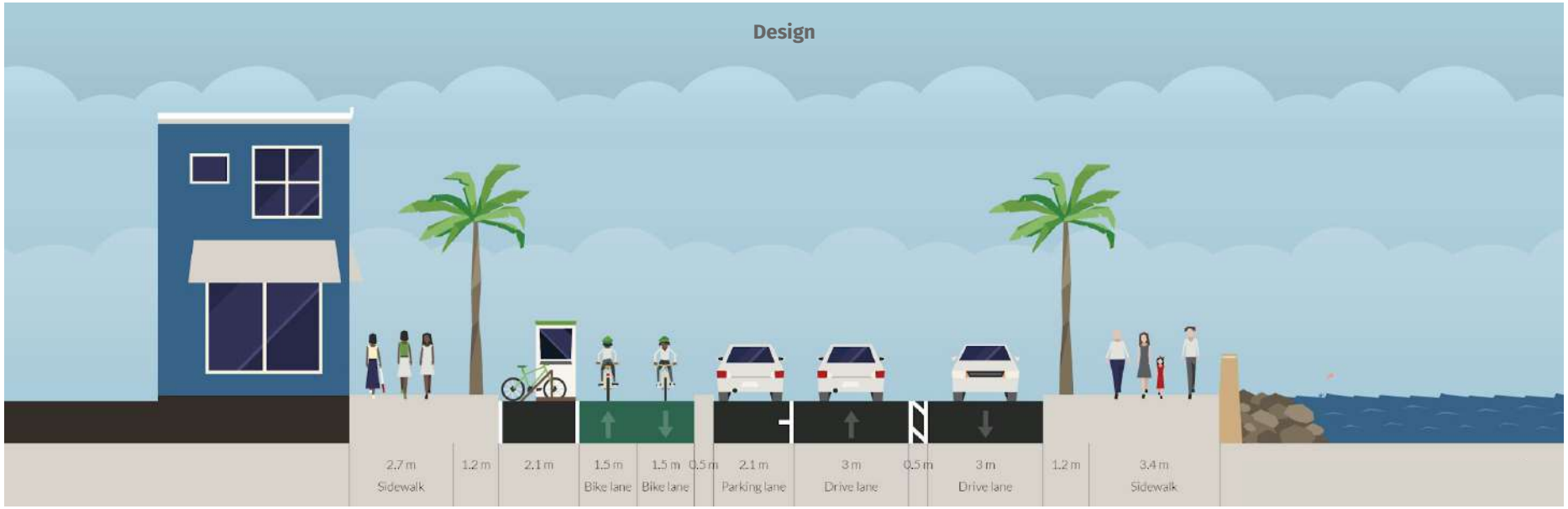
4.1. Bike Lane and Bike-Share





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4.1. Bike Lane and Bike-Share

Existing

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4.1. Bike Lane and Bike-Share

Design

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4.1. Bike Lane and Bike-Share

Combine Bike Lane with Bike-Share

- Bike-share system is a type of ride sharing service using shared bicycles that are made available for short-term basis.
- One of the obstacles to promote cycling is the availability of the bikes, especially in tourist area.
- With bike share, tourists in Ao Nang don't have to own the bike, they can just grab the available bike, pay within the apps and start cycling.
- This system allows people to lend and use the bike to get around. People can grab and return the bike at different stations and locations.
- It creates a new way of travel, particularly for short trips.
- The addition of bike lane combined with bike-share will create safer and more enjoyable cycling environment in Ao Nang.

Bike-Share in Jakarta, Indonesia

Bike-Share in Guangzhou, China

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4.1. Bike Lane and Bike-Share

Bike-Share Parking Locations Map

Proposed Bike-Share Parking Locations

- Planning of the parking locations is crucial and should be determined by density, position and scale.

The parking locations should be placed close to demand, such as tourist attractions, hotels, restaurants, residentials, etc.

- It is estimated the requirement of 49 bike parking locations along the bike lane with 10 dockless bike share at each location.
- The project is also feasible with electric (pedal-assist) bike share to make effortless cycling especially on hilly contour on shared line.

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4.1. Bike Lane and Bike-Share

Electric Bike-Share

- Electric bike-share can also play important role in urban transport.
- The goal is to make easier for people to cycle more and increase number of trips made on bike.
- The pedal-assist electric bikes is a complement to bike-share programs.
- Allows for longer rides.
- Easier for steep terrain.
- Assists those who may have certain physical limitation.

