



Traffic Impact Assessment

Construction of a Green Ammonia Pipeline from Farm 58 to the Walvis Bay Port Area

Submitted to:
Environmental Compliance Consultancy (Pty) Ltd
PO Box 91193, Klein Windhoek
Windhoek, Namibia

Submitted by:
Zutari Namibia (Pty) Ltd.
Mandela Offices 1
Windhoek, Namibia
Project Number 1002938

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1 Introduction and Background

1.1 Introduction

Cleanergy Solutions Namibia (Pty) Ltd is a joint venture between Ohlthaver & List (O&L) Group and CMB.TECH, the Ohlthaver & List (O&L) Group is the largest privately owned consortium in Namibia, with an operational track record spanning over a century and covering a diverse number of industries. CMB.TECH, a Belgium company specialising in the design, construction and operations of large marine and industrial modes of transportation that utilise hydrogen and ammonia. It forms an integral part of Compagnie Maritime Belge which is a family-owned shipping group, founded in 1895.

Cleanergy Solutions Namibia intends on becoming a driving force in the growth of the Namibia's hydrogen economy, while contributing to the global shift for industrial decarbonisation. The organisation is in the process of finalising the construction of the first hydrogen production plant in Namibia, with first production intended for the latter part of 2024.

As part of the bigger intended hydrogen and ammonia infrastructure development and operation, which Cleanergy Solutions are actively pursuing, the proposed construction of a green ammonia pipeline is envisioned and will be constructed from Farm 58 to the Walvis Bay port area, in the Erongo Region, Namibia (Figure 1). The proposed pipeline can be accessed via the D1984 road and the B2 road between Swakopmund and Walvis Bay.



Figure 1 - Locality map of the project

1.2 Route Description

The study was based on the current road network; the expected affected routes between Farm 58 and the Walvis Bay Port area; the present traffic operating and pavement conditions; and an evaluation of the impact of the proposed pipeline traffic generation on the existing road network.

The following road sections were identified which might be impacted by the new development:

Ammonia Pipeline Route (Hot):

- The High-volume sealed road, B2
- The High-volume sealed road, D1984

Ammonia Pipeline Route (Cold):

- The High-volume sealed road, B2

The B2 Road as well as the D1984 Road are bituminous surfaced roads, designed and constructed for high traffic volumes. Maintenance on these roads is carried out under the Roads Authority of Namibia.

