

Passenger Satisfaction: Assessment on the Current Queueing Management System in the Port of Dumaguete Ticketing Outlets

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Abstract. The study examines the queueing system and passenger satisfaction at the ticketing outlets of Dumaguete City Port, where growing tourism and inter-island travel have intensified congestion, particularly during peak hours. It employs a quantitative-descriptive research design, gathering data from 100 purposively selected walk-in passengers through time-motion observations and a structured questionnaire with high internal consistency (Cronbach's $\alpha = 0.92$). Queueing theory, specifically M/M/1 models and Little's Law, together with descriptive statistics, is used to analyze key performance indicators such as arrival rate (λ), service rate (μ), average waiting time in queue (Wq), average queue length (Lq), and server utilization (ρ). Results indicate that demand sharply increases around midday and on late weekdays, with high-traffic operators such as OceanJet and Montenegro exhibiting arrival rates up to 0.383 passengers per minute, waiting times reaching 9.67 minutes, long queues, and utilization levels of $\rho = 0.92$, indicative of severe congestion and near-saturation of service capacity. In contrast, FastCat and HS Star Marine maintain more stable operations with shorter waiting times. All outlets employ single-server, first-come, first-served (FCFS) queues, which promote fairness but constrain throughput during demand surges. Passenger behavior remains generally orderly, with minimal queue-jumping, yet overall satisfaction is only neutral ($\bar{x} = 3.36/5$), lowest in aspects related to queue layout and peak-period performance. The findings suggest that while the current system functions adequately off-peak, it becomes strained under high demand. The study recommends increasing the number of service counters, implementing dynamic staffing, improving physical layouts with barriers and clear signage, and adopting digital solutions such as self-service kiosks and mobile applications to enhance operational efficiency and passenger satisfaction.

Introduction

Efficient queue management poses a major global challenge in high-traffic settings such as ports, airports, banks, and public offices. Long wait times lead to passenger frustration, reduced productivity, and significant economic losses (Erkan & Ozdemir, 2026). Around the world, basic systems such as single-line or first-come, first-served approaches result in average delays of 15–30 minutes or more during peak periods. This leads to overcrowding, uneven service, staff burnout, and low customer satisfaction (Ainbinder et al., 2024). Research shows that these problems can reduce overall performance by up to 40%, as observed in international airports and urban transit hubs. Key interventions include ticket dispensers, priority lanes for seniors and families, digital displays, and virtual queueing applications. Data-driven improvements are essential to enhance service flow, ensure fairness, and boost economic viability (Lionpulsedev, 2025).

The Philippines faces similar queueing challenges in public transport terminals and regulated ports. As an archipelagic nation reliant on sea travel, it handles high passenger volumes during peak seasons, holidays, and weekends. The Philippine Ports Authority (PPA) and the Department of Tourism (DOT) highlight congestion, manual ticketing, and limited digital

tools as ongoing issues that negatively affect passenger experience and tourism growth (PPA, 2023; DOT, 2022). Reports from the World Bank and the ASEAN Secretariat point out that weak management systems create travel delays, encourage informal fixers, and erode public trust (World Bank, 2020; ASEAN Secretariat, 2019). Small and medium ports often continue to rely on manual, unstructured queuing systems without the application of industrial engineering solutions. National infrastructure weaknesses are clearly evident at Dumaguete City Port. Ticketing offices struggle to manage surging ferry traffic to Cebu, Siquijor, and Dapitan, driven by tourism and daily commutes in Negros Oriental. Passengers endure chaotic lines, hours-long waits, and slow manual processes, as seen in the massive crowds on May 17, 2025. Governor Manuel Sagarbarria's letter on May 16 demanded action against "ticket fixers," who charge high fees by falsely claiming that ships are full despite the availability of seats (Gomez, 2025). This practice causes missed departures, wastes time, damages public trust, harms the tourism image, and reduces revenue from this vital gateway. Local advocates describe the system as disorganized, slow, and inefficient, discouraging both visitors and residents.

This study addresses the lack of data by evaluating the queue system at Dumaguete Port through direct measurements of wait times, queue lengths, and service rate variations during peak hours. In the absence of prior research, it diagnoses structural flaws and vulnerabilities that contribute to delays and exploitation. The results provide a baseline and practical recommendations to increase throughput, promote transparent ticketing, and eliminate fixers using industrial engineering principles. This work also supports key United Nations Sustainable Development Goals (SDGs). It advances SDG 9 (Industry, Innovation, and Infrastructure) by enhancing resilient transport systems (Muth et al., 2023), supports SDG 11 (Sustainable Cities and Communities) by promoting inclusive and safe public services, and strengthens SDG 16 (Peace, Justice, and Strong Institutions) by addressing fixers and fostering accountable systems. In this way, local improvements are connected to broader global sustainability goals.

Research Questions

This study aimed to assess the current queuing systems in the ticketing outlets of Dumaguete City Port and develop targeted improvements to enhance passenger flow efficiency and service quality. Specifically, this study sought to answer the following questions:

1. What is the profile of the passengers in terms of:
 - 1.1 age;
 - 1.2 sex;
 - 1.3 type of passenger (local resident of Neg.Or. or tourist);
 - 1.4 travelling with a group or alone;
 - 1.5 priority passenger;
 - 1.6 destination; and
 - 1.7 time of travel?

