

# STUDY THE AFFECTING FACTORS FOR BREAK BULK VESSEL TURNAROUND TIME AT PORT OF COLOMBO

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**ABSTRACT** - This research is mainly focused on identifying the affecting factors for break bulk Vessel Turnaround Time (VTT) at Port of Colombo and the relative importance of each factor to VTT using the Analytic Hierarchy Process (AHP) method. Identified eleven (1. Berths unavailability, 2. Weather conditions while vessel berthing, 3. Administrative and financial issues, 4. Pilotage delays, 5. Weather conditions while cargo handling operation, 6. Inefficiency of ship cranes, 7. Equipment breakdown, 8. Labour issues, 9. Shifts changing, 10. Cargo unavailability, 11. Cargo clearance delays) factors are categorized (as sub-criteria) into three main criteria considering break bulk vessel handling procedure. Berthing delays, cargo handling delays, cargo availability related delays are the main criteria of the **AHP model**. Calculated weights of main criteria and global weight of sub criteria represent the relative importance of affecting factors for VTT. Among the main criteria, cargo handling delays is the most influential factor while berthing delays is secondary. All sub factors are ranked according to their global weights. Weather conditions while cargo handling operation, shifts changing, berth unavailability and, inefficiency of ship cranes are the critical areas that needed to be considered when reducing VTT of break-bulk operations in port of Colombo.

**Keywords:** Break Bulk Vessel; The Port of Colombo; Conventional Cargo Handling; Vessel Turnaround Time (VTT); Analytic Hierarchy Process (AHP).

## 1. INTRODUCTION

Maritime transportation still remains the backbone of the global manufacturing supply chains and the international trade. Also, the demand for maritime transport still grows year by year. According to UNCTAD [1], over 90% of merchandise cargo volume is transported by sea, proving the above factor [2]. Port of Colombo is regularly accessed by various types of vessels, which can be divided into two main categories as container vessels and conventional cargo vessels. Conventional vessel handling remains as a very important operation for the supply chain of the country, while container vessel handling is becoming the major operation of the port of Colombo. Among them, break bulk vessels are bringing important materials for the production lines of the country. Break bulk cargoes are mainly handled by Sri Lanka Ports Authority (SLPA) at few locations in the port of Colombo.

Vessel Turnaround Time (VTT) is defined as “total time that a vessel spends at a port from its arrival to departure” [3]. VTT is used as a main Key Performance Indicator (KPI) of the port operation efficiency. Therefore, shipping lines are highly considerate about VTT when they select their calling port. Port of Colombo has a good break-bulk vessel market (1.1 million tons of break bulk cargo were handled in 2015 [4]). Currently port of Hambanthota and other regional ports are competing with port of Colombo in break bulk cargo handling. Therefore, the port operator should constantly improve the efficiency of

break bulk cargo handling operations to remain competitive in the region. Considering all those aspects, this study was conducted with the following two objects.

- 1 Identify the affecting factors for break bulk vessel turnaround time at the port of Colombo
- 2 Identify how does each factor influence to the VTT

Many researchers have studied on VTT of container vessels around the world and few scholars have conducted research on affecting factors for the VTT of container vessel focusing on port of Colombo using different methods and choosing different areas. However, there is not any previous research on break-bulk vessel operation and affecting factors for VTT. The author of this paper intends to bridge that research gap through this research. Even though VTT has been taken as a single measure, it is actually a summation of time spent on various activities carried out during the arrival of a ship to a port, activities inside a port & during the departure of a ship from a port. “Those sub activities include waiting time for a berth, maneuvering time, mooring/ unmooring time, idle time, cargo handling time and other time components until the vessel leaves port limits” [3] [2]. Premathilaka,[2] has studied the factors affecting the turnaround time of container vessels using regression model at the port of Colombo. Rupasinghe et al.,[5] and Gayathma et al.,[6] studied on analyzing VTT focusing on Port of Colombo using different methods. They have offered further insight on the factors that might affect on VTT. In Rupasinghe et al.,[5] research, researchers were able to provide a number of important factors that lead to adverse VTT. Out of many, crane utilization has been identified as the major factor for vessel turnaround time. Gayathma et al.,[6] research has identified three main factors and ten sub factors that affect container vessels, focusing on the three main terminals at the port of Colombo. The results show the relative importance of every main and sub factor towards vessel turnaround time for three terminals separately.

