Designing future-proof container terminals

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Executive summary

This white paper examines best practices and recommended approaches to structuring the design process of container terminals. Especially when moving towards increased levels of terminal automation, terminal design is a complex process that requires extensive planning and careful risk management. Early decisions made during the design phase have huge implications later on, so a structured evaluation of various scenarios is essential for project success. For the best results, terminal design needs to leverage technology and data to the maximum, including the use of simulations, modelling and detailed business case analysis.

Industry studies have highlighted that many shipping lines are dissatisfied with the service they receive at terminals, and that they would be willing to invest more in return for improvements in, for example, the availability of equipment as well as the reliability, efficiency and consistency of the service they receive. Better decision making at the terminal planning stage can go a long way towards solving these issues while ultimately improving service levels and customer satisfaction.

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1. Industry trends and investment drivers

Today's container terminals operate in a competitive, highly pressured global business environment. Heavy consolidation between major shipping lines has led to a continuous increase in average ship capacity at terminals of all sizes. Simultaneously, terminal operators face high cost pressure while having to meet ever more demanding eco-efficiency targets.

As global logistics chains become faster, more transparent and more intensely competitive, the key challenge for terminal operators becomes one of doing things better by leveraging new technology. At the same time, operators need to reconcile the need for heavy terminal investments that will shape their operations for many decades to come with shorter-term uncertainty on market dynamics, global traffic patterns and their business environment.

To design a successful container or general cargo terminal is thus a highly challenging task that must decrease the cost of operation, improve service quality and effectiveness, and keep the terminal competitive for a wide range of potential future scenarios. The decision on the operational concept of the terminal depends on many factors including the expected size of vessels, traffic forecasts, available plot size, labour market conditions, cost structure and environmental impacts. Furthermore, the terminal needs to consider how to differentiate from its competition to maintain and grow its market share.

> The key challenge for terminal operators becomes one of doing things better by leveraging new technology.

1.1 PLANNING FOR AUTOMATION

Automation has been steadily gaining ground in container terminal operations over the last several years. In particular, yard automation and driverless cranes have become a standard product during the past decade, but horizontal transport between the quayside and the yard, as well as ship-to-shore (STS) cranes are not yet at the same level of automation adoption on average. However, automated guided vehicles (AGVs) as well as automated straddle and shuttle carriers have been deployed and proven for horizontal transport at numerous facilities. Automation and remote control of STS cranes has also been implemented successfully at a number of ports.

Automation is widely accepted as the primary way for terminals to improve the consistency and competitiveness of their operations in the future. Compared to traditional manually operated terminals, automated

> A well-structured and detailed investment study is crucial in the design phase.

terminals require a significantly different approach in many areas, from the planning and design phase all the way to service and maintenance. Automating a part of a container terminal is a major investment, and operators must be able to create a sound business case that not only provides a solid basis for future operations, but also builds trust in financiers. Due to the complexity of terminal automation projects, a well-structured and detailed investment study thus becomes crucial in the design phase.

In traditional manually operated terminals, it is common practice to experiment on production systems since any changes only affect operating procedures and personnel. With automated systems, such on-the-fly experimentation is not practical due to the high level of integration between various software applications and interfaces. Therefore, alternative ways of testing the operational impact of of different changes must be considered, for example by building a simulation model of the terminal.

Eco-efficiency is another important focus area for today's container terminals. Terminal operators are continuously taking additional steps to reduce emissions and energy consumption in their operations. Eco-efficient performance also translates into direct cost savings that improve the bottom line of the terminal, while promoting corporate responsibility and fulfilling stakeholder requirements. Particularly in areas in which changes in legislation are steering terminal operators heavily towards eco-efficient solutions, it is crucial to be able to demonstrate compliance with requirements already at the design stage.

1.2 AVOIDING THE COMMON DESIGN PITFALLS

> A system is only as strong as its weakest link.

Typically, when designing a terminal – and especially when considering automation – operators have challenges in thinking through the full implementation plan for the design. When moving towards the implementation phase, it is easy to take shortcuts and make assumptions such as assuming the productivity figures of an ASC block based on data from another location, without taking into account local conditions and the terminal's own specific traffic profile.

Likewise, terminals often struggle with the level of integration required for terminal automation. The quay, container stack and gate may all be optimised separately instead of as a unified system. A system is only as strong as its weakest link, and especially for the deep technical interdependencies involved in an automated terminal, the only practical way to gain a realistic view of the total system is to perform careful testing with simulations that utilise authentic scenarios and data.

> "Each business case is extremely dependent on the individual conditions of the terminal.

Ultimately, operators face two main challenges when seeking to design successful terminals. Firstly, the required decisions are extremely complex and involve multiple interlinked variables, so they can only be handled with a structured approach and purpose-built tools. Secondly, each business case is extremely dependent on the individual conditions of the terminal. Generalised guidelines (e.g. how many cranes are needed for a container block of a given size) are of limited value, and designers must do the evaluation based on the specific situation and business goals of their own terminal.