2. What is the passenger satisfaction levels of the current queueing system based on the following dimensions:
 - 2.1 passenger arrival patterns;
 - 2.2 queue structure;
 - 2.3 service process;
 - 2.4 queue behavior; and
 - 2.5 queue performance metrics?

3. What is the current state of the queuing systems at the ticketing outlets of Dumaguete City Port using the following dimensions:
 - 3.1 passenger arrival patterns:
 - 3.1.1 passenger volume by time period; and
 - 3.1.2 peak and off-peak arrival rate?
 - 3.2 queue structure:
 - 3.2.1 number of service counters; and
 - 3.2.2 queue type (single queue or multiple queue)?
 - 3.3 service process:
 - 3.3.1 service rate per ticketing outlet; and
 - 3.3.2 average service time per passenger?
 - 3.4 queue behavior;
 - 3.5 queue discipline;
 - 3.6 queue performance metrics:
 - 3.6.1 average queue length;
 - 3.6.2 average waiting time; and

- 3.6.3 system utilization?
4. Based on the findings of the study, what improvements can be proposed to improve the queuing management systems at Dumaguete City Port ticketing offices.

Methodology

Research Design

This study employed a quantitative-descriptive observational research design to assess the passenger satisfactions at the Dumaguete City Port ticketing outlet area. Time-and-motion analysis, using queue checklists, was conducted to measure arrival times, service times, and waiting times. In addition, a structured was administered to quantify passenger satisfaction with the current queueing management system.

Research Environment

The study was conducted at the ticketing offices of Dumaguete City Port in Negros Oriental, Philippines, a key transport hub for travel to Cebu, Siquijor, and Mindanao. High passenger volumes during peak periods, holidays, and weekends contribute to congestion at service counters, making the site suitable for assessing queue efficiency and identifying potential improvements.

Research Respondents

The primary respondents consisted of 100 purposively selected walk-in passengers, including locals, tourists, families, seniors, PWDs), at ticketing outlets. This sample size is appropriate for small-scale surveys despite logistical constraints, as it captures diverse queuing experiences and provides reliable insights.

Research Instruments

This study employed three primary instruments to measure objective queuing parameters aligned with the Statement of the Problem. A structured observation checklist was used to record passenger arrival patterns, queue behavior, and discipline. Time-and-motion sheets captured waiting times, service times per passenger, service rates per outlet, and system utilization. A three-part survey questionnaire was utilized to assess passenger satisfaction: Part I included informed consent and instructions; Part II gathered passenger profiles, including destinations and departure times; and Part III measured satisfaction with the queuing system. The questionnaire underwent expert validation by three faculty members and was pilot-tested. A Cronbach's α of 0.92 confirmed excellent internal consistency (above the 0.70 threshold), ensuring reliability in evaluating satisfaction, queue organization, and service experience.

Ethical Consideration

This study adhered to ethical guidelines, protecting participants' rights, privacy, and well-being during surveys, questionnaires, and observations at Dumaguete City Port. Informed consent was obtained; participation was voluntary with withdrawal rights. No personal identifiers were collected; responses remained anonymous and securely stored. Observations focused solely on system metrics in public areas, avoiding individual identification or recordings. Non-sensitive queue-related questions ensured no harm. AI tools (OpenAI, QuillBot, Perplexity AI, Consensus AI) aided language clarity only, with full researcher accountability. Data integrity was maintained through honest reporting and port authority permission.

Research Procedure

Data collection followed a systematic process. Permission was obtained from port management; fixed observation points were set near ticketing offices. Enumerators were trained on timing rules, queue counting, and behavior definitions. Observations spanned peak/off-peak periods: morning (8:00-9:30am), midday (11:30am-1:00pm), afternoon (5:30-7:00pm). Arrival timestamps measured interarrival times, rates (λ), and passenger types. Queue configurations (counters, signage, space) were recorded. Time-motion data captured waiting/service times per passenger, ticket fixer events. Post-transaction surveys assessed satisfaction and behavior.

Statistical Treatment

Microsoft Excel analyzed survey and observation data from OceanJet, Montenegro, FastCat, and HS Star Marine outlets. Descriptive statistics included frequency/percentage for profiles (age, sex, type, destination, time) and queue types;

means/standard deviation for volumes, satisfaction, λ (arrivals/time), service rates (1/mean service time), waiting times (service start-arrival), queue lengths (periodic averages), and utilization ($\lambda/s\mu$). Likert scale (1-5) interpreted satisfaction. These suited observational sampling for congestion analysis and peak/off-peak comparisons.

Delimitation of the Study

This study was intentionally scoped to defined parameters to maintain focus and practicality. Observations were restricted to specified intervals: morning (8:00–9:30 a.m.), midday (11:30 a.m.–1:00 p.m.), and afternoon (5:30–7:00 p.m.) encompassing peak and off-peak conditions, while excluding extended seasonal variations, holidays, or continuous 24-hour operations. The participant pool comprised 100 purposively sampled walk-in passengers, with assessment limited specifically to their satisfaction with the current queuing system at four ticketing outlets: OceanJet, FastCat, Montenegro Lines, and HS Star Marine. Outlets such as Lite Ferries (limited operating hours) and Cockaliong Shipping Lines (located off-site) were omitted. Data collection was confined to 1.5-hour sessions per outlet owing to logistical limitations, precluding concurrent multi-outlet monitoring. External influences including weather, events, or abrupt traffic surges were neither controlled nor analyzed. These boundaries provided a focused foundation for queue performance evaluation and targeted recommendations at Dumaguete City Port.