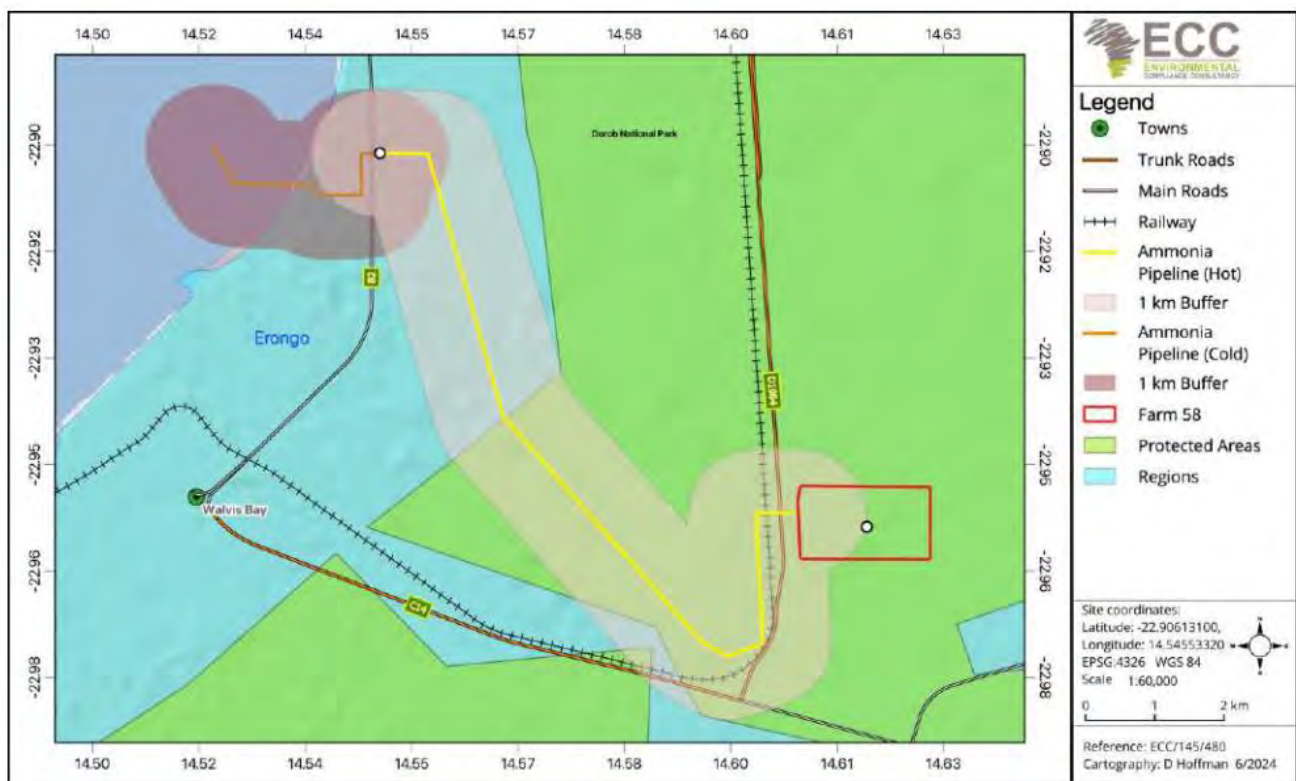


Figure 2 – Route area map

1.3 Objective of the study

Environmental Compliance Consultancy (ECC) needs a traffic impact assessment study for the proposed construction of a 12 km ammonia pipeline from Farm 58 to the Walvis Bay port area, Erongo region, Namibia. The project, owned by Cleanergy Solutions Namibia (Pty) Ltd., aims to connect a green ammonia production plant on Farm 58 to an ammonia terminal near the Walvis Bay port area.

2 Approach and Methodology

In line with the objectives of this study and with reference to the planned traffic expected to be generated by the construction and operation of the ammonia pipeline from Farm 58 to the Walvis Bay port area, the following methodology guided the Traffic Impact Assessment:

- A meeting was held with the Client to clarify and confirm the proposed route options, items discussed at the participation meeting regarding the road and traffic and items to be included in the study from ECC's side.
- Discussions were held with representatives of the Roads Authority to identify possible future upgrades.
- A site investigation was undertaken to evaluate the surface condition of the roads identified, observe existing traffic flow operations, identified dwellings along the routes, affected communities, safety concerns and possible problematic crossings.
- Traffic data from traffic counting stations located on B2 and D1984 was obtained from the Road Management System of the Roads Authority. Traffic data was used to determine the average daily traffic (ADT) and annual average daily traffic (AADT).
- The expected generated traffic as received from Cleanergy Solutions Namibia were assigned to the road network and added to the existing traffic volumes.
- The effect that the expected additional generated traffic will have on the conditions of the transport routes was assessed.

The effect of the generated traffic on the affected communities were also assessed in terms of construction activities and additional traffic volumes.

3 Site Investigation

A site investigation was undertaken, and the following observations were recorded during the visit:

- **Access to the ammonia production plant (Farm 58) and the ammonia terminal (Walvis Bay Port area)**

The options for access from the B2 Main Road and the D1984 Road was investigated as well as the impact on the surrounding roads.

- **Existing Intersections affected by the Project**

An inventory of all the accesses to the farms and settlements were recorded. This information was used to provide an indication of the affected communities and stakeholders along the proposed transport routes.

- **Existing Pavement Condition**

The condition of the existing pavement was surveyed to determine the overall condition and the effect of what newly generated traffic will have.

- **Geometric Alignment Evaluation**

Sight distances at all accesses and intersections were investigated and assessed to ensure the safety of the public from any additional traffic.

- **Evaluation on traffic of Proposed Crossings**

An evaluation was done to determine how construction of pipe crossings will affect the existing traffic.

