

Initial Environmental Examination

June 2018

SRI: SASEC Port Access Elevated Highway

Annexures 10 to 17

Prepared by Road Development Authority, Democratic Socialist Republic of Sri Lanka for the Asian Development Bank.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

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ANNEXURE 10: CEA CLEARANCE

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Your Ref.

අපේ ලේඛන අංකය
Our Ref.

WFO/08/08/40/2016

දිනය
Date 09.06.2016

මධ්‍යම පරිසර අධිකාරිය
மத்திய சுற்றுமடல் அதிகாரசபை
Central Environmental Authority



"පරිසර පිටස" 104, ඩෙන්සිල් කොබ්බෑකඩුව මාවත, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"பரிசரா பியச" 104, டென்சில் கொப்பகடுவ மாவத்தை, பத்தரமுலகார, இலங்கை.
"Parisara Piyasa", 104, Denzil Kobbekaduwa Mawatha, Battaramulla, Sri Lanka.
Web : www.cea.lk

The Access
Elevated Highway
No. 299, Pannimbiya Road,
Battaramulla

Director General
Road Development Authority
1st floor, 'Maganagama Maha Madura'
No 216, Denzil Kobbakaduwa Mawatha
Battaramulla.

Obtaining Environmental Recommendations from Central Environmental Authority for the proposed Port Access Elevated Highway Project - from Ingurukade Junction (0+000 km) to proposed Colombo port city (5 + 312km) by Road Development Authority of Sri Lanka

This has reference to the Basic Information Questionnaire dated 24.03.2016 submitted to this Authority by Director General, Road Development Authority.

This is to inform you that this Authority recommends granting your approval for the requested length of 5.312km subject to following conditions, which should be strictly adhered by the developer to abate environmental pollution likely to arise from the operation of the above project.

1. LAND FILLING/ SPOIL DISPOSAL

- 1.1 If the project activities involve in reclamation of paddy lands prior approval shall be obtained from the Agrarian Development Department.
- 1.2 Excavated material excess top soil or material generated due to demolishing of structures should not be disposed at road sides or into water ways or at a site where it is likely to enter a water body. These materials shall be stockpiled at suitable locations and removed from the site to suitable disposal grounds/ landfill sites in nuisance free manner.
- 1.3 Suitable disposal grounds/land fill sites should be identified and approval should be obtained from the relevant Local Authority and other relevant authorities before commencing any kind of clearing activity.
- 1.4 Loading and unloading of materials such as soil, boulders etc. should be restricted to the time between 6.00hrs to 22.00 hrs. only.

2. EXCAVATION, HANDLING, PROCESSING OF MATERIALS

- 2.1 For operation of quarry sites and borrow areas approvals should be obtained from relevant authorities such as Geological Survey & Mines Bureau (GS & MB), Local Authority, Divisional Secretariats and the CEA.

Handwritten notes:
10. April
10. April
10. April

Chairman Tel : 2872261, 2872148 Fax : 2872347	Director General Tel : 2872359 Fax : 2872608	Gen. Off. Tel : 2872278, 2873447, 2873448 Fax : 7877277-280	Control Unit : 0713603333, 2888900
Deputy Director General Tel : 2869206 Fax : 2877515	Env. Mgt & Assess. Division Tel : 2872358 Fax : 2872206	Env. Edu & Awareness Division Tel : 2872350 Fax : 2877629	
Director General Tel : 2872601 (Admin), 2872258 (Finance) Tel : 2872301 (HRD), 2877258 (Finance) Fax : 2872607 (Admin), 2863984 (Finance)	Env. Mgt & Assess. Division Tel : 2873452 (R&D) Tel : 2872606 (Lab) Fax : 2872296	Env. Mgt & Assess. Division Tel : 2873452 (R&D) Tel : 2867263 (R&D) Fax : 2872296	Env. Edu & Awareness Division Tel : 2877629 Tel : 2877629 (Legal) (Western Province) Tel : 2862821 Fax : 2865291

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AA
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- 2.2 All blasting/ quarrying activities shall be carried under approval and supervision of CS & MB.
- 2.3 Required approval for operation of asphalt plants, crusher plants and concrete batching plants should be obtained from the CEA.
- 2.4 Prior approval should be taken from Ceylon Electricity Board, National Water Supply and Drainage Board and Sri Lanka Telecom for shifting electricity lines, Water lines and telecommunication lines.
- 2.5 Prior approval should be taken from Marine Environmental Pollution Control Authority for relocation of oil tanks.

3. AIR QUALITY

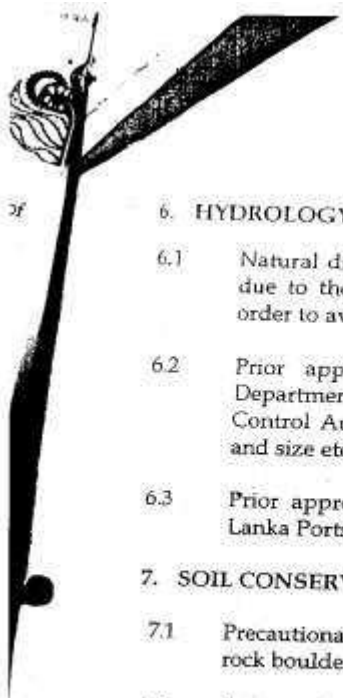
- 3.1 All the materials (sand, soil, rubble, metal, cement etc.) required for the construction shall be stored with proper covers to minimize dust emissions.
- 3.2 The loaded trucks shall be covered while on transportation in order to reduce the possibility of dust emission.
- 3.3 During dry periods it is necessary to dampen the exposed areas of roads at regular intervals to prevent emission of dust.

4. NOISE & VIBRATIONS

- 4.1 Appropriate mitigatory measures should be adopted, in order to maintain noise levels within the standards stipulated by the CEA in Gazette Extra Ordinary No. 924/12 dated 23rd May 1996.
- 4.2
 - a. Compaction activities and heavy vehicle movements shall be carried out in such a way that Ground Vibration (GV) peak particle velocity should not exceed the value of 02mm/s at any building due to construction activities.
 - b. Mitigatory measures should be taken to avoid Ground Vibration (GV) peak particle velocity exceeding the value of 02 mm/s mentioned in above 4.2 (a).

5. TRAFFIC AND TRANSPORTATION OF MATERIAL & EQUIPMENT

- 5.1 ~~Movement of heavy loads on public roads for project purposes shall be done with the concurrence of the concerned authorities such as Local Authorities etc. and shall be done at non-peak traffic times.~~
- 5.2 ~~The routes for transport shall be done in consultation with the appropriate traffic authorities.~~
- 5.3 ~~Action shall be taken to minimize the disturbance to existing traffic due to project activities.~~



6. HYDROLOGY AND DRAINAGE ASPECT

- 6.1 Natural drainage pattern of the surrounding area of the road should not be disturbed due to the project activities and adequate drainage facilities shall be maintained in order to avoid water logging, flooding etc.
- 6.2 Prior approval should be taken from relevant authorities such as Irrigation Department, Provincial Irrigation Department ; Marine Environmental Pollution Control Authority, Cost Conservation Department and Local Authority etc., for type and size etc. of any cross drainage structures.
- 6.3 Prior approval should be taken from Department of Archaeology for effect of Sri Lanka Ports Authority Head office building and Maritime Museum .

7. SOIL CONSERVATION AND STABILIZATION OF ROAD EMBANKMENT

- 7.1 Precautionary measures shall be taken to ensure slope stability especially from unstable rock boulders of the road embankment where cut and fill operations are carried out.
- 7.2 Site-specific protection measures (such as rubble masonry walls /concrete retaining walls/gabion walls or soil nailing etc.) at embankment slopes, stream banks, hill slopes, etc., shall be constructed where it is required.

8. VISUAL ENVIRONMENT

- 8.1 Clearing of vegetation shall be minimized as much as possible. Suitable species of trees, lianas and creepers should be planted appropriately either side of the road and its embankments where possible.

9. GENERAL CONDITIONS

- 9.1 According to Gazette Extraordinary No.1466/5 dated 10/10/2006 polythene or polythene products which are 20 microns (20µm) or below in thickness shall not be used for the industrial/ domestic activities.
- 9.2 According to gazette extraordinary No- 1627/19 dated 26.11.2009 municipal solid waste shall not be dumped along sides of any national highway.
- 9.3 If vehicle servicing stations are required to be established for the vehicles of the project, it should be done with prior approval of the CEA.
- 9.4 Setting up of labour camps should be done with prior approval of the relevant authorities such as Local Authorities etc.
- 9.5 Suitable compensation scheme should be introduce for affected properties before any construction activity is started.

ANNEXURE 11: AMBIENT AIR REPORT**INDUSTRIAL TECHNOLOGY INSTITUTE (ITI)** ^{CTS 1709061}

P. O. Box, 787, 363, Baddhaloka Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379850
120/4 A, Vidya Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379950

TEST REPORT

Reference No: CTS 1709061

Report to:

Katahira & Engineers International
NO 2/A, 3/1, CBM House,
Lake Drive,
Colombo 08

Issued by:

Chemical & Microbiological Laboratory
Industrial Technology Institute

2017/07/05

THE REPORT IS ISSUED SUBJECT TO CONDITIONS MENTIONED OVERLEAF

"PLEASE ADDRESS ALL COVERS TO THE DIRECTOR GENERAL"

Page 1 of 6

TEST REPORT

Reference No: CTS 1709061

CUSTOMER : Katahira & Engineers International NO 2/A, 3/1, CBM House, Lake Drive, Colombo 08	TEST ITEM : AMBIENT AIR Service requested : Sampling and analysis for Particulate Matter, aerodynamic diameter is less than 10 μm in size (PM_{10}), Particulate Matter, aerodynamic diameter is less than 2.5 μm in size ($\text{PM}_{2.5}$), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Carbon Dioxide (CO_2) and Ozone (O_3) in ambient air at selected locations as requested in the letter dated 2017/05/09 by the customer.
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1. BACKGROUND INFORMATION:

Ambient air quality monitoring was carried out on the request made by the Katahira & Engineers International at locations around Port Access Elevated Highway Project by using mobile air quality monitoring laboratory.

1.1. SAMPLING LOCATIONS : Details of sampling locations are given below

Location	Description	GPS
L1	At open space (ground) in front of "Agamathi Vidyalaya" at Blumendal Road.	6°57'27.36"N,79°52'5.66"E
L2	At the premises of Roadside Store, Supplies section belongs to Sri Lanka Ports Authority. (In front of St. Anthony's Church)	6°56'54.94"N,79°51'25.31"E
L3	At the premises of "Sri Sambodhi Chaithya" belongs to Sri Lanka Ports Authority.	6°56'18.03"N,79°50'30.88"E

1.2. AMBIENT AIR QUALITY REGULATION IN SRI LANKA

According to the National Environmental (Ambient Air Quality) standards, gazetted in Gazette Extraordinary No 1562/22, dated 15th August 2008 under the provisions of section 32 of the National Environmental Act No 47 of 1980, maximum permissible concentrations of air pollutants in ambient air should be less than the recommended in the table given below.

Pollutant	Averaging time	Maximum Permissible level		Method of Measurement
		$\mu\text{g}/\text{m}^3$	ppm	
Particulate Matter Aerodynamic diameter is less than 10 μm in size (PM_{10})	Annual	50	-	Hi-volume sampling and Gravimetric or Beta Attenuation
	24 hours	100	-	
Particulate Matter Aerodynamic diameter is less than 2.5 μm in size ($\text{PM}_{2.5}$)	Annual	25	-	Hi-volume sampling and Gravimetric or Beta Attenuation
	24 hours	50	-	
Nitrogen Dioxide (NO_2)	24 hours	100	0.05	Colorimetric using saltzman Method or equivalent Gas phase chemiluminescence
	08 hours	150	0.08	
	01 hour	250	0.13	


AMBIENT AIR QUALITY REGULATION IN SRI LANKA Cont.....

Pollutant	Averaging time	Maximum Permissible level		Method of Measurement
		$\mu\text{g}/\text{m}^3$	ppm	
Sulfur Dioxide (SO_2)	24 hours	80	0.03	Pararosaniline Method or equivalent Pulse - Fluorescent
	08 hours	120	0.05	
	01 hour	200	0.08	
Ozone(O_3)	01 hour	200	0.10	Chemiluminescence Method or equivalent Ultraviolet photometric
Carbon Monoxide (CO)	08 hours	10,000	9.00	Non-Dispersive Infrared spectroscopy
	01 hour	30,000	26.00	
	Any Time	58,000	50.00	

1.3. SAMPLING METHODOLOGIES

All requested parameters for Ambient Air Quality were measured by using state of the art mobile ambient air quality monitoring station that includes sensitive automated equipments with USEPA approved reference methodologies. Those methods are recommended for Ambient Air Quality monitoring by National Environmental (Ambient Air Quality) regulations published in Gazette Extraordinary No 1562/22, dated 15th August 2008, under the provisions of section 32 of the National Environmental Act No 47 of 1980. Details of relevant methodologies are given below.

Parameter	Method	Description	Equipment
Suspended Particulate Matter aerodynamic Diameter less than $10 \mu\text{m}$ (PM_{10})	Beta ray Attenuation Method	USEPA Ref Number EQPM-RFPS-0706-162 LDL - $4.0 \mu\text{g}/\text{m}^3$	Sprint BAM particulate monitor Ecotech, Australia. (Manufactured in USA)
Suspended Particulate Matter aerodynamic Diameter less than $2.5 \mu\text{m}$ ($\text{PM}_{2.5}$)	Beta ray Attenuation Method	USEPA Ref Number EQPM-0308-170 LDL - $4.0 \mu\text{g}/\text{m}^3$	Sprint BAM particulate monitor Ecotech, Australia. (Manufactured in USA)
Sulfur Dioxide (SO_2)	UV pulsed fluorescent radiation technology method.	USEPA Ref Number EQSA-0809-188 LDL - 0.3 ppb,	Serinus 50, SO_2 Analyzer, Ecotech, Australia.
Nitrogen Dioxide (NO_2)	Chemiluminescence method	USEPA Ref Number RFNA-0809-186 LDL - 0.4 ppb,	Serinus 40, NO_x Analyzer, Ecotech, Australia.
Carbon Monoxide (CO) Carbon Dioxide (CO_2)	NDIR gas filter correlation method CO_2 measurements are made using the electrochemical sensor	USEPA Ref Number RFCA-0509-174, LDL - 40 ppb	Serinus 30, CO Analyzer, Ecotech, Australia.
Ozone (O_3)	UV photometric method	USEPA Ref Number EQOA-0809-187 LDL - 0.5 ppb	Serinus 10, O_3 Analyzer, Ecotech, Australia.



... Continuation Sheet

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SAMPLING METHODOLOGIES Cont.

- Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO) Carbon Dioxide (CO₂) and Ozone (O₃) measuring analyzers were normally calibrated against USEPA recommended gas dilution calibration system with international accepted NIST traceable standard calibration Gases.
- Meteorological parameters were measured together with above mentioned air pollutant parameters and those sensors and equipments were calibrated against internationally accepted NIST traceable factory calibrated calibrators
- Beta Attenuation Monitors (BAM) for PM₁₀ and PM_{2.5} monitoring were verified automatically in hourly basis by internationally accepted 800 µg standard span foil.

2. DETAILS OF SAMPLING:**2.1. DISCRPTION OF SAMPLING/MEASUREMENTS CONDITION**

Location	Sampling duration /Weather Condition
L 1	Duration –From 23:00 hours, 15th June to 05:00 hours, 17th June 2017. Light rain was occurred during the 04:00, 05:00 & 23:00 hours on 16 th June 2017 and 01:00 to 03:00 hours on 17 th June 2017 during the period of measurement. Relative humidity varied from 67% to 92% and maximum solar radiation was 712 Wm ⁻² . Wind blew from Southeast direction to South direction with the maximum speed of 2.3 ms ⁻¹ . Heavy vehicle movements were observed at the Blumendal road 16:45 to 19:15 hours on 16 th June 2017.
L 2	Duration –From 15:00 hours, 14th June to 18:00 hours, 15th June 2017. Dry and sunny weather except 11:00 hour on 15 th June 2017 which was observed a light rain. Relative humidity varied from 61% to 86% and maximum solar radiation was 762 Wm ⁻² . Moon's light strike increased the solar radiation during the 00:00 to 05:00 hours on 15 th June 2017. Wind blew from Southeast & Southwest directions to South direction with the maximum speed of 2.3 ms ⁻¹ .
L 3	Duration –From 11:00 hours, 19th June to 16:00 hours, 20th June 2017. Light rain was observed during the 13:00 hours on 19 th June 2017 and 04:00 to 05:00 hours on 20 th June 2017 during the period of measurement. Relative humidity varied from 68% to 83% and maximum solar radiation was 915 Wm ⁻² . Wind blew from Southwest direction to West direction with the maximum speed of 2.8 ms ⁻¹ .