Results and Discussion

This chapter presents, analyzes, and interprets data on passenger profiles, existing queuing systems at Dumaguete City Port ticketing offices, and proposed improvements for enhanced productivity and service quality. It covers three sections: (1) demographic profiles, (2) queuing system assessments, and (3) recommended enhancements. Findings from 100 respondents are illustrated via tables and graphs, with detailed analysis for comprehensive insights.

Age Generations	Frequency	Percentage
Generation Z	67	67%
Generation Y / Millennials	19	19%
Generation X	14	14%
Total	100	100%

Table No. 1 Age Profile of the Respondents

Table 1 presents that, among the 100 respondents, Generation Z predominated (67%), followed by Millennials/Generation Y (19%) and Generation X (14%). This younger demographic profile reflects high mobility among Generation Z for academic, work, and leisure travel, alongside Millennials' employment-related inter-island trips. The lower representation of Generation X (14%) suggests reduced reliance on ferry transport among older working-age cohorts, likely due to differing travel preferences or the availability of alternative transport options. These findings indicate a concentration of demand among younger travelers, informing service enhancements in digital accessibility, scheduling flexibility, and passenger comfort tailored to these segments (Veitch et al., 2024).

Sex	Frequency	Percentage
Male	47	47%
Female	39	39%
Prefer not to say	14	14%
Total	100	100%

Table No. 2 Sex Profile of the Respondents

Table 2 shows that males slightly outnumber females (47% vs. 39%), with 14% of respondents not disclosing their sex, indicating a generally balanced gender representation. Males tend to favor business-related travel, while females are more inclined toward leisure travel (Collins & Tisdell, 2002). The 14% non-disclosure may reflect increasing awareness of gender inclusivity, particularly among younger populations. This distribution highlights the need for inclusive ferry services that address diverse passenger needs, such as work-oriented facilities for business travelers and family- or leisure-oriented options, while also respecting the preferences of those who choose not to disclose their gender.

Type of Passenger	Frequency	Percentage
Local Resident of NegOr	58	58%
Tourist	42	42%
Total	100	100%

Table No. 3 Type of Passenger Profile of the Respondents

Table 3 shows that local residents of Negros Oriental dominate the sample (58%), compared to tourists (42%), reflecting a locally driven yet balanced passenger base. Locals tend to prioritize reliability, affordability, and frequent schedules to meet daily travel needs, while tourists place greater emphasis on comfort and amenities. These findings support the need for targeted strategies that balance commuter efficiency with service enhancements for tourists.

Travelling	Frequency	Percentage
With group	57	57%
Alone	43	43%
Total	100	100%

Table No. 4 Travelling Profile of the Respondents

Table 4 displays that group travel dominates (57%) over solo travelers (43%) among the 100 respondents, reflecting social, family, and leisure travel patterns that enhance relaxation (Pearl Plymouth, 2020). Group travelers, such as tourists or families, require family-friendly areas and effective crowd management, particularly during weekends. In contrast, solo travelers tend to prioritize commuting efficiency along Negros Oriental routes, highlighting the need for balanced service design in both amenities and capacity planning.

Priority Passenger	Frequency	Percentage
No	87	87%
If Yes:	-	-
Senior Citizen	8	8%
PWD	3	3%
Pregnant	2	2%
With Infant/Child	0	0%
Total	100	100%

Table No. 5 Priority Passenger Profile of the Respondents

Table 5 shows non-priority passengers dominating (87%) over priority groups (13%), with seniors leading (8%), PWDs (3%), pregnant (2%), none with infants and children. This reflects RA 9994 policies prioritizing vulnerable groups for accessibility; requires dedicated lanes, seating, and assistance to ensure equity and enhance satisfaction across all passengers (Guzman, 2026).

Destination	Frequency	Percentage
Siquijor	42	42%
Dapitan	24	24%
Cebu	18	18%
Bohol	16	16%
Total	100	100%

Table No. 6 Destination Profile of the Respondent

Table 6 presents Siquijor as the dominant destination (42%), followed by Dapitan (24%), Cebu (18%), and Bohol (16%) among the 100 respondents. This distribution is largely driven by proximity and the frequency, shorter duration, and lower cost of trips to nearby destinations, which attract both commuters and tourists (PPA; DOT). In contrast, longer routes such as Cebu and Bohol are more likely to be complemented by air transport alternatives. Overall, this pattern underscores

strong short-haul travel demand, particularly for Siquijor routes, which has implications for queue management strategies and capacity planning during peak periods at Dumaguete City Port (ITF, 2021).

