

Distribution of Filling Stations in Hinthada Town, Ayeyarwady Region

Cho Cho Myint¹, Saw Sandar Win², Khin Kay Khaing³

Abstract

Hinthada Town is located in Hinthada District within Ayeyarwady Region. It is one of the towns in Ayeyarwady Region. The Town is connected to all nearby places and major places with railway, road and waterway. The main aim of the study is to present the distribution and distribution pattern of filling stations in Hinthada Town. Primary data and secondary data are used in this study. Filling stations are collected by field observation with the help GPS. Total filling stations are 37 stations in Hithada Town. The distribution of filling stations is analysed by Spatial Statistics Tool, mean center and standard distance. The mean center of filling stations in the town is found at Pyi daw thar road (residential road) near railway station. Twenty-five filling stations fall within the 1standard deviation (150m), which occupy 68% of all filling stations in Hinthada Town. Within the distance between 1standard deviation (150 m) and 2 standard deviation (300 m), 12 stations are found. In addition, the distribution pattern of filling stations is analysed by Average Nearest Neighbor. The result showed that the distribution pattern of filling station in Hinthada Town is clustered with Z-score – 3.146 and NNR of 0.729.

Key words: distribution, filling stations, Hinthada Town, Ayeyarwady Region

INTRODUCTION

Hinthada Town is located near the apex of Ayeyarwady Delta, along the Ayeyarwady River opposite Tharrawaw. It is a port for rice, pulses and tobacco grown the surrounding area and is connected by road and rail with Patheingyi, Kyaukpadaung, and Yangon. The Town is low-lying area protected by embankments along the Ayeyarwady River. The population of Hinthada Town increased from 77,743 in 2009 to 81,137 in 2018. Similarly, the number of motor cycle and car were increased. The growth of population and increase of motor cycles and cars are forced to establish the filling station. In addition, universities, market, hospitals and railway station are located in the study area.

Myanmar has seen a sharp increase in the number of filling stations since government opened up the industry to the private sector in 2010. The number of privately-owned stations has now reached 2445, according to data from MOEE updated on March 25. Stations are unevenly distributed, Mandalay Region has 622, while Yangon Region with a bigger population, has 178. Ayeyarwady Region has 214 station which occupy 9% of the whole country. There are only four stations in Chin State. (Myanmar time, April 17, 2019)

In 2018, the top partner countries from which Myanmar *Imports Fuels* include Singapore, Malaysia, Thailand, India and United Arab Emirates. (World bank)

Fuel imports (% of merchandise imports) in Myanmar was reported at 20.73% in 2018, according to the World Bank collection of development indicators, compiled from officially sources. (Trading economic)

Geographic Information Systems (GIS) provide the appropriate tools for analyzing the effective factors on spatial data and non-spatial data (Bowman and Lewis, 2006). Mohammed (2014) presented GIS is a powerful tool for analysis of the location of filling stations in Metropolitan Kano against the Physical Planning Standards.

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In addition, Chukwudi (2015) did Site Suitability Assessment of Petrol Filling Stations (PFSs) in Oyo Town State, Nigeria using a Geographic Information Systems (GIS) Approach. Oloko-oba (2016) carried out assessment of filling station in ILORIN, Kwara State, Nigeria using Geospatial Techniques to determine the distribution pattern and assess the level of conformity of the filling stations against the physical standards by the regulating bodies. Aazagreyir et al. (2020) wrote GIS-Based Analysis of the Location of Filling Stations in La-Nkwantanang Madina Municipal Assembly against Ghana's Planning Standards using Spatial Statistics (Nearest Neighbour Statistics) and Proximity (Buffer) analysis.

In this study, distribution of filling stations in Hinthada Town is analysed by using the GIS tool, measuring geographic distribution.

Study Area

Hinthada Town is located in Hinthada Township, Ayeyarwady Region. Hinthada Town is one of the towns in Ayeyarwady Region. It extends 5.36 km from north to south and 4.26 km from east to west. It lies between north latitudes 17° 15' and 17° 39' and between east longitudes 95° 13' and 95° 35'. It has an area of 17.52 square kilometer (6.34 sq.miles). Hinthada Town is bordered with Kaing Chaung village tract, Ayeyarwady River, Gaung Say Kyun, Lel Taw, Kan Hla, Taung Lone Su, Konegyi and Chaung Phyar village tracts. It comprises 21 wards in urban area. The shape of the town is a rectangular one. The Town is located in low-lying flat alluvium plain. Therefore the earthen embankment was built to protect the flooding in the study area. The Town experiences Tropical Monsoon (Am) climate according to Koppen's climatic classification. The total population is 94658 in 2019. Figure 1 (a, b, c, and d) show the location of Hinthada Town. Number of wards, areas, population and population density of Hinthada Town in 2019 are presented in Table 1.