3. TEST RESULTS:

Parameter	Averaging Time	Units	Concentration of each location			*Maximum permissible level
			L 1	L 2	L 3	
Suspended Particulate Matter aerodynamic diameter is less than 10 µm (PM ₁₀)	24 hour average	µg/m ³	47	40	32	100
	1 hour average**	µg/m ³	109	201	84	Not Available
Suspended Particulate Matter aerodynamic diameter is less than 2.5 µm (PM _{2.5})	24 hour average	µg/m ³	12	20	14	50
	1 hour average**	µg/m ³	32	157	24	Not Available
Sulfur Dioxide (SO ₂)	24 hour average	ppm	0.011	0.015	0.004	0.03
		µg/m ³	29	39	10	80
	1 hour average **	ppm	0.015	0.019	0.009	0.08
		µg/m ³	39	50	24	200



... Continuation Sheet

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3. TEST RESULTS Cont.....

Parameter	Averaging Time	Units	Concentration of each location			*Maximum permissible level
			L 1	L 2	L 3	
Nitrogen Dioxide (NO ₂)	24 hour average	ppm	0.011	0.011	0.005	0.05
		µg/m ³	21	23	9	100
	1 hour average **	ppm	0.020	0.019	0.010	0.13
		µg/m ³	38	36	19	250
Carbon Monoxide(CO)	24 hour average	ppm	0.539	0.402	0.161	Not Available
		µg/m ³	703	475	189	Not Available
	1 hour average **	ppm	1.354	0.829	0.302	26
		µg/m ³	1551	950	346	30,000
Ozone (O ₃)	24 hour average	ppm	0.006	0.002	0.009	Not Available
		µg/m ³	10	4	18	Not Available
	1 hour average **	ppm	0.012	0.007	0.015	0.10
		µg/m ³	24	14	29	200

* As specified in the National Environmental (Ambient Air Quality) regulations in Gazette Extraordinary No 1562/22, dated 15th August 2008 under the National Environmental Act No 47 of 1980.

**Maximum one hour average concentration during the measurement period.

4. REMARKS:

- During the measurement period, recorded 24 hour average concentrations for PM₁₀ and PM_{2.5} for all locations were not exceeded the maximum permissible level stipulated in National Ambient Air Quality Regulations under the National Environmental Act. Considering the one hour average high concentrations of PM₁₀ and PM_{2.5} (201 µg/m³ and 157 µg/m³ respectively) were observed at location 2 due to the smoke from open burning of solid waste in the vicinity.
- During the measurement period, for all locations one hour average concentrations of Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Ozone (O₃) and Carbon Monoxide (CO) were not exceeding the maximum permissible level stipulated in National Ambient Air Quality Regulations under the National Environmental Act.

Measurements, Data processing, validation and report preparation was done by D.R.C Perera, Research Scientist, Industrial Technology Institute.

Note:

- USEPA : United State Environmental Protection Agency
- NIST : National Institute of Standards and Technology, United States of America


Authorized Signatory

Appendix I : Location Map
Appendix II : Wind Rose Plots
Appendix III : Hourly data

R. N. R. Jayaratne (BSc, MPhil)
Senior Research Technologist
(Air Quality)
Chemical and Microbiological Laboratory
Industrial Technology Institute

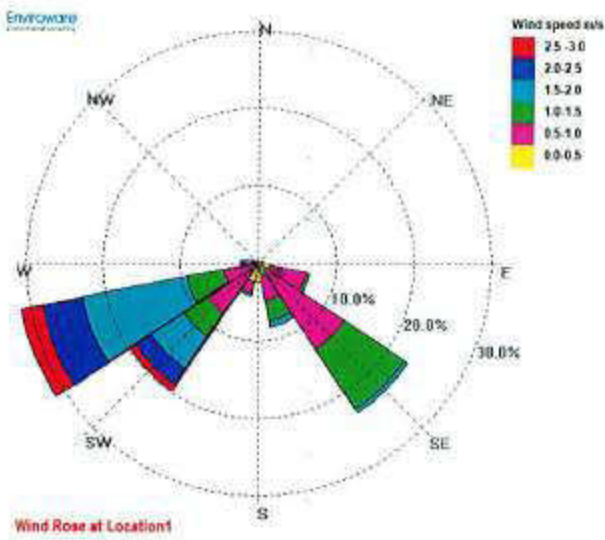


Location Map

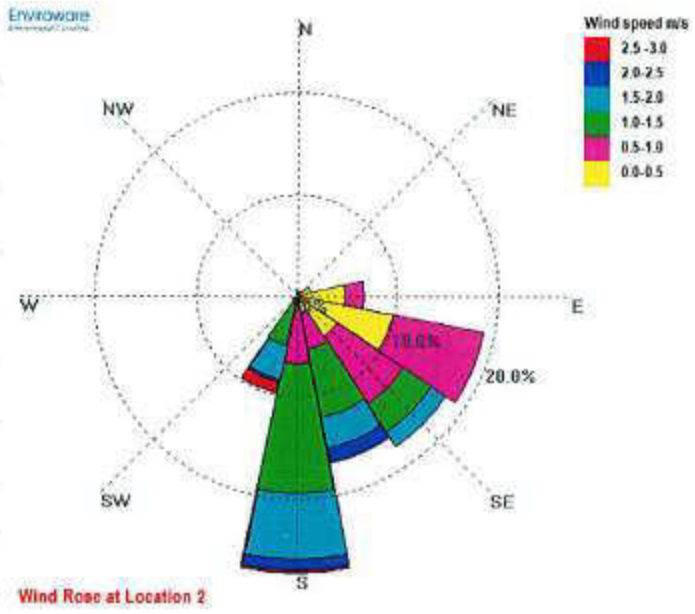


Appendix II

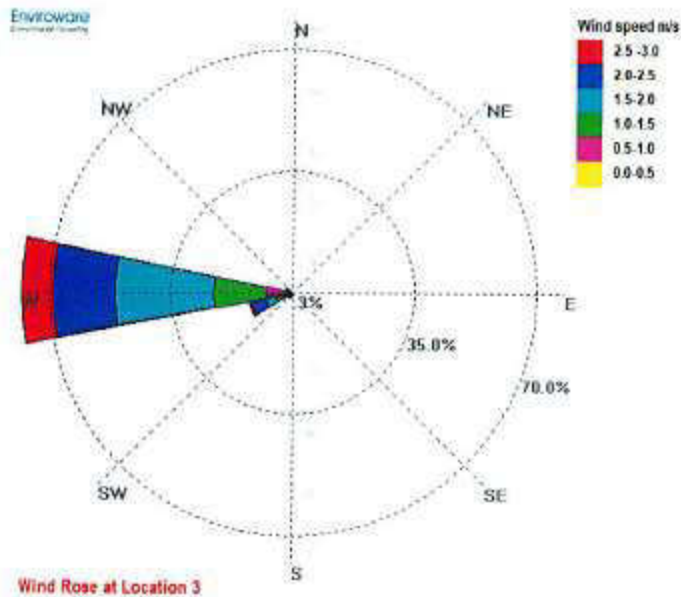
Wind Rose Plots



Wind Rose plot Location 1



Wind Rose plot Location 2



Wind Rose plot Location 3

Appendix III - Hourly data

Location 1

Calibration	C/L
Missing Data	MD

Below minimum detection level	N/D
Instrument Maintenance	M

Date & Time	PM _{2.5}	PM ₁₀	O ₃	CO	CO ₂	NO ₂	SO ₂
6/15/2017 23:00			C/L	C/L	C/L	C/L	C/L
6/16/2017 0:00	8	27	0.001	0.093	422	0.010	0.009
6/16/2017 1:00	3	19	0.002	0.165	404	0.005	0.008
6/16/2017 2:00	N/D	15	0.004	0.222	398	0.003	0.007
6/16/2017 3:00	N/D	18	0.005	0.211	399	0.003	0.006
6/16/2017 4:00	N/D	13	0.004	0.205	402	0.005	0.008
6/16/2017 5:00	N/D	12	0.004	0.158	406	0.007	0.008
6/16/2017 6:00	10	25	0.001	0.087	415	0.015	0.010
6/16/2017 7:00	19	34	0.001	0.374	413	0.016	0.012
6/16/2017 8:00	12	30	0.005	0.070	403	0.011	0.013
6/16/2017 9:00	11	28	0.008	0.382	407	0.007	0.013
6/16/2017 10:00	7	37	0.009	0.508	411	0.005	0.010
6/16/2017 11:00	7	41	0.011	0.569	404	0.007	0.009
6/16/2017 12:00	8	41	0.006	0.661	406	0.012	0.010
6/16/2017 13:00	5	43	0.009	0.632	406	0.010	0.012
6/16/2017 14:00	C/L	64	0.010	0.603	403	0.010	0.013
6/16/2017 15:00	6	51	0.012	0.516	400	0.007	0.012
6/16/2017 16:00	7	68	0.011	0.782	405	0.010	0.007
6/16/2017 17:00	17	93	0.010	1.058	412	0.013	0.013
6/16/2017 18:00	32	109	0.004	0.980	415	0.020	0.012
6/16/2017 19:00	9	69	0.002	0.812	408	0.019	0.011
6/16/2017 20:00	6	59	0.002	0.698	410	0.015	0.011
6/16/2017 21:00	15	57	0.001	0.819	417	0.016	0.011
6/16/2017 22:00	M	90	0.001	1.354	447	0.020	0.015
6/16/2017 23:00	31	57	C/L	C/L	C/L	C/L	C/L
Minimum	3	12	0.001	0.070	398	0.003	0.006
Maximum	32	109	0.012	1.354	447	0.020	0.015
Average	12	47	0.006	0.539	409	0.011	0.011

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Location 2

Calibration	C/L
Missing Data	MD

Below minimum detection level	N/D
Instrument Maintenance	M

Date & Time	PM _{2.5}	PM ₁₀	O ₃	CO	CO ₂	NO ₂	SO ₂
6/14/2017 16:00			C/L	C/L	C/L	C/L	C/L
6/14/2017 17:00	16	55	0.002	0.663	417	0.019	0.012
6/14/2017 18:00	13	42	0.001	0.768	421	0.018	0.010
6/14/2017 19:00	12	26	0.001	0.829	421	0.015	0.015
6/14/2017 20:00	N/D	16	0.001	0.721	414	0.011	0.009
6/14/2017 21:00	N/D	26	0.001	0.523	407	0.010	0.014
6/14/2017 22:00	16	37	0.001	0.702	429	0.013	0.015
6/14/2017 23:00	12	35	0.000	0.622	453	0.012	0.016
6/15/2017 0:00	12	27	0.000	0.298	461	0.009	0.016
6/15/2017 1:00	7	21	0.000	0.208	457	0.007	0.017
6/15/2017 2:00	6	18	0.001	0.165	451	0.008	0.011
6/15/2017 3:00	13	13	0.001	0.138	457	0.007	0.010
6/15/2017 4:00	7	9	0.000	0.103	463	0.007	0.012
6/15/2017 5:00	N/D	7	0.001	0.096	457	0.007	0.013
6/15/2017 6:00	4	20	0.001	0.200	427	0.009	0.013
6/15/2017 7:00	13	39	0.001	0.526	430	0.012	0.014
6/15/2017 8:00	7	40	0.003	0.508	412	0.012	0.016
6/15/2017 9:00	157	201	0.005	0.662	404	0.015	0.018
6/15/2017 10:00	18	M	0.004	0.378	403	0.012	0.019
6/15/2017 11:00	12	M	0.003	0.390	408	0.013	0.018
6/15/2017 12:00	10	66	0.005	0.286	400	0.011	0.017
6/15/2017 13:00	8	40	0.006	0.185	401	0.011	0.016
6/15/2017 14:00	8	43	0.007	0.258	404	0.011	0.016
6/15/2017 15:00	11	44	0.006	0.284	407	0.011	0.015
6/15/2017 16:00	46	79	0.005	0.406	408	0.011	0.016
Minimum	4	7	0.000	0.096	400	0.007	0.009
Maximum	157	201	0.007	0.829	463	0.019	0.019
Average	20	40	0.002	0.402	426	0.011	0.015

Location 3

Calibration	C/L
Missing Data	MD

Below minimum detection level	N/D
Instrument Maintenance	M

Date & Time	PM _{2.5}	PM ₁₀	O ₃	CO	CO ₂	NO ₂	SO ₂
6/19/2017 11:00	MD	MD	C/L	C/L	C/L	C/L	C/L
6/19/2017 12:00	17	37	0.011	0.283	394	0.003	0.009
6/19/2017 13:00	5	11	0.012	0.259	404	0.003	0.008
6/19/2017 14:00	16	29	0.010	0.196	404	0.003	0.008
6/19/2017 15:00	15	36	0.010	0.223	414	0.005	0.005
6/19/2017 16:00	12	25	0.010	0.264	400	0.004	0.007
6/19/2017 17:00	10	21	0.009	0.244	399	0.004	0.008
6/19/2017 18:00	9	39	0.007	0.267	409	0.006	0.009
6/19/2017 19:00	14	41	0.007	0.301	407	0.007	0.004
6/19/2017 20:00	16	38	0.006	0.273	412	0.009	0.002
6/19/2017 21:00	18	36	0.005	0.302	408	0.010	0.003
6/19/2017 22:00	10	26	0.006	0.291	398	0.005	0.005
6/19/2017 23:00	18	42	0.007	0.249	404	0.007	0.004
6/20/2017 0:00	11	21	0.008	0.100	404	0.004	N/D
6/20/2017 1:00	N/D	12	0.008	0.099	406	0.003	N/D
6/20/2017 2:00	N/D	11	0.008	0.093	409	0.004	N/D
6/20/2017 3:00	N/D	9	0.009	0.077	409	0.003	N/D
6/20/2017 4:00	N/D	12	0.008	0.102	408	0.005	0.002
6/20/2017 5:00	N/D	15	0.008	0.064	406	0.004	0.000
6/20/2017 6:00	15	35	0.009	0.081	402	0.003	0.001
6/20/2017 7:00	10	42	0.009	0.074	400	0.002	0.001
6/20/2017 8:00	18	51	0.009	0.113	403	0.004	0.002
6/20/2017 9:00	11	27	0.010	0.102	404	0.003	N/D
6/20/2017 10:00	14	30	0.011	0.076	402	0.004	0.002
6/20/2017 11:00	17	68	0.015	0.039	409	0.005	0.005
Minimum	5	9	0.005	0.039	394	0.002	0.001
Maximum	24	84	0.015	0.302	414	0.01	0.009
Average	14	32	0.009	0.161	405	0.005	0.004

ANNEXURE 12: NOISE AND VIBRATION LEVELS**INDUSTRIAL TECHNOLOGY INSTITUTE (ITI)**

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ISO/IEC 17025
TL 004-04

**Monitoring of Background Noise Levels and
Existing Noise Levels, Existing Vibration levels
Report No. CTS- 1707065**

Report to :

**SASEC Port Access Elevated Highway Project.
Katahira and Engineers International
No: 2A,3/1,C.B.M.House,Lake Drive,
Colombo 08.**

Issued By:

**Noise & Vibration Group
Electro Technology Laboratory**

2017 July, 04

Page 01 of 10

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"PLEASE ADDRESS ALL COVERS TO THE DIRECTOR GENERAL"

Report No. CTS- 1707065

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March 2017





... Continuation Sheet

**Monitoring of Background Noise Levels
And Existing Noise Levels, Existing Vibration Levels**
Report No. CTS- 1707065



ISO/IEC 17025
TL 004-04

1. **Customer :**
SASEC Port Access Elevated Highway Project.
Katahira and Engineers International
No: 2A,3/1,C.B.M.House,Lake Drive,
Colombo 08.

2. **Scope of the Project:**
To determine the background noise levels and existing noise levels and existing vibration levels at specified locations that are most affected (or that will be most affecting) by noise and vibration, from the proposed elevated highway.