3.1 Access to the Ammonia Production Plant and Ammonia Terminal

The start of the ammonia pipeline is located just outside Walvis Bay at Farm 58 (Ammonia Production Plant) and the end of the ammonia pipeline is located at the Walvis Bay Port Area (Ammonia Terminal). During the construction and operational phases, access from D1984 Road to the ammonia production plant and access from the B2 Main Road to the ammonia terminal will be required. Potential accesses were identified, and they were assessed to determine the impact of the generated traffic from the construction and operational phases of the ammonia pipeline:

- Access from D1984 Road to the Ammonia Production Plant
- Access from B2 Main Road to the Ammonia Terminal



Figure 3 – Potential Accesses from B2 Main Road and D1984 Road

Access from D1984 Road to the Ammonia Production Plant

The access from the D1984 Road to the Ammonia Production Plant is major intersections and newly constructed bridge with capacity for high volume traffic from the Walvis Bay Harbor. Analysing the current capacity as well as the high volume of traffic currently on the D1984 Road, the expected generated traffic by the proposed project should have little to no effect on the current proposed intersection. The sight distance is adequate at the intersection and no safety concerns were identified. The road surface is in an excellent condition as it is a newly constructed intersection/bridge.



Figure 4 - Access from D1984 Road to the Ammonia Production Plant

Access from B2 Main Road to the Ammonia Terminal

Possible access, next to the Ammonia Terminal on the B2 Main Road between Swakopmund and Walvis Bay, was investigated. A new intersection will have to be constructed to gain access to the B2 Main Road from the Ammonia Terminal. Sight distances to both sides were investigated and found to be adequate. An intersection, with a deceleration lane and a passing lane, is proposed. Additional traffic generated by the ammonia pipeline during construction and operational phases will have little to no impact on the existing traffic and upgrading of the existing road is not deemed necessary.



Figure 5 – Potential access from B2 Main Road to the Ammonia Terminal

3.2 Existing Intersections affected by the Project

All existing intersections along the B2 and D1984 roads were identified in the study area. These intersections provide communities and stakeholders access to the following:

- Industrial Property
- National Park (Dorob Park)
- Afrodite Beach
- Dolphin Beach
- Langstrand
- Walvis Bay Residential Area

The residential properties are mostly located around the Walvis Bay town area with access to the Long Beach, Dolfin Beach and Afrodite Beach also located in the sturdy area. Most of the tourist attractions along the study area consists of lookout points along the B2 Main Road next to the ocean. The Walvis Bay town area consist of an industrial area and residential properties located near the ammonia pipeline.

There are five intersections identified on the B2 Main Road and only one intersection identified on the D1984 Road. The locations of these intersections are located as shown in Figure 6 and Figure 7 on the next page.



Figure 6 - Identified intersections along B2 Main Road



Figure 7 - Identified intersections along D1984 Road

The tables below indicate the location of the intersections, affected stakeholder as well as the condition of the intersections identified in the study area.

Table 1 - Intersections located on the B2 Main Road and D1984 Road

Intersection No.	Location	Size	Stakeholder	Condition	Adequate sight Distance	Potential Access to Pipeline
B2-1	22°55'19"S 14°32'38"E	Major, West side	Walvis Bay Residents	Good	Yes	Yes, West Side
B2-2	22°51'16"S 14°32'32"E	Major, West side	Afrodite Beach Residents	Good	Yes	No
None	22°54'22"S 14°32'40"E	N/A	Ammonia Terminal Access	N/A	Yes	Yes, East Side
B2-3	22°50'21"S 14°32'34"E	Major, West side	Dolphin Beach Residents	Good	Yes	No
B2-4	22°49'31"S 14°32'40"E	Major, West side	Langstrand South Residents	Good	Yes	No
B2-5	22°49'02"S 14°32'44"E	Major, West side	Langstrand North Residents	Good	Yes	No
D1984-1	22°57'11"S 14°36'14"E	Major, Bridge	Green Hydrogen Pilot Plant	Excellent	Yes	Yes, West Side

The major intersections along the B2 Main Road provide access to various residential areas. During the site investigation it was found that a large percentage of vehicles make use of these intersections. They are in a good condition with minor defects identified at selected intersections. None of the identified intersections can be utilized in future to provide potential access to the ammonia pipeline during the construction and operational phases. Due to the high volume of traffic currently on the B2 Main Road, the additional traffic added by the proposed project should have little to no effect on the current traffic and infrastructure.

