PRE FEASIBILITY STUDY REPORT

For: TNPA, Port of Durban

Project Name: Bayhead and Langeberg Road – Civil and Electrical Infrastructure Upgrade
Project Number: TBC

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Pre-Feasibility Study Report

PREFACE

A Pre-Feasibility Study (PFS) is a precursor to a Feasibility Study (FS). Its main purpose is to document the scope, procedure and outcomes of FEL-2 in a clear and consistent manner, in order to facilitate the quick and accurate review and evaluation of those outcomes. It also provides a detailed summary of the process and various actions taken for record purposes.

The terms of reference should make it clear as to whether the Pre-Feasibility Study is intended to:

- Present a range of options and prepare a PFS on each,
- Investigate a range of options, but recommend and document only one, or
- Undertake a PFS and prepare documentation on an already identified option.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The upgrade of Bayhead and Langeberg roads project is located within the Durban Port area, within the eThekwini Municipality in the KwaZulu-Natal Province. The volume of road freight has significantly increased over the past few years placing mounting pressure on transportation infrastructure, leading to traffic congestion. In particular, the road network within the eThekwini region, especially in close proximity to the Port of Durban, experiences severe congestion with no viable alternatives. The consequences thereof are longer travel times, higher operating costs, an increase in gas emissions, employees arriving late for work, deliveries being delayed, missed appointments, and higher transportation costs. These factors inevitably impact on communities around the port and also have a negative impact on the economy. The port of Durban Decongestion Task Team which comprises of all role players (Transnet Operating Divisions, Terminal Operators, Truck Associations, Shipping Lines, Cargo Owners, Local Authority etc.) in the freight movement within the port has been setup to collaborate on efforts to mitigate congestion.

The decongestion Task Team has three major focus areas which include:

- Understanding stakeholders outside of Transnet and devising interventions that they can embrace, that will help them better synchronize their port activities with role players;
- Improving Transnet efficiencies across all the operating divisions related to the port;
- Long term interventions which entail development projects aimed at further minimizing port and road congestion.

In line with the third item above, the purpose of this project is to mitigate this congestion through the upgrading of Bayhead Road and Langeberg Roads by lane widening. Surface failures have also been noted on the road. It is assumed to be as a result of heavy traffic on the roads, mainly trucks. The project will also look into assessing and upgrading of the aging infrastructure in conjunction with alleviating the congestion on Bayhead road and Langeberg road.

1.1. Introduction

The eThekwini Transnet Integrated Freight Transport Systems Plan' (ETIFTSP) aims for Transnet SOC Ltd. and the eThekwini Municipality to jointly develop a conceptual integrated, sustainable transport system plan in the South Durban Basin (inclusive of all port areas) that supports the port developments, city growth and enhances the region for businesses as well as residents. The study builds on the work that Aurecon previously undertook for the eThekwini Transport Authority for the establishment of a new Arterial Route into the Port of Durban (2014). The objective of this exercise was to identify bottlenecks on the current road network and propose short-term road upgrades in mitigation of these bottlenecks. The study included:

- Undertaking traffic surveys where required
- Commission traffic counts to fill in gaps in the existing available data
- Developing an AIMSUIN traffic Simulation Model for the base year (2014) and horizon year (2020) traffic conditions.
- Identification of bottlenecks on the current road network using the simulation model in conjunction with onsite observations.
- Propose short-term road upgrades to mitigate the congestion problems identified in the modelling process.

The 'Integrated Freight and Logistics Strategic Framework and Action Plan for eThekwini was adopted as a point of departure for the study; with the strategic recommendations forming the foundation for investigations into the freight infrastructure, operations, land use proposals and regulatory requirements. The Upgrade of the Bayhead and Langeberg Road was one of the infrastructure upgrades recommended on the road network to mitigate the congestion problems identified in the traffic modelling.

In 2020 TNPA engineering team completed a prefeasibility study for this project which was built up from the above mentioned studies.

1.2. Study Methodology

The study methodology and the stages of the prefeasibility study were as follows:

a) Traffic Loading Studies

Traffic counts were conducted by Consultants in February 2013, November 2014 and February 2015. The counts were conducted over 12 hour periods from 06:00 to 18:00 at the Bayhead and Langeberg Road Intersection as well as South Coast-, Crabtree and Bayhead Road intersection.

The traffic data provided for the Bayhead area included summaries of the following data:

- Existing 2013 12 Hour traffic volumes
- Existing AM peak hour traffic volumes
- Predicted 2020 AM peak hour traffic volumes
- Predicted 2035 AM peak hour traffic volumes

A sensitivity analysis was conducted on the expected traffic growth rates and the equivalent E80 factors in order to accurately estimate the expected traffic volumes over a design period of 20 years. The traffic growth rates ranged from 2% -6%. The expected traffic volumes was used to calculate the pavement category for the proposed additional lanes and slip lanes along Bayhead road and at two main intersections respectively. The volumes on Bayhead Road resulted in an ES100 design traffic loading class, which is the highest pavement category class.

b) Visual Condition Assessment

A visual condition assessment was conducted by TNPA Engineering Team on Bayhead and Langeberg Road in 2021. The Visual Assessment was classified according to TMH 9 visual assessment for flexible pavements, which looks at surfacing, structural and functional categories for the assessment.

Bayhead Road

The overall condition of Bayhead Road is poor due to the occurrence of severe structural defects. The degree and extent of the crocodile cracking and rutting on the wheel paths indicates fatigue on the pavement layers, due to excessive loading from the heavy vehicles using this road. There is an existing storm water system, however, the majority of the inlets are damaged with the storm water manholes and pipes blocked.

A pavement reconstruction to strengthen or upgrade the pavement structure is recommended to effectively carry the heavy vehicle traffic using the road. Furthermore, additional traffic lanes are recommended to ease the current traffic congestions at Bayhead road and to accommodate future traffic growth.

Langeberg Road

The pavement structure of the Langeberg road is still in good condition, as the road was rehabilitated in 2016. However, the drainage system is very poor and needs urgent attention. The storm water manholes and pipes are blocked and needs to be flushed out to ensure a functional storm water system.

c) Pavement Investigation and Testing

Geotechnical investigations were conducted in 2013 for the South Port Roads combined Project, which included the Bayhead and Langeberg Road upgrade. Fieldwork was performed and involved manual excavation and logging of inspection pits and the probing of CBR Dynamic Cone Penetrometer tests, to investigate the existing road layer works and subgrade, as well as the in-situ materials in the areas to be widened. In addition, the objective of the investigations was to identify problematic areas, such as low bearing capacity soils, unstable materials and the presence of ground water.

Laboratory test work conducted included the following:

- Moisture Contents (SANS 3001 –GR20);
- Road Indicators: Sieve analysis and Atterberg limits (SANS 3001-GR1 and SANS 3001-GR11);
- Determining of MDD and OMC, and CBR (California Bearing Ratio) (SANS 3001-GR30 and SANS 3001-GR40), for COLTO G classification.