3. **Location of Project :**
The proposed elevated highway from New Kelani bridge to Colombo port over the existing port accesses road. The proposed road transfer from Ingurukade junction and end at Galle face.

4. **Definitions**
 - 4.1 **Background Noise Level**
The background noise level is defined as the underlying level of noise present on ambient noise where all unusual extraneous noise is removed. Sounds contributing to background noise can include, sound from nearby traffic, industries, machinery, birds, insects, animals and similar sources including human activities are the normal features of the location. The background noise level is measured using $L_{A90,15min}$ descriptor.

 - 4.2 **Assessment Background Level (ABL)**
The single figure background level representing each assessment period, day, evening and night (three assessment background levels are determined for each 24-hour monitoring period.) The **tenth percentile method** is used to determine the assessment background level.

 - 4.3 **Rating Background Level (RBL)**
The overall single figure background level representing each assessment period day, evening and night over the whole monitoring period. The rating background level is the level used for assessment purposes for 24 hours monitoring programme. Rating background level is determined by the **median value** of day, evening and night.

 - 4.4 **Existing Noise Level (ENL)**
The existing noise levels is determined as the logarithmic average of individual $L_{Aeq,15min}$ levels of each day, evening and night over a 24 hour periods or day, evening/night time period.



... Continuation Sheet

Report No. CTS- 1707065

ISO/IEC 17025
TL 004-04

- 4.5 Equivalent Continuous Sound Pressure Level ($L_{Aeq,T}$)**
The equivalent steady sound level in dB containing the same acoustic energy as the actual fluctuating sound level over the given period, T
- 5. Assessment Period**
- 5.1 Twenty four hour background and existing noise level measurements**
The background noise level measurements were carried out 24 hours continuously at the three locations including, day, evening and night. The period for a day where the assessments are made is given below.
- Day - 0600h to 1800h
 - Evening - 1800h to 2200h
 - Night - 2200h to 0600h
- 5.2 Three hour background and existing noise level measurements**
In addition to the 24 hour background noise monitoring programme mentioned above, short term (Three hour) background noise measurements were carried out at one locations, The period is given below.
- Day - Two hour at each location between 0700h to 1500h
 - Evening/Night - One hour at each location between 1800h to 2400h
- 5.3 One hour background and existing vibration level measurements**
The six measurement points were selected for vibration level measurements
- Day - One hour at each location (0600h to 1800h)
- 6. Instrumentation Details**
The following instruments and software used to determine the background noise levels and vibration level measurements.
- 6.1 Noise data logger** : Modular precision Level Analyzer, Bruel and Keajer Type 2250,2250L- Enhanced sound analysis software BZ 7202 versions 2, Bruel and Keajer
- Field calibrator** : The above meter was calibrated before the measurements against an acoustic calibrator B & K Type 4231, traceable to primary standard maintained at Brüel & Kjær , The Calibration Laboratory, Denmark. Certificate No. CLK 1601194
- 6.2 Vibration data logger** : Pulse Multi Channel Analyzer, Bruel and Kjaer (B&K) type 3160- A-042, Model LAN-XI
- Software** : Pulse Lab shop software version 19.0



... Continuation Sheet

Report No. CTS- 1707065

ISO/IEC 17025
TL 004-04**7. Measurement Procedure****7.1 Noise level**

The noise level measurements were carried out in accordance with the test method MM /SL/ 04- Monitoring of background noise level and existing noise level.

The following steps involved in background noise level monitoring.

Calibrated the sound level analyser using acoustic calibrator at the site before measurements.

Measurements carried out at least 3.5 m away from any reflecting structure other than the ground to minimize the influence of reflections.

Measurement height of the microphone 1.5 m above the ground.

Monitoring of background noise levels ($L_{A90, 15min}$ and $L_{Aeq, 15min}$)

7.2 Vibration Level*

Three sensors were mounted in X, Y & Z directions on a metal block and it was placed on a permanent structure in ground level. The level of vibration was simultaneously measured in three perpendicular directions using Pulse Multi Channel Analyzer, Bruel and Kjaer (B&K) Type 3160- A-042, Model LAN-XI with Pulse Lab shop software version 19.0

*Non Accredited

7.3 The Team Involved in Noise and Vibration Monitoring Programme

C.M.Kalansuriya	Research Scientist
D.C.Jayarathne	Reserch Technologist
K.K.N.Darshana	Assistant Reserch Technologist
P.N. Alagiyawanna	Assistant Reserch Technologist

Representatives from the ITI was present on the day of measurement-

Mr. H. K. S. P. Perera Instrument Operator

8. Result

The results of the measurements carried out by ITI are given in the tables below;

8.1 - Summary of noise level measurement data for three measurement locations are presented in table 1. (day, evening and night. - 24 hour locations)

8.2 - Summary of noise level measurement data for one measurement location is presented in table 2. (day, evening/night. - 3 hour location)

8.3 - Summary of vibration level measurement data for six measurement locations are presented in table 3 to 8. (day time - one six location)



ISO/IEC 17025
TL004-04



8.1 Summary of Noise level data

Summary of measurement data for three measurement locations are presented in table 1 (day, evening and night - 24 hour locations)

Table 1: Noise Level Results – 24 hour Measurement Locations

Date	Measurement Location		Assessment time period- Day			Assessment time period- Evening			Assessment time period- Night		
			ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)	ABL dB(A)	RBL dB(A)	ENL dB(A)
2017 May 30,31	N1	6°57'6.31"N 79°52'22.17"E	52	57	70	56	57	69	49	51	74
2017 May 30,31	N2	6°57'19.05"N 79°51'54.35"E	56	61	71	61	62	72	53	56	68
2017 June 22,23	N3	6°56'47.61"N 79°51'22.48"E	56	65	74	65	67	75	53	58	70

ABL - Assessment background level ($L_{A90,15min}$)
 RBL - Rating background level ($L_{A90,15min}$)
 ENL - Existing noise level ($L_{Aeq,t}$) h-hour

... Continuation Sheet
 Report No. CTS- 1707065



01



... Continuation Sheet

Report No. CTS- 1707065



ISO/IEC 17025
TL 004-04

8.2 Summary of noise level measurement data for one measurement locations are presented on table 2. (day, evening/night. – 3 hour location)

Table 2: Noise Level Results - 3 hour Short Term Location

Date	Measurement Location		Assessment time period			
			ENL dB(A)		RBL dB(A)	
			Day-	Evening / Night	Day-	Evening / Night
2017 June 09	N4	6°56'18.09"N 79°50'33.28"E	57	54	54	53

ENL - Existing noise level ($L_{Aeq,h}$) h-hour

RBL - Rating background level ($L_{A90,15min}$)



... Continuation Sheet

Report No. CTS- 1707065

ISO/IEC 17025
TL 004-04**8.3 Summary of vibration level data ***

Summary of measurement data for vibration Max. Peak value in velocity mode (mm/sec.)

Vibration Level Results - 1 hour**Table 3: Measurement Location – V1**

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.12	0.13	0.10	0.20
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	12.25	12.25	12.25	12.25

Table 4: Measurement Location - V2

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.11	0.11	0.11	0.22
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	23.75	23.75	23.75	23.75

Table 5: Measurement Location - V3

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.28	0.20	0.28	0.21
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	24.50	24.50	24.50	24.50



... Continuation Sheet

Report No. CTS- 1707065

ISO/IEC 17025
TL 004-04

Table 6: Measurement Location – V4

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.24	0.24	0.20	0.28
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	25.50	25.50	25.50	25.50

Table 7: Measurement Location – V5

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.18	0.14	0.23	0.15
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	11.13	11.13	11.13	11.13

Table 8: Measurement Location – V6

Description	Assessment period - Day			
	0-15 min	15-30 min	30-45 min	45-60 min
Category of the structure	Type 3	Type 3	Type 3	Type 3
Results – Vibration				
Max. Peak value in velocity mode (mm/sec.)	0.27	0.23	0.19	0.17
Frequency range (Hz)	10 – 50	10 – 50	10 – 50	10 – 50
Predominant Frequency (Hz)	14.25	14.25	14.25	14.25





... Continuation Sheet

Report No. CTS- 1707065

ISO/IEC 17025
TL 004-04**8.4 Measurement data**

- Annex 1 : Noise & Vibration level measurements locations
- Annex 2 : Map of the Noise & Vibration level measurements locations
- Annex 3 : Method for determining the tenth percentile value
- Annex 4 : Definitions of terms
- Annex 5 to 7 : Measurement data of 24 hour
- Annex 8 : Measurement data of 3 hour
- Annex 9 to 14 : Vibration measurement detail
- Annex 15 & 16 : Environment conditions (Ambient temperature, Ambient Humidity and Wind speed)

9. Reference Documents

- o NSW Industrial Noise Policy 2000 -Environmental Protection Authority, Australia.
- o IEC 61672-1: (2002-05) – Electro acoustic - Sound Level Meters - Specification
- o ISO 1996, International Organization for Standardization, Geneva
Acoustics – *Description, measurement and assessment of environmental noise*

Part 1. Basic quantities and assessment procedures (second edition 2003-08-01)

Part 2. Determination of environmental noise levels (second edition 2007-03-15)
- o BS 4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*, British Standards Institution (BSI), London 1997.

Authorized by

2017, July 04

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Performed by

P.N. Alagiyawanna
Assistant Research Technologist



... Continuation Sheet

Industrial Technology Institute
Proposed elevated highway project

**Noise & Vibration level measurements locations**

Date	Measurement Location	G.P.S. Point	Location
2017 May 30 2017 May 31	N1/V1	6°57'6.31"N 79°52'22.17"E	Sirimuthu Sewana U.D.A. Housing Complex
2017 May 30 2017 May 31	N2/V2	6°57'19.05"N 79°51'54.35"E	Sirisanda Sewana U.D.A. Housing Complex
2017 June 22 2017 June 23	N3/V3	6°56'47.61"N 79°51'22.46"E	St. Anthony's Shrine Kochikade
2017 June 09	N4/V4	6°56'18.09"N 79°50'33.28"E	Port Authority Museum
2017 June 09	V5	6°56'15.24"N 79°50'42.10"E	Grand Oriental Hotel
2017 June 09	V6	6°56'16.73"N 79°50'42.68"E	Port authority/ Port bridge