Mexico City offers traditional and pedal assist e-bikes.

Lime electric bike in Sydney, Australia. (The Guardian)

4.2 Local Shuttle Service

Existing Conditions

Public transport service

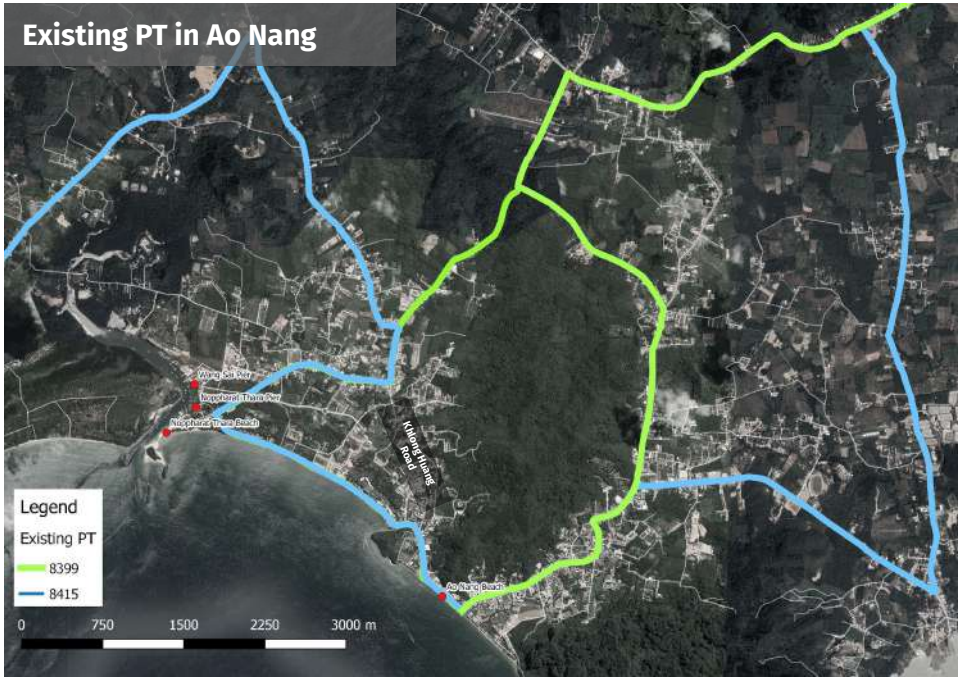
- Only route 8399 (Krabi - Ao Nang) and 8415 (Krabi Airport - Klong Muang) that pass through Ao Nang area.
- It is long-distance routes, considered as less-frequent service, and there is no local shuttle service to get around in Ao Nang.

Coverage

- The existing service only serves the main road.
- Khlong Huang Road, where hotels are also concentrated, is blank spot for public transport service.

Bus stops infrastructure

- There are only six (three pairs, one on each way) official bus stops along the main road in Ao Nang.
- The current system fails to accommodate passengers due to lack of proper infrastructure.
- As a result, passengers can board and alight anywhere they like.



Typical of Official Bus Stops in Ao Nang. There are only 6 of them.

