Utilizing GIS Technology for Updating and Maintaining Port-to-Port Distances in the Philippine Maritime Sector

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Abstract: Accurate measurement and regular updates of port-to-port distances are essential for the effective management of the environmental impact of maritime operations. Traditional manual methods are often outdated and labor-intensive. This study explores the use of Geographic Information System (GIS) technology as an efficient alternative for automating the measurement and updating of port-to-port distances in the Philippine maritime sector. Annual port call data from the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA) for 2022 was used to demonstrate how GIS can streamline data processing and improve accuracy. The results establish a comprehensive database that agrees with the previously established database (max error: 21%). This database can be regularly updated without the need for huge manpower to support energy and emissions inventories and contribute to better environmental policy-making and maritime transportation sector management. This study also produced a Philippine port database containing 1,038 public and private ports with coordinates.

Keywords: Geographic Information Systems (GIS), Port-to-Port Distances, Maritime GHG-MRV, Maritime Transportation Activity, Data Automation

1. INTRODUCTION

As an archipelagic country, the maritime transportation sector plays a crucial role in the Philippines. The ships operating in the country support domestic trade and facilitate the movement of goods and people between islands. In 2022, the Philippine maritime industry served substantial traffic volumes, with maritime agencies reporting a domestic cargo throughput of approximately 150 million metric tons and passenger traffic exceeding 74 million (MARINA, 2024). However, the environmental impact of maritime operations, particularly in terms of energy consumption and emissions, has become a significant concern.

A study by Vergel et al. (2022) found that the maritime sector had the second highest energy demand among the transportation modes in the Philippines.

Producing bottom-up estimates for energy demand and emissions for the sector would significantly help in creating an inventory of the current situation, as well as assessing the effects of policies and strategies in terms of managing and addressing the environmental impact of the maritime sector. One methodology utilized by Salison and Vergel (2021) was to establish port-to-port trips from annual port calls report obtained from the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA). These trips are then combined with a database of all port-to-port distances from the National Mapping and Resource Information Authority (NAMRIA) to determine the actual transportation activity and, in effect, energy demand and emissions from maritime transport activities. However, a critical problem encountered by the study was that not all the port segment pairs in NAMRIA's list match the port call logs from PPA and it took the researchers a lot of time and manpower to generate useful insights from the PPA and CPA records. This problem was also mentioned by Vergel et al. (2022) and they recommended that there should be an accurate measurement and recording of port-to-port distances as this was essential data for calculating the domestic maritime sector's carbon footprint.

Historically, the determination of port-to-port distances for domestic maritime navigation routes in the Philippines has primarily been conducted on an ad hoc basis, driven by requests from local government units (LGUs) or ship operators. Currently, NAMRIA maintains a database of port-to-port distances derived from previous requests, supplemented by manual measurements obtained through tracing routes on nautical charts[1]. However, this database may contain outdated port information and may not include current routes due to the dynamic nature of maritime operations in the country. Regular updating of the database has proven challenging, as it would involve significant data collection efforts and incur additional manpower and financial costs for the agency.

The emergence of Geographic Information System (GIS) presents an opportunity to automate and streamline the port-to-port distance measurement process and potentially enhance the accuracy and efficiency of updating the database. GIS software facilitates the integration of spatial data, advanced algorithms, and visualization tools, and could be utilized as a powerful platform for analyzing and modeling maritime navigation routes. These features could help mitigate the challenges associated with manually handling voluminous port and trip data and updating the port-to-port distance database.

This study aims to address the limitations of manual data processing and route tracing and measurement by leveraging GIS technology to generate baseline port-to-port distances for commonly plied routes in domestic maritime navigation within the Philippines. The study will also utilize port traffic data from the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA) for the year 2022, and attempt to establish a comprehensive database of these distances, which is crucial for supporting energy and emissions inventory efforts in the maritime sector.

The specific objectives of this study are as follows:

[1] Routes that were manually traced were primarily made during the 1990s and 2000s, based on an internal interview with NAMRIA personnel.

Objective 1: Develop a database of Philippine ports. Collate and locate the ports recorded in the 2022 port traffic summaries of PPA and CPA and develop these into a database of ports with coordinates.

Objective 2: Generate port-to-port distances using GIS. Utilize GIS to accurately determine the distances between ports for commonly plied domestic maritime routes in the Philippines.

Objective 3: Maintain a database of domestic port-to-port distances. Establish and maintain a database of these port-to-port distances to support energy and emissions inventories for maritime operations.

2. REVIEW OF RELATED LITERATURE

Shipping is a cornerstone of global trade, facilitating the movement of approximately 80 percent of world trade by volume, and is expected to have a moderate growth rate of around 2.1 percent for the period 2024 – 2028. However, this extensive maritime network also has a significant environmental footprint, primarily due to the heavy fuel oil used by ships, which results in substantial greenhouse gas (GHG) emissions, including CO2, CH4, and N2O. These emissions contribute to global warming and climate change, posing a serious challenge to environmental sustainability (UNCTAD, 2023).

To address the environmental impact of shipping, the International Maritime Organization (IMO) has emphasized the monitoring and reduction of GHG emissions from ships. For instance, the Marine Environment Protection Committee's (MEPC) mandates the collection of fuel consumption data for ships as part of the energy efficiency measures that the IMO implemented in 2018[2]. In the Philippines, the Maritime Industry Authority (MARINA) also implements these same measures for domestic ships. As early as 2019, the agency has encouraged shipping companies in the country to prepare for the transition towards the implementation of IMO guidelines (MARINA, 2019).

To strengthen its decarbonization efforts, MARINA has aligned its strategy with the MARPOL Annex VI and has worked to target the reduction of air pollution from ships through the release Memorandum Circular SR 2021-05. This initiative is complemented by Republic Act 11285, which was implemented by the Department of Energy (DOE). This law aims to enhance energy efficiency across various energy-consuming sectors and encourages the adoption of energy conservation measures and the implementation of efficient technologies to reduce energy consumption and minimize environmental impact.

MARINA enforces compliance with international standards, including the Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP). These regulations are part of broader initiatives which help monitor and reduce GHG emissions (MARINA, 2020). Through these policies, the agency mandates that ships report their fuel consumption and emissions, and aims to enhance the efficiency of maritime operations.

One effective method for estimating emissions is the bottom-up approach. This method involves collecting detailed data on individual ships' activities, including fuel consumption,

[2] https://sdg.iisd.org/news/imo-approves-mandatory-fuel-consumption-data-collection-for-ships/

speed, and operational patterns, to come up with an accurate emissions estimate based on transportation activity. Vergel et al. (2022) emphasize that a bottom-up approach allows for a more precise estimation of energy demand and emissions, as it considers specific ship operations and route characteristics. This granularity can help identify operational inefficiencies and model how policies affect energy consumption and emissions, thereby informing targeted mitigation strategies and policies.

Recent studies have focused on estimating ship emissions using Automatic Identification System (AIS) as source of transportation activity data. For instance, Ribeiro da Silva et al. (2024) developed a methodology for predicting ship emissions, validated through case studies in Portugal, revealing significant differences in emissions between ship types, such as ferries and cruise ships. Nunes et al. (2017) reviewed various activity-based methodologies for assessing ship emissions, emphasizing the importance of accurate input data and the growing use of AIS data for tracking ship activities. They noted that containerships are major contributors to in-port emissions. Yoon et al. (2023) assessed air quality in the Daesan port area, correlating AIS-based vessel emissions with real-time air pollutant measurements, achieving a correlation coefficient of approximately 0.33.

However, this method is not common in the local setting because AIS is still not widely adopted. Despite MARINA requiring shipping companies to install and operate AIS on passenger ships weighing 300 GT and above and cargo ships weighing 500 GT and above since 2015 (Memorandum Circular No. 2015-02), data for monitoring these AIS-installed vessels is insufficient, with only 33 AIS receivers around the Philippines, and 18 of them are operational only 50% of the time (Lorenzo, 2022). This results in a lack of systematic data that hinders the effectiveness of AIS for activity data. Local projects by De La Salle University, in partnership with the Department of Science and Technology-Philippine Council for Industry, Energy and Emerging Technology Research and Development (DOST-PCIEERD), have worked on developing locally made AIS technology (Lorenzo, 2022). However, the adoption of this local AIS technology among local ships remains limited.

To address the limitations in the availability and reliability of AIS data, Vergel et al. (2022) have proposed using port call data from the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA), combined with port-to-port distances from the National Mapping and Resource Information Authority (NAMRIA). A significant challenge during the implementation of their research was that not all the port segment pairs in NAMRIA's list matched the port call logs from PPA and CPA. To supplement the NAMRIA data, each port-to-port distance identified in the port call data that were not in the NAMRIA data were manually measured through the use of Google Maps. This method requires considerable time and manpower to generate useful insights from the records.

Historically, the determination of port-to-port distances for domestic maritime navigation routes in the Philippines has primarily been conducted on an ad hoc basis, driven by requests from local government units (LGUs) or ship operators. Currently, NAMRIA maintains a database of port-to-port distances derived from previous requests, supplemented by manual measurements obtained through tracing routes on nautical charts. Based on an internal interview with NAMRIA, routes that were manually traced were primarily made during the 1990s and 2000s.[3]

The review of related literature highlights the critical need for accurate and up-to-date port-to-port distance data to support bottom-up approaches in monitoring and managing GHG emissions from ships. Given these challenges, the current paper proposes a more efficient methodology for updating port-to-port distances and speeding up the calculation of maritime energy demand. This approach aims to make use of currently available data while the maritime sector is still in transition toward using AIS technology. Furthermore, it highlights Geographic Information System (GIS) technology as a promising solution to the challenges of maintaining and updating port-to-port distance data. GIS is seen as an efficient alternative that requires less manpower and time to update the port-to-port distances database.

3. METHODOLOGY

3.1 Development of a database of Philippine ports

Port traffic summaries were obtained from the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA). For the year 2022, 434,306 and 150,344 port traffic entries were recorded by PPA and CPA, respectively, totaling 584,650 port traffic entries for the year.

In Figure 1, each ABC represents one port traffic entry recorded. Similar with Vergel et al. (2022), to prevent considering a trip twice, only the first leg of the trip was considered (A to B, highlighted in red). This is because the second leg of the trip (B to C), was assumed to be recorded as a first leg in the port traffic entry at the next call (C).

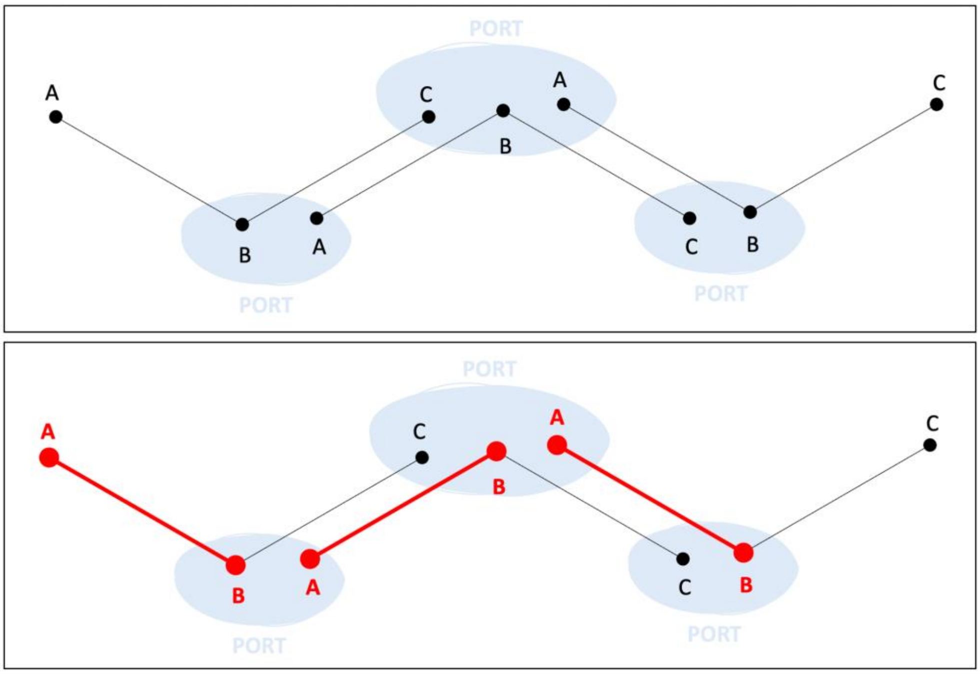


Figure 1. Illustration of port traffic entries: the *last call* or where the ship came from (A), the port where the ship arrived (B), and the *next call* or where the ship will go next (C)

[3] Based on NAMRIA interview

To manage the voluminous traffic entries, instead of deriving port segment pairs, all unique port names were derived from the port traffic summaries using the UNIQUE function of Microsoft Excel. This initial step reduced the volume to be handled from 584,650 port traffic records to 5,515 unique port names.

Table 1. Philippine Ports Authority (PPA) and Cebu Port Authority (CPA) data

	PPA	CPA	Total
Total no. of port traffic entries for year 2022	474,306 ↓	150,344 ↓	624,650 ↓
No. of unique port names from the *last calls* (A)	3,296	1,393	5,515
No. of unique port names from the the port where the ship arrived (B)	532	294	

Table 2. Sample of unique port names from the 2022 port traffic summaries of Philippine Ports Authority (PPA) and Cebu Port Authority (CPA)

Sample from PPA data		Sample from PPA data	
unique port names from the last calls (A)	unique port names where the ship arrived (B)	unique port names from the last calls (A)	unique port names where the ship arrived (B)
“CAVITE” “MANILA HARBOR CENTRE PORT SERVICES, INC” “BASECO” “CORON” “PALAWAN” “LIMINANGCONG P.” “CUYO P.” “LINAPACAN P.” “CORON PALAWAN” “BASECO”	"Abra" "Alegria" "Ambulong" "Aparri" "Aras-asan" "Aroroy" "Babak" "Bacacay" "Balanacan" "Balbagon"	"SEMIRARA ANTIQUE" "VILLANUEVA MISAMIS ORIENTAL" "JAGNA BOHOL" "ALBUERA LEYTE" "PAMPANGA CITY" "SAN JOSE SAMAR" "NAVAL BILIRAN" "GARCIAPORT CAGAYAN" "DANAO CITY" "NAGA SAKASHIPYARD"	“TALOOT WHARF" "DOLOMITE MINING CORP. (Formerly Phil Mining and Smeltering Corp)" "MABUHAY PORT ANCH." "MABUHAY PORT" "NAGA ANCH." "Solid Earth Development Corporation ANCH." "SOLID EARTH DEVELOPMENT CORPORATION (For Taiheiyo Cement Phils. Inc.)" "Libor ANCH." "APO ANCH." "APO CEMENT PRIVATE PORT"

The 5,515 unique port names were initially matched with a port database started by UP-NCTS (2021) which contains 315 ports with coordinates. If the coordinates were not available in the said port database, the ports were manually located through Google Earth. As needed, inquiries were sent to the ports through their publicly available contact details to confirm their location. Occasional entries containing international last and/or next calls were omitted from this port database development. Publicly available lists of public and private ports from PPA were also used as reference.