Figure1(a) Location of Ayeyarwady Region in Myanmar
Source: Survey Department, Yangon

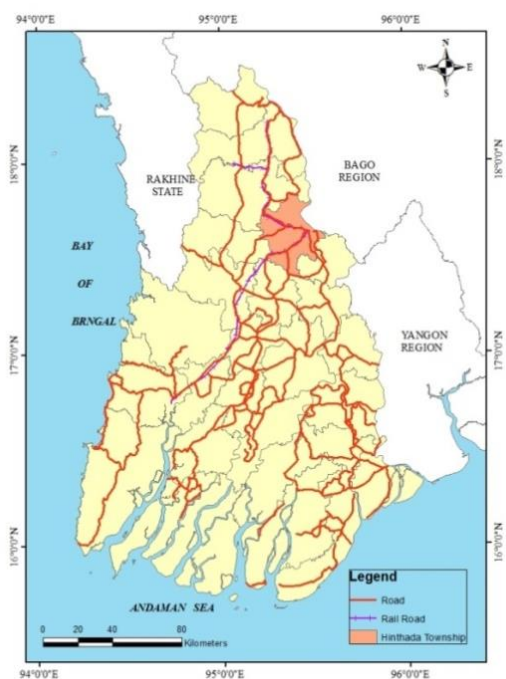
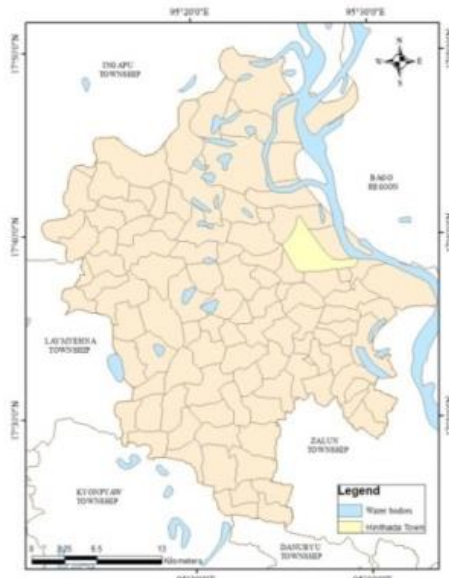


Figure1(b) Location of Hinthada Township in Ayeyarwady Region
Source: Department of Agricultural Land Management and Statistics



.Figure. 1(c) Location of Hinthada Town in Hinthada Township
Source: Department of Agricultural Land Management and Statistics

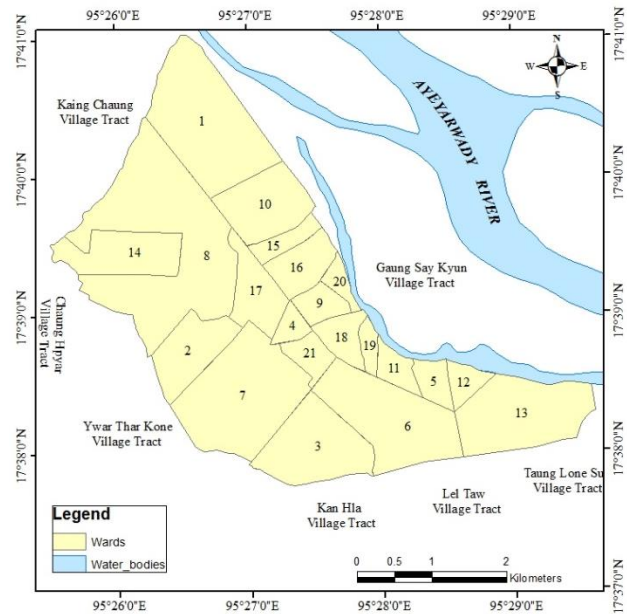


Figure.1(d) Location of Hinthada Town
Source: Department of Agricultural Land Management and Statistics

Table 1.Wards, Area, Population and Population Density of Hinthada Town
Source: General Administrative Department, Hinthada