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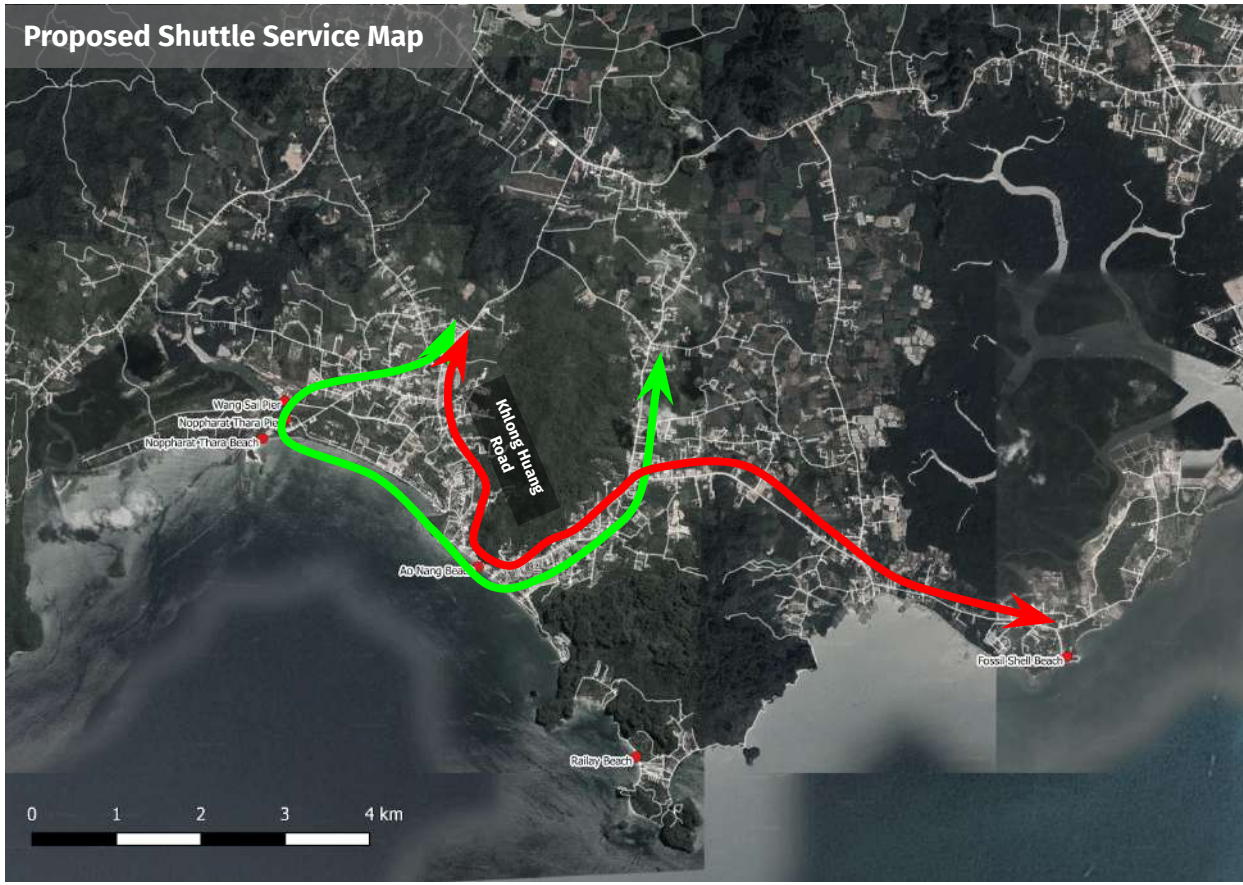
4.2 Local Shuttle Service

Route Proposal

- Goal 1: Provide shuttle service along the beachfront and main road in Ao Nang (green arrow).
- Goal 2: New shuttle service to serve Khlong Huang Road (red arrow).
- The red arrow shuttle is extended to Fossil Shell Beach, serving 4203 road to the east.
- The new shuttle service should run on a dedicated schedule with regular headway of 10 to 15 minutes.