Upon processing, the 5,515 unique port names were further streamlined to 1,038 cleaned port names and are grouped according to their port management office and location. Reasons for this reduction include the same port being typed differently in various port traffic entries (e.g. "CUYO P.", "CUYO PALAWAN", "CUYO, PALAWAN") as well as ports being counted two or more times since they may be recorded both in the PPA and CPA lists, and in the *last calls* (A) and the port where the ship arrived (B) lists.

The final database of ports and their coordinates derived from the 2022 port traffic summaries of PPA and CPA is the first output of this study and is found in the Appendix of this paper. All these ports were then turned into point shapefiles using ArcGIS as input to the generation of port-to-port distances.

3.2 Generating port-to-port distances using GIS to establish and maintain a database

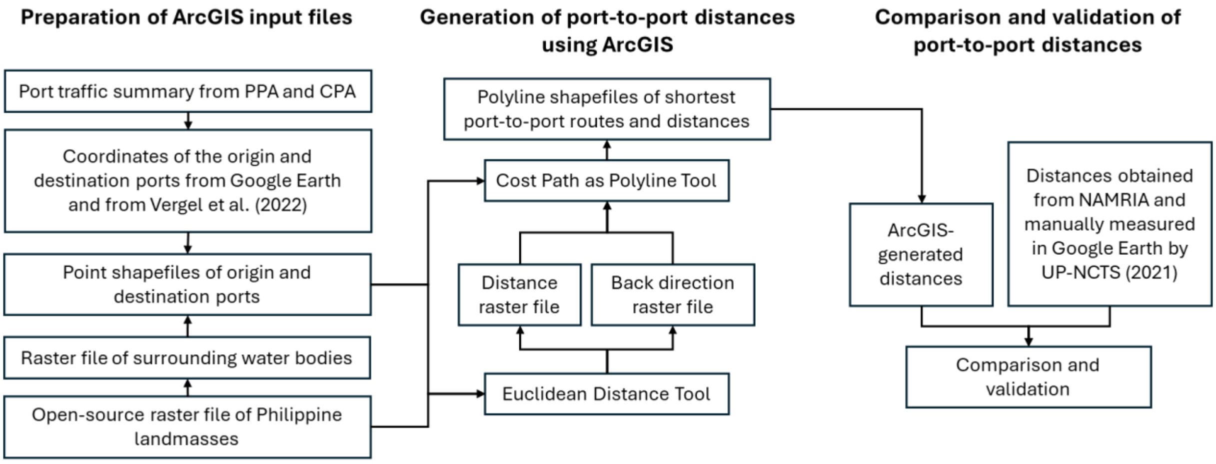


Figure 2. GIS-based methodology to generate port-to-port distances

The GIS-based methodology proposed in this study to efficiently generate domestic port-to-port distances, primarily for the purpose of estimating energy demand and emissions in the Philippine maritime transportation sector, is presented in Figure 2. The GIS software used in this study is ArcGIS Desktop 10.8.1.

The extensive port database developed in Section 3.1 is a critical input to determine the annual maritime transportation activity of the Philippines. For the purpose of demonstrating the GIS-based methodology proposed by this study, this study outlines the mass generation of port-to-port distances from the located ports to one sample port, the Manila North Harbor Port.

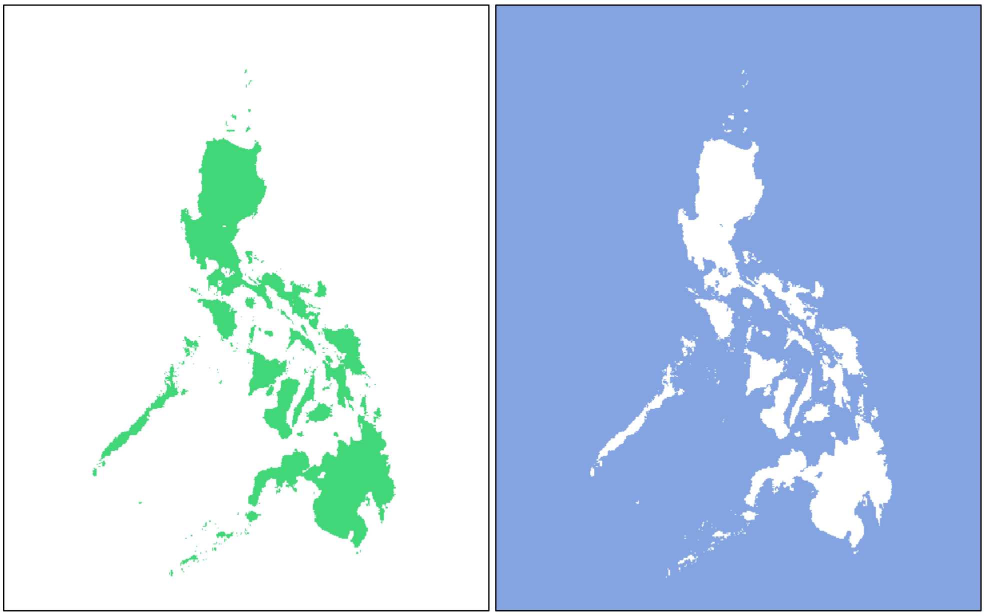
a. Preparation of ArcGIS input files

The two baseline assumptions set in generating the port-to-port distances are (1) their paths are set to follow the shortest distance possible and (2) their paths are set to only traverse Philippine water bodies and avoid landmasses. A raster file of the Philippines (Figure 3a) was used to determine the landmasses the paths shall avoid. A raster file of the surrounding water bodies was created from this (Figure 3b), representing the permissible area the paths can traverse.

These raster files were used in the following steps:

- The landmasses raster file (Figure 3a) was set as the feature barrier data for the ArcGIS tool Euclidean Distance.

- The surrounding water bodies raster file (Figure 3b) was used to adjust the port point shapefiles.



(a) (b)

Figure 3. Raster files of (a) Philippine landmasses and (b) surrounding water bodies

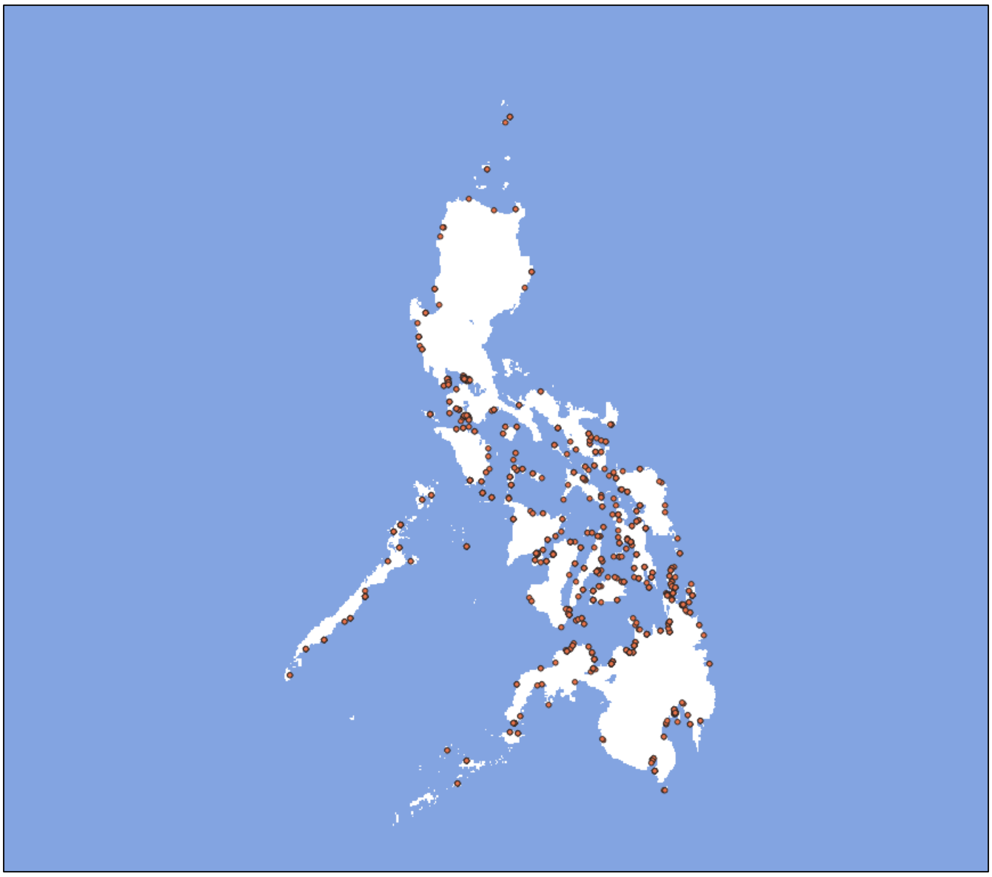


Figure 4. Located ports from the port traffic summaries of Philippine Ports Authority (PPA) and Cebu Port Authority (CPA)

Figure 4 shows the located ports from the port traffic summaries of PPA and CPA. For the shortest distances between ports to be generated using the Cost Path as Polyline tool, the points representing the ports need to fall within the water bodies, otherwise distances will not be generated because paths are set to not traverse landmasses. Some ports however were located "on land", hence the need to adjust them into the water bodies. A buffer of water points, shown in Figure 5, were generated in ArcGIS. These water points are the midpoints of the surrounding water bodies' (Figure 2b) raster cells.

The ports that fell "on land" were assigned to the water point nearest them. Some ports in the same area were assigned to the same water point, which led to further reduction in the volume handled when mass generating port-to-port distances. A sample of this are Piers 4, 6, and 8 of the Manila North Harbor Port, labeled D353, D354, and D355, respectively, in Figure 6. They are assigned to the same water point, represented as the black dot in Figure 5.

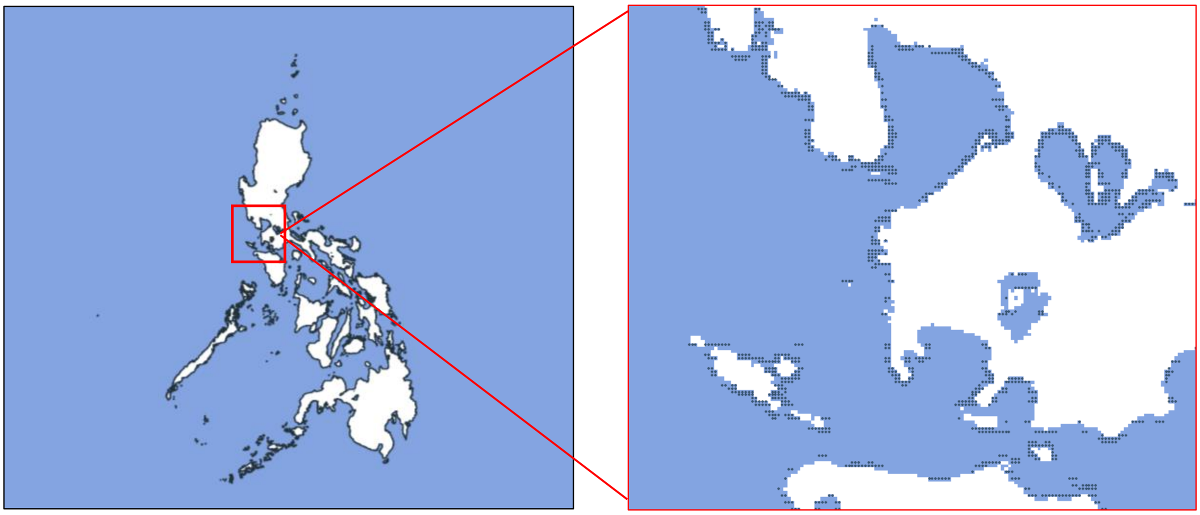


Figure 5. Buffer of water points

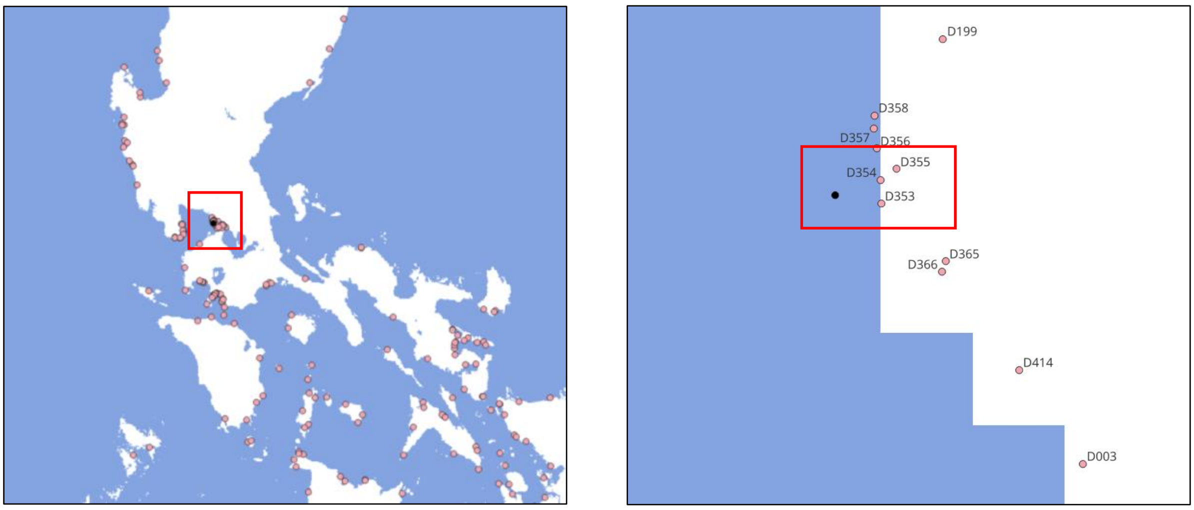


Figure 6. Piers 4, 6, and 8 (D353, D354, and D355) at the Manila North Harbor Port and the nearest water point to them (black dot)

b. *Generation of port-to-port distances using ArcGIS*

The Euclidean Distance tool is used to mass generate distances from many ports to one destination port. The default behavior of ArcGIS tools is to use Euclidean (or planar) distance for backward compatibility with previous versions that do not include a geodesic option, and because it is faster to run. Geodesic distance produces more accurate results but for distances measured at low altitudes near the equator its difference from the Euclidean distance is small. As an example, the distance between two equatorial cities, Singapore and Nairobi, is approximately 7,440 kilometers, and the Euclidean distance computes to less than a meter farther. (*Geodesic Versus Planar distance—ArcGIS Pro | Documentation*, n.d.). In the interest of mass generating port-to-port distances in a shorter time, and since the study area is situated near the equator, this proposed methodology uses Euclidean distance.