No	Wards	Area (sq.km)	Population (2019)	Population Density Per Sq.km
1	Pyin Ma Chaung	1.8	3350	1861
2	Mya Wadi	0.8	4715	5894
3	Pan Be Dan	1.5	4999	3333
4	Pa Da Myar	0.28	1378	4921
5	Za Kar	0.25	3858	15432
6	Tar Ka lay	1.6	12529	7831
7	Ka Naung Su	1.7	13715	8068
8	Lel Ti Kwin	2.42	4213	1741
9	Yone Gyi	0.28	2516	8986
10	Nyaung Pin	1.02	7120	6980
11	Shwe Ku	0.29	3364	11600
12	Kin	0.34	3858	11347
13	Pa Khan	1.4	2172	1551
14	Aye Mya Thar Yar	0.81	3158	3899
15	Tar Ngar Se (N)	0.25	2444	9776
16	Tar Ngar Se (S)	0.46	2384	5183
17	Thone Pin Kwin	1.4	8483	6059
18	U_Yin (N)	0.31	3207	10345
19	U_Yin (S)	0.14	2984	21314
20	Let Tha Mar	0.15	1673	11153
21	Hpa Yar Gyi	0.32	2538	7931
Total		17.52	94658	5403

Research Questions

- How many filling stations are in Hinshada Town?
- How do they distribute in Hinshada Town?

AIM AND OBJECTIVES

The main aim of this paper is to present the distribution and distribution pattern of filling stations in Hinshada Town.

The objectives of this study are to present the filling stations, to show the distribution of filling stations and to determine the distribution pattern of filling stations in Hinshada Town.

Previous Investigation and Literatures

Mohammed M.U et al. (2014) wrote GIS-Based Analysis of the Location of Filling Stations in Metropolitan Kano against the Physical Planning Standards. This paper analysed the location of filling stations in Kano Metropolis against the physical planning standards set by Department of Petroleum Resource, DPR (2007) and Kano Urban Planning and Development Agency, KNUPDA (2013). All the analyses were performed in the Arcmap environment using spatial statistics, spatial analyst and proximity tools available in the software. The finding showed that there are 214 filling stations located along the 43 roads in the study area, of which 69% are owned by independent marketers, 26% owned by major marketers and 5 % owned by the Nigerian National Petroleum Corporation. Most of the stations satisfied the minimum requirement of 15 meter distance from the road (96%). Equally 98% of the filling stations met the minimum distance of 100 meter from the health care facilities. However many stations had not met the criteria of 400 meter minimum distance to other stations that are located on same road side and not separated by any road or street. The research concludes that regulatory agencies need to look into the issue and take appropriate measures.

Chukwudi et al. (2015) did Site Suitability Assessment of Petrol Filling Stations (PFSs) in Oyo Town State, Nigeria: a Geographic Information Systems (GIS) Approach. In this study, a GIS was developed for PFS site suitability assessment. The results showed that, out of the 113 PFSs in the area, only 3, representing just 2.654 percent are in high suitability zone, 6 PFSs (5.309 percent) in medium as well low and 98 stations (86.725 percent) in very low suitability zone. Considering the Oyo State Urban Regional Planning Board criterion, 76 PFSs are at unacceptable distances to residential land use and as much as 102 PFSs considering the DPR criterion. Also, assessing the size of PFSs, 41 stations (39 percent) have the standard land area while 69 PFSs (61 percent) were deficient. Furthermore, only 6 stations, representing 5 percent of PFSs in the area have their dispensing pumps at least 15m off the road. More so, the assessment of the spatial pattern of PFSs in the area showed that the distributions of petrol stations are very clustered. In a nutshell, it can be concluded that most PFSs in Oyo town, considering both local and national siting standards are not suitably sited and also contravene planning standards. Also, the substandard requirements proliferated by the local planning authorities, who are defiant of the national standards undoubtedly increase the threats on the health and safety of users and residents in the vicinity of the PFSs.

Oloko-oba,O.M. et al. (2016) carried out Assessment of Filling Station in Ilorin, Kwara State, Nigeria Using Geospatial Techniques. The study uses geospatial techniques to determine the distribution pattern and assess the level of conformity of the filling stations against the physical planning standards by the regulating bodies. The finding shows 255 filling stations in the study area with a clustered pattern of distribution.71.6% of the filling stations met the 15 m

distance from the edge of the road and 28.4% violation. Also 97.3% of the filling stations violate the 400m apart with only 2.7% in compliance. 98.7% deviate from the 2km radius of four stations with 1.3 % in compliance. However, all the stations ensured that the drainage from their site does not flow into a river and does not lie within pipeline or high tension cable Right of Way. The study therefore concludes and recommend that the regulating bodies should be firm in discharging their duties diligently in enforcing compliance at all level of the guidelines for the safety of the hosting communities and even distribution across the study area.