At the core of a successful terminal design project is a structured design approach that leverages technology and data for the best results. The tools and processes for making more informed design decisions already exist, and a small investment in the design stage can be orders of magnitude more economical than having to make changes later on in the process.

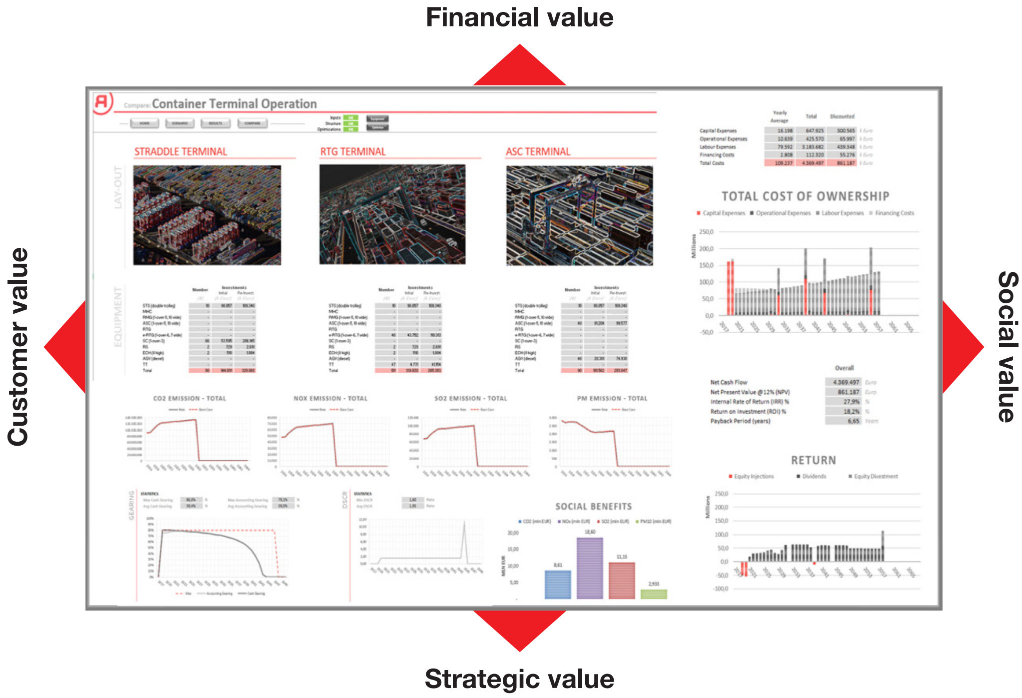
In this paper, we present a basic framework for this kind of structured design approach, while providing an overview of some of the tools that are available for terminal operators seeking to minimise the impact of the unknown in a difficult one-time decision event. In essence, this process involves combining operational, technical financial and environmental data with a clear market and business focus. If the design process can be shaped with a phased approach in which key decisions can be kept open until later on in the project, designers can reach more certainty about input parameters and thus make better and more informed decisions before locking onto the chosen solution.

2. Building business cases that link operations to total value

Whether designing a new (greenfield) terminal or upgrading an existing (brownfield) site, design and operating decisions need to be linked to sound project appraisal by framing the problem in a holistic manner. The financial assessment is more than just an instrument for quantifying the impact on terminal running costs and total cost, profit or return on investment. On the contrary, the development of a flexible business case fosters business solution thinking throughout the entire design process. The business cases stimulate explicit thinking alongside multiple business dimensions by addressing issues and challenges from various angles such as customer needs, changes in technology and staffing requirements, impact on maintenance and civil infrastructure development.

It is clear that terminal (re)design will impact total value, particularly when automation is being deployed. Value creation should not merely be seen as enhancing the financial performance of the terminal by improving its operational setup. Starting from the physical and technical constraints of the terminal infrastructure as well as the technical options, the business case approach will extend the view from operations towards full-fledged terminal business reasoning.

For this purpose, business cases are developed to consider the options from a 360-degree perspective on value creation. In this way, the choices and trade-offs in the operational design can be linked directly to customer value, financial value and strategic value and social value.



CUSTOMER VALUE encompasses the satisfaction of the users of the terminal, including vessel operators and cargo owners. The impact of changes in performance at the customer end, such as equipment availability, speed (turnaround time) and particularly the reliability of service should be valued. Accordingly, customer value is linked to financial value through potential gains (or losses) in market share, as well as through positive or negative impact on pricing levels.

STRATEGIC VALUE reflects the terminal's agility towards changes in the market and the broader operating environment. The business case thus evaluates options to expand, reduce or exit operations over time. Designs that increase flexibility or save on scarce resources such as land, offer important benefits to terminals. The conditions of concession agreements will amplify the relevance of such strategic value drivers over the long-term operating horizon.