Time of Travel	Frequency	Percentage
Afternoon (12NN - 5:59PM)	37	37%
Morning (6AM - 11:59AM)	24	24%
Evening (6PM-11:59PM)	21	21%
Dawn (12MN - 5:59AM)	18	18%
Total	100	100%

Table No. 7 Time of Travel of the Respondents

Table 7 shows that afternoon travel dominates (37%), followed by morning (24%), evening (21%), and dawn (18%), reflecting peak concentrations aligned with human activity patterns, ferry schedules, and inter-island demand (ITF, 2021; PPA). This distribution highlights the afternoon period as a critical queuing bottleneck, necessitating additional counters, dynamic staffing, and time-based adjustments to reduce waiting times and enhance service efficiency at Dumaguete City Port ticketing outlets.

Indicators	\bar{x}	LoS
1. Passenger flow is well managed during both peak and off-peak hours whenever I purchase a ticket.	3.82	S
2. The number of passengers present when I arrive at the ticketing outlet is manageable	3.04	N
3. Ticketing lines are handled efficiently on the day I arrived at the queue, compared to other days from my experience.	2.18	D
Factor Average	3.01	N

Table No. 8 Passenger Satisfaction on Passenger Arrival Patterns

Table 8 shows passengers' neutral overall satisfaction with arrival patterns at Dumaguete City Port ticketing outlets, with a factor mean of 3.01. Respondents rated flow management during both peak and off-peak hours positively (3.82) and found the number of passengers upon arrival manageable (3.04). However, they gave low ratings to ticketing line efficiency during specific high-demand periods such as weekends compared to weekdays (2.18). This suggests generally effective crowd handling but clear inefficiencies during peak demand periods.

This pattern aligns with queuing theory in industrial engineering, where high arrival rates (λ) during peak periods exceed service rates (μ), resulting in queue buildup and reduced system efficiency that is reflected in lower satisfaction regarding line handling. In the context of Dumaguete, weekend tourist surges from nearby destinations can overwhelm limited ticketing counters, as group transactions typically require longer processing times than individual weekday transactions. Similar dynamics have been observed in port systems, where peak-hour congestion caused by irregular arrival patterns leads to delays and neutral-to-negative satisfaction outcomes (Gross et al., 2018).

Indicators	\bar{x}	LoS
1. I am satisfied with the number of ticket counters available to serve passengers.	4.08	S
2. I am satisfied with how the queue system (single or multiple lines) ensures fair and smooth movement toward the counters.	2.46	D
3. I am satisfied with the layout and space allocated for the queue.	2.31	D
4. I am satisfied with the organization and adequacy of the waiting area for passengers.	2.29	D
Factor Average	2.79	N

Table No. 9 Passenger Satisfaction on Queue Structure

Table 9 shows passengers' neutral overall satisfaction with queue structure at Dumaguete City Port ticketing outlets, with a factor mean of 2.79. Respondents rated the number of ticket counters positively (4.08), but expressed dissatisfaction with queue system fairness and smoothness (2.46), queue layout and space (2.31), and waiting area organization (2.29). This indicates that while staffing levels are perceived as sufficient, there are notable weaknesses in infrastructure design and passenger flow management.

Queuing theory explains this mismatch, as single-server, single-line systems that is commonly observed across operators such as FastCat, HS Star Marine, Montenegro, and OceanJet, prioritize fairness through a first-come, first-served approach but tend to create bottlenecks when arrival rates (λ) are high. This is particularly evident given the mixed passenger profile (58% locals and 42% tourists) and the high proportion of group travelers (57%), especially during weekends. Limited spatial capacity further exacerbates congestion and discomfort, as single-line configurations cannot easily scale without proper zoning or spatial redesign. Similar findings in port studies show that poor queue layouts contribute to congestion, inefficiency, and perceived inequity in service delivery (Saeed & Larsen, 2016; Tonade & Orkpeh, 2025).

Indicators	\bar{x}	LoS
1. The ticketing procedures are clear and easy to understand.	4.02	S
2. I am attended to promptly when it is my turn at the counter.	3.80	S
3. The ticketing process moves at a pace that keeps the line progressing.	3.69	S
Factor Average	3.84	S

Table No. 10 Passenger Satisfaction with Service Process

Table 10 presents passengers' satisfaction levels with the service process at Dumaguete City Port ticketing outlets, achieving an overall factor average of 3.84. Specific indicators include ticketing procedures rated highest at $\bar{x}=4.02$, confirming they are clear and easy to understand, which helps reduce confusion for travelers using signs, forms, and instructions. Prompt attendance at the counter scored $\bar{x}=3.80$, reflecting efficient staff response once passengers reach the front. The line progression pace received the lowest mark at $\bar{x}=3.69$, suggesting noticeable delays during peak crowd times that affect the overall flow. These results indicate a solid foundation in individual service quality but highlight the need to address queue bottlenecks for better experiences.

Predictable times at leading outlets reduce individual waits and boost counter ratings, but inconsistencies elsewhere prolong queues. Weekend increases reflect demand adjustments, yet gaps persist. Findings align with research showing clear procedures and fast service drive satisfaction, while capacity shortfalls cause delays (Chen & Hickman, 2023). Improvements like extra staff on peaks, digital queuing, or training could elevate scores to Very Satisfied and optimize the system.