Aazagreyir et al. (2020) wrote GIS-Based Analysis of the Location of Filling Stations in La-Nkwantanang Madina municipal assembly against Ghana's planning standards. In this study uses GIS is used to analyse the location of filling stations in La-Nkwantanang Madina municipal assembly against Ghana's planning standards set by Ghana Town and Country Planning Department. The finding of the study revealed that 37 filling stations are located along major roads in the study area with a cluster pattern of distribution. About 92% of the filling stations complied to the 15m standard distance from buildings while all the filling stations are compliance to the 10m standard distance between neighbor filling stations. The study recommends that the regulatory bodies should be proactive in the discharge of their duties and ensure total compliance to all the regulations.

Data and Method

Both primary data and secondary data are used in this research. Location of filling stations is collected by field observation with the help of GPS. Roads and road types are derived from Open street map. Primary data related to filling stations such as location (street name and ward name), selling the types of fuel, vehicle, and fuel sources are obtained by interviews with the owners and managers of filling stations. Location of public buildings such as universities, hospitals, market, and railway station are derived from GPS. Secondary data such as area and population are obtained from General Administrative Department, Hinthada Township.

Mean center and Standard distance are used to find out the distribution of filling stations within the Town. Distribution pattern of filling stations is analysed by Nearest neighbor analysis.

RESULTS AND DISCUSSION

According to field observation, there are 37 filling stations in Hintaha Town. Filling stations are presented in Figure 2. Filling stations are grouped into three: Type 1, Type 2, and Type 3 according to the fuel types. Table 2 shows the filling stations and types of filling station in Hinthada Town. Type1 stations sell the fuel 92 Ron for vehicles especially motorcycles. In this table, most of the filling stations are Type 1, which occupy 65% of the total stations. Type 2 stations sell the fuel 92 and 95 Ron for a few cars and motorcycles, which occupy 24% of filling stations. In type 3, fuels such as 92, 95, diesel and premium diesel are sold and distributed. They occupy 11% of the total stations in Hinthada Town. They distribute the fuel to type 1 and type 2 filling stations in the Town. They sell the fuel for vehicles, especially cars.

Table. 2 Number of Filling Station by Types of Fuel in Hinthada Town

Types of Filling Stations	Fuel Types	Number of Filling Stations	%
Type 1	92 Ron	24	65
Type 2	92 and 95 Ron	9	24
Type 3	92,95,diesel, premium diesel	4	11
Total		37	100