FINANCIAL VALUE is primarily derived from the investment and operating cash flows. Alternative design options are typically compared against their financial performance measured by the Internal Rate of Return, the Pay Back period or Net Present Value. Business cases must help in understanding how financial value can be improved through savings in operational expenditures and better planning of capital layouts.

SOCIAL VALUE are the cost and benefits for third parties such as employees, inhabitants, economic system, the government and the surrounding scarce natural resources. Design options impact value measured in terms of gains in safety, security, emissions, know how, taxes and economic efficiency. In particular it should not be forgotten that ports and terminals contribute to the social economic health of a region. Accounting for social value, terminal operators can demonstrate social responsibility.

> Maximum flexibility and adaptability are embedded into the entire design process.

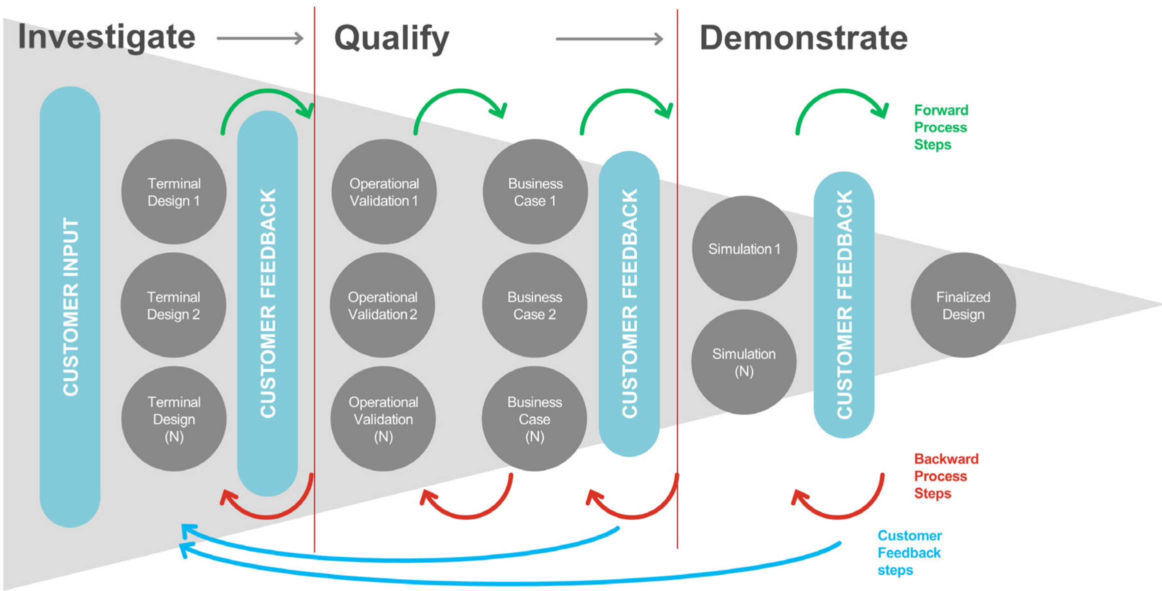
The development of a robust business case is an iterative process. A first version will support initial design thinking by considering a broad range of technical options. Assumptions are challenged and each business case version is tested and re-tested with sensitivity analysis. Accordingly, the business cases will focus the design process and ensure attention is given to the right parameters that enhance value. The business cases also help identify knowledge gaps and highlight the importance of data quality. An integrated and dynamic setup will stimulate the joint creation of alternatives and multiple scenarios instead of locking too fast into a single vision. As such, maximum flexibility and adaptability are embedded into the entire design process. The model will gradually develop into a full business simulator capturing all options for value enhancement.

As multidisciplinary teams are involved in the setup of the business cases from the beginning, the model is not perceived merely as a black box converting numerous input assumptions into financial numbers. On the contrary, the business simulator is a learning tool with which design teams can learn how they can affect financial performance and other value drivers through flexible terminal layouts that can cope with a wide range of changes or disruptions in the business environment or logistics stream, while ensuring a design that can be scaled up efficiently as the business grows. By doing so, design efforts will concentrate on the most value enhancing options. Involvement and ownership will contribute to realistic business cases that return explicit results.

3. Structuring the design process

In large-scale terminal design projects, the standard way of working typically involves a limited depth of preliminary evaluation as well as an early focus on a single concept. It is the view of the authors of this paper that a better approach is a structured phase-by-phase method that leverages technology and data to provide additional time for evaluation before committing to the final concept.

It should be noted that this step-by-step approach does not mean carrying out small-scale pilot projects, but acquiring more information and improving decisions while retaining the flexibility to adapt. An essential concept is to create a decision tree that will provide the ability to evaluate options and respond to changes in the environment, by purposefully "stretching" the design process at every stage. At each phase, designs and business cases are evaluated iteratively, retracing back to earlier steps as needed.