No major geotechnical flaws were noted along the route of the proposed upgrade to Bayhead and Langeberg Road.

The geology of the site comprises mainly Harbour Bed sands which are overlain by hydraulic Fill and in the roads an engineered fill for the road pavement layers. Samples of the existing road layers were taken and have been found to be suitable for reuse in the road, with suitability ranging

from subbase to selected layers of subgrade. The majority of the material adjacent to the road was found to be suitable as selected layers and subgrade. The hydraulic fill varies in quality from G7/G8 to G4/G5, whilst the Harbour Bed sands could be re-compacted to G7/G* materials. Clayey and silty soils were found in pits along Bayhead Road adjacent to the canal and were found to be unsuitable as subgrade.

d) Identification of Existing Structures and Underground Services

Railway Lines

Existing railway lines under the Congela Bridge, at Crabtree Road's intersection with Bayhead road will be affected by the proposed additional slip lane. This will require retaining structures to prevent the fill embankments from extending onto an existing railway line. The three railway lines belong to PRASA, TNPA and TFR. These affected stakeholders will be consulted during FEL 3 phase when the actual impact is determined, and their inputs will form part of the final design.

Structures

There are three bridge structures identified along Bayhead Road, in which one is constructed above railway lines, and the other two are constructed over existing stormwater canals. Langeberg Road has one bridge which is constructed above a railway, serving the Container Terminal.

Underground Services

The known underground services have been identified from TNPA drawing archives. In addition, a survey will be conducted during FEL 3 before design stage to identify all underground services around the Construction area. During FEL 3, owners of the exposed and impacted services will be consulted to confirm the services and a way forward will be determined on how the services will be accommodated on the proposed design. The services that have been identified at this stage are as follows:

- Storm water;
- Communication services;
- Electricity services;
- Water services.

e) Preliminary Drawings

Preliminary drawings for the proposed widening and upgrade of Bayhead and Langeberg Road were developed and attached as Appendix-A on this report. The drawings illustrate the following scenarios:

- The Bayhead/Langeberg Road intersection will be reconfigured by the addition of a 3.5m wide left–turn slip lane on Bayhead Road towards the Transnet Entrance gates. The existing left turn lane, together with the addition of another lane, will be assigned as two continuous dedicated freight lanes. The existing through–lanes and right turn lane on Bayhead road approach will remain as they currently are.
- The Langeberg Road approach towards Seafarer Road will be simplified by introducing a three-lane configuration. This will consist of a left-turning lane and two through lanes. Additional painted islands will be added on Langeberg Road, together with addition of a simplified traffic island at Seafarer Road, in order to conform to design standards, and to simplify the layout and efficiency of the junction.
- A through-lane at Langeberg Road will be added. This will eliminate the current situation towards Pier 2 entrance where traffic changes lanes to oncoming traffic due to staging of trucks at Pier 2 entrance approach.
- The required configuration at Bayhead Road and South Coast Road intersection, consists of two right-turn lanes, two through lanes, and a new left-turn slip lane. As the existing median and lane drop at Bayhead Road is sufficient to accommodate the proposed lane configuration, the only addition to Bayhead is a 3.5 m lane drop consisting of a 1:15 taper, 75m stacking length and a slip lane. Pedestrian Facilities along this approach and crossing are required, implemented by means of pedestrian crossing lines at the intersection.
- The Crabtree Road upgrades will include a right turn lane, two through lanes, and a new left turn lane. The new left turn lane will be constructed by widening Crabtree road. This will require retaining structures to prevent the fill embankments from extending onto an existing railway line next to Crabtree Road, which crosses under Bayhead Road.

1.3. Summary of Analysis

The studies that were conducted which included Traffic loading studies for current and estimated future traffic growth, geotechnical conditions and the current pavement condition were analysed to determine possible options to mitigate the current challenges along Bayhead Road and Langeberg Road. The analysis also considered how Bayhead Road and Langeberg Road were going to feature on the long term plans of the South Port Operations.

1.3.1 Options Identified

The following options were identified and investigated during the prefeasibility study and option B is the preferred option:

a) Do Nothing – Maintain the Status Quo

Should this option be chosen then the traffic congestion and deterioration of the road infrastructure will persist, and the road will become unsafe for the road users.

b) Bayhead and Langeberg Road Upgrade

This option will entail road widening at main intersections and provide additional lanes to relieve the current traffic congestion and cater for future traffic growth. Existing road pavement structures will be re-designed to extend the pavement design life. This option will eliminate the current traffic congestion and cater for future traffic growth.

c) Rehabilitation of Bayhead and Langeberg Road- Mill and Replace

This option will provide a temporary solution for the poor road condition, as it will only be dealing with the surface distress. However, the whole pavement structure at Bayhead road needs to be strengthened to accommodate the current traffic and anticipated traffic growth. This option will still not resolve the current traffic congestions.

1.3.2 Constraints and Limitations

The main constraint of the preferred option is that, the Bayhead Road is the main access link to the South Port Operations, meaning access to Durban Container Terminal, Pier 1 and Island view is through the Bayhead Road. Therefore, the construction will have to be done around operations

and a detailed traffic management plan will need to be developed to ensure there is minimum disruptions to port operations due to this project.

1.3.3 Costs

The cost estimate for the Bayhead and Langeberg road upgrade is indicated on Table 1 below:

Table 1: Cost estimate for Bayhead and Langeberg Road Upgrade

	Detailed Design Stage	**Implementation stage**	**Total**
Direct Costs	R 16 050 400.00	R 115 176 045.00	R 131 226 445.00
Indirect Costs	R2 407 560.00	R 31 097 532.35	R 33 505 092.35
Contingency	R1 605 040.00	R 11 517 604.30	R 13 122 644.30
Borrowing Costs	R2 206 930.00	R 15 779 118.17	R 17 986 048.17
Total	**R 22 269 930,00**	**R 173 570 300**	**R 195 840 230**

1.3.4 Project Schedule

The key milestones for the project are indicated on Table 2 below:

Table 2: FEL 3 Project Schedule

No.	**Milestone**	**Date**
1	Technical Review	April 2021
	Gate Review	July 2021
2	TNPA Investment Forum	November 2021
3	TNPA CAPIC	December 2021
4	Advertise Tender for Remainder of FEL 3	March 2022
5	Tender Award	May 2022
6	Completion of Detailed Engineering	February2023

The project team has estimated to obtain execution funding by September 2022 and the completion and project closeout is estimated to be December 2025.

1.4. Objectives and likely scope

1.4.1 Relieve Traffic Congestion

The current traffic congestion along Bayhead Road has become a major problem. On most days there is a backlog of container trucks along Bayhead Road resulting from operational processes into the terminals not coping with the number of trucks arriving. In order to relieve this backlog this project must provide key relief measures to lessen the congestion of traffic;

- To provide additional lanes to cater for the increased traffic volumes.
- Widening of the two Main intersections for easy traffic flow.
- Provide sidewalks where necessary for safety of pedestrians.