9

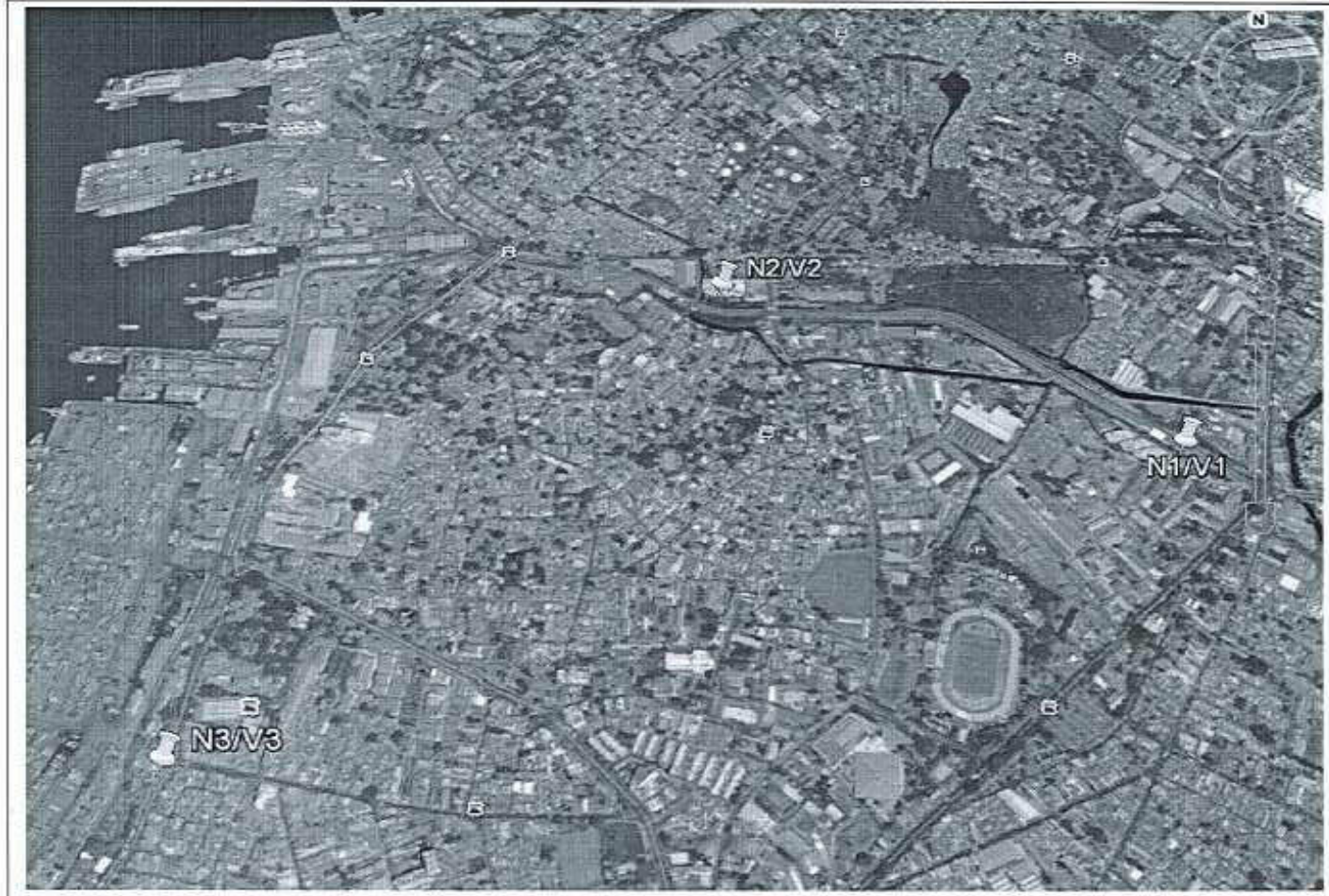


Annexure 02: 17025
TL 004-04

... Continuation Sheet



Map of the Noise & Vibration level



2

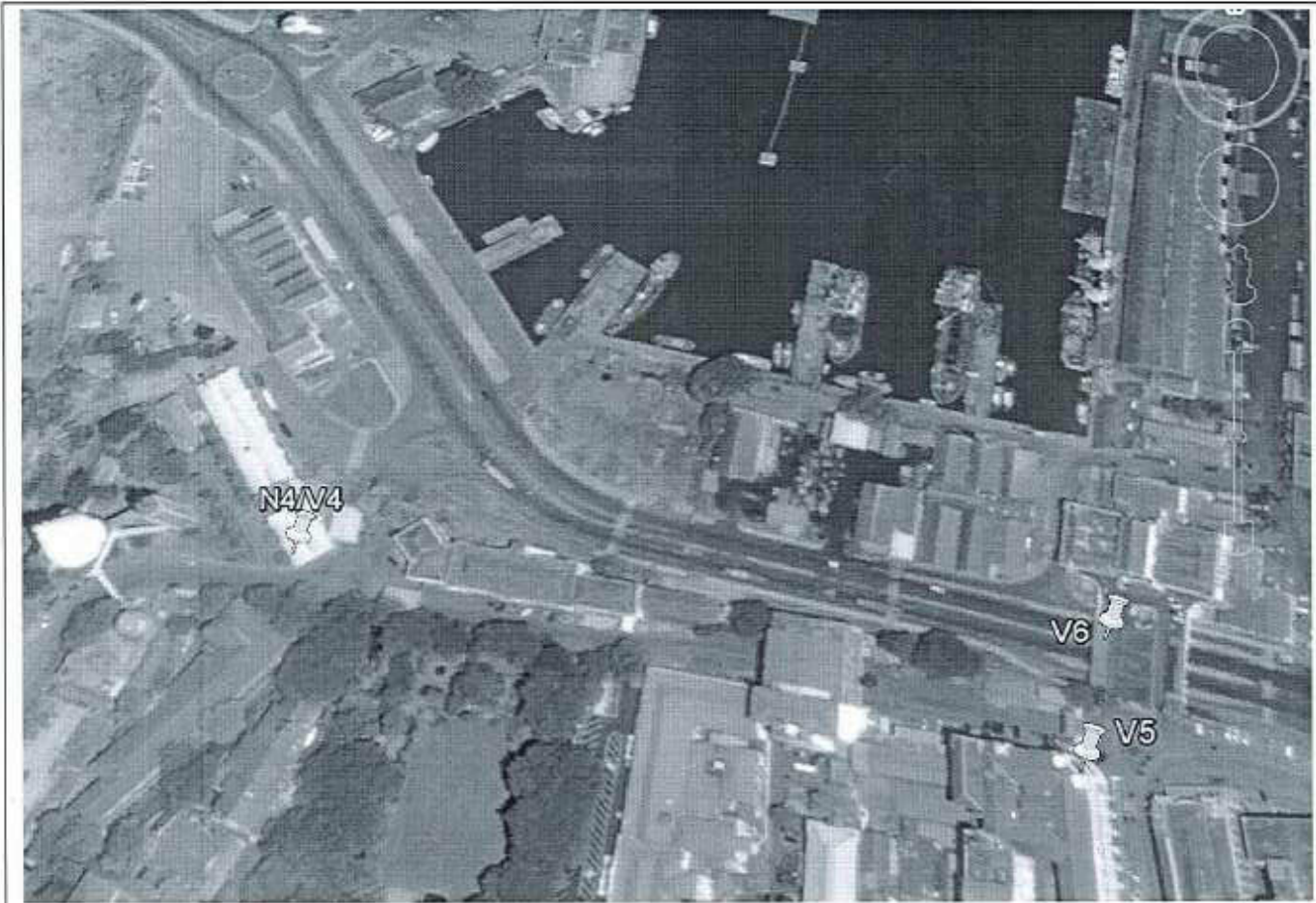
a



... Continuation Sheet



Map of the Noise & Vibration level





... Continuation Sheet



1. Method for determining the tenth percentile value

Step 1	Sort the $L_{A90, 15 \text{ minutes}}$ data in each assessment period in ascending order .
Step 2	Work out the tenth per cent position of the number of samples in the assessment period. This can be calculated by multiplying the number of $L_{A90, 15 \text{ minutes}}$ values in the assessment period by 0.1.
Step 3	<p>Determine the tenth percentile (essentially the lowest tenth per cent value).</p> <p>If the tenth per cent position (from Step 2) is an integer, then the tenth percentile is determined by taking the arithmetic average of the value of the $L_{A90, 15 \text{ minutes}}$ at the tenth per cent position and the next highest value.</p> <p>If the tenth per cent position (from step 2) is not an integer, then the tenth percentile is the next highest $L_{A90, 15 \text{ minutes}}$ value above the value at the tenth per cent position.</p> <p>Examples :</p> <ol style="list-style-type: none"> For a data set of size 40, the tenth per cent position is 4 (i.e. 0.1×40). As this is an integer, the tenth percentile is the average of the values at the 4th position and the 5th position, counting from the lowest value of the sorted data (from Step 1) For a data set of size 44, the tenth per cent position is 4.4 (i.e. 0.1×44). As this value is not an integer, the tenth percentile is the value at the 5th position counting from the lowest value of the sorted data (from Step 1)

2. Method for determining Median Test

Median' is the middle value in a number of values. For an odd number of values, the value of the median is simply the middle value in a number of values ranked in ascending or descending order. For an even number of values, the median is the arithmetic average of the two middle values.

3. Method for determining the existing L_{Aeq} noise levels

Risk of noise impact	Measurement period ¹	Definition of existing level
Low risk	One day-covering the defined day/evening/night periods relevant to the periods the proposed development would operate.	The Logarithmic average ² of individual $L_{Aeq, 15 \text{ minutes}}$ levels for each day/ evening/ night assessment period over the measurement period.

Notes :

1. It is recommended that the L_{Aeq} be measured on a 15 - minute basis.

$$2. \text{ Logarithmic average} = 10 \log_{10} \left(\left(\sum_{i=1}^n 10^{\left(\frac{L_{Aeq, 15 \text{ min}}}{10} \right)} \right) / n \right)$$

where n = number of $L_{Aeq, 15 \text{ min}}$ values in each assessment period over the measurement period.

2



... Continuation Sheet

Definitions of terms



Adverse weather :

Weather effects that enhance noise (that is, wind and temperature inversions) occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter),

Ambient noise :

The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.

Assessment period :

The period in a day over which assessment are made: day (0700h to 1800h), evening (1800h to 2200h) or night (2200h to 0700h).

Assessment background level (ABL)

The single figure background level representing each assessment period-day, evening and night (that is three assessment background levels are determined for each 24h period of the monitoring period). Its determination is by the tenth percentile method described in Appendix A.

Background noise :

The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.

C-weighted :

C-weighting is an adjustment made to sound level measurements which takes account of low-frequency components of noise within the audibility range of humans.

Construction activities :

Activities that are related to the establishment phase of a development and that will occur on a site for only a limited period of time.

Cumulative noise level :

The total level of noise from all sources.

dB :

Abbreviation for decibel - a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

dB(A) :

Unit used to measure 'A-weighted' sound pressure levels. A-weighting is an adjustment made to sound level measurement to approximate the response of the human ear.

Default parameters :

In assessing meteorological enhancement of noise, refers to set values for weather parameters, such as wind speeds and temperature gradients, to be used in predicting source noise levels.



... Continuation Sheet

Equivalent continuous noise level:

The level of noise equivalent to the energy average of noise levels occurring over a measurement period.



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TL 004-04

Extraneous noise :

Noises resulting from activities that are not typical of the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.

L_{A90} :

The A-weighted sound pressure level that is exceeded for 90 per cent of the time over which a given sound is measured. This is considered to represent the background noise.

L_{Aeq} :

The equivalent continuous noise level - the level of noise equivalent to the energy, average of noise levels occurring over a measurement period.

Low frequency :

Noise containing major components in the low-frequency range (20Hz to 250 Hz) of the frequency spectrum.

Median :

The middle value in a number of values sorted in ascending or descending order. Hence, for an odd number of values, the value of the median is simply the middle value. If there is an even number of values the median is the arithmetic average of the two middle values.

Meteorological conditions :

Wind and temperature inversion conditions.

Most affected location(s) :

Locations that experience (or will experience) the greatest noise impact from the noise source under consideration. In determining these locations, one needs to consider existing background levels, exact noise source location(s), distance from source (or proposed source) to receiver, and any shielding between source and receiver.

Receiver :

The noise-sensitive land use at which noise from a development can be heard.

Continuation Sheet
Measurement Data of 24 Hours **Measurement Locations**
Industrial Technology Institute



Proposed elevated highway project

Measurement Point : N1

Date of measurement : 30 May 2017 & 31 May 2017

Day : (0600h to 1800h) Evening : (1800h to 2200h) Night : (2200h to 0600h)

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	64	52
0615h	2	64	52
0630h	3	65	52
0645h	4	64	52
0700h	5	65	52
0715h	6	63	51
0730h	7	66	52
0745h	8	65	52
0800h	9	66	54
0815h	10	69	53
0830h	11	67	53
0845h	12	65	53
0900h	13	64	54
0915h	14	66	55
0930h	15	69	55
0945h	16	72	54
1000h	17	68	56
1015h	18	69	56
1030h	19	69	59
1045h	20	70	57
1100h	21	70	59
1115h	22	66	57
1130h	23	71	59
1145h	24	73	59
1200h	25	76	61
1215h	26	73	60
1230h	27	70	59
1245h	28	69	58
1300h	29	69	59
1315h	30	71	59
1330h	31	72	61
1345h	32	70	61
1400h	33	70	58
1415h	34	69	56
1430h	35	68	58
1445h	36	68	58
1500h	37	69	56
1515h	38	67	56
1530h	39	69	57
1545h	40	71	57
1600h	41	71	58
1615h	42	71	59
1630h	43	72	61
1645h	44	70	62
1700h	45	69	60
1715h	46	70	59
1730h	47	71	60
1745h	48	70	61

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	69	61
1815h	50	69	60
1830h	51	68	59
1845h	52	69	60
1900h	53	68	57
1915h	54	69	57
1930h	55	70	58
1945h	56	70	57
2000h	57	68	57
2015h	58	67	56
2030h	59	66	56
2045h	60	68	56
2100h	61	68	57
2115h	62	70	57
2130h	63	70	58
2145h	64	71	56
2200h	65	70	55
2215h	66	74	55
2230h	67	67	56
2245h	68	67	55
2300h	69	69	55
2315h	70	68	58
2330h	71	69	54
2345h	72	66	53
0000h	73	69	55
0015h	74	69	55
0030h	75	67	49
0045h	76	67	50
0100h	77	70	50
0115h	78	71	49
0130h	79	63	48
0145h	80	73	50
0200h	81	71	51
0215h	82	88	53
0230h	83	64	51
0245h	84	63	50
0300h	85	65	49
0315h	86	65	51
0330h	87	62	48
0345h	88	65	49
0400h	89	58	48
0415h	90	61	49
0430h	91	72	51
0445h	92	72	50
0500h	93	61	53
0515h	94	64	52
0530h	95	69	54
0545h	96	66	52

2

... Continuation Sheet
Measurement Data of 24 hours - Measurement Locations
 Industrial Technology Institute



Proposed elevated highway project

Measurement Point N2

Date of measurement : 30 May 2017 & 31 May 2017

Day : (0600h to 1800h) Evening : (1800h to 2200h) Night : (2200h to 0600h)

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	65	56
0615h	2	66	56
0630h	3	70	56
0645h	4	67	57
0700h	5	67	57
0715h	6	66	57
0730h	7	66	57
0745h	8	73	56
0800h	9	69	55
0815h	10	67	57
0830h	11	68	56
0845h	12	66	55
0900h	13	72	55
0915h	14	68	56
0930h	15	68	59
0945h	16	70	59
1000h	17	71	59
1015h	18	68	60
1030h	19	69	61
1045h	20	75	60
1100h	21	74	61
1115h	22	70	61
1130h	23	70	61
1145h	24	71	61
1200h	25	71	60
1215h	26	73	62
1230h	27	71	61
1245h	28	77	62
1300h	29	80	60
1315h	30	74	61
1330h	31	73	61
1345h	32	73	62
1400h	33	72	62
1415h	34	71	61
1430h	35	72	61
1445h	36	70	62
1500h	37	71	62
1515h	38	70	63
1530h	39	70	62
1545h	40	70	62
1600h	41	72	62
1615h	42	72	61
1630h	43	71	63
1645h	44	69	61
1700h	45	69	62
1715h	46	70	61
1730h	47	69	60
1745h	48	70	61

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	72	61
1815h	50	70	62
1830h	51	72	62
1845h	52	74	62
1900h	53	68	63
1915h	54	73	63
1930h	55	71	64
1945h	56	71	63
2000h	57	71	63
2015h	58	72	63
2030h	59	72	62
2045h	60	73	63
2100h	61	72	61
2115h	62	71	62
2130h	63	70	62
2145h	64	71	62
2200h	65	68	61
2215h	66	70	62
2230h	67	68	60
2245h	68	70	61
2300h	69	70	61
2315h	70	68	61
2330h	71	67	58
2345h	72	70	59
0000h	73	70	57
0015h	74	70	60
0030h	75	69	58
0045h	76	70	60
0100h	77	69	58
0115h	78	67	58
0130h	79	69	55
0145h	80	69	56
0200h	81	68	56
0215h	82	68	56
0230h	83	68	55
0245h	84	68	53
0300h	85	68	52
0315h	86	66	54
0330h	87	68	53
0345h	88	70	58
0400h	89	65	53
0415h	90	64	54
0430h	91	67	55
0445h	92	66	54
0500h	93	67	55
0515h	94	66	56
0530h	95	68	56
0545h	96	66	55

5

... Continuation Sheet
Measurement Data of 24 hours - Measurement Locations
 Industrial Technology Institute



Proposed elevated highway project
 Measurement Point : N3
 Date of measurement : 22 June 2017 & 23 June 2017
 Day : (0600h to 1800h) Evening : (1800h to 2200h) Night : (2200h to 0600h)

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
0600h	1	67	56
0615h	2	67	56
0630h	3	67	57
0645h	4	68	58
0700h	5	66	56
0715h	6	64	54
0730h	7	65	55
0745h	8	67	57
0800h	9	69	56
0815h	10	67	56
0830h	11	67	56
0845h	12	66	55
0900h	13	66	57
0915h	14	66	58
0930h	15	67	57
0945h	16	68	55
1000h	17	68	57
1015h	18	67	56
1030h	19	69	58
1045h	20	69	63
1100h	21	75	67
1115h	22	75	67
1130h	23	76	65
1145h	24	77	66
1200h	25	74	66
1215h	26	76	68
1230h	27	74	67
1245h	28	76	67
1300h	29	74	66
1315h	30	75	65
1330h	31	77	66
1345h	32	75	66
1400h	33	76	67
1415h	34	76	66
1430h	35	75	66
1445h	36	74	65
1500h	37	72	65
1515h	38	74	65
1530h	39	73	65
1545h	40	86	65
1600h	41	73	66
1615h	42	74	66
1630h	43	74	67
1645h	44	73	65
1700h	45	73	66
1715h	46	73	66
1730h	47	74	67
1745h	48	76	67

Start time	Time Interval (15 min)	Measured Noise Level (dBA)	
		LAeq	LA90,15min
1800h	49	75	68
1815h	50	75	68
1830h	51	74	67
1845h	52	74	67
1900h	53	77	69
1915h	54	75	69
1930h	55	75	68
1945h	56	74	68
2000h	57	77	68
2015h	58	75	67
2030h	59	74	68
2045h	60	73	67
2100h	61	74	66
2115h	62	74	66
2130h	63	73	65
2145h	64	72	65
2200h	65	70	62
2215h	66	70	62
2230h	67	70	63
2245h	68	69	62
2300h	69	69	61
2315h	70	69	60
2330h	71	72	58
2345h	72	67	58
0000h	73	76	58
0015h	74	67	57
0030h	75	68	58
0045h	76	68	58
0100h	77	66	57
0115h	78	68	57
0130h	79	66	56
0145h	80	64	55
0200h	81	65	55
0215h	82	70	55
0230h	83	69	56
0245h	84	65	55
0300h	85	67	55
0315h	86	66	55
0330h	87	68	59
0345h	88	66	58
0400h	89	67	57
0415h	90	67	55
0430h	91	69	56
0445h	92	67	56
0500h	93	69	58
0515h	94	72	65
0530h	95	76	61
0545h	96	68	65

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... Continuation Sheet

Measurement Data of 3 hours - Measurement Locations
Industrial Technology Institute

Proposed elevated highway path project

Date of measurement : 09 June 2017



Location – N4			Measured Noise Level dB(A)	
	Time Interval (15 min)	Time	L _{Aeq}	L _{A90-15 min}
Day	1	0900h-1100h	57	54
	2		58	53
	3		58	54
	4		57	54
	5		58	54
	6		56	53
	7		58	54
	8		57	54
Night	1	1900h-2000h	55	53
	2		54	53
	3		54	52
	4		53	50