In practice, the design team will move between a high-level planning workflow and the tactical realities in the daily operations of the terminal. By taking in daily real-world experiences as inputs to the process, the overall design can continuously improve from phase to phase, taking into account the operational realities of the terminal. This is essential since too often terminal design is carried out on a single theoretical basis that forgets the actual circumstances on-site.

> Process flow is divided into three major phases: investigate, qualify, demonstrate.

3.1 OVERALL PROJECT FLOW

A proven, successful approach to structuring the terminal design process flow is to divide it into three major phases:

First, the **INVESTIGATE** phase examines a wide range of potential design solutions while taking into account the terminal's business environment goals, preferred investment strategy, and physical site footprint. The implementation phase is considered on a general level, but no single terminal design concept is yet locked down at this point. Next, the **QUALIFY** phase includes more detailed operational validation and business case analysis on a variety of options. Finally, the **DEMONSTRATE** phase ensures and validates that the selected design meets its objectives by utilising tools such as terminal simulations and 3D modelling. These project phases will be examined in more detail in subsequent sections of this paper.

3.2 TYPICAL DESIGN PROBLEMS AND CHALLENGES

Based on extensive real-world experience on terminal design projects as well as the business and financing processes involved, some of the most common challenges that designers face include the following:

Business case comprehensiveness. Are your calculations detailed and realistic enough? Do they include equipment, IT and infrastructure costs, with realistic assumptions for each?

Risk and scenario comprehensiveness. Is your chosen design robust towards changes and alternative scenarios? What will happen if traffic patterns, container volumes or your business environment change suddenly?

Involving all required skills. Are you making optimum use of the available know-how all through the project, both within your organisation as well as with suppliers and external partners?

Later refinements or additional information. As new data and real-world experience comes in, it is easy to overlook feeding it back into the models to verify if the selected concept is still the optimal choice.

Comparing apples to apples. It is often difficult to compare different scenarios, as their cost elements may differ significantly. Careful structuring of the models is needed to ensure meaningful outputs.

Too little time available for a proper analysis. Project timeframes may exert significant pressure on designers to move forward with selecting a terminal concept. However, at the analysis stage, even a small additional investment in time and money for analysis will bring huge savings by avoiding costly changes later in the project.

Design feasibility. Can the proposed design actually be implemented at the site in the intended timeframe, when taking into consideration coexisting operations at the terminal, as well as the physical requirements of transporting and setting up equipment? Often, the end result is defined without thinking about all the intermediate steps of the actual implementation process, which can be costly and/or time consuming.

The typical end result of failing to address these challenges is that in order to meet time, skill set and budget limitations, there is a premature focus on one operational concept, without performing solid checks of sensitivities and sufficient evaluation of alternative scenarios.

3.3 ESSENTIAL TOOLS

The key tool for managing the terminal design process is an integrated Flexible Decision Tool. This is software that utilises a wide range of available information to facilitate informed, optimised decision making and to create a set of realistic business cases on the basis of real-world data.

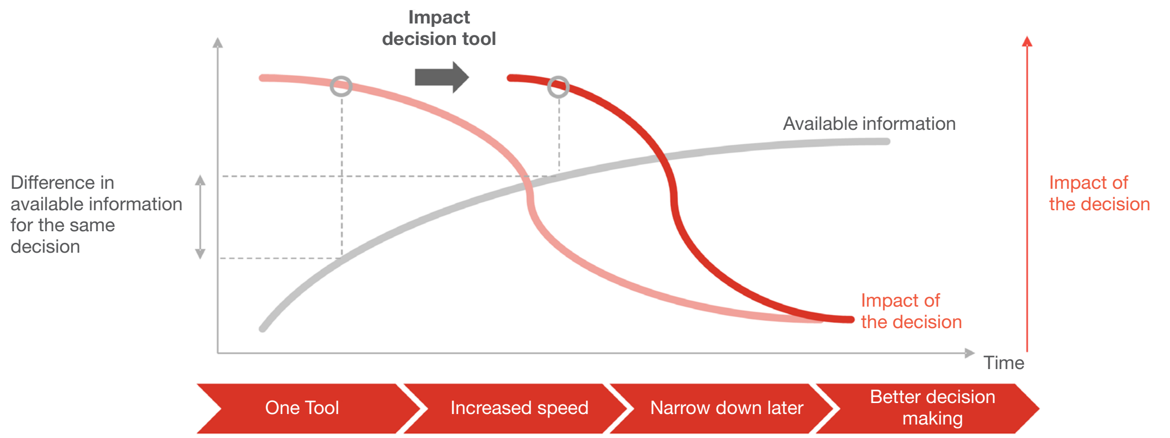
> "Even a small additional investment in time and money for analysis will bring huge savings.