1.4.2 Rehabilitation of Road

Bayhead road has reached the end of its design life and therefore, the goal of this project is to reconstruct the pavement and provide a structure that will be able to carry the anticipated traffic growth over the next 20 years. Langeberg road is relatively good condition, however the lane capacity of the road has to be increased in order to meet the future traffic volume demands.

1.5. Risks

A risk register was developed for the implementation of the project and the following are the high level risks.

Table 3: High level Risk from the risk register

Risk	Causes	Consequences	Mitigation Measures
Delays in project executions	• Poor Stakeholder engagement. • Prolong Governance Processes • Adverse weather	• Cost Implications • Brand reputation • Congested Roads	• Project Schedule • Project Progress Meetings
Lack of collaboration between Municipality and Transnet	• Misalignment on MOU and Strategies between Municipality and Transnet. • Lack of engagement between relevant parties.	• Project Delays • Congested Roads	Estuary Committee Meeting with Municipality

	• Changes in Municipality Political Leadership		
Traffic congestion and delays on Bayhead and Langeberg roads	• Poor Traffic Management Plan • Unclear detour signage's	• Project delays • Costs implications • Brand reputation • Loss of revenue	• Traffic Management Meeting between TNPA and Terminals. • Traffic management Plan • Collaboration between Metro Police Services and Transnet
Damages to unknown services	• Unavailability of as built drawings • Insufficient survey report information	• Damages to existing services • Cost implication • Additional scope work • Delays in project schedule	Ensure that service provider conduct proving trenches to identify underground services

1.6. Recommendations and Conclusion

It is recommended that approval be granted to proceed to the next stage of the project which will be the implementation of Feasibility studies and detailed designs for the Bayhead and Langeberg Road Upgrade.

2. INTRODUCTION

2.1. Pre-Feasibility Study Introduction

a) Proposal

The eThekwini Transnet Integrated Freight Transport Systems Plan' (ETIFTSP) aims for Transnet SOC Ltd. and the eThekwini Municipality to jointly develop a conceptual integrated, sustainable transport system plan in the South Durban Basin (inclusive of all port areas) that supports the port developments, city growth and enhances the region for businesses as well as residents. The study builds on the work that Aurecon previously undertook for the eThekwini Transport Authority for the establishment of a new Arterial Route into the Port of Durban (2014). The objective of this exercise was to identify bottlenecks on the current road network and propose short-term road upgrades in mitigation of these bottlenecks. The study included:

- Undertaking traffic surveys where required

- Commission traffic counts to fill in gaps in the existing available data
- Developing an AIMSUIN traffic Simulation Model for the base year (2014) and (2020) horizon traffic conditions.
- Identification of bottlenecks on the current road network using the simulation model in conjunction with onsite observations.
- Propose short-term road upgrades to mitigate the congestion problems identified in the modelling process.

The 'Integrated Freight and Logistics Strategic Framework and Action Plan for eThekwini was adopted as a point of departure for the study; with the strategic recommendations forming the foundation for investigations into the freight infrastructure, operations, land use proposals and regulatory requirements. The Upgrade of the Bayhead and Langeberg Road was one of the infrastructure upgrades recommended on the road network to mitigate the congestion problems identified in the traffic modelling.

In year 2020 TNPA engineering team completed a prefeasibility study for this project which was a build up from the above mentioned study.

b) Location of Project

The Bayhead and Langeberg roads project is located within the Durban Port area in the eThekwini Municipal area in the KwaZulu-Natal Province. Bayhead Road is located along the southern boundary of the Port of Durban, and forms the important link from South Coast Road to Pier 1 Salisbury Island within the port precinct. The Langeberg Road is one of the intersections from Bayhead road to the Durban Container Terminal at Pier 2. The section of Bayhead Road within this study area is located between the South Coast Intersection and the Langeberg intersection. The Langeberg section is from the Bayhead intersection until Pier 2 (Two) entrance gate.

c) Pre-Feasibility Study Scope of Work

The prefeasibility study scope of work entailed the following:

- Study to develop Short Term Recommendations for the Reduction in Congestion in Bayhead Road and Langeberg Road.
- Traffic Study of Short and Long Term Interventions to Accommodate Additional Traffic Generated from South Port Area.

- Pavement Investigations and Testing
- Visual Condition assessment
- Identification existing services along Bayhead and Langeberg Roads
- Preparation of preliminary drawings for the preferred option
- Selection of the preferred Option

d) Study Methodology

i. Traffic Loading Studies

Traffic counts were conducted by Service Providers in February 2013, November 2014 and February 2015. The counts were conducted over 12 hour periods from 06:00 to 18:00 at the Bayhead and Langeberg Road Intersection as well as South Coast-, Crabtree- and Bayhead Road intersection. Figure 1 below illustrates the location where the traffic counts were taken (indicated by Red Cross).

