



DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
MINISTRY OF PORTS AND HIGHWAYS
ROAD DEVELOPMENT AUTHORITY (RDA)



**PROPOSED SECOND NEW KELANI BRIDGE PROJECT
A PROJECT FOR TRAFFIC IMPROVEMENT AROUND EXISTING
NEW KELANI BRIDGE**



ENVIRONMENTAL IMPACT ASSESSMENT

(Final Report)

August 2013

Volume II A – Annexes

Submitted to;
Central Environmental Authority
Ministry of Environmental and Renewable Energy

Submitted By;
Road Development Authority
Ministry of Ports and Highways

Prepared By:
Oriental Consultants Co., Ltd, Japan
Katahira & Engineers International, Japan
Consulting Engineers and Architects Associated (Pvt.) Ltd., Sri Lanka

Annex 1.1
Terms of Reference

ඔබේ යොමුව
உமது தொடர்பு
Your Ref.

අපේ යොමුව
எமது தொடர்பு
Our Ref.

දිනය
திகதி
Date

08/EIA/Trans/02/2013

05.03.2013

මධ්‍යම පරිසර අධිකාරිය

மத்திய சுற்றாடல் அதிகாரசபை

Central Environmental Authority

"පරිසර පියස", 104, ඩෙන්සිල් කොට්ඨාසයේ මාවත, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"பரிசர பியச", 104, டென்சில் கொப்பேகடுவ மாவத்தை, பத்தரமுல்ல, ஸ்ரீ லங்கா.
"Parisara Piyasa", 104, Denzil Kobbekaduwa Mawatha, Battaramulla, Sri Lanka.
Web : www.cea.lk

Annex 1.1

ENVIRONMENTAL AND SOCIAL
DIVISION
ROAD DEVELOPMENT AUTHORITY

Received by.....

Ref. No.....

Act on.....

13

Director/ Planning Division,
Road Development Authority,
"Sethsiripaya",
Battaramulla

THE SECOND NEW KELANI BRIDGE PROJECT

This has reference to the application dated 31.01.2013 submitted to the CEA and to the environmental scoping meeting held on 14.02.2013 at the CEA regarding the above subject.

As decided at the above meeting, you are required to prepare an Environmental Impact Assessment (EIA) report in respect of the above project, the Terms of Reference (ToR) of which are attached hereto.

The EIA report must address all significant impacts of the project. If the EIA report fails to address such matters it will render the EIA report inadequate and you will be required to make necessary amendments and re-submit the report.

Please submit draft final EIA report for the purpose of checking for adequacy. Once checked for adequacy, required number of copies of the EIA report has to be submitted for the purpose of technical and public review. Please note that the EIA report should be translated into Sinhala and Tamil languages and copies thereof should also be furnished.

Letter No. H/Exp/AIA/WP/2013 dated 20.02.2013 sent by the Department of Archaeology is also attached herewith for necessary action.

Kanthi De Silva
Director (EIA)
CENTRAL ENVIRONMENTAL AUTHORITY

Cc : 1. Director General/ Road Development Authority
2. Director/ Env't. & Soc. Dev. Division/ RDA

① Mr. Malaka/ 20-II (EIA)
pl. discuss v. early

[Signature]
2013/03/08

Mr. Malaka
f.u.a.d.
[Signature]
2013/03/11

② 20-II (EIA)
give a copy of the TOR
to Mr. Tashima of JICA
pl. not 2 file.

Chairman	Tel : 2872361, 2872348 Fax : 2872347	Director General	Tel : 2872359 Fax : 2872608	Gen. Office	Tel : 2872348, 2872349, 2872350, 2872351, 2872352, 2872353, 2872354, 2872355, 2872356, 2872357, 2872358, 2872359, 2872360, 2872361, 2872362, 2872363, 2872364, 2872365, 2872366, 2872367, 2872368, 2872369, 2872370, 2872371, 2872372, 2872373, 2872374, 2872375, 2872376, 2872377, 2872378, 2872379, 2872380, 2872381, 2872382, 2872383, 2872384, 2872385, 2872386, 2872387, 2872388, 2872389, 2872390, 2872391, 2872392, 2872393, 2872394, 2872395, 2872396, 2872397, 2872398, 2872399, 2872400, 2872401, 2872402, 2872403, 2872404, 2872405, 2872406, 2872407, 2872408, 2872409, 2872410, 2872411, 2872412, 2872413, 2872414, 2872415, 2872416, 2872417, 2872418, 2872419, 2872420, 2872421, 2872422, 2872423, 2872424, 2872425, 2872426, 2872427, 2872428, 2872429, 2872430, 2872431, 2872432, 2872433, 2872434, 2872435, 2872436, 2872437, 2872438, 2872439, 2872440, 2872441, 2872442, 2872443, 2872444, 2872445, 2872446, 2872447, 2872448, 2872449, 2872450, 2872451, 2872452, 2872453, 2872454, 2872455, 2872456, 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TERMS OF REFERENCE

(This ToR is valid only for one and half years from the date of issue.)

This ToR has been issued by the CEA only as a means of providing guidance for preparation of the EIAR for the proposed project. Required information on impacts mitigation measures etc. which will be useful in decision making should be incorporated in the EIA report based on the findings of the EIA study.

Issuance of the ToR does not in any way reflect an agreement on the part of the CEA regarding the granting of approval for the project. It is the responsibility of the project proponent to clear any issues regarding land ownership and to obtain approvals required from agencies other than the CEA. In the case where the project is to be sited on state land we recommend obtaining "in principle" approval of the land owner, prior to embarking on the EIAR preparation. The CEA will not be responsible for any costs incurred by the project proponent in EIAR preparation in case the project is rejected.

Project Name	:	THE SECOND NEW KELANI BRIDGE PROJECT
Project Proponent	:	Road Development Authority
Project Approving Agency	:	Central Environmental Authority
Report requirement	:	Environmental Impact Assessment (EIA) report
Date of issue of the ToR	:	05.03.2013

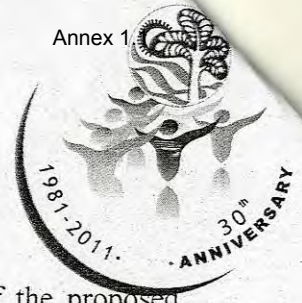
Report format :

Executive Summary

1. Introduction
2. Description of the Project and reasonable alternatives
3. Description of the existing environment
4. Anticipated environmental impacts of proposed project
5. Proposed mitigatory measures
6. Cost - Benefit Analysis
7. Monitoring Programme
8. Conclusion and Recommendation

Annexures

- I Terms of Reference
- II References
- III Sources of data & information
- IV List of preparers including their work allocation (Report should be authenticated by the preparers.)
- V Comments made by the public, NGOs and other agencies during formal and informal scoping meetings held by the EIA Team.
- VI Complete set of relevant maps, tables, charts, layout plans and other details.



Executive Summary

The summary should be a brief, non-technical summary of the justification of the proposed project, description of the salient features of the project, the existing environment of the project sites and its environs, key environmental impacts, the measures proposed to mitigate the environmental impacts, monitoring programme and conclusions. A one page summary table indicating the significant impacts and proposed mitigatory measures should be presented.

1. INTRODUCTION

- Background of the project (Brief history of the project, its current status, implementing agency etc)
- Objective of the proposed project and justification of the project (Summarize the need or problem being addressed by the project and how the proposed project is expected to resolve the problem or the issue).
- Objective of the EIA report (Specify the objectives of the assessment and the relationship of the results to project design and implementation).
- Methodologies and technologies adopted in EIA report preparation
- Conformity with Government policies and plans
- Preliminary approvals needed for the project and any conditions laid down by state agencies in granting preliminary clearance for the project

2. DESCRIPTION OF THE PROPOSED PROJECT AND REASONABLE ALTERNATIVES

2.1 Evaluation of Alternatives

- Describe reasonable alternatives considered in the course of developing the project (e.g. design, siting, technology selection, construction techniques, no action alternative etc.).
- Compare alternatives in terms of potential environmental impacts, mitigatory measures, capital and operating costs, reliability etc and give a clear recommendation.

2.2 Description of the proposed project

Following details should be given in order to get a clear picture of the project.

- Location, indicating the Divisional Secretariat Division/s and the Local Authority area/s within which the project site falls. GPS coordinates of the Centre Line of the final trace and the bridge to be given.
- Location map/s of appropriate scale indicating the road trace and surrounding land use.



- The layout plan of the project at appropriate scale. This should indicate all the project components and reservation area/s to be maintained.
- Design details of all project components including design details of the bridge (number of piers, bridge span, length, width), length of the traces, viaduct sections, cut/fill sections, height of the embankment, width of the ROW, number of lanes, interchanges, grade separated crossings (overpasses, underpasses etc), drainage provisions etc
- Methodology of construction including whether a cofferdam is envisaged, sources & quantities of raw material required and locations & quantities of disposal of waste
- Details of service roads to be built/ improved, other facilities and services to be provided.
- Requirement and availability of workforce (during construction), labour camps etc
- Details of time schedule.
- Methodology of operation of the project components, any maintenance requirements during operational phase and methodologies to be used
- Project cost, investment and funding sources.

3. DESCRIPTION OF THE EXISTING ENVIRONMENT

Study Area

The study area for the assessment shall include the following;

- i) Project site (area within proposed Right of Way) and 100m either side of the project site
- ii) Any area beyond the above corridor, where there is potential for environmental impacts due to the project

Assemble, evaluate and present available baseline data on the relevant environmental characteristics of the study area.

This chapter should provide information on physical, biological socio-economic, archaeological and cultural aspects of the environment likely to be affected by any activity of the project during and after the project construction period. Information should be presented in a comprehensive format using photographs, tables, maps and diagrams where appropriate. The maps provided must be clear, readable and in coloured form and appropriate scale. An updated satellite images may also be used. The methods used to collect data should be clearly stated under each category.



The existing environment should be described under following;

3.1 Physical environment:

- Topography including existing ground levels with respect to MSL along the trace, geology and soil, climate and meteorology etc
- Surface and groundwater hydrology and drainage
 - Drainage pattern across the proposed trace
 - Flood peak values, inundation levels and retention areas and inundation periods
 - List of existing irrigation or drainage / flood protection schemes encountered
 - Retention areas, marshlands or any other water bodies encountered
 - Drainage capacity of existing waterways and flood ways across the proposed trace
 - Present flood detention capacity of the lowlands on both sides of the trace
- Water quality, sources of water pollution if any etc
- Existing land use
- Ambient air quality and noise
- Records on natural disasters occurred

3.2 Biological Environment:

- An assessment of the present ecological status including the presence of sensitive habitats and their importance.

3.3. Socio-cultural Environment :

- Existing houses, commercial and government buildings within the direct impact area and the surroundings.
- Socio Economic status of populations
- Principal economic activities
- Planned development activities
- Availability of infrastructure facilities (roads, railways, water supply, power supply, health care, education etc.)
- Culturally, historically and archaeologically important objects/places
- Noise sensitive receptors such as hospitals, schools etc.
- Existing environmental considerations, problems or issues prevailing in the area.

4. ANTICIPATED ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

This chapter should show the overall effects of the project on the individual environmental components. Impacts should include the direct and indirect, long and short-term, positive and negative effects. When describing the impacts indicate which are irreversible or unavoidable and which can be mitigated to the extent possible. Wherever possible describe impacts quantitatively.



Significance of impacts should be assessed using appropriate techniques. Impacts should be discussed in the order of significance.

Special attention should be given to;

- (1) Socio economic impacts
 - No. of settlements and other institutions to be affected
 - Impacts of relocation
 - Impacts on livelihood and economic activities
 - Impacts due to disruption of existing infrastructure facilities
 - Possible nuisance to neighbourhood during construction and operation.
 - Health and safety impacts
 - Any other socio economic issues
- (2) Hydrological impacts
 - Impacts on natural flow / pattern of the Kelani river
 - Impacts on drainage pattern of the area
 - Impacts on flood protection schemes. (Flood bunds/ gates etc.)
 - Impacts during floods due to loss of retention/ detention area and blockage of drainage pathways.

Note : Impacts on the natural drainage system should be studied using a mathematical model and the model should be calibrated and verified for several flood scenarios so that the impacts in both construction and operational phase of the proposed bridge on the drainage could be analyzed properly.

- (3) Air quality, noise and vibration impacts during construction and operation
- (4) Traffic congestion
- (5) Impacts on aquatic / terrestrial habitats

5. PROPOSED MITIGATORY MEASURES

This chapter should set out the proposed measures to minimize the impacts identified in Chapter 4 to acceptable levels including conformity to regulations and national standards. Alternative methods of mitigation should be discussed and effectiveness of the proposed measures that are to be provided should be stated. Mitigation methods should be defined in specific practical terms. A rationale should also be presented for selection of chosen mitigatory measures.

Schedule of implementation of mitigation plans, responsible agencies, budget estimates, staffing and other necessary support services to implement the mitigatory measures/alternatives should be planned/ prepared.



6. EXTENDED COST BENEFIT ANALYSIS

Extended cost benefit analysis for the selected option of the project (if any). (The cost of the proposed remedial/ mitigation measures should be included in the project cost)

7. ENVIRONMENTAL MONITORING PROGRAMME

A suitable monitoring programme should be submitted to monitor the changes of environment and implementation of mitigatory measures. This plan should include the following;

- Parameters to be monitored and methodology to be used
- Monitoring locations, frequency and timing of sampling (should be decided base on the activities, sensitivity of the receptors etc.)
- Institutional arrangements for mitigation and monitoring of impacts, monitoring and reporting
- Responsible agency/ agencies of monitoring and reporting
- Availability of funds, expertise and facilities



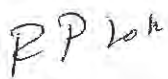
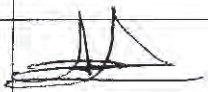
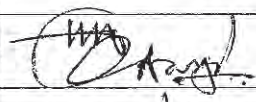

8. CONCLUSION AND RECOMMENDATION

The environmental acceptability of the proposed project and key findings and recommendations of the assessment should be clearly stated.

Any programme to improve general environmental conditions can also be stated here.

Annex 1.2
List of Experts

Annex 1.2- List of Experts Involved in the EIA Study

Name	Position	Qualifications	Duties carried out	Signature
Mr.D. A. J. Ranwala	Team Leader	B.Sc. (Eng.), M.Eng, FIE(SL), C. Eng., MIEP (SL), Chartered Environmentalist	Overall team direction, Hydrological and drainage aspects, formulation of the report	
Mr. G.M.S.W.B Gajasinghe	Environmentalist	B.Sc.(Sp), M.Phil, Chartered Environmentalist	General environmental aspects on impacts and formulation of environmental management and monitoring programs.	
Mr. R.P. Lokuratna	Civil Engineer	B.Sc. Eng. (Hon.), MEng (Melb), Grad. Dip (Deakin), MIE (Aus.) CPEng.	All design and construction aspects	
Dr. P.M.C. Bandara Digana	Ecologist	B.Sc., PhD	Ecological analysis and mitigation	
Mrs. P.M.H.G.S. Arangala	Socio-economist	B.Sc. (Sp), M.Sc. (Special)	Socio-economic analysis	
Mrs. S.K.K. Ranasinghe	Coordinator – (CEAA)	B. A. (Hons) Economics, PG. Dip (Marketing)	Line agency coordination. Organizing and monitoring household surveys	

Annex 3.1
Further Details of Alternatives

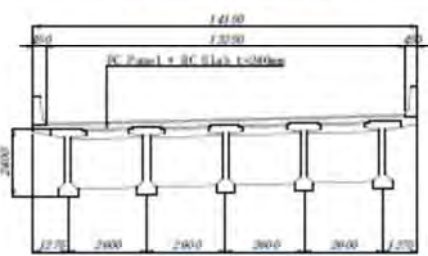
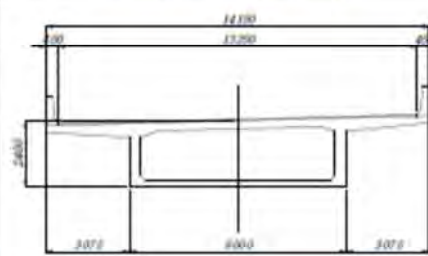
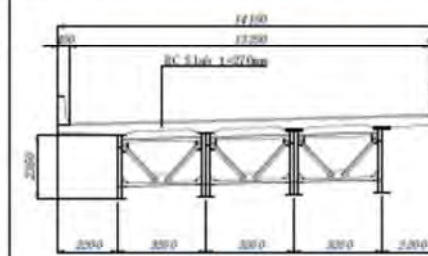
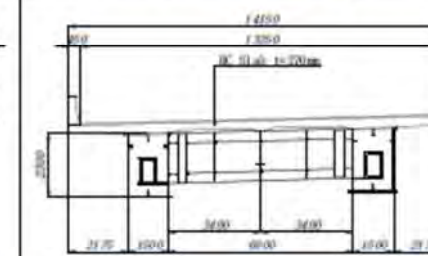
Annex 3.1- Further Details of Alternatives

Design details and the comparison of different design types for the main bridge

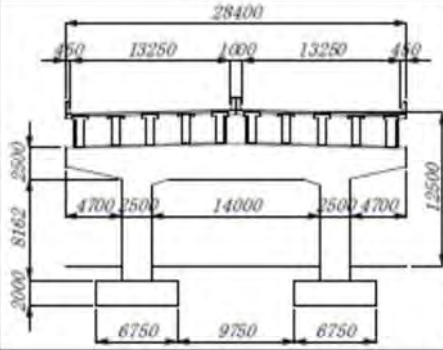
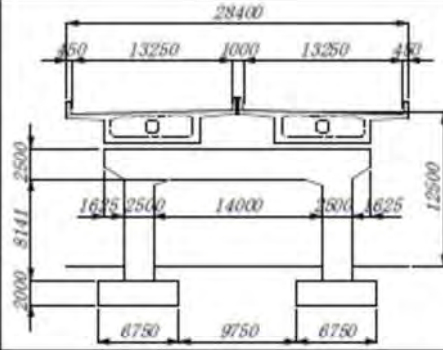
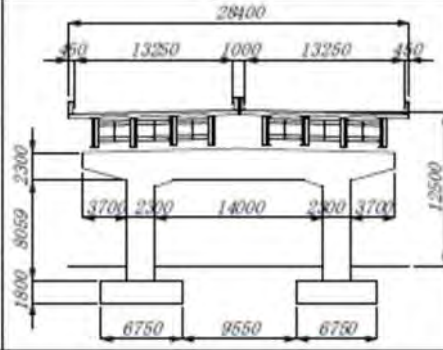
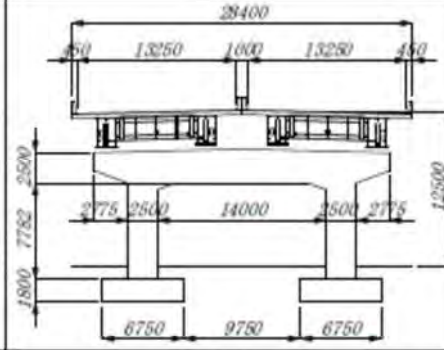
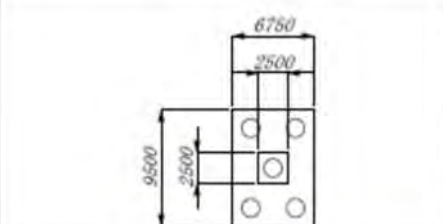
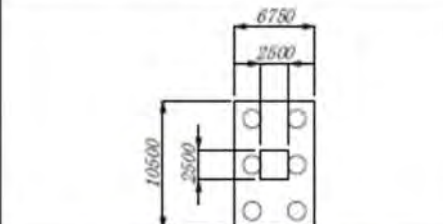
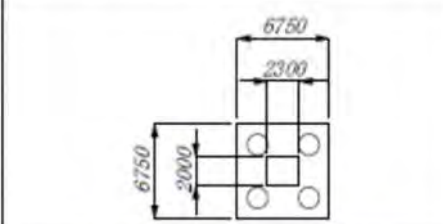
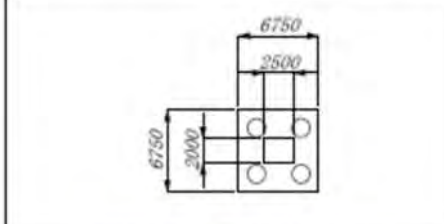
Bridge Type	Option 1 Box Girder Bridge	Option 2 Extra-Dosed Bridge	Option 3 Cable Stayed Bridge
Side View			
Span Length	50m~140m	100m~200m	100m~250m
Cross Section			
Self-weight	860kN/m (Girder)	1,010kN/m (Girder)	850kN/m (Girder)
Foundation	36-Steel Pile Well Foundation D=1.0m L=40m 	24-Cast in Place Bored Pile D=2.5m L=30 	36-Cast in Place Bored Pile D=2.5m L=30
Aesthetic	Normal	Good (Symbolic)	Good (Symbolic)
Scouring	Depth=9.3m	No Problem	No Problem
Constructability	2 Piers in the river	Good (Cantilever)	Good (Cantilever)
Construction Period	32 Month	36 Month	48 Month
Construction Cost	4,082 mill Rs (1.00)	4,507 mill Rs (1.10)	6,026 mill Rs (1.48)
Maintenance Cost	Low	Normal	High

