Mobilise Your City

AFD
AGENCE FRANÇAISE DE DÉVELOPPEMENT

Kochi Municipal Corporation

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Preparation of a Mobility Improvement Plan along North-South Railway Station corridor in Kochi

Executive Summary

suez

CPPR Centre for Public Policy Research

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Draft Executive Summary

Version	Date	Coordinator	Modifications
1	19/08/2020	V. Lichère	Creation / Draft
2	29/09/2020	V. Lichère	Complements following AFD and KMC comments
3	28/10/2020	V. Lichère	Addition of long-term vision + final KMC observations

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1 Context and objectives of the project

Economic capital of Kerala state, with a metropolitan population of 2.5 million, Kochi has two main railway stations, namely Ernakulam North (also known as Ernakulam Town) and Ernakulam South (also known as Ernakulam Junction). A corridor of 2.5 km connects the two stations, along the railway tracks. A major bus terminal and a bus depot of Kerala State Road Transport Corporation (KSRTC) is present in the corridor, as well as a sport field (Ambedkar Stadium), a major hospital and several schools and colleges. Beside these facilities, the corridor is mostly residential, with some economic activities. It is very close to Kochi main city centre: Mahatma Gandhi (MG) Road is about 600 m from the corridor.

There is no continuous road along the corridor. It is generally difficultly accessible, only by foot in many places, and it mostly appears as a "backyard" and landlocked area. Yet, **the corridor is frequented by significant mobility flows**. Surveys that were conducted for this study show that it is frequented daily by about:

- 10'000 pedestrians, including 6000 who walk along the railway tracks and 4000 who cross the tracks;
- 3000 autorickshaws on the closest parallel roads, transporting about 8000 people;
- 400 bicycles.

Globally, almost 15'000 people travel every day along the corridor using non-motorised transport or autorickshaws. These flows suffer from **very bad conditions of comfort, security and safety**. The existing path are uneven. Pedestrians often walk on the railway tracks. There is no light at night. The place is poorly manageable and unclean. Autorickshaws use long, complex and congested routes.

To improve the situation and solve these problems, **Kochi Municipal Corporation wishes to develop a Mobility Improvement Plan along the corridor**. This study is a first step to design this plan. The Mobility Improvement Plan will combine multimodal mobility actions with urban and landscape improvement. It would be developed according the objectives of sustainable development, in the form of a **"Green Mobility corridor"**.

Figure 1-1: Overview of the corridor and its challenges

Figure 1-2: Photographs of the corridor

2 Approach and methodology

The flow chart below summarises the stages and methodology of the study. After an urban and mobility diagnosis stage combining primary and secondary input data, the objectives of the project were refined and validated. The Mobility Improvement Plan was developed and evaluated subsequently.

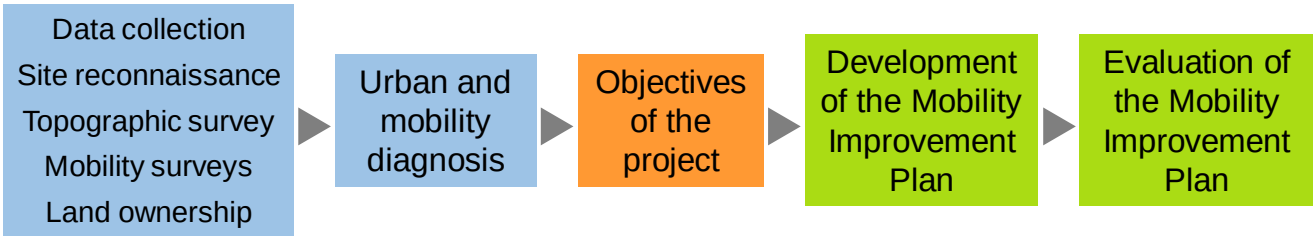

Figure 2-1: Methodology of the study

Four mobility surveys were performed in February 2020 as part of the study:

- Classified traffic volume counts on 9 locations along and around the corridor (6am to 9pm);
- Pedestrian counts on four locations along the corridor (7am to 7pm);
- Origin-destination survey by interview of 2000 persons in four locations along the corridor (personal and travel information, 7am to 7pm);
- Parking survey on two stretches along the corridor (7am to 7pm).

3 Components and design principles of the Mobility Improvement Plan

3.1 Components of the Mobility Improvement Plan

The proposed Mobility Improvement Plan will be formed of four components:

Figure 3-1: The four components of the Mobility Improvement Plan

The first and main component is the **development of a green corridor adapted to non-motorised transportation** (NMT). NMT flows are already numerous along the corridor, and a central goal of the project is to improve the walking and cycling conditions. Many trips along the corridor are within a range of distance adapted to NMT. NMT modes are the most sustainable and affordable of all, so it is logical to give them priority as part of a Green Mobility corridor project. Another reason is that, along most of the corridor, there is no room for a vehicular road between the railway and the adjacent properties. Extending the right-of-way on adjacent properties would mean demolishing many buildings and houses, which does not appear desirable nor practical at short or medium terms. Finally, developing an NMT facility is also a way to improve streetscape, connectivity and social activities in the corridor.

The second component is the **development of e-rickshaw** (electric autorickshaw) **services**. Intermediate public transport has a major role to play in sustainable mobility in urban contexts, on short distances. Autorickshaws are already highly active along the corridor, with a major hub near the KSRTC bus terminal. As part of the Green Mobility corridor project, autorickshaws should progressively transform into their more sustainable and silent version: e-rickshaws, as already developed in Kochi as feeder to metro stations. A shuttle service of shared e-rickshaws would perfectly complement the NMT corridor. They would partly use the same alignment as NMT along the railway, and partly use parallel streets.

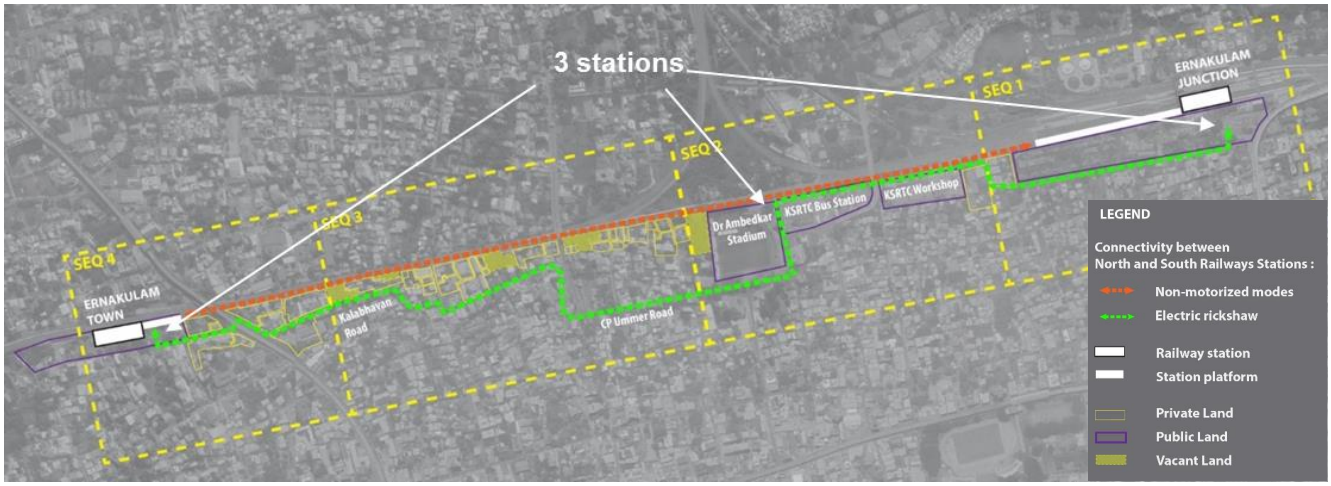

Figure 3-2: Proposed e-rickshaw route and stations

The third component of the Mobility Improvement Plan is the **development of hubs and connections to the city centre**. The project is organised with various "hubs" along the corridor, providing intermodal connections between transport modes and articulating the North-South corridor with East-West connections to the city centre (MG Road). The hubs are also places where nice public spaces and social and commercial activities can be developed.