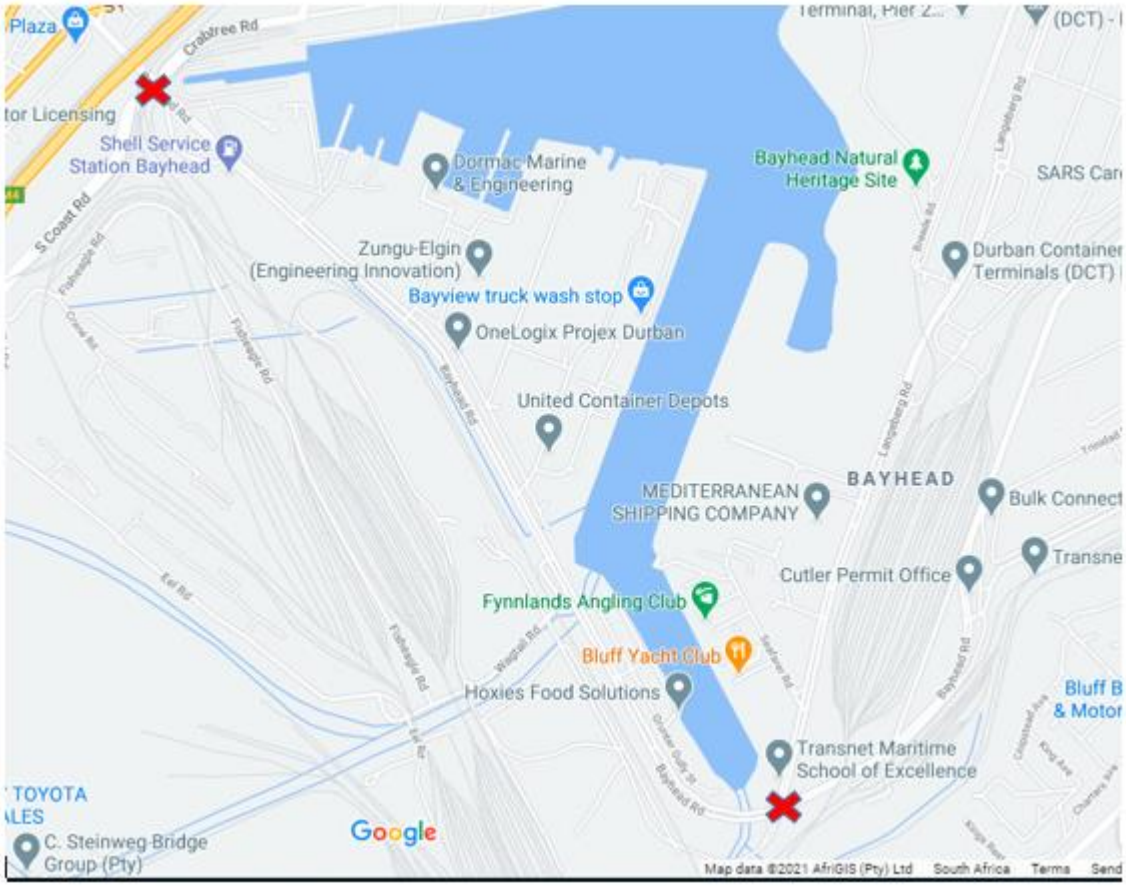

Figure 1: Areas where the Traffic Counts were performed along the Bayhead Area (Image from Google Maps.

The traffic data provided for the Bayhead area included summaries of the following data:

- Existing 2013 12 Hour traffic volumes
- Existing AM peak hour traffic volumes
- Predicted 2020 AM peak hour traffic volumes
- Predicted 2035 AM peak hour traffic volumes

The traffic count data was used to calculate the expected traffic loading for the following scenarios:

Scenario A - All traffic turning Northbound into Langeberg road at the Bayhead-Langeberg intersection for the new freight lanes in Bayhead-, Langeberg-, and Seafarer Road.

Scenario B - Traffic turning left into South Coast Road from Bayhead for the new left turning slip lane

Scenario C - Traffic turning left into Bayhead road from Crabtree Road for the new left turning lane.

Design Traffic Calculations

The 12 hour traffic counts conducted were used to estimate the expected annual average daily traffic for the different scenarios discussed above. A summary of the traffic data is shown in Table 4 below.

Table 4: Existing Traffic Volumes Expected for the New Lanes that are to be constructed.

Location	Location Description	12 HOUR TRAFFIC COUNTS				AADT	AADTT*
		Light Vehicles	Heavy Vehicles	Total Flow	% HV		
A	Bayhead-, Langeberg-, & Seafarer Road (New freight lanes)	1867	2019	3886	52.0%	4547	2362

B	Bayhead Road (Only left turn slip lane into South Coast Road)	958	1288	2246	57.3%	2628	1507
C	Crabtree Road (Only left turn slip into Bayhead Road)	1931	489	2420	20.2%	2831	572

*AADTT – Annual Average Daily Truck Traffic

Heavy Vehicle Growth Rates and E80 Factor

A sensitivity analysis was done on the expected traffic growth rates and the equivalent E80 factors in order to accurately estimate the expected traffic volumes over a design period of 20 years. The following information was used in the traffic sensitivity analysis:

- Traffic growth rates ranged from 2% – 6%
- The Annual Average Daily Track Traffic (AADTT), was estimated from traffic accounts as:
  - 2362 HV's on new freight lanes on Bayhead, Langeberg, and Seafarer Road (70%:30%split)
  - 1507 HV's turning left into South Coast Road from Bayhead Road
  - 572 HV's turning left into Bayhead Road from Crabtree Road
- A design period of 20 years was considered
- The Equivalent standard Axle (E80) per truck ranged from 3.0 -5.0 per heavy vehicle.

Considering the range of traffic growth rates, and the expected equivalent E80 values, Figure 2 to Figure 4 depicts the expected E80's for the traffic scenarios discussed above.

Design Period (Years)	=	20
AADT/direction	=	2362
% Heavy Vehicles	=	100.00
E80/HV (Expected Average)	=	4.0 (3 - 5)
HV Growth Rate (Most Likely)	=	4% (2% - 6%)

Traffic Sensitivity Analysis (E80s)		% Growth Rates				
		2.0%	3.0%	4.0%	5.0%	6.0%
E80 per HV	3.0	48E+6	53E+6	60E+6	67E+6	75E+6
	3.5	56E+6	62E+6	69E+6	78E+6	87E+6
	4.0	63E+6	71E+6	79E+6	89E+6	100E+6
	4.5	71E+6	80E+6	89E+6	100E+6	112E+6
	5.0	79E+6	89E+6	99E+6	111E+6	125E+6

Legend
< ES 1
ES 3
ES 10
ES 30
ES 100
> ES 100

Figure 2: Sensitivity Analysis and expected E80's for the new Freight Lane (Bayhead, Langeberg and Seafarer Road)

Sensitivity Analysis: Vehicle Equivalency Factor (VEF) versus % Growth

Design Period (Years)	=	20
AADT/direction	=	1507
% Heavy Vehicles	=	100.00
E80/HV (Expected Average)	=	4.0 (3 - 5)
HV Growth Rate (Most Likely)	=	4% (2% - 6%)

Traffic Sensitivity Analysis (E80s)		% Growth Rates				
		2.0%	3.0%	4.0%	5.0%	6.0%
E80 per HV	3.0	43E+6	48E+6	54E+6	61E+6	68E+6
	3.5	51E+6	57E+6	63E+6	71E+6	80E+6
	4.0	58E+6	65E+6	72E+6	81E+6	91E+6
	4.5	65E+6	73E+6	81E+6	91E+6	102E+6
	5.0	72E+6	81E+6	90E+6	101E+6	114E+6

Legend
< ES 1
ES 3
ES 10
ES 30
ES 100
> ES 100

Figure 3: Sensitivity Analysis and expected E80's for the Left Slip lane into South Coast Road from Bayhead Road.

Sensitivity Analysis: Vehicle Equivalency Factor (VEF) versus % Growth

Design Period (Years)	=	20
AADT/direction	=	572
% Heavy Vehicles	=	100.00
E80/HV (Expected Average)	=	4.0 (3 - 5)
HV Growth Rate (Most Likely)	=	4% (2% - 6%)

Traffic Sensitivity Analysis (E80s)		% Growth Rates				
		2.0%	3.0%	4.0%	5.0%	6.0%
E80 per HV	3.0	16E+6	18E+6	21E+6	23E+6	26E+6
	3.5	19E+6	21E+6	24E+6	27E+6	30E+6
	4.0	22E+6	25E+6	27E+6	31E+6	35E+6
	4.5	25E+6	28E+6	31E+6	35E+6	39E+6
	5.0	27E+6	31E+6	34E+6	38E+6	43E+6

Legend
< ES 1
ES 3
ES 10
ES 30
ES 100
> ES 100

Figure 4: Sensitivity Analysis and expected E80's for the Left Slip lane Bayhead Road from Crabtree Road