Design details and the comparison of different design types for the approach bridges (viaducts, separated section)

Comparison study for superstructure types, Separated section

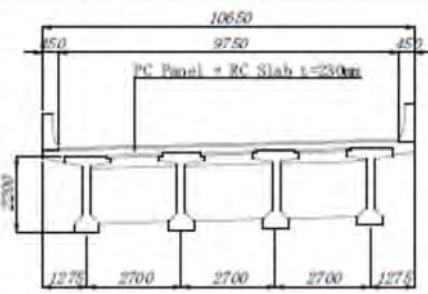
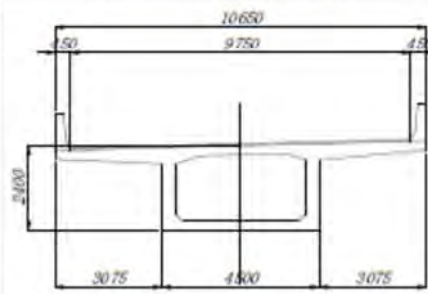
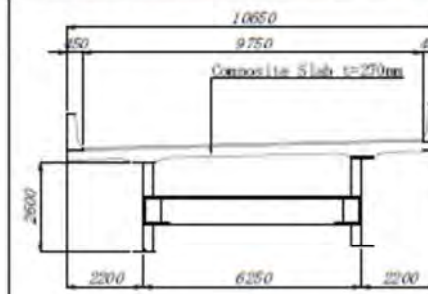
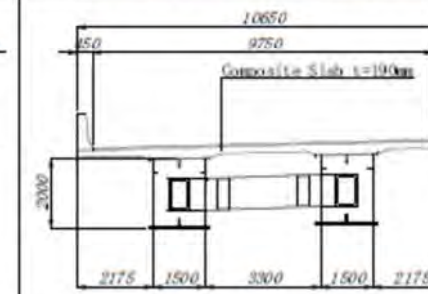
	Option 1	Option 2	Option 3	Option 4
	PC I Girder Simple	PC Box Girder Continuous	Steel I Girder(Conventional) Continuous	Steel Box Girder(Conventional) Continuous
Slab	Cast in place with PC plate form	Common as the upper flange	Cast in place with timbering form	Cast in place with timbering form
Cross Section				
Span Length	25m~45m (Adopted 40m)	30m~110m (Adopted 50m)	30m~60m (Adopted 40m)	40m~80m (Adopted 50m)
Self-weigh	253kN/m (Ratio:1.00)	265kN/m (Ratio:1.05)	176kN/m (Ratio:0.70)	187kN/m (Ratio:0.74)
Structural Feature	Most general girder. Design & fabrication method are well known. Big substructure & foundation are necessary.	Long overhang slab & torsional rigidity. Adaptable for sharp curve section. Big substructure & foundation are necessary.	Thin steel plates & stiffened members. Design & fabrication method are well known. Substructure & foundation are smaller than PC.	High flexural & torsional rigidity. Most adaptable for sharp curve section. Substructure & foundation are smaller than PC.
Production Fabrication work	Wide production yard is necessary. PC cable arrangement in thin web is difficult. Suitable for mass production.	Wide construction yard is necessary. Management is more difficult than PC-I Girder. Impossible to produce without erection method.	Special factory is necessary. The production period is long. Easy quality inspection & erection reinforcement.	Special factory is necessary. The production period is long. Easy quality inspection & erection reinforcement.
Erection work	Handling weight is heavy. Big equipments are necessary. Limited transportation weight & size.	Handling weight is the heaviest. Big equipments are necessary. Limited transportation weight & size.	Handling weight is the lightest. Stability in a single member is low. Erection at narrow space is possible.	Handling weight is light. Stability is high. Erection at narrow space is possible.
Aesthetic	Complex shape does not suit for urban highway.	Due to smooth surface, its view looks clear.	Bottom view shall be complicated.	Bottom view shall be simple.
Constructability	Normal	Good	Good	Good
Construction Cost	1.00	1.49	2.29	2.68
Maintenance Cost	The cost for many expansion joints & bearings is necessary.	Costs are cheaper than other options.	Paint or atmospheric corrosion resistant steel plate is necessary.	Paint or atmospheric corrosion resistant steel plate is necessary.

Comparison study for superstructure types, Separated section with piers

	Option 1	Option 2	Option 3	Option 4
	PC I Girder Simple	PC Box Girder Continuous	Steel I Girder(Conventional) Continuous	Steel Box Girder(Conventional) Continuous
Span Length	40m	50m	50m	50m
Reaction	25,678kN	32,588kN	21,394kN	24,768kN
Cross Section				
Substructure	RC Pier	RC Pier	RC Pier	RC Pier
Footing				
Pile	10-Cast in place piles D=1.5m L=30m	12-Cast in place piles D=1.5m L=30m	8-Cast in place piles D=1.5m L=30m	8-Cast in place piles D=1.5m L=30m
Aesthetic	Poor	Good	Poor	Good
Constructability	Normal	Normal	Good	Good
Construction Period	40 Month	36 Month	36 Month	32 Month
Construction Cost	184,454 Rs/m ² (Ratio: 1.00)	212,894 Rs/m ² (Ratio: 1.15)	270,332 Rs/m ² (Ratio: 1.47)	285,172 Rs/m ² (Ratio: 1.55)
Evaluation		Recommended		

Design details and the comparison of different design types for the approach bridges

Comparison study for superstructure types, Overlapped Sections

	Option 1	Option 2	Option 3	Option 4
	PC I Girder Simple or Combined girder	PC Box Girder Continuous	Steel I Girder(Fewness) Continuous	Steel Box Girder(Fewness) Continuous
Slab	Cast in place with PC plate form	Common as the upper flange	Cast in place with steel composite slab	Cast in place with steel composite slab
Cross Section				
Span Length	25m~45m (Adopted 40m)	30m~110m (Adopted 50m)	30m~60m (Adopted 40m)	40m~80m (Adopted 50m)
Self-weight	193kN/m (Ratio:1.00)	198kN/m (Ratio:1.03)	139kN/m (Ratio:0.72)	126kN/m (Ratio:0.65)
Structural Feature	Most general shape. Design & fabrication method are well known. Big substructure & foundation are necessary.	Long overhang slab & torsional rigidity. Adaptable for sharp curve section. Big substructure & foundation are necessary.	Thick plates & few members. Highest girder. Substructure & foundation are smaller than PC.	High flexural & torsional rigidity. Most adaptable for sharp curve section. Substructure & foundation are smaller than PC.
Production Fabrication work	Wide production yard is necessary. PC Cable arrangement in thin web is difficult. Suitable for mass production	Wide production yard is necessary. Management is more difficult than PC-I Girder. Impossible to produce before erection method.	Special factory is necessary. The production period is long. Easy quality inspection & erection reinforcement.	Special factory is necessary. The production period is long. Easy quality inspection & erection reinforcement.
Erection work	Handling weight is heavy. Big equipments are necessary. Limited transportation weight & size.	Handling weight is heavy. Big equipments are necessary. Limited transportation weight & size.	Handling weight is the lightest. Stability in a single member is low. Erection at narrow space is possible.	Handling weight is light. Stability is high. Erection at narrow space is possible.
Aesthetic	Complex shape does not suit for urban highway.	Due to smooth surface, its view looks clear.	Bottom view shall be simple.	Bottom view shall be simple.
Constructability	Normal	Good	Good	Good
Construction Cost	1.00l	1.47	2.20	2.38

Comparison study for superstructure types, Overlapped Sections with piers

	Option 1	Option 2	Option 3	Option 4
	PC I Girder Simple	PC Box Girder Continuous	Steel I Girder (Conventional) Continuous	Steel Box Girder (Conventional) Continuous
Span Length	40m	50m	40m	50m
Reaction	19,862kN	24,748kN	17,026kN	18,330kN
Cross Section				
Substructure	RC Pier	RC Pier	RC Pier	Rigid Steel Pier
Footing				
Pile	8-Cast in place piles D=1.5m L=30m	9-Cast in place piles D=1.5m L=30m	6-Cast in place piles D=1.5m L=30m	6-Cast in place piles D=1.5m L=30m
Road Elevation	High	High	High	Low
Aesthetic	Poor	Good	Poor	Good
Construction Period	40 Month	36 Month	36 Month	24 Month
Construction Cost	200,148 Rsm ² (Ratio:1.00)	229,808 Rsm ² (Ratio:1.15)	285,780 Rsm ² (Ratio:1.43)	300,664 Rs/m ² (Ratio:1.50)
Evaluation				Recommended

Design details and the comparison of different design types for the ramp bridges

Comparison study for superstructure types, Ramp Bridge

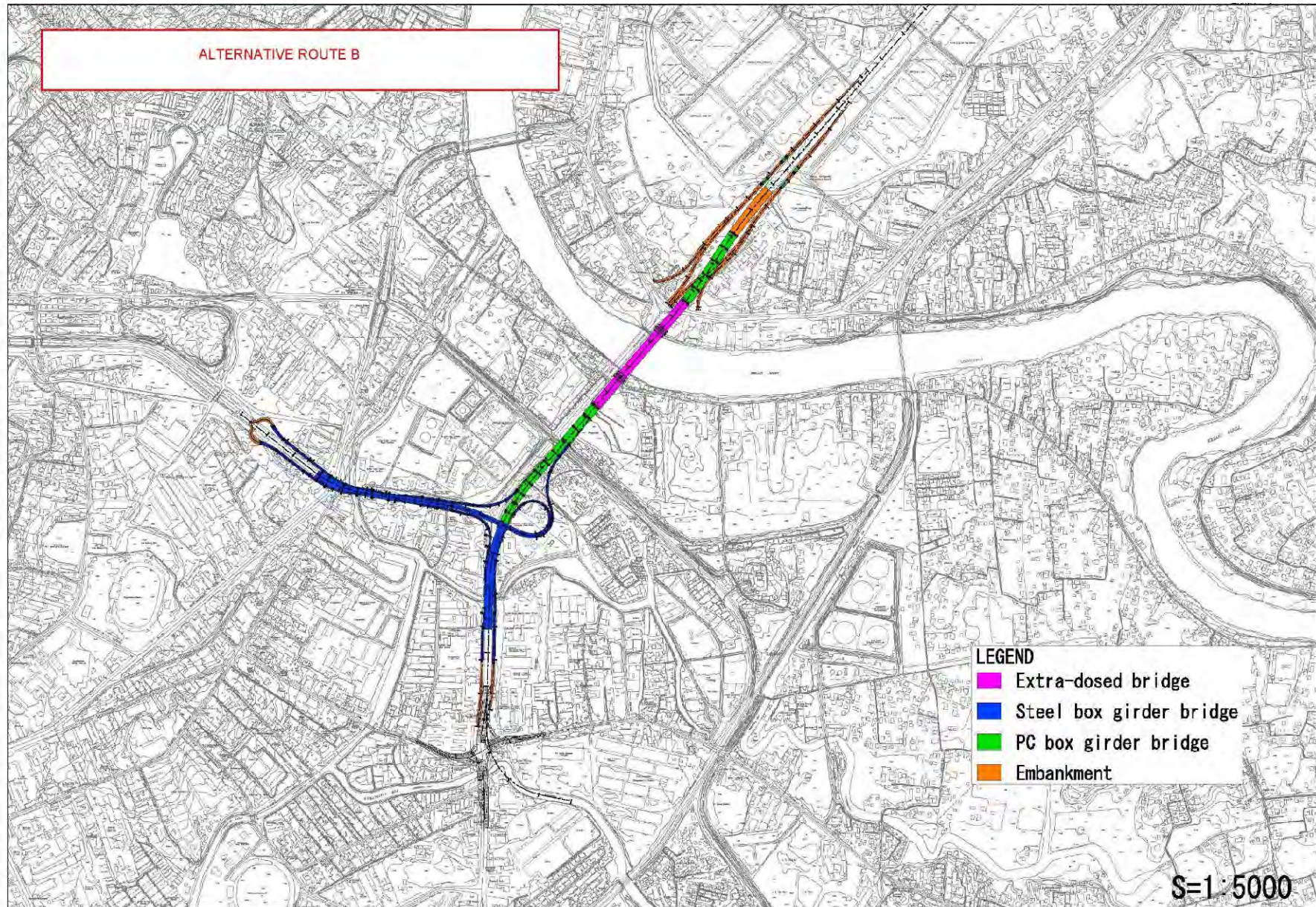
	Option 1 PC Box Girder Continuous	Option 2 Steel Box Girder Continuous
Slab	Common as the upper flange	Cast in place with steel composite slab
Cross Section		
Span Length	30m~60m (Adopted 50m)	40m~80m (Adopted 50m)
Minimum Radius	50m	30m
Self-weight	152kN/m (Ratio:1.00)	105kN/m(Ratio:0.78)
Structural Feature	Torsional rigidity. Adaptable for sharp curve section.	High flexural & torsional rigidity. Adaptable for sharp curve section. Substructure & foundation are smaller than PC Box Girder.
Production Fabrication work	Wide construction yard is necessary. Production management is difficult. Impossible to produce without erection method.	Special factory is necessary. The production period is long. Easy quality inspection & erection reinforcement.
Erection work	Handling weight is heavy. Big equipments are necessary. Limited transportation weight & size.	Handling weight is light. Stability is high. Erection at narrow space is possible.
Aesthetic	View looks clear.	View looks clear.
Constructability	Normal	Good
Construction Cost	1.00	1.55

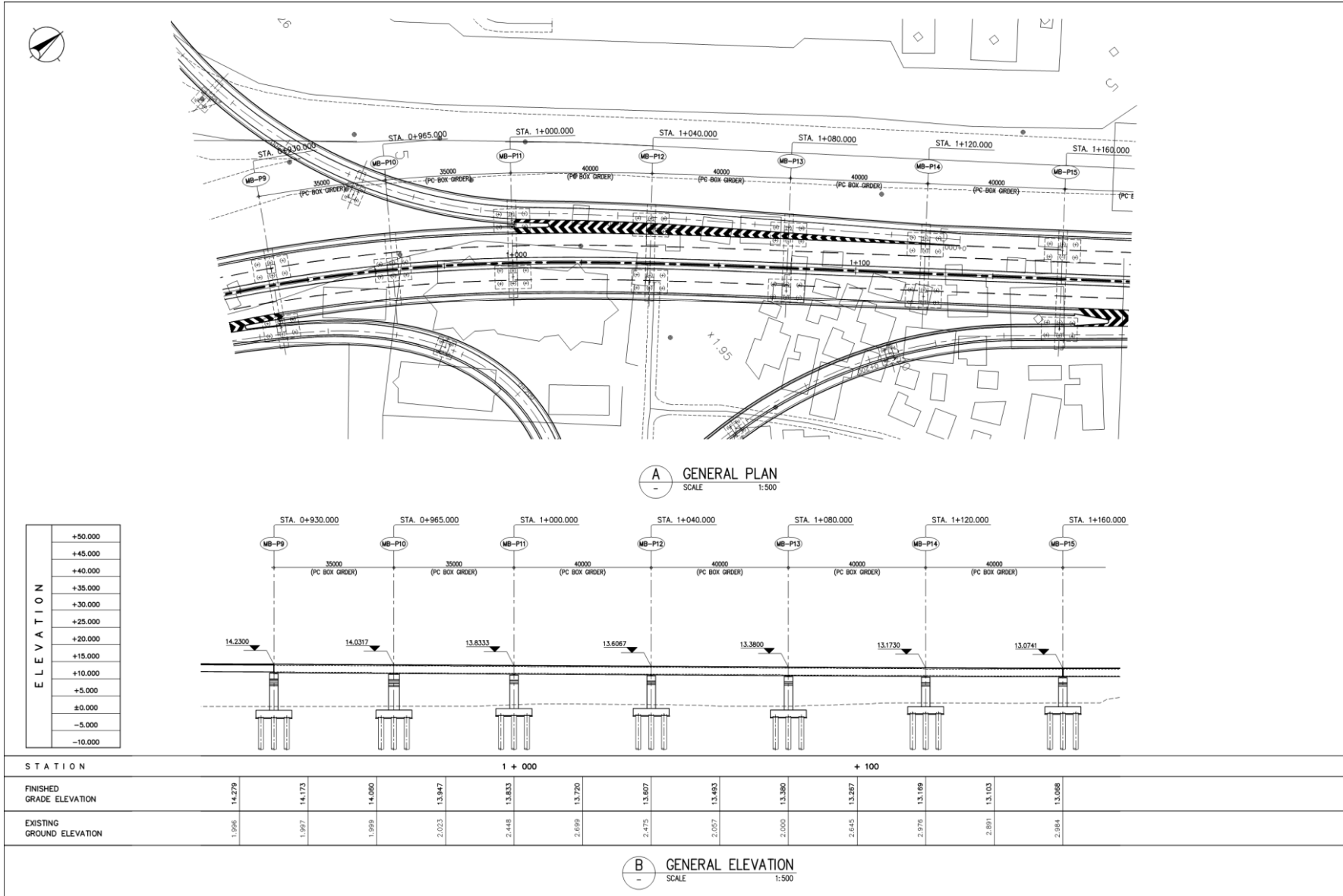
Comparison study for bridge types, Ramp section with pier

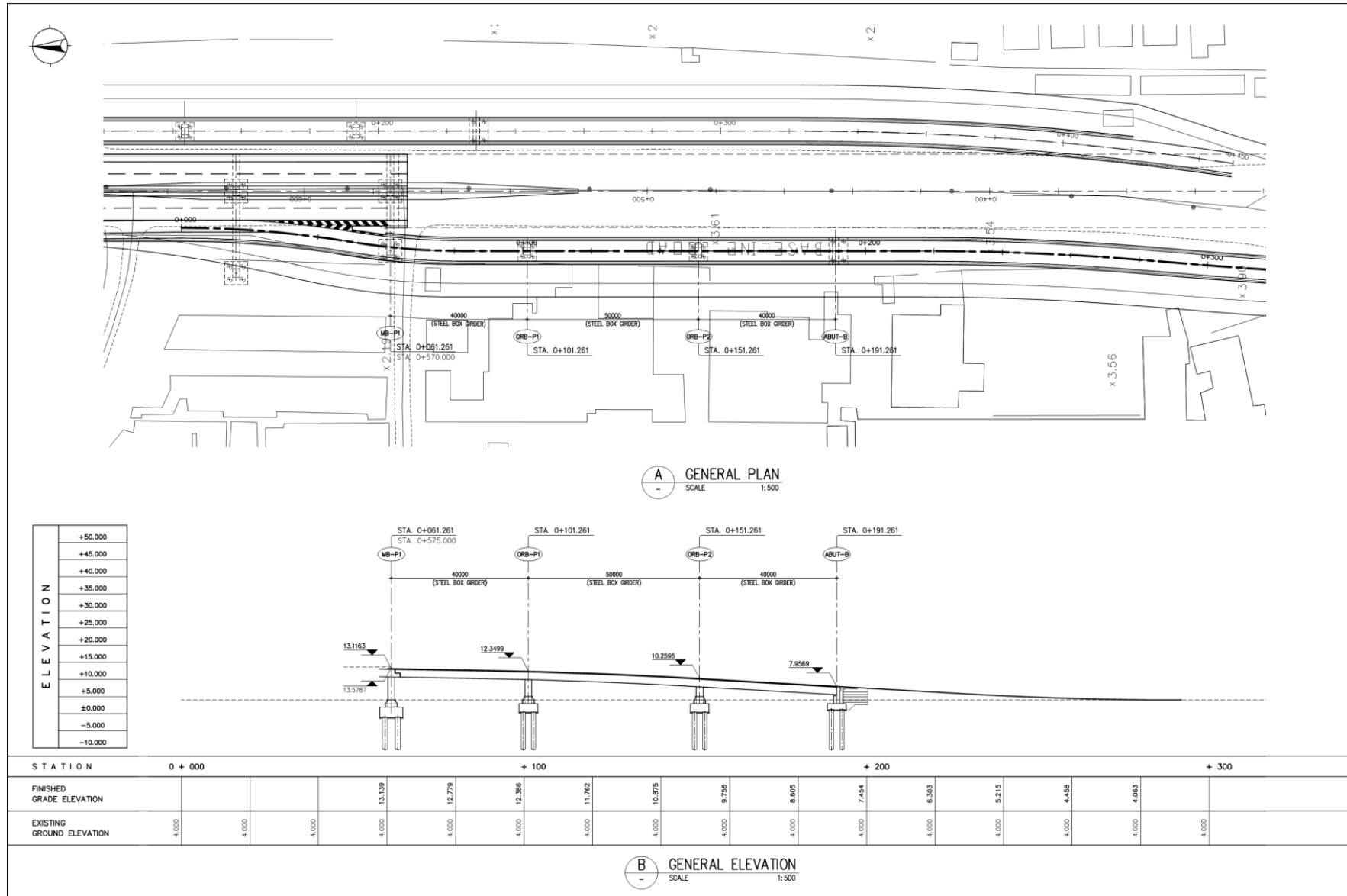
Bridge Type	Option 1	Option 2
	PC Box Girder Continuous	Steel Box Girder Continuous
Span Length	50m	50m
Reaction	9,466kN	7,109kN
Cross Section		
Substructure	RC Pier	Steel Pier
Footing		
Pile	4-Cast in place pile D=1.5m L=30m	4-Cast in place pile D=1.2m L=30m
Aesthetic	Good	Good
Constructability	No Good	Good
Construction Period	30 Month	18 Month
Construction Cost	307,448 Rs/m ² (Ratio:1.00)	354,426 Rs/m ² (Ratio:1.15)
Evaluation		Recommended