Indicators	\bar{x}	LoS
1. Passengers generally follow proper queueing practices.	3.86	S
2. Passengers remain in line until they are served.	3.85	S
Factor Average	3.86	S

Table No. 11 Passenger Satisfaction on Passenger Behavior

Table 11 shows that passengers are satisfied with passenger behavior with an average mean score of 3.86. Specifically, passengers generally follow proper queueing practices ($\bar{x}=3.86$) and remain in line until served ($\bar{x}=3.85$). This indicates positive compliance with basic queueing etiquette among ferry users. This finding aligns with studies on public transport behavior, where clear signage, cultural norms of orderliness, and peer pressure contribute to high queue adherence, particularly in high-volume ferry terminals serving routine commuters (Kissinger et.al., 2023). This satisfaction with queuing reflects the predominance of local residents (58%) and younger adults (67%) who demonstrate familiarity with boarding procedures, unlike tourist-heavy routes where inexperience disrupts flow.

The satisfied rating suggests effective terminal management through visual cues and staff enforcement, though it underscores opportunities to maintain these standards during peak weekend crowds when tourist groups slow processes (Smart, 2016). In general, strong passenger cooperation on queuing supports efficient ferry operations and reinforces the need for continued infrastructure investments to sustain satisfaction across diverse user groups.

Indicators	\bar{x}	LoS
1. Ticket counters and staff are utilized efficiently to minimize waiting time.	3.62	S
2. The waiting time before being served is acceptable.	3.51	S
3. The number of passengers in line is reasonable and does not result in excessive crowding.	3.25	S
4. The queue remains orderly even during busy periods.	2.85	N
Factor Average	3.31	N

Table No. 12 Passenger Satisfaction on Performance Metrics

Table 12 shows passengers' neutral overall satisfaction with performance metrics at Dumaguete City Port ticketing outlets, with a factor mean of 3.31. Passengers gave positive ratings to efficient use of ticket counters and staff to reduce waiting (3.62), acceptable waiting times before service (3.51), and reasonable number of passengers in line without too much crowding (3.25). However, they felt neutral about the queue staying orderly during busy times (2.85).

This pattern follows basic queuing theory: the system handles normal passenger arrivals well, keeping waits short and lines manageable through good staff use. But during high-demand periods, like weekends with more tourists, queues become unstable as arrival rates exceed service speed, leading to disorder without extra help like signs or more workers (Saeed & Larsen, 2016; Cabrera, 2026). Lean Six Sigma methods can fix this by adding simple tools, such as barriers for order, more staff at peaks, or digital apps for virtual lines, to make queues smoother and raise satisfaction scores (Tonade & Orkpeh, 2025).

Shipping Outlet	Morning	Noon	Afternoon	Overall Mean
OceanJet	17	20	12	16
Montenegro	14	23	11	16
HS Star Marine	13	18	5	12
FastCat	7	8	5	7
Overall Mean	12	17	8	13

Table No. 13 Average passenger volume by outlet and time period

Table 13 shows noon passenger volume surging highest ($\bar{x} = 17$) across outlets, with OceanJet and Montenegro leading overall Table 3.1.1 illustrates the distribution of average passenger volumes across various shipping outlets and time periods at Dumaguete City Port. The findings show that passenger traffic is unevenly distributed throughout the day, with a significant surge occurring during the noon period (mean 17) across all outlets. OceanJet and Montenegro recorded the highest overall mean volumes at 16 passengers each, followed by HS Star Marine (12) and FastCat (7). This concentration of passengers during specific times indicates that outlets experience varying degrees of demand pressure throughout the day.

This uneven volume distribution directly correlates with the neutral overall satisfaction scores reported in Table 2.1 (Factor Mean: 3.01). Although passengers generally view the management of flow as satisfactory (3.82) under normal conditions, the high passenger counts at noon exceed the processing capacity of the available ticketing counters. This discrepancy explains the low marks for line efficiency (2.18), as the port's infrastructure struggles to handle the increased load during these peak intervals, resulting in longer waiting times and reduced traveler convenience.

The data confirms that while the port effectively manages low-to-moderate volume periods, it faces operational challenges during peak hours. To bridge the gap between current neutral satisfaction and higher levels of traveler approval, the port may benefit from optimizing its staffing levels during noon peaks or implementing streamlined ticketing processes. Aligning the operational capacity with these known volume patterns would likely resolve the inefficiencies cited by passengers, leading to a more consistent and positive experience across all service periods (Tonade & Orkpeh, 2025).

Shipping Ticketing Outlet	Classification	Day	Time Period	Arrival Rate (λ)	Passenger Volume
FastCat	Peak	Friday	Morning	0.200	18
FastCat	Off-peak	Monday	Noon	0.017	2
HS Star Marine	Peak	Friday	Morning	0.230	21
HS Star Marine	Off-peak	Sunday	Afternoon	0.022	2
Montenegro	Peak	Tuesday	Noon	0.308	37
Montenegro	Off-peak	Wednesday	Morning	0.078	7
OceanJet	Peak	Friday	Noon	0.380	46
OceanJet	Off-peak	Tuesday	Morning	0.078	7

Table No. 14 Peak and off-peak arrival periods by outlet

Table 14 shows extreme difference between peak and off-peak arrival patterns of the four ticketing outlets: OceanJet hits highest arrival rate $\lambda=0.380$ (Friday noon, 46 passengers), Montenegro $\lambda=0.308$ (Tuesday noon, 37 passengers); off-peak drops to $\lambda < 0.03$ (FastCat/HS Star Marine). One-counter setup can't handle rush crowds, causing Table 8 neutral satisfaction. Good normal flow (3.82) but poor line speed (2.18) during tourist peaks. Need flexible staffing or digital queues for busy periods (Gross et al., 2018; Tonade & Orkpeh, 2025).