Cumulative Design Traffic Loading

The estimated Million E80 values (MESA) consider the following assumptions:

- Low - Growth Rate of 3%, E80 per HV of 3.5
- Realistic - Growth Rate of 4%, E80 per HV of 4.0
- High - Growth Rate of 5%, E80 per HV of 4.5

The design traffic E80's, and the required pavement category for each scenario listed above is listed below:

Table 5: Estimated Design Traffic E80s and Required Pavement Category over the Design Period

LOCATION	LOCATION DESCRIPTION	AADTT*	MILLION E80's (MESA) LOW - [REALISTIC] - HIGH					PAVEMENT DESIGN CATEGORY
A	Bayhead-, Langeberg-, & Seafarer Road (New freight lanes)	2362	62	-	[80]	-	100	ES 100
B	Bayhead Road (Only left turn slip lane into South Coast Road)	1507	57	-	[73]	-	92	ES 100
C	Crabtree Road (Only left turn slip into Bayhead Road)	572	21	-	[27]	-	35	ES 30

*AADTT – Annual Average Daily Truck Traffic

These traffic volumes were compared to the forecasted AM peak hour heavy vehicle traffic volumes for the left turning lane from Bayhead Road into South Coast Road, which were estimated to be:

- 31 HV's in 2020 and
- 154 HV's in 2035

The volumes on Bayhead Road resulted in an ES100 design traffic loading class.

ii. Pavement Investigation & Testing

Geotechnical investigations were conducted in 2013 for the South Port Roads combined Project, which included the Bayhead and Langeberg Road upgrade. Fieldwork was performed and involved manual excavation and logging of inspection pits and the probing of CBR Dynamic Cone Penetrometer tests, to investigate the existing road layer works and subgrade, as well as the subsoils in the areas to be widened. In addition, the objective of the investigations was to identify problematic areas, such as low bearing capacity, unstable materials and the presence of ground water.

Laboratory test work conducted included the following:

- Moisture Contents (SANS 3001 –GR20);
- Road Indicatos: Sieve analysis and Atterberg limits (SANS 3001-GR1 and SANS 3001-GR11);

- Determining of MDD and OMC, and CBR (California Bearing Ratio) (SANS 3001-GR30 and SANS 3001-GR40), for COLTO G classification.

The figures and tables below shows test pits locations and geological results from the investigations.

The Upgrade of the Bayhead Road and Langeberg Road Intersection

Figure 5: Geological Results for Test Pit TP6 and F16 along Bayhead and Langeberg Intersection

Table 6: Geological Results for Test Pit TP6 and F16 along Bayhead and Langeberg Intersection

Test Pit: TP6	Layer mm	Colto G-Class	Test pit:F16	Layer mm	Colto G-Class
AC x 3	130	-	Sand and roots	300	G6
Crusher run	100	G5	Sand	250	G7 + (G7)
Crusher run	150	G5	Course sand	250	G7
Sandy gravel	140	G6	Sandy gravel	150	<G9
Sandy, slag and estuarine gravels	250	G7	Sandy and estuarine gravels	600	<G9
Geotechnical considerations:		-	Geotechnical considerations:		-
			From 0,8 m depth material appeared to be unsuitable for roads		

The Upgrade of the Bayhead Road and South Coast Intersection:

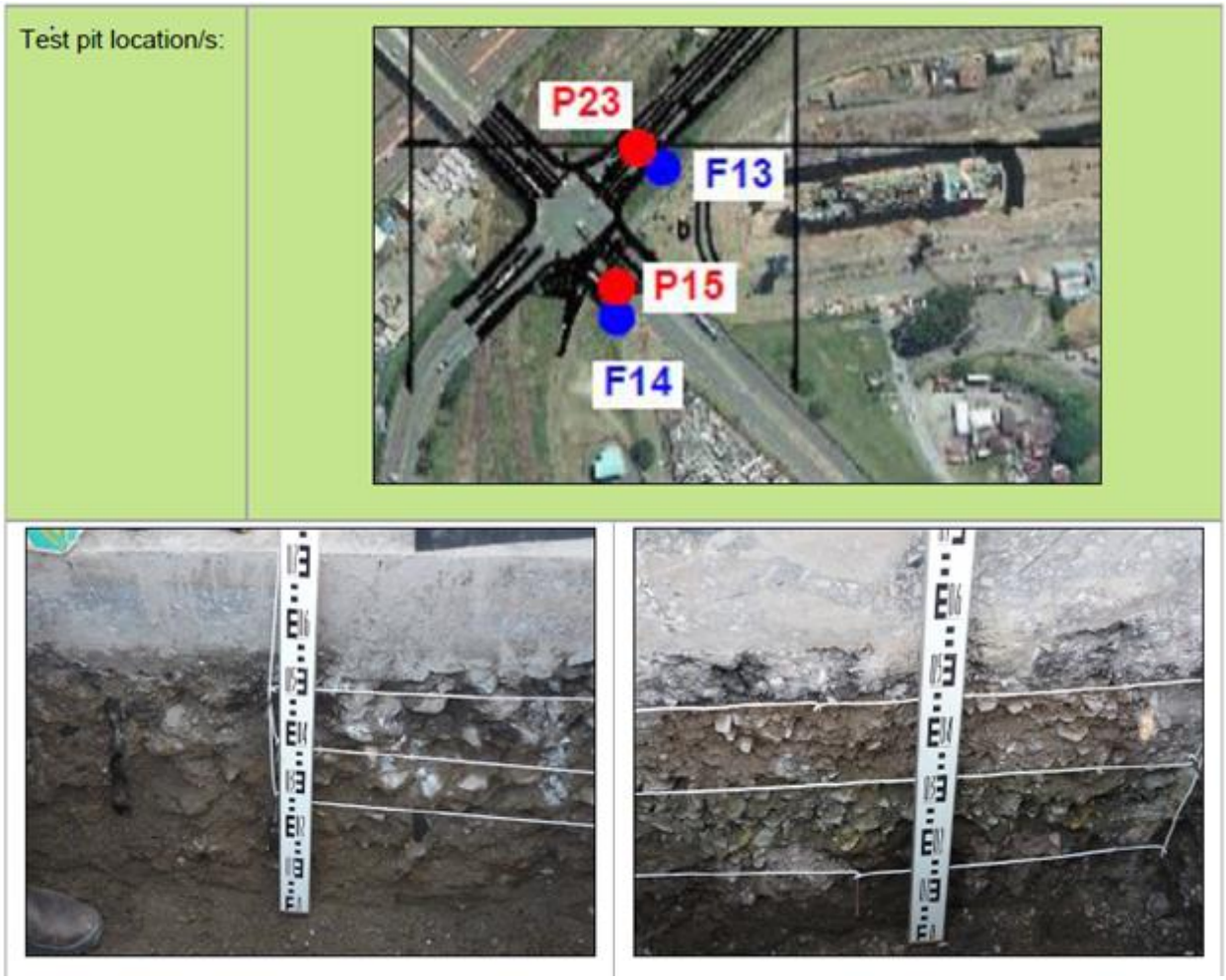

Figure 6: Geological Results for Test Pit TP23 and P15 along Bayhead and South Coast Intersection