Source: Field Observation, 2020

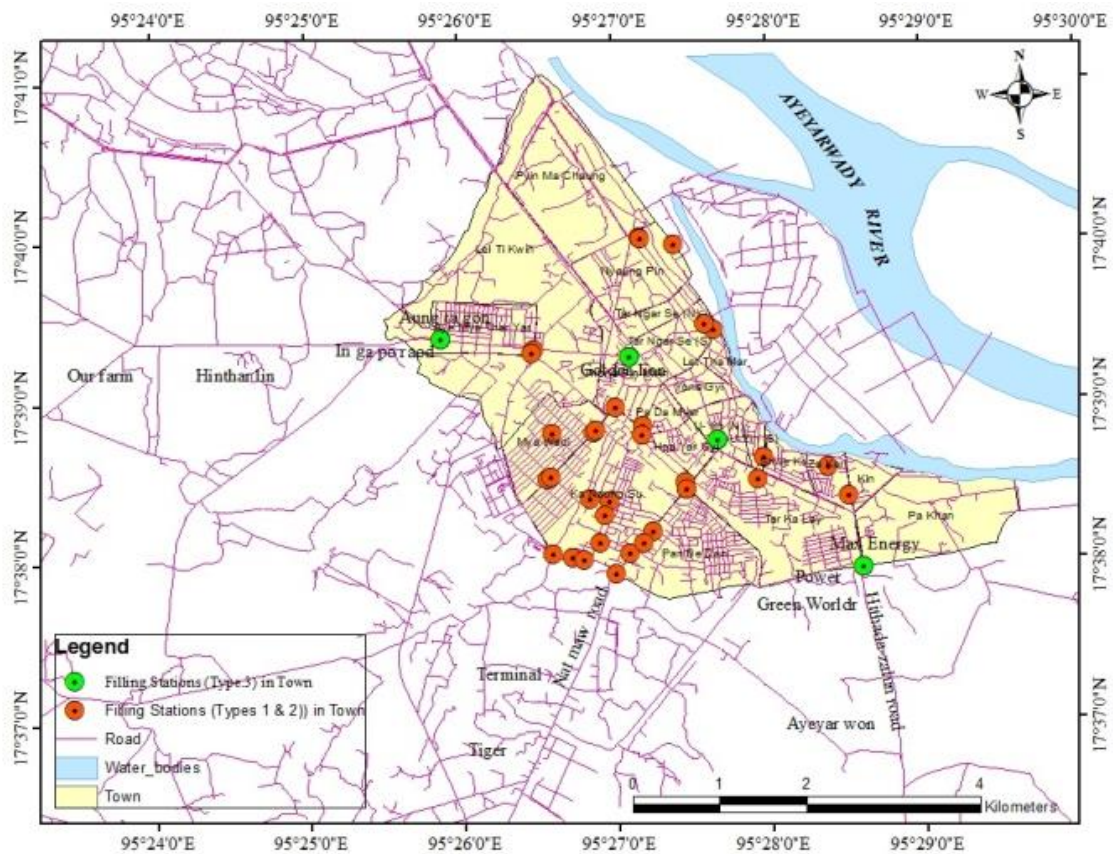


Figure 2. Location of Filling Stations in Hinthada Town
Source: Field Observation, 2020

The distribution of filling stations along the rodeside is presented in Table 3. According to the table, filling stations are found in primary road, secondary road, tertiary road, service road and residential road. In the primary road 9 stations are found, especially Nat maw and In ga po roads. Eight stations are found in secondary road such as Bo myat tun, Hinthada-Zalun, and university avenue roads. In the tertiary road, seven stations are found. Only one station is found in service road. Twelve stations are found in residential roads. It can be found that most of the filling stations are located in residential roads. The Second highest percentage of filling stations is found in Primary roads and the third largest amount found in secondary roads.

Figure 3 shows the distribution of filling stations in Hinthada Town. The distribution of filling stations in Hinthada Town is analysed by measuring geographic distribution. The result shows that the mean center of filling station is found in Pyi daw thar road (residential road) near railway station. One standard deviation from mean center is 150 metres and two standard deviation is 300 metres. The number of stations within standard distance (150 m) is 25 stations, which occupy 68% of total stations in Hinathada Town. The number of stations between 1 standard deviation (150m from mean center) and 2 standard deviation (300 m from mean center) is 12, which occupy 32% of all stations in Town. The percentages of filling station lie within one standard deviation and between one standard deviation and two standard deviation are shown in Figure 4.

Table.3 Distribution of Filling Station by Types of Road in Hinathada Town

Road Name	Filling Stations	Types of Road	Filling Stations
Nat maw road	6	Primary Road	9
In ga po road	3		
Bo myat tun road	3	Secondary Road	8
Hinthada-zalun road	1		
University-avenue road	4		
U wi sar ya road	1	Tertiary Road	7
University road	4		
Bo aung kyaw road	2		
Ta yoke kyaung road	1	Service Road	1
Thiri 5, Yan shin 7, Pyi daw thar, and etc	12	Residential Road	12
Total			37