Annex 3.2
Details of Selected Alternative – Final Alignment

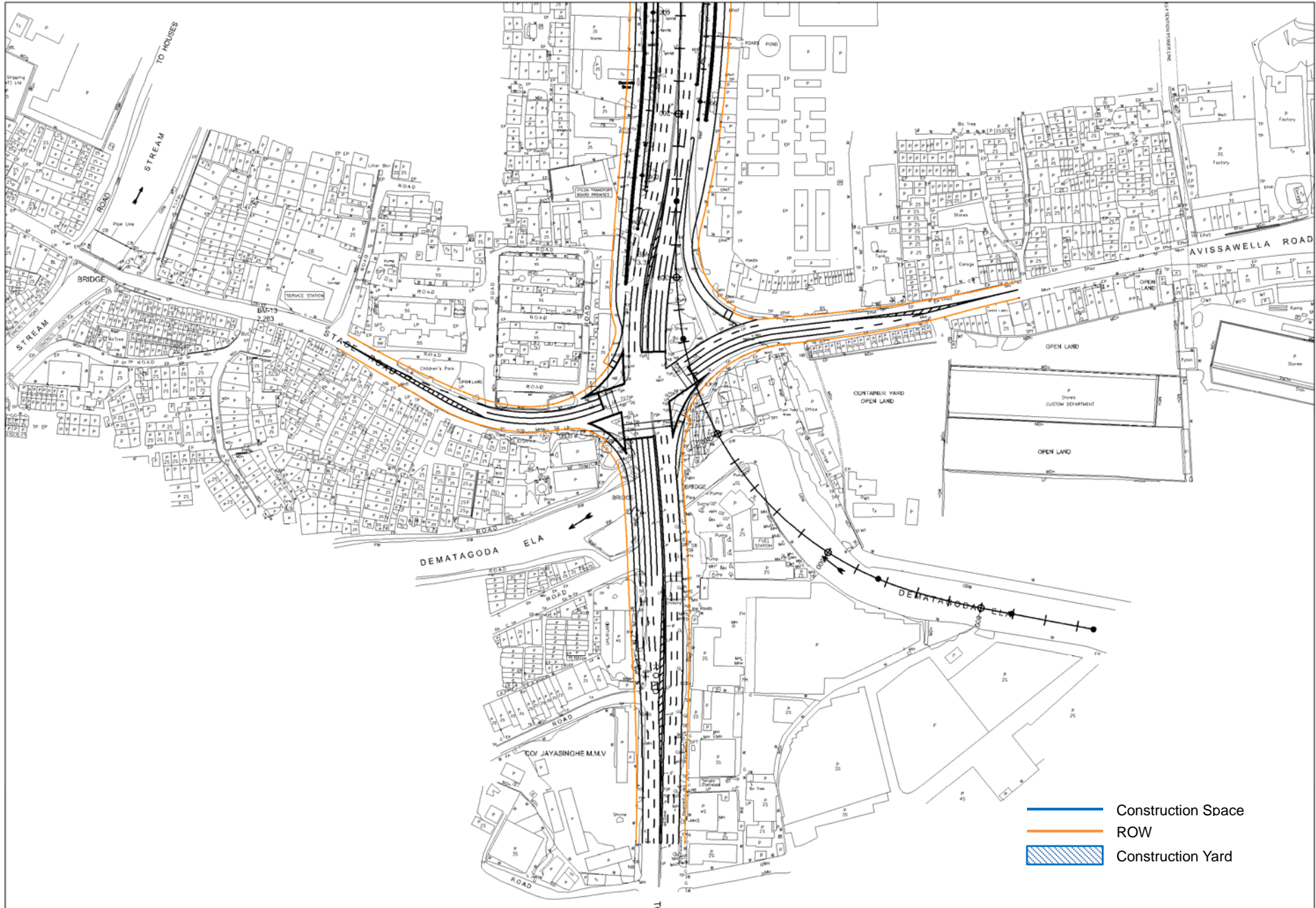
Annex 3.2 – Details of Selected Alternative – Final Alignment

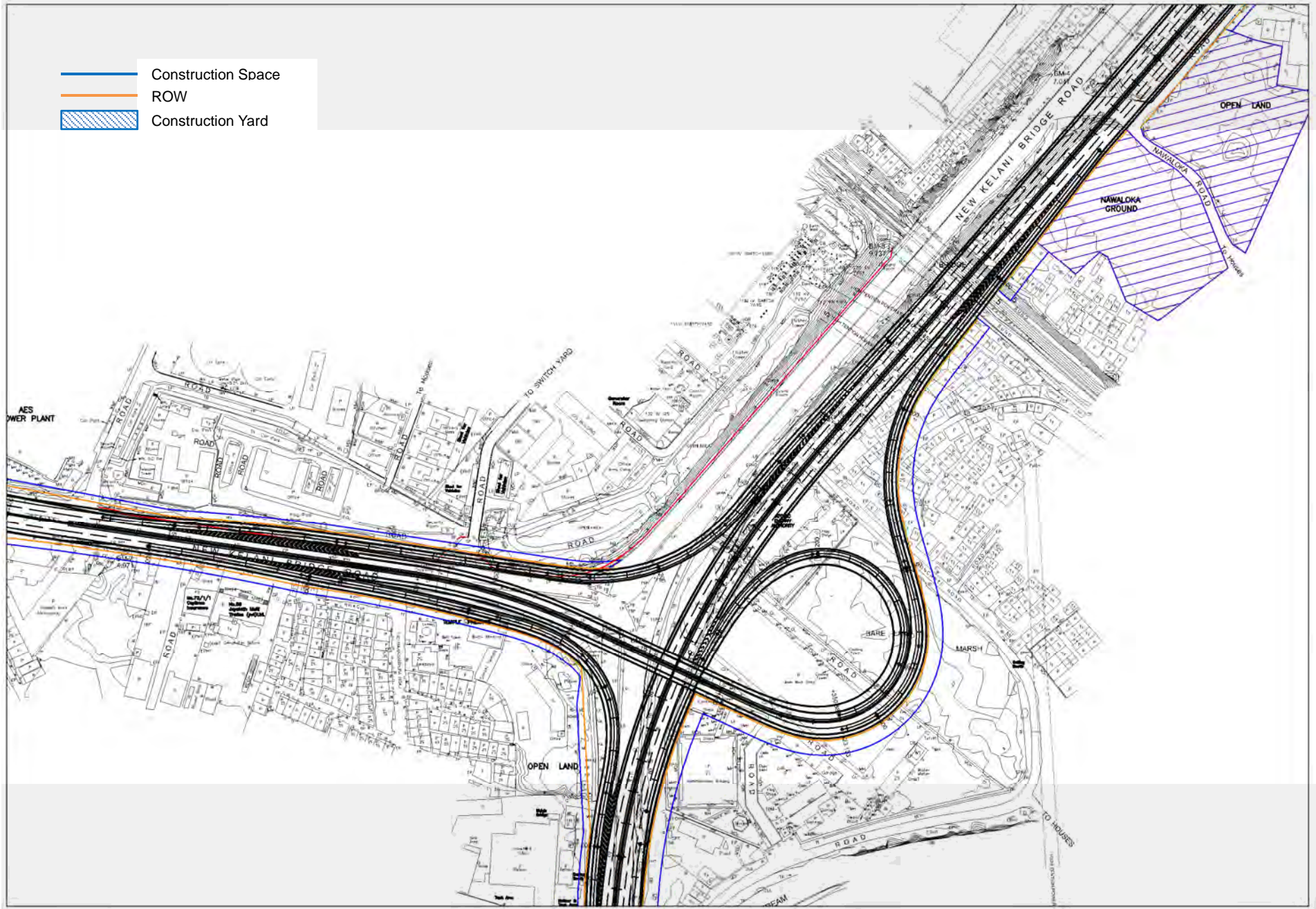


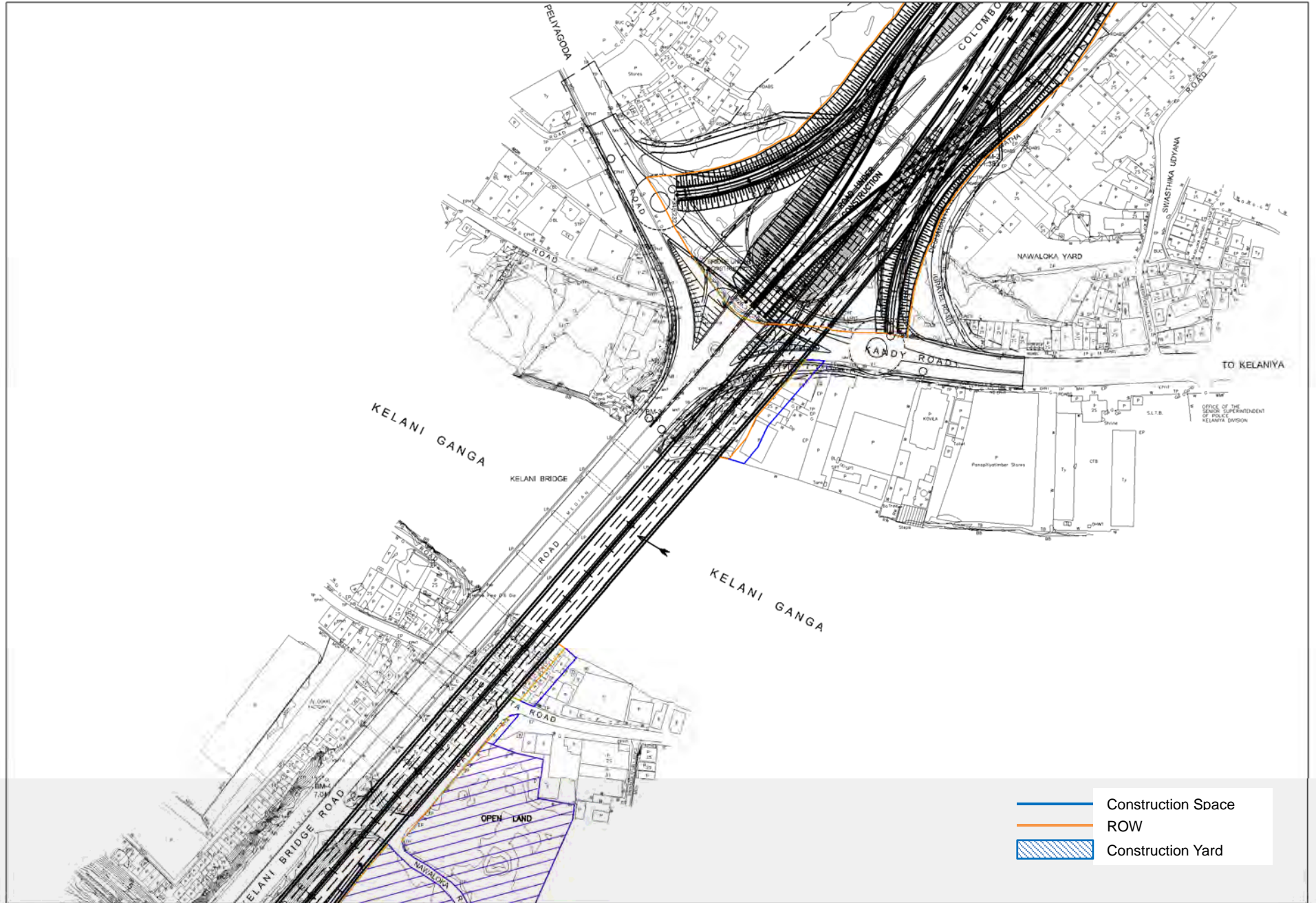


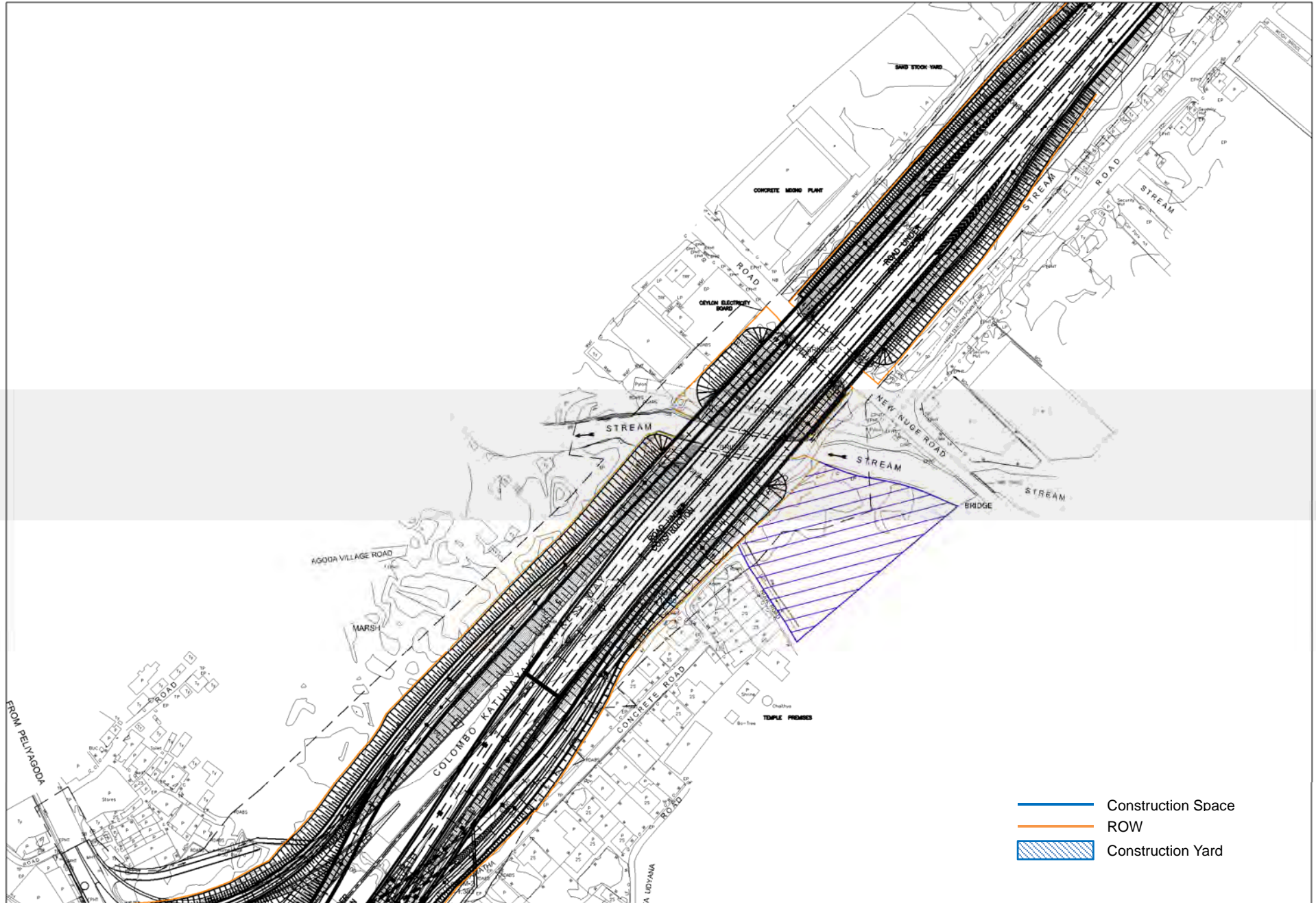


Annex 3.3
Details of Acquisition and Project Structure Boundaries











Annex 4.1
Details of Flora & Fauna-Ecology

Annex 4.1 Details of Flora & Fauna - Ecology

Table 5.9 Details of the affected trees due to proposed construction

Location	Species	Number of trees	Important
From Kelani river up to Orugodawaththa junction (Left side)	<i>Alstonia scholaris</i> - Ruk attana	04	The Bo tree (<i>Ficus religiosa</i>) located in Orugoda watta junction is religiously important tree Most of the trees observed within the premises of Atomic Energy Authority and Administration building
	<i>Polyalthia longifolia</i> –Villo	16	
	<i>Mangifera indica</i> – Amba	07	
	<i>Filicium decipiens</i> – Pihimbiya	10	
	Palm Spp.	10	
	<i>Pettophorum pterocarpum</i> –Kaha mara	04	
	<i>Azadirachta indica</i> – Kohomba	07	
	<i>Madhuca longifolia</i> – Mee	03	
	<i>Cocos nucifera</i> – Pol	10	
	<i>Terminalia arjuna</i> - Kumbuk	04	
	<i>Tectona grandis</i> - Thekka	01	
	<i>Ficus religiosa</i> – Bo	02	
	<i>Artocarpus hetarophyllus</i> – Kos	01	
	<i>Albizia saman</i> - Para mara	02	
<i>Persea Americana</i> - Ali pera	01		
	<i>Pettophorum pterocarpum</i>		
From Orugodawaththa junction up to Ingurukade junction (Left side)	<i>Azadirachta indica</i> – Kohomba	07	The Bo tree (<i>Ficus religiosa</i>) located in Ingurukade junction is religiously important
	<i>Albizia odoratissima</i> - Suriya mara	02	
	<i>Polyalthia longifolia</i> –Villo	02	
	<i>Mangifera indica</i> – Amba	02	
	<i>Ficus religiosa</i> – Bo	03	
	<i>Spathodia campanulata</i>	02	
	<i>Alstonia scholaris</i> - Ruk attana	07	
	<i>Ficus benghalensis</i> - Nuga	02	
	Casia spp-Ehela	06	
	<i>Pettophorum pterocarpum</i> - Kaha Mara	03	
	<i>Tectona grandis</i> - Thekka	07	
	<i>Cocos nucifera</i> – Pol	08	
	<i>Mangifera indica</i> – Amba	01	
	<i>Dichrostachys cinerea</i> - Andara	02	
From Ingurukade junction up to Kelani bridge (Left side)	<i>Alstonia scholaris</i> - Ruk attana	08	Most of the trees located adjacent to the Road within CEB premises
	<i>Azadirachta indica</i> – Kohomba	01	
	<i>Spathodia campanulata</i>	03	
	<i>Mangifera indica</i> – Amba	12	
	<i>Artocarpus hetarophyllus</i> – Kos	01	
From Kelani bridge up to proposed section of Nigambo road	<i>Ficus religiosa</i> – Bo	01	
	<i>Cocos nucifera</i> – Pol	01	
	<i>Artocarpus hetarophyllus</i> – Kos	02	
	<i>Swietenia macrophylla</i> – Mahogany	01	
	<i>Mangifera indica</i> – Amba	06	
	<i>Terminalia catappa</i> – Kottamba	03	
	<i>Azadirachta indica</i> – Kohomba	02	
	<i>Filicium decipiens</i> – Pihimbiya	04	
<i>Alstonia scholaris</i> - Ruk attana	03		