Inputs of the Flexible Decision Tool can include, among others:

- Timing aspects: concession duration and construction period
- Financing assumptions: inflation, taxes, debt funding
- Terminal parameters: area, volume characteristics, TEU ground slots, stacking height
- Activity statistics: horizontal transport, yard moves, gate, inspection, housekeeping
- Equipment parameters: maximum running hours per unit, moves per hour, spare parts cost, maintenance per hour, useful economic lifetime, emissions per hour
- Investment costs: infrastructure, equipment, IT
- Other operational costs: labour, energy and fuel, insurance
- Revenues per container type

The outputs for each scenario include, among others:

- Total Cost of Ownership, Internal Rate of Return, Net Present Value
- Cash flow statement
- Balance sheet
- Environmental impact



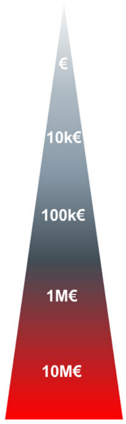
Note: The flexible decision tool is to be kept up to date during the entire design process to enable ongoing verification that the chosen operational concept is the optimum choice

3.4 PLAN WELL NOW, SAVE MONEY LATER

In any terminal design project, it is crucial to remember that focusing on the planning phase will actually save money later on. This is the reason for using the Flexible Decision Tool, as faster and more detailed evaluation of multiple scenarios enables options to be kept open longer, thus improving the quality of decision making as additional information becomes available.

~ 3 - 6 years

High-level design	Terminal layout • Equipment • Civil • IT	Business case	Validation, Simulation	Automation level & organization	Project evaluation and approval
Detailed design	Terminal Detailed Design	Civil – equipment	Simulation of sensitivities	Detailed BPM & Prelim. Operational Hazard Analysis	Project budget & business case
Final specification & procurement	Civil works contracts	Equipment contracts	Software / IT contracts	Change management plan/ hire personnel	Project masterplan
Implementation	Civil works	Equipment deliveries	SW deliveries	Change management process / hire personnel	Joint Testing & training
Operation	Go Live	Continuous improvement	Upgrades	Maintenance	Training



Finally, a factor that is worth careful consideration is choosing the right design services partner with real-world experience in terminal integration. Every terminal is unique, even though superficially most container terminals follow one of a few well-established design schemes. For designers in today's terminal industry, the key question is how to do things better by taking advantage of the new technology that is available. The ultimate value will come from knowing how utilise the possibilities that are available and tailor them to the unique situation of the terminal. This capability can only be acquired by practical experience in integrating systems, solutions and equipment in the field.

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"The goal is to map out various options for design alternatives in order to meet the business objectives.

4. Phase 1: Investigate

The goal of the Investigate phase is to map out various options for design alternatives in order to meet the business objectives of the terminal. This phase examines the relative strengths of different layout options, terminal concepts and transportation systems (automated stacking cranes vs. rubber-tyred gantry cranes, straddle carriers vs. automated guided vehicles etc). Pathways to automation can already be evaluated at this stage.

This project phase also examines the terminal design process from the wider context of the terminal's investment goals and financing structure. In simplification, the various options can be divided into Low CAPEX / "short-horizon" and High CAPEX / "long-horizon" terminal concepts. A solution with lower capital expenses will offer a shorter timeframe in recouping the investment and will provide easier options for adjusting equipment fleet sizes due to changes in capacity demand or other factors.

"Short-horizon" terminal concepts typically offer flexibility in both terminal layout and investment terms; however, maximum capacity and throughput may be limited compared to solutions with a larger fixed infrastructure. Typical "long-horizon" terminal concepts include ASC terminals with various types of automated horizontal transportation. These systems typically offer the maximum potential for autonomous/ automated solutions, high throughput and maximum stacking density, but may be less flexible in some aspects.

Additionally, the Investigate phase needs to address the implementation plan when upgrading or redesigning existing terminal operations. For operational (brownfield) projects, this is a highly relevant question that may, in some situations, even rule out the optimal operating modes, simply because there is no way to implement them in the middle of a live operation due to the operational disruption caused by implementation activities.

5. Phase 2: Qualify

The Qualify project phase researches and numerically assesses alternative solutions in extensive detail. The full range of layout options is evaluated, and a comprehensive business case analysis (CAPEX, OPEX, ROI etc.) is prepared for several potentially viable scenarios.

At this phase, the high-level delivery and project plan begins to take shape, supported by terminal capacity calculations and fleet size estimations. Sensitivity analysis is an essential step that explores the effects of changes in various parameters such as operating volumes, dwell times, TEU ratios or a wide range of other metrics. The end goal is to begin to shape a solution that will be robust towards changes while continuing to provide the business results required by the terminal.