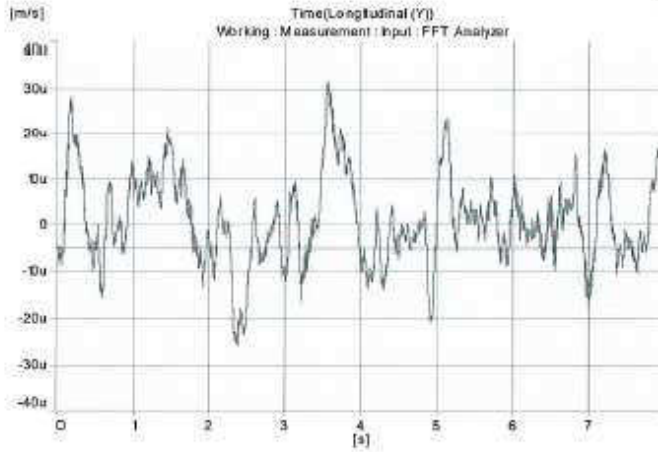


... Continuation Sheet

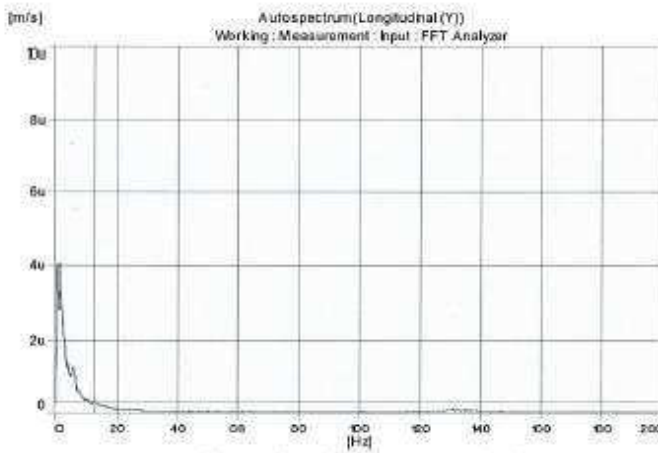
Location Point – V1



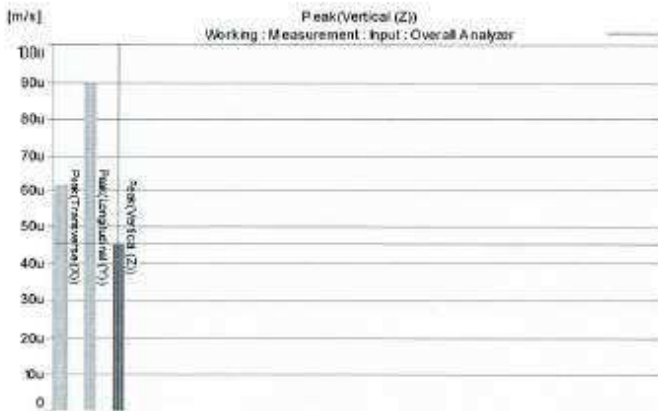
ISO/IEC 17025
TL 004-04



Time history analysis



Narrow band frequency analysis



Overall analysis

e

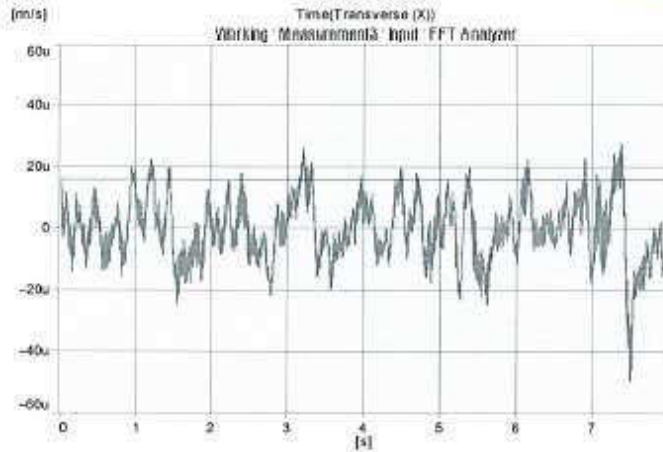


... Continuation Sheet

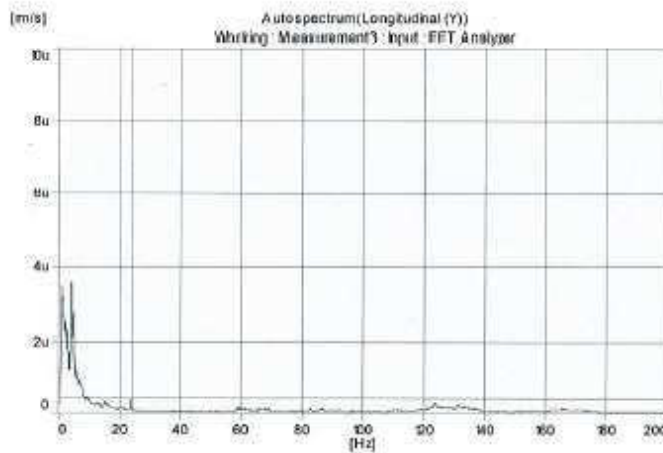
Location Point - V2



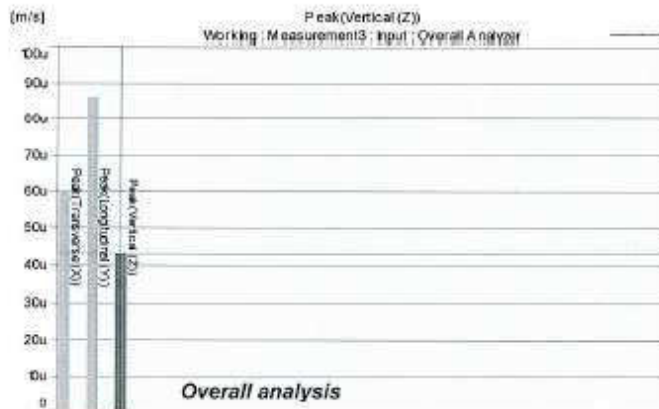
ISO/IEC 17025
TL 004 - 04



Time history analysis



Narrow band frequency analysis



Overall analysis

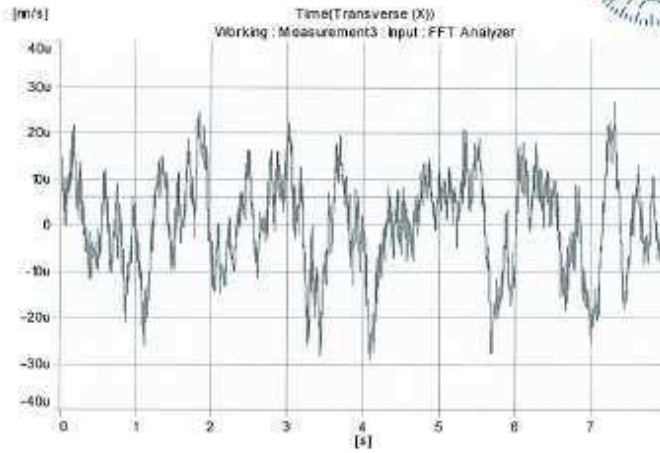
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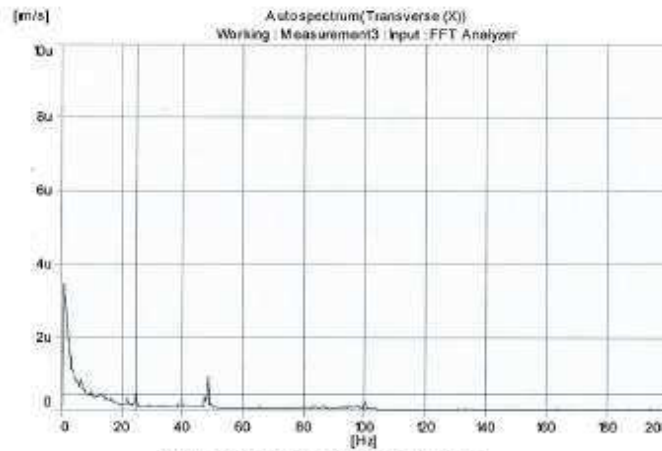
... Continuation Sheet
Location Point – V3



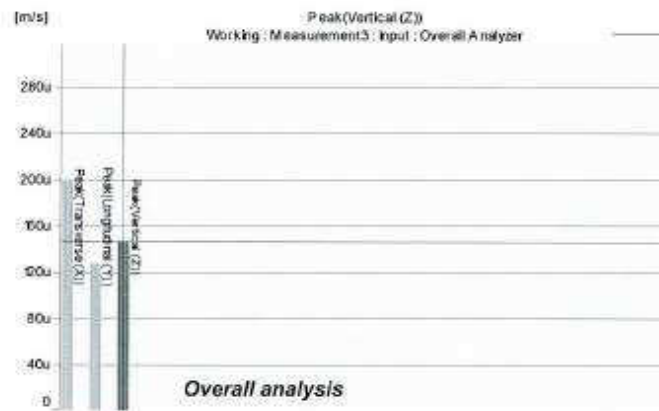
ISO/IEC 17025
TL 004-04



Time history analysis



Narrow band frequency analysis

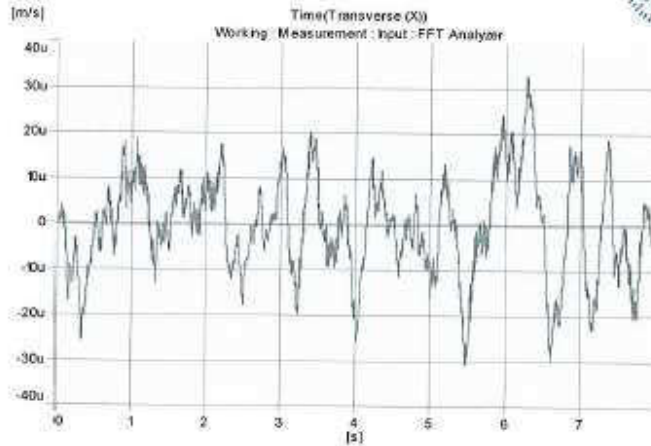


Overall analysis

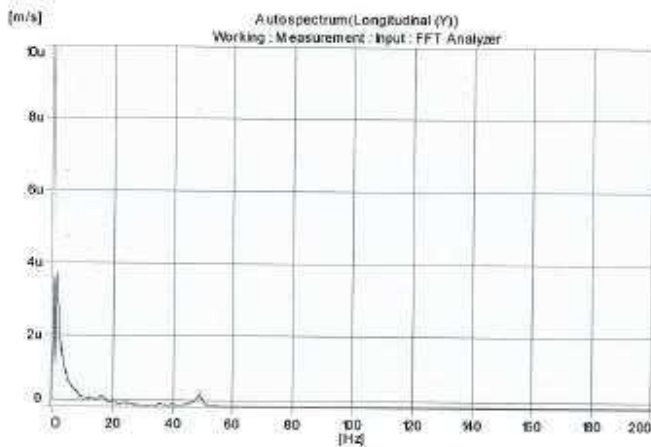
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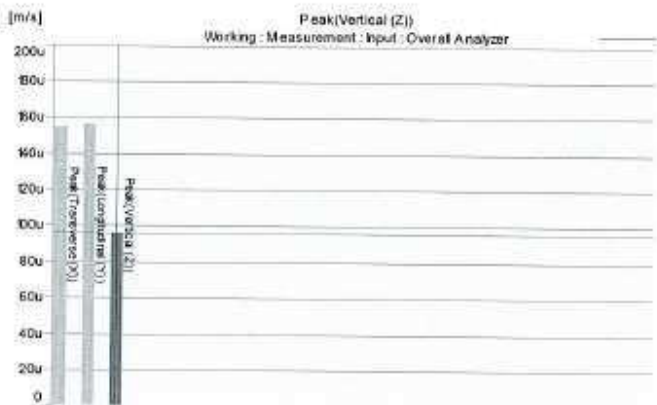
... Continuation Sheet
Location Point – V4



Time history analysis



Narrow band frequency analysis



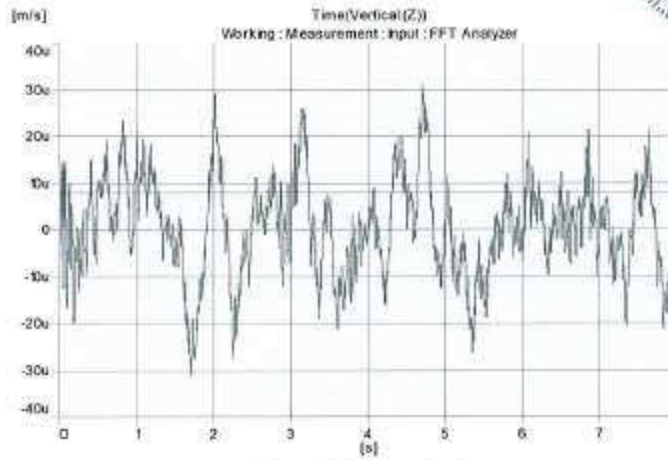
Overall analysis



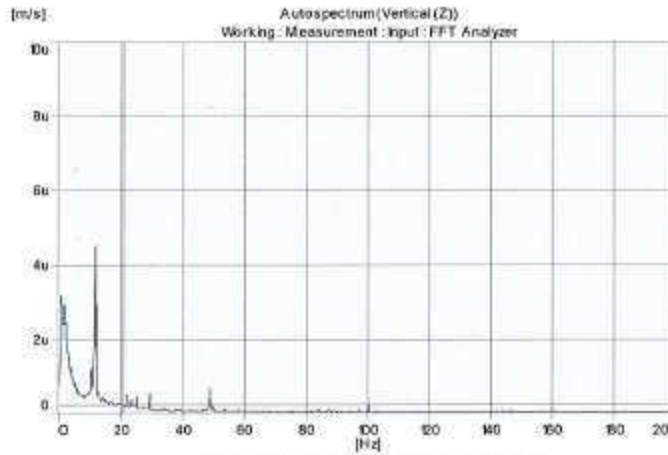
... Continuation Sheet
Location Point - S08



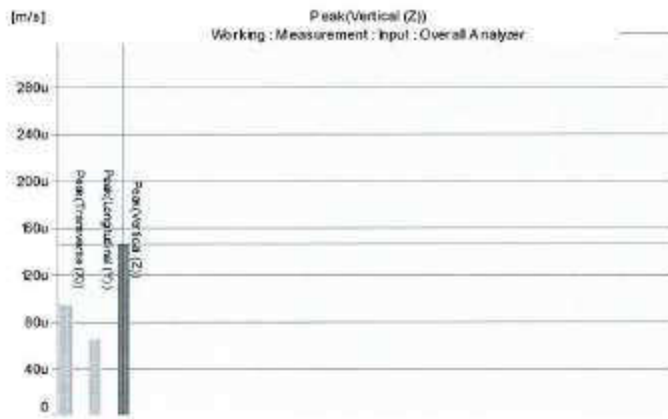
ISO/IEC 17025
TL 004-04



Time history analysis



Narrow band frequency analysis

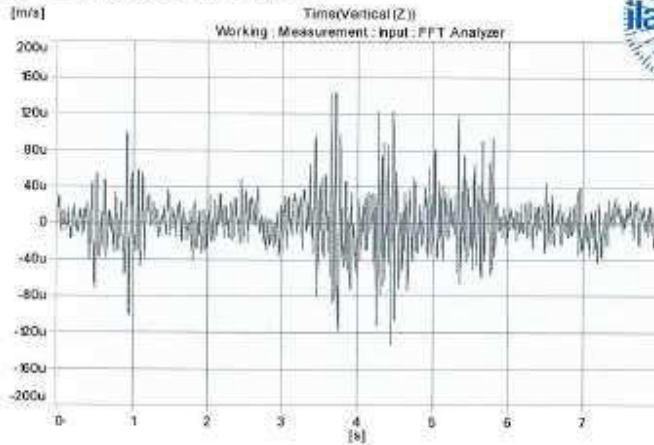


Overall analysis

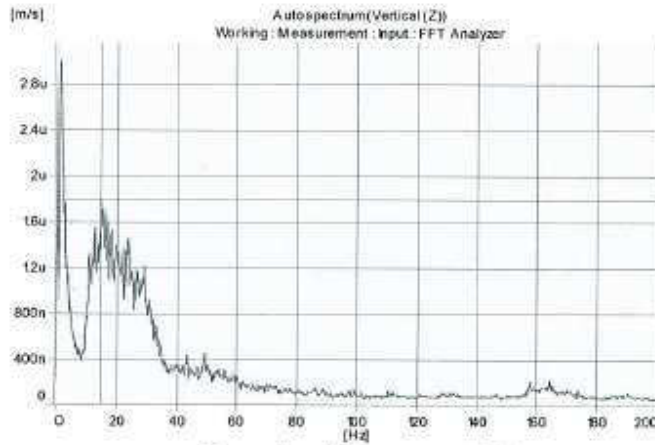
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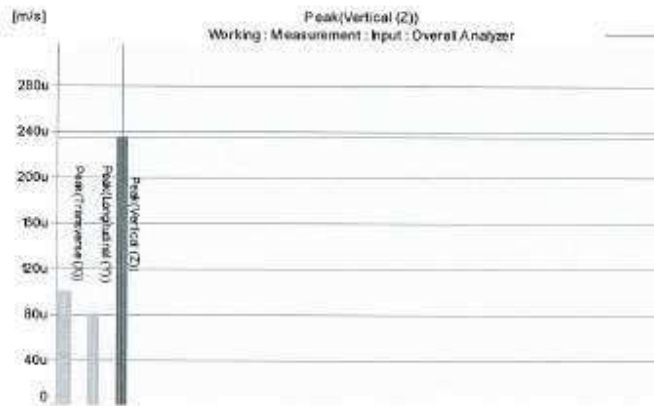
Location Point – V6 ... Continuation Sheet