The major intersection/bridge along the D1984 Road provides access to the Green Hydrogen Pilot Plant. This intersection/bridge is in an excellent condition with no defects identified during the site investigation. The intersection has the capacity to accommodate the current traffic using the D1984 Road and future traffic volume added from the Walvis Bay Port. Analyzing the current capacity as well as the high volume of traffic currently on the D1984 Road, the generated traffic added by the new project should have little to no effect on the current intersection/bridge.

3.3 Existing pavement conditions

This survey was conducted during August 2024. The condition of the two affected roads was inspected, and the survey findings of the B2 Main Road summarized below.

B2 Main Road

The 35km section of road between Swakopmund and Walvis Bay is a high traffic volume sealed bitumen surfaced road. Most of the road section is in a good condition with minor defects identified on isolated sections listed below:

- Isolated edge breaks
- Minor rutting near intersections
- Small potholes
- Small Cracks



Figure 8 – Photos taken on section of the B2 Road (Cracks and Potholes)

During the site investigation a team from the Roads Authority of Namibia Maintenance division was busy with edge break repairs and the team informed that pothole and crack repairs were scheduled within the next year.

D1984 Road

The D1984 road section between Swakopmund and Walvis Bay is currently being upgraded to bitumen standards. The road is upgraded to a dual carriage way with capacity to accommodate the future traffic from the Walvis Bay Port and is in an excellent condition.



Figure 9 - Photo taken on section of the D1984 Road

3.4 Geometric Alignment Evaluation

The geometric alignments of the affected road sections were also evaluated to determine if any sections of the road should be upgraded to accommodate the additional generated traffic. Both the horizontal alignment as well as the vertical alignment was found to be adequate for the design speed of these roads. Sight distances at all the accesses and intersections were checked to determine if this conforms to minimum standards.

Existing Intersections

All the accesses and intersections were found to have ample sight distance in both directions to ensure that the road users could safely use them. The stopping distances, for the design speed of the road, are adequate and if an obstruction is detected, ample reaction time is allowed to avoid a collision.

Potential access to the ammonia pipeline

One existing Intersection as well as a position for a newly constructed intersection was identified that could be potentially used in future to gain access to the ammonia pipeline from both the Ammonia Production Plant as well as the Ammonia Terminal. As per Table 1, the Intersections are:

- Ammonia Terminal Access
- D1984-1

The above-mentioned intersections give access to the ammonia pipeline from both the start and end points of the pipeline. Both identified locations have sufficient sight distance in both directions to ensure that they can safely be used during the construction and operational phase of the ammonia pipeline.



Figure 10 – Intersection/bridge (D1984-1)



Figure 11 – Ammonia Terminal Access (B2)

Making use of the existing intersection/bridge (D1984-1), will minimize the cost if the proposed intersection is utilized during the construction and operational phases of the ammonia pipeline. The proposed location for the ammonia terminal access has enough sight distance in both directions should an intersection be constructed to gain access to the ammonia pipeline during the construction and operational phases.

3.5 Evaluation of Proposed Road Crossings

During the site investigation the proposed ammonia pipeline crossings was inspected and the following was observed and recorded.

- Sight distance for potential new access
- Final Road level above natural ground level
- Potential Crossing Structures
- Surrounding landscape (Topography)
- Affected Services

Green Hydrogen Pilot Plant Crossing

Location: 22°57'24"S 14°36'07"E

The current gravel salt road is being upgraded to a bitumen standard sealed road, but no provision has been made for the new ammonia pipeline crossing. The final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no structures (e.g. culverts) in the vicinity, to utilize for the new pipeline crossing underneath the road. The surrounding landscape is flat.

The current proposed crossing will cross an existing railway line just before it crosses the D1984 Road. Overhead NamPower powerlines should also be taken into consideration during the construction of the ammonia pipeline.



Figure 12 - D1984 Road crossing at the Green Hydrogen Pilot Plant

Walvis Bay Port Area Crossing

Location: 22°54'22"S 14°32'39"E

At the proposed ammonia pipeline crossing, the final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no alternative crossing structures (e.g. culverts) to utilize for the new pipeline crossing in the vicinity. The surrounding landscape is flat. The current proposed crossing will cross an existing fence next to the road.