Key inputs to the Euclidean Distance tool are the following:

- the shapefile of all origin ports,
- the shapefile of the destination port, say the water point representing Piers 4, 6, and 8 of the Manila North Harbor Port,
- and a feature barrier, if needed. For this study, the feature barrier is set as the Philippine landmass raster file (Figure 3a).

Running the Euclidean Distance tool produces two raster files for the destination port: distance and back direction raster files. The distance raster file, shown as the background of Figure 7, has as raster cell values the Euclidean distance of each cell to the destination port. The back direction raster contains the calculated direction in degrees. The direction identifies the next cell along the shortest path back to the closest source while avoiding barriers. (*Euclidean Distance (Spatial Analyst)—ArCGIS Pro | Documentation*, n.d.)

Using the Cost Path as Polyline tool, polylines, or paths, from all origin ports to the set destination port were generated, as shown in Figure 7. The lengths of these polylines in terms of the set metric units, e.g. kilometers and nautical miles, were then obtained using the function Calculate Geometry.

The ArcGIS-generated port-to-port distances were then validated by comparing them to the distances previously obtained from the National Mapping and Resource Information Authority (NAMRIA) and manually measured from Google Earth by UP-NCTS (2021). It is also important to note that this study was not able to compare these results with actual shipping distances due to the limited availability of such data, as highlighted in the literature review. Instead, we compared our results with the current port-to-port distances database from NAMRIA and UP-NCTS (2021).

Since Piers 4, 6, and 8 of the Manila North Harbor Port are within the vicinity as the rest of Manila North Harbor Port's piers as well as the Manila South Harbor Port, the generated distances in Figure 7 were considered to collectively arrive at Manila. With this, all port pairs involving Manila, whether as origin or destination port, in the port-to-port distances from NAMRIA and UP-NCTS (2021), were matched with the ArcGIS-generated port-to-port distances. A total of 91 port-to-port distances matched for comparison.

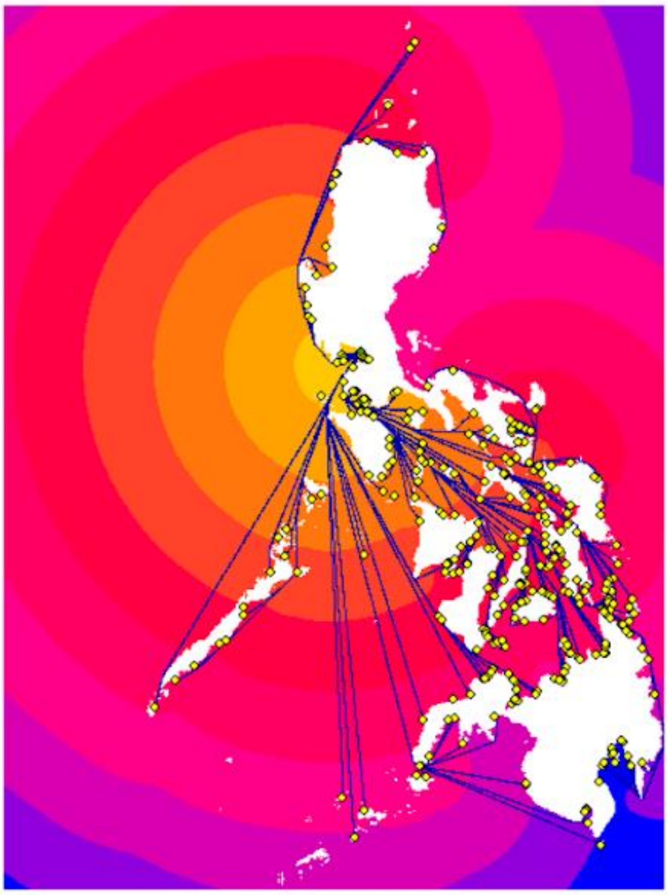


Figure 7. Generation of shortest port-to-port distances from sample origin ports to Piers 4, 6, and 8 of the Manila North Harbor Port

4. RESULTS AND DISCUSSION

4.1 Development of a database of Philippine ports

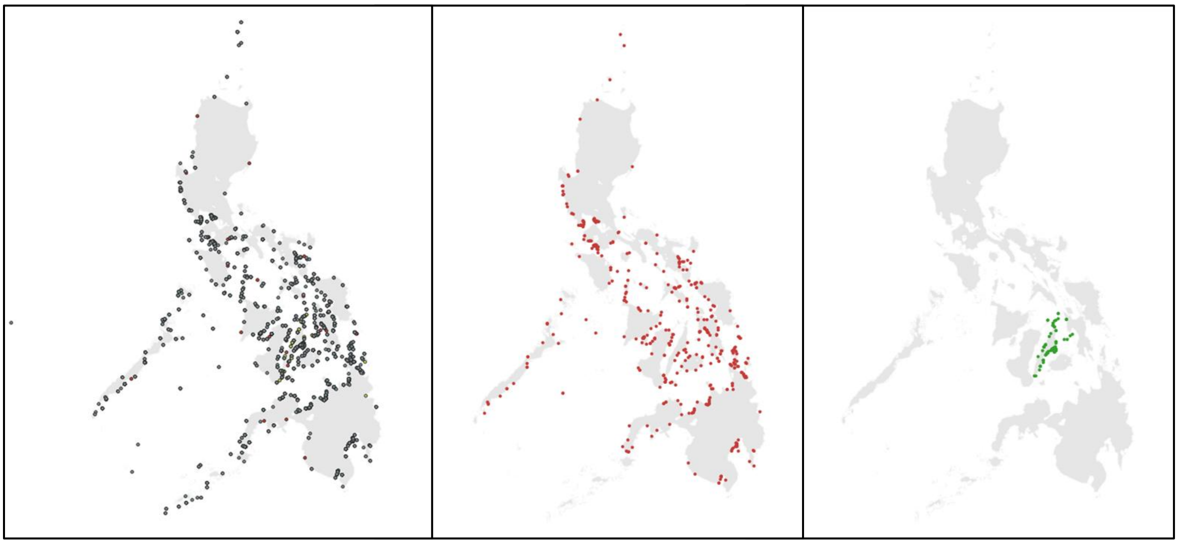
The database of Philippine ports recorded in the 2022 port traffic summaries of the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA) is found in the Appendix of this paper. This database contains a total of 1,038 ports, with 670 and 368 public and private ports, respectively. The ports' coordinates were obtained, and they were categorized by the port management office (PMO) and province they belong to. A sample of how this database is organized is shown in Table 3.

Table 3. Sample of database of ports recorded in the 2022 port traffic summaries of the Philippine Ports Authority (PPA) and Cebu Port Authority (CPA)

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
AGS	**Agusan Del Norte**	Butuan	8.95324	125.54270	Agata Processing Inc. (formerly Minimax Mineral Exploration Corporation)	9.27624	125.50542
		Cabadbaran	9.12605	125.52442	San Roque Metals Inc.	9.18332	125.52893
		Cabinet	9.11765	125.52333	SR Metals Inc.	9.18232	125.52998
		Jabonga	9.34845	125.51587	Therma Marine, Inc.	8.97818	125.33163
		Masao	9.01137	125.50341	Agsur Shipyard Ships Repair and Ships Manufacturing	8.97347	125.53129

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Nasipit	8.97902	125.33600	Pilipinas Shell Petroleum Corporation (Cabadbaran)	9.12485	125.52416
		Tubay	9.17855	125.52886			
PNG	**Aklan**	Alegria	11.84928	121.88877			
		Boracay	11.94083	121.93917			
		Caticlan	11.92778	121.94887			
		Dumaguit	11.59564	122.48166			
		Manoc-Manoc	11.94105	121.94309			
		Nabas	11.90836	122.00019			
		New Washington	11.65114	122.43062			
		Pook	11.69917	122.39568			
		Sambiray	11.91908	121.94642			
		Tabon	11.93919	121.95446			

All ports, the ports where PPA port traffic entries were recorded, and the ports where CPA port traffic entries were recorded are plotted in Figures 8a, 8b, and 8c respectively. As expected, the ports where PPA port traffic entries were recorded (Figure 8b) are located throughout the Philippines while the ports where CPA port traffic entries were recorded are concentrated in the Cebu Island (Figure 8c).



(a) (b) (c)

Figure 8. Ports recorded in the 2022 port traffic summaries of Philippine Ports Authority (PPA) and Cebu Port Authority (CPA): all ports (a), PPA (b) and CPA (c)

4.2 Validation of GIS-generated port-to-port distances

Figure 9 presents the GIS-generated port-to-port distances along with the distances obtained from NAMRIA and manually measured from Google Earth by UP-NCTS (2021). The fuller figure and a table of distances with values and differences in kilometers and percentages are in the Appendix. A portion of the table is presented in Table 4.

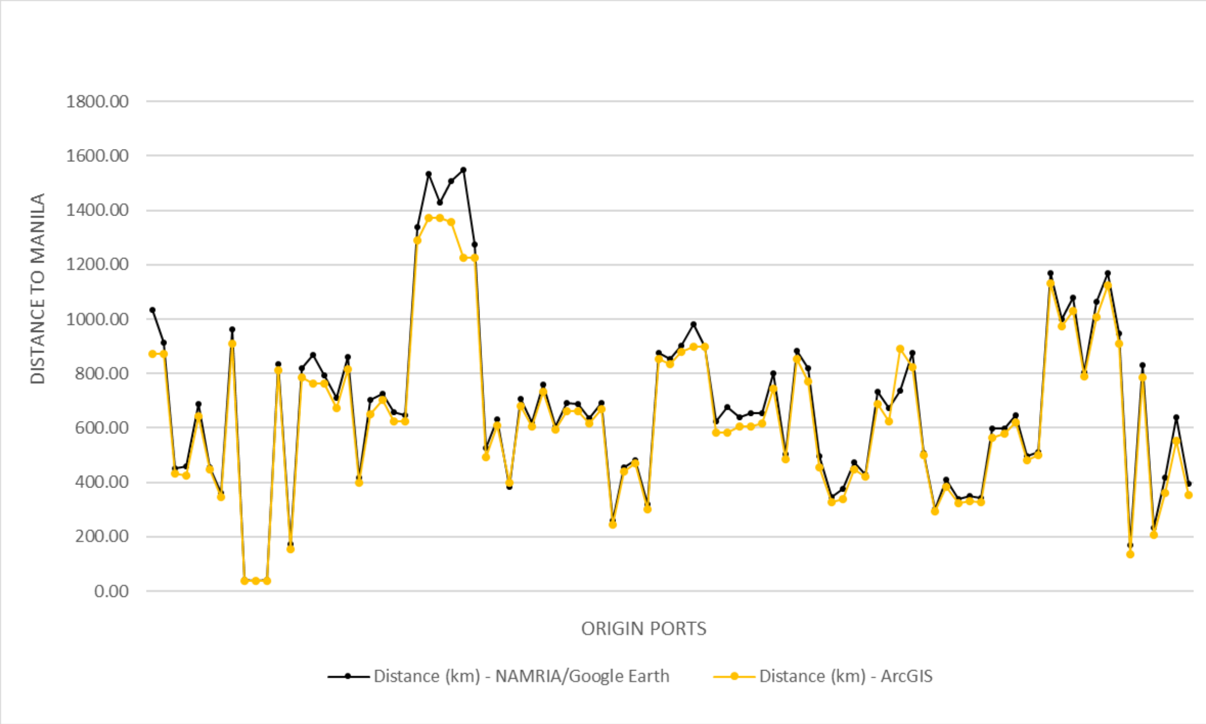


Figure 9. Comparison of ArcGIS-generated port-to-port distances with distances obtained from NAMRIA and manually measured from Google Earth by UP-NCTS (2021)

Table 4. Sample of the comparison of ArcGIS-generated port-to-port distances with distances obtained from NAMRIA and manually measured from Google Earth by UP-NCTS (2021)

No.	Region	Distances from NAMRIA/manually measured from Google Earth			Distances generated from ArcGIS		Difference	
		Origin Port	Notes	Distance to Manila (km)	Origin Port	Distance to Manila (km)	(km)	(%)
1	Agusan del Norte	BUTUAN CITY	via Tablas Strait	1033.42	Butuan	872.24	161.17	16%
2	Agusan del Norte	BUTUAN CITY	via Visayan Sea	913.04	Butuan	872.24	40.79	4%
3	Aklan	DUMAGUIT, NEW WASHINGTON	via Romblon Pass	450.04	Dumaguit	433.68	16.35	4%
4	Aklan	NEW WASHINGTON	via Romblon Pass	459.30	New Washington	424.20	35.10	8%
5	Albay	TABACO		687.09	TABACO, ALBAY	643.15	43.94	6%
6	Antique	CULASI		453.74	CULASI, ROXAS	446.05	7.69	2%
7	Antique	SEMIRARA, CALUYA	via Calavite Pass	359.29	Semirara	345.65	13.64	4%
8	Basilan	ISABELA	via Tablas Str.	961.19	Isabela	908.38	52.81	5%
9	Bataan	LIMAY		40.19	LIMAY BATAAN	38.02	2.17	5%
10	Bataan	LIMAY		38.89	LIMAY BATAAN	38.02	0.87	2%

From Figure 9, the ArcGIS-generated distances do not vastly deviate from the distances from NAMRIA and those manually measured through Google Earth by UP-NCTS (2021). The percentage differences between these two sets of distances range from ±21%. 80 out of the 91 comparisons have percentage differences that are 10% and below. While this validates the proposed GIS-based methodology to generate port-to-port distances, this at the same time validates the distances used by UP-NCTS (2021) to estimate the energy demand from the maritime transportation sector. As stated, the distances from NAMRIA may be outdated and may not include current routes. In reference to the best practice outlined in the IPCC 2006 guidelines, uncertainties in transportation activity data may vary, with other datasets reaching as high as 50 percent. However, it is expected that data will improve when reports from actual trips become available.

Majority at 89 out of 91 of the ArcGIS-generated distances are also shorter than the distances used by UP-NCTS (2021). This is expected since the ArcGIS tools used are set to obtain the shortest distances between ports. The manual measurements done using Google Earth for example use the ferry lines as reference, which are not necessarily the shortest distance between ports. Existing ferry lines were still referenced in this study to qualitatively validate the general alignment of the paths generated in ArcGIS. However, due to the unavailability of free-access shapefiles, ferry lines were not utilized as GIS data sets. There were also some port pairs for which no corresponding ferry lines were available.