Location	Species	Number of trees	Important
	<i>Ficus religiosa</i> – Bo	01	
	<i>Acacia</i> spp-Narrow leaves	05	
From Kelani bridge up to proposed section of Kandy road	<i>Terminalia catappa</i> – Kottamba	08	Some trees located in bridge mouth has already removed
	<i>Artocarpus hetarophyllus</i> – Kos	05	
	<i>Mangifera indica</i> – Amba	08	
	<i>Alstonia scholaris</i> - Ruk attana	01	
	<i>Ficus religiosa</i> – Bo	01	
	<i>Albizia odoratissima</i> - Suriya mara	01	
	<i>Kasuarina</i> spp. Kasa	01	
Proposed section of Stace road from Orugoda waththa junction	<i>Albizia odoratissima</i> - Suriya mara	13	
	<i>Polyalthia longifolia</i> –Villo	01	
	<i>Ficus religiosa</i> – Bo	01	
	<i>Spathodia campanulata</i>	01	
	<i>Terminalia catappa</i> – Kottamba	01	
	<i>Pettophorum pterocarpum</i> - Kaha Mara	01	
	<i>Casia</i> spp- Ehela	01	
	<i>Acacia</i> spp-Narrow leaves	01	
Proposed section of Awissawella road from Orugodawaththa junction	No trees		
Port access road	No trees		
Proposed section of Dr Danister de Silva Mw, from Orugodawaththa junction	<i>Polyalthia longifolia</i> –Villo	14	
	<i>Terminalia catappa</i> – Kottamba	04	
	<i>Albizia saman</i> - Para mara	01	
	<i>Dichrostachys cinerea</i> - Andara	01	
	<i>Artocarpus hetarophyllus</i> – Kos	01	

Terrestrial and aquatic floral species found in the proposed Bridge construction area.**TS** - Taxonomic status**I** – Introduced**T** - Tree**C** - Climber**KRV**- Kelani River & Riverine Vegetation**CAA**-Canals & Associated Areas**CS:** Conservation status**E** - Endemic**S** - Shrub**Ep** -Epiphytes**N** – Native**TR**- Threatened**H** - Herb**AQ** – Aquatic**RR**- Road Reservations**MRC**- Mixed Residential and Commercial area**IUCN Sri Lanka 2012**

Scientific name	Common name	Habit	TS	CS	Habitats			
					MRC	RR	KRV	CAA
<i>Polyalthia longifolia</i>	Villo	T	I		+	+	-	-
<i>Spathodia campanulata</i>		T	I		-	+	-	-
Palm spp.		T	I		-	+	-	-
<i>Pettophorum pterocarpum</i>	Kaha Mara	T	I		+	+	-	-
<i>Aegle marmelos</i>	Beli	T	I		+	-	-	+
<i>Aeschynomene indica</i>	Diyasiyambala	Aq H	N		-	+	-	+
<i>Casia spp</i>	Ehela	T	I		-	-	-	-
<i>Albizia odoratissima</i>	Suriya mara	T	N		+	+	+	-
<i>Albizia saman</i>	Para mara	T	I		+	+	-	-
<i>Alocasia macrorrhizos</i>	Habarala	H	N		-	+	+	+
<i>Alstonia scholaris</i>	Ruk attana	T	N		+	+	+	-
<i>Alternanthera sessilis</i>	Mukunuwenna	H	N		+	+	-	-
<i>Amaranthus viridis</i>	Kura tampala	H	N		-	+	-	-
<i>Anacardium occidentale</i>	Caju	T	I		+	-	-	-
<i>Annona glabra</i>	Wel-atta	S	I		-	-	-	+
<i>Areca catechu</i>	Puwak	T	N		+	-	-	-
<i>Artocarpus hetarophyllus</i>	Kos	T	I		+	+	+	-
<i>Artocarpus incises</i>	Rata del	T	I		+	-	+	-
<i>Azadirachta indica</i>	Kohomba	T	N		-	+	-	-
<i>Basella alba</i>	Niviti	H	I		+	-	-	-
<i>Bougainvillea spp.</i>	Bougainvillea	S	I		+	+	-	-
<i>Bumusa vulgaris</i>	Una	T	N		+	+	+	-
<i>Caesalpinia pulcherrima</i>	Monara mal	S	I		-	+	-	-
<i>Calotropis gigantean</i>	Wara	S	N		-	+	-	-
<i>Capsicum annum</i>	Miris	H	N		+	-	-	-
<i>Carica papaya</i>	Papol	H	N		+	-	-	-
<i>Cassia fistula</i>	Ehela	T	I		-	+	+	-
<i>Cassia occidentalis</i>	Peni tora	H	N		+	+	-	-
<i>Cassia tora</i>	Tora	H	N		-	+	-	-
<i>Cebera odollam</i>	Gon kaduru	S	I		-	+	+	+
<i>Ceiba pentandra</i>	Pulun	T	N		+	-	+	-
<i>Cocos nucifera</i>	Pol	T	N		+	-	+	-
<i>Colocasia esculenta</i>	Gahala	H	N		-	+	-	-
<i>Datura metel</i>	Attana	H	I		-	+	-	-
<i>Delonix regia</i>	Mal mara	T	I		--	+	-	
<i>Dendrophthoe falcate</i>	Pilila	E	N		-	+	-	--
<i>Desmodium heterocarpon</i>	Et undupiyali	H	N		-	+	-	-
<i>Desmodium triflorum</i>	Heen Undupiyali	H	N		-	+	-	-
<i>Dichrostachys cinerea</i>	Andara	S	N		-	+	+	-
<i>Eichhornia crassipes</i>	Japan jabara	Aq H	I		-	-	-	+
<i>Elaeocarpus serratus</i>	Weralu	T	N		+	+	-	-
<i>Ficus benghalensis</i>	Nuga	T	N		-	+	+	+
<i>Ficus religiosa</i>	Bo	I	N		-	+	+	+
<i>Filicium decipiens</i>	Pihimbiya	T	N		+	+	+	-

<i>Flueggea leucopyrus</i>	Katu pila	S	N		-	+	-	-
<i>Gliricidia sepium</i>	Weta hiriya	T	I		-	-	+	-
<i>Hedyotis neesiana</i>	Pita sudu pala	H	I		-	+	-	-
<i>Hibiscus rosa sinensis</i>	Wada	S	I		+	-	-	-
<i>Hibiscus rosa-sinensis</i>	Wada	T	I		+	-	-	-
<i>Hibiscus tiliaceus</i>	Beli patta	T	N		-	-	-	+
<i>Ipomoea aquatica</i>	Kankung	Aq	N		-	-	-	+
<i>Lantana camara</i>	Ganda pana	S	I		-	+	-	-
<i>Lasia spinosa</i>	Kohila	N	N		+	-	-	+
<i>Leucaena leucocephala</i>	Ipil ipil	T	I		+	+	+	-
<i>Macaranga peltata</i>	Kenda	T	N		-	+	+	-
<i>Madhuca longifolia</i>	Mi	T	N		-	+	-	-
<i>Mangifera indica</i>	Amba	T	I		+	+	+	-
<i>Manihot esculenta</i>	Manyokka	T	I		+	-	-	-
<i>Melia azedarach</i>	Lunu midella	T	N		+	-	-	-
<i>Mikania cordata</i>	Vatu palu	C	N		-	+	-	-
<i>Mimosa pudica</i>	Nidi kumba	H	I		+	+	-	-
<i>Mitragyna tubulosa</i>	Helamba	T	N		-	-	+	-
<i>Muntingia calabura</i>	Jam	T	I		+	+	-	+
<i>Musa x</i>	Kessel	T	N		+	-	-	-
<i>Nephelium lappaceum</i>	Rambutan	T	I		+	-	-	-
<i>Pandanus kaida</i>	Weta keyiya	S	N		-	+	+	+
<i>Pandanus odoratissimus</i>	Watake	S	N		+	-	-	+
<i>Persea Americana</i>	Ali pera	T	I		+	-	-	-
<i>Pistia stratiotes</i>	Diya parade	Aq H	I		-	-	-	+
<i>Plumeria rubra</i>	Araliya	S	N		+	+	-	-
<i>Pongamia pinnata</i>	Karada	T	N		-	+	-	+
<i>Psidium guajava</i>	Pera	T	I		+	-	-	-
<i>Ricinus communis</i>	Endaru	S	I		+	+	-	+
<i>Ricinus communis</i>	Beheth endaru	S	I		-	+	-	+
<i>Sesbania grandiflora</i>	Katuru murunga	T	I		+	-	-	-
<i>Spathodia campanulata</i>		T	I		-	+	-	-
<i>Spondias dulcis</i>	Ambarella	T	I		+	-	-	-
<i>Stachytarpheta jamaicensis</i>	Balu nakuta	H	I		-	+	-	-
<i>Swietenia macrophylla</i>	Mahogany	T	I		-	-	-	-
<i>Tabernaemontana divaricate</i>	Wathu sudda	T	I		+	-	-	-
<i>Tectona grandis</i>	Thekka	T	I		+	+	-	-
<i>Terminalia arjuna</i>	Kumbuk	T	N		-	+	+	-
<i>Terminalia catappa</i>	Kottamba	T	I		+	+	+	+
<i>Typha angustifolia</i>	Hambu pan	H	N		-	-	-	+
<i>Vernonia cinerea</i>	Monara kudumbiya	H	N		-	+	-	-

Terrestrial and aquatic faunal species found in the proposed Bridge construction area..

SS: Species status

CS: Conservation status

TR- Threatened

EN- Endemic

MI- Migrant

EX: Exotic

CAA-Canals & Associated Areas

MRC- Mixed Residential and Commercial area

RR - Road Reservations

KRV- Kelani river& Riveraine Végétation

IUCN Sri Lanka 2012

Scientific Name	Common Name	Status		CAA	RRH	MRC	KRV
		SS	CS				
Order: Odonata	Dragonflies						
Family: Libellulidae							
<i>Neurothemis tullia</i>	Black velvet wing	-	-	+	-	+	
<i>Rhyothemis variegata</i>	Variable glider	-	-	+	+	-	+
Order: Lepidoptera	Butterflies						
Family: Papilionidae							
<i>Graphium doson</i>	Common jay	-	-	+	-	+	-
Family: Pieridae							
<i>Leptosia nina</i>	Psyche	-	-	-	-	+	-
<i>Delias eucharis</i>	Jezerbel	-	-	+	-	+	-
<i>Erema hecabe</i>	Common grass yellow	-	-	-	-	+	-
Family: Danaidae							
<i>Danaus chrysippus</i>	Plain tiger	-	-	-	-	+	-
<i>Euploea core</i>	Common crow	-	-	-	-	+	-
Family: Nymphalidae							
<i>Neptis hylas</i>	Common sailor	-	-	-	+	+	-
<i>Junonia atlites</i>	Grey Pansy	-	-	+	+	-	-
Family: Satyridae							
<i>Melanitis leda</i>	Common evening brown	-	-	+	-	-	-
<i>Ypthima ceylonica</i>	White four ring	-	-	-	-	+	-
<i>Elymnias hypermnestra</i>	Common palmfly	-	-	-	-	+	-
Class: Osteichthyes	Bony fishes						
Family: Poeciliidae							
<i>Poecilia reticulata</i>	Guppy	EX	-	+	-	-	-
Family: Cichlidae							
<i>Oreochromis mosambicus</i>	Tilapiya	EX	-	-	-	-	+
<i>Trichogaster pectoralis</i>	Snake skin-guramy	EX	-	+	-	-	
Family: Channidae							
<i>Channa striata</i>	Murrel	-		-	-	-	+
Family: Anabantidae							
<i>Channa punctate</i>	Spotted snakehead	-		-	-	-	+
<i>Anabas testudineus</i>	Climbing perch	-		+	-	-	
Family: Loricariidae							
<i>Hyposarcus pardalis</i>	Sucker-mouthed cat fish	EX		-	-	-	+
Class: Amphibia	Amphibians						
Family: Ranidae							
+ <i>Euphlyctis hexadactylus</i>	Edible frog	-	-	+	-	-	-
Family- Bufonidae							
<i>Bufo melanostictus</i>	Common house toad	-	-	-	-	+	-
Class: Reptilia	Reptilels						

Family-Gekkonidae							
<i>Hemidactylus frenatus</i>	Common house gecko	-	-	-	+	+	-
Family: Agamidae							
<i>Calotes calotes</i>	Green garden lizard	-	-	-	-	+	-
Family: Varanidae							
<i>Varanus salvator</i>	Water monitor	-	-	+	-	+	-
<i>Varanus bengalensis</i>	Land monitor	-	-	+	-	+	-
Family: Elapidae							
<i>Naja naja</i>	Cobra	-	-	+	-	+	-
Family: Colubridae							
<i>Ptyas mucosa</i>	The common rat snake	-	-	-	-	+	-
Class: Aves	Birds						
Family: Phalacrocoracidae							
<i>Phalacrocorax fuscicollis</i>	Indian Shag	-	-	+	-	-	-
<i>Phalacrocorax niger</i>	Little cormorant	-	-	+	-	-	+
Family: Ardeidae							
<i>Casmerodius albus</i>	Great egret	-	-	+	-	-	+
<i>Egretta grazetta</i>	Little egret	-	-	+	-	-	+
<i>Butorides striatus</i>	Little green heron	-	-	+	-	-	-
<i>Ardeola grayii</i>	Pond heron	-	-	+	-	+	+
Family: Accipitridae							
<i>Spiloris cheela</i>	Crested Serpent eagle	-	-	-	+	-	-
<i>Haliastur Indus</i>	Brahminy kite	-	-	-	+	-	-
<i>Accipiter badius</i>	Shikra	-	-	+	+	-	-
Family: Rallidae							
<i>Amaurornis phoenicurus</i>	White-breasted water hen	-	-	+	-	+	+
Family: Charadriidae							
<i>Vanellus indicus</i>	Red wattled lapwing	-	-	+	-	-	-
Family: Columbidae							
<i>Streptopelia chinensis</i>	Spotted dove	-	-	+	+	+	+
<i>Columba livia</i>	Domestic pigeon	-	-	+	+	+	+
Family: Psittacidae							
<i>Psittacula krameri</i>	Rose-ring parakeet	-	-	+	+	-	+
Family: Cuculidae							
<i>Eudynamis scolopacea</i>	Asian Koel	-	-	-	-	+	+
<i>Centropus sinensis</i>	Common coucal	-	-	+	+	+	+
Family: Alcedinidae							
<i>Halcyon smyrnensis</i>	White breasted kingfisher	-	-	+	+	+	+
Family: Meropidae							
<i>Merops philippinus</i>	Blue tail bee eater	-	-	+	-	-	-
Family: Capitonidae							
<i>Megalima zeylanica</i>	Brown headed barbet	-	-	-	+	+	+
<i>Megalima rubicapilla</i>	Small barbet	-	-	-	+	-	-
Family: Picidae							
<i>Dinopium bengalensis</i>	Red backed woodpecker	-	-	-	+	+	-
Family: Pittidae							
<i>Pitta brachyuran</i>	Indian pitta	MI	-	-	-	+	-
Family: Hirundinidae							
<i>Hirundo rustica</i>	Barn swallow	MI	-	+	+	-	-
Family: Pycnonotidae							
<i>Pycnonotus cafer</i>	Red vented bulbul	-	-	+	+	+	+
Family: Laniidae							
<i>Lanius cristatus</i>	Brown shrike	MI	-	-	-	-	-
Family: Turdidae							
<i>Copsychus saularis</i>	Magpie robin	-	-	+	-	-	-
Family: Timaliidae							

<i>Turdoides affinis</i>	Common babbler	-	-	+	+	+	+
Family: Sylviidae							
<i>Orthotomus sutorius</i>	Tailor bird	-	-	+	+	+	+
Family: Dicaeidae							
<i>Dicaeum erythrorhynchos</i>	Small frowerpecker	-	-	-	-	+	-
Family: Nectariniidae							
<i>Nectarinia zeylonica</i>	Purple rumped sunbird	-	-	+	+	+	-
<i>Nectarinia lotenia</i>	Long billed sunbird	-	-	+	+	+	+
Family: Estrididae							
<i>Lonchura striata</i>	Black rumped munia	-	-	-	-	-	-
Family: Sturnidae							
<i>Acridotheres tristis</i>	Common myna	-	-	+	+	+	+
Family: Oriolidae							
<i>Oriolus xanthornus</i>	Black headed oriole	-	-	+	-	+	+
Family: Dicuridae							
<i>Dicrurus caerulescens</i>	White vented drongo	-	-	+	-	-	+
Family: Corvidae							
<i>Corvus macrorhynchos</i>	Black crow	-	-	+	+	+	+
Class: Mammalia	Mammals						
Family: Muridae							
<i>Mus musculus</i>	House mouse	-	-	-	-	+	-
<i>Rattus rattus</i>	House rat	-	-	-	-	+	-
<i>Bandicota indica</i>	Bandicote rat	-	-	-	+	+	-
<i>Rattus norvegicus</i>	Brown rat	-	-	-	-	+	-
Family: Sciuridae							
<i>Funambulus palmarum</i>	Palm squirrel	-	-	-	+	+	-
Family-Leporidae							
<i>Lepus nigricollis singhala</i>	Black napped hare	-	-	-	-	+	-
Family: Bovidae							
<i>Bos indicus</i>	Domestic cow	-	-	-	+	+	-
Family- Canidae							
<i>Canis familiaris</i>	Domestic dog	-	-	-	+	+	-
<i>Felis catus</i>	Domestic cat	-	-	-	+	+	-
Family: Pteropodidae	Bat						
<i>Pteropus giganteus</i>	Flying fox	-	-	-	+	+	+
<i>Rousettus leschenaultia</i>	Dog faced fruit bat	-	-	-	+	+	+
<i>Cynopterus sphinx</i>	Short nosed fruit bat	-	-	-	+	+	+
Family- Viverridae							
<i>Paradoxurus hermaphrodites</i>	Indian palm cat	-	-	+	-	+	-
Family-Hystricidae							
<i>Hystrix indica</i>	Indian crested porcupine	-	-	+	-	-	-