5.1 CASE STUDY EXAMPLE

To illustrate this project phase, we have prepared an illustrative case study for evaluating the financial returns for three different operational concepts at a balanced import/export terminal with a capacity of 2 million TEU:

- Straddle carrier terminal
- RTG terminal (terminal tractors and electric-drive rubber-tyred gantry cranes)
- Semi-Automated terminal (automated guided vehicles with automated stacking cranes)

Figure A.1
Straddle carrier

Figure A.2
Rubber-tyred gantry crane (RTG)

Figure A.3
Automated stacking crane (ASC)

The theoretical terminal assumes a quay length of 1,000 m and a yard depth of 500 m. For the straddle carrier terminal, the number of TEU Ground Slots (TGS) has been maximized as per the below figure. Allowing sufficient manoeuvring space along the apron, in between the blocks and at the backside of the terminal, a total of 10,635 TGS are foreseen divided over 15 blocks.

> The end goal is to begin to shape a solution that will be robust towards changes.

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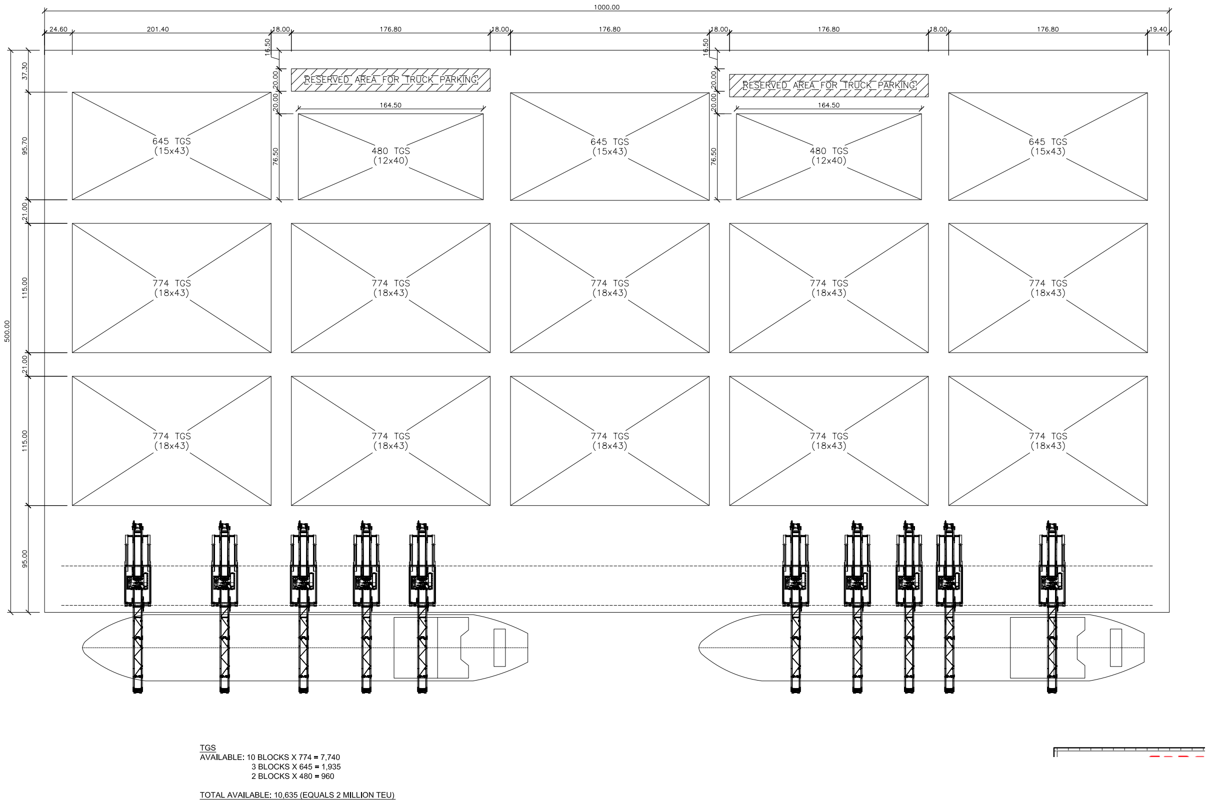
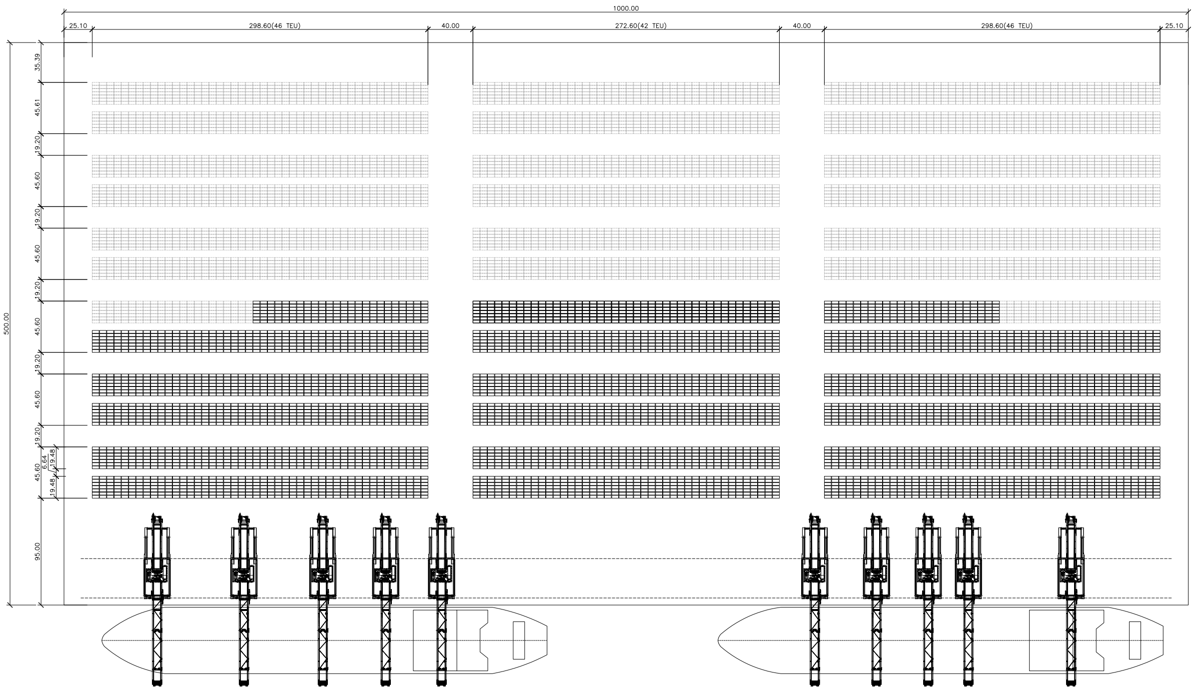