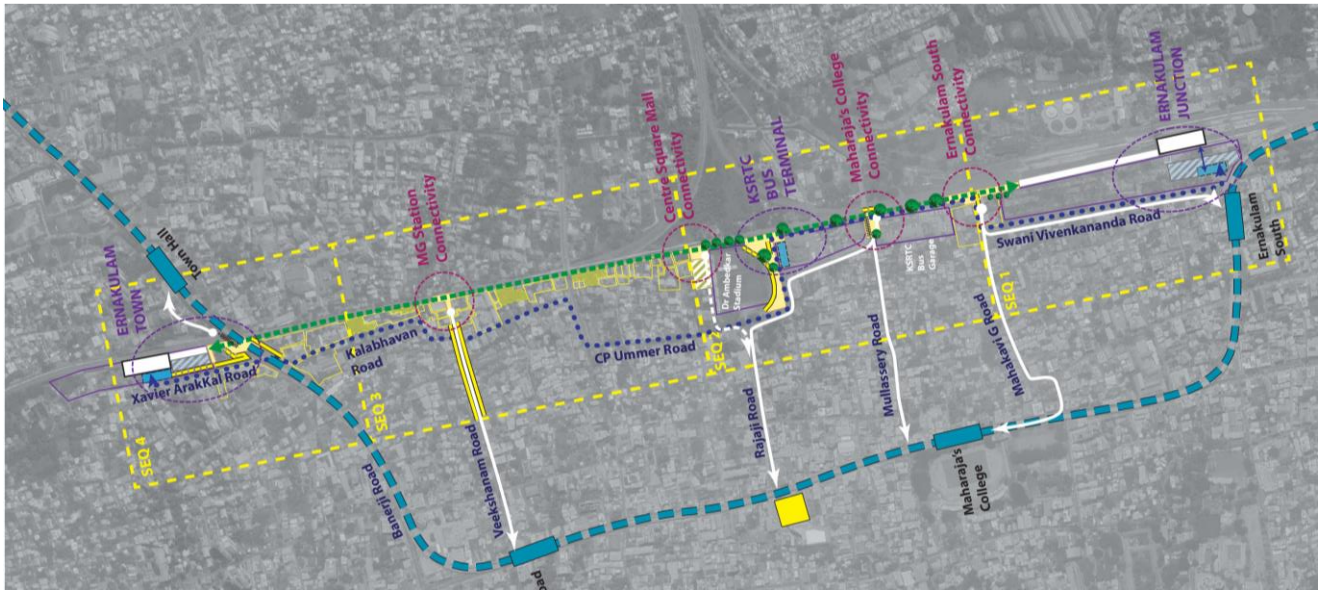

Figure 3-3: Proposed hubs and connections to the city centre

The last component consists in the **development of social and commercial activities** along the corridor. Small shops selling drinks or lottery tickets can be found along the corridor, mainly at intersections with other roads. There are also some social and recreation facilities, playgrounds and sport fields. The Green Mobility corridor is an opportunity to consolidate and develop these activities. The existing activities can be:

- Sheltered in small wooden constructions, easily identifiable and similar all along the corridor;
- Shifted, whenever necessary, to more spacious spaces;
- Made more visible by upgrading public spaces in their surroundings.

Activities under the Ambedkar Stadium stands would be upgraded and developed.

3.2 Design principles

The development of the Green Mobility corridor firstly consists in **functional improvements** of the partly existing pathway, with the following principles:

- General width of 4.5 m, allowing the passage of pedestrian and cyclists, with some narrow points of 3 m;
- Limited range of surfacing materials;
- Levelling the ground whenever possible; in some places it would be necessary to create low retaining walls on several metres;
- Materialisation of limits: fences, palisades, hedges, in order to delineate and secure the various spaces; we also recommend the implementation of a fence all along the railway line;
- Illumination of the Green Mobility corridor and of its adjacent spaces through an elaborate lighting program; the objective is to improve security and safety, and also to participate in the beautification of the corridor.

The project is designed with **very limited land acquisition**, at least at short term: only local extensions on publicly-owned land and demolition of small buildings. A longer-term variant in the North railway station area would impact presumably private land and larger buildings.

The corridor is marked by the presence of water, with a continuous drain all along and some crossing canals, and by numerous railway utilities. A large part of the **drains** is already covered by concrete slabs, often uneven and discontinuous. To create an even and easily practicable pathway for NMT, we propose a continuous coverage of the drain on the whole corridor, with integration of channel gratings along the property walls. Covered drains will be used only by pedestrians and cyclists, and not by motorized vehicles.

Figure 3-4: Partly covered drain and technical utilities along the corridor

Various **technical utilities** can be found around the railway line: catenary poles, electric boxes, milestones… In some places they are implanted very close to the property walls, narrowing the available right-of-way. The project is designed as to maintain these utilities, even if it narrows the passage to 3 m locally.

A **landscape project** comes with the NMT pathway. The objective is to value and highlight the existing elements of each area: green spaces, plantations, creation or extension of existing high-stem tree alignments whenever possible. To ensure continuity and visibility of the Green Mobility corridor, we also propose interventions on the built elements:

- Demolition / reconstruction of some enclosure walls;
- Small modular wooden buildings, housing commercial activities and services;
- Rehabilitation of emblematic structures: Ambedkar Stadium stands, distinctive / heritage buildings…;
- Locally, suppression of buildings or technical items to improve the functionality.

We recommend using **sustainable material**, consistent with the green corridor concept:

- Deactivated concrete for NMT pathways;
- Concrete tiles for trafficable spaces;
- Gravel for technical areas;
- Wood structures protecting the shops and new services or hiding technical utilities;
- Canopy (possibly with electro-voltaic panels) for the rickshaw stations;
- A range of lighting devices depending on the context: light posts, wall lighting.

Figure 3-5: Proposed material and equipment

4 Project description by sequence

The corridor is composed of four sequences corresponding to the different urban fabrics encountered and to the condition of mobility along the corridor:

- In the South half (sequences 1 and 2), the corridor is mostly bordered by large public parcels: railway land, KSRTC land, Ambedkar Stadium. In Sequence 1, the existing street is distant from the railway tracks, separated by the station itself and by a residential area belonging to the Indian Railways; the railway platform covers most of the sequence and is extended by an informal pedestrian pathway. In Sequence 2, the railway land is bordered by a street up to KSRTC terminal.
- In the North half (sequences 3 and 4), the corridor goes mostly along private parcels, smaller and interlocked; railway land can only be found when reaching the North station. Along Sequence 3, the profile is somewhat continuous, with very narrow space between the railway tracks and the private properties, partly occupied by a drain. Sequence 4 begins with a short pathway along the tracks, and then the corridor split into two routes: direct access to the North station platforms requiring walking on the tracks, or detour through Kalabhavan Road.