Overall, the strong agreement between the results obtained from the presented methodology and the existing NAMRIA and NCTS databases confirms the validity of this approach. In the absence of AIS data for the local fleet, this GIS-based methodology provides a reliable alternative to estimating the maritime transportation activity for future energy and emissions estimates in the maritime sector. Since the presented method is easily replicable and scalable, it can serve as a crucial tool for generating accurate transportation activity data, essential for environmental assessments and policy development within the Philippine maritime industry.

5. CONCLUSIONS AND RECOMMENDATIONS

This study presents a methodology for estimating the port-to-port distances using GIS technology to improve the efficiency and speed of calculating maritime transport activity. This influences the generation of energy demand and emissions estimates from maritime operations. This study also produced a Philippine port database containing 1,038 public and private ports with coordinates.

The results successfully demonstrate the use of GIS technology to address the limitations of manual data processing and route tracing to generate baseline port-to-port distances for commonly plied routes in domestic maritime navigation within the Philippines. These are validated with previously obtained port-to-port distances from NAMRIA and with those manually measured using Google Earth. An initial database of ArcGIS-generated distances from other ports to Manila is also developed to support energy and emissions inventories for maritime operations.

In generating the distances, the two baseline assumptions set were (1) the paths are to follow the shortest distance possible and (2) the paths are to only traverse Philippine water bodies and avoid landmasses. Other information such as water depth, wind and water currents, established ferry lines, actual paths traversed, if available, may be useful additional inputs to the determination of port-to-port distances, depending on how refined they need to be and for what purpose they will be used. For the purpose of estimating transportation energy demand and emissions of the maritime sector, these baseline port-to-port distances are deemed sufficient because the estimates are not highly sensitive to the distances travelled.

Moving forward, the authors recommend exploring the possibility of replicating the methodology using more accessible GIS technology, such as QGIS. It is also recommended for the maritime sector to have a standardized naming of ports which will especially be helpful in processing port traffic summaries. The initial database of port-to-port distances found in the Appendix follows the naming of the ports as recorded by the Philippine Ports Authority in their 2022 port traffic summary. The database of Philippine ports with coordinates in the Appendix initially proposes a more standardized port naming convention.

There are publicly available lists of public and private ports in the Philippines such as those from the Philippine Ports Authority. However, to the authors knowledge, this is the first attempt to develop a Philippine port database with coordinates, which makes the database usable for GIS applications, that is extensively derived from a year's worth of port traffic records.

These developments of an extensive database of Philippine ports (Objective 1), a GIS-based method to more efficiently generate port-to-port distances (Objective 2), as well as an initial database of validated GIS-generated domestic port-to-port distances (Objective 3) are intended to support the Philippine maritime sector, including but not limited to estimating maritime transportation activity for energy demand and emissions inventories.

It is relevant to mention that there is an ongoing project at the Intelligent Transport Systems Lab at the UP National Center for Transportation Studies (ITSLab-UP NCTS), funded by DOST-PCIEERD, which aims to develop local weather routing software. This software will take into consideration the structural and dynamic response of a particular ship design given forecasted wind and wave conditions to develop optimized routing plans for ships. The baseline port-to-port distances generated in this study can serve as a reference to assess how much additional distance a ship might travel if, for example, a route is optimized for safety versus cost or time.

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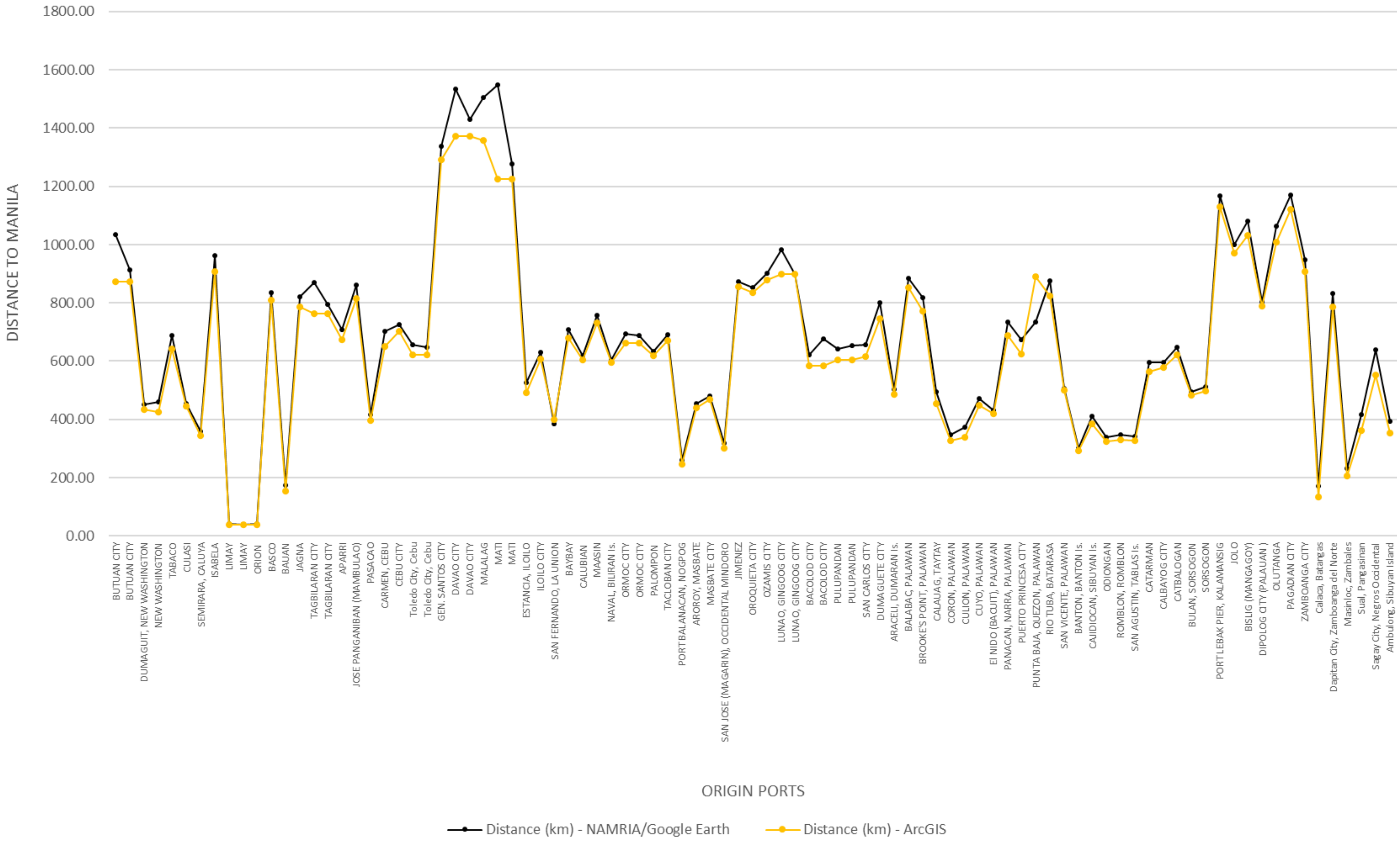
Appendix A. COMPARISON OF ARCGIS-GENERATED PORT-TO-PORT DISTANCES WITH DISTANCES OBTAINED FROM NAMRIA AND MANUALLY MEASURED FROM GOOGLE EARTH BY UP-NCTS (2021)

No.	Region	Distances from NAMRIA/manually measured from Google Earth			Distances generated from ArcGIS		(km)	(%)
		Origin Port	Notes	Distance to Manila (km)	Origin Port	Distance to Manila (km)		
1	Agusan del Norte	BUTUAN CITY	via Tablas Strait	1033.42	Butuan	872.24	161.17	16%
2	Agusan del Norte	BUTUAN CITY	via Visayan Sea	913.04	Butuan	872.24	40.79	4%
3	Aklan	DUMAGUIT, NEW WASHINGTON	via Romblon Pass	450.04	Dumaguit	433.68	16.35	4%
4	Aklan	NEW WASHINGTON	via Romblon Pass	459.30	New Washington	424.20	35.10	8%
5	Albay	TABACO		687.09	TABACO, ALBAY	643.15	43.94	6%
6	Antique	CULASI		453.74	CULASI, ROXAS	446.05	7.69	2%
7	Antique	SEMIRARA, CALUYA	via Calavite Pass	359.29	Semirara	345.65	13.64	4%
8	Basilan	ISABELA	via Tablas Str.	961.19	Isabela	908.38	52.81	5%
9	Bataan	LIMAY		40.19	LIMAY BATAAN	38.02	2.17	5%
10	Bataan	LIMAY		38.89	LIMAY BATAAN	38.02	0.87	2%
11	Bataan	ORION		42.60	ORION DACKYARD	38.82	3.77	9%
12	Batanes	BASCO		835.25	Basco Batanes	810.45	24.80	3%
13	Batangas	BAUAN		173.16	Bauan Batangas	153.82	19.34	11%
14	Bohol	JAGNA	via W Coast of Leyte	820.44	Jagna	787.04	33.39	4%
15	Bohol	TAGBILARAN CITY	via Tablas Strait	868.59	Tagbilaran	763.90	104.69	12%
16	Bohol	TAGBILARAN CITY	via Visayan Sea to Cebu Str	794.51	Tagbilaran	763.90	30.61	4%
17	Cagayan	APARRI		709.32	APARRI	674.02	35.30	5%
18	Camarines Norte	JOSE PANGANIBAN (MAMBULAO)	via Ticao Pass	861.18	Jose Panganiban	814.21	46.97	5%
19	Camarines Sur	PASACAO		416.70	Pasacao	396.67	20.03	5%
20	Cebu	CARMEN, CEBU		701.91	Carmen Port Cebu	651.72	50.19	7%
21	Cebu	CEBU CITY	via Visayan Sea	725.98	CEBU	702.18	23.80	3%
22	Cebu	Toledo City, Cebu		657.46	Toledo	622.87	34.59	5%
23	Cebu	Toledo City, Cebu	via E Coast of Panay to Asuncion Pass	646.35	Toledo	622.87	23.48	4%
24	Cotabato (South)	GEN. SANTOS CITY	via Tablas Strait to North Sta Cruz Is	1337.14	General Santos	1290.49	46.65	3%
25	Davao del Sur	DAVAO CITY	via Tablas Strait to Basilan Strait	1535.31	Davao	1372.99	162.32	11%
26	Davao del Sur	DAVAO CITY	via Visayan Sea to E Coast of Mindanao	1429.74	Davao	1372.99	56.76	4%
27	Davao del Sur	MALALAG	via Tablas Strait to N Sta. Cruz Is.	1505.68	MALALAG	1357.16	148.51	10%
28	Davao Oriental	MATI	via N Sta Cruz Is to Mindanao Sea	1548.27	Mati	1224.74	323.53	21%
29	Davao Oriental	MATI	via Visayan Sea to E Coast of Mindanao	1276.03	Mati	1224.74	51.29	4%
30	Iloilo	ESTANCIA, ILOILO		525.97	ESTANCIA	492.62	33.35	6%
31	Iloilo	ILOILO CITY	via Tablas Strait	629.68	Iloilo	607.67	22.01	3%
32	La Union	SAN FERNANDO, LA UNION		385.22	San Fernando	398.18	-12.97	-3%

No.	Region	Distances from NAMRIA/manually measured from Google Earth			Distances generated from ArcGIS		(km)	(%)
		Origin Port	Notes	Distance to Manila (km)	Origin Port	Distance to Manila (km)		
33	Leyte	BAYBAY	via Visayan Sea	707.46	Baybay	680.18	27.28	4%
34	Leyte	CALUBIAN	via Masbate Pass	618.57	Calubian	604.11	14.46	2%
35	Leyte	MAASIN	via W Coast of Taguingui Is.	757.47	Maasin City	731.76	25.70	3%
36	Leyte	NAVAL, BILIRAN Is.	via Masbate Pass	605.60	NAVAL	595.28	10.32	2%
37	Leyte	ORMOC CITY	via Visayan Sea	692.65	Ormoc	661.87	30.78	4%
38	Leyte	ORMOC CITY	via W Tanguingui Is. Lt	688.94	Ormoc	661.87	27.08	4%
39	Leyte	PALOMPON	via Visayan Sea	633.38	Palompon	618.00	15.38	2%
40	Leyte	TACLOBAN CITY	via Masbate Pass to San Juanico Str.	690.80	Tacloban	670.46	20.33	3%
41	Marinduque	PORT BALANACAN, NOGPOG		259.28	TMO Balanacan	245.09	14.19	5%
42	Masbate	AROROY, MASBATE		455.59	Aroroy, Masbate	439.17	16.42	4%
43	Masbate	MASBATE CITY		479.67	MASBATE	469.36	10.31	2%
44	Occidental Mindoro	SAN JOSE (MAGARIN), OCCIDENTAL MINDORO	via W Coast of Mindoro	318.54	San Jose Mindoro	301.74	16.80	5%
45	Misamis Occidental	JIMENEZ	via Tablas Strait	874.14	JIMENEZ	854.08	20.06	2%
46	Misamis Occidental	OROQUIETA CITY	via Tablas Strait	853.77	Bajo,Oroquieta City	834.96	18.81	2%
47	Misamis Occidental	OZAMIS CITY	via Tablas Strait	901.92	Ozamis	877.77	24.15	3%
48	Misamis Oriental	LUNAO, GINGOOG CITY	via Tablas Strait	981.56	GINGOOG CDO	899.24	82.32	8%
49	Misamis Oriental	LUNAO, GINGOOG CITY	via Visayan Sea	898.22	GINGOOG CDO	899.24	-1.02	0%
50	Negros Occidental	BACOLOD CITY	via E Coast of Panay	622.27	Bacolod	584.18	38.09	6%
51	Negros Occidental	BACOLOD CITY	via N Coast of Panay to Iloilo Strait	675.98	Bacolod	584.18	91.80	14%
52	Negros Occidental	PULUPANDAN	via Romblon Pass to E Panay	640.79	PULUPANDAN	603.92	36.87	6%
53	Negros Occidental	PULUPANDAN	via Tablas Striat	653.76	PULUPANDAN	603.92	49.83	8%
54	Negros Occidental	SAN CARLOS CITY	via E Coast of Panay	655.61	SAN CARLOS	616.15	39.46	6%
55	Negros Oriental	DUMAGUETE CITY	via Tablas Starit	801.36	Dumaguete	744.54	56.82	7%
56	Palawan	ARACELI, DUMARAN Is.		501.89	DUMARAN	485.51	16.38	3%
57	Palawan	BALABAC, PALAWAN	via W Coast of Palawan	883.40	Balabac	851.93	31.48	4%
58	Palawan	BROOKE'S POINT, PALAWAN		818.58	BROOKE'S POINT	771.79	46.79	6%
59	Palawan	CALAUAG, TAYTAY		495.41	TAYTAY	455.29	40.12	8%
60	Palawan	CORON, PALAWAN	via E Busuanga Is.	346.32	CORON	327.50	18.82	5%
61	Palawan	CULION, PALAWAN		374.10	CULION	338.16	35.94	10%
62	Palawan	CUYO, PALAWAN	via W of Manamoc Is. Light	472.26	CUYO P.	448.60	23.66	5%
63	Palawan	El NIDO (BACUIT), PALAWAN	via W Busuanga	429.66	EL NIDO PALAWAN	420.12	9.54	2%
64	Palawan	PANACAN, NARRA, PALAWAN		733.39	NARRA PALAWAN	687.38	46.01	6%
65	Palawan	PUERTO PRINCESA CITY		672.28	Puerto Princesa	625.63	46.64	7%
66	Palawan	PUNTA BAJA, QUEZON, PALAWAN		735.24	QUEZON	889.48	-154.23	-21%