Figure A.4: Straddle carrier terminal

A dwell time of 4.3 days and a peak factor of 1.15 have been adopted, which results in a capacity of 2 million TEU.

Similarly for the RTG and ASC terminal configurations, we have maximised the number of TGS (see figures below). The following table summarises the main terminal characteristics for each concept.

	STRADDLE CARRIER	RTG	ASC
TEU GROUND SLOTS (TGS)	**10,635**	**11,316**	**9,600**
STACKING HEIGHT	**3**	**6**	**5**
MAXIMUM CAPACITY IN TEUS	**2,000,000**	**4,260,000**	**3,010,000**



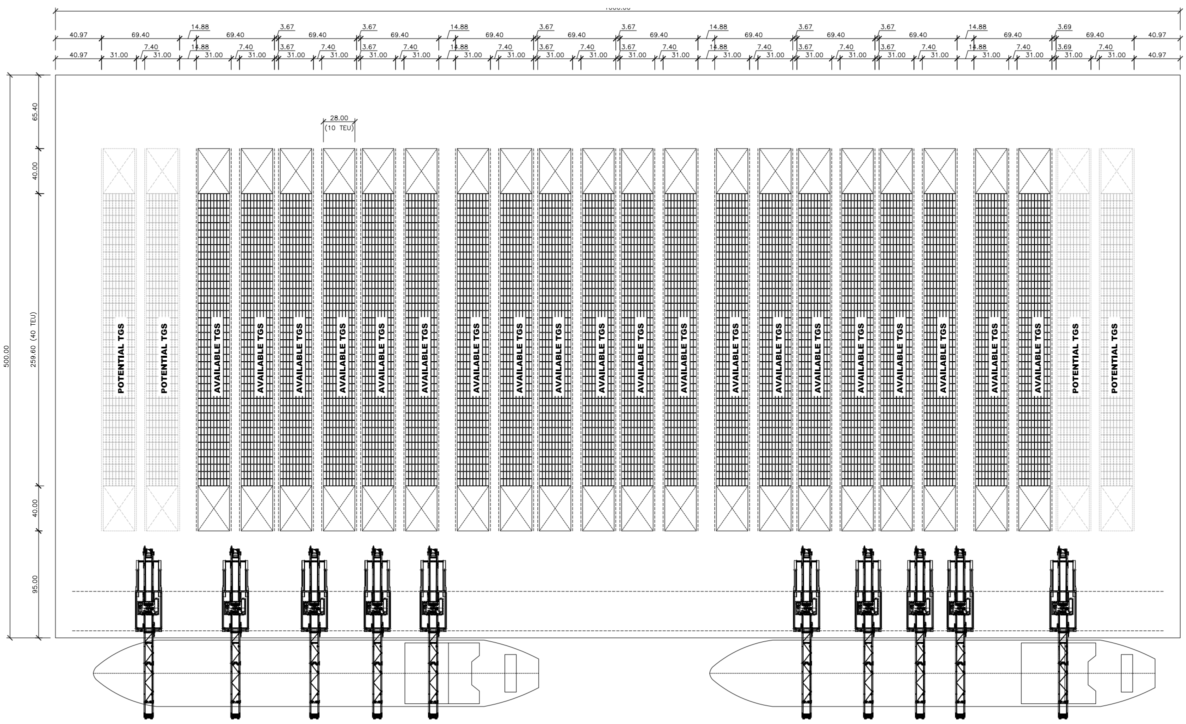
TGS
AVAILABLE: 10 STACKS X 322 = 3,220
6 STACKS X 294 = 1,764
2 STACKS X 231 = 336