Table 7: Geological Results for Test Pit TP23 and P15 along Bayhead and South Coast Intersection

Test Pit: P23	Layer mm	Colto G-Class	Test pit:P15	Layer mm	Colto G-Class
AC + BC	220	-	AC X 3	300	-
Silty gravel	530	G6/G7	Crusher run	130	G5
			Crusher run	170	G7
			Sandy gravel	200	G6
Geotechnical considerations:		-	Geotechnical considerations:		-

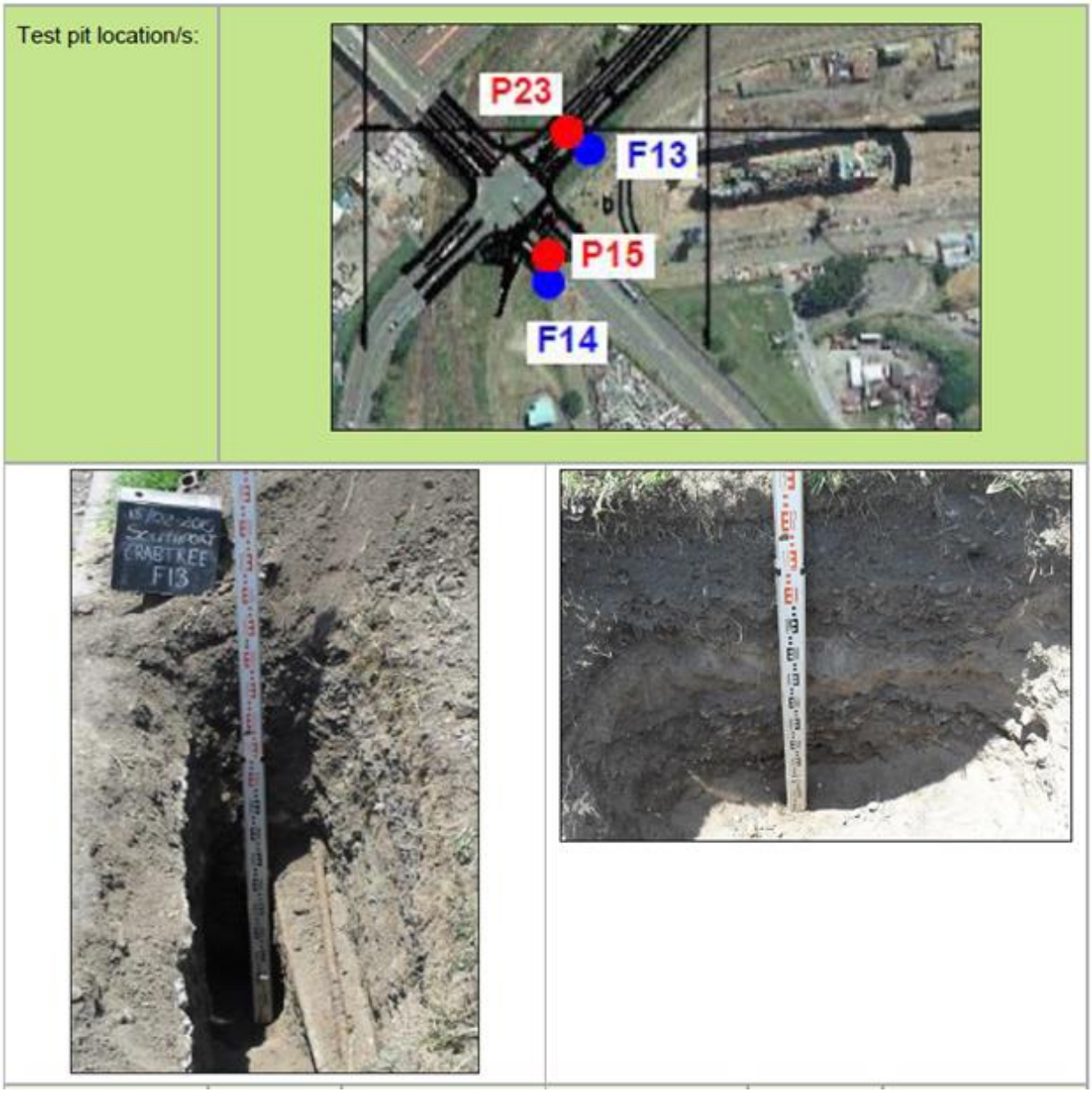

Figure 7: Geological Results for Test Pit F13 and F14 along Bayhead and South Coast Intersection

Table 8: Geological Results for Test Pit F13 and F14 along Bayhead and South Coast Intersection

Test Pit: F13	Layer mm	Colto G-Class	Test pit:F14	Layer mm	Colto G-Class
Gravel + roots	200	(G8)	Sand + roots	100	(G8)
Sandy gravel	200	(G8)	Gravel with sand	450	G5
Gravel with sand	700	G7	Gravel with sand	300	G5
Gravel with silty sand	400	G6	Old concrete	50	-

Colluvium	100	(G6)	Old crusher run	400	G9
Geotechnical considerations:		-	Geotechnical considerations:		-
Notice of old services at the bottom of pit.					

No major geotechnical flaws were noted along the route of the proposed upgrade Bayhead and Langeberg Road.

The geology of the site comprises mainly Harbour Bed sands which are overlain by hydraulic Fill and in the roads an engineered fill for the road pavement layers. Samples of the existing road layers were taken and have been found to be suitable for reuse in the road, with suitability ranging from subbase to selected layers to subgrade. The majority of the material adjacent to the road was found to be suitable as selected layers and subgrade. The hydraulic fill varies in quality from G7/G8 to G4/G5, whilst the Harbour Bed sands could be re-compacted to G7/G* materials. Clayey and silty soils were found in pits along Bayhead Road adjacent to the canal and were found to be unsuitable as subgrade.

iii. Visual Condition Assessment

A visual condition assessment was conducted by TNPA Engineering Team on Bayhead Road and Langeberg Road in 2021. The Visual Assessment was classified according to TMH 9 visual assessment for flexible pavements, which looks at surfacing, structural and functional categories for the assessment.

Bayhead Road

The overall condition of the Bayhead Road is poor due to the occurrence of severe structural defects. The degree and extent of the crocodile cracking and rutting on the wheel paths indicates fatigue on the pavement layers due to excessive loading from the heavy vehicles using this road. There is an existing storm water system, however, the majority of the inlets are damaged with storm water manholes and pipes blocked.

A pavement reconstruction to strengthen or upgrade the pavement structure is recommended to effectively carry the heavy vehicle traffic using the road. Furthermore, additional traffic lanes are recommended to ease the current traffic congestions at Bayhead road and to accommodate future traffic growth.