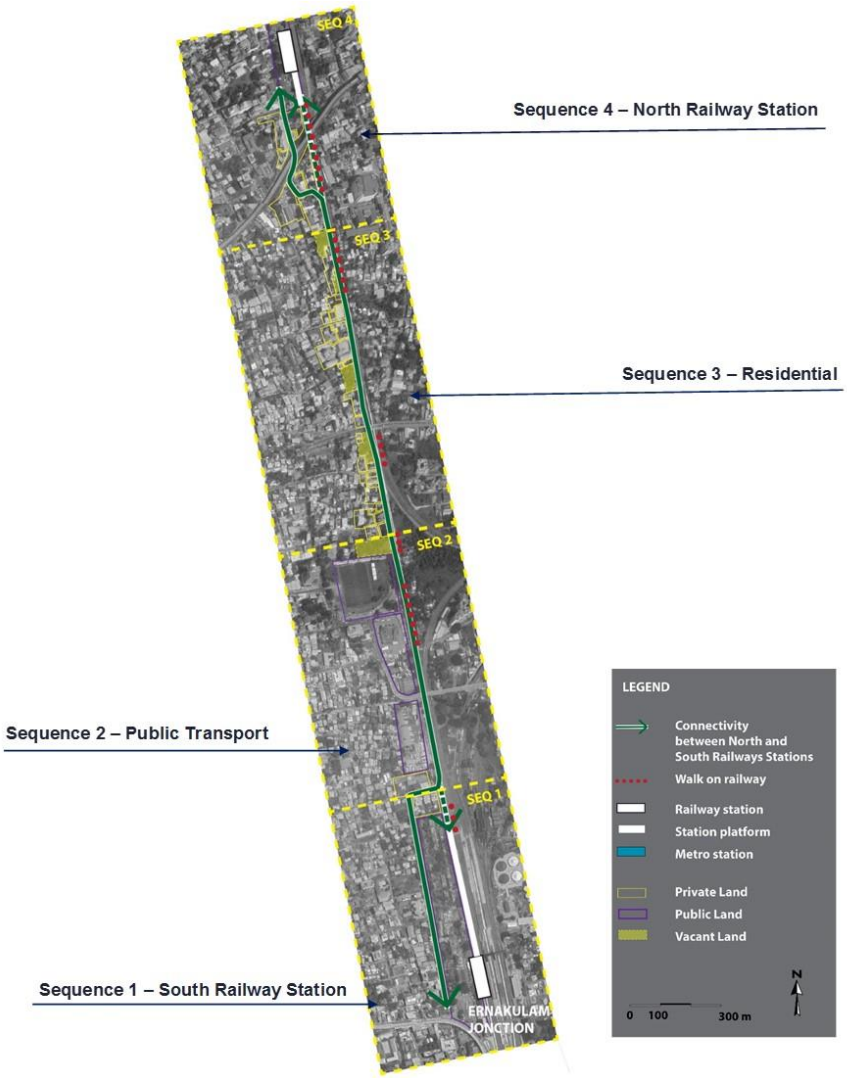

Figure 4-1: Overall map of the four sequences

4.1 Sequence 1: South Railway Station

This first sequence corresponds to the South Railway station (Ernakulam Junction). The land is mostly owned by the Indian Railways. The station platform runs along most of the sequence. Presently, pedestrians walk along the tracks between the railway station platform and Swami Vivekananda Road.

For this first sequence, the goal is to create, starting from the station platform, a continuous pathway fully separated from the railway tracks, so the pedestrians can join Swami Vivekananda Road as directly and safely as possible. A plaza with activities would be developed in front of Saint-Joseph Upper Primary School.

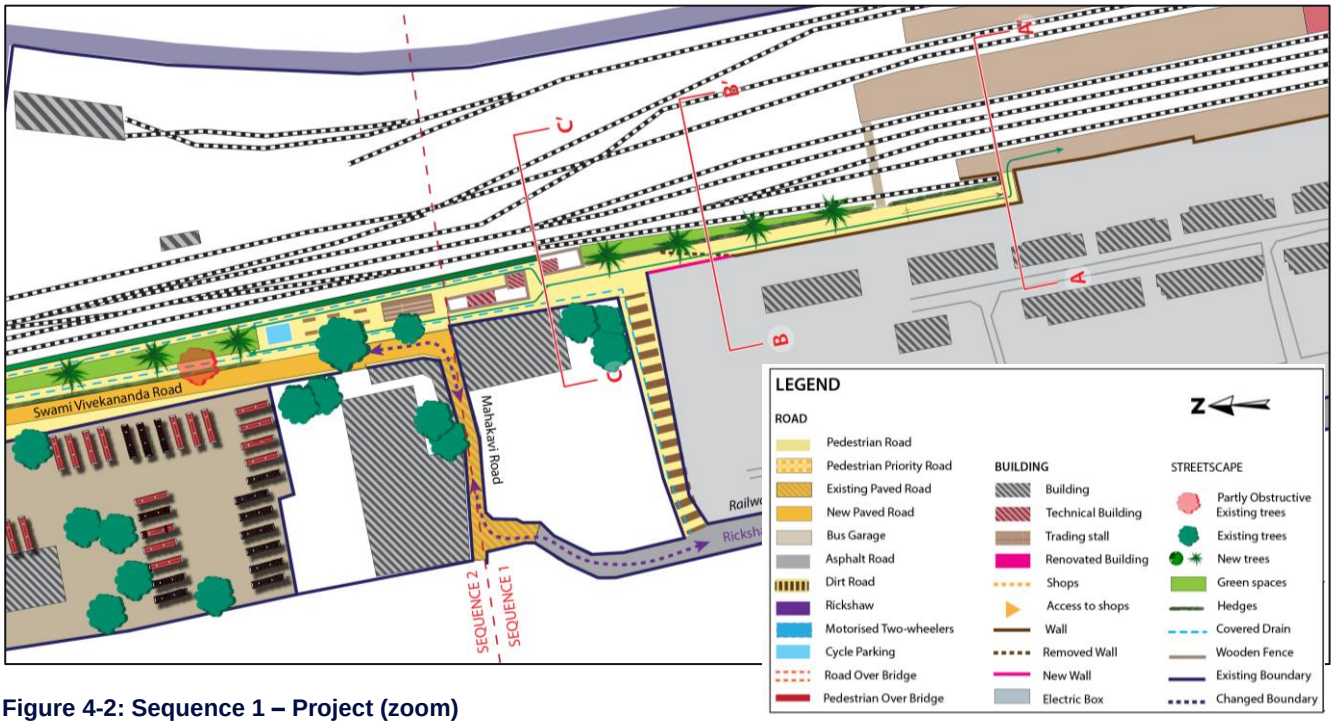

Figure 4-2: Sequence 1 – Project (zoom)