No.	Region	Distances from NAMRIA/manually measured from Google Earth			Distances generated from ArcGIS		(km)	(%)
		Origin Port	Notes	Distance to Manila (km)	Origin Port	Distance to Manila (km)		
67	Palawan	RIO TUBA, BATARASA	via E Coast of Palawan	876.00	Rio Tuba Nickel Mining Corporation (RTNMC) HPP	823.24	52.76	6%
68	Palawan	SAN VICENTE, PALAWAN		505.60	SAN VICENTE PALAWAN	499.45	6.15	1%
69	Romblon	BANTON, BANTON Is.		300.02	Banton	292.46	7.56	3%
70	Romblon	CAJIDIOCAN, SIBUYAN Is.	via Romblon Pass	411.14	CAJIDIOCAN	384.53	26.61	6%
71	Romblon	ODIONGAN		338.92	Odiongan Romblon	323.01	15.91	5%
72	Romblon	ROMBLON, ROMBLON		348.18	ROMBLON	328.99	19.19	6%
73	Romblon	SAN AGUSTIN, TABLAS Is.		342.62	San Agustin	325.82	16.80	5%
74	Northern Samar	CATARMAN	via Ticao Pass to Biri Channel	596.34	Catarman Oill Mill Inc.	563.53	32.82	6%
75	Western Samar	CALBAYOG CITY	via Masbate Pass	596.34	Calbayog	579.40	16.95	3%
76	Western Samar	CATBALOGAN	via Masbate Pass	648.20	CATBALOGAN	620.20	28.00	4%
77	Sorsogon	BULAN, SORSOGON		494.48	Bulan	482.45	12.04	2%
78	Sorsogon	SORSOGON		511.15	Sorsogon	498.86	12.29	2%
79	Sultan Kudarat	PORT LEBAK PIER, KALAMANSIG	via Tablas Strait to N Sta. Cruz Is.	1168.61	Kalamansig	1129.75	38.86	3%
80	Sulu	JOLO		1000.08	Jolo, Sulu (ARMM)	971.84	28.24	3%
81	Surigao del Sur	BISLIG (MANGAGOY)	via W Coast of Tanguingui Is.	1079.72	Bislig, Sua	1030.48	49.23	5%
82	Zamboanga del Norte	DIPOLOG CITY (PALAUAN)	via Tablas Strait	803.77	Dipolog	787.69	16.07	2%
83	Zamboanga del Norte	OLUTANGA	via Tablas Strait N Sta. Cruz Is.	1063.05	OLUTANGA	1008.16	54.88	5%
84	Zamboanga del Norte	PAGADIAN CITY	via Tablas Strait to Sta. Cruz Is.	1170.46	PAGADIAN	1122.36	48.10	4%
85	Zamboanga del Norte	ZAMBOANGA CITY	via Tablas Strait	948.22	ZAMBOANGA	908.60	39.63	4%
86	NCR-NORTH	Calaca, Batangas	Google Maps	170.04	SEM-CALACA POWER CORPORATION	133.91	36.13	21%
87	NCR-NORTH	Dapitan City, Zamboanga del Norte	Google Maps	831.77	Dapitan	785.57	46.20	6%
88	NCR-NORTH	Masinloc, Zambales	Google Maps	233.11	Masinloc	205.14	27.97	12%
89	NCR-NORTH	Sual, Pangasinan	Google Maps	417.74	Sual	360.56	57.18	14%
90	NCR-NORTH	Sagay City, Negros Occidental	Google Maps	639.67	Sagay	552.75	86.92	14%
91	NCR-NORTH	Ambulong, Sibuyan Island	Google Maps	394.38	Ambulong	354.24	40.14	10%

Figure A1. COMPARISON OF ARCGIS-GENERATED PORT-TO-PORT DISTANCES WITH DISTANCES OBTAINED FROM NAMRIA AND MANUALLY MEASURED FROM GOOGLE EARTH BY UP-NCTS (2021)



Appendix B. DATABASE OF PORTS RECORDED IN THE 2022 PORT TRAFFIC SUMMARIES OF PHILIPPINE PORTS AUTHORITY (PPA) AND CEBU PORT AUTHORITY (CPA) WITH COORDINATES

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
AGS	Agusan Del Norte	Butuan	8.95324	125.54270	Agata Processing Inc. (formerly Minimax Mineral Exploration Corporation)	9.27624	125.50542
		Cabadbaran	9.12605	125.52442	San Roque Metals Inc.	9.18332	125.52893
		Cabinet	9.11765	125.52333	SR Metals Inc.	9.18232	125.52998
		Jabonga	9.34845	125.51587	Therma Marine, Inc.	8.97818	125.33163
		Masao	9.01137	125.50341	Agsur Shipyard Ships Repair and Ships Manufacturing	8.97347	125.53129
		Nasipit	8.97902	125.33600	Pilipinas Shell Petroleum Corporation (Cabadbaran)	9.12485	125.52416
		Tubay	9.17855	125.52886			
PNG	Aklan	Alegria	11.84928	121.88877			
		Boracay	11.94083	121.93917			
		Caticlan	11.92778	121.94887			
		Dumaguit	11.59564	122.48166			
		Manoc-Manoc	11.94105	121.94309			
		Nabas	11.90836	122.00019			
		New Washington	11.65114	122.43062			
		Pook	11.69917	122.39568			
		Sambiray	11.91908	121.94642			
		Tabon	11.93919	121.95446			
BCL	Albay	Bacacay	13.29814	123.79421	Bogtong Passenger Terminal Port	13.21708	124.02216
		Bagacay	13.06883	123.76115	Globe Coco Products Manufacturing Corporation	13.21910	123.76890
		Bilbao	13.26914	124.03131	New Horizons Cargo Services	13.21059	123.76552
		Legazpi	13.14542	123.75865	Sta. Clara Shipping Corporation	13.36252	123.73727
		Lidong	13.21168	123.76421			
		Liguan	13.26465	123.91520			
		Malilipot	13.32125	123.76236			
		Malinao	13.40967	123.71414			
		Malobago	13.17189	124.20226			
		Misibis	13.23702	123.91232			
		Morcborocan	13.21850	124.09951			
		Padang	13.21042	123.76572			
		Pantao	13.19376	123.32484			
		Pio Duran	13.02780	123.44379			
		Rapu Rapu	13.18524	124.12374			
		Sula	13.23998	123.86761			
		Tabaco	13.36087	123.73760			
PNG	Antique	Barbaza	11.24220	122.04822	DMC-CERI	12.05619	121.35907
		Bugasong	11.07226	122.04157	Semirara Mining and Power Corporation	12.07088	121.39227
		Caluya	11.95811	121.55959			
		Culasi	11.46969	122.05665			
		Libertad	11.76771	121.91710			
		San Jose de Buenavista	10.73760	121.93861			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Semirara	12.05387	121.35690			
BNA	Aurora	Casiguran	16.24077	122.07741			
		Dilasag	16.39606	122.22011			
		Dingalan	15.38266	121.39654			
ZBA	Basilan	Al-Barka	6.46163	122.19316			
		Lamitan	6.67446	122.15924			
		Malamawi	6.71396	121.97280			
		Maluso	6.54693	121.86875			
		Pilas Island	6.66166	121.58594			
		Sumisip	6.41122	122.03191			
BNA	Bataan	Capinpin	14.58540	120.59072	Dive Industries Philippines, Inc.	14.42429	120.56527
		Lamao	14.51427	120.61123	Herma Shipyard Inc.	14.43781	120.50639
		Limay	14.51405	120.61126	Hyatt Terminal and Industries Corp.	14.43145	120.56717
		Lusong	14.44660	120.43264	Jetti	14.47528	120.60803
		Mariveles	14.43137	120.48576	Mariveles Grain Corporation	14.44091	120.50229
		Orion	14.58661	120.59219	Mariveles Grain Corporation Corporate office	14.44091	120.50229
		Roxas	14.55211	120.59987	Mariveles Power Generation Corporation (MPGC) - Mariveles Coal-Fired Power Plant	14.45014	120.43253
		Seafront	14.45790	120.60297	National Power Corporation (Limay)	14.54484	120.60323
					Oillink International Corporation	14.48149	120.60672
					Orion Dockyard, Inc.	14.59364	120.58406
					Petron	14.52913	120.59983
					Philcement	14.42972	120.51149
					Philcement (Bataan)	14.42972	120.51149
					PNOC Alternative Fuels Corp. (formerly PNOC Petrochemicals Dev. Corporation (PNOC-PDC))	14.49718	120.60555
					San Miguel	14.43711	120.50496
					San Miguel Consolidated Power Corp.	14.52029	120.59840
					Seafront Shipyard & Marine Services Corporation	14.47082	120.60308
					SMC Shipping and Lighterage Corporation (Orion)	14.58941	120.58483
					Total Philippines Corporation	14.43278	120.56889
NLZ	Batanes	Basco	20.44744	121.96669			
		Itbayat	20.78029	121.82021			
		Mahatao	20.42101	121.94781			
		Mavulis Island	21.11753	121.94658			
		Sabtang	20.33577	121.87263			
BGS	Batangas	Ambulong	14.08635	121.06005	Balayan Distillery Inc. (BDI)	13.91210	120.83382
		Anilao	13.76099	120.92692	Batangas Bay Terminal Inc. (BBTI)	13.78136	120.97347
		Batangas	13.75521	121.04358	Bauan International Port Inc. Shipping service	13.79034	120.99103
		Bauan	13.77983	121.00813	Calaca Industrial Seaport Corp. - Phase 1 (Phoenix Petroterminals & Industrial Park Corp.) [Phoenix Petroleum Calaca Depot.]	13.91858	120.82343
		Berberabe	13.70392	121.05612	Calaca Industrial Seaport Corp. - Phase 2 (Bacnotan Industrial Park Corp.)	13.91858	120.82343
		Calaca	13.91561	120.82342	Chevron Philippines Inc.	13.77425	121.02057
		Calatagan	13.82275	120.62843	Ecozone Properties Inc.	13.78187	120.98701

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Lian	13.96184	120.61246	EEI Corporation [EEI Fabrication Batangas Yard - Main Shop]	13.77803	120.97116
		Lobo	13.64465	121.17987	First Gas Power Corporation	13.77669	121.03351
		Mainaga	13.76079	120.95637	Golden Bay Grain Terminal Corporation	13.73999	120.94421
		Nasugbu	14.08336	120.62125	GSMI MG8 Terminal Inc. Depot	13.77348	120.96314
		San Antonio	13.53484	121.07183	Himmel Industries Inc.	13.68847	121.05192
		San Juan	10.26332	125.17157	Holcim	13.92524	120.79273
		Simlong	13.66151	121.05058	Holcim Mabini	13.73708	120.94218
		Subukin	13.72203	121.44843	JG Summit Petrochemical Corporation	13.67663	121.05516
		Tabangao	13.71335	121.06126	Kepco Ilijan Corporation	13.62260	121.07793
		Talaga	13.73389	120.93615	Keppel Offshore & Marine	13.78506	120.98400
		Tingloy	13.66221	120.87382	Landoor Pier	13.76799	120.96108
		Wawa	14.08269	120.62058	Lemery Oil Terminal	13.90984	120.84800
					LMG Land Development Corporation	13.69224	121.05140
					Mabini Batangas Premier Terminal, Inc. (MBPTI)	13.76943	120.96136
					Mabuhay Vinyl Corporation	13.78079	120.97284
					Petron	13.75866	120.95622
					Pilipinas Shell Petroleum Corporation	13.72163	121.06826
					PNOC-EC ESB (Energy Supply Base)	13.75802	120.95467
					San Miguel Mills, Inc. - Bauan	13.74402	120.94764
					San Miguel Mills, Inc. - BP	13.71135	121.06307
					Seaoil Lubricants Blending Plant	13.76605	120.95994
					SEM-Calaca Power Corporation (SCPC)	13.93242	120.78955
					SL Mariveles Drydocking & Shipyard Corporation	13.78431	120.97696
					South Point Terminal Inc.	13.93154	120.74664
					Southbay Bulk Terminal, Inc. (SBTI)	13.92683	120.79149
					Suntrak Corporation	13.76286	120.95723
					Tiger Land Realty Corporation	13.65602	121.04860
					Unioil	13.69238	121.05142
					Chemoil Pinamucan	13.69335	121.04886
					United Coconut Chemicals, Inc.	13.78079	121.01509
WLB	**Biliran**	Biliran	11.46319	124.47317			
		Cabucgayan	11.47245	124.57431			
		Higatangan	11.56517	124.27460			
		Kawayan	11.68217	124.35927			
		Maripipi	11.77748	124.34955			
		Naval	11.56015	124.39156			
BHL	**Bohol**	Bien Unido	10.13746	124.38142	Pilipinas Shell Petroleum Corporation	9.65137	123.84920
		Buenavista	10.09052	124.11305			
		Catagbacan	9.86183	123.82873			
		Clarin	9.96830	124.02313			
		Garcia Hernandez	9.61683	124.30922			
		Getafe	10.15522	124.15877			
		Guindulman	9.76130	124.48844			
		Jagna	9.64873	124.36751			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Loay	9.59844	124.00898			
		Loon	9.86248	123.82862			
		Marijuboc	9.73727	123.84075			
		Popoo	10.05731	124.53247			
		Tagbilaran	9.64935	123.84592			
		Talibon	10.15318	124.32844			
		Tapal	10.05341	124.52612			
		Tubigon	9.95635	123.95785			
		Tungod	10.03659	124.05550			
		Ubay	10.06208	124.47307			
		Balicasag	9.51394	123.68432			
BNA	**Bulacan**	Hagonoy	14.76770	120.74135			
NLZ	**Cagayan**	Aparri	18.36495	121.62868			
		Calayan	19.26894	121.45646			
		Claveria	18.61399	121.05041			
		San Jose	18.38253	122.10895			
MOC	**Camiguin**	Balbagon	9.24317	124.73733			
		Benoni	9.13957	124.79397			
		Guinsilaban	9.09877	124.78785			
BCL	**Camarines Sur**	Bula	13.39741	123.20697	BESCOM	13.50731	123.05271
		Guijalo	13.73642	123.86995	Pilipinas Shell Petroleum Corporation (Pasacao)	13.50176	123.03418
		Nato	13.61242	123.53652			
		Pasacao	13.50782	123.04249			
		Ragay	13.84976	122.64863			
		Sabang	13.72857	123.21461			
BCL	**Camarines Norte**	Calaguas Island	14.47565	122.95012	Magna-Kron Realty Philippines Inc.	14.32266	122.67295
		Calambayungan	14.30202	122.64957			
		Jose Panganiban	14.31441	122.67396			
		Mercedes-Manguisoc	14.10967	123.01290			
		Osmena	14.31426	122.67396			
PNG	**Capiz**	Ivisan	11.54762	122.63648	Petron	11.60735	122.72162
		Libas	11.59626	122.72199	San Miguel Brewery Inc. Roxas Sales Office	11.59646	122.71937
		Roxas	11.60411	122.70962			
BCL	**Catanduanes**	Cabugao	13.59360	124.28078	Powerzone Petroleum Products Corporation	13.57117	124.22359
		Codon	13.66517	124.03817			
		San Andres	13.59755	124.09659			
		Virac	13.58214	124.23388			
NCS	**Cavite**	Corregidor	14.38875	120.58608	Cavite Gateway Terminal Inc.	14.35858	120.79045
		San Nicolas	14.43534	120.79331	Sabang East Central North Boat Terminal	14.38873	120.58627
CPA	**Cebu**	Angasil	10.30252	124.01851	ALD Sea Transport	10.30131	123.91609
		Argao	9.88013	123.60978	Apo Cement Corporation	10.18915	123.75013
		Badian	9.86951	123.37625	Arctura Corporation	10.32384	123.96077
		Balamban	10.46455	123.68546	Asian Grains Corporation	10.20254	123.76177
		Bantayan	11.16564	123.71638	Asian Shipping Corporation	10.31556	123.93334