Langeberg Road

The pavement structure of Langeberg road is still in good condition, as the road was rehabilitated in 2016. However, the drainage system is very poor and needs urgent attention. The storm water manholes and pipes are blocked and needs to be flushed out to ensure a functional storm water system.

Assessment and Functional assessment.

Figures 8 -1 to 8-2 shows illustrates major structural distress identified on Bayhead Road.

Figure 8-1: Crocodile & Rutting on Bayhead Road

Figure 8-2: Damaged Kerb Inlets at Bayhead Road

Figure 8-3 to Figure 8-4 shows some of visual assessment findings at Langeberg Road.

Figure 8-3: Smooth Road Surface at Langeberg Road

Figure 8-4: Water ponding, blocked and overgrown drainage channel at Langeberg Road

iv. Identification of Structures & Services along Bayhead & Langeberg Road

Railway Lines

There is a level crossing and three railway lines under the Congela Bridge that will be affected by the widening of the Bayhead road. The rails under the bridge will be affected by the additional slip lane which will result in bridge widening at Bayhead and South Coast Roads intersection. The level crossing in the middle of Bayhead road belongs to TNPA, and the railway lines under Congela Bridge belong to TNPA, PRASA and TFR. The affected parties will be consulted during FEL 3 stage to determine a plan to work around the tracks with minimal disruption to general operations.

Bridge Structures:

There are three bridge structures identified along Bayhead Road, in which one is constructed above railway lines, and the other two are constructed over existing stormwater canals. Langeberg Road has one Bridge which is constructed above a railway, serving the Container Terminal.

Underground Services

The known underground services have been identified from TNPA drawing archives. In addition, a survey will be conducted during FEL 3 before design stage, to identify all underground services around the Construction area. During FEL 3, owners of the exposed and impacted services will be consulted to confirm the services and a way forward will be determined on how the services will be accommodated on the proposed design. The services that have been identified at this stage are as follows:

- Storm water;
- Communication services;
- Electricity services;
- Railway services;
- Water services.

3. OPTIONS ASSESSED & OPTIONS DELETED

The FEL 2 phase produced a number of options which were assessed and analysed as indicated in the following tables.

3.1. OPTION A: Do Nothing

This option entails maintaining the status quo and continues maintenance of surface distresses. The following table highlights the advantages, disadvantages, estimated construction costs and period for this option.

Table 9: Advantages and disadvantages for Do Nothing Option (A)

BAYHEAD ROAD AND LANGEBERG ROAD					
Options A		**Financial Sustainability**	**Disturbance to Pier 2 DCT operations during construction**	**Sustainability in Road storm water system, civil & electrical infrastructure**	**Road Safety**
Do Nothing	**Advantages**	No funding required	No disturbance		

	Disadvantages	Non-efficiency movement in the Port of Durban		Current storm water drainage system will not be upgraded	Traffic congestion and deteriorating road infrastructure .
	Estimated Construction Costs	Nil*			
	Estimated Construction Period	Nil			
	*The execution of maintenance works is currently the responsibility of the eThekwini Municipality				

3.2. OPTION B: Upgrade of Road Infrastructure on Bayhead and Langeberg Roads

This option entails widening of Bayhead road by adding single lanes on the inbound and outbound carriageway and widening of two main intersections, thus making Bayhead to have three lanes in both directions. The pavement structure is proposed to be reconstructed to enable effective strength for current and future traffic growth.

The following table highlights the advantages, disadvantages, estimated construction costs and period for this option.

Table 10: Advantages and disadvantages for the Upgrade of Bayhead and Langeberg Road Option (B)

BAYHEAD ROAD AND LANGEBERG ROAD					
Option B		**Financial Sustainability**	**Disturbance to Pier 2 DCT operations during construction**	**Sustainability in Road storm water system, civil & electrical infrastructure**	**Road Safety**
Upgrade of road infrastructure on Bayhead and Langeberg road (widening and	**Advantages**	Savings over a period of time. Improve accessibility to Durban Container Terminal & Island view.	Minimal disturbance to maritime business	Serve as a good long term solution	Reduction on extent of accidents

pavement upgrade)					
	Disadvantages	High Capital funding Required. Project cannot be executed immediately	Trucks may use alternative routes within residential areas	High cost to upgrade	May attract more traffic volumes on completion
	Estimated Construction Costs	R 115 176 045,00			
	Estimated Construction Period	18 Months			

3.3. OPTION C: Rehabilitation of Bayhead & Langeberg Road – Mill and Replace

This option entails rehabilitation works, which entails milling and replacing the surface material and possible base materials to eliminate the surface distresses. This option is a short-term measure to address the surface distress and make the road smooth again.

The following table highlights the advantages, disadvantages, estimated construction costs and period for this option.

Table 11: Advantages and disadvantages for the Rehabilitation of Bayhead and Langeberg Road Option (C)

BAYHEAD ROAD AND LANGEBERG ROAD					
Option C		**Financial Sustainability**	**Disturbance to Pier 2 DCT operations during construction**	**Sustainability in Road storm water system, civil & electrical infrastructure**	**Road Safety**
Rehabilitation of Bayhead and Langeberg road – Mill and Replace	**Advantages**	Low cost due to minimal construction activities.	Considerate disturbance to daily Durban container terminal operations	Requires minimal planning. No new storm water mains will be constructed	Maximum safety of vehicles

	Disadvantages	Minimal direct and indirect return on investment	Some clients may become frustrated due to the disturbance	Road will last for short space of time. Road sub-layer works will not be sustainable. Current storm water drainage system will not be upgraded	Minimum safety of pedestrians Traffic congestion will not be eliminated
	Estimated Construction Costs	R 30 000 000,00			
	Estimated Construction Period	6 Months			

4. EVALUATION CRITERIA

The following criteria was used to select the preferred option:

- Design life span of 20 years
- Reduce traffic congestions and cater for future traffic increase
- Reduce costs associated with regular maintenance
- Positive impact to Transnet business
- Capital Costs Comparison
- Improve accessibility to Port Operations
- Improvement to Road Safety

5. CAPITAL COST ESTIMATE

The following table shows a summary breakdown of the Capital costs for the preferred option, Option B.

Table 12: Breakdown of FEL 3 Costs estimate for the preferred option

No.	Item	Cost Estimate
1	Project Management and Disbursements	R 2 382 400,00
2	Engineering Services for Road Design (Geometric & Pavement)	R 8 885 000,00
3	Review and validation of Traffic Studies and Modelling	R 1 183 000,00

4	Additional Geotechnical Studies	R 566 000,00
5	Design of Electrical Infrastructure	R 1 113 000,00
6	EIA including Specialist Studies	R 635 000,00
7	HAZCON Studies	R 386 000,00
8	FEL 4 Documentation	R 900 000,00
	Sub total	R 13 668 000,00
	Total Direct Costs	R 16 050 400,00
9	Owner's Costs (5%)	R 802 520,00
10	Contingency (10%)	R 1 605 040,00
11	Escalation (10%)	R 1 605 040,00
	Project Total Excuding Borrowing Costs	R 20 063 000,00
12	Borrowing Costs	R 2 206 930,00
	Project Total (incl. Borrowing Costs)	R 22 269 930,00

6. OPERTATING & MAINTENANCE COST ESTIMATE

EThekwini Municipality is and will continue being responsible for the Maintenance of Bayhead road and Langeberg Road. Therefore, Maintenance costs will be budgeted by EThekwini Municipality.