Figure 13 – B2 Main Road crossing at the Ammonia Terminal

4 Affected Communities

During the site investigation all the affected communities along the proposed route of the ammonia pipeline were identified. The traffic impact on these communities were identified and assessed in the section below. The following communities were identified:

- Walvis Bay Town Residents
- Swakopmund Town Residents
- Afrodite Beach Residents
- Dolphin Beach Residents
- Langstrand Residents

Walvis Bay Town Residents

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road and D1984 Road to gain access to the Walvis Bay town is high in comparison with the additional traffic to be added by the ammonia production plant and ammonia terminal during both phases. The closest intersection to gain access to the Walvis Bay Municipal area has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 14 – Walvis Bay Town, Residents

Swakopmund Town Residents

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the ammonia production plant and ammonia terminal during both phases.

Afrodite Beach Residents

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the ammonia production plant and ammonia terminal during both phases. The intersection to gain access to Afrodite Beach has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 15 – Afrodite Beach, Residents

Dolphin Beach

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the ammonia production plant and ammonia terminal during both phases. The intersection to gain access to Dolphin Beach has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 16 – Dolphin Beach, Residents

Langstrand Residents

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the ammonia production plant and ammonia terminal during both phases. Both intersections to gain access to Langstrand has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 17 - Langstrand, Residents

5 Traffic Assessment

5.1 Existing Traffic Data

Existing traffic data collected included available historic traffic data, moving traffic counts and estimated traffic data from the Roads Authority of Namibia. Below are the positions where traffic counts were taken:

- Permanent Counting Station 021 (RA St 021) on B2 Main Road (364-day data, 2023)
- Permanent Counting Station 253 (RA St 253) on B2 Main Road (302-day data, 2023)
- Estimated Traffic D1991 Road, at B2 Main Road Intersection (Estimated from 2021 data)

In Table 2 below, traffic data, as received from the Roads Authority and the moving traffic counts are being summarized. The Average Daily Traffic (A.D.T) has been presented in following table.

Table 2 - Average Daily Traffic Volumes per Link

Description	ADT Light	ADT Heavy	ADT Total
B2:			
RA Station 21 (2023) – Swakopmund to Arandis	2,339	951	3,290
RA Station 253 (2023) – Arandis to Usakos	1,766	841	2,607
Moving Traffic Count – Swakopmund to Walvis Bay	3,480	165	3,645
D1991:			
Estimated Traffic B2 Intersection (2021)	38	35	73
D1984:			
Moving Traffic Count	420	780	1200

The data from the moving vehicle count, has been converted to 24 hour counts by using the information from the permanent and ad hoc stations. The heavy vehicles as a percentage of the ADT for each section is listed below:

- 29% of the ADT on the B2 Main Road between Swakopmund and Arandis.
- 32% of the ADT on the B2 Main Road between Arandis and Usakos.
- 4.5% of the ADT on the B2 Main Road between Swakopmund and Walvis Bay.
- Estimated 48% of the ADT on the D1991 Road at B2 intersection
- 65% of the ADT on the D1984 Road between Swakopmund and Walvis Bay.

The data from the RA Station (ST021), located on the B2 Main Road between Swakopmund and Arandis, and the moving traffic count (D1984) was compared. The traffic volumes between Swakopmund and Arandis were found to be higher than the traffic volumes between Swakopmund and Walvis Bay (D1984). This can be expected due to the transporting people and goods from Swakopmund to all the Mines located around Arandis.

Analysing the data from both moving traffic counts, it was found that most of the heavy vehicles using the roads between Swakopmund and Walvis Bay are using the D1984 Road instead of the B2 Main Road. This is due to

a restriction (heavy vehicles) put in place by the Roads Authority of Namibia on the B2 Main Road between Swakopmund and Walvis Bay.

Most of the light vehicles on the B2 Main Road between Swakopmund and Walvis Bay are the residents commuting from home to their respective places of work. Small delivery vehicles and trucks are also making use of the B2 Main Road to deliver various services and goods to the respective residential areas.

5.2 Additional Traffic Data

The information from the draft scoping report was used to determine the additional traffic that will be added to the existing road infrastructure during the construction and operational phases of the project. Using the available data as well as estimating peak additional traffic contributions during both phases are summarised in the next sections.

Construction Phase Additional Traffic

The scoping report indicates that approximately 30 to 100 workers will be hired during the construction phase with two security guards on night duty. The workers will be transported from Walvis Bay and Swakopmund to site using two busses on a daily basis.