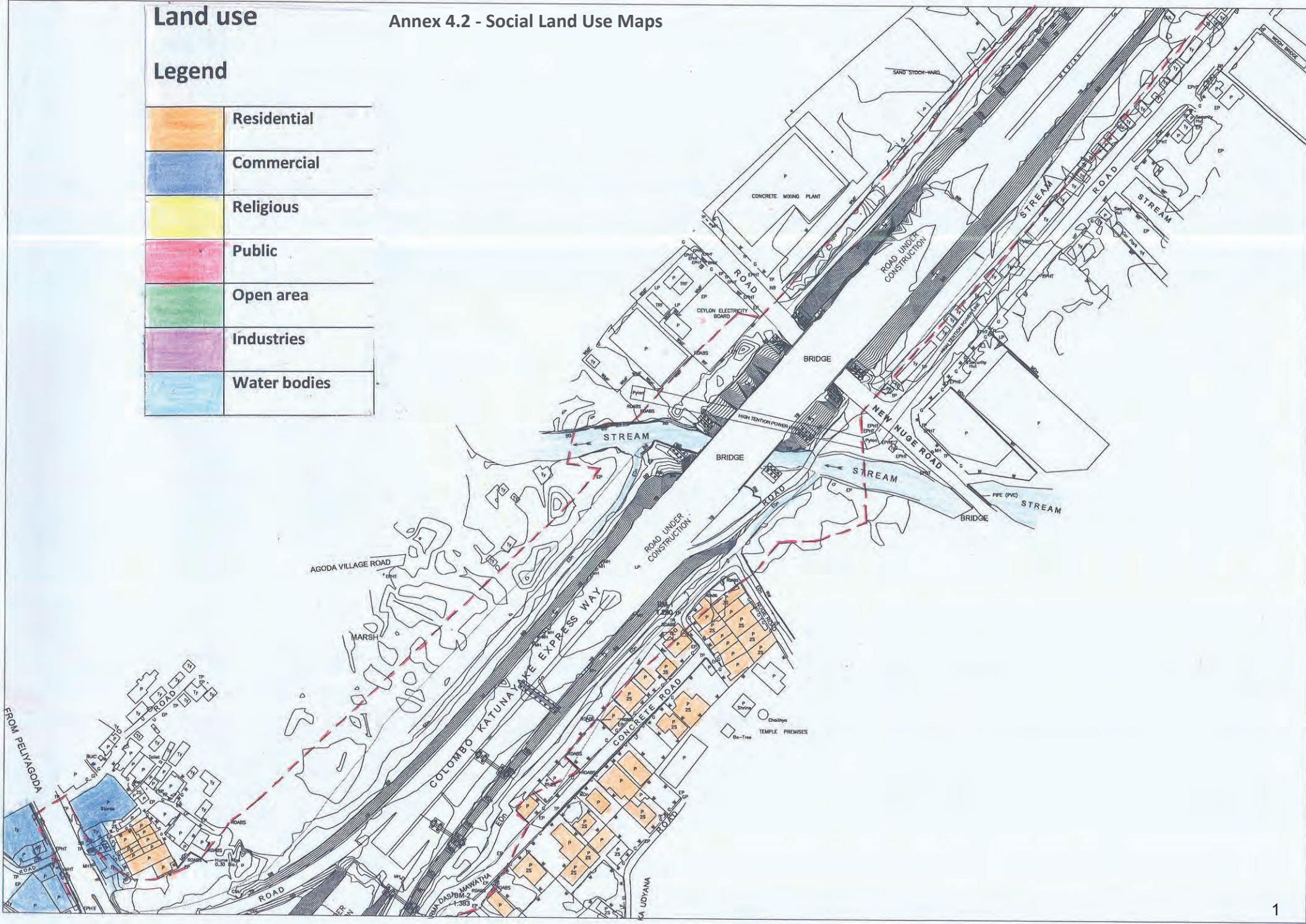
Annex 4.2
Social Land Use Maps

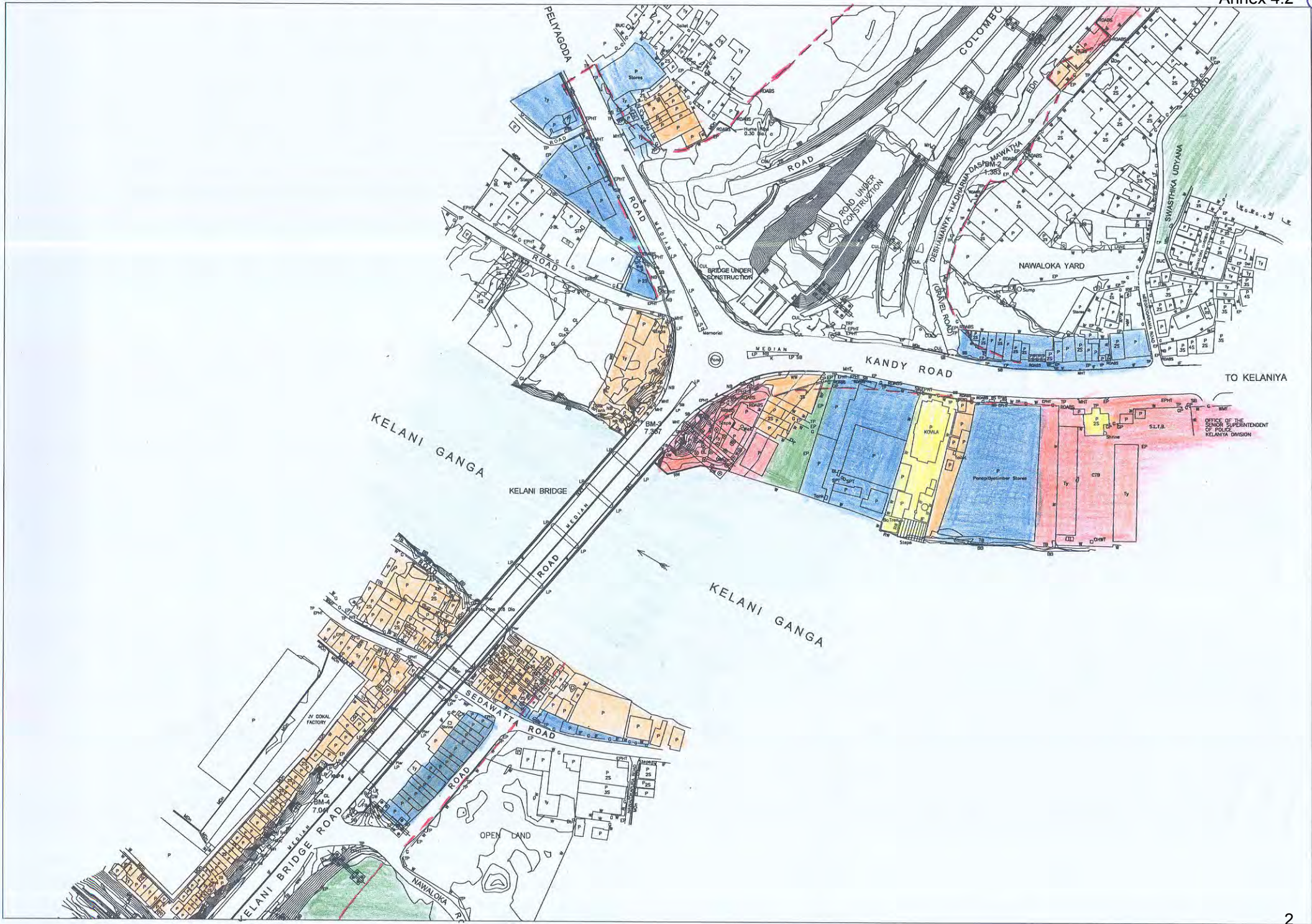
Annex 4.2 - Social Land Use Maps

Land use

Legend

	Residential
	Commercial
	Religious
	Public
	Open area
	Industries
	Water bodies













Annex 4.3
Socio Economic Data

Annex 4.3 – Socio Economic Data

Section No 1.2 Socio Cultural Environment

Section 1.2.2 Socio Economic Status of Population

Further Details

Table 4.22(a) Gender composition - within the surrounding GN divisions

DS division	GN division	Total population	Male	Female
Colombo	1 Bloemendhal	13,752	6,749	7,003
	2 Grandpass (North)	8,798	4,329	4,469
	3 Nawagampura	6,773	3,453	3,320
Kolonnawa	1 Sedawatta	6,887	3,488	3,399
	2 Wadullawatta	7,582	3,801	3,781
	3 Orugodawatta	5,882	3,022	2,860
Kelaniya	1 Peliyagoda – Gangabada East 174B	2,028	1,015	1,013
	Total	51,702	25,857 (50%)	25,845 (49.9%)

Source: Department of Census & Statistics - 2012

Table 4.22(b) Gender composition - within the direct impact area

DS division	GN division	Total population	Male	Female
Colombo	1 Bloemendhal	137	74	63
	2 Grandpass (North)	-	-	-
	3 Nawagampura	77	44	33
Kolonnawa	1 Sedawatta	475	223	252
	2 Wadullawatta	980	468	512
	3 Orugodawatta	46	22	24
Kelaniya	1 Peliyagoda – Gangabada East 174B	28	17	11
	Total	1743	848 (49%)	895(51%)

Source : Socioeconomic field survey April/May 2013

Table 4.22(c) Ethnic composition - within the surrounding GN divisions

DS division	GN division	Total population	Sinhala	Tamil	Moor	Others
Colombo (Resource profile 2010/2011)	1 Bloemendhal	18,529	7,050 (38%)	8,738 (47%)	2,312 (13%)	429 (2%)
	2 Grandpass (North)	11,298	2,422 (21%)	1,810 (16%)	6,782 (60%)	284 (3%)
	3 Nawagampura	13,538	4,066 (30%)	5,548 (41%)	3,720 (28%)	204 (1%)
Kolonnawa (Resource profile – 2012)	1 Sedawatta	6,879	3,131 (45%)	2,746 (40%)	947 (14%)	55 (1%)
	2 Wadullawatta	7,579	2,007	4,580	815	177

DS division	GN division	Total population	Sinhala	Tamil	Moor	Others
			(26%)	(60%)	(12%)	(2%)
	3 Orugodawatta	5,882	1,402 (24%)	3,110 (53%)	1,212 (21%)	158 (3%)
Kelaniya (Resource profile – 2013)	1 Peliyagoda – Gangabada East 174B	2,025	1,555 (77%)	306 (15%)	130 (6%)	34 (2%)
	Total	65,730	21,633 (33%)	26,838 (41%)	15,918 (24%)	1,341 (2%)

Source: Department of Census & Statistics, 2012

Table 4.22(d) Ethnic composition - within the direct impact area

DS division	GN division	Total population	Sinhala	Tamil	Moor	Others
Colombo	1 Bloemendhal	137	62 (45%)	59 (43%)	16 (12%)	0
	2 Grandpass (North)	-				
	3 Nawagampura	77	30 (39%)	30 (39%)	17 (22%)	0
Kolonnawa	1 Sedawatta	475	233 (49%)	182 (38%)	56 (12%)	4 (1%)
	2 Wadullawatta	980	330 (34%)	581 (59%)	65 (7%)	4
	3 Orugodawatta	46	16 (47%)	16 (35%)	14 (19%)	0
Kelaniya	1 Peliyagoda – Gangabada East 174B	28	9 (32%)	19 (68%)	0	0
Total		1,743	680	887	168	8

Source: Socioeconomic field survey April/May 2013

Table 4.22(e) Religious composition - within the surrounding GN divisions

DS division	GN division	Total population	Buddhist	Christian	Islam	Hindu	Others
Colombo (Resource profile 2010/2011)*	1 Bloemendhal	19,171	5,645 (30%)	5,598 (29%)	2,353 (12%)	4,924 (26%)	651 (3%)
	2 Grandpass (North)	11,575	2,100 (18%)	1,210 (10%)	6,828 (59%)	1,143 (10%)	294 (3%)
	3 Nawagampura	13,809	3,796 (27%)	1,689 (13%)	3,782 (27%)	4,263 (31%)	279 (2%)
Kolonnawa (Resource profile – 2012)	1 Sedawatta	6,879	2,886 (42%)	1,080 (16%)	1,017 (15%)	1,896 (27%)	0
	2 Wadullawatta	7,579	1,780 (23%)	1,219 (16%)	957 (13%)	3,621 (48%)	2
	3 Orugodawatta	5,882	1,335 (22%)	808 (14%)	1,282 (22%)	2,456 (42%)	1
Kelaniya	1 Peliyagoda –	2,025	1,499	164	144	218	0

DS division	GN division	Total population	Buddhist	Christian	Islam	Hindu	Others
(Resource profile – 2013)	Gangabada East 174B		(74%)	(8%)	(7%)	(11%)	
		66,920	19,041 (28%)	11,768 (18%)	16,363 (24%)	18,521 (28%)	1,227 (2%)

Source: Department of Census & Statistics -2012

Note: Total population for ethnic composition and religious composition in same resource profile shows difference.

Table 4.22 (f) Religious composition - within the direct impact area

DS division	GN division	Total population	Buddhist	Christian	Islam	Hindu
Colombo	1 Bloemendhal	137	57 (42%)	35 (26%)	16 (12%)	29 (21%)
	2 Grandpass (North)					
	3 Nawagampura	77	30 (39%)	0	17 (22%)	30 (39%)
Kolonnawa	1 Sedawatta	475	226 (48%)	89 (19%)	56 (12%)	104 (22%)
	2 Wadullawatta	980	295 (30%)	147 (15%)	67 (7%)	471 (48%)
	3 Orugodawatta	46	14 (30%)	7 (15%)	14 (30%)	11 (25%)
Kelaniya	1 Peliyagoda – Gangabada East 174B	28	9 (32%)	0	0	19 (68%)
Total		1,743	631 (36%)	278 (16%)	170 (10%)	664 (38%)

Source: Socioeconomic field survey April/May 2013

Table 4.22 (g) Age composition - within the surrounding GN divisions

DS division	GN division	Total population	Less than 15 years	16 – 59 years	60 years & over
Colombo	1 Bloemendhal	13,752	3,467 (25%)	8,918 (65%)	1,367 (10%)
	2 Grandpass (North)	8,798	2,458 (28%)	5,428 (62%)	912 (10%)
	3 Nawagampura	6,773	1,752 (26%)	4,445 (66%)	576 (8%)
Kolonnawa	1 Sedawatta	6,887	1,843 (27%)	4,580 (66%)	464 (7%)
	2 Wadullawatta	7,582	2,018 (27%)	4,975 (65%)	589 (8%)
	3 Orugodawatta	5,882	1,594 (27%)	3,720 (63%)	568 (10%)
Kelaniya	1 Peliyagoda – Gangabada East 174B	2,028	415 (20%)	1,348 (67%)	265 (13%)
Total		51,702	13,547 (26%)	33,414 (65%)	4,741 (9%)

Source : Department of Census & Statistics -2012

Table 4.22 (h) Age composition - within the direct impact area

DS division	GN division	Total population	Age 0 -5	Age 6 - 17	Age 18 – 60	Age 61 & above
Colombo	1 Bloemendhal	137	17	23	90	7
	2 Nawagampura	77	4	11	53	9
Kolonnawa	1 Sedawatta	475	51	94	300	30
	2 Wadullawatta	980	106	242	574	58
	3 Orugodawatta	46	5	8	31	2
Kelaniya	1 Peliyagoda – Gangabada East 174B	28	2	3	20	3
	Total	1,743(100%)	185 (11%)	381 (22%)	1068 (61%)	109 (6%)

Source : Socioeconomic field survey April/May 2013

Table 4.25 Condition of housing – within the surrounding GN divisions

DS division	GN division	Total Housing units in GN Division	Permanent		Semi-permanent		Temporary		No response	
			No	%	No	%	No	%	No	%
Colombo	1 Bloemendhal	3,205	2,116	66	587	18	499	16	03	0
	3 Grandpass (North)	1,670	1,126	67	506	30	33	03	05	0
	3 Nawagampura	1,446	1,012	70	283	20	149	10	02	0
Kolonnawa	1 Sedawatta	1,572	1,121	71	194	12	245	16	12	01
	2 Wadullawatta	1,759	1,034	59	293	17	341	19	91	05
	3 Orugodawatta	1,205	926	77	209	17	64	05	06	01
Kelaniya	1 Peliyagoda – Gangabada East 174B	466	310	67	71	15	85	18	0	0
	Total	11,323	7,645	68%	2,143	19%	1,416	12%	119	01%

Source : Socioeconomic field survey April/May 2013

Table 4.26 Condition of housing and commercial - direct impact area

DS division	GN division	Total units in GN Division	Permanent		Semi-permanent		Temporary	
			No	%	No	%	No	%
Colombo	1 Bloemendhal	45	17		25		3	
	3 Grandpass (North)	05	5		0		0	
	3 Nawagampura	26	20		1		5	
Kolonnawa	1 Sedawatta	107	80		15		12	
	2 Wadullawatta	252	22		82		148	
	3Orugodawatta	9	7		2		0	

Kelaniya	1 Peliyagoda – Gangabada East 174B	06	6		0		0	
	Total	450	157 (35%)		125 (28%)		168 (37%)	

Source : Socioeconomic field survey April/May 2013

Table 4.27 Household assets – in the direct impact area

Assets	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
Electrical Items & others								
1. Television	21		14	72	161	6	5	279
2. Radio/CD player	16		9	47	106	4	5	187
3. Sewing machine	4		6	25	42	2	1	80
4. Fan	9		4	40	135	2	3	193
5. Refrigerator	8		10	32	37	3	5	95
6. Gas cooker	12		10	43	71	4	3	143
7. Kerosene cooker	21		9	60	171	6	1	268
8. Air conditioner	1		0	3	0	0	1	5
9. Motor cycle	0		2	16	14	1	0	33
10. Bicycle	3		1	17	39	3	1	64
11. Three wheeler	2		1	14	23	3	0	43
12. Car/cab	0		0	0	0	0	0	0
13. Bus/Van	0		0	0	3	0	0	3
14. Water pump	0		0	2	1	0	1	4
15. Washing machine	1		3	10	6	1	0	21
16. Other	2		0	3	17	0	0	22

Assets	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
Total	100		69	384	826	35	26	1,440

Source: Socioeconomic field survey April/May 2013

Table 4.28 Categories of employment – direct impact area

Occupation	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
Permanent								
1.Salary employment	1		7	16	13	7	3	47
2.Salaried employment (Skilled)	3		4	21	36	2	2	68
3.Salaried employment (unskilled)	5		2	22	40	2	3	74
Total	9		13	59	89	11	8	189 (11%)
Temporary								
1.Daily paid labor	29		9	97	196	8	2	341 (19%) (daily paid labour to total temporary 64%)
2.Contract labor	2		0	0	7	0	0	9
3.Self employment	14		5	48	103	4	3	177
Total	45		14	145	306	12	5	527 (30%)
Foreign employment	3		6	13	28	2	0	52 (3%)

Occupation	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
Unemployment								
1.Retired/old/disabled	1		6	15	35	1	4	62
2.House wives	17		10	49	89	6	3	174
3.Students	26		16	103	237	8	6	396
4.Un employed	36		12	91	196	6	2	343(20%)
Total	80		44	258	557	21	15	975 (56%)
Grand total	137		77	475	980	46	28	1743(100%)

Table 4.29 Impact of flood on dwelling & livelihood – direct impact area

No.	Views	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
01	Experience in floods								
	1. Yes	5		1	67	183	5	0	261 (66%)
	2. No	25		13	26	58	4	6	132 (34%)
	Total	30		14	93	241	9	6	393 (100%)
02	Frequency of impact(as an average) past ten years								
	1.Once	1		0	14	25	1	0	41 (15%)
	2.Twice	0		0	14	40	0	0	54 (21%)
	3.More than twice	4		0	41	121	4	0	170 (64%)
	Total	5		0	69	186	5	0	265
03	Degree of impact								
	1.Dewelling not abandoned (until	4		0	50	147	3	0	204 (77%)

No.	Views	Bloemend.	Grandp. (North)	Nawagam.	Seedawa.	Wadullaw.	Orugodaw.	Peliyago. Gangabada (East)	Total
	recession of flood)								
	2.Had to abandon the dwelling totally (until recession of flood)	1		0	15	18	1	0	35 (13%)
	3.Had to abandon the livelihood totally (during flood time)	0		0	4	14	1	0	19 (7%)
	4.Destruction to production	0		0	0	1	0	0	1 (1%)
	5.Products un saleable	0		0	0	3	0	0	3 (1%)
	6.Others	0		0	0	2	0	0	2 (1%)
		5		0	69	185	5	0	264 (100%)

Source : Socioeconomic field survey April/May 2013

Gender

Sri Lanka has gained considerable progress in human development since its independence in 1948. Sri Lanka ranks mid-way on the United Nations Gender – related Development Index (#99 out of 177 countries). Life expectancy at birth in 2005 was 75.6 years for women and 67.9 years for men. High life expectancy rate for women reflects adequate nutrition and universal free health care. The adult literacy ratio for females in 15+group for female are 89.1 and for male are 92.3%. The combined gross enrolment rate for primary, secondary and tertiary education is quite close for women and men at 64% and 63% respectively. Sri Lankan women have relatively higher status than those in other developing countries¹

Sri Lanka's gender achievements are the dividends of extensive social welfare programs such as for free education, free health care and free food rations implemented by successive Governments since, the independence in 1948. The status of women in the project area is highlighted in Table 4.30

Table 4.30 Women status - direct impact area

¹ Country Gender Assessment, Sri Lanka, South Asia Regional Department and Regional and Sustainable Development Department, Asian Development Bank, Manila, Philippines, 2004

No.	Women Status	Bloemendal	Grandpass (North)	Nawagampura	Seedawatta	Wadullawatta	Orugodawatta	Peliyagoda Gangabada (East)	Total
01	Gender of chief householder								
	1. Male	24 (55%)	4 (80%)	20 (77%)	47 (44%)	136 (54%)	6 (67%)	5 (83%)	242 (54%)
	2. Female	20 (45%)	1(20%)	6 (23%)	60 (56%)	116 (46%)	3 (33%)	1 (17%)	207 (46%)
	Total	44 (100%)	5	26 (100%)	107 (100%)	252 (100%)	9 (100%)	6 (100%)	449 (100%)
02	Vulnerable status								
	1.Old aged	0		0	2	0	1	0	3 (3%)
	2.Disabled	4		2	13	3	0	0	22 (24%)
	3.Chronically ill	4		2	9	1	1	0	17 (20%)
	4.Widowed	3		2	17	25	1	1	49 (53%)
	Total	11		6	41	29	3	1	91 (100%)
	Percentage - Total Female headed HH to total vulnerability HH	55%		100%	68%	25%	100%	100%	
03	Women participation in decision making – Household level								
	1. Yes	21 (95%)		14 (88%)	60 (94%)	154 (89%)	9 (90%)	6 (100%)	264 (91%)
	2. No	1 (5%)		2 (12%)	4 (6%)	19 (11%)	1 (10%)	0	27 (9%)
	Total	22 (100%)		16 (100%)	64 (100%)	173 (100%)	10 (100%)	6 (100%)	291 (100%)
04	Participation in decision making – Community level								
	1. Yes	21		7	48	124	2	6	208 (71%)
	2. No	1		9	16	49	8	0	83 (29%)
	Total	22		16	64	173	10	6	291 (100%)

Source : Source : Socioeconomic field survey April/May 2013

Children's rights

There are number of Legislations and policies are prevalent to protect children's rights in Sri Lanka. In 1996, a Presidential Task Force on the prevention and control of child abuse was set up, which made far-reaching recommendations, including the establishment of a National Child Protection Authority (NCPA) its basic goal being elimination of child abuse in all its forms and manifestation operating on four main areas; protection, advocacy, rehabilitation, and legal reform. Very often, child abuse entails an element of trafficking. The NCPA is the pre-eminent national agency driving the anti-trafficking mission. In March 2001, Sri Lanka ratified the ILO Convention No. 182 and developed a National Plan of Action (NPA) to combat trafficking of children for sexual and labour exploitation

In Sri Lankan Constitution, 1978, Article 27 (13) Directive Principles of State Policy and Fundamental Duties, the state pledges to 'promote with special care the interest of children and youth so as to ensure their full development, physical, mental, moral, religious, social and to protect them from exploitation and discrimination'. In addition, the draft Constitution (August 2000) Article 22, entitled special rights for children, gives constitutional guarantees to the right of a child to be protected from abuse; to have access to free education between the ages of 5 to 14, and to not be employed in any hazardous activity. It also defines conclusively a child as a person under the age of 18 years.