Time history analysis



Narrow band frequency analysis



Overall analysis



... Continuation Sheet

Environmental Condition – 24 hour



Annexure 12
17025
TL 004-04

Location : L1
Date : 2017 May 30 & 31

Time period	Temperature (°C)	Humidity (%)	Wind speed (m/s)	
			Avg.	Max.
06.00 - 06.15	25	70	0.0	0.0
06.15 - 06.30	24	70	0.0	0.0
06.30 - 06.45	25	70	0.5	1.2
06.45 - 07.00	25	70	0.0	0.0
07.00 - 07.15	25	70	0.7	1.0
07.15 - 07.30	25	70	0.0	0.0
07.30 - 07.45	25	70	0.5	1.0
07.45 - 08.00	26	70	0.7	1.0
08.00 - 08.15	27	70	0.7	1.8
08.15 - 08.30	27	70	0.0	1.3
08.30 - 08.45	28	70	0.0	1.1
08.45 - 09.00	28	70	0.7	1.5
09.00 - 09.15	27	70	0.0	1.2
09.15 - 09.30	28	70	1.0	2.2
09.30 - 09.45	28	70	0.6	1.8
09.45 - 10.00	28	70	0.6	1.4
10.00 - 10.15	29	69	0.9	1.8
10.15 - 10.30	30	68	0.7	1.5
10.30 - 10.45	30	68	1.0	2.6
10.45 - 11.00	30	68	0.6	1.6
11.00 - 11.15	30	68	0.5	1.2
11.15 - 11.30	31	68	1.3	2.4
11.30 - 11.45	30	68	0.8	2.1
11.45 - 12.00	31	68	1.8	2.9
12.00 - 12.15	32	68	0.0	2.3
12.15 - 12.30	30	67	0.8	2.1
12.30 - 12.45	32	68	1.0	2.6
12.45 - 13.00	30	68	0.8	1.9
13.00 - 13.15	30	60	0.9	2.1
13.15 - 13.30	32	67	0.6	2.0
13.30 - 13.45	30	68	1.4	2.8
13.45 - 14.00	31	68	1.5	3.4
14.00 - 14.15	31	61	1.2	3.1
14.15 - 14.30	30	61	0.9	1.8
14.30 - 14.45	31	61	0.7	2.4
14.45 - 15.00	30	61	0.8	2.4
15.00 - 15.15	30	61	0.6	1.3
15.15 - 15.30	31	61	0.0	1.0
15.30 - 15.45	30	61	0.0	0.0
15.45 - 16.00	30	60	0.0	1.0
16.00 - 16.15	30	61	0.0	1.1
16.15 - 16.30	30	61	0.6	1.3
16.30 - 16.45	30	60	0.6	1.5
16.45 - 17.00	29	61	0.7	1.6
17.00 - 17.15	29	61	0.6	1.6
17.15 - 17.30	30	61	0.0	0.0
17.30 - 17.45	26	66	0.0	0.6
17.45 - 18.00	26	66	0.0	0.0



... Continuation Sheet



ISO/IEC 17025
TL 004-04

Environmental Condition – 24 hour

Location : L1

Date : 2017 May 30 & 31

Time period	Temperature (°C)	Humidity (%)	Wind speed (m/s)	
			Avg.	Max.
18.00 - 18.15	26	66	0.0	0.8
18.15 - 18.30	26	68	0.0	1.7
18.30 - 18.45	27	66	0.0	1.4
18.45 - 19.00	26	68	0.9	2.2
19.00 - 19.15	25	72	0.0	0.0
19.15 - 19.30	26	72	0.0	0.0
19.30 - 19.45	26	72	0.0	1.2
19.45 - 20.00	27	72	0.0	0.0
20.00 - 20.15	28	74	0.0	0.0
20.15 - 20.30	28	75	0.0	1.0
20.30 - 20.45	27	72	0.0	0.0
20.45 - 21.00	28	75	0.0	0.0
21.00 - 21.15	27	73	0.0	0.0
21.15 - 21.30	28	73	0.0	0.0
21.30 - 21.45	28	73	0.0	0.0
21.45 - 22.00	28	73	0.6	1.7
22.00 - 22.15	29	73	0.0	0.0
22.15 - 22.30	29	75	0.0	0.0
22.30 - 22.45	29	73	0.0	0.0
22.45 - 23.00	28	75	0.0	0.0
23.00 - 23.15	27	73	0.0	0.0
23.15 - 23.30	27	75	0.0	1.3
23.30 - 23.45	27	75	0.0	0.0
23.45 - 24.00	26	75	0.0	0.0
00.00 - 00.15	27	75	0.0	0.0
00.15 - 00.30	26	76	0.0	0.0
00.30 - 00.45	26	76	0.0	1.1
00.45 - 01.00	24	75	0.0	0.0
01.00 - 01.15	25	77	0.0	0.0
01.15 - 01.30	25	78	0.0	0.0
01.30 - 01.45	24	78	0.0	0.0
01.45 - 02.00	24	75	0.5	1.2
02.00 - 02.15	24	75	0.0	0.8
02.15 - 02.30	25	75	0.0	0.0
02.30 - 02.45	24	75	0.0	0.0
02.45 - 03.00	24	78	0.0	0.5
03.00 - 03.15	25	78	0.0	0.0
03.15 - 03.30	24	78	0.0	0.0
03.30 - 03.45	24	76	0.5	1.2
03.45 - 04.00	24	77	0.0	0.0
04.00 - 04.15	25	76	0.0	0.0
04.15 - 04.30	24	77	0.0	1.0
04.30 - 04.45	24	76	0.0	0.0
04.45 - 05.00	24	74	0.0	0.0
05.00 - 05.15	24	74	0.0	0.0
05.15 - 05.30	25	73	0.0	0.0
05.30 - 05.45	26	66	0.0	0.0
05.45 - 06.00	26	66	0.0	0.0



... Continuation Sheet

Environmental Condition – 24 hour

Location : L3
Date : 2017 June 22 & 23



Time period	Temperature (°C)	Humidity (%)	Wind speed (m/s)	
			Avg.	Max.
06.00 - 06.15	25	75	0.0	0.0
06.15 - 06.30	25	75	0.0	0.0
06.30 - 06.45	26	75	0.5	1.2
06.45 - 07.00	25	73	0.0	0.0
07.00 - 07.15	26	72	0.0	1.0
07.15 - 07.30	25	72	0.0	0.0
07.30 - 07.45	26	72	0.0	0.0
07.45 - 08.00	26	72	0.0	0.0
08.00 - 08.15	27	72	0.7	1.8
08.15 - 08.30	27	72	0.0	1.3
08.30 - 08.45	28	72	0.0	1.1
08.45 - 09.00	27	70	0.7	1.5
09.00 - 09.15	28	70	0.0	1.2
09.15 - 09.30	28	70	1.0	2.2
09.30 - 09.45	27	70	0.6	1.8
09.45 - 10.00	28	70	0.0	1.4
10.00 - 10.15	28	69	0.9	1.8
10.15 - 10.30	30	66	0.7	1.5
10.30 - 10.45	30	67	1.0	2.6
10.45 - 11.00	31	66	0.6	1.6
11.00 - 11.15	30	66	0.0	1.2
11.15 - 11.30	31	66	1.3	2.4
11.30 - 11.45	32	65	0.0	2.1
11.45 - 12.00	31	64	1.8	2.9
12.00 - 12.15	32	62	0.0	2.3
12.15 - 12.30	30	63	0.8	2.1
12.30 - 12.45	31	62	1.0	2.6
12.45 - 13.00	31	63	0.8	1.9
13.00 - 13.15	31	63	0.9	2.1
13.15 - 13.30	31	63	0.6	2.0
13.30 - 13.45	31	62	1.4	2.8
13.45 - 14.00	31	63	1.5	3.4
14.00 - 14.15	31	62	1.2	3.1
14.15 - 14.30	31	62	0.9	1.8
14.30 - 14.45	33	63	0.7	2.4
14.45 - 15.00	33	63	0.8	2.4
15.00 - 15.15	33	62	0.0	1.3
15.15 - 15.30	31	62	0.0	1.0
15.30 - 15.45	32	63	0.0	0.0
15.45 - 16.00	32	62	0.0	1.0
16.00 - 16.15	31	63	0.0	1.1
16.15 - 16.30	30	63	0.0	1.3
16.30 - 16.45	30	64	0.6	1.5
16.45 - 17.00	30	63	0.7	1.6
17.00 - 17.15	30	63	0.6	1.6
17.15 - 17.30	30	64	0.0	0.0



... Continuation Sheet
Environmental Condition – 24 hour



Location : L3

Date : 2017 June 22 & 23

ISO/IEC 17025

TL004-04

Time period	Temperature (°C)	Humidity (%)	Wind speed (m/s)	
			Avg.	Max.
17.30 - 17.45	28	75	0.0	0.0
17.45 - 18.00	28	75	0.0	0.0
18.00 - 18.15	27	75	0.5	1.2
18.15 - 18.30	26	73	0.0	0.0
18.30 - 18.45	26	72	0.0	0.0
18.45 - 19.00	26	72	0.0	0.0
19.00 - 19.15	25	72	0.0	0.0
19.15 - 19.30	26	72	0.0	0.0
19.30 - 19.45	26	72	0.7	1.8
19.45 - 20.00	25	72	0.0	1.3
20.00 - 20.15	25	72	0.0	1.1
20.15 - 20.30	25	70	0.7	1.5
20.30 - 20.45	26	70	0.0	1.2
20.45 - 21.00	26	70	1.0	2.2
21.00 - 21.15	26	70	0.6	1.8
21.15 - 21.30	26	70	0.0	1.4
21.30 - 21.45	26	69	0.9	1.8
21.45 - 22.00	26	66	0.7	1.5
22.00 - 22.15	26	67	1.0	2.6
22.15 - 22.30	25	66	0.6	1.6
22.30 - 22.45	24	66	0.0	1.2
22.45 - 23.00	24	66	1.3	2.4
23.00 - 23.15	24	65	0.0	2.1
23.15 - 23.30	24	64	1.8	2.9
23.30 - 23.45	25	62	0.0	2.3
23.45 - 24.00	24	63	0.8	2.1
00.00 - 00.15	23	62	1.0	2.6
00.15 - 00.30	24	63	0.8	1.9
00.30 - 00.45	24	63	0.9	2.1
00.45 - 01.00	24	63	0.6	2.0
01.00 - 01.15	24	62	1.4	2.8
01.15 - 01.30	24	63	1.5	3.4
01.30 - 01.45	23	62	1.2	3.1
01.45 - 02.00	23	62	0.9	1.8
02.00 - 02.15	23	63	0.7	2.4
02.15 - 02.30	23	63	0.8	2.4
02.30 - 02.45	24	62	0.0	1.3
02.45 - 03.00	24	62	0.0	1.0
03.00 - 03.15	24	63	0.0	0.0
03.15 - 03.30	25	62	0.0	1.0
03.30 - 03.45	24	63	0.0	1.1
03.45 - 04.00	25	63	0.0	1.3
04.00 - 04.15	24	64	0.6	1.5
04.15 - 04.30	25	63	0.7	1.6
04.30 - 04.45	25	63	0.6	1.6
04.45 - 05.00	25	64	0.0	0.0
05.00 - 05.15	25	63	0.0	0.0
05.15 - 05.30	25	62	0.0	0.0
05.30 - 05.45	25	75	0.5	1.2
05.45 - 06.00	25	75	0.0	0.0

e

ANNEXURE 13: WATER QUALITY



INDUSTRIAL TECHNOLOGY INSTITUTE (ITI)

P. O. Box, 787, 363, Baudhaloka Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379850
120/4 A, Vidya Mawatha, Colombo 7, Sri Lanka.
Telephone: 0094 011 2379800 Fax: 0094 011 2379950



TEST REPORT

Reference No: SS 1707063

Report to :

Katahira & Engineers International
No. 2/A, 3/1, CBM House,
Lake Drive,
Colombo 08.

Issued by :

Chemical and Microbiological Laboratory
Industrial Technology Institute

2017/07/05

Page 01 of 04 pages

17/07/05
17/04/05

THE REPORT IS ISSUED SUBJECT TO CONDITIONS MENTIONED OVERLEAF

"PLEASE ADDRESS ALL COVERS TO THE DIRECTOR GENERAL"

The Report is issued under the following conditions:

CONFIDENTIALITY: Strict Confidentiality is maintained in all interactions with clients. The client must not use the Industrial Technology Institute (ITI) name and / or data in any manner, which might cause harm to the institute's reputation and / or business. Under no circumstances is the name of the institute, to be published either alone or in association with that of any other party without prior written approval from the Director General of the Institute.

TEST/CALIBRATION METHODS: In the absence of a specific request from the customer, ITI will adopt any appropriate national/international standard method for conducting the test/calibration. In the absence/non accessibility of standard methods, ITI may adopt any other relevant published test/calibration method or follow a method developed at ITI.

TEST/CALIBRATION REPORT: 1. The report is issued for the information of the customer and shall not be reproduced in total or in part without the prior written authority of the Director General, ITI. Any person or any party who alters or adds or deletes or interpolates any provisions or words or letters or figures shall be liable to legal action. 2. The report is not a Certificate of Quality. It only applies to the item of the specific product/equipment tested/calibrated or to the consignment/lot/batch from which a representative sample has been drawn by ITI. The results shall not be used to indicate or imply that they are applicable to other similar items. In addition such results must not be used to indicate or imply that ITI approves, recommends or endorses the manufacturer, supplier or user of such product/equipment or that ITI in any way guarantees the later performance of the product/equipment. 3. The report furnished by ITI shall not be used in any advertising or sales promotion without the prior written authority of the Director General ITI. 4. The report is limited specifically to the item/s submitted unless otherwise mentioned. 5. Conformities to a standard specifications may be mentioned as required by standard specification on request by the customer. 6. The ITI will not offer any opinion/advise or recommendation with respect to the suitability or otherwise of the item for any application or use. Interpretation of results and professional opinion and recommendations if required should be requested by customer and will be provided for an additional fee paid for by customer. 7. Under no circumstances does the ITI accept any liability or loss or damage caused by misuse of the ITI report. Liability is limited to the fee charged in case of proven negligence by the ITI.

COPIES OF REPORT: Only one copy of the report will be made available to the customer. Extra copies if necessary could be requested by customer at the time of submission of job and will be provided on the payment of an extra charge. Additional copies of the report endorsed by the Authorized signatory could be made available at the request of the customer within a period of 01 year from the date of issue of report, on a written request by the customer and on payment of an extra charge. No third party can obtain such a report without written authorization from the customer to ITI.

QUERIES ON REPORT: Customer queries on reports will be entertained only up to a period of 01 year from the date of issue of the report.

RETENTION OF TEST ITEMS: Perishable items will be destroyed immediately after testing, other items after 01 month from the date of issue of the report.

RETURN OF TEST ITEMS: Test items will be returned to the customer at the sole discretion of the ITI only on a written request by the customer.

LOSS OR DAMAGE: While the ITI exercises every care in respect of work entrusted to the Institute by customers, the Institute is not liable for any loss/damage howsoever caused to person/property, including property entrusted by customer to the Institute whether such loss, damage or delay may have been caused by reasons beyond the control of the Institute or otherwise.

LITIGATION: All costs associated with litigation or dispute for oral or written testimony or preparation of same or for any other purpose related to work provided by the ITI shall be paid by the customer. Such costs include, but are not limited to hourly charges, travel and accommodation, mileage, court fee, legal fees and all other expenses associated with the said litigation and dispute.

CHANGE OF CONDITIONS: ITI may at its sole discretion add to or amend the conditions of this report at the time of issue of the report and such additions or amendments shall be binding on the customer.