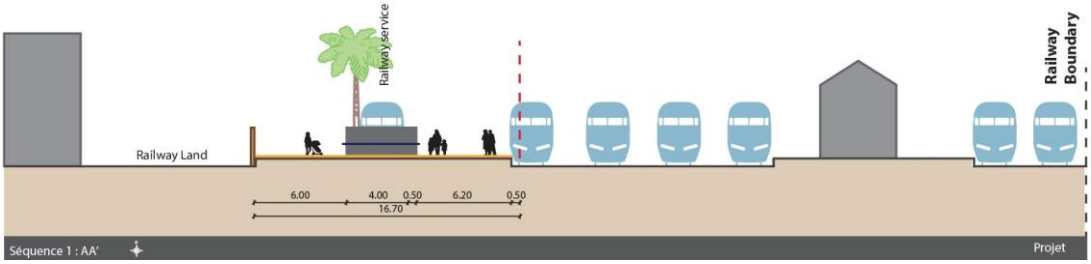

Figure 4-3: Section 1 – AA' – Project

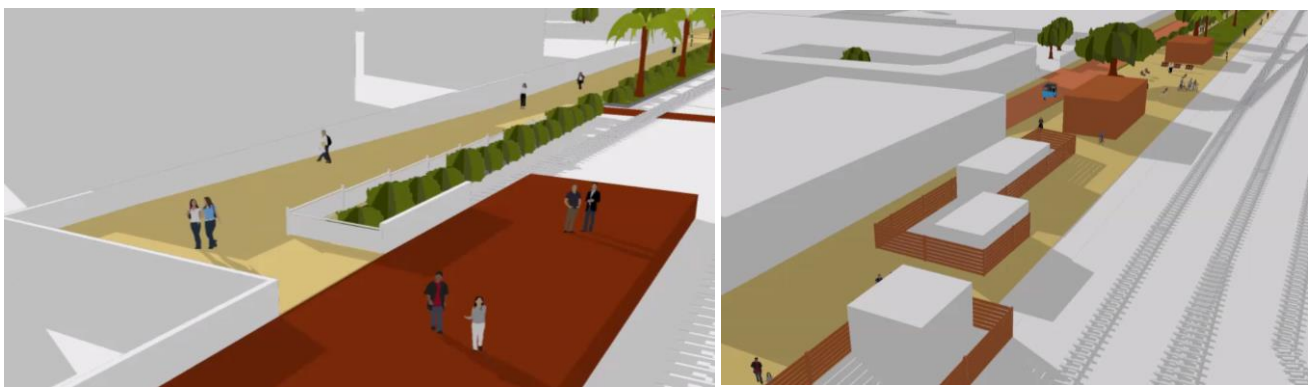

Figure 4-4: South end of the railway station platform and projected ramp. Technical buildings enclosed with palisades

4.2 Sequence 2: Public Transport

The second sequence corresponds to the surroundings of KSRTC bus garage et bus terminal. The right-of-way is very wide along the first part of the sequence. The street ends in a dead-end and stops at the middle of the KSRTC bus terminal. Presently, pedestrians walk along the tracks between Swami Vivekananda Road and the dirt road bordering the stadium.

For this second sequence, the objective is to extend Swami Vivekananda Road up to the North of the bus terminal and to the rickshaw station, close to the Ambedkar Stadium. For the pedestrians, the project is to extend the drain coverage to organize a pathway all along this sequence.

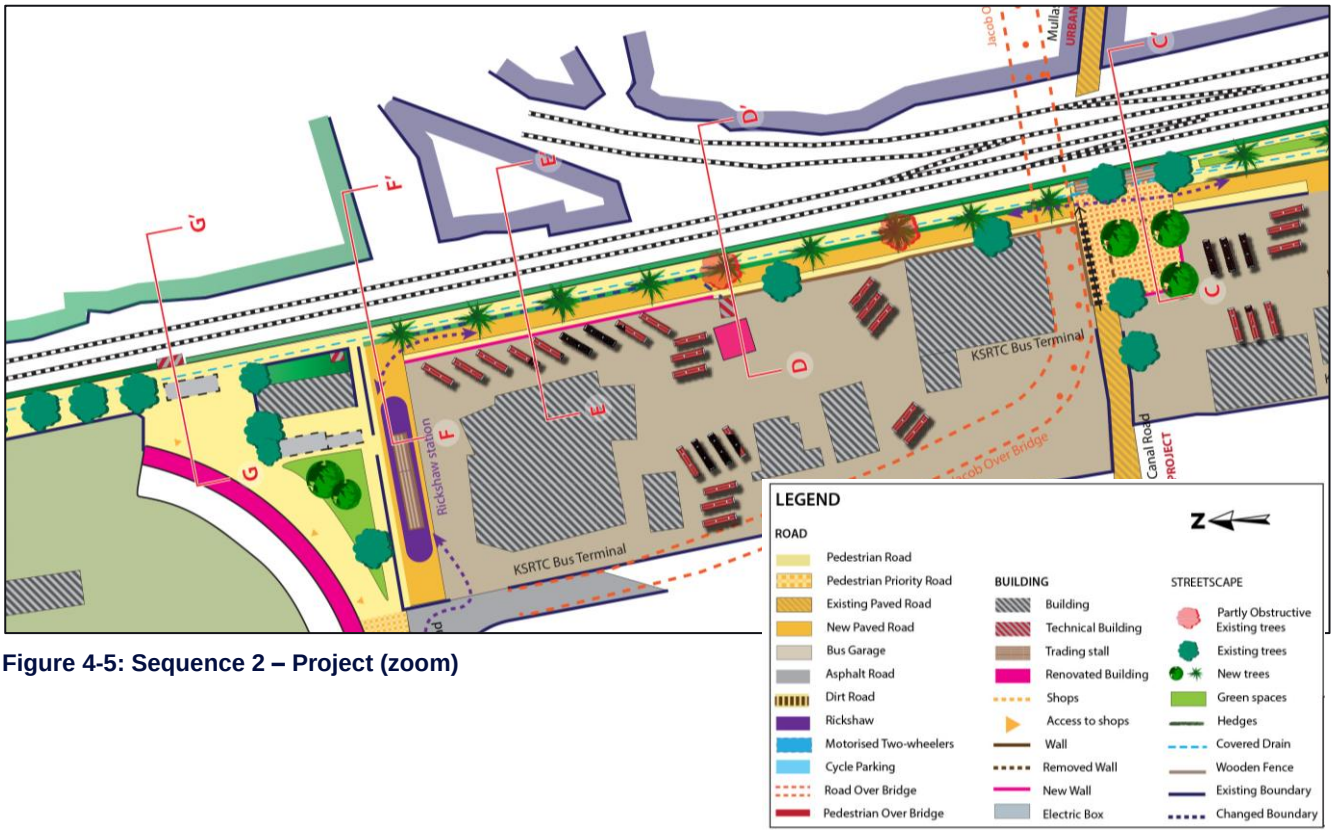

Figure 4-5: Sequence 2 – Project (zoom)

At the intersection with Mullassery Canal Road, we propose to create a public space highlighting this junction with a major road leading to the city centre. Mullassery Canal Road is a connecting link between both sides of the railway line. It is going to be part of large-scale urban requalification. It is the outlet of the stairway coming from Jacob Over Bridge.

Figure 4-6: View from Mullassery Canal Road – Existing situation and photomontage

In the bus terminal and Ambedkar stadium area, we propose:

- To create an NMT continuity by covering the drain and demolishing small buildings/structures;
- To connect Swami Vivekananda Road and CP Ummer Road for e-rickshaws only, taking a small land strip of KSRTC bus terminal;
- To upgrade the existing autorickshaw station to accommodate e-rickshaws;
- To develop activities and public space near the stadium, with upgrade of the stadium stands.

Figure 4-7: Along the Bus Terminal

Light posts would be installed in the high-stem trees alignment and around the rickshaw station. Ground lightings would upgrade the public space at the intersection with Mullassery Road and around the stadium.