The minimum age for employment of children was raised to 14 years in December 1999 by an amendment to the employment of women, young persons and children Act (No.47), 1956. Further, through the Ministry of Labour, the legislation has been amended to provide for payment of compensation to victims, by employers violating this minimum age. Under the regulations framed in 1997, under the Education Ordinance of 1940, education and attendance at schools were made compulsory for every Sri Lankan child aged between 5 and 14 years. In August 2006, there has been a change in the legislation which now empowers the Ministry of Labour to enact laws that prohibited the employment of children in hazardous forms of child labour. Accordingly, a list of hazardous form of child labour is in the process of being finalized.

Various surveys carried out by institutions on child labour indicate the degree of significance of child labour use in economic activities (informally) in the country. This indicates the gravity of labour in the country. Most of these child labour pockets are confined to certain areas of the country where poverty is acute, up country tea plantation areas, slum and squatter settlements in Colombo district and some agriculture areas in dry zone of the country.

In September 2007, A Youth Employment Policy & National Action Plan, supported by the ILO, was presented for eliminating child labour by placing great emphasis on the issue of access of quality education.

In June 11, 2008 – Sri Lanka marked the World Day against child labour. The theme was “education is the right response to child labour”. To support these activities in the island were designed to raise general awareness on the importance of education.

HIV/AIDS

According to UNAIDS/WHO, Sri Lanka, with a population of 20 Million, is a low HIV prevalence country in the South Asia Region with an estimated adults prevalence rate of less than 0.1%². Two decades since the detection of the first HIV infection in Sri Lanka, a cumulative total of 957 HIV infections and 266 AIDS cases have been detected in the country³.

Hence, Sri Lanka remains one of the few countries in the region with a low-level HIV epidemic. Many infections are associated with overseas work. HIV prevalence appears to be low, even in populations such as sex workers, despite their vulnerability and exposure to risks. It is apparent that some important vulnerability factors are either absent or operating at a low level in Sri Lanka. High literacy rates, the relatively high status of women and good access to health-care services all act to protect individuals and communities against HIV infection. Condition of high vulnerability, on the other hand, include conflict, high mobility of the military, internally displaced persons (IDPs), and separation of spouses due to overseas employment. Moreover, new economic developments such as the expansion of international free trade zones, and broad social changes such as the increasing migration of young adults from rural areas to large urban centers might, in the future, result in further expansion of social vulnerability factors.

The Western Province as the highest population concentrated Zone (29% of the population are concentrated in Colombo (2,309,809), Gampaha (2,294,641) and Kalutara (1,217,260) of the country, has higher probability of having and spreading of HIV/AIDS due to number of vulnerability factors in the zone are supported positively. To prove the factor, cumulative HIV cases by province of residence by end of the year 2012 is given below.

Table 4.32 Cumulative HIV cases by province of residence by end 2012 – (Latest up dated on 27.03.2013)

Province	Number	%	% Out of total known
Western	926	56.15	59.2
North Western	137	8.30	8.8
Central	122	7.39	8.0
Southern	106	6.42	6.8
Nothern	62	3.75	4.0
Eastern	61	3.69	3.9
Sabaragamuwa	71	4.30	4.5

² Sexually Transmitted Diseases (STD) clinic in Sri Lanka

³ Dr. Samarakoon, Current HIV/AIDS situation in Sri Lanka and its impact on the world of work, 2005

Province	Number	%	% Out of total known
North-Central	48	2.91	3.1
Uva	32	1.94	2.0
Total Known	1,565	94.90	100
Unknown	84	5.09	-
Grand Total	1,694	100	

Source : Web site: www.aidscontrol.gov.lk

Table 4.33 Housing ownership - direct impact area

DS division	GN division	Total Households	Title holders	Government owned houses for rental	Private owned Houses for rentals	Share ownership	Squatter on Govt. land	Squatters on private land	Uncertain ownership	Others
Colombo	1 Bloemendhal	33	1				31		1	
	2 Grandpass (North)	0								
	3 Nawagampura	14	8	4	1		1			
Kolonnawa	1 Seedawatta	93	20		2		70		1	
	2 Wadullawatta	240	2		2		236			
	3 Orugodawatta	9					9			
Kelaniya	1 Peliyagoda – Gangabada East 174B	6	4		2					
	Total	395	35	4	7	0	347 (88%)		2(1 %)	0

Source : Socioeconomic field survey April/May 2013

Table 4.34 Availability of infrastructure - surrounding GN divisions

No.	Infrastructure in GN divisions	Latitude	Longitude	Affected infrastructure
01	Bloemendhal			
	1.Port access Road			Affected
	2.Jayantha Mallimarachchi Road			
	3.Agamethi Vidyalaya school	6.958161	79.868781	
	4.Housing scheme	6.951978	79.871999	
	5.Irrigation Dept. (Mahawatta GND)*	6.955087	79.876791	
	6.Flood Gague station (Mahawatta GND)*	6.954962	79.876760	
	7. Bloemendhal primary school			
	8. Bloemendhal Tamil School			
02	Grandpass(North)			
	1.Sirima Bandaranayake Road			Affected
	2.Nagalagam Street			
	3.Temple	6.950664	79.873932	
	4.Irrigation Dept. (Mahawatta GND)	6.955087	79.876791	
03	Nawagampura			
	1.Stace Road			Affected
	2.Pragathi Mawata Road			
	3.Samagimawata Road			
	4.Denister de. Silva Mawatha (End part of the Base Line Road)			Affected
	5.Nawagampura play ground	6.946272	79.877753	
	6.Nawagampura Community Hall			
	7.Nawagampura Housing scheme			

No.	Infrastructure in GN divisions	Latitude	Longitude	Affected infrastructure
	8.CTB premises	6.945334	79.878082	Affected
	9.Sena Oil Mill	6.948917	79.878097	Affected
	10.Central Engineering Fabrics			Affected
	11.Pala Auto Electrical			Affected
	12.St. Sebastian Canal			
04	Grandpass (South)			
	1.Rajasinghe Central College			
05	Sedawatta			
	1.New Kelani Bridge Road			Affected
	2.Seedawatta-Ambatale Road			Affected
	3.Nawaloka Ground Road			Affected
	4.Nawaloka Cross Road			Affected
	5.Nawaloka Ground	6.952733	79.881324	Affected
	6.RDA yard	6.953662	79.881679	Affected
06	Wadullawatta			
	1.New Kelani Bridge Road			Affected
	2.Port access Road			Affected
	3.2 nd Nawagampura Road			Affected
	4.Kovil by Road			Affected
	5.NAITA Training Center Road			Affected
	6.Kelanitissa Power station (distance from fuel department to inter change at New Kelani Bridge Road 300 ^m)	6.952354	79.876658	
	7.Old Kelanivelly Railway line & flood controlling bond			Affected
	8.132kv High-tension Power transmission line			Affected
	9.Church	6.950878	79.879835	
	10.Shrine (distance from NITA training centre 92M)	6.950878	79.880735	

No.	Infrastructure in GN divisions	Latitude	Longitude	Affected infrastructure
	11.NITA Workshop	6.949819	79.879523	Affected
	12.Atomic Energy Centre	6.950802	79.879336	Affected
	13.GN Office (distance from NITA Training Centre 100 ^m)	6.949619	79.880866	
	14.Housing scheme – 1(distance from NITA Training Centre 110 ^m)	6.949069	79.881209	
	15.Housing scheme – 2(distance from NITA Training Centre 100 ^m)	6.948701	79.879753	
	16. Temple – Sanchi Viharaya	6.950223	79.877745	Affected
	17.Sacret Bo tree (distance from service corridor of proposed project)	6.950241	79.877381	
	18.Badrakali Amman Hindu Temple (Kovil)	6.950450	79.876873	Affected
	19.Canal (Branch of Orugodawatta)			
07	Orugodawatta			
	1.Railway line (distance from Orugodawatta Junction 750 ^m)			
	2.Avissawella Road			Affected
	3.Majeed Road			
	4.Sri Saddatissanahimi Road			
	5.Sacret Bo tree and shrine at the Orugodawatta Junction	6.944069	79.788331	Affected
	6.RDA quarters	6.945125	79.878555	
	7.Hindu Temple (Kovil) (distance from Orugodawatta Junction 150 ^m)	6.944415	79.879661	
	8.Custom Office (distance from Orugodawatta Junction to Custom Main	6.943595	79.880449	
	9.Sri Sambuddaloka Buddhist Temple			
	10. United Motor Service Centre			Affected
	11.State Timber Corporation Sales Dept.			Affected
	12. Vocational Skills Development Centre & National Trade Testing Institute			Affected

No.	Infrastructure in GN divisions	Latitude	Longitude	Affected infrastructure
08	Peliyagoda – Gangabada (East)			
	1.Kandy Road (A1)			
	2.Neegrodharama Road			
	3.Srawasthika Garden Road			
	4.Nuge school	6.957291	79.887321	
	5.Hindu Temple			
	6.RDA premises			Affected
	7.Government land			Affected

Source: Google Map

Note: *Some important infrastructure close to the project area, but outside the road influential area also included.

Table 4.35 Availability of infrastructure - direct impact area

Type of infrastructure	Kolonnawa DSD			Colombo DSD			Kelaniya DSD	Total
	Sedawatta	Wadullawatta	Orugodawatta	Bloemendhal	Grandpass (South)	Nawagampura	Peliyagoda Gangabada East 174B	
1. Telephone Posts	09	10	03	03	04	11	03	
2. Electricity Transmission Posts	07	22	02			05	04	
3. Lamp Posts	16	64	01	10	05	30	06	
4. Manhole (Telecom)		04	01		07	13	01	
5. High Tension Electric Post	03	07	03			01	03	
6. Name Boards		13		2	02	29	02	
7. Sign Boards		10			04	04	04	
8. Electric Cable Box						01		
9. Manhole (Water)		02				07		
10. Manholes		04		3	10	09		
11. Traffic Signal Posts		13		4	04	16		
12. Telecom Cable Box				2	01	04		
13. Manhole (Sewer)					05			
14. Oil Pump Line	01							
Other common facilities								
15. Play Grounds/Children' parks	01	01			01	01		
16. Public Hall						01		
17. Common Toilets	01	01		4				
18. Bathing places/common Tap	02	01		2				

Type of infrastructure	Kolonnawa DSD			Colombo DSD			Kelaniya DSD	Total
	Sedawatta	Wadullawatta	Orugodawatta	Bloemendhal	Grandpass (South)	Nawagampura	Peliyagoda Gangabada East 174B	
19. Three Wheeler parks	01							
20. Bus halts	01	03		2				
Total	42	156	10	32	43	132	23	

Source: Socioeconomic field survey April/May 2013

Table 4.37 Sanitary facilities attached to housing units - direct impact area

DS division	GN division	Total Housing units in GN Division	Availability of sanitary facilities			
			Yes		No	
			No.	%	No.	%
Colombo	1 Bloemendhal	33	12	7%	21	9%
	3 Grandpass (North)	0				
	3 Nawagampura	14	14	8%	0	0
Kolonnawa	1 Sedawatta	93	46	26%	47	22%
	2 Wadullawatta	240	99	56%	142	65%
	3 Orugodawatta	09	0	0	9	4%
Kelaniya	1 Peliyagoda – Gangabada East 174B	06	6	3%	0	0
	Total	395	177 (45%)	100%	219 (55%)	100%

Source : Socioeconomic field survey April/May 2013

Land Use

In addition to the land use maps prepared using standard land use feature another land use map was prepared during the social survey by physically identifying most essential land use categories to the project. The main land use themes considered are;

- (1) residential
- (2) commercial
- (3) religious
- (4) public institutions
- (5) open areas
- (6) industries
- (7) water bodied

These information was marked in a project area drawing which shows house boundaries and other land features. Details are provided in Annex 4.2

Annex 4.4
Clearance Letter from Department of Archeology

ජනරාල්
 தொண்டைநகர் இல. 011-2695255
 Telephone Nos.
 பொது இல. 011-2696250
 Director-General
 பெண்கள்
 Fax
 011-2696250



எனது இல. } H/EXP/ASA/LSP/201
 My No.

Email : arch@diamond.lanka.net
 Website : www.archaeology.gov.lk

ඔබේ අංකය }
 உமது இல. }
 Your No. }
 இலக் 011-2696250
 011-2696250
 கொழும்பு 7.
 Sir Maicus Fernando Mawatha,
 Colombo 7.

පිටපත් } පුරාවිද්
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 Grams } Puravid.

පුරාවිද්‍යා දෙපාර්තමේන්තුව
தொல்லியல் திணைக்களம்
DEPARTMENT OF ARCHAEOLOGY
 ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජය
 இலங்கை சனநாயக சோசலிசக் குடியரசு
 Government of the Democratic Socialist Republic of Sri Lanka

දිනය } 2013-05-08
 திகதி }
 Date

අධ්‍යක්ෂ ජනරාල්,
 මාර්ග සංවර්ධන අධිකාරිය,
 සෙන්සිටිවය,
 බත්තරමුල්ල.

පුරාවිද්‍යා හානි ඇතුළු වාර්තාවක් ලබා ගැනීම සම්බන්ධවයි.

ඉහත කරුණ සම්බන්ධයෙන් මා වෙත යොමු කරන ලද මබ්ගේ 2013.05.08 දිනැති අයැමීමක හා බැඳේ.
 එම අයැමීමකට අනුව කොළොන්නාව, කොළඹ කැළණිය ප්‍රාදේශීය ලේකම් කොට්ඨාසයන්හි නව මාර්ග
 ඉදිකිරීමට යෝජිත ප්‍රදේශ අපගේ නිර්ධාරී විසින් පරීක්ෂා කර වාර්තාව ලබා දී ඇත. එම වාර්තාවට අනුව පහත
 සඳහන් කොන්දේසි යටතේ අදාළ ව්‍යාපෘතිය සඳහා අනුමැතිය ලබා දෙන බව කාරුණිකව දන්වා සිටිමි.

කොන්දේසි :

- I. සෞභූ පරීක්ෂාවේ දී පෙන්වන ලද යෝජිත ස්ථානයේ හැර වෙනත් ස්ථානයන් ව්‍යාපෘතිය ක්‍රියාත්මක නොකළ යුතුය.
- II. ව්‍යාපෘතිය ක්‍රියාත්මක කිරීමේ දී පුරාවිද්‍යාත්මක වශයෙන් වැදගත් සාධක හමුවුවහොත් වහාම පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල් වෙත දැනුම් දිය යුතුය.
- III. මෙම දෙපාර්තමේන්තුවේ නිර්ධාරීන්ට මනුෂ්‍ය අවස්ථාවක ස්ථානය පරීක්ෂා කිරීමේ අයිතිය තිබිය යුතුය.

(Handwritten Signature)

ජී.පී.එල්. බිලකරවර්ධන
 J.P.L. Bilakkarawardana
 Director General
 Department of Archaeology

ජී.පී.එල්. බිලකරවර්ධන
 චැ. බී. සහකාර අධ්‍යක්ෂ (වංචල හා නිශ්චල දේපළ)
 පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල් වෙනුවට.

පිටපත් -

- | | |
|---|------------------|
| 01. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය මහ ලේකම් කාර්යාලය, කොළඹ | - දැන ගැනීම සඳහා |
| 02. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය මහ ලේකම් කාර්යාලය, කැළණිය | - දැන ගැනීම සඳහා |
| 03. ප්‍රාදේශීය ලේකම්, ප්‍රාදේශීය මහ ලේකම් කාර්යාලය, කොළොන්නාව | - දැන ගැනීම සඳහා |
| 04. සහකාර අධ්‍යක්ෂ (බටහිර) | - දැන ගැනීම සඳහා |

ප්‍රධාන කාර්යාලය - ලොදු අංක தலைமை அலுவலகம் - பொது இல. Head Office - General Numbers	011-2692840 011-2692841	ප්‍රවාහන විනාශය වැළැක්වීමේ පොලීස් ජනකය தொல்பொருள் அழிவை தடுக்கும் பொலீஸ் அலகு Police Unit - Prevention of Destruction and Theft of Antiquities	General 011-2394727 Hot Line 011-222 333
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11th July 2013

Director General,
Road Development Authority,
'Sethsiripaya',
Battaramulla

Assessment Report on Archaeological Destruction

This is in response to your application dated 08th May 2013, submitted to me on the above subject.

As per your application our officers inspected the area proposed for the construction of new road within the Divisional Secretary areas of Kolonnawa, Colombo and Kelaniya and submitted a report. According to that report we kindly inform you that we give permission for the above project subject to the following conditions;

- I) Project should not be executed in any area other than the proposed area pointed out at the field investigation.
- II) If any evidences of archaeological importance are found during project execution, Director General of Archaeology should be informed immediately.
- III) Officers of this department should have the right to inspect the site at any time.

