

AI Report

Artificial Intelligence in Port and Free Zone Master Planning

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1.0 Introduction

Transport is at the heart of all activities related to mobility and logistics. The main aim of logistics is to move goods or services by the fastest and most efficient means, whether by land, air, or sea. Most goods are transported by sea. Sea port operations have been under development since the global standardization of using container boxes as the main unit for transportation in the . The units have been redesigned over the years, but always with a view to what ports can accommodate.

The design of port gates and how they operate has also evolved. Developments range from optimizing the number of entry and exit lanes to automating entry barricading and allocating time slots for arrivals and departures.

All activities at a port are coordinated and monitored from the control room. While technology already plays a major role in the efficient operation of ports as most processes are automated, human input is still required in planning decisions and in the event of an emergency.

2.0 Smart automation and aggregator platforms

Automation is a basic form of artificial intelligence (AI) that began to appear after the Industrial Revolution to speed up production processes and increase efficiency. Today's more advanced AI technologies take automation to the next level by adding analysis to data processing.

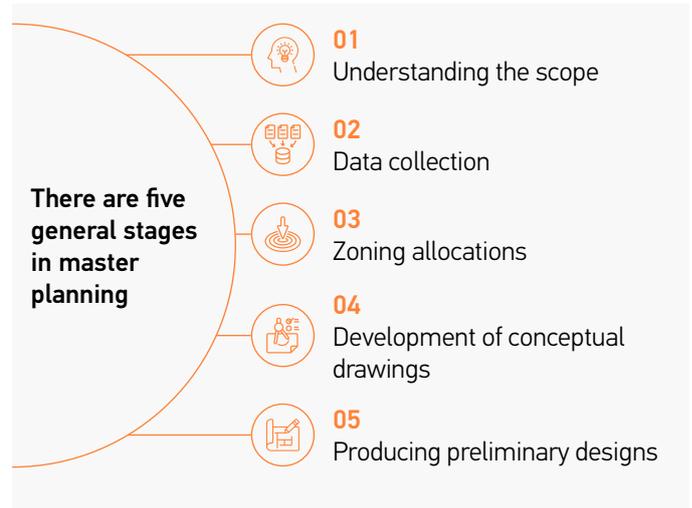
Smart automation can be adapted into an aggregator platform, where several processes are combined in a single location. AI can also read, process, and suggest solutions for future applications. The option of having a central platform where all the data, design methods, previous projects, lessons learned, and best practices can be accessed is, in itself, a useful tool—but adding an AI element to this platform revolutionizes our thinking about port and free zone master planning and opens up new opportunities.

AI uses algorithms and machine learning to read, sort, analyze, and understand huge sets of data. Translating these complex calculations into a simple interface for users can help give designers and master planners a holistic perspective of operations. One of this tool's strengths is its ability to forecast possible trends based on the sheer amount of data processed. This unlocks new possibilities in master planning designs as it reduces the need to rely on a small number of factors at the initial concept stage to help predict growth trends.

A good example of the use of AI in master planning is in traffic management. Advanced software modules that deal with traffic planning and management do exist, but congestion in free zones and ports still occurs. AI can assist in analyzing

plans for free zone and port traffic management. By processing size, demographics, infrastructure, zoning, and land use traffic generation data, AI can come up with efficient traffic and transportation designs for free zones and ports that do not affect neighboring areas (Mahendra, 2021).

3.0 Master planning and AI



In terms of **understanding the scope**, AI will have no effect in the short term as this process revolves around human interactions to build up an understanding of project needs.

Data collection involves researching historical information, conducting surveys, and forecasting future data for analysis by the teams responsible for engineering and other tasks. Introducing AI into this phase will significantly reduce the time needed for analysis. AI can assist designers in forecasting trends and probabilities more accurately as it can process multiple variants simultaneously.

Master planners and designers have learned best practice for **zoning allocations** through experience. This considers factors including where each zone should be placed, the dependencies and requirements of each zone in relation to other zones, and different environmental criteria in different regions. But there is a degree of trial and error involved. AI can use its access to global master planning databases to suggest locations, correlations, and innovations for zoning allocations, and it can connect these to propose a tailored solution for any port project.

The **development of conceptual drawings** is usually based on the engineering feed provided by master planners and on 3D visuals created by designers. It is important to preserve the creativity that designers bring to projects, as well as their understanding of various requirements, but AI can assist with this part of the design process similarly to how it can help with zoning allocations. This will entail using models as templates

to reduce the time needed to create visuals from scratch while still allowing space for designers to add a layer of creativity on top.



The iterative process of **producing preliminary designs** generally involves refinement of the conceptual drawings by master planners to take rules and regulations into account. AI’s ability to process data means it could automate the input received in the form of conceptual drawings and overlay the regulatory requirements to produce the level of detail required for the preliminary design. This step can be used as a reference model that the master planner will adjust to suit the scope of the project (Zhongwen, 2021).