Shipping Lines Outlet	Number of service counters	Queue Type
FastCat Ferries	1	Single line
HS Star Marine Inc.	1	Single line
Montenegro Line	1	Single line
Ocean Jet Fast Ferries	1	Single line

Table No. 15 Current state of Queue Structure

Table 15 presents the queue configuration for ticketing outlets of four shipping lines at Dumaguete City Port: FastCat, HS Star Marine, Montenegro, and OceanJet. Each outlet operates with one service counter and a single-line queue system, indicating a uniform setup across all locations.

This configuration reflects a consistent single-server, single-line structure, where passengers join a single queue and are served on a first-come, first-served basis by one counter. Single-line systems generally promote fairness by minimizing line-jumping and reducing confusion compared to multiple-line arrangements, as supported by queue management literature. However, the single-server design inherently limits service capacity, as only one transaction can be processed at a time, creating potential bottlenecks when arrival rates exceed service rates during peak demand periods.

In interpretation, this structure ensures simplicity in management and equity in service distribution but increases the risk of longer waiting times during high-traffic conditions, which are common in ports with fluctuating passenger volumes. Studies on queuing theory in terminal operations, such as those at the Manila International Container Terminal, emphasize that such systems require a balance between arrival and service rates to prevent congestion and maintain passenger satisfaction (Saeed & Larsen, 2016).

Day	OceanJet	HS Star Marine	Montenegro	FastCat
Monday	0.50	0.36	0.44	0.23
Tuesday	0.39	0.28	0.44	0.11
Wednesday	0.50	0.42	0.33	0.19
Thursday	0.39	0.34	0.33	0.18
Friday	0.50	0.50	0.44	0.31
Saturday	0.37	0.50	0.50	0.39
Sunday	0.39	0.44	0.33	0.31
Overall Average	0.43	0.41	0.40	0.25

Table No. 16 Average Service Rate (μ) per Day per Ticketing Outlet

The results in Table 16 show the average service rate (μ) of each ticketing outlet across the week, reflecting how efficiently passengers are served. Based on the overall averages, OceanJet has the highest service rate (0.43), followed by HS Star Marine (0.41) and Montenegro (0.40), while FastCat records the lowest overall average (0.25). This indicates that OceanJet and HS Star Marine generally process passengers more quickly and efficiently, whereas FastCat operates at a comparatively slower service pace.

In terms of daily trends, OceanJet maintains a relatively consistent service rate, frequently reaching 0.50 on several days, which suggests stable operational performance. HS Star Marine likewise demonstrates strong service rates, particularly on Friday and Saturday (0.50), indicating its ability to maintain efficiency even during peak periods. Montenegro shows moderate but slightly fluctuating service rates, while FastCat consistently records lower values, notably on Tuesday (0.11), reflecting slower and less stable service during certain days.

In conclusion, the findings indicate that queue performance is strongly influenced by the balance between service rate and passenger demand. Outlets with higher service rates are generally more capable of processing passengers efficiently; however, congestion may still occur when demand exceeds capacity. This underscores the importance of improving service rates, particularly during peak periods, to better align with passenger arrivals and reduce waiting times within the queueing system.

Day	FastCat	OceanJet	Montenegro	HS Star Marine
Monday	4.33	2	2.33	3
Tuesday	1	2.67	1.33	1.67
Wednesday	2.33	2	2.33	2
Thursday	2.67	2.67	3	2.33
Friday	3.33	2	2.33	2
Saturday	2.67	4.67	2	2
Sunday	3.33	2.67	3	2.33
Overall Average	2.81	2.67	2.33	2.19

Table No. 17 Average Service Time (in Minutes) per Day per Ticketing Outlet

The results in Table 17 show the average service time of each ticketing outlet across the week, which reflects how long it takes to serve each passenger. Based on the overall averages, HS Star Marine has the lowest service time (2.19 minutes), followed by Montenegro (2.33 minutes), OceanJet (2.67 minutes), and FastCat with the highest (2.81 minutes). This means that HS Star Marine is the fastest in serving passengers, while FastCat tends to take longer on average.

Looking at the daily data, OceanJet generally maintains a consistent service time around 2 to 2.67 minutes, although there is a noticeable increase on Saturday (4.67 minutes), which may be due to peak demand. Montenegro shows moderate and stable service times, mostly between 2 to 3 minutes, indicating fairly consistent performance. HS Star Marine also shows stable service times, which supports its low overall average and suggests efficient service operations. In contrast, FastCat shows the most variation in service time, ranging from as low as 1 minute to as high as 4.33 minutes. This indicates that its service process is less consistent, which may affect overall efficiency, especially if passenger demand increases.