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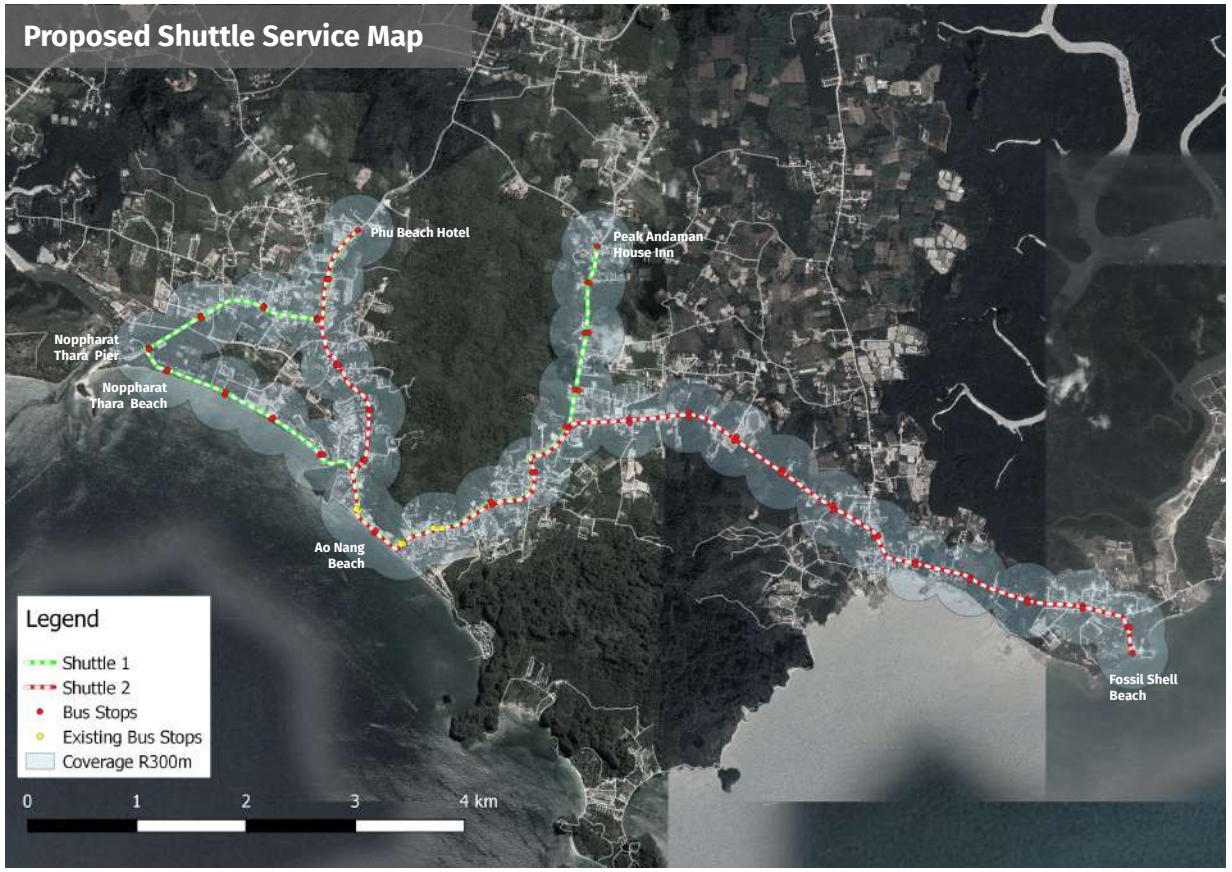
4.2 Local Shuttle Service

Route Proposal

- Operational hours 06.00 - 18.00
- Average bus speed 22 km/h
- 69 bus stops including three terminus for the bus to turn around
- Two-ways service
- The total fleet requirement is 17 which includes 10% for spare



Shuttle	Origin	Destination	Length (km)	Headway (mins)	Daily Bus km	Fleet Requirement
1	Ao Nang (Phu Beach Hotel)	Ao Nang (Peak Andaman House Inn)	9.6	10 - 15	173	8
2	Ao Nang (Phu Beach Hotel)	Fossil Shell Beach	11.5	10 - 15	161	9

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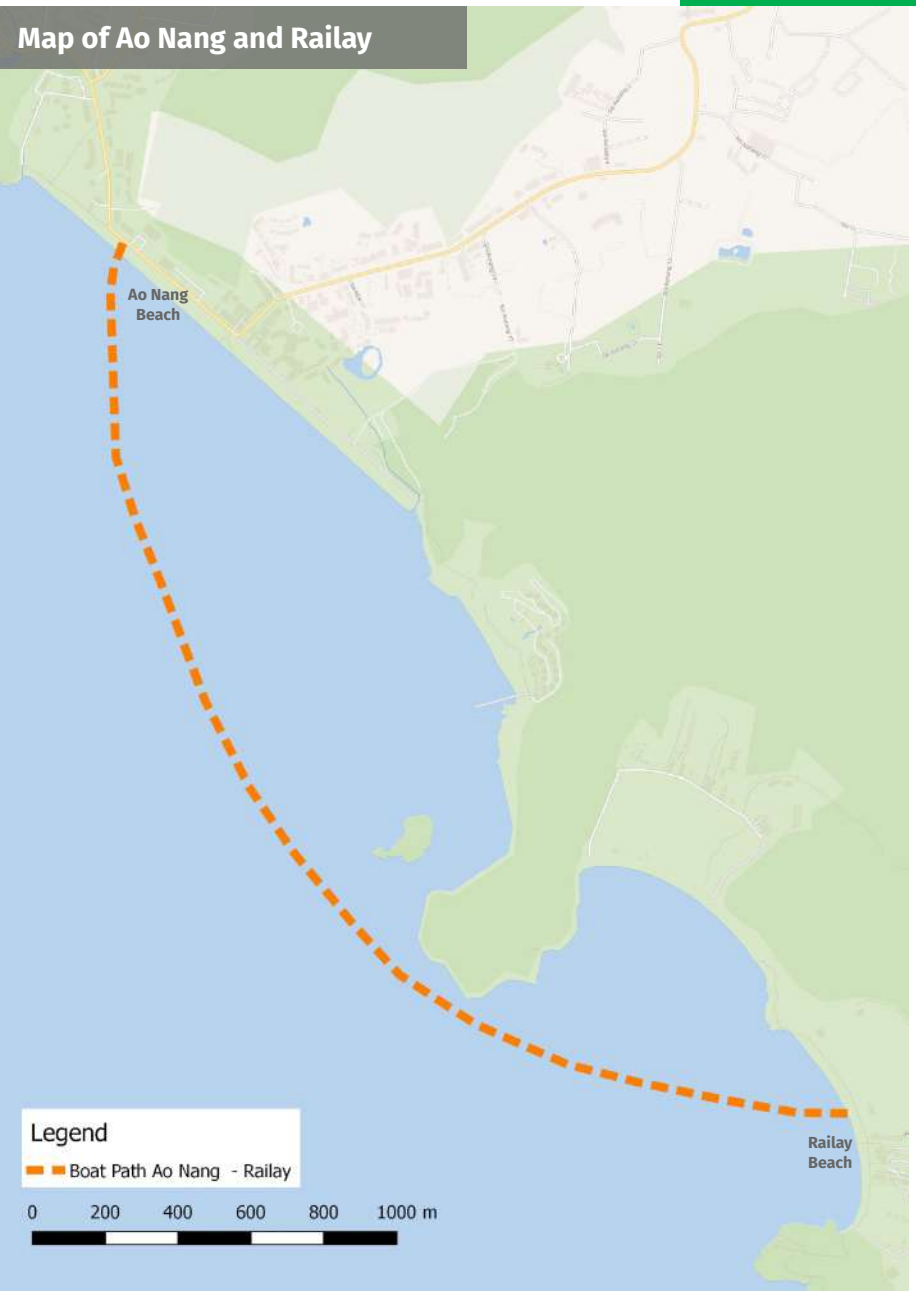
4.3. Provision of Jetty