7. PROJECT SCHEDULE

The time budgeted for the FEL 4 execution phase of the project is given in the table below. The timelines indicate a worst case scenario which will be condensed and finalized upon the appointment of the Service Provider.

Table 13: FEL 4 Forecasted Project Timeframe for the preferred option

No.	Milestone	Date
1	Execution Funding Approval	September 2023
2	Procure Construction Contractor	May 2024
3	Site Access	June 2024
4	Construction Complete	December 2025
5	De-establish and Contract Close-out	February 2026
6	Project Close-out	February 2026

TIME FRAME FOR FEL 3 PHASE COMPLETION

The estimated time frame for FEL 3 phase is given in table below:

Table 14: FEL 3 Project Time frame for the preferred option

No.	Milestone	Date
1	Technical Review	April 2021
	Gate Review	July 2021
2	TNPA Investment Forum	November 2021
3	TNPA CAPIC	December 2021
4	Advertise Tender for Remainder of FEL 3	March 2022
5	Tender Award	May 2022
6	Completion of Detailed Engineering	February2023

8. ENVIRONMENTAL

A high level environmental assessment was conducted and an Environmental Screening report was compiled, this process was conducted for the purpose of evaluating the need for Environmental Authorization or Licenses for the proposed upgrade of Bayhead and Langeberg Road, the General Scope of Work of the project was assessed against the following legal provisions:

- EIA Regulations published in terms of Section 24 of National Environmental Management Act, Act 107 of 1998;
- Listed Activities in terms of National Environmental Management: Waste Act, Act 59 of 2008;
- National Water Act, Act 36 of 1998;
- National Forest Act, Act 84 of 1998

Through the screening process it has been identified that that the following listed activities will be triggered.

Listing Notice 1, Activity 48.

The expansion of—

(i) infrastructure or structures where the physical footprint is expanded by 100 square metres where such expansion occurs—
(a) within a watercourse;
(b) in front of a development setback; or
(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;or more.

excluding—

(aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;

The exclusionary clause for existing ports and harbours under this activity will not apply.

Bayhead Road is currently on the boarder of the Port Limits and the proposed expansion works may extend beyond the Port Limits. Secondly, the project will extend over undeveloped land and increase the development footprint of the port.

Listing Notice 1, Activity 19A.

The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from—

(i) the seashore;

(ii) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater;

The proposed works for the expansion of the bridge will fall within the Estuarine Functional Zone and area of tidal influence outside to Port Limits triggering activity 19A.

9. LONG LEAD ITEMS

There are no long lead Items anticipated for this project.

10. RISK ANALYSIS

A Risk analysis was conducted for the three options identified, and a detailed Risk register was developed for the preferred option.

10.1. Option A– Do Nothing (Maintain Status Quo)

Table 15: Identified Risks for the Option A- Do Nothing Option

No	Risk Name	Causes	Consequences
	Road Accidents	Poor Pavement Conditions Traffic Congestion	Operation delays
	Un-catered Vehicle Claims from road users	Poor Road Conditions (potholes)	Unplanned costs

10.2. Option B – Upgrade of Bayhead and Langeberg Road (Widening & Pavement Reconstruction)

Table 16: Identified Risks for the Option B- Upgrade of Bayhead and Langeberg Road

No	Risk Name	Causes	Consequences
1.	Delays in project executions	• Poor Stakeholder engagement • Prolong Governance Processes • Adverse weather	• Cost Implications • Brand reputation • Congested Roads
	Lack of collaboration between Municipality and Transnet	• Misalignment on MOU and Strategies between Municipality and Transnet • Lack of engagement between relevant parties. • Changes in Municipality Political Leadership	• Project Delays • Congested Roads
	Traffic congestion and delays on Bayhead and Langeberg roads	• Poor Traffic Management Plan • Unclear detour signage's	• Project delays • Costs implications • Brand reputation • Loss of revenue
	Prolonged Governance Approvals	• Changes in design and specifications • Changes cause by internal requirements • Changes in procurement processes that are not communicated9 PPM, CIBD requirements)	• Project delays Unhappy stakeholders • Cost implication

10.3. Option C – Rehabilitation of Bayhead and Langeberg Road (Mill & Replace)

Table 17: Identified Risks for the Option C- Rehabilitation of Bayhead and Langeberg Road (Mill & Replace)

No	Risk Name	Causes	Consequences
1.	Delays in project executions	• Poor Stakeholder engagement • Prolong Governance Processes • Adverse weather	• Cost Implications • Congested Roads
2.	Increased traffic Congestions	• Current and Future traffic growth	• Road Accidents due to frustrated road users. • South Ports Operation delays

11. PREFERRED OPTION

Option B is the preferred option due to the following reasons:

- Improved accessibility to Pier 1 and Pier 2 of Durban Container Terminal.
- Fewer accidents and minimization of traffic congestion.
- Improved storm water and drainage system for Langeberg Road
- Longer design life for Bayhead Road
- Improved Road Safety

12. ASSUMPTIONS

The following assumptions were made:

- Feasibility funding will be made available. TNPA has enough capital budget to finance this project.
- EThekwini Municipality will approve the project plans and specifications
- Project won't trigger a full Environmental Impact Assessment approval.

13. CONSTRAINTS

The major constraints that should be factored into the project are:

- Timelines – the project is to be initiated and brought to completion within shortest possible timeline as the challenges continue to worsen.
- Construction will be executed around Port Operations.
- Existing railway lines might be a constraint on certain sections of road widening.
- Unknown underground services.

14. FURTHER ACTION

14.1. Feasibility Study Requirements

The scope of work for the Feasibility study (FEL 3) is as follows:

a) Validation of existing traffic studies on Bayhead and Langeberg Roads, including analysis of road network and connectivity.
b) Review the recommendations on the best access strategy at intersections along Bayhead and Langeberg Roads.
c) Geometric designs for Bayhead and Langeberg roads lane widening.
d) Structural designs for road over river/rail crossings (deck & pier bridge designs).
e) Pavement designs for Bayhead and Langeberg roads.
f) Design of the road furniture i.e. signage, guardrails etc.
g) Road traffic signaling design.
h) Road landscaping and sidewalk design.
i) Design of Civil infrastructure i.e. Storm water drainage, and other services.
j) Design of Electrical infrastructure.
k) Additional Geotechnical investigations if required.

15. APPENDICES

- Condition Assessment Report
- Preliminary drawings
- Project Schedule
- Geotechnical Report
- Survey Drawings