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Bato	9.45926	123.30151	Atlas Fertilizer Corporation	10.39086	123.63759
		Berth 10	10.30410	123.91844	Austal Philippines Pty Limited	10.46453	123.68739
		Berth 11	10.30374	123.91807	CCLEX	10.28450	123.90042
		Berth 12	10.30325	123.91727	Cebu Energy Development Corporation	10.38774	123.63651
		Berth 13	10.30230	123.91599	Cebu Private Power Corporation	10.28935	123.89824
		Berth 14	10.30033	123.91606	Cebu South Harbor & Container Terminal Corporation	10.25555	123.87049
		Berth 15	10.30091	123.91415	Cebu South Port Infrastructure Corporation	10.23392	123.79862
		Berth 16	10.30064	123.91356	Cebu Yacht Club	10.32938	123.97711
		Berth 17	10.30018	123.91303	Century Peak Metals	10.26554	123.57863
		Berth 18	10.29870	123.91162	Chevron Philippines Inc.	10.30647	123.93722
		Berth 19	10.29799	123.91164	Colorado Shipyard	10.34880	123.97819
		Berth 2	10.30889	123.92469	Concrete Solutions Inc.	10.32085	123.94221
		Berth 20	10.29763	123.91116	Dynacast Shipbuilding & Repairs Inc.	10.52755	124.03341
		Berth 21	10.29667	123.91054	East Asia Utilities Corporation	10.33406	123.98520
		Berth 22	10.29578	123.90983	F.F. Cruz Shipping Corporation	10.31387	123.93101
		Berth 23	10.29452	123.91054	FF Cruz	10.31370	123.93113
		Berth 24	10.29427	123.90957	Fortune Shipworks	10.34897	123.97452
		Berth 25	10.29378	123.90888	GAM Engineering Services	11.10012	123.94120
		Berth 26	10.29284	123.90878	General Milling Corporation (Lapu-Lapu)	10.31697	123.95320
		Berth 27	10.29214	123.90822	Goldenbridge Shipping Inc	10.34979	123.95912
		Berth 28	10.29109	123.90739	Gothong Private Wharf	10.31399	123.93233
		Berth 29	10.29073	123.90596	KEPCO SPC Power Corporation	10.21688	123.76371
		Berth 3	10.30794	123.92345	Ludo & Luym Corporation	10.28747	123.89036
		Berth 4	10.30709	123.92226	Mactan Grains Terminal	10.31792	123.95581
		Berth 5	10.30653	123.92145	Mactan Marina Wharf	10.32935	123.97522
		Berth 6	10.30591	123.92066	Mactan Shipyard	10.30982	123.94318
		Berth 7	10.30556	123.92013	Nagasaka Shipyard	10.35007	123.97242
		Berth 8	10.30495	123.91937	Oriental Vision Mining Philippines Corporation	10.32262	123.93514
		Berth 9	10.30439	123.91875	Petron	10.32326	123.95504
		Bogo	11.06873	123.99736	Philippine Mining Service Corporation Alcoy Plant	9.73652	123.50774
		Boljoon	9.62682	123.48144	Philippine Trigon Shipyard Corporation	10.12729	123.68514
		Carmen	10.58437	124.02452	Phoenix Petroleum Philippines	10.35073	123.99012
		Carnaza	11.50666	124.09739	PKS Shipping Co. Inc	10.34961	123.98464
		Cawit	10.72919	124.50137	Porters Marina	10.35474	124.00142
		Cebu	10.30247	123.91497	Republic Drydock	10.57032	124.02729
		Cebu International Port	10.30898	123.92463	Republic Drydock Compound	10.56602	124.02518
		Consuelo	10.63653	124.29761	Sandoval Shipyard	10.34876	123.97179
		Cordova	10.24228	123.95635	Santiago Shipyard and Shipbuilding Corporation	10.35135	123.98033
		Daanbantayan	11.25068	123.99740	SMC Shipping & Lighterage	10.32014	123.94372
		Dalaguete	9.76177	123.53701	Taiheyo Cement Philippines Port	10.15417	123.70889
		Danao	10.52045	124.02975	Tsuneishi Heavy Industries	10.47147	123.68970
		Gilutongan	10.21002	123.98873	VM Cabahug Shipyard	10.32643	123.96201
		Hagnaya	11.09326	123.94552	Visayas Land Realty Solution	10.33038	123.97740
		Hilton	10.31042	124.02445			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Ibo	10.32968	123.97682			
		Jagutapay	10.68502	124.49806			
		Kasamahan	10.31496	123.95056			
		Labogon	10.35422	123.96333			
		Lanao	10.76268	124.50332			
		Lapu-Lapu	10.31395	123.94794			
		Libor	10.18179	123.73413			
		Liloan	10.40089	124.00314			
		Mabuhay	10.30103	123.91614			
		Madridejos	11.26803	123.75852			
		Magellan Bay	10.32327	124.00653			
		Malapascua	11.32929	124.11307			
		Maribago	10.28314	123.99955			
		Marigondon	10.25745	123.98183			
		Maya	11.28029	124.06302			
		Medellin	11.18308	123.94362			
		Moalboal	9.93504	123.39211			
		Naga	10.20248	123.76096			
		Naval Base	10.30452	123.93555			
		Opao	10.32573	123.96276			
		Oslob	9.43195	123.35936			
		Ouano	10.32003	123.94853			
		Pier 03	10.29701	123.91106			
		Pier 1	10.29201	123.90959			
		Pilar	10.80606	124.56935			
		Polambato	11.07234	123.99970			
		Poro	10.62694	124.41051			
		Puertobella	10.68468	124.49789			
		Punta Engaño	10.30992	124.02573			
		San Fernando	10.15423	123.70738			
		San Francisco	10.61410	124.36267			
		San Pedro	10.29109	123.90693			
		Santa Fe	11.16530	123.80564			
		Santa Rosa	10.27327	124.04215			
		Santander	9.41694	123.30762			
		Tabogon	10.94540	124.03196			
		Tabuelan	10.83194	123.87054			
		Taloot	9.95384	123.62294			
		Tangil	10.07023	123.44601			
		Tapilon	11.27965	124.03059			
		Tayud	10.34885	123.97931			
		Ting Guan	10.32008	123.95191			
		Toledo	10.37843	123.63380			
		Tuburan	10.73044	123.82406			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Tudela	10.63488	124.47047			
DVO	Davao Del Norte	Babak	7.13371	125.68437	Hijo Integrated Port Services, Inc. (HIPSI) [Hijo Resources Corp.]	7.36429	125.81867
		Samal	7.12125	125.67321	Davao International Container Terminal Inc.	7.29436	125.71674
		Tagpopongan	7.12406	125.79226	Maewess Company Inc.	7.12156	125.67369
		Talicud	6.93867	125.71825	Balunos Private Beach	7.07183	125.67105
DVO	Davao De Oro	Maco	7.34919	125.85445			
DVO	Davao Del Sur	Astorga	6.89698	125.45686	Caltex	7.11434	125.65722
		Bunawan	7.20784	125.65224	Chevron	7.11268	125.65679
		Davao	7.13193	125.66316	Davao Bay Coconut Oil Mills. Inc	7.16102	125.66001
		Malalag	6.59654	125.41327	Davao Modern Port Terminal Inc. (DMPTI)	7.16405	125.65954
		Santa Ana	7.07596	125.62632	First Coconut Manufacturing, Inc. (nee Leg Oil) [Legaspi Oil Co., Inc.]	7.11625	125.66052
		Sasa	7.12940	125.66310	Holcim Philippines Inc. (Formerly Davao Union Cement Corporation)	7.17480	125.65362
		Sta Cruz	6.83308	125.41869	International Copra Export Corporation	7.12335	125.66006
		Talomo	7.03331	125.55003	KTC Container Terminal Corporation	7.20968	125.64913
		Toril	7.00387	125.50677	Kudos Trucking Corporation	7.12264	125.65429
					My Gas Petroleum Corporation	7.16434	125.65926
					New Davao Oil Mill (NDOM)	7.16268	125.65987
					Oro Cemento Industries Corporation	6.93543	125.48599
					Paper Industries Corporation of the Philppines	7.11911	125.65465
					Petron	7.11208	125.65634
					Phoenix Petroleum Philippines Inc. (PPPI)	7.11005	125.65176
					Pilipinas Shell Petroleum Corporation (Davao)	7.12075	125.66209
					Seaoil Philippines Inc.	6.88909	125.45523
					Seaoil Tibungco	7.17475	125.65614
					Terminal Facilities & Services Corporation Inc. (TEFASCO)	7.17195	125.65550
					Therma South	6.96249	125.48255
DVO	Davao Occidental	Mabila	5.41292	125.42592	San Miguel Global Power	6.39081	125.62216
DVO	Davao Oriental	Banay-Banay	7.06213	125.95357	Arc Nickel Resources, Inc. (ANRI)	7.06660	125.94974
		Governor Generoso, Magdug (Beaching)	6.60003	126.09152	International Copra Corporation	6.93299	126.24000
		Luban	6.43268	126.22285			
		Lupon	6.89003	126.00616			
		Mati	6.94944	126.21839			
SUG	Dinagat	Basilisa	10.06208	125.59703	Cagdianao Mining Corporation	10.16583	125.65940
		Cagdianao	9.92388	125.67351	Century Peak Mining Corporation	10.40790	125.67158
		Dinagat	9.95961	125.59015	Libjo Mining Corporation	10.25500	125.52049
		Libjo	10.19470	125.53032	Oriental Synergy Mining Corporation	10.39562	125.60695
		Loreto	10.35905	125.58179	Oriental Vision Mining Philippines Corp	10.25307	125.63243
		Malinao	10.25756	125.62742	Sinosteel Philippines H.Y. Mining Corporation	10.39951	125.64236
		San Jose	10.00638	125.56990	Westernshore Nickel Corporation	10.27792	125.52683
		Tubajon	10.32525	125.55688			
		Valencia	10.16589	125.65801			

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			Lat	Long		Lat	Long
		Wilson	10.02542	125.58801			
ELS	Eastern Samar	Arteche	12.26972	125.37255	Emir Mineral Resources Corporation	10.72873	125.69489
		Borongan	11.60748	125.44611	Global Min-Met Resources Inc.	10.72883	125.74592
		Cabunga-an	11.08207	125.68341	NICKELACE INC./VERUM TERRA GEOSCIENCE, INC [Verum Terra Geoscience Inc]	10.69069	125.79540
		Guiuan	11.02900	125.71940	Techiron Resources Inc.	10.69036	125.77008
		Homonhon Island	10.74414	125.72222			
		Lalawigan	11.59134	125.47384			
		Oras	12.13805	125.44141			
PNG	Guimaras	Jordan	10.66558	122.58470			
		Puyo	10.53749	122.52672			
		Sibunag	10.49702	122.67474			
NLZ	Ilocos Norte	Currimao	17.99026	120.48724	Bayog Wind Power Corp. Temporary Landing Pad	18.53049	120.68934
					Omnico Natural Resources Incorporation	17.97612	120.47786
NLZ	Ilocos Sur	Salomague	17.78423	120.41552			
PNG	Iloilo	Ajuy	11.04448	122.93515	Fort San Pedro Terminal	10.69121	122.58298
		Banate	11.00139	122.82264	FF Cruz Shipping Corporation	10.70390	122.58939
		Bancal	11.55716	123.16054	Iloilo Commercial Port Complex	10.70655	122.59313
		Barotac Nuevo	10.89988	122.78913	Iloilo Fastcraft & Roro	10.69614	122.57392
		Concepcion	11.18228	123.12781	Iloilo Jar Corporation	10.69763	122.56104
		Culasi	11.07674	122.98836	Jarfel Corporation	10.70094	122.57923
		Dumangas	10.77661	122.70792	NPC - POWER BARGE	10.69868	122.59030
		Estancia	11.45190	123.15388	Palm Concepcion Power Corp	11.18781	123.12102
		Guimbal	10.65814	122.32296	Panay Energy Development Corp.	10.72531	122.59347
		Igbon	11.21685	123.17999	Petron	10.69700	122.58364
		Iloilo	10.69061	122.58270	Montenegro Shipping Lines Inc.	10.69908	122.57491
		Iloilo Fish Port Complex	10.68822	122.55732	F.F. Cruz Shipping Corporation	10.70119	122.57851
		Iloilo River Wharf	10.69734	122.57870			
		La Paz	10.68729	122.58035			
		Sicogon	11.46255	123.24574			
ZBA	Isabela	Palanan	16.97963	122.46870	Dinapigue Mining Corporation	16.59023	122.31891
		Basilan	6.70904	121.97171			
LNI	Lanao Del Norte	Iligan	8.23099	124.23253	Granexport Manufacturing Corporation	8.28138	124.26513
		Kauswagan	8.19586	124.08344	GN Power Kauswagan LTD. CO.	8.18922	124.11463
		Kiwalan	8.28231	124.26227	Pilmico Foods Corporation	8.28856	124.25980
		Kolambugan	8.11590	123.89527	Republic Cement Inc.	8.28774	124.26313
		Mukas	8.10229	123.84285	PSPC	8.20990	124.21984
		Tubod	8.05754	123.78803	Petron	8.21144	124.22233
					Mabuhay Vinyl Corporation	8.19814	124.18294
LNI	Lanao Del Sur	Balabagan	7.50157	124.12007			
NLZ	La Union	Damortis	16.24057	120.40361	1590 EC Pier National Power Corporation	16.48801	120.32052
		La Union	16.61036	120.29890	SMC Shipping & Lighterage (La Union)	16.25244	120.40069
		Poro	10.62714	124.40959	SMC Namonitan	16.25255	120.40060