July 2014

17/07/05

17/07/05



... Continuation Sheet

ISO/IEC 17025
TL 004 - 01

TEST REPORT

Reference No. SS 1707063

CUSTOMER : Katahira & Engineers International No. 2/A, 3/1, CBM House, Lake Drive, Colombo 08.	Test Item : Water Service requested : Sampling and analysis for parameter requested by the customer's request received on 2017/04/26
Collection Points	: 01 - Bluemandal down stream - 6°57'13.75"N, 79°51'58.43"E 02 - Bluemandal up stream - 6°57'25.33"N, 79°51'49.79"E 03 - Beira up stream - 6°56'4.55"N, 79°50'52.19"E 04 - Beira down stream - 6°56'15.44"N, 79°50'51.52"E (See the annexure)
Sampling Method	: Grab sampling #
Description of test items	: 01 - Turbid bad odour water with some particles 02 - Turbid water with some particles 03 - Turbid water with particles 04 - Turbid water with particles
Quantity of test items	: Approximately 07 litres collected into plastic, glass containers and 200 mL in to a sterilized bottle (each sample)
Sampling carried out by	: Mr. Deshan Perera of ITI. (Customer was informed about the visit)
Witness	: Mr. K. H. Jayasinghe, Environmental Specialist from Road Development Authority
Date & Time of sampling	: 2017/06/16 from 12.00 noon to 1.45 p.m
Temperature of test items at collection	: 01 - 32.2 °C 02 - 29.6 °C 03 - 30.5 °C 04 - 30.2 °C
Date & time of reception of test items at ITI	: 2017/06/16 at 2.55 p.m
Temperature of test items at reception	: 01 - 29 °C 02, 03, 04 - 28 °C (stored in a cooling box)
Condition of test items at reception	: Satisfactory
# SLAB Accredited	
Test dates : 2017/06/16 - 2017/06/21	

Handwritten signatures and dates: 19/6/16, 20/6/16, 21/6/16


 ISO/IEC 17025
 TL 004 - 01

SS 1707063

TEST RESULTS :

Test	Unit	Method	Results				E.U.% (K=2)
			01	02	03	04	
Electrical Conductivity at 25°C	µS/cm	APHA 2510 B	1225 #	640 #	27700	32200	4
Salinity		APHA 2520 B	0.6	0.2	17.0	20.0	-
# Turbidity	NTU	APHA 213 0 B	9.6	12.3	8.5	4.4	20
# pH *		APHA 4500 – H ⁺ B	6.41 at 32.2 °C	6.37 at 29.6 °C	6.83 at 30.5 °C	6.82 at 30.2 °C	-
Temperature,* °C		APHA 2550 B	32.2	29.6	30.5	30.2	-
Dissolved Oxygen	mg/L	APHA 4500 OG	0.6	0.6	0.2	0.4	-
# Total Suspended Solids at 103– 105 °C,	mg/L	APHA 2540 D	15	35	40	45	3
# Total Dissolved Solids at 180° C,	mg/L	APHA 2540 C	550	280	17780	19500	5
BOD ₅ at 20 °C	mg/L	APHA 5210 B	53	101	36	41	-
# COD,	mgO ₂ /L	Modified APHA 5220 D	115	1100	100	75	7
Oil & Grease,	mg/L	APHA 5520 B	5	4	3	3	-
<i>E. coli</i> / 100 mL (MPN)	-	APHA 9221 C : 2012 (22 nd edition)	170	4.3 x 10 ²	5.4 x 10 ³	More than 1.6 x 10 ⁶	-

APHA – Standard Methods for the examination of water and waste water APHA, AWWA , WEF, 2012 22nd edition
 # SLAB Accredited test L.O.D – Limit of detection E.U – Expanded Uncertainty * Measured on site

Analyses were carried out by Mr. D. Perera – Research Scientist, Ms. Y. Pitawela – Senior Research Technologist, Ms. M. Peiris, Mr. E. Hasalaka - Assistant Research Technologists and Ms. R. Weerasuriya – Assistant Research Technologist under supervision of Dr. (Ms). K. Mahathantila - Research Scientist.


 Authorized Signatory

2017/07/05 /ids
Dr. Kushani Mahathantila
 B.Sc., M.Phil., D.Sc. (Japan)
 Research Scientist
 Chemical and Microbiological Laboratory


 Authorized Signatory

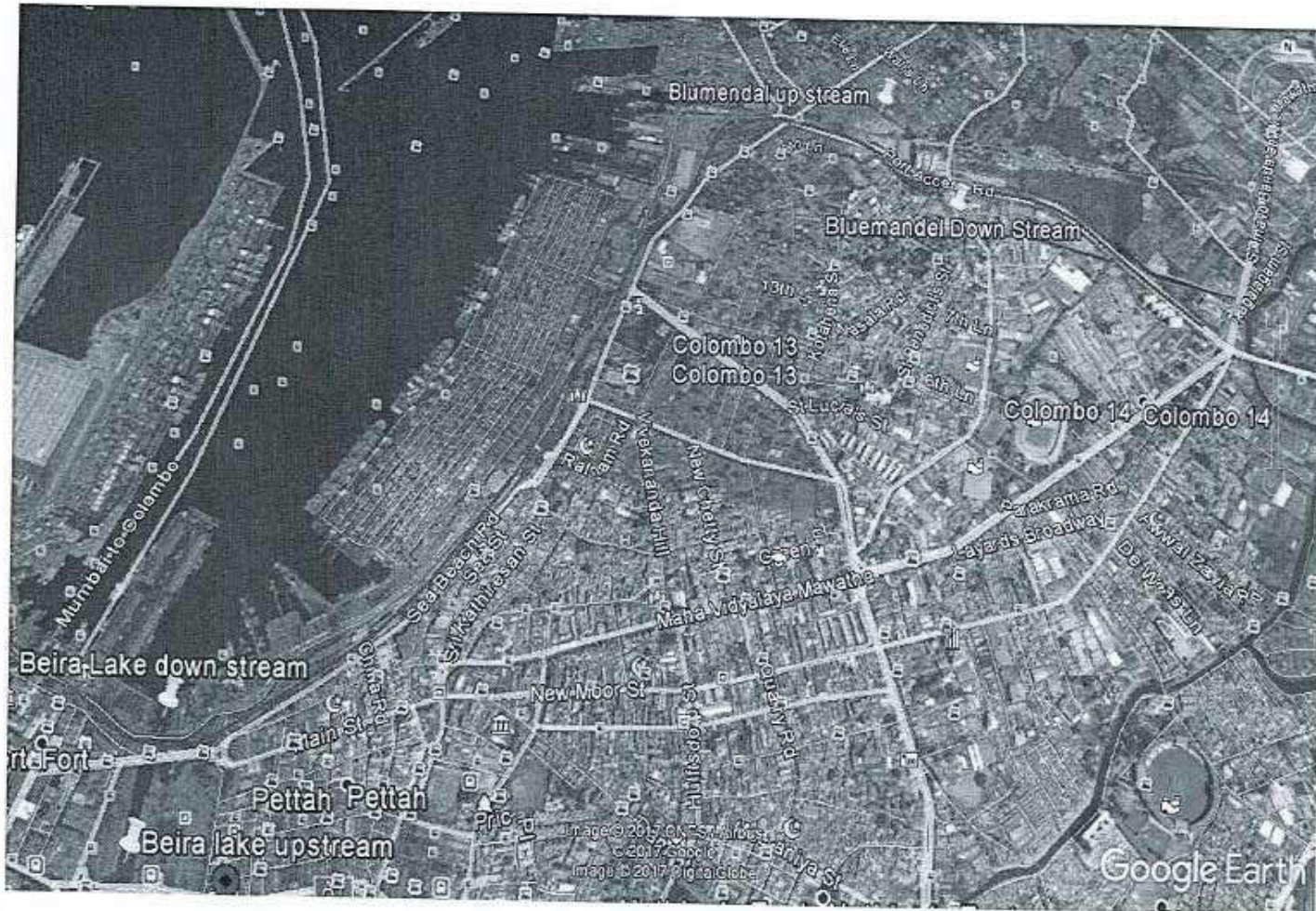
Sajeevika Perera
 B.Sc (Botany, sp, Hons), M.Sc (Microbiology)
 Principal Research Scientist
 Chemical and Microbiological Laboratory
 Industrial Technology Institute

Page 04 of 04 pages



... Continuation Sheet

SS 1707063
Annex 1 : Location Map of water sampling points



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ANNEXURE 14: CURRENT ENVIRONMENTAL STANDARDS AND REGULATIONS

A. Water Quality Standards

Under the regulations of section 32 read with section 23A and 23B of the National Environmental Act No, 47 of 1980 (Gazette Notification No. 1534/18 of 1st Feb 2008), following tolerance limits for the discharge of effluents into Inland surface waters are given. Therefore, all wastewaters discharge from the Asphalt plants, batching plants and other sources of the OCH Northern Section 1 will be confirmed to this General Standards as in the table 01

Table 01: General Standards for Discharge of Effluents into Inland Surface Waters (Schedule I of the Gazette Notification No. 1534/18 of 1st Feb 2008 published under National Environmental Act)

Determinant	Tolerance limit
Total suspended solids, mg/l, max	50
p ^H value of ambient temperature	6.0 – 8.5
Biochemical Oxygen Demand (BOD ₅ in five days at 20 ^o c or BOD ₃ In three days at 27 ^o) mg/l, max	30
Temperature of discharge ^o C, max	Will not exceed 40°C in any section of the stream within 15m downstream from the effluent outlet.
Oils and greases, mg/ l max	10.0
Lead, (as Pb), mg/l, max	0.1
Zinc (as Zn), mg/l, max	2.0
Chemical Oxygen Demand (COD), mg/l, max	250
Ammoniacal Nitrogen (as N), mg/l, max	50
Total residual chlorine mg/l, max	1.0

Tolerance Limits for Domestic Waste Discharged Into Marine Coastal Areas as per National Environmental Act, No. 47 of 1980 Gazette Ordinary No. 1534/18 (2008)

LIST III

TOLERANCE LIMITS FOR INDUSTRIAL AND DOMESTIC WASTE DISCHARGED INTO MARINE COASTAL AREAS

No.	Parameter	Unit Type of limit	Tolerance Limit Values
1.	Total suspended solids	mg/l, max.	150
2.	Particle size of -		
	(a) Floatable solids	mm, max.	3
	(b) Settlaabe solids	µm, max.	850
3.	pH at ambient temperature	-	5.5 - 9.0
4.	Biochemical oxygen demand (BOD ₅ in five days at 20 ^o C or BOD ₃ in three days at 27 ^o C)	mg/l, max.	100
5.	Temperature	°C, max	45°C at the point of discharge
6.	Oils and greases	mg/l, max.	20

B. Air Quality Standards

Below Ambient Air Quality standards were published in Gazette notification (NO.1562 /22 of 15th August2008) under the provision of National Environmental Act of Sri Lanka.

1. Noise Standards

Regulations under National Environmental act for control noise pollution were published in Gazette notification on 21st May 1996 (No. 924/12). Table 3 gives the maximum permissible noise levels during the period of construction as per National Environmental act.

Maximum permissible noise level for the operation of other activities (Prescribed activities) in local authority areas and within silent zones are given in Table 4.

Table 2: National Environmental (Ambient Air Quality) regulations in the Gazette No. 1562/22 Of 15th November 2008.

Pollutant	Average Time	Maximum permissible level	
		$\mu\text{gm-3/m}^3$	ppm
Carbon Monoxide (CO)	8 hr	10000	9
	1 hr	30000	26
	Any time	58000	50
Nitrogen Dioxide (NO ₂)	24hr	100	0.05
	8hr	150	0.08
	1hr	250	0.13
Sulfur Dioxide (SO ₂)	24hr	0.03	0.03
	8hr	0.05	0.05
	1hr	0.08	0.08
Ozone	1hr	200	0.10
Particulate Matter Aerodynamic diameter is less than 10 μm in size (PM10)	Annual	50	0
	24hrs	100	0
Particulate Matter Aerodynamic diameter is less than 10 μm in size (PM2.5)	Annual	25	0
	24hrs	50	0

Table 03: Maximum permissible noise level for construction activities as per in schedule-III (Regulation 4) of Gazette notification on 21st May 1996 (No. 924/12) under the National Environment act.

Permissible Noise Level at boundaries in $L_{\text{Aeq,T}}$ where the source of noise located	Day Time (06.00-21.00) 75 dB(A)	Night Time (21.00-06.00) 50 dB(A)
-----------------------------------------------------------------------------------------------	------------------------------------	--------------------------------------

Table 04: Maximum permissible noise levels for prescribed activities as per in schedule-IV (Regulation 7 (a)) of Gazette notification on 21st May 1996 (No. 924/12) under the National Environment act.

Area	Maximum Permissible Noise Levels at Boundaries in $L_{\text{Aeq,T}}$	
	Day time	Night time
Rural Residential Area	55	45
Urban Residential Area	60	50
Noise Sensitive Area	50	45
Mixed Residential Area	63	55

Area	Maximum Permissible Noise Levels at Boundaries in $L_{Aeq, T}$	
	Day time	Night time
Commercial Area	65	55
Industrial Area	70	60

Interim Standards for vibration control of the construction activities, vehicle movements, and rock blasting operations are as per the Table 5

Table 05: Maximum permissible vibration levels for construction activities

Activity	Category of the Structure	Frequency/type	Permissible Vibration in PPV (mm/Sec.)	Air Blast Over Pressure (ABOP) in dB (L)
Construction activity / vehicle movements	Type 3	10 – 50 (Continuous)	2.0	
Rock blasting with multi bore holes and with delay detonators	Type3	Impulsive	5.0	115

Activities prescribed by the Central Environment Authority to obtain Environmental Protection License (EPL) are given in Table 6. Separate activities need separate Environment Protection License Scheme (EPLS) and should obtain the EPL before commencing the actual operations at the site.

Table 6: Activities that prescribed by CEA to obtain EPL during construction stage.

Activity number as at the gazette No.1533/16 dated 25.01.2008	Prescribed Activity
15 (A category)	Operations of asphalt plants
49 (A category)	Operations of concrete batching plants where having daily aggregate capacity 50 m ³ or more.
56 (A category)	Metal Crushing plant where having aggregate daily capacity 25 m ³ or more. Accommodations. Motor pool Yards
29 (B category)	Hostels and similar dwelling places (25 or more boarders and less than 200)
47 (A category)	Mechanical yards
70 (A category)	Vehicle service/container yards

ඔබේ යොමුව
உமது தொப்பு
Your Ref.

අපේ යොමුව
எமது தொப்பு
Our Ref.

දිනය
திகதி
Date

08/EIA/Trans/03/2014

25 August 2014

මධ්‍යම පරිසර අධිකාරිය
மத்திய சுற்றாடல் அதிகாரசபை
Central Environmental Authority



"පරිසර පීඨය", 104, ඩෙන්සිල් කොබ්බෑකඩුව මාවත, බත්තරමුල්ල, ශ්‍රී ලංකාව.
"பரிசர பியச", 104, டென்சில் கொப்பையகடுவ மாவத்தை, பத்தரமுல்ல், ஸ்ரீ லங்கா.
"Parisara Piyasa", 104, Denzil Kobbekaduwa Mawatha, Battaramulla, Sri Lanka.
Web : www.cea.lk

Project Director
Southern Highway Extension towards Colombo Project
Road Development Authority
No 25, Laxapana Mawatha
Jayanthipura
Battaramulla.

EIA for the Proposed Elevated Highway along Baseline and Port access Road under the Southern Highway Extension towards Colombo Project

This has reference to your letter No: RDA/ADB/HSETC/EIA/36 dated 13/08/2014 regarding the above project.

This is to inform you that the noise standards for Elevated Urban Highways are not available for Sri Lanka and enactment of such standards take a long time.

Therefore, we wish to provide you with the following guidelines;

Guideline Values:

1. Noise level shall not exceed 70 dB (A) as L Aeq. 1h during 06.00 hours to 22.00 hours at the point 5 m away from the ROW or where the affected party is located. The measurement shall be carried out during the worst hour of the above time period.
2. Noise level shall not exceed 65 dB(A) as L Aeq.1h during 22.00 hrs to 06.00 hours at the point 5 m away from the ROW or where the affected party is located. The measurement shall be carried out during the worst hour of the above time period.
3. Noise level shall not exceed 60 dB (A) as L Aeq. 1h during 06.00 hours to 22.00 hours inside the buildings of hospitals and schools. The measurement shall be carried out during the worst hour of the above time period.
4. Noise level shall not exceed 55 dB (A) as L Aeq. 1h during 22.00 hours to 06.00 hours inside the buildings of hospitals and, schools. The measurement shall be carried out during the worst hour of the above time period.