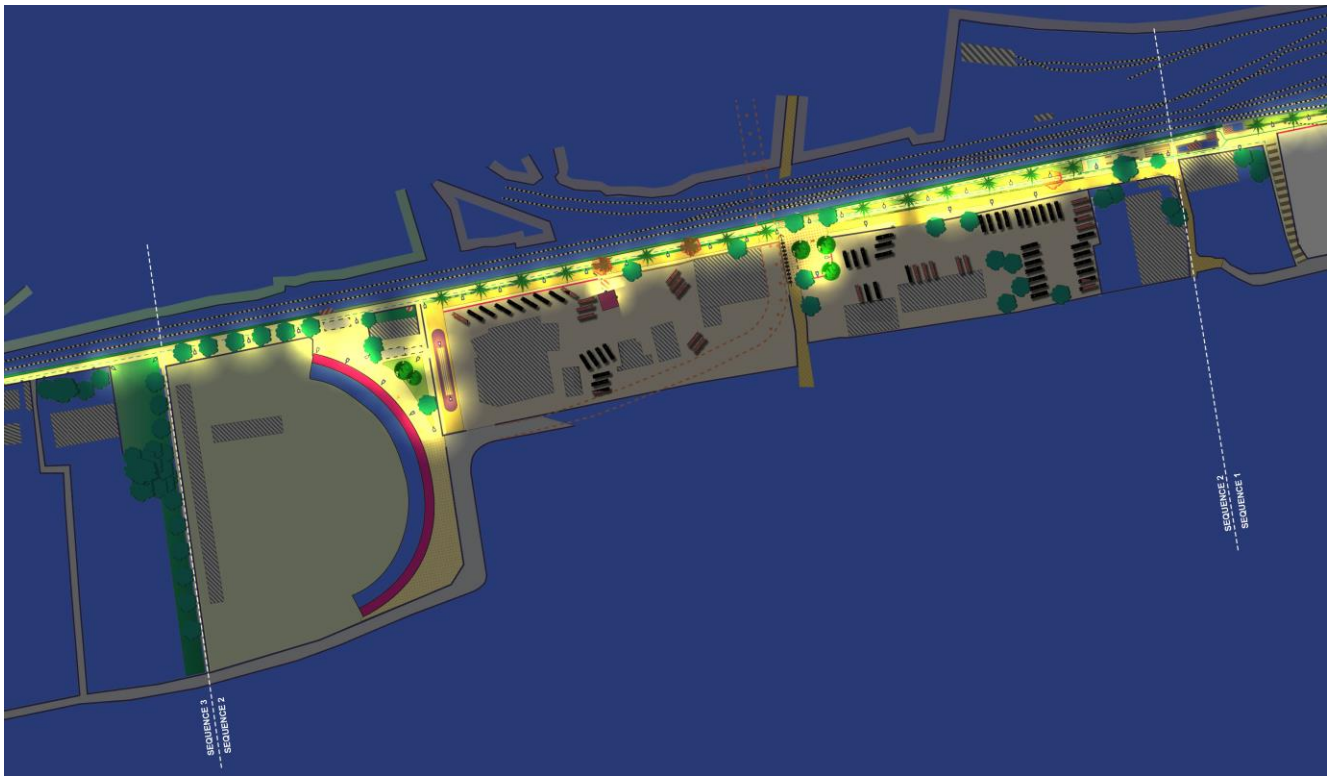

Figure 4-8: Illumination of Sequence 2

4.3 Sequence 3: Residential

The third sequence of 640 m corresponds to a residential area bordering the railway line. The drain serves as border: alternately open or covered, it follows the enclosure walls. The available right-of-way does not exceed 4.5 m, and in many places electric boxes narrow the right-of-way down to 3 m. Presently, pedestrians walk along the railway tracks almost all along the sequence: the drain is only partially covered, bushes and electric boxes create bottlenecks on an already narrow space.

Figure 4-9: Typical existing corridor conditions along Sequence 3

For this third sequence, the objective is to organise an NMT pathway in the continuity of the previous sequences. The goal is to optimise the use of the rather narrow available right-of-way. Unlike in the previous sequences, there are no publicly-owned land that could be used for the Green Mobility corridor. An alignment of numerous small properties goes along the railway line, often with buildings very close to the enclosure walls. Vehicular access would require building demolitions all along.

Starting from this sequence, e-rickshaws have a separate route from the NMT and use the existing road network: CP Ummer Road, Arangath Road, Kalabhavan Road and Xavier Arakkal Road up to the North railway station.

Figure 4-10: Sequence 3 – Project

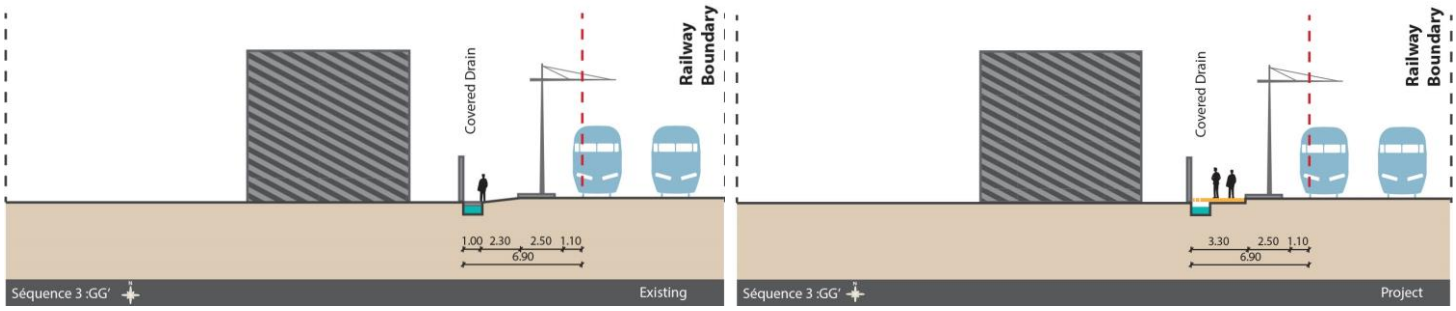

Figure 4-11: Section 3 GG' – Existing and project

Figure 4-12: Near Kotten Canal Road – Existing situation and photomontage

Figure 4-13: Pullepady Railway Over Bridge, existing situation and photomontage

4.4 Sequence 4: North Railway Station

This last sequence leads to the Northern station. Concerned land parcels belong either to the Indian railways, either to private owners. At the North end of Sequence 4, users join the railway station using first a dirt pathway, quite wide compared to the previous sections, and then mostly continue by walking between the railway tracks and buildings or property walls. Another possibility is using Kalabhavan Road, but few people take this longer way, which is, as it is today, not comfortable nor practical for pedestrians.

For this last sequence, the goal is to propose a short-term solution, and a longer-term variant which requires land acquisition and demolition of buildings to enable a more direct access to the station in good conditions of comfort and safety.