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Sto. Tomas	16.24078	120.40352	Holcim	16.76312	120.33448
					Solitech Seaport	16.61533	120.30808
ELS	Eastern Leyte	Abuyog	10.62194	125.14944	DS CATINGUB SEAPORT [DS Catingub Private Seaport]	10.96480	124.64163
		Albuera	10.91851	124.69188	EBR Lutao Private Ports [Port Albuera]	10.94602	124.66915
		Babatngon	11.42703	124.84717	GGC Group ,Inc.	11.00984	124.59779
		Baybay	10.67408	124.79524	LM Baltonado Construction	11.02695	124.59484
		Burgos	10.03092	125.01922	Megaship Builders Inc. Shipyard	10.88136	124.71150
		Calubian	11.44887	124.42947	Nicua Corporation	10.80228	125.00461
		Carigara	11.30395	124.68813	PASAR Corporation	10.89555	124.42909
		Dulag	10.95156	125.03633	Petron	11.25949	124.98895
		Durano	11.29918	124.36963	Philippine Association Smelting And Refining Corp.	10.89334	124.43573
		Hilongos	10.36915	124.74170	Philippine Phosthate Fertilizer Corp	10.89667	124.43779
		Hindang	10.44351	124.72834	Philphos	10.89651	124.43787
		Isabel	10.92257	124.43213	Pilipinas Shell Petroleum Corp.	11.26020	124.98575
		Javier	10.78669	125.00565	Pingag Ferry Terminal	10.89635	124.45102
		Lutao	10.94593	124.66920	PMI	10.87864	124.70700
		Marasbaras	11.26961	124.96760	Premium Megastructures Inc.	10.87861	124.70698
		Merida	10.90727	124.53905	R. A. Bensig Construction & General Service	11.01502	124.59997
		Ormoc	11.00203	124.60641	SAN ANTONIO SAND & GRAVEL SUPPLY	10.96279	124.64490
		Palanas	10.87807	124.70751	St. Vincent Private Port	10.85079	124.73404
		Palo	11.17182	125.01247	Tacloban Oil Mill Inc.	11.03056	125.03832
		Palompon	11.05127	124.38266	Visayan Oil Mill Inc.	10.79509	124.77384
		Pinamopoan	11.30643	124.58700	Vispet Development Corp.	11.40974	124.81313
		Puertobello	10.63775	124.38454			
		Sogod	10.38288	124.98138			
		Tabango	11.30474	124.36973			
		Tacloban	11.24931	124.99870			
		Tolosa	11.03361	125.03925			
		Villaba	11.21145	124.38930			
CBO	Maguindanao	Parang	7.37232	124.25823			
		Polloc	7.34854	124.22493			
		Timaco	7.21542	124.17161			
NCN	Manila North	Manila	14.60286	120.95917	ASIAN SHIPPING CORP. - OCEAN TRANSPORT GROUP	14.63938	120.95833
		Marala	14.63365	120.95705	Asian Shipping Corporation - iPrudential	14.63584	120.95609
		Pier 2	14.60082	120.95861	ENERGIES SUPPLY CHAIN SOLUTIONS, INC.	14.64236	120.95414
		Pier 2 Lambatan	14.64200	120.95049	FILOIL Logistics Corporation	14.63078	120.94819
		Pier 4	14.60214	120.95924	Frabelle Fishing Corporation	14.64237	120.95539
		Pier 5	14.58636	120.96485	Harbour Centre Port Terminal, Inc.	14.62079	120.96590
		Pier 5 Navotas	14.64743	120.94597	Jocfer Marine Corporation	14.62291	120.95573
		Pier 10	14.60837	120.95875	Manila Harbour Centre	14.63306	120.94355
		Pier 13	14.58264	120.96769	Manila North Harbour Container Port Inc	14.61410	120.96000
		Pier 14	14.60243	120.95917	Marine Slipway [Josefina Spillway Inc. Naval St, Navotas]	14.67159	120.94058
		Pier 18	14.62618	120.95960	Mcfish International Corporation	14.67083	120.94114
		Tangos	14.67148	120.93239	Mega Lifters Handling Corporation	14.63451	120.94852

