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USING A DISCRETE EVENT SIMULATION TO IMPROVE CHECK-IN OPERATIONS AT THE PORT OF DOVER

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ABSTRACT

This paper showcases our use of discrete event simulation (DES) to enhance check-in operations at the Port of Dover (PoD). PoD is the busiest international ferry port in the UK and since the UK left the European Union, the port has experienced increased processing times and considerable delays in passenger check-in. Three independent ferry operators run individual check-in systems for freight and tourist vehicles, leading to efficiency challenges, notably prolonged queuing times and limited throughput. Our study investigates two alternatives: a common check-in booth for all operators and vehicle types, and a system that retains operator-specific booths but merges the process for all traffic types. We aim to identify an improved operational model that reduces queue times and to explore a range of solutions that could improve check-in operations at the Port of Dover, which not only make the check-in process more efficient but also significantly reduces queuing times.

1 INTRODUCTION

Since the United Kingdom's decision to leave the European Union (Brexit), new customs and border controls have been implemented, adding layers of complexity for international entry and exit points in the UK. The Port of Dover, a vital node within this system, has been particularly impacted as it has juxtaposed borders. The introduction of these new border controls have led to increased processing times with subsequent traffic congestion, with the issues further exacerbated during school holidays and peak hours as a result of sheer volume. In response to these new challenges, the Port Authority has initiated a Knowledge Transfer Partnership (KTP), focusing on the utilization of simulation techniques for operational improvement. Discrete Event Simulation (DES) is frequently applied to urban traffic management problems, such as traffic flow prediction and signal optimization (Jiang et al. 2021) and assessing air traffic movement (Ann et al. 2021). It enables modelling complex scenarios and testing solutions for improved traffic flow and operational efficiencies.

Brexit has brought about significant changes in trade dynamics between the UK and Europe. Enhanced border checks have resulted in substantial delays at ports, indicating a necessity for operational enhancements. Therefore, this study constructs a DES model that explores two potential solutions: the establishment of common check-in booths for all operators and vehicle types, and a system that retains operator-specific booths but combines the check-in process for all vehicles. Our goal is to gain insight into an operational model that can significantly reduce queuing times and improve throughput at the port. This study will transform the operational efficiency at the Port of Dover, improve user experience (passenger and ferry operator), and support the Port's vital role within the UK's transportation network.

2 SYSTEM AND MODEL DESCRIPTION

In this study, the Port's Eastern Docks is divided into 4 main areas. Both freight and tourist vehicles initially enter a designated buffer zone. Subsequently, these vehicles progress to both French and UK border controls, where passport verification is carried out. A stage of random checks follows this verification process, encompassing both tourist and freight vehicles to ensure compliance and security. The final stage involves proceeding to the check-in areas designated for ferry operators, as illustrated in Figure 1. The model features a buffer zone for outgoing traffic, which is crucial for controlling traffic flow and ensuring that vehicles are prepared to proceed to the border check-in. It also considers both French and UK border checks, which are important parts of the process that can greatly affect how long check-in takes and how efficiently it runs. The possibility of random custom checks, which can disrupt the normal flow of vehicles, is also considered. Check-in booths for each of the three ferry operators are at the core of the process and are included in our model. To accurately represent the build-up of traffic during busy times, the model incorporates separate queuing lanes for freight and tourist cars. Managing these lanes effectively is crucial for maintaining smooth operations. Lastly, the model distinguishes between freight and tourist cars, accounting for their different needs and processing times. In addition, data, as emphasized by Oren et al. (2023), is central to the simulation process, acting both as input for and output from models. To ensure maximum accuracy, our model integrates historical records from the summer of 2023, a time known for heightened tourist and freight traffic at the Port of Dover. Additionally, we've incorporated traffic arrival times from a driver survey, providing us with a nuanced understanding of arrival patterns. This combination of historical and firsthand data bolsters the simulation's reliability and its capability to offer solutions.

Figure 1: Traffic flow at the ferry terminal Port of Dover.

3 CONCLUSION

Through our detailed study, we simulated and evaluated scenarios at the Port of Dover, finding that common check-in booths for all vehicles and operators reduces check-in time and resource usage. This centralization leads to heightened efficiency and operational throughput, informing our data-driven decision-making for managing the port. This investigation is a part of a larger project, where we will create discrete event and hybrid simulation models to further optimize port operations.

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