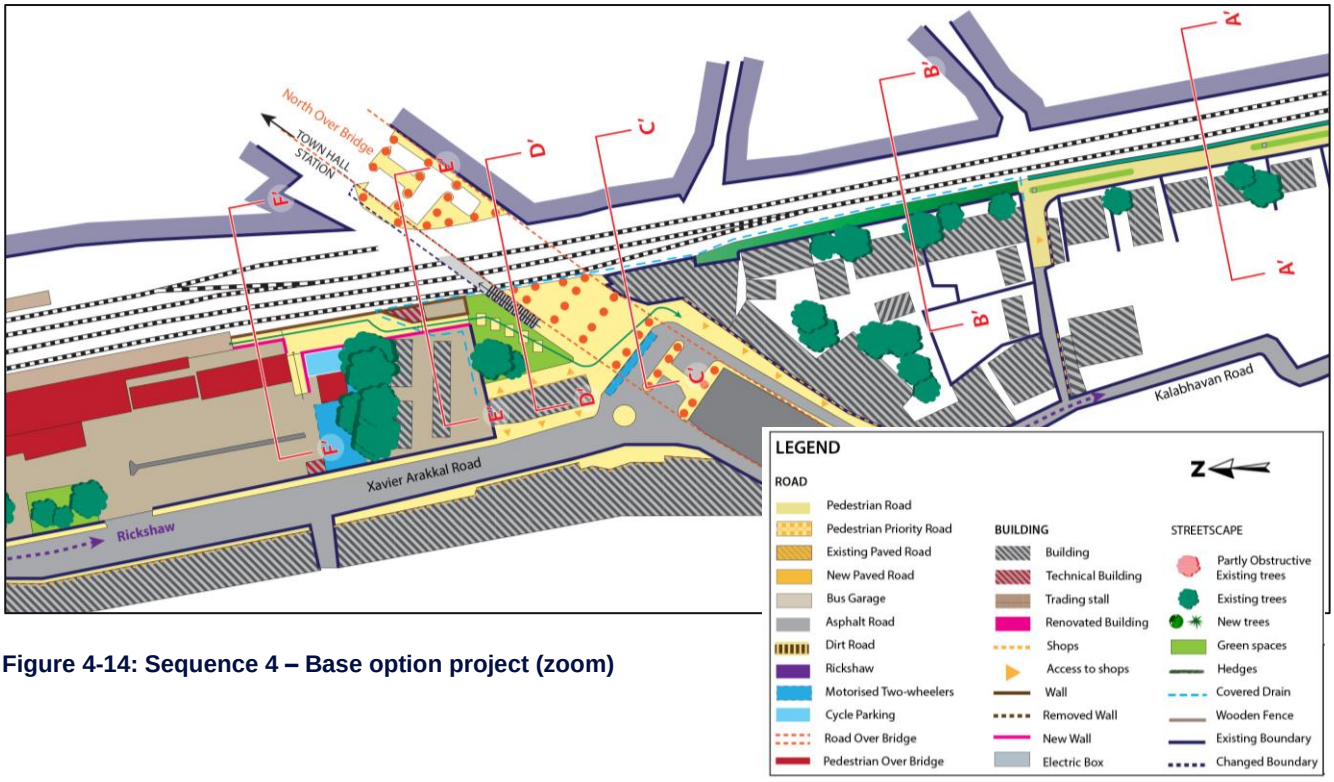

Figure 4-14: Sequence 4 – Base option project (zoom)

Figure 4-15: Beginning of Sequence 4 – Existing situation and photomontage

This area is specially constrained because of the proximity of the railway tracks and of the enclosure walls, and because of two existing electric boxes. This is why, in the short-term solution, we propose a path through Kalabhavan Road while physically impeding, with a barrier, the direct way along the railway tracks.

The proposed variant aims at continuing the 4.5 m NMT pathway along this stretch. Closer to the flyover, two buildings are bordering the railway tracks. In this variant, these two buildings would have to be demolished.

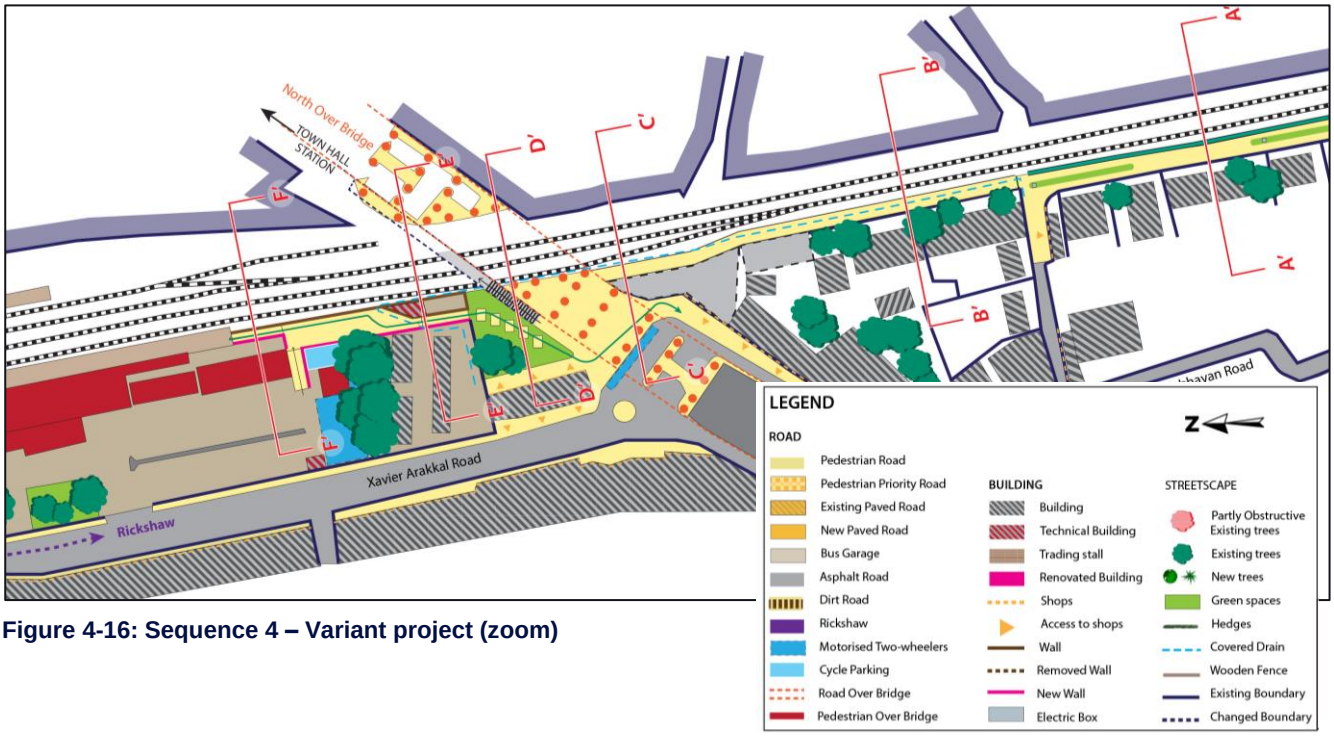

Figure 4-16: Sequence 4 – Variant project (zoom)

Figure 4-17: Variant project in Sequence 4 – Existing situation and photomontage

Under Banerji flyover, the existing situation includes a parking area for motorized two-wheelers, a pedestrian area and the stairway leading to the pedestrian bridge over rail and to Town Hall metro station. This space is marked by the numerous piers of the flyover and of the metro viaduct. We propose to move a part of the parking facility closer to the railway station, to enlarge the pedestrian area and create a real covered square, on which the stairway would be connected.

As a complement, we propose the upgrade of the neighbouring green space with new plantings. A building with shops at ground level is bordering the place. We propose that these shops open also toward the square to participate to its animation.