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Pier 4	14.60278	120.95828	Midbound Vitas Central Terminal & Shipyards Corporation	14.62679	120.95874
		Pier 6	14.60386	120.95912	Navotas Shipyard	14.67133	120.94056
		Pier 8	14.60593	120.95907	SL Harbour Bulk Terminal Corporation	14.63089	120.95267
		Pier 12	14.60998	120.95869	Universal Robina Corporation	14.62563	120.95462
					Vitas Marine Loading Station	14.62629	120.95448
NCS	**Manila South**	Baseco	14.58432	120.95887	AAM-PHIL Natural Resources Exploration & Development Corporation	14.57460	120.98106
		Baseco Breakwater	14.57783	120.95720	Asian Terminals Inc.	14.58192	120.96805
		Delpan	14.59523	120.96362	Asturias Industries, Inc.	14.58998	121.05704
		Mandaluyong	14.56992	121.03294	ATI-Manila South Harbour	14.58008	120.96887
		Manila	14.58636	120.96483	Atlantic Grains Inc. Calaca	14.58616	120.96607
		Pasay	14.54222	120.97961	General Milling Corp (Bo Ugong)	14.56067	121.06660
		Paranaque	14.53011	120.98338	IDHI Port and Shipping Inc.	14.58464	120.97323
					Jetti Petroleum, Inc.	14.53852	121.00051
					Liberty Flour Mills Inc.	14.57729	121.02693
					Malay Resources, Inc.	14.58804	121.01569
					Manila International Container Terminal	14.59851	120.95185
					Negros Navigation Ferry Terminal	14.60086	120.95931
					Outside Breakwater	14.56192	120.98134
					Pasig Government Bay & River	14.59665	120.96619
					Pasig Government Coastwise	14.59546	120.96579
					Pioneer Float Glass Manufacturing Inc	14.55434	121.09371
					Republic Flour Mill	14.56819	121.05186
					Resins Inc.	14.57155	121.07181
					S.I. RESOURCES	14.58480	120.97414
MRQ	**Marinduque**	Balacanan	13.53399	121.86533			
		Balogo	13.50577	122.04751			
		Buyabod	13.48050	122.05566			
		Cawit	13.38346	121.82040			
		General Luna	13.53455	122.12463			
		Sta Cruz	13.48711	122.03701			
		Maniwaya	13.52698	122.11839			
MSB	**Masbate**	Aroroy	12.51319	123.39642	Algimar Port Mgt. and Allied Svcs., Inc.	12.34892	123.64427
		Batuan	12.41877	123.77990	DMCI Masbate Power Corporation	12.34894	123.64046
		Calasuche	12.21693	123.53093	Filminera Resources Corporation [Atlas Consolidated Mining & Dev't. Corp.]	12.45316	123.39910
		Calumpang	11.90455	123.16500	Mintac (Antonio T. Kho)	11.95562	124.02014
		Cataingan	12.00271	124.00374	Mobo roro port	12.34211	123.65245
		Cawayan	11.92038	123.75318	Pilipinas Shell Petroleum Corporation (Pulang Bato)	12.36252	123.60624
		Claveria	12.90691	123.24618			
		Esperanza	11.73555	124.03881			
		Kinamaligan	12.35797	123.59924			
		Lagundi	12.38935	123.74715			
		Mandaon	12.22498	123.28077			
		Masbate	12.36927	123.61636			
		Milagros	12.21678	123.50880			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Monreal	12.64491	123.66253			
		San Fernando	12.48491	123.76431			
		San Jacinto	12.57095	123.73288			
		San Pascual	13.12876	122.97542			
MOZ	Misamis Occidental	Jimenez	8.33226	123.85751	Third Millennium Oil Mill (TMOMI)	8.32321	123.86139
		Loboc	8.49300	123.80405			
		Oroquieta	8.45938	123.81793			
		Ozamiz	8.13968	123.84571			
		Plaridel	8.60733	123.72578			
		Punta Sulong	8.64288	123.59420			
		San Vicente Bajo	8.45940	123.81574			
		Silanga	8.06526	123.77420			
		Tangub	8.05268	123.75799			
MOC	Misamis Oriental	Balingasag	8.73562	124.77626	Asia Pacific Timber & Plywood Corp.	8.84392	125.06974
		Balingoan	9.00522	124.84604	Cagayan Corn Products Corporation (CCPC)	8.48313	124.72570
		Bohol Sea	9.84669	124.79902	Cagayan de Oro Oil Company Incorporated	8.48755	124.73133
		Cagayan De Oro	8.49135	124.66431	Cagayan De Oro Timber Corporation	8.49851	124.65415
		Casinglot	8.51635	124.74915	Carlos A. Gothong Lines Inc	8.47759	124.71480
		Cugman	8.47778	124.69771	Felcor Petroleum Depot	8.57432	124.36405
		Gingoog	8.83146	125.09954	General Milling Corp	8.48247	124.72303
		Gracia	8.52641	124.74382	Holcim	8.33541	124.25045
		Jasaan	8.64656	124.75745	Insular Oil Corporation (Formerly Mobil Oil Jetty) [Insular Oil Corporation - Petro De Oro]	8.47699	124.71646
		Kinoguitan	9.00642	124.81991	International Mindanao Container Port	8.52256	124.74881
		Lugait	8.33586	124.25060	Minergy Power Corporation (MPC)	8.76647	124.76771
		Maanas Wharf	8.90494	125.02592	Petron	8.51457	124.75565
		Macabalan	8.49255	124.66150	Philippine Iron Construction and Marine Works (PICMW)	8.64338	124.74946
		Medina	8.90486	125.02605	Pilipinas Kao Inc./Misamis Oriental Land Development Corporation	8.63402	124.76236
		Opol	8.52776	124.57242	Pryce Gases, Inc. (PGI)	8.71854	124.78065
		Tablon	8.48007	124.72158	RI Chemicals Inc. (RIChem)	8.64242	124.74773
		Talisayan	9.00032	124.88278	Sanjia Steel Corp	8.55236	124.73985
		Villanueva	8.57819	124.75835	Wilmar Edible Oil Phils.	8.88147	125.03884
					LYL Development Corporation	8.47591	124.70770
NBB	Negros Occidental	Banago	10.70271	122.93994	Asian Alcohol Corporation	10.52615	122.80015
		Barcelona	10.82039	123.55925	BREDCO	10.67649	122.94022
		Cadiz	10.95793	123.32530	BREDCO Seaport	10.67669	122.94002
		Calatrava	10.58979	123.48320	Daima Shipping Corporation	8.14258	123.84662
		Danao	10.81650	123.55080	Distileria De Bago	10.58397	122.88535
		Dapdap	10.46774	123.43468	La Filipina Uy Gongco Corp.	10.67332	122.94187
		Enrique Magalona	10.92150	123.00769	Philippine Bulk Corporation	10.52351	122.79762
		Himamaylan	10.15968	122.85821	San Carlos Bioenergy	10.51497	123.42097
		Hinoba-an	9.63198	122.45114	Sipalay Eco Port	9.69807	122.40548
		Pulupandan	10.52102	122.79625	Shell Bacolod	10.68953	122.95109
		Sagay	10.95008	123.42840			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Salvacion	9.63223	122.45047			
		San Carlos	10.47764	123.42225			
		Tandayag	9.44230	123.23685			
		Toboso	10.71296	123.51622			
		Victorias	10.90548	123.06094			
NOS	**Negros Oriental**	Apo Island	9.07815	123.26768	Central Azucarera de Bais	9.55417	123.14647
		Ayungon	9.83920	123.13482	DOCUM	9.22117	123.28651
		Bacong	9.23087	123.29266	Filoil	9.44307	123.23773
		Bais	9.58238	123.13691	Lo-oc Silica Bay	9.84065	123.13487
		Basak	10.22032	123.30561	Maayo Shipping Port Facilities	9.44159	123.23584
		Bayawan	9.36859	122.80160	Maayo Shipping Terminal	9.36138	123.28519
		Bolado	10.18965	123.29135	MAP 2000 TERMINALS, INC./FIL OIL ENERGY, INC.	9.44357	123.23745
		Dumaguete	9.31313	123.31068	Negros Navigation Ferry Terminal	9.23048	123.29282
		Guihulngan	10.10883	123.27107	ORBYSY HOLDING, INC.	9.30824	123.30884
		Malapatay	9.12169	123.21397			
		Manjuyod	9.64786	123.14908			
		Siaton	9.05637	123.11972			
		Sibulan	9.36134	123.28551			
		Tampi	9.44105	123.23650			
		Tayasan	9.92137	123.17329			
ELS	**Northern Samar**	Allen	12.50448	124.28354	Archipelago Philippine Ferries Corporation	12.49099	124.28520
		Biri	12.68150	124.36135	Balwharteco Ferry Terminal	12.50436	124.28292
		Camparanga	12.55495	124.96181	Catarman Oill Mill Inc.	12.52344	124.50502
		Capul	12.42299	124.18360	SanVic	12.37762	124.34005
		Dapdap	12.49021	124.28547	Sta. Clara Shipping Corp.	12.47720	124.28341
		Jubasan	12.47808	124.28320			
		Laoang	12.56716	125.01370			
		Lapinig	12.31585	125.30700			
		Lavezares	12.53560	124.32998			
		Paninirongan	12.57288	124.87448			
		San Isidro	12.37119	124.33909			
		San Jose	12.53389	124.48603			
		San Luis	12.46564	124.15095			
		San Vicente	12.27359	124.09647			
		Vinisitahan	12.44519	124.26139			
		Gamay	12.39069	125.31017			
MDO	**Occidental Mindoro**	Abra de Ilog	13.46746	120.77254			
		Lubang	13.81614	120.20149			
		Paluan	13.41160	120.46480			
		Rizal	12.46370	120.95610			
		Sablayan	12.83252	120.76917			
		San Jose	12.33004	121.08851			
		Sitio Aroma	13.22323	120.58702			
		Tayamaan	13.22712	120.56737			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Tilik	13.81622	120.20189			
MDO	Oriental Mindoro	Bansud	12.86209	121.49027			
		Bulalacao	12.31375	121.34192			
		Calapan	13.43033	121.19559			
		Mansalay	12.52006	121.45078			
		Pinamalayan	13.03191	121.49135			
		Puerto Galera	13.50598	120.93280			
		Roxas	12.59344	121.53048			
		Recodo	13.03211	121.49131			
		Gloria	12.95575	121.49649			
PLW	Palawan	Agutaya	11.14634	120.93789	Berong Nickel Corporation (BNC)	9.46694	118.19663
		Araceli	10.55032	119.98626	Citinickel Mines & Development Corporation (CMDC) - Narra [Citi Nickel Mines Pier]	9.17956	118.28654
		Bagong Silang	9.73128	118.73253	Citinickel Mines & Development Corporation (CMDC) - Punang	9.00798	118.07134
		Balabac	7.98848	117.06492	Filoil	9.73089	118.73730
		Bataraza	8.49964	117.45181	IPILAN MINING CORPORATION [Ipilan Nickel Corporation]	8.85318	117.94277
		Brooke's Point	8.77075	117.82794	Isla LPG Corporation (Formerly Shell Gas(LPG) Philippines Inc.)	9.85003	118.73640
		Bugsuk	8.18666	117.30840	Lime El Nido Resorts	11.15579	119.39789
		Buliluyan	8.33350	117.20734	Miniloc El Nido Resorts	11.14931	119.32043
		Busuanga	12.13529	119.93005	Pangulasian El Nido Resorts	11.11286	119.33577
		Cagayancillo	9.57854	121.20187	Petron	9.72939	118.73914
		Calle Bajo	9.74472	118.73585	Pilipinas Shell Petroleum Corporation (Puerto Princesa)	9.73152	118.73253
		Candaraman	8.07877	117.09910	Rio Tuba Nickel Mining Corporation (RTNMC) HPP	8.55917	117.42854
		Concepcion	12.04979	119.97016	Rio Tuba Nickel Mining Corporation (RTNMC) Jetty Pier	8.50201	117.45177
		Coron	11.99123	120.21142	Star Oil Depot	9.72936	118.73742
		Corong-Corong	11.16937	119.39398			
		Culion	11.90077	120.02127			
		Cuyo	10.85254	121.00395			
		Dumaran	10.52485	119.76177			
		El Nido	11.18151	119.38683			
		Galoc	11.96696	119.84850			
		Liminangcong	11.00851	119.30776			
		Linapacan	11.49008	119.87138			
		Malampaya	10.82902	119.51662			
		Manamoc	11.30702	120.67198			
		Narra	9.24520	118.40776			
		Oyster Bay	10.06774	118.75723			
		Pag-asa Island	11.05167	114.27774			
		Pamalican	12.08235	119.87465			
		Puerto Princesa	9.73028	118.73247			
		Punang	9.00868	118.07107			
		Quezon	9.24056	117.99503			
		Rio Tuba	8.50121	117.45165			
		Roxas Feder	10.31585	119.33844			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		San Fernando	11.32850	119.54051			
		San Vicente	10.52860	119.25399			
		Sta. Cruz	10.80992	119.59551			
		Taytay	10.82916	119.51659			
		Tubbataha Reef	8.85004	119.91711			
BNA	**Pampanga**	Sapang Kawayan	14.80428	120.68796			
NLZ	**Pangasinan**	Agno	16.11560	119.79750	Macroserve Port Facility and Development Corporation	15.83491	119.91242
		Bolinao	16.38784	119.90428	Team Sual Corporation	16.12681	120.09220
		Sual	16.06917	120.09952			
MRQ	**Quezon**	Alabat	14.10251	122.00913	Azora Terminal Container terminal	13.88143	121.55899
		Atimonan	14.00277	121.92855	Pagbilao Power Plant	13.89343	121.74524
		Cabungalunan	14.95200	121.99755	San Miguel Corporation - Siain	13.95666	122.02105
		Catanauan	13.56937	122.33198	Union Equities Inc.	13.87042	121.56348
		Cotta	13.91293	121.60610	World Granary, Inc	13.88550	121.56781
		Guisguis	13.85388	121.50093	Quezon Power Plant	14.22917	121.76073
		Gumaca	13.93608	122.08236			
		Jomalig	14.71084	122.32405			
		Lucena	13.90710	121.62663			
		Mauban	14.19187	121.73501			
		Mulanay	13.51932	122.40221			
		Panukulan	14.93394	121.81596			
		Patnanungan	14.75283	122.21799			
		Perez	14.19126	121.92505			
		Pitogo	13.77928	122.09119			
		Plaridel	13.95670	122.02114			
		Polilio	14.71495	121.93520			
		Real	14.67118	121.61339			
		San Andres	13.32262	122.67907			
		Silangan	14.00403	122.18497			
		Talao-Talao	13.90837	121.63100			
		Unisan	13.83705	121.97505			
BGS	**Romblon**	Alcantara	12.25937	122.05707	Sibuyan Nickel Properties Devt. Corp.	12.36763	122.52996
		Ambulong	12.49496	122.48912			
		Azagra	12.27982	122.63252			
		Banton	12.94552	122.09615			
		Caijidiocan	12.37129	122.68891			
		Calatrava	12.62114	122.06821			
		Carmen	12.61731	122.12234			
		Concepcion	12.91275	121.72028			
		Malbog	12.21943	122.01088			
		Odiongan	12.41776	121.98866			
		Romblon	12.57898	122.26890			
		Said	12.05414	121.95918			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		San Agustin	12.56712	122.13633			
		Sta. Fe	12.15812	121.99031			
		Corcuera	12.78175	122.05133			
		Tablas	12.41793	121.98867			
ELS	Samar	Almagro	11.92587	124.29141	Samar Coco Oil Mill	12.11442	124.47549
		Calbayog	12.06372	124.59185			
		Catbalogan	11.77474	124.87929			
		Daram	11.63612	124.79687			
		Jiabong	11.75407	124.93588			
		Manguino-o	12.13853	124.45746			
		Pagsanghan	11.96713	124.72000			
		Sierra	11.82361	124.69781			
		Sto. Nino	11.92792	124.44942			
		Zumarraga	11.63840	124.83949			
SSG	Sarangani	Glan	5.82772	125.20237	Gensan Shipyard Machine Works Inc.	5.95334	125.10128
		Malapatan	5.97092	125.28531	Saranggani Energy Corporation	5.86529	125.08179
		San Jose	5.57803	125.30769	SM200 Power Plant	5.86551	125.08148
NOS	Siquijor	Larena	9.25144	123.59142			
		Lazi	9.12336	123.63746			
		Siquijor	9.21822	123.51238			
		Solong-on	9.19849	123.46116			
		Tambisan	9.19325	123.45258			
BCL	Sorsogon	Bulan	12.66653	123.87235	Gerona Enterprises	12.58395	124.08785
		Castilla	12.95543	123.88312			
		Matnog	12.58439	124.08784			
		Sorsogon	12.96442	124.00510			
SSG	South Cotabato	Bawing	5.97047	125.11475	Atlantis Fishing Development Corporation	6.05216	125.14972
		General Santos	6.09240	125.15531	Cargill Oil Mills Philippines, Inc.	6.12015	125.17220
		Makar	6.09374	125.15754	Damalerio Realtors, Inc. [Damalerio Fishing]	6.05757	125.15012
		Tambler	6.02964	125.14416	General Milling Corp. (General Santos)	6.08282	125.15464
					GS SFI Integrated Services, Inc.	6.06115	125.15004
					RDEX Food International Phils Inc. (General Santos)	6.08730	125.15426
					RFII SHIPYARD SERVICES	5.97087	125.11424
					Safi Shipyard	6.02295	125.14055
					YBS Green Oil	5.99024	125.11738
ELS	Southern Leyte	Benit	9.91878	125.29308			
		Guadalupe	10.16727	124.75774			
		Liloan	10.15933	125.12462			
		Magallanes	9.91096	125.07747			
		SAMOA	10.15657	125.11898			
		San Ramon	10.35514	124.97228			
		San Ricardo	9.91866	125.29259			
		St. Bernard	10.27732	125.13877			
WLB		Limasawa	9.92747	125.07079			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Maasin	10.13160	124.84116			
		Padre Burgos	10.03095	125.01915			
CBO	Sultan Kudarat	Kalamansig	6.55268	124.04417	Titan Minerals	6.15778	124.27792
		San Roque	6.15778	124.27792			
		Santa Clara	6.53611	124.05155			
BPMO	Sulu	Jolo	6.05606	120.99994			
		Lugus	5.69662	120.80212			
		Luuk	6.00845	121.31114			
		Pangutaran	6.30303	120.58721			
		Siasi	5.54584	120.81288			
		Tubig Maasin	6.23909	120.53744			
SUG	Surigao Del Norte	Caub	9.89467	125.89543	Admin Building, Pacific Nickel Philippines, Inc.	9.82194	125.61852
		Claver	9.54391	125.84063	Admiral Marine Shipyard (Tagana-an)	9.69236	125.59217
		Dapa	9.75507	126.05045	Adnama Mining Resources, Inc.	9.55864	125.78972
		Del Carmen	9.86765	125.96845	Claver Mining Development Corporation	9.48415	125.88542
		Dumoyog	9.84587	125.98222	Hinatuan Mining Corporation	9.75871	125.71913
		Jubang	9.76311	126.00792	Platinum Group Metal Corporation	9.50108	125.87777
		Lipata	9.81630	125.45452	Shell Jetty 2	9.82192	125.61870
		Lisondra	9.88086	125.56547	Taganito High Pressured Acid Leach	9.54030	125.81234
		Malimono	9.61827	125.40028	Taganito Mining Corporation	9.54419	125.81851
		Nonoc	9.82036	125.58186			
		Pamosaingan	9.65181	125.92140			
		Pangi	9.82721	126.00400			
		Placer	9.65950	125.60200			
		Sabang	9.80115	125.46105			
		San Fernando	9.82166	125.97623			
		Socorro	9.61707	125.96633			
		Sta. Monica	10.01638	126.03381			
		Surigao	9.78274	125.50085			
		Tagana-an	9.70567	125.60225			
		Taganito	9.54219	125.84067			
		Talavera	9.75300	125.69586			
		Talisay	9.82038	125.61645			
		Urbiztondo	9.55508	125.78311			
SUG	Surigao Del Sur	Aras-asan	8.88946	126.31751	Carrascal Nickel Corporation	9.39044	125.93007
		Bislig	8.23812	126.43183	CTP Construction & Mining Corporation - Adlay and Dahican	9.43218	125.90414
		Cantilan	9.37984	125.98780	Marcventures Mining and Development Corporation	9.38445	125.93635
		Carrascal	9.41575	125.94976	VTP Mining and Construction Corporation	9.43822	125.92126
		Lawigan	8.23794	126.43184			
		Lianga	8.61760	126.08625			
		Tandag	9.08440	126.19711			
BPMO	Tawi-Tawi	Bongao	5.03440	119.77417			
		Banaran	5.03699	120.10633			
		Languyan	5.26214	120.07663			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Lau Tabawan	5.21711	120.60928			
		Mapun	6.97272	118.51524			
		Sibutu	4.84465	119.45369			
		Simunul	4.90108	119.85277			
		Sitangkai	4.67590	119.41614			
		Taganak	6.07162	118.31137			
		Tandubas	5.13778	120.31829			
		Ubian	5.19335	120.49190			
WLB	**Western Leyte**	Bato	10.32789	124.78717			
NLZ	**Zambales**	Botolan	15.26713	120.01692	Aggresand Quarrying, Inc - Botolan	15.26827	120.01275
		Cabangan	15.15482	120.03653	Agila Subic Port Facility/Shipyard Complex	14.82477	120.20863
		Cawag	14.82014	120.21271	Alpha Water Realty & Services Corporation	15.56735	119.92371
		Masinloc	15.53805	119.94773	Benguet Corp. Nickel Mines, Inc.	15.75002	119.91019
		Matalvis Island	15.48414	119.92706	DMCI Mining Corp	15.75003	119.89158
		Palauig	15.45361	119.90583	Huang Construction Corporation	15.15467	120.03679
		San Felipe	15.04925	120.06362	LNL Archipelago Minerals Inc.	15.74842	119.90986
		Seafront Subic	14.83516	120.21247	Masinloc Coal Power Plant	15.56735	119.92371
		Sta. Cruz	15.75009	119.89213	Nacin Property Matalvis Port	15.49231	119.90633
		Subic	14.81591	120.28336	Shangfil Mining & Trading Corporation Port	15.75096	119.89305
					Subic Container Terminal	14.80417	120.26497
ZBA	**Zamboanga**	Cawit	6.95197	121.97673	Petron	6.91375	122.04371
		Lamao	8.13802	122.67597	WINSI	6.93448	121.99781
		Sangali	7.06864	122.21241			
		Zamboanga	6.90290	122.07345			
		Katatagan	6.92270	122.02096			
ZDN	**Zamboanga Del Norte**	Dapitan	8.63688	123.38254	Dacon Company	7.58671	122.13574
		Dipolog	8.56013	123.32775	Dipolog Coconut Oil Mills, Inc.	8.52392	123.21989
		Galas	8.55993	123.32880	Wilmar Edible Oils Philippines (Roxas)	8.51939	123.25225
		Lintangan	7.21726	121.94919			
		Nabilid Roxas	8.51657	123.25483			
		Sibuco	7.29318	122.06239			
		Sindangan	8.25152	122.98759			
		Siocon	7.76122	122.11887			
		Taguilon	8.69653	123.40243			
ZBA	**Zamboanga Del Sur**	Margosatubig	7.57921	123.16746	International Copra Corporation (INTERCO)	6.91415	122.04680
		Pagadian	7.81814	123.43912	Philippine International Development Corporation (PHIDCO)	6.91193	122.05602
		Patalon	7.07775	121.89760	Timber Exports, Inc. (TIMEX)	6.90638	122.07373
					San Miguel	6.91022	122.05379
ZBA	**Zamboanga Sibugay**	Alicia	7.50162	122.93828			
		Baliwasan	6.90999	122.05249			
		Guicam	7.43613	122.83973			
		Ipil	7.74500	122.58430			
		Malangas	7.62634	123.03356			

PMO	Province	Public Ports	Coordinates		Private Ports	Coordinates	
			Lat	Long		Lat	Long
		Naga	7.78167	122.69580			
		Olutanga	7.30425	122.84622			