Source: Field Observation, 2020 and Open Street map

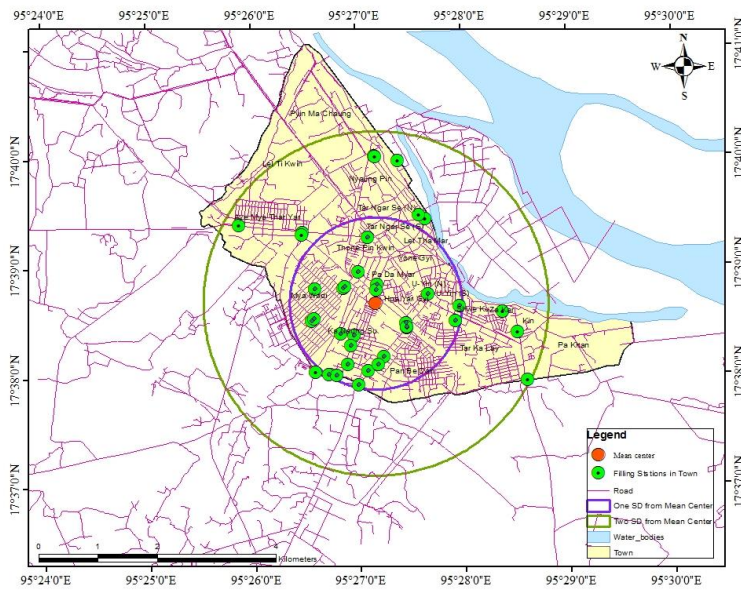


Figure 4. Distribution of Filling Stations in Hinthada Town
Source: Field Observation and Result of Analysis

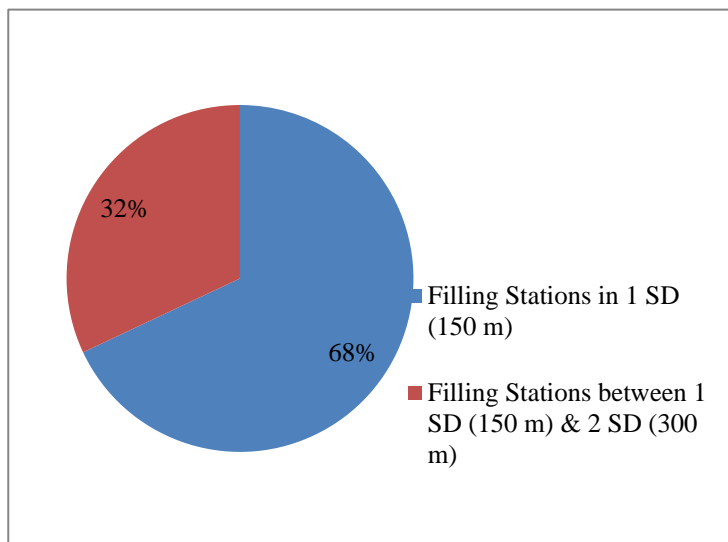


Figure 4. Percentages of Filling Stations within 1 SD and between 1 SD and 2 SD
Source: Results of Analysis

The distribution pattern of filling stations is analysed by Nearest Neighbor Analysis. According to the result, Nearest Neighbor ratio is 0.729, less than 1 and Z-score of -3.146. Therefore the distribution pattern of filling stations in Town is cluster pattern. Figure 5 presents the Average Nearest Neighbor Summary.

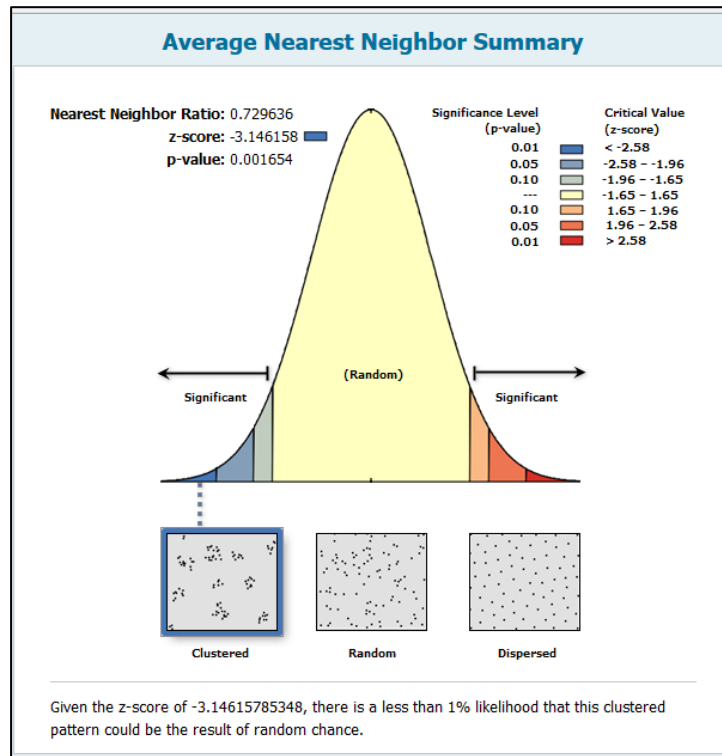


Figure.5 Average Nearest Neighbor Summary
 Source: Result of Nearest Neighbour Analysis

In this study, filling stations (Types 1 & 2) are mostly found, but Type 3 is less significant within the Town. The filling stations (Types 1 and 2) sell the fuel to the vehicles especially motorcycles which carry people and goods to public buildings. Therefore, they are found near public buildings such as Universities, Hospitals, Market, and Railway station. However, Type.3 filling stations are found in primary road and secondary road, especially In ga po and Bo myat tun roads. They sell the fuel for vehicles especially cars, and motorcycles.