Figure 4-18: Existing situation under Banerji flyover

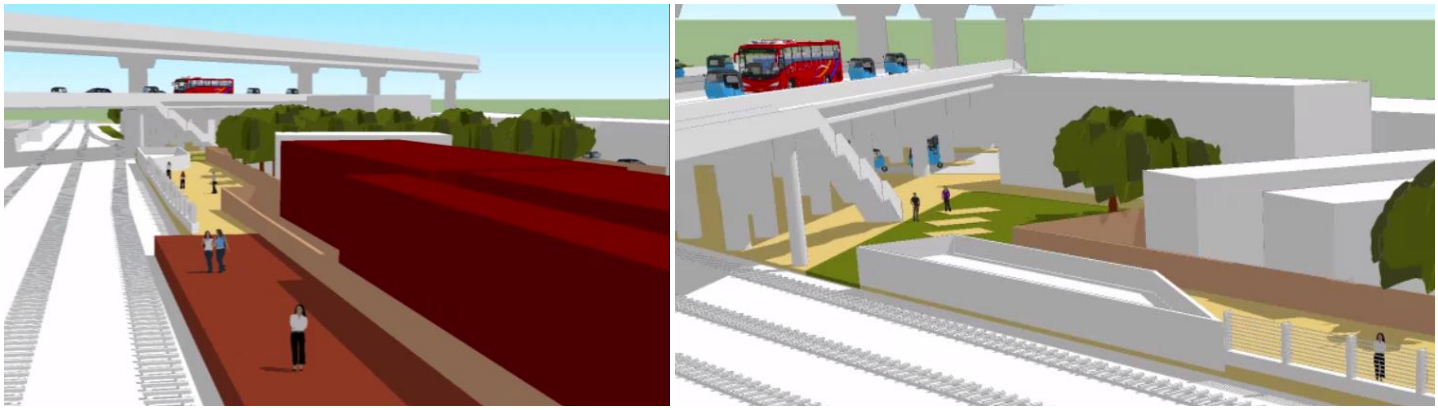

Figure 4-19: Connection of the corridor with the North railway platform

Light posts would be the preferred lighting solution for the larger spaces, including the existing dirt pathway, the trafficable roads and the station parking area. Several ground lightings at the foot of the piers would upgrade the space under the flyover. Wall lightings would illuminate the newly built passage between the covered square and the railway platform.

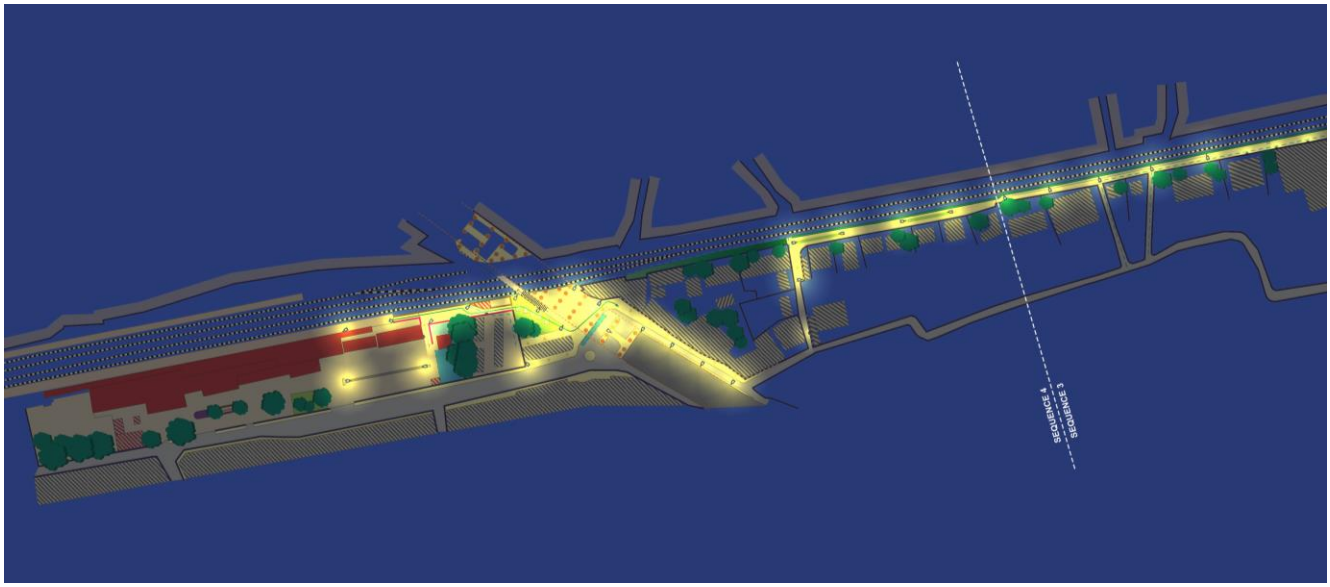

Figure 4-20: Illumination of Sequence 4

5 Evaluation of the Mobility Improvement Plan

5.1 Land acquisition and building demolition

Although the project is designed to fit as far as possible within the available right-of-way, some land acquisitions and demolitions would be required. Necessary land acquisitions and demolitions of buildings are summarised below.

SEQUENCES		ITEM	LOCATION	OWNER	GROUND SURFACE AREA (m²)	
					Base option	Variant
SEQUENCE 1	a	Pathway widening		Indian Railways	70	_
SEQUENCE 2	b	Creation of Square Mullassery Road	KRSTC Garage	KRSTC	500	_
	c	Extension of paved road	KRSTC Terminal	KRSTC	450	_
	d	Demolition informal buildings	Stadium	?	250	_
	e	Demolition small residential building	Stadium	?	76	_
SEQUENCE 3	_	_	_	_	_	_
SEQUENCE 4	f	Demolition small residential buildings	South of the flyover	?	_	215
	g	Demolition multi-storey building	South of the flyover	?	_	450
	h	Creation of green space	South of the flyover	?	675	_
	i	Creation of pedestrian ramp	South of the flyover	Indian Railways	430	_

Table 5-1: Summary of land acquisitions and building demolitions

5.2 Financial costing

The investment (capital) cost of the project is evaluated by sequence and by item, based on quantities and ratios, based whenever possible on the Schedule of Rates of the Central Public Works Department of India (CPWD-SOR), adapted to the cost index of Kochi. It is important to keep in mind that the project is still at preliminary stage and an order of magnitude to be confirmed at later stage. The investment cost does not include land acquisition costs.

	Length (m) *Along railway line, between railway station platforms*	**Base option** *INR Crores*	**Variant** *INR Crores*
Sequence 1	180	1.8	
Sequence 2	640	13.5	
Sequence 3	840	5.2	
Sequence 4	390	3.4	4.6
Total	**2,050**	**24**	**25**

Table 5-2 below gives the total estimated investment cost by sequence, in INR Crores. **The order of magnitude of the investment cost is evaluated at INR 25 Crores.**

	Length (m) *Along railway line, between railway station platforms*	**Base option** *INR Crores*	**Variant** *INR Crores*
Sequence 1	180	1.8	

Sequence 2	640	13.5	
Sequence 3	840	5.2	
Sequence 4	390	3.4	4.6
Total	**2,050**	**24**	**25**

Table 5-2: Summary of project costing

The cost of Sequence 2 alone accounts for about half of the total, for only a third of the distance. This is because the project develops to a wider extent in this sequence than in the others, including several public spaces and hubs.

Maintenance costs can be estimated at 3% of the investment cost, or about **INR 0.7 Crore/year**.