A waste management plan will be implemented on site which may include a small truck to transport waste. Temporary waste bins will be available on-site varying in waste categories such as general household waste, plastic, steel, concrete and hazardous waste. It is assumed that removal of waste will be done on a daily basis by means of a small truck or LDV.

The Carbon Steel pipes will be transported to site during the construction phase and stored at various locations. The pipes will be transported in 12m segments of which will make up the total length of the 12.7km pipeline. Assuming a single truck can transport 580m of pipes with one load, a total of 22 truckloads will be required to transport all the pipe segments to site. There are 2 proposed intersections that can be utilized to gain access to the ammonia pipeline from the B2 Road and the D1984 Road. Each of the intersections will have to accommodate 11 truckloads during the construction phase. If two trucks are used to transport the pipes to site from Walvis Bay, on the peak it will add two trucks to the current traffic on a 2-hourly basis. Alternatively, transporting less pipes will only increase the number of days needed, and will not impact the total number of trucks used.

Additional materials will also be transported to site (cement, water, tools, ext.). The assumption was made that the delivery of these materials will be done once per day using a truck.

The construction supervision team as well as the foremen will travel to site on a daily basis to monitor all construction activities. This will be done by means of LDV's and it is estimated that a maximum of 5 LDV's will be utilized during the construction phase of the project.

Table 3 - Average Daily Traffic Volumes added during the Construction Phase

Description	ADT Light	ADT Heavy	ADT Total
B2:			
Vehicles added during construction phase	5	9	14
D1984:			
Vehicles added during construction phase	5	9	14

It is recommended that during peak delivery of the carbon steel pipes, that the contractor makes use of temporary road signs as well as flag ladies. These resources can be stationed at the intersections along the B2 Main Road and D1984 Road to always ensure safe access of all construction and delivery vehicles.

Operational Phase Additional Traffic

During the operational phase, liquid ammonia with a mass flow between 20 to 60 ton/h will be transported 12.7 km from the proposed ammonia production plant on Farm 58 to the ammonia terminal near the Walvis Bay north port area for storage. Trained personnel will continuously monitor operations and ensure safety procedures are followed.

There will be constant monitoring with a fibre optic cable of possible leakages points, pressure switches and vibrations (external digging). These systems will be monitored from Farm 58. Infield surveys will also be conducted on a regular basis and/or when required. It is estimated that a maximum of 2 LDV's will be utilized during the operational phase of the project on a daily basis with a truck to transport material when repairs and maintenance is required.

It is advised that already available Trans Namib service road be used during the construction and operational phases of the project. This is in alignment with the recommendations recorded in the Biophysical Assessment report compiled by Peter Cunningham.

Table 4 – Estimated Average Daily Traffic Volumes added during the Operational Phase

Description	ADT Light	ADT Heavy	ADT Total
B2:			
Vehicles added during operational phase	3	2	5
D1984:			
Vehicles added during operational phase	3	2	5

5.3 Traffic Impact

The expected generated traffic was assigned to each road section of the affected routes and added to the existing traffic volumes as to ascertain the impact of the proposed project on the surrounding road network. To illustrate the impact of the additional traffic on receptors along the routes, the following log-graphs were developed. These graphs show the current traffic, generated traffic and the total traffic on each road section.