Sgd/

A.E.L. Thilakawardhana
Acting Assistant Director (Movable & Immovable Property)
for Director General of Archaeology

Cc: 01. Divisional secretary, Divisional Secretary office, Colombo for information
02. Divisional secretary, Divisional Secretary office, Kelaniya for information
03. Divisional secretary, Divisional Secretary office, Kolonnawa for information

Annex 5.1
Details of Air quality, Noise & Vibration Predictions

Annex 5.1A Formula for Green House Gases Prediction

Estimation of CO2 emissions from Vehicles

Formula of CO2 emission factor of vehicle type

Standard-sized car : $EF=1864.3/v-2.3201v+0.020070v^2+166.85$

Small-sized cargo : $EF=528.18/v-4.98621v+0.03926v^2+308.57$

Standard-sized cargo : $EF=50.285/v-27.312v+0.20875v^2+1592.7$

Bus : $EF=2784.6/v-12.752v+0.10590v^2+854.18$

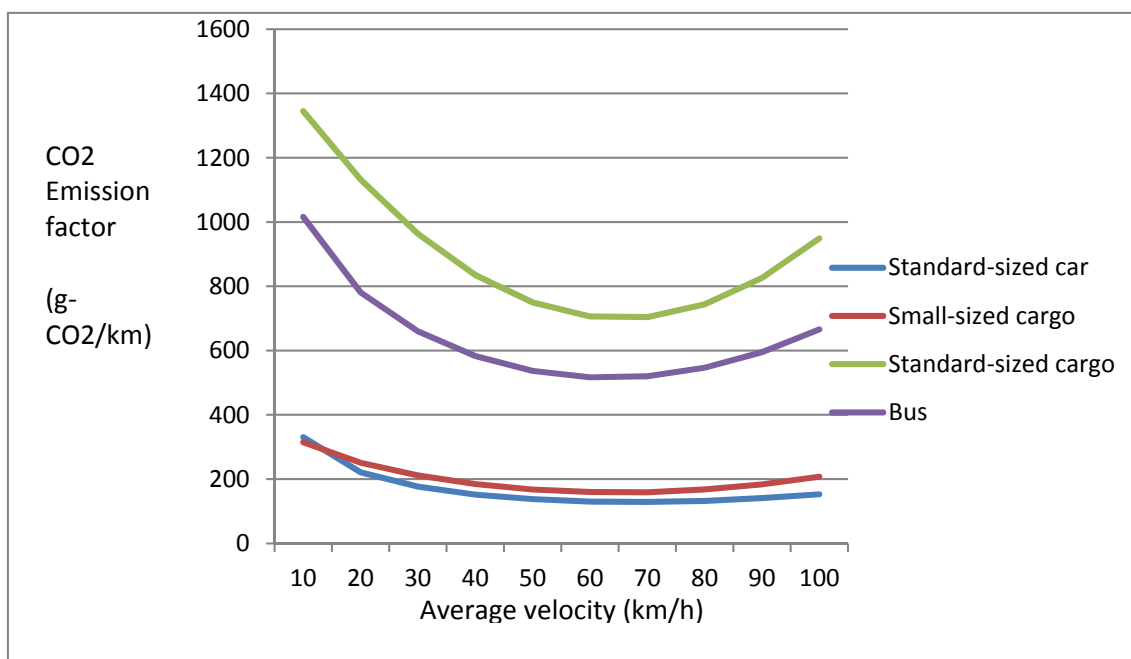
EF : CO2 emission factor (g-CO2/Km•car)

v : Velocity

CO2 emission Factor

(UNIT : g-CO2/km)

Average velocity (km/h)	Standard-sized car	Small-sized cargo	Standard-sized cargo	Bus
10	331	315	1345	1016
20	221	251	1132	781
30	177	212	963	660
40	152	185	835	583
50	138	168	750	537
60	130	160	706	517
70	129	159	704	520
80	132	168	744	547
90	141	184	826	595
100	153	208	949	666



Annex 5.1B- Air Pollution Prediction**(1) Air pollution from traffic during operation**

• Plume model formula (Constant wind speed, wind speed > 1.0 m/s)

$$C(x, y, z) = \frac{Q}{2\pi \times u \times \sigma_y \times \sigma_z} \times \exp\left(-\frac{y^2}{2\sigma_y^2}\right) \times \left[\exp\left\{-\frac{(z-H)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z+H)^2}{2\sigma_z^2}\right\} \right]$$

C(x,y,z) Concentration in NOx (ppm), SPM (mg/m³) at (x,y,z)

Q Strength of emission of NOx (ml/s), SPM (mg/s) from the point source
Emission

u Wind velocity (m/s)

H Effective height of emission (m)

δy Horizontal dispersion coefficient (m)

δz Vertical dispersion coefficient (m)

x Downwind distance along the wind direction (m)

Y crosswind distance (m)

z Vertical distance (m)

• Puff model formula (no wind shear, wind speed < 1.0 m/s)

$$C(x, y, z) = \frac{Q}{(2\pi)^{3/2} \times \alpha^2 \times \gamma} \times \left\{ \frac{1 - \exp\left(-\frac{\ell}{t_0^2}\right)}{2\ell} + \frac{1 - \exp\left(-\frac{m}{t_0^2}\right)}{2m} \right\}$$

$$\ell = \frac{1}{2} \left\{ \frac{x^2 + y^2}{\alpha^2} + \frac{(z-H)^2}{\gamma^2} \right\}$$

$$m = \frac{1}{2} \left\{ \frac{x^2 + y^2}{\alpha^2} + \frac{(z+H)^2}{\gamma^2} \right\}$$

t₀ Time corresponding to the initial diffusion width (s)

α, γ The coefficient on the diffusion width

Emission factor of two type vehicle classification

Average travelling speed (Km/h)	NOx		SPM		CO		SO ₂	
	Small-car g/km · car	Large-car g/km · car	Small-car g/km · car	Large-car g/km · car	Small-car g/km · car	Large-car g/km · car	Small-car g/km · car	Large-car g/km · car
20	0.107	2.775	0.00210 9	0.02555 0	1.231	1.497	0.00650 9	0.00648 2
30	0.085	2.101	0.00154 2	0.02065 5	0.936	1.274	0.00533 6	0.00542 8
40	0.068	1.652	0.00111 6	0.01658 8	0.661	1.037	0.00463 0	0.00569 9
50	0.056	1.393	0.00088 4	0.01366 6	0.502	0.873	0.00419 8	0.00423 2
60	0.051	1.293	0.00083 9	0.01202 7	0.493	0.791	0.00397 5	0.00401 2
70	0.052	1.360	0.00095 2	0.01171 6	0.648	0.808	0.00393 5	0.00403 9
80	0.058	1.596	0.00128 9	0.01274 7	0.973	0.925	0.00406 3	0.00431 1

source : Calculation of automobile emission factor to be used in the road environment impact assessment

(2) Air pollution during construction (applicable to NO₂ and SPM only)

Calculations in the diffusion width of horizontal direction, wind direction and distance, refer to the "Technique of the Road Environmental Impact Assessment.

- Plume model formula (Constant wind speed, wind speed > 1.0m/s)

Horizontal dispersion coefficient (δy)

$$\delta y = \delta y_0 + 1.82 \cdot \delta y_p$$

$$\delta y_0 = Wc/2$$

δy_0 Width of Horizontal initial diffusion (m)

δy_p Horizontal diffusion width by Pasquill-Gifford (m)

Wc Emission source arrangement interval (m)

Vertical dispersion coefficient (δz)

$$\delta z = \delta z_0 + \delta z_p$$

$$\delta z_0 + \delta z_p$$

δz_0 Width of Vertical initial diffusion (m)

δz_p Vertical diffusion width by Pasquill-Gifford (m)

Puff model formula (no wind shear, wind speed < 1.0 m/s)

Time corresponding to the initial diffusion width (t_0)

$$t_0 = Wc / 2\alpha$$

Wc Emission source arrangement interval (m)

α The coefficient on the diffusion width by Turner 's parameter

Emission strength for construction work

Item	Unit	Strength of emission of air pollutants (g/unit/day)		Height of exhaust nozzle (m)
		Nox	SPM	
Earth work				
	Embankment construction (Road body, Subgrade)	8,600	260	3.0
	Slope shaping	4,400	140	2.4
Soil Improvement work				
	Sand compaction pile driving	34,000	100*	2.3
Pile work				
	Cast-in-place pile	18,000	100*	2.3
Bridge construction work				
	Steel bridge	15,000	100*	2.1
	PC bridge	15,000	100*	2.1
Pavement work				
	Asphalt pavement (Surface layer, Base layer)	11,000	100*	1.7

source : Technique of the Road Environmental Impact Assessment , Road environment Institute 2007. *=Assumptions

Annex 5.1C-Noise Level Prediction

The formula used for numerical analysis

Numerical analyses were made based on the formula proposed by:

“Technique of the Road Environmental Impact Assessment”, National Institute for Land and Infrastructure management, Ministry of Land, Infrastructure and Tourism, Japan, 2013

Noise

(1) Traffic noise

$$LA_{eq} = LAE + 10 \log N - 35.6$$

ASJ CN-Model 2007

LA_{eq} : Equivalent noise level, d(B(A))

Noise increment ration in case of concrete pavement

$$LAE = 10 \log (1/T - \sum (10 LA_i / 10 - \Delta T))$$

LAE : Power level in average from a vehicle, dB(A)

$$LA_j = Lw - 8 - 20 \log r_i$$

Power level from l'th vehicle, dB(A)

r_i : Distance from l'th source to the location of prediction

$$LwA = 46 + 6 \cdot a_2 + 30 \log V \text{ (high gear driving)}$$

$$LwA = 90; \log V \text{ (low gear driving)}$$

a_1 Ratio of smaller vehicle = 0.9

a_2 Ratio of larger vehicle = 0.1

ℓ Distance from source to the location of prediction (m)

H Effective emission height, 0.3m

d Average car head spaces, $d = 1000V/N$

V Average driving speed km/h

N Average hourly number of vehicle num/h

α_d Reduction by diffraction [dB(A)] in case:

$$\alpha_d = -9 \log 10 \delta - 14.3 \quad 0.5 < \delta$$

$$-2.7(\log 10 \delta)^2 - 10.5 \log 10 \delta - 14.5 \quad 0.07 < \delta < 0.5$$

$$-3 \log 10 \delta - 9.5 \quad 0.01 < \delta < 0.7$$

$$-10 \log 10 \delta (0.2 + 2.5 \delta) - 10 \quad -0.001 < \delta < 0.01$$

$$0.24 \delta \log 10 |\delta| - 2.2 \quad -0.015 < \delta < -0.01$$

$$0.2 \delta \log 10 |\delta| + 1 \quad -0.3 < \delta < -0.015$$

δ : difference of transmission distance

Power level of the travel noise

	Steady travels	Unsteady travels
Two-wheeled vehicle	$L_w=49.6 + 30\log_{10}V$	$L_w=85.2 + 10\log_{10}V$
Small car class	$L_w=46.7 + 30\log_{10}V$	$L_w=82.3 + 10\log_{10}V$
Large car class	$L_w=53.2 + 30\log_{10}V$	$L_w=88.8 + 10\log_{10}V$

V= travelling speed (Km/h)

(2) Noise level by construction work

$$L_{Aeq,T,con} = 10\log (1/T (\sum T_i - 10L_{Aeff,i}/10))$$

$$L_{Aeff,i} = L_{WAeff,i} - 20 \cdot \log(r/r_0) + \Delta L_{d,i} + \Delta L_{g,i} + \Delta L$$

$L_{Aeq,T,con}$: Total noise by construction work

T : Working time

Noise level by i-th construction work unit

$L_{WAeff,i}$ Power level by construction work unit at the reference point

ΔL Correction

r Distance to the location of prediction

r_0 Distance to the reference point

$\Delta L_{d,i}$ Reduction by diffraction, neglected for safety side

$\Delta L_{g,i}$ Reduction by the ground surface condition, neglected for safety side

Construction work power level at the reference point

Item	Unit	Power level (L_{WAeff})	ΔL (dB)
Earth work	Embankment construction(Road body, Subgrade)	108	5
	Slope shaping	100	5
Soil Improvement work	Sand compaction pile driving	111	5
Retaining wall work	Cast-in-place retaining wall construction	108	5
Pile work	Cast-in-place pile	85	3
Bridge construction work	Steel bridge	111	3
	PC bridge	108	5
Pavement work	Asphalt pavement (Surface layer, Base layer)	101	6

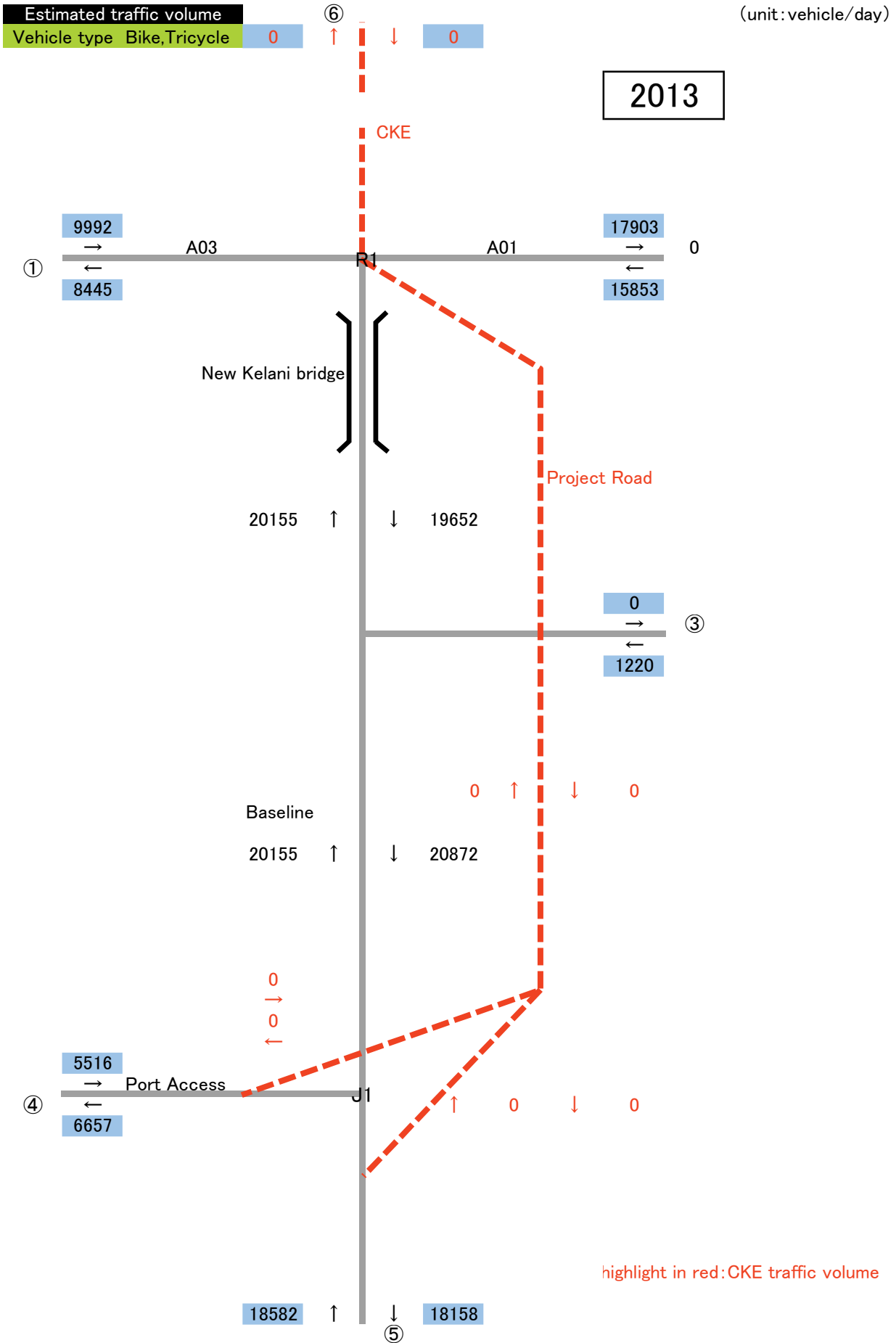
source : Technique of the Road Environmental Impact Assessment , Road environment Institute 2007

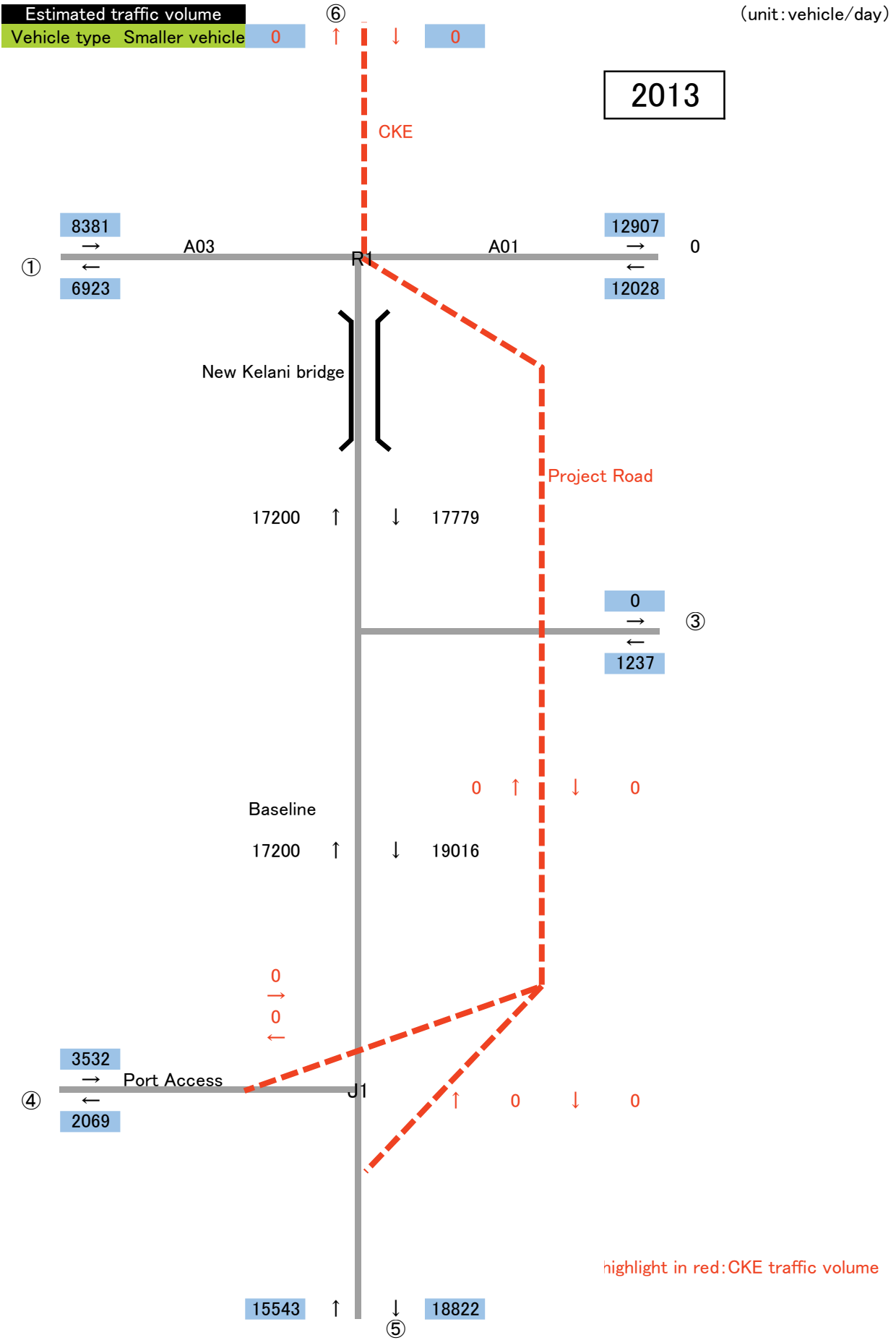
Annex 5.1D- Vibration Level Prediction**(1) Vibration by Traffic during operation**

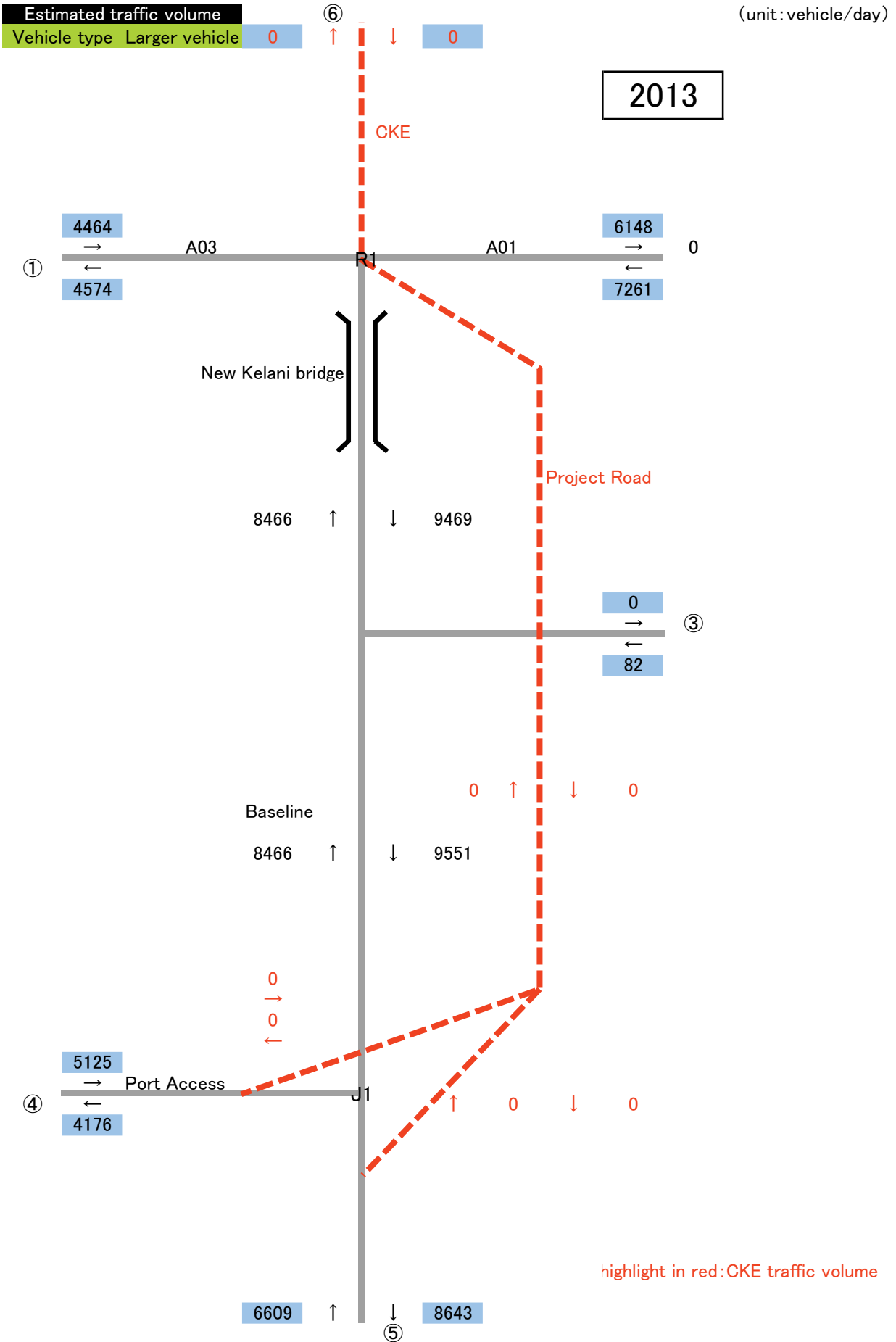
Traffic vibration levels during operation were forecasted by the calculation methodology in the Environmental Impact assessment Guideline, Ministry of Land, Infrastructure, Transport and Tourism in Japan 2012. In detail, traffic vibration levels were calculated on a pro-rata basis by using baseline (2013) and forecasted (2035) values of traffic volume and driving speed on the roads adjacent to measuring locations.