5.3 Frequentation and impacts of the project

The potential frequentation of the Green Mobility corridor can be estimated based on the surveys and traffic counts that were made as part of this study in February 2020. We will consider four categories of users:

- **Present NMT users** of the corridor, who would continue to use it but with much improved conditions. According to the surveys and counts, between the two railway stations, the North-South railway corridor is frequented daily by about 6,000 pedestrians and 400 cyclists.
- **Autorickshaw users** travelling on the roads close and parallel to the railway corridor (CP Ummer Road, Kalabhavan Road etc.) for trips limited to the area between the two railway stations: they are about 3,200 on average day according to the surveys. Once the Green Mobility corridor is constructed, a part of them would transfer to walking, cycling or using e-rickshaws.
- **Private vehicles** (motorised two-wheelers, private cars) **or cab** (Ola, Uber) **users** travelling within the corridor: there are about 800 motorcyclists and 900 car or cab users every day, excluding longer trips and through traffic. A part of them would also transfer to walking, cycling or e-rickshaws.
- **People** who are presently not travelling on the corridor, due to the bad conditions, but **who would use it when it is constructed**: “induced demand”.

The table below details the estimation of the potential frequentation of the corridor, based on the surveys and traffic counts made as part of this study. The result is about **11,000 people frequenting the Green Mobility corridor every day**, to be compared with about 6,400 “green mobility users” today. The number of pedestrians and cyclists would increase by 50%: more than 9,000 pedestrians and about 600 cyclists. The e-rickshaw system could attract about 1,200 people daily.

Present mode	**Current daily passengers**	**Transferred to Green Mobility corridor**			
		Walking	**Cycle**	**E-rickshaw**	**Total**
Walking	6 010	6 010	-	-	**6 010**
Cycle	380	-	380	-	**380**
Autorickshaw	3 160	790	60	820	**1 670**
Motorcycle	810	250	30	100	**380**
Car / Cab	860	260	0	60	**320**
Induced trips	-	1 830	120	250	**2 200**
Total	**11 220**	**9 140**	**590**	**1 230**	**10 960**

Table 5-3: Evaluation of potential frequentation of the corridor

The potential and impact of the corridor can also be compared to the number of people living or having daily activities in the corridor. From GIS data on population per census zone, we can estimate that there are 20,000 people living within 500m of the Green Mobility corridor. Including people working or studying in the corridor, it is about **30,000 people who live or have daily activities in the corridor**.

Thanks to the transfers between transport modes permitted by the Green Mobility corridor, the project will result in a diminution of vehicle-km on the neighbouring roads and of emissions of greenhouse gases and local pollutants. **2,840 vehicle-km would be transferred every day to green modes on the corridor**: 1,650 from autorickshaws, 600 from motorcycles and 350 from cars and cabs. **The project would save about 84 tonnes of CO_2 emissions every year.**

The project will considerably improve the safety of the corridor users. First, it will **prevent people from walking on the railway tracks**, thanks to the development of a continuous pathway and to the installation of a fence separating the pathway from the railway infrastructure. Second, it will offer to pedestrians and cyclists **a way fully separated from the vehicular traffic** all along the corridor. Third, the implementation of **street lighting** will strongly improve the safety during night hours. Last, **CCTV surveillance** system was suggested and included in the design and costing of the project.

6 Long-term vision

A longer-term option can be considered and has been proposed by the State Government as part of discussions on the project with KMC and other stakeholders. In this option, **a continuous 12m-wide street would be created between the South railway station and the North railway station**, to ensure the provision of a uniform passage with priority to green mobility. This option will allow the e-rickshaws to use the same direct alignment as the pedestrian and cyclists, and save about 5 minutes between the railway stations. Other vehicles might be accepted, but **the street should be designed to dissuade through-traffics**: narrow carriageway, surfacing favouring slow speed. A regulation could also reserve the access to non-motorised vehicles, e-rickshaws and residents. Heavy vehicles should not be allowed on the street.

The total cost of the project is not possible to evaluate at this stage, due to the numerous impacts. A first draft estimate of the construction cost leads to an order of magnitude of INR 40 Crores, excluding land acquisition and the potential impacts on the main structures (bridges over rail). **About 35 private properties and more than 25 residential buildings would be impacted.** Land acquisition can be approximately estimated at 27'000 m² / 6.7 acres of mostly privately-owned constructed land, to be compared with 2'500 m² / 0.6 acre of public corporations' unbuilt land in the base option.

To be consistent with the objectives of the project, the organisation of the 12m profile is proposed as follows:

- A wide sidewalk of 5m for the pedestrians, and possibly for the cyclists, on the East side (railway line), with an alignment of medium-stem trees every 15m;
- A carriageway of 5.5m for e-rickshaws, bicycles if they are not inserted on the sidewalk, and possibly other vehicles that would be allowed on the street;
- A sidewalk of 1.5m on the West side.

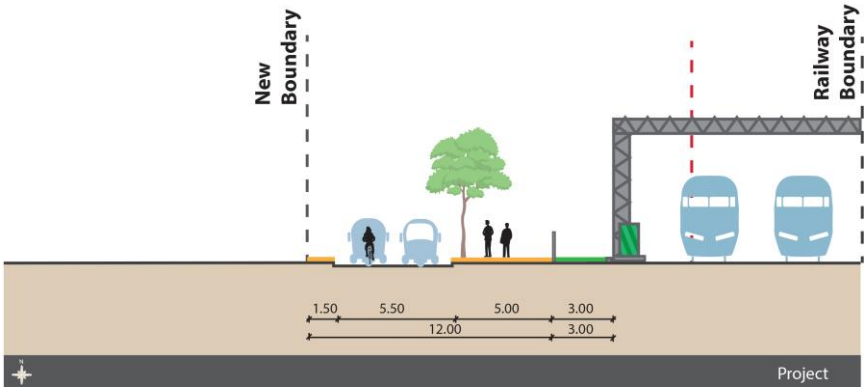

Figure 6-1: Proposed cross-sections for the long-term vision: option 1

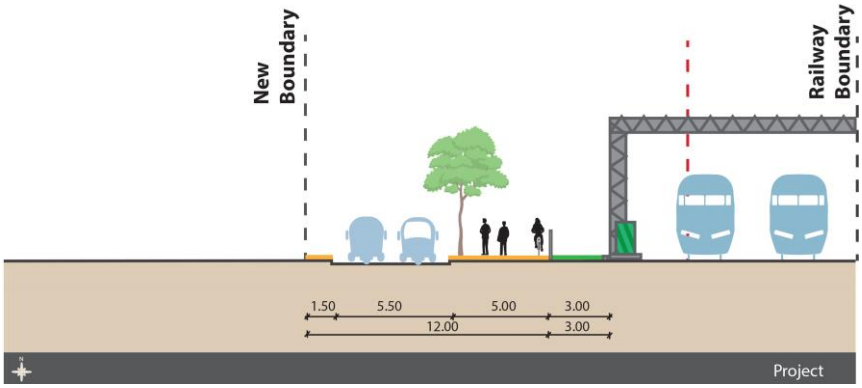

Figure 6-2: Proposed cross-sections for the long-term vision: option 2

7 Conclusion

This study **confirms the feasibility of a Green Mobility corridor** joining the two main railway stations in Kochi. **The project could be implemented at short term**, with limited land acquisition. It could also easily be constructed by stages. **It would bring comfort, safety and security to the numerous existing users of the corridor, and will attract new ones**, including people transferring from less environmental-friendly modes to non-motorised transportation and e-rickshaws. It would also considerably **improve the urban quality and landscape** of the corridor and would help **develop new social and economic activities**. The area would be better included in the city and better connected to the city centre. A long-term vision with a new continuous street all along the railway alignment can be envisaged, but with major impacts on land properties and buildings.