In conclusion, the findings suggest that shorter and more consistent service times lead to better queue efficiency, but they must be enough to match the number of arriving passengers. If service time increases during peak periods, it can slow down the system and contribute to longer queues. This highlights the importance of maintaining fast and consistent service, especially during high-demand periods, to improve the overall performance of the queueing system.

Shipping Line	Morning Observation			Afternoon Observation			Evening Observation		
	Balking	Reneging	Jockeying	Balking	Reneging	Jockeying	Balking	Reneging	Jockeying
OceanJet	3	2	0	10	3	0	3	2	0
Montenegro	0	0	0	2	6	0	0	0	0
FastCat	0	0	0	0	0	0	0	0	0
HS Star Marine	1	1	0	0	2	0	0	0	0

Table No. 18 Current State on Passenger Behavior

Table 3.4 indicates low incidences of balking (16 cases), reneging (18 cases), and zero jockeying during morning, afternoon, and evening observations across four shipping lines: OceanJet, Montenegro, FastCat, and HS Star Marine. The afternoon period recorded the highest occurrences (23 cases), primarily from OceanJet (10 balks, 3 reneges) and Montenegro (2 balks, 6 reneges). Morning (6 cases) and evening (5 cases) periods showed minimal issues, with FastCat reporting none throughout. These findings correspond with Table 2.4's satisfied ratings (proper queuing: $\bar{x} = 3.86$ $\bar{x} = 3.86$; remaining in line: $\bar{x} = 3.85$; factor average: $\bar{x} = 3.86$), reflecting generally positive adherence to queuing norms.

The limited balking and reneging stem from familiarity among local residents (58%) and young adults (67%), reinforced by clear signage, cultural expectations of order, peer influence, and staff oversight in high-traffic commuter areas (Kissinger et al., 2023). Afternoon peaks arise from congestion involving tourists unfamiliar with boarding and vehicle loading procedures, in contrast to FastCat's consistent efficiency (Smart, 2016). The absence of jockeying is attributed to the single-server setup per shipping line observed (Table 3.2); however, larger family or tourist groups during weekends may increase reneging risks with prolonged waits.

To summarize, the data demonstrate strong passenger cooperation that supports efficient ferry operations, yet they highlight the need for enhanced peak-period strategies—such as additional staffing, improved signage, or dedicated family areas—to mitigate surges, prevent weekend delays, and sustain satisfaction among diverse passengers, from solo commuters to group travelers.

Shipping Line	Queue Discipline
OceanJet	First-Come-First-Serve (FCFS)
Montenegro	First-Come-First-Serve (FCFS)
FastCat	First-Come-First-Serve (FCFS)
HS Star Marine	First-Come-First-Serve (FCFS)

Table No. 19 Current State on Queue Discipline

Table 3.5 highlights that all four shipping lines, like OceanJet, Montenegro, FastCat, and HS Star Marine, uniformly utilize the First-Come-First-Serve (FCFS) queue discipline at their ticketing outlets. This system ensures that every passenger is served strictly based on their order of arrival, maintaining a transparent and equitable process for both local commuters and tourists.

This standardized FCFS approach provides a foundation of procedural fairness; however, its effectiveness depends heavily on the service capacity of each individual outlet. While the simplicity of FCFS minimizes confusion and prevents line-jumping, it can create significant bottlenecks during peak arrival periods when high passenger volumes overwhelm a single service counter. Research indicates that while FCFS is highly regarded for its perceived fairness, it can lead to longer wait times and increased passenger frustration when demand surges outpace the service rate, particularly for outlets like OceanJet and Montenegro that experience higher peak-hour traffic (Saeed & Larsen, 2016; Tonade & Orkpeh, 2025).

Day	Outlet	Avg Waiting Time (mins)	Avg Queue Length (pax)	Avg Utilization (ρ)
Monday	OceanJet	1.67	0.21	0.26
	Montenegro	3.33	0.39	0.26
	FastCat	0	0	0.17
	HS Star Marine	1	0.09	0.21
Tuesday	OceanJet	1.67	0.03	0.05
	Montenegro	0.67	0.14	0.20
	FastCat	0.67	0.01	0.02
	HS Star Marine	0.67	0.09	0.21
Wednesday	OceanJet	3	0.36	0.21
	Montenegro	4.67	0.64	0.16
	FastCat	1.33	0.07	0.09
	HS Star Marine	1.67	0.18	0.21
Thursday	OceanJet	3.33	0.59	0.39
	Montenegro	3.67	0.44	0.37
	FastCat	0.33	0.01	0.11
	HS Star Marine	0.67	0.10	0.28
Friday	OceanJet	9.67	3.32	0.61
	Montenegro	7.67	2.08	0.62
	FastCat	2.67	0.41	0.52
	HS Star Marine	2.67	0.58	0.40
Saturday	OceanJet	4.33	1	0.92
	Montenegro	2.33	0.45	0.38
	FastCat	1	0.13	0.29
	HS Star Marine	1.33	0.19	0.26
Sunday	OceanJet	3.33	0.59	0.46
	Montenegro	3.67	0.59	0.46
	FastCat	0	0	0.28
	HS Star Marine	2	0.28	0.25

Table No. 20 Current state of Queue Performance Metrics

Table 3.6 shows the operational data for the four ferry outlets: OceanJet, Montenegro, FastCat, and HS Star Marine. According to the data, Friday represents the system's primary "stress test," characterized by a sharp increase in both wait times and queue lengths. OceanJet, for instance, sees its average waiting time surge to 9.67 minutes on Friday, coinciding with a utilization rate of 0.61. This aligns with the principles of queuing theory, which posit that as utilization increases, the waiting time and queue length grow at a non-linear, exponential rate (Hillier & Lieberman, 2021).