Chairman	Tel : 2872361, 2872348 Fax : 2872347	Director General	Tel : 2872359 Fax : 2872680	Gen. Office	Tel : 2872278, 2875447, 7877277-280, 2873448 Hot Line : 2888999	Media Unit	2873449
Deputy Director Generals	HRD, Admin & Finance Division Tel : 2865298 Fax : 2872301	Env. Pollution Control Division	Tel : 2873453 Fax : 2872005	Env. Mgt & Asses. Division	Tel : 2872388 Fax : 2872286	Env. Edu. & Awareness Division	Tel : 2872287 Fax : 2872609
Directors	2873697 (Admin) 2872301 (HRD), 2877280 (Finance) 2872801 (Admin), 2863988 (Finance)	2873492 (EPC), 2872806 (Law) 2862335 (WM)	2872346 (NRM), 2876643 (EIA) 2867263 (R&D)	2869266 (EBA) Fax : 2872609	2872804 (Legal) (Western Province) Tel : 2862831 Fax : 2862804		



In these guidelines,

1. "ROW" means right of the way for proposed elevated highway
2. "Worst hour" means the hour of the relevant period of the date of measurement in which the highest noise level is recorded.
3. Noise levels shall be measured in terms of L_{Aeq}, (T) by Integrating Averaging Sound level meter complying with type 2 – of BS 6698: 1986 (IEC 804) or any other measuring equipment recommended by the Central Environmental Authority.
4. Where there is no space to carry out noise level measurement at the required location following the noise measuring guidelines, the noise level measurements shall be made at the most appropriate/representative location to which the affected party is located.

With regard to vibration, interim standards which are being practiced at present will be applicable for this project. A copy of the interim standards is attached herewith for your easy reference.


G. Jayasinghe
Deputy Director General (EM&A)
CENTRAL ENVIRONMENTAL AUTHORITY

CC : Deputy Director General (EPC) / CEA

emaanu\e\mydoc\hgs\highway noise guideline HSFTC Project Director

ANNEXURE 15: CLEARANCE FROM THE DEPARTMENT OF ARCHEOLOGY



සමස්ත අධ්‍යාපන හා මහාමාර්ග අමාත්‍යාංශය
உயர் கல்வி மற்றும் நெடுஞ்சாலைகள் துறைமுகம்
MINISTRY OF HIGHER EDUCATION & HIGHWAYS



මහලු මාර්ග සංවර්ධන ප්‍රවර්ධන
இலங்கை சாலை மேம்பாட்டு அதிகார சபை
ROAD DEVELOPMENT AUTHORITY

ප්‍රවහන ව්‍යාපෘති සැකසීමේ පහසුකම් ව්‍යාපෘතිය
போக்குவரத்துத் திட்டங்கள் தயாரிப்படுத்தலுக்கான ஏற்பாடு
TRANSPORT PROJECTS PREPARATORY FACILITY

5 වන මහල- 'A' අටයන්නය, කෙට්ටිපාය පළමු අදියර, බත්තරමුල්ල, ශ්‍රී ලංකාව
5 වන மாளிகை, பகுதி 'A', செத்சிரிபாய கட்டிடம் 1, பத்தரமுல்ல, இலங்கை
5th Floor-Wing 'A', Sethsiripaya Stage I, Battaramulla, Sri Lanka

My No: RDA/TPPF/PAEH/CON/17/47

Date: 26th April 2017

Mr.Ryoji Tsukamoto
Team Leader, KEI-NKI JV,
No 2A, 3/1, CBM House,
Lake Drive,
Colombo 08.

Dear Sir,

ADB FUNDED TRANSPORT PROJECT PREPARATORY FACILITY (TPPF)
SASEC PORT ACCESS ELEVATED HIGHWAY (PAEH) PROJECT
CONSULTANCY SERVICES FOR DETAILED DESIGN OF PORT ACCESS ELEVATED HIGHWAY

Subject: Archeological Concern

The letter from the Department of Archeology obtained during Feasibility Study is annexed herewith for your incorporation please.

Yours faithfully,

A.H.M. Nizar
Project Coordinator
Transport Project Preparatory Facility
Road Development Authority

RECEIVED	
29-04-17	*
Port Access Elevated Highway Project	C A
Team Leader	
Structure Design Eng.	✓
Highway Design Eng.	✓
Geotechnical Eng.	✓
K. Fujikawa	✓
Env & Soc Work	✓

V:\TPPF\PAEH\LETTERS\2017\CONSULTANT\RDA-PAEH-CON-17-47.DOCX

General: +94 0112889740 Project Director: +94 112889636 Engineers: +94 112889433 Accountant: +94 112889901 Fax: +94 112889947 Email: tppfmad@gmail.com

පුරාවිද්‍යා දෙපාර්තමේන්තුව
 Telephone Nos. 011-2696255
 011-2696250
 Fax
 Email : arch@diamond.lanka.net
 web site : www.archaeology.gov.lk



පුරාවිද්‍යා දෙපාර්තමේන්තුව
 දිග්‍රාලනීය නිලධාරීන්ගේ
DEPARTMENT OF ARCHAEOLOGY
 ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජය
 Government of the Democratic Socialist Republic of Sri Lanka

මාගේ අංකය
 My No. } 4/EXP/AJA/44P/2014
 ඔබේ අංකය
 Your No. }
 ලිපි ලේඛන ප්‍රකාශන මධ්‍යස්ථානය, කොළඹ 7,
 Sir Marcus Fernando Mawatha,
 Colombo 7.
 දිනය
 Date } 2014-12-01

දුරකථන
 telegrams } පුරාවිද්‍යා
 Puravid.

අධිකාරී
 2014-12-01
 03 DEC 2014
 (SHETC & SHETC Approval)

ව්‍යාපෘති අධ්‍යක්ෂ,
 සදරන් හයිටේ ඊක්ස්ප්ලෝරේෂන් ඩ්‍රිලින්ග් කලමනාකරු,
 මාර්ග සංවර්ධන අධ්‍යක්ෂ,
 කො. 25 ලක්ෂ්‍යාන මාවත,
 පස්වැව්,
 බත්තරමුල්ල.

පුරාවිද්‍යා හානි ඇගයුම් පරීක්ෂණය - දකුණු අධිකරණ මාර්ගය කොළඹ දෙසට දිරස කිරීම අදියර I

උසස් කරුණට අදාළව මා ඇමතු මගේ සමාන RDA/ADB/SHETC/EIA/10 හා 2014.05.23 දිනැති ලිපි හා සබැඳි.

02. එයට අනුව මාගේ නිලධාරීන් විසින් ස්ථානය පරීක්ෂාකර බලා මාවත වාර්තා කර ඇත. එම වාර්තාවට අනුව දක්ෂ අධිකරණ මාර්ගය කොළඹ දෙසට දිරස කිරීමේ ව්‍යාපෘතියේ අදියර I සඳහා අපගේ සහන සඳහන් කොන්දේසි සටහන් නිර්දේශ ලබාදෙන බව කාරුණිකව දන්වා සිටිමි.

කොන්දේසි -

- I. යෝජිත භූමිය තුළ පමණක් ව්‍යාපෘතිය ක්‍රියාත්මක කළ යුතුයි.
- II. පොළොව යට කැණීමේදී හෝ වර්ගයක මාර්ගය ගමන් කිරීමේදී හෝ ඕනෑම අවස්ථාවක මෙම දෙපාර්තමේන්තුවේ නිලධාරීන්ට භූමිය පරීක්ෂාකර බැලීමේ අවකාශ තිබිය යුතුය.
- III. ව්‍යාපෘතිය ක්‍රියාත්මක කරන අවස්ථාවේදී යම්කිසි පුරා-සංවිකාසක් හමුවුවහොත් ඒ බව වහාම පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල් වෙත හෝ සහකාර අධ්‍යක්ෂ (බටහිර) වෙත දන්වා සිටිය යුතුය.

එන්. ඩී. කරුණාංග
 සහකාර අධ්‍යක්ෂ
 (නිර්වේද දේශන ව. න.)
 පුරාවිද්‍යා දෙපාර්තමේන්තුව
 කොළඹ 07.
 වැ. අ. සහකාර අධ්‍යක්ෂ (නිර්වේද දේශන)

අ/කමැල් - ආචාර්ය සහකාර ජ්‍යෙෂ්ඨ විද්‍යාඥයා
 පුරාවිද්‍යා අධ්‍යක්ෂ ජනරාල්

පිටපත -

01. සහකාර අධ්‍යක්ෂ (බටහිර) - දැන ගැනීම සඳහා

TRANSLATION

Department of Archeology

Reference 4/exp/aia/wp/2014
2014.12.02

Project Director.
Southern Highway towards Colombo Project.
Road Development Authority.
No 25, Lakshapana Mawatha,
Jayanthipura,
Baththaramulla.

Survey on damages to Archeological Places. Southern Highway towards Colombo
Project- Stage 1.

This refers to your letter dated 12.02.2014 and No- RDA/ADB/SHETC/EIA/10

According to your request officers from our department has surveyed the site and submitted a report. According to the report you can continue the above-mentioned project subject to undermentioned condition.

Conditions.

- 1) Excavations should be implemented only within the given project site.
- 2) Our officers have the right to examine any excavations or construction activity.
- 3) In case of finding any archeological value , it should be immediately inform the DG of Archeology or Assistant Director- West.

Signature.
N.B.Karawgahanga.
Assistant Director.
Department of Archeology
Colombo. 7

Signed by
Dr. Senarath Dissanayake
Director General of Archeology

ANNEXURE 16: GENERAL GUIDELINE FOR TREE REMOVAL AND REPLANTING ACTIVITIES OF THE PROJECT.

The trees to be removed are not under any protected area system and are in a densely human dominated landscape. These are no trees situated in the private properties within the required corridor which will have to be compensated for in monetary terms. No of trees of each species identified along the project corridor is provided in the paragraph 229 of the final IEE report. Contractor is requested to prepare detailed method of statement for trees removal before commencing the activity. The following recommendations shall be considered when preparing the tree removing plan.

- The existing trees along the roadside should not be removed if they are not affecting the road safety of the location.
- All trees designated for removal should be counted and marked to avoid excessive cut and provide proper treatment to the remaining trees. The care should be given to the trees which are not subject to removal.

Some construction works will require tree removal or trimming that has not been included in the design. Where additional impacts to trees are proposed, the following process should be followed:

- The site engineer should notify the contractor's Environmental specialist of the project about the tree and the specific location.
- The contractor's Environmental specialist should confirm that the tree (or other vegetation type) is not heritage listed, a habitat tree nominated for retention or protected under relevant legislation and is legally able to be removed and/or trimmed.
- The contractor's Environmental specialist should notify the Employer through the consultants Environmental Specialist for advice on management options and where possible take and organize a site visit;
- If the tree is to be removed or trimmed, the contractor's Environmental specialist will contact the site engineer to undertake the removal or trimming of the tree(s) as instructed by the employer;
- Site engineer should await confirmation from the contractor's Environmental specialist prior to re-commencing works around the tree(s).
- The storage of soils/material under trees and compact soil, will limit water and oxygen uptake, damage roots and cause tree death. Therefore prior to the commencement of works near trees, the contractors Foreman or other construction personnel should determine areas where machinery, materials and equipment can be stored that are outside the drip line of trees.

Recommendations for replanting of trees.

The main objectives of replanting are:

- Improving the landscape;
- Protection of surrounding habitat in addition the plantation may positively impact the environment and recreation value of the area.

The following recommendations may be taken into consideration for preparation of trees planting action plan for identified areas of the road alignment and the

- There should not be any new trees planted too close to the roadsides, as it will affect the visibility of the vehicle drivers on the road.
- Therefore, the contractors replanting program shall be approved by the employer.

- When selecting locations for planting trees, religious places, school premises or any suitable public place which is located at close vicinity can be considered according to their request or consent.
- School children or the people in public or private organizations of the area can be participated for tree planting program.
- Only local species of trees adjustable to the surrounding ecosystems should be planted.
- Proper treatment and frequent watering will be provided for the trees planted.
- Tree planting program should be completed at the end of the project (by the completion of project activities).
- When scheduling the replanting program, the seasonal variations should be considered (eg. Rainy periods and to avoid Dry periods).
- Effective monitoring schedule should be incorporated to the replanting program and timely implemented.
- Replanting and monitoring progress will be reported with photographic evidence in the related monthly and by annual reports.

ANNEXURE 17: QUALITY OF WATER GOVERNMENT NOTIFICATION (1534/18 2008
FEBRUARY GAZETTE)

ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජයේ ගැසට් පත්‍රය
ಶ්‍රී ලංකා
The Gazette of the Democratic Socialist Republic of Sri Lanka
EXTRAORDINARY

අංක 1534/18 - 2008 කෙසෙසවාරි 01 වැනි සිකුමදා - 2008.02.01
No. 1534/18 - FRIDAY, FEBRUARY 01, 2008

(Published by Authority)

PART I : SECTION (I) — GENERAL
Government Notifications

L.F.S. 491

NATIONAL ENVIRONMENTAL ACT, No. 47 OF 1980

REGULATIONS made by the Minister under Section 52 read with Section 23A and 23 B of the National Environmental Act, No. 47 of 1980.

PALLI CHANDRICK KODIRAJA,
Minister of
Environment and Natural Resources.

Columbo,
14th January, 2008.

Regulations

1. These Regulations may be cited as the National Environmental (Protection and Quality) Regulations, No. 1 of 2008.

PART I

DATE OF ENVIRONMENTAL PROTECTION LICENSE FOR EMISSION OR DISCHARGE OF WASTE

2. No person shall, discharge, deposit or emit waste into the environment or carry on any prescribed activity determined by an Order made under Section 23A of the National Environmental Act, No. 47 of 1980 in circumstances which cause or are likely to cause pollution, or noise pollution, otherwise than -

- (a) under the Authority of a license issued by the Central Environmental Authority (hereinafter referred to as "the Authority"); and
- (b) in accordance with the such standards and criteria specified in Schedule I hereto, in respect of the specified industries.

3. Notwithstanding anything contained in regulation 2, the Authority may, by a direction issued under regulation 12, impose more stringent standards and criteria than those specified in Schedule I hereto in respect of any prescribed activity, having regard to the need to protect the receiving environment.

10A විනෝදය : (I) වර්ගය - ශ්‍රී ලංකා ප්‍රජාතාන්ත්‍රික සමාජවාදී ජනරජයේ දැනී විවේචන කැඟලි පත්‍රය - 2008.02.01
PART I - Sec. (I) - GAZETTE EXTRAORDINARY OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA - 01.02.2008

LIST III (Contd.)

TOLERANCE LIMITS FOR INDUSTRIAL AND DOMESTIC WASTE DISCHARGED INTO MARINE COASTAL AREAS

No.	Parameter	Unit Type of limit	Tolerance Limit Values
7.	Phenolic compounds (as Phenolic OH)	mg/l, max.	5
8.	Chemical oxygen demand (COD)	mg/l, max.	250
9.	Total residual chlorine	mg/l, max.	1.0
10.	Ammoniacal Nitrogen (as N)	mg/l, max.	50
11.	Cyanide (as CN)	mg/l, max.	0.2
12.	Sulphides (as S)	mg/l, max.	5.0
13.	Fluorides (as F)	mg/l, max.	15
14.	Arsenic (as As)	mg/l, max.	0.2
15.	Cadmium (as Cd)	mg/l, max.	2.0
16.	Chromium, total (as Cr)	mg/l, max.	2.0
17.	Chromium, Hexavalent (as Cr ⁶⁺)	mg/l, max.	1.0
18.	Copper (as Cu)	mg/l, max.	3.0
19.	Lead (as Pb)	mg/l, max.	1.0
20.	Mercury (as Hg)	mg/l, max.	0.01
21.	Nickel (as Ni)	mg/l, max.	5.0
22.	Selenium (as Se)	mg/l, max.	0.1
23.	Zinc (as Zn)	mg/l, max.	5.0
24.	Pesticides	mg/l, max.	0.005
25.	Organo-Phosphorus compounds	mg/l, max.	1.0
26.	Chlorinated hydrocarbons (as Cl)	mg/l, max.	0.02
27.	Faecal coliform	MPN/100ml, max.	60
28.	Radio Active Material :		
	(c) Alpha emitters	micro curie/ml, max	10 ⁴
	(d) Beta emitters	micro curie/ml, max	10 ⁷

Note 1: All efforts should be made to remove unpleasant odour and colour as far as practicable.

Note 2: These values are based on dilution of effluents by at least 8 volumes of clean receiving water. if the dilution is below 8 times, the permissible limits are multiplied by the 1/8 of the actual dilution.