Map of Ao Nang and Railay



Connecting Ao Nang and Railay

- Railay is another favourite tourist destination with secluded beach, soaring cliffs and various things to do.
- Railay is not connected by any roads due to tall limestone cliffs that surround it. It can only be reached by sea journey.
- There are Noppharat and Wang Sai Pier but it is quite far and tourists prefer directly go from Ao Nang beach.
- The 3.5 km distance takes around 15 minutes journey time.
- It is common witnessing people carry their own luggages and rucksacks across the shore and then effortly lift it to the boat.
- The situation happens both on Ao Nang to Railay beach due to lack of jetty infrastructure.

Huge number of long-tail boats are idle on Wang Sai Pier

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4.3. Provision of Jetty

The Urgency of Jetty

- People are having slight difficulty when accessing the long-tail boats both on Ao Nang and Railay Beach as shown on the pictures.
- It is common to see people carrying bags or luggages as some tourists are also staying at hotels in Railay.
- Better accessibility infrastructure on both beaches will be exceptionally helpful especially for people who need to be dry and carrying things.

Accessing the Boat at Ao Nang Beach.

Getting into the Boat.

Egressing the Boat at Railay Beach.

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4.3. Provision of Jetty

Recommendations

- Provide jetty at Ao Nang and Railay beach.
- The jetty design and material should be based on the passenger demand, soil conditions and marine reports.
- The jetty will be beneficial for people to access the long-tail boat at ease.

Basic jetty structure made of timber in Penang.

Visualization of jetty at Ao Nang beach.

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Costing

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5 Costing

Item	Quantity	Price per Unit (USD)	Total (USD)
Krabi Town			
Centralized Bus Stop	9 Bus Bays	10,000	90,000
Fleet Modernization (Electric Microbus)	36 E-Microbuses	178,000	6,408,000
Charging Facility	18 Charging Stations	50,000	900,000
Sidewalk Improvement	8,900 m Road Length	250	4,450,000
Crossing Facility	145 Crossings	360	52,200
		Total	**11,900,200**
Ao Nang			
Bike Lane	7 km of Bike Lane	78,000	546,000
Dockless Electric Bike-share	490 E-Bikes	1,000	490,000
Shuttle Fleets (Electric Microbus)	17 E-Microbuses	178,000	3,026,000
Charging Facility	9 Charging Stations	50,000	450,000
Bus Stops	69 Bus Stops	5,000	345,000
Jetty at Ao Nang and Railay	2 Jetties	32,000	64,000
		Total	**4,921,000**