Construction Phase

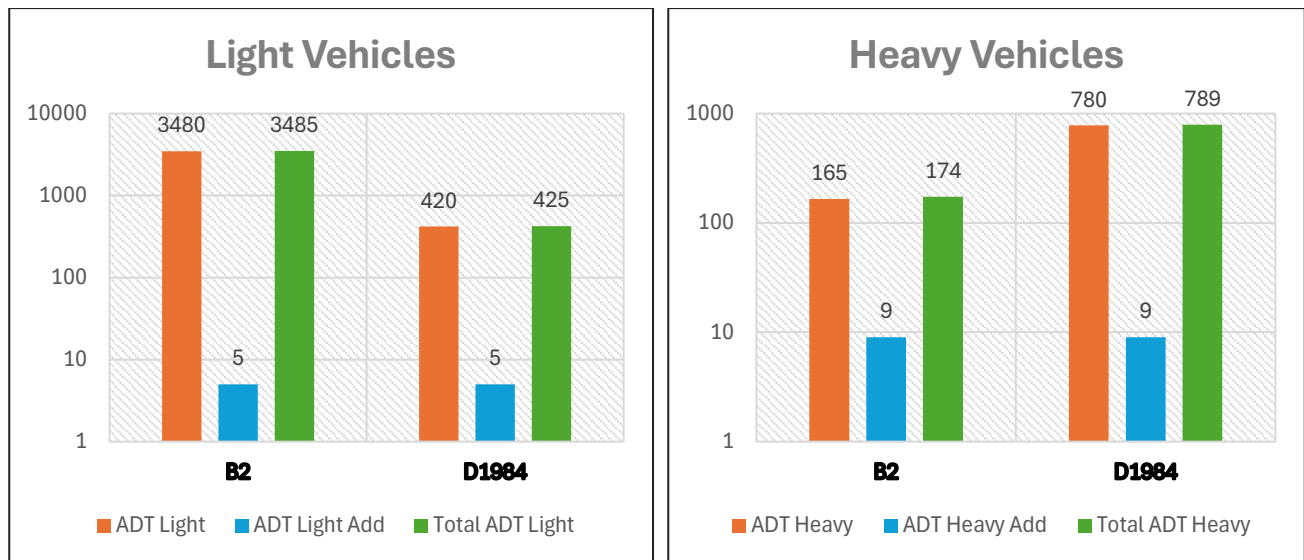


Figure 18 - Impact of generated light and heavy traffic during the construction phase