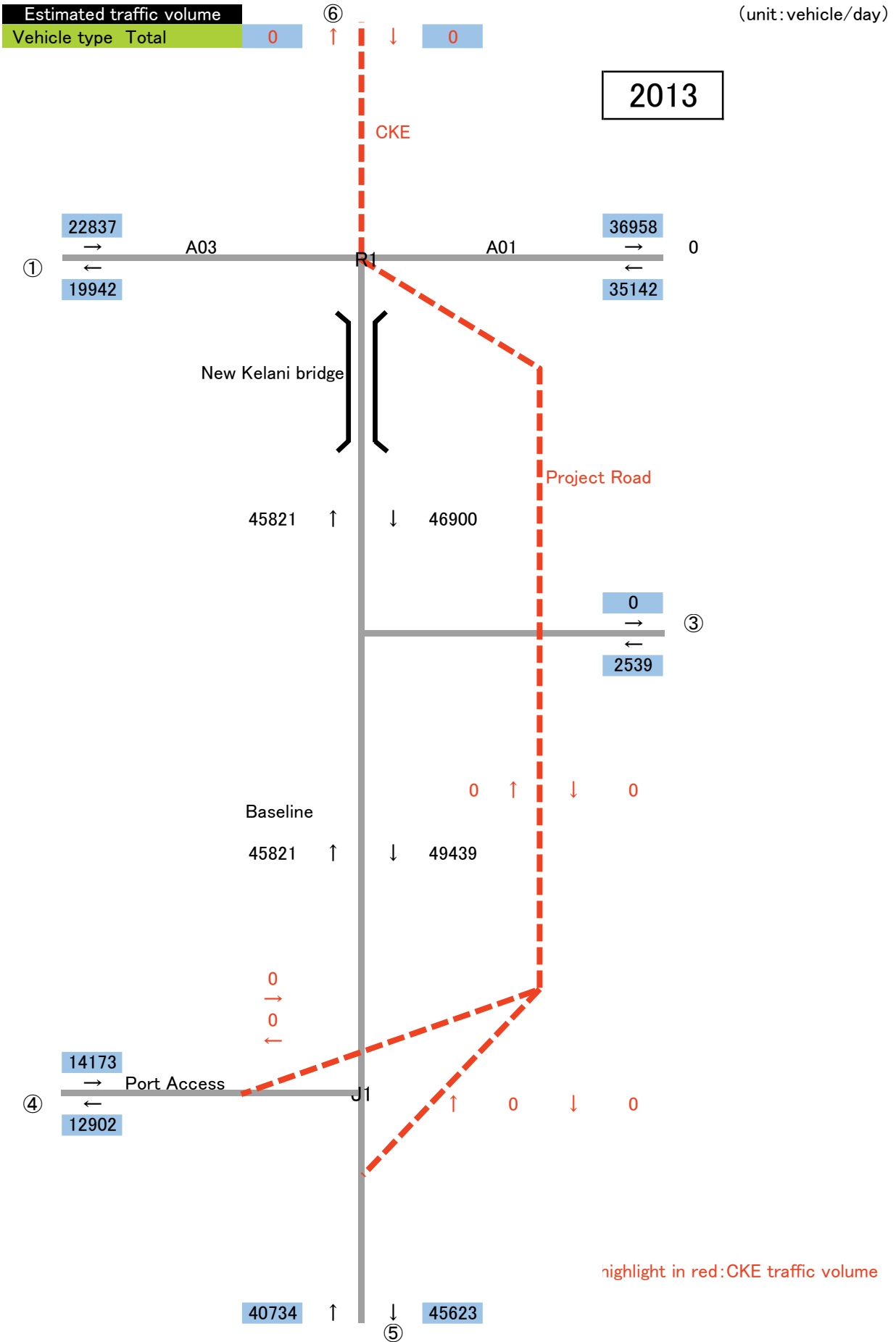
Annex 5.2
Estimate Traffic Volume

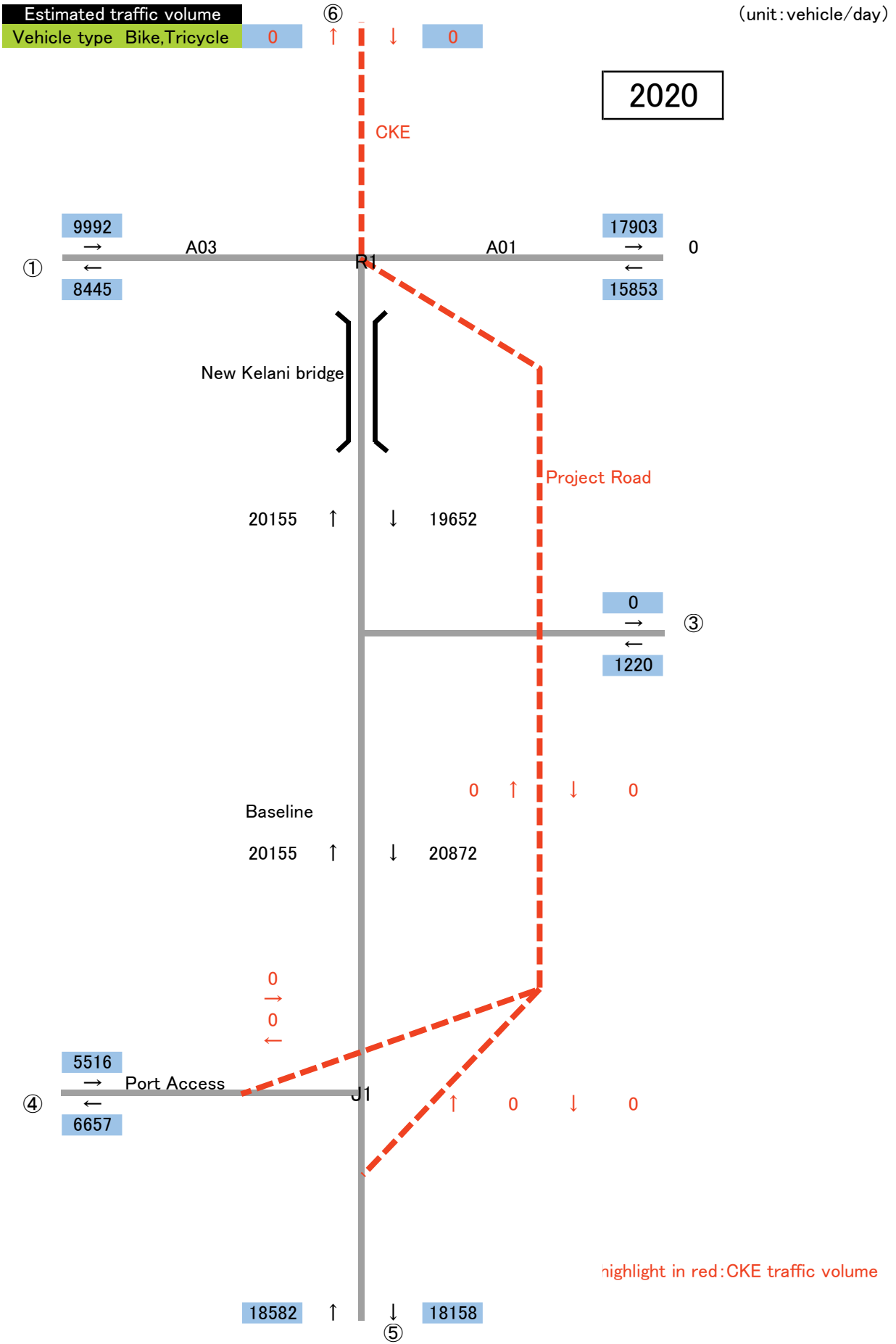
Annex 5.2- Estimate Traffic Volume

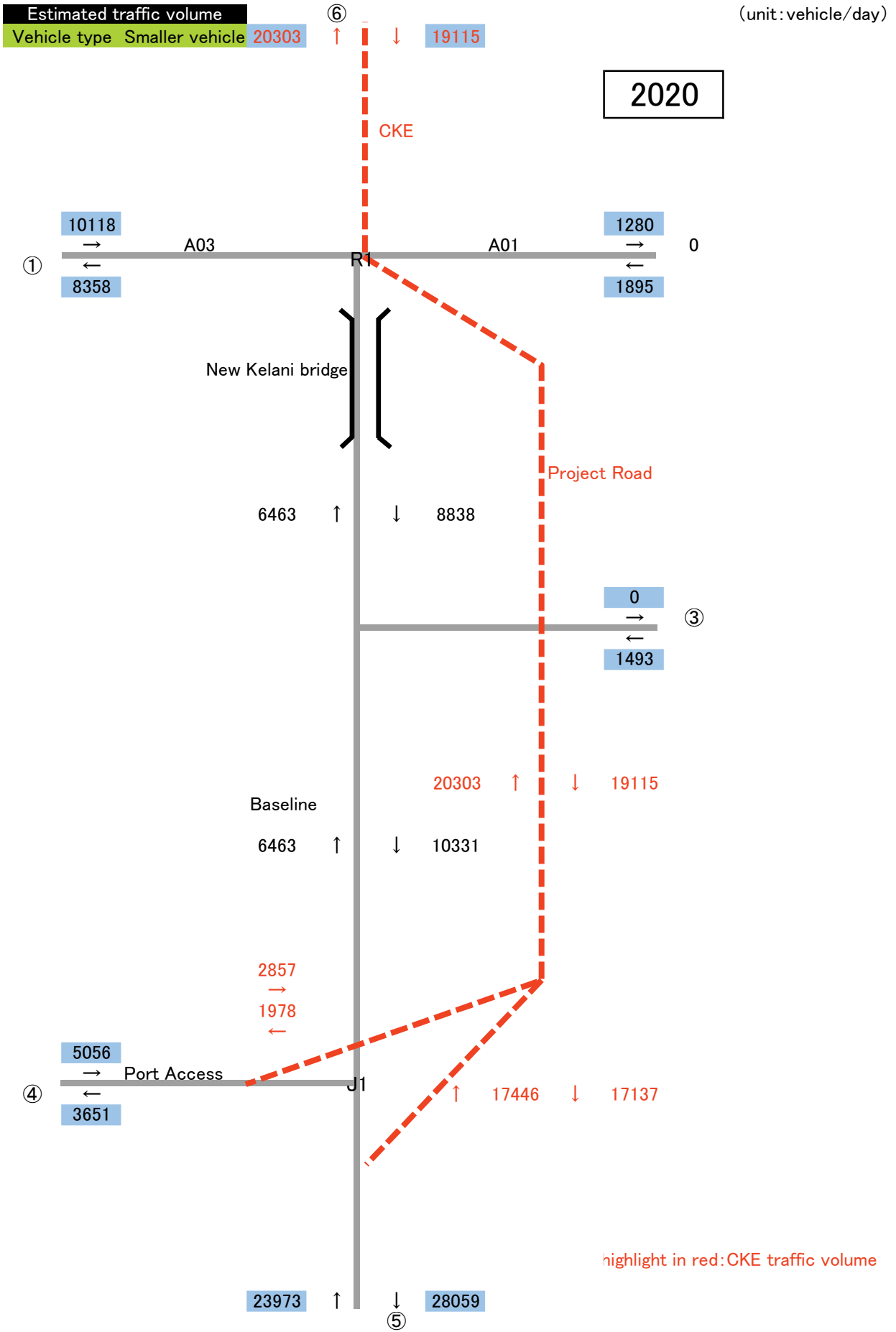


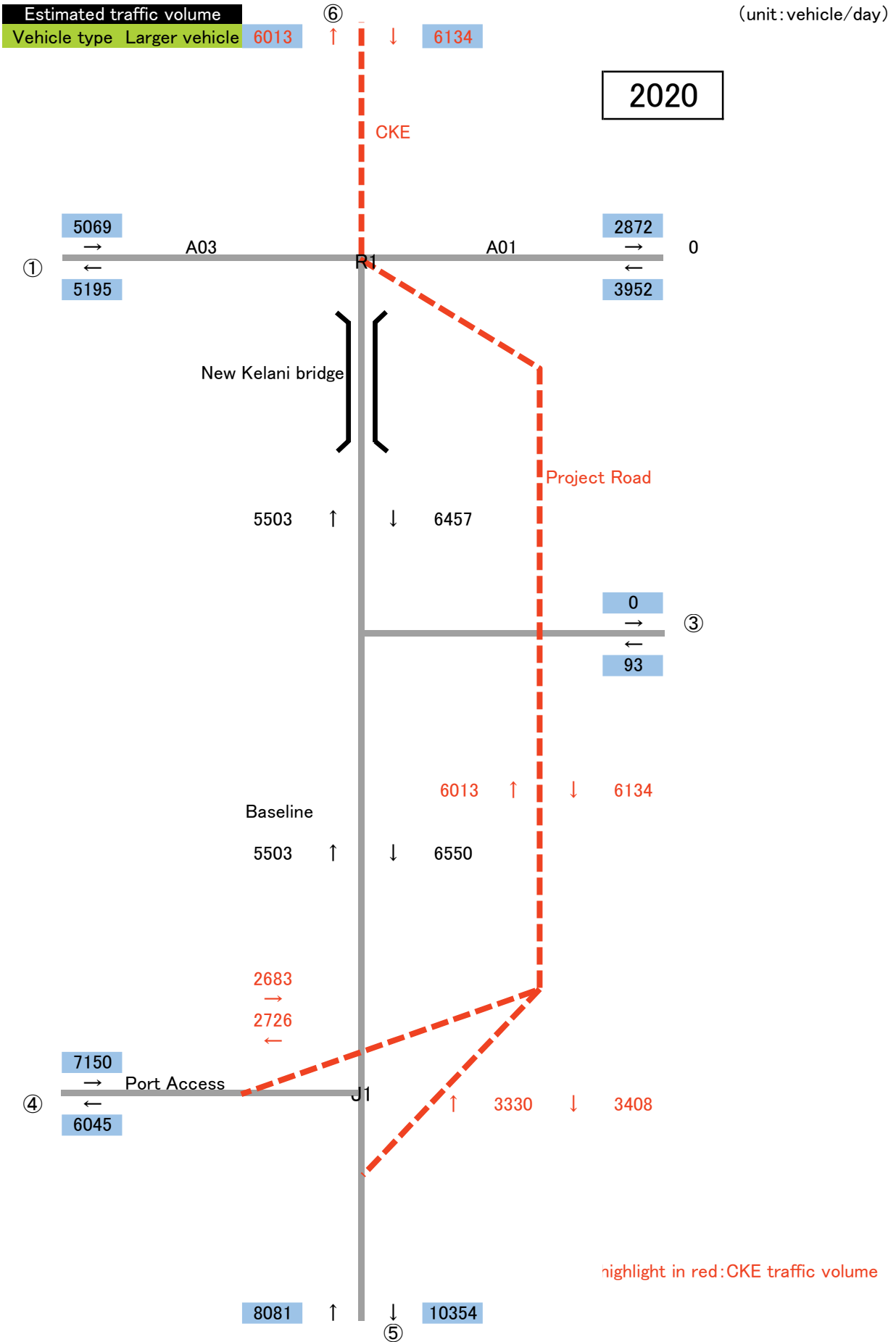


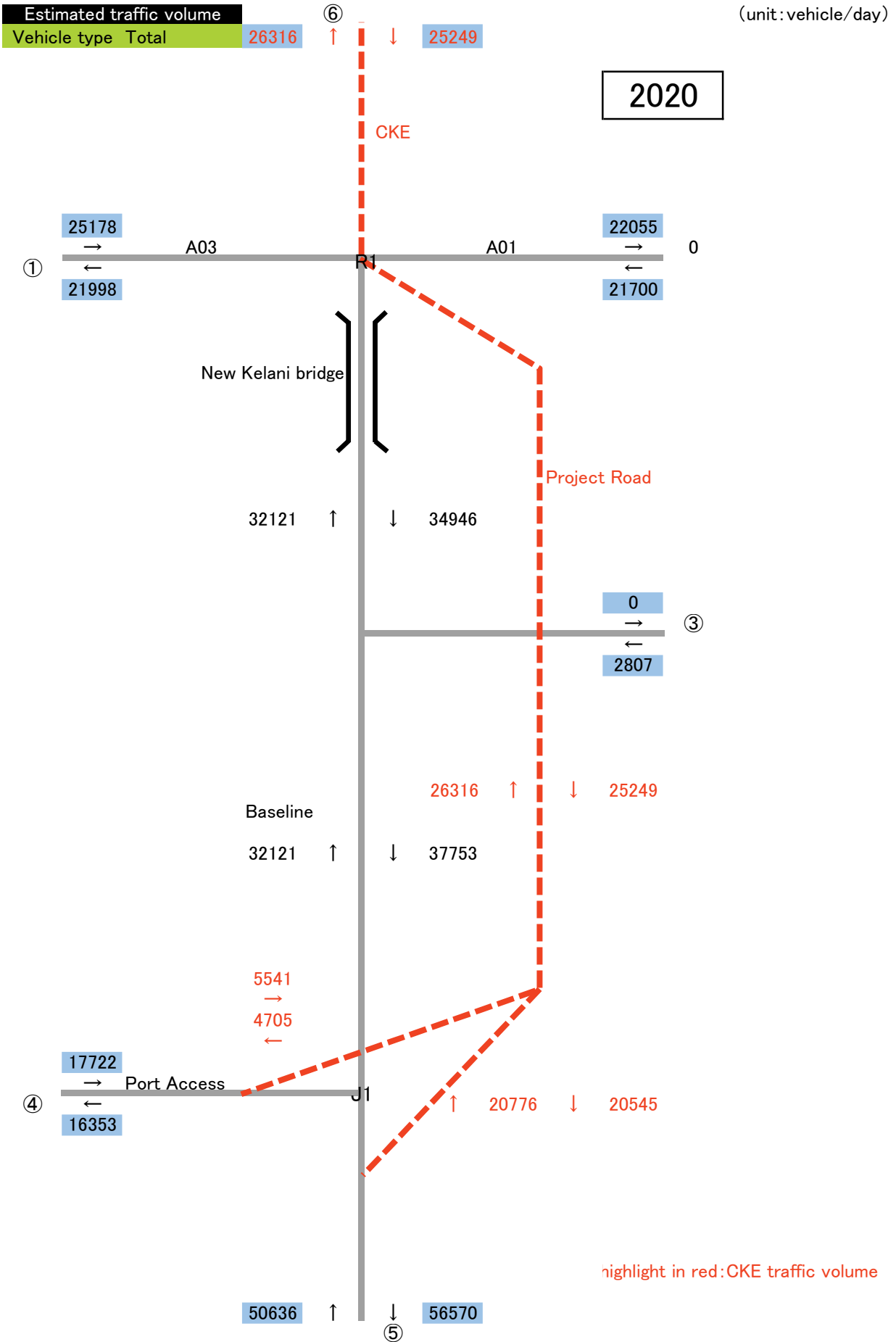












Annex 5.3
Photos of the Landscape of the Project Area

Annex 5.3 Photos of the Landscape of Project Area



Sanchi temple, at Wadullawatta



S W R D Bandaranayaka Statue



Left bank of New Kelani Bridge



High tension power line



One of the Buddhist shrines, Wadullawatta



Baseline road (Orugodawatta Junction)



Squatter dwellings, Wadullawatta



Trees on the sides of Base line road



Kamkarupura Near Orugodawatta junction



View of Shanties from New Kelani Bridge



Condition of Kittampahuwa canal, near Port access road



Condition of St. Sebastian canal, Nawagampura



Condition of canal, near Port access road



Condition of canal, near Port access road



High tension power line



View houses from New Kelani bridge



Buddhist shrine and Bo tree, Orugodawatta JCT



South flood bund Kelani River