In addition, most of the filling stations (Type 3) are found near the Town, especially Hinthada-Nat maw Road, Hinthada-zalun road, and In ga po road. These roads are highway roads. Figure 6 (a, and b) show the filling stations in Hinthada Town and its environs.

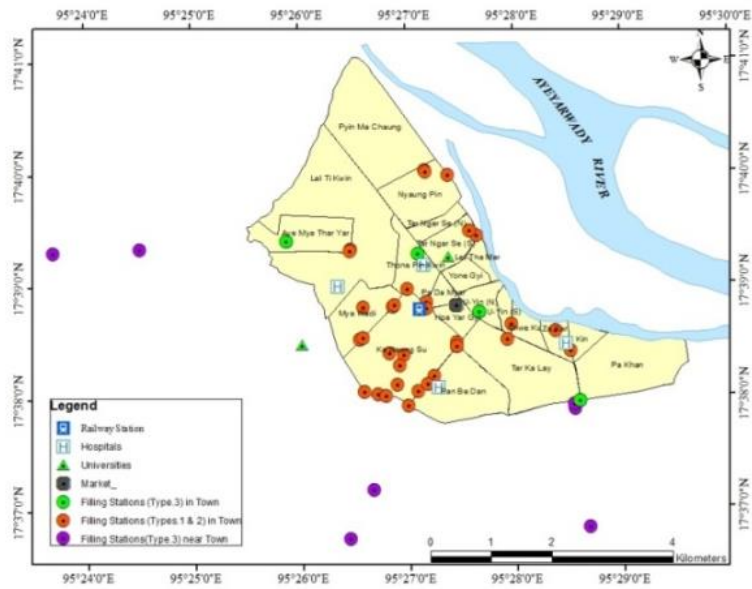


Figure 4. Filling Stations in Hinthada Town and its Environs
 Source: Field Observation, 2020

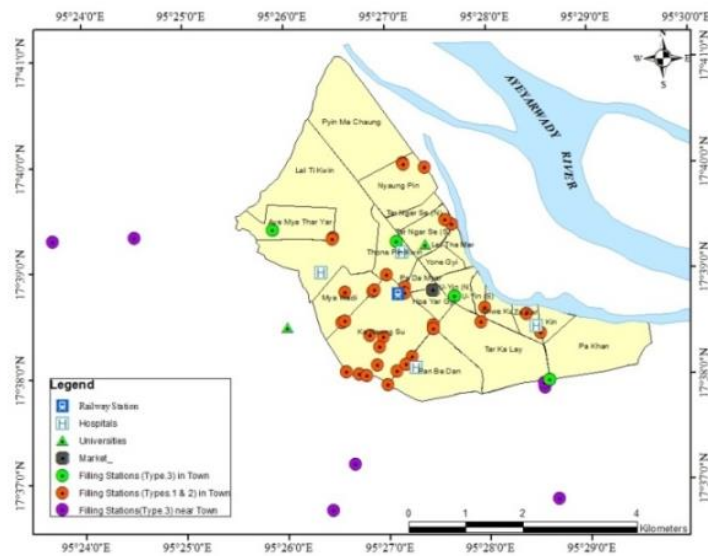


Figure 6(b) Filling Stations in Hinthada Town and its Environs
 Source: Field Observation, 2020

CONCLUSION

In this study, total number of filling stations are 37 in Hinthada Town. Three types of filling station are found. Among these three types, Type 1 and 2 filling stations are mostly found within the Town, especially along the residential roads. Type 3 is less significant within the town. However, most of the Type 3 is mainly found near the town, especially along the highway roads. Mean center of filling stations is found in residential road. Sixty-eight percentage of filling stations lies within the distance of 150 metre from the mean center. Growth of population, increase number of vehicles, transportation network, universities, market, and hospitals is the main reason to establish the filling stations in Town. The distribution pattern of filling stations is clustered pattern in the Town. The study concluded that the filling stations are clustered near residential areas.

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