A critical observation in the dataset is the high utilization rate of OceanJet on Saturday, which reaches $\rho = 0.92$. In the context of service operations, a utilization rate exceeding 0.90 indicates that a system is operating dangerously close to its maximum capacity, leaving virtually no "buffer" to absorb random arrivals or processing delays. While the waiting time on Saturday (4.33 minutes) is lower than on Friday, the near-total saturation of the service suggests that the outlet is experiencing a steady, high-volume flow of passengers throughout the day. This creates a state of high operational risk; any minor disruption in service during such periods would result in a rapidly escalating queue that could take hours to clear (Fitzsimmons & Fitzsimmons, 2011). In contrast, the performance of FastCat and HS Star Marine highlights a significant disparity in demand distribution across the hub. FastCat maintains an average utilization of approximately 0.21, frequently recording waiting times near zero. From a service quality perspective, this represents an ideal experience for the passenger; however, from an organizational standpoint, such low utilization indicates "idle capacity," where resources are being paid for but not fully utilized.

Overall, the data suggests that a static approach to staffing and resource allocation is insufficient for this environment. The sharp contrast between the "quiet" periods on Tuesday and the congestion on Friday and Saturday suggests that these outlets would benefit from a more dynamic capacity management strategy. By aligning service capacity with the predictable surge in weekend demand, the providers could reduce the variance in passenger wait times and improve the overall efficiency of the ferry terminal.

Conclusion and Recommendations

The queuing system at Dumaguete City Port ticketing outlets functions effectively under normal conditions but reveals significant strain during peak demand periods, particularly noon and afternoon hours, and Fridays and Saturdays, as validated through queueing theory (M/M/1 models) and passenger satisfaction metrics. The study confirms strong performance in service process clarity ($\bar{x}=3.84$), passenger behavior compliance ($\bar{x}=3.86$), and FCFS fairness across all outlets (OceanJet, Montenegro, FastCat, HS Star Marine), with HS Star Marine demonstrating optimal efficiency ($\mu=0.41$, service time 2.19 min). However, neutral overall satisfaction ($\bar{x}=3.36$) stems from capacity constraints in single-server setups, evidenced by peak arrival rates (λ up to 0.380), extended waits (9.67 min max), and high utilization ($\rho=0.92$), disproportionately affecting high-traffic outlets. This universal performance gap that is consistent across young local-dominated profiles (Gen Z 67%, groups 57%) highlights the system's inability to scale for predictable surges to destinations like Siquijor (42%), despite low behavioral disruptions. A key insight is the identified "peak-period bottleneck," where infrastructure limitations prevent "highly satisfied" status despite operational fairness, underscoring the need for dynamic countermeasures.

Based on the findings and conclusions drawn, the following are hereby recommended to the local government, Dumaguete port authority, LGU, and the academic community:

- 1) Port Management Authority:
 - i. Expand service counters to multi-server queues to address single-server overloads
 - ii. Implement dynamic staffing for peak hours to match surging demand and prevent capacity shortfalls.
 - iii. Install digital queue systems (ticket machines, displays) to improve transparency and fix neutral structure ratings.
 - iv. Redesign terminal layout with barriers and lanes to resolve and eliminate bottlenecks.
- 2) Ticketing and Frontline Service Personnel:
 - v. Standardize procedures across counters to minimize service time variability.
 - vi. Undergo a regular training on efficiency and digital tools to reduce peak delays despite strong process ratings.
 - vii. Enforce queue discipline to prevent line-cutting and fixers amid low disruptions.
- 3) Terminal Supervisors and Queue Marshals:
 - viii. Monitor lines with CCTV to curb afternoon renegeing peaks and maintain order.
 - ix. Track real-time metrics like queue length and utilization for swift adjustments.
 - x. Guide passenger flow during weekend surges to boost throughput and reduce congestion.
- 4) Port ICT Unit / Systems Management:
 - xi. Develop a centralized dashboard for live queue and counter monitoring to support data-driven decisions on uneven demand.

- xii. Integrate automated tracking of service times and arrivals for long-term planning beyond limited observations.
- 5) Policy Makers / Transport Authorities:
 - xiii. Allocate budgets for digitalization and infrastructure upgrades to enable smart port scalability and efficiency.
- 6) Future Recommendations for the Next Study:
 - xiv. Extend observations to holidays and peaks with simulation modeling to test configurations safely.
 - xv. Trial digital kiosks and online booking to shorten service times.
 - xvi. Analyze seasonal demand patterns and passenger satisfaction links for holistic improvements.

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Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to applicable data privacy and ethical considerations.

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Appendices

No appendices are attached to this study.