3.1 The value of the aggregator platform in traffic management

The US Transportation Research Board has highlighted the role AI played in traffic and transportation management in the early 2000s, saying that AI is considered one of the major solutions to transportation issues. Driverless vehicles and other smart equipment depend heavily on AI to function. The fast pace of development in the automotive industry will lead to a future in which there are more autonomous vehicles on the road.

Autonomous vehicles use AI to determine what sort of obstacles are in the environment around them and to figure out how to negotiate them safely. While this approach is suitable for dealing with static objects such as road signs, buildings, and other elements on the road, problems can arise when driverless cars interact with moving objects, such as pedestrians and other vehicles.

While the technology has advanced significantly in recent years, more work is still needed. If the AI system on each autonomous vehicle were able to interact with those of other vehicles, it would reduce the risk caused by moving objects and enhance safety. There could be a possibility to connect the AI on all autonomous vehicles to a central aggregator platform that shares information between cars. This could be done not just with vehicles that are near each other, but with those in wider areas too, presenting significant opportunities to boost the efficiency of transportation planning, fully optimize infrastructure use to reduce congestion, speed up delivery times, and reduce the number of accidents (Team, 2022). Sustainability is a core value for all industries in the **21st century**. This is especially the case in the UAE as 2023 has been designated its Year of Sustainability and the country is set to host COP28 in November. AI not only saves businesses money—it also reduces carbon dioxide emissions. The advantages of AI for traffic management can be summarized as:

-  Real-time route optimization
-  More efficient space utilization
-  Improved forecasting analytics
-  Lower operational costs
-  Enhanced end user experience

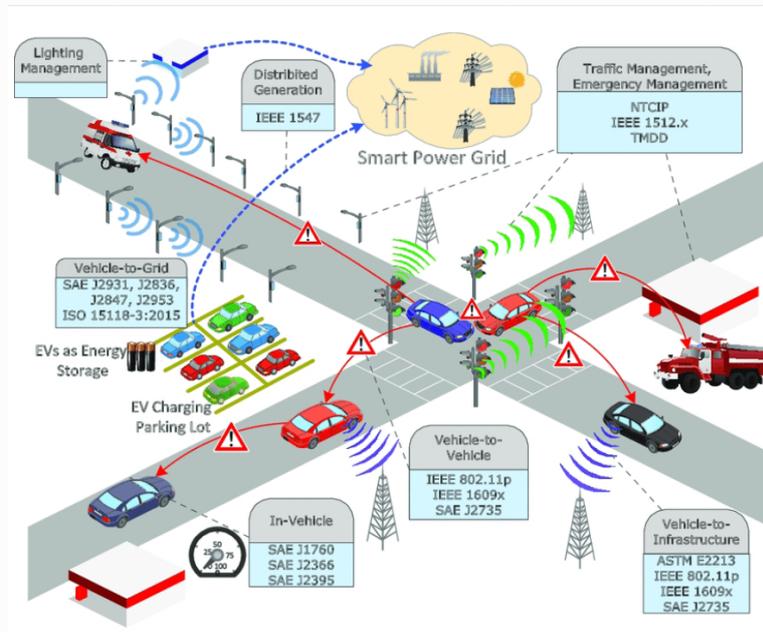


Figure 2: AI and transportation model

4.0 The next phase of AI in master planning

AI undoubtedly presents opportunities to improve planning and operations in mobility and logistics. The next phase will be moving to widespread adoption. An increasing number of stakeholders and designers will begin introducing the technology into their design processes, initially deploying AI to make the current design process more efficient. Increasing levels of adoption will be critical as the aggregator platform will learn more quickly if it is used more frequently. As more projects are delivered, AI may help us find ways to complete master planning designs without having to go through all five of the main stages.

As with the emergence of any new technology, it will cause some initial disturbances. Although engineers and master planners might feel threatened by AI, the technology can automate time-consuming tasks and free up time for them to focus on innovation.

This new way of designing will improve the accuracy of future input data. This in turn will help aggregator platforms, which will initially need training to filter out low-quality data. However, as AI-led data will be supplied by different platforms, entities, and applications, it will be necessary to identify any associated biases. This will be key in realizing one potentially huge advantage of AI and machine learning—that as a non-emotional process, it can ultimately produce accurate data without any “noise” (Mahendra, 2020).

5.0 The future of AI in mobility and logistics

The logistics and mobility sector is sure to utilize advancements in technology as the sector must adopt any technology that will facilitate access to services. Big data, the internet of things, AI, and blockchain must be adopted for the sector to remain vital and to reach more users.

Many areas of the world lack the infrastructure that is available in more advanced countries; AI is a tool that will enable developing regions to improve their standards of living.

There are new trends on the way: generative design and autonomous cities, where the principle of city design is determined through AI; community and AI participation, where AI takes part in the analysis of decision making using blockchain technology; and smart cities and future planning initiatives, where AI and big data play a significant part in integrating citizens’ daily lives in design choices. These trends will advance the technology further and influence how AI is used in many industries, especially the mobility and logistics sector.

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