## 2. MATERIALS AND METHODS

After studied previous research, identified a list of factors that affect the break bulk VTT were presented to the industry experts such as operation managers in the conventional cargo handling section at the port of Colombo. With their advice the finalized list of factors was created adding new important factors and removing irrelevant factors. Identified eleven factors were categorized into three main criteria considering break bulk vessel handling procedure (anchorage in the outer harbor, vessel berthing, cargo handling, sailing). **Berthing delays, cargo handling delays, cargo availability related delays** were the main criteria of the AHP model. **Berths unavailability, weather conditions while vessel berthing, administrative and financial issues, pilotage delays** were sub criteria under the berthing delays. **Weather conditions while cargo handling operation, inefficiency of ship cranes, equipment breakdown, labour issues, shifts changing** were identified sub factors that influence to the cargo handling delays. **Cargo unavailability and cargo clearance delays** were categorized under the cargo availability related delays.

To achieve the second objective of the study, it was required to collect data and analyse collected data using the AHP method. Break bulk cargo handled by conventional cargo division of the SLPA. Employees in the conventional cargo division and stockholders were selected as the targeted population for this study. Better understanding and experience about break bulk vessels and cargo handling process required to give accurate answer to the questionnaire. Therefore, operation managers, duty managers and assistant unit superintend (AUS) were selected as the sample. The questionnaire was designed using the pairwise comparison technique and 1 to 9 rating scale was used for factor evaluation. Ten responses were collected by hand overing the questioner while interviewing selected operational experts in conventional cargo division.

Collected data analysed following step of AHP method and using MS excel as analysis tool. AHP is one of the multi-criteria decision-making methods which was developed by the mathematician Thomas L.Saaty and it is a tool of comparing intangible or qualitative attributes relatively by a process of pairwise comparisons. The comparisons rely on the absolute judgments and opinions of experts and individuals who are related to testing attributes [7]. The global weight (GW) of the main criteria and sub criteria indicate the relative importance of each criterion to the breakbulk VTT and priority vectors (PV) of sub factors are indicated relative importance to the main factor. Calculated Consistency Ratio (CR)  $\leq 10\%$  is consider as consistent of input data.

### 3. RESULTS AND DISCUSSION

According to the derived weights (GW & PV; all weights of factors will indicate in bracket next to the factor) contribution of main factors to break bulk VTT and contribution of sub factors to the main factor was ranked. The most influential main factor to the VTT was cargo handling delays (GW=60.49%). The secondary influential main factor was berthing delays (GW=31.07%) while cargo availability related delays (GW=8.44%) have less influence on the VTT. Among five sub factors that affect the cargo handling delays, according to the PV of each factor, weather conditions while cargo handling operations (34.84%) was the most influencing sub factor. And secondly shift changing (28.21%), thirdly inefficiency of ship crane (15.39%), fourthly equipment breakdown (13.51%), and lastly, labor issues (8.05%) were influencing to cargo handling delays. There were four sub factors that affect the berthing delays. According to the PV, the most affecting sub factor was berths unavailability (49.02%). Secondly Pilotage delays (27.82%), thirdly weather conditions while vessel berthing (15.29%). Lastly, administrative and financial issues (7.87%). The impact of cargo availability related delays was very less compared to other main criteria. Among the sub criteria, cargo clearance delays (77.34%) had a higher influence compared to cargo unavailability (22.66%).

### 4. CONCLUSION

Among the considered factors, shifts changing, inefficiency of ship cranes, equipment breakdown and labour issues are the critical areas that needed to be considered when reducing VTT and increase the efficiency of the port operation.

### REFERENCES

1. UNCTAD, "Review of Maritime Transport 2019," 2019.
2. W. H. V Premathilaka, "Determining the factors affecting the turnaround time of container vessels: a case study on Port of Colombo container vessels: a case study on Port of Colombo," Colombo, 2018.
3. D. Moon, "Terminal Performance Measures," World Maritime University, 2018.
4. Maritime & Transport Business Solutions B.V., *Democratic Socialist Republic of Sri Lanka : National Port Master Plan - The Colombo Port Development Plan- Volume 1 (Part 3)*, no. February. 2020.
5. S. Rupasinghe, I. Sigera, and S. Cahoon, "The analysis of vessel turnaround time at Port of Colombo," *ecite.utas.edu.au*, p. 22, 2014.
6. K. Gayathma, I. Sigera, and S. Cahoon, "The factors affecting the container vessel turnaround time at Port of Colombo," pp. 1–17, 2015.
7. S. T. L., "Decision Making with the Analytic Hierarchy Process.," *Int. J. Serv. Sci.*, 2008.