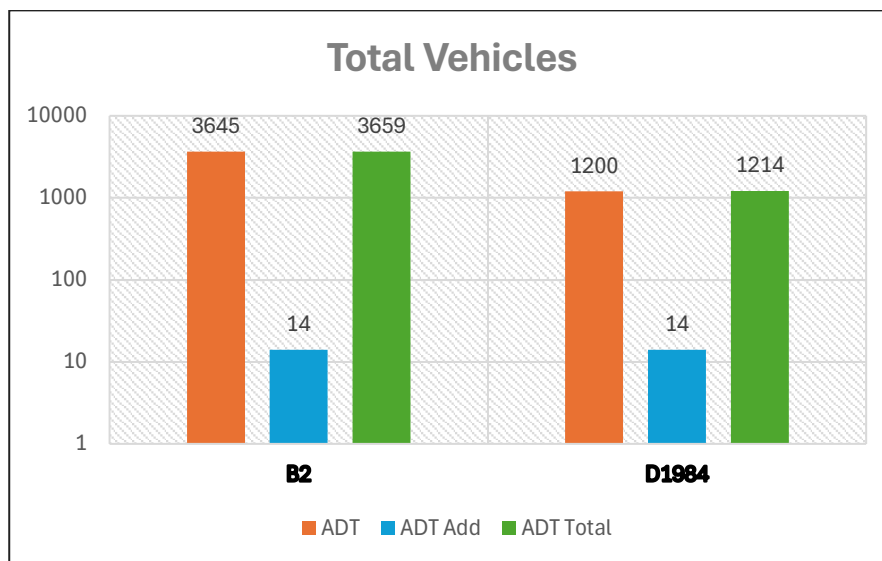


Figure 19 - Impact of Total generated traffic during the construction phase

Operational Phase

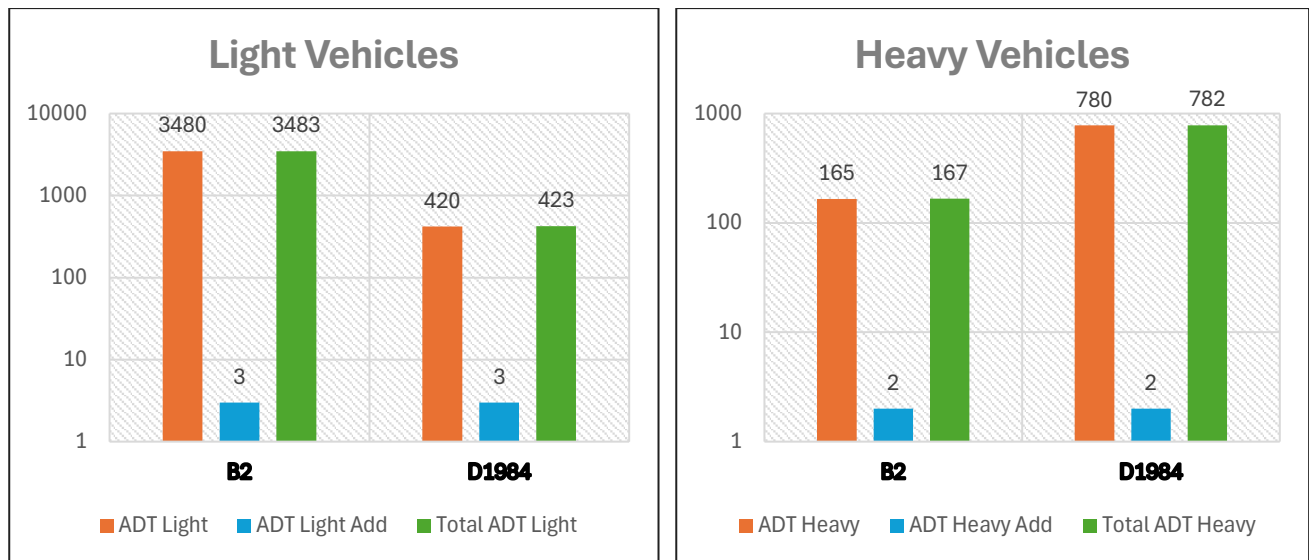


Figure 20 - Impact of generated light and heavy traffic during the construction phase

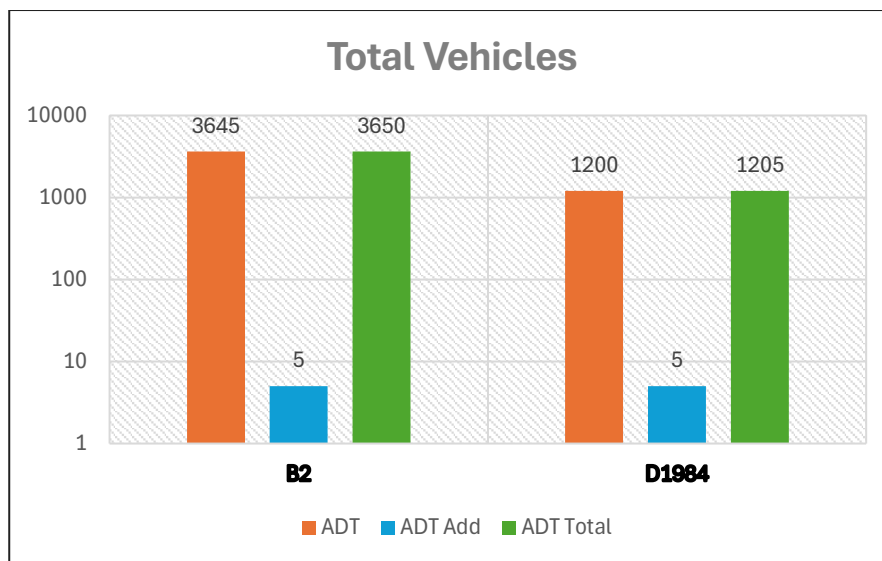


Figure 21 - Impact of Total generated traffic during the construction phase

5.4 Conclusion

Cleanergy Solutions Namibia is in the process of finalising the construction of the first hydrogen demonstration plant in Namibia, with first production intended for the latter part of 2024.

As part of the bigger intended hydrogen and ammonia infrastructure development and operation, which Cleanergy Solutions are actively pursuing, the proposed construction of a green ammonia pipeline is envisioned and will be constructed from Farm 58 to the Walvis Bay port area, in the Erongo Region, Namibia.

The Traffic Impact Assessment performed by Zutari Namibia covered the investigation into the current situation, including the current traffic, condition of the road infrastructure and the safety concerns on the current roads. The study further reported on the impact of expected generated traffic on the road infrastructure, affected communities along the route and the necessary mitigation and control measures.

It is concluded that:

- The road surface of the investigated roads and intersections are currently in a good condition.
- The geometry of the intersections is adequate for the current as well as the expected generated traffic.
- Sight distances of the intersections along the routes are adequate for the designed speed.
- The expected generated traffic will have little to no impact on the current traffic, road infrastructure as well as on the communities along the route.