TOTAL AVAILABLE = 5,380 (EQUALS 2 MILLION TEU)

POTENTIAL: 12 STACKS X 322 = 3,864
6 STACKS X 294 = 1,764
2 STACKS X 154 = 308

TOTAL POTENTIAL = 5,936

Figure A.5: RTG terminal



TGS
AVAILABLE: 20 CASSETTES X 400 = 8,000 (EQUALS 2 MILLION TEU)
POTENTIAL: 4 CASSETTES X 400 = 1,600

Figure A.6: ASC terminal

"A typical design error is to validate for only one future scenario.

The 'Container Terminal Operation - Flexible Decision Tool' purposely prepared for the above case study allows the user to amend specific features of the site such as concession duration, characteristics of the volume to be processed, labour costs, etc. and provides financial results of each of the scenarios chosen. It should be noted that the outputs are for illustrative purposes only, and an actual production study would include a significantly larger number of both inputs and outputs. The purpose of the case study is to highlight how external factors in the wider business environment of the terminal can significantly influence the relative investment profitability of different terminal concepts, sometimes in ways that may be hard to predict intuitively.

The base case assumes a capped volume of 2M TEUs per annum and a concession duration of 40 years. Labour costs are based on the European market. The following table indicates changes in preferred concept based on sensitivities of the concession period and labour cost:

TERMINAL		STRADDLE	RTG	ASC
Base Case (concession duration 40 years)				
	Internal Rate of Return (%)	29.9%	29.7%	31.2%
	Payback Period (years)	6	7	7
Concession duration 20 years				
	Internal Rate of Return (%)	28%	25%	22%
	Payback Period (years)	6	8	9
Labour cost x 0.8 (concession duration 40 years)				
	Internal Rate of Return (%)	35%	37 %	32%
	Payback Period (years)	5	6	6

6. Phase 3: Demonstrate

Finally, the Demonstrate phase includes careful validation that the selected design option meets its objectives. Terminal simulations are used to demonstrate the design and to verify its operation in different scenarios. An essential point to remember is that simulations are dynamic models that make it possible to validate scenarios that cannot be addressed with static spreadsheet-based models. 3D modelling of the preferred terminal design is a useful tool for visualising potential issues, and simulations can utilise real-world terminal data for maximum accuracy. Even at this stage, iterative process steps are taken back and forth before finalising the selected design.

6.1 AVOIDING SCENARIO LOCK-IN

A typical design error is to validate for only one future scenario. Instead, the design sensitivity tests should again be run against a wide range of different scenarios and use cases. These may include, for example, the impact of:

- Equipment and vessel speeds and delays
- Fleet sizes
- Variances to reveal bottlenecks
- Traffic arrival patterns
- Stacking height
- Unexpected changes and crisis situations
- TOS (Terminal Operating System) decision making
- Human decision making during operation

To provide meaningful outputs, the simulations must be run with high-quality input data as well as accurate equipment and software modelling that corresponds to the actual operations of the terminal. 3D equipment models can reveal previously overlooked space issues as well as potential areas for congestion. Historical and current real-world data from terminal operations is the ideal input for simulations. Furthermore, the outcomes of the simulation should also be fed back into the static models created earlier in the project to review their potential impact on the business cases.

6.2 HOW TO GET THE MOST OUT OF SIMULATIONS

Simply running terminal simulations or creating visually attractive 3D renderings of various terminal concepts is not enough. Based on the experience of the authors, to gain the maximum benefit from the design process and to reach the best possible outcome, the following points are crucial.

Create an involved team. Trusted partners can provide support in the design process, but responsibility for the future cannot be outsourced. The terminal organisation needs to create a common understanding of the processes that are being modelled, while also being aware of the inherent simplification that is involved in any simulation. When done right, simulation is a great way to become familiar with the cause and effect relationships that affect terminal capacity and performance.

Utilize the simulation model built. Too often, terminals commission detailed simulations during the design phase and then bury the results in the drawer. Models can be kept up to date, calibrated to reality and reused after the go-live to validate production processes under changing conditions.

7. Conclusions

Designing a container terminal – whether an existing site or new installation – is an exacting task that calls for complex decision making based on limited information and changing external conditions. However, the process can be managed in a structured way to maximise the ability to utilise technology and data to keep design options flexible as long as possible. The key elements of a well-planned and successfully executed terminal design process can be summarised as follows:

- Don't save on the design phase. Time and money invested in the design phase will be paid back later in the project, at which point correcting early mistakes will cost significantly more.
- Get really involved – take responsibility for your future.
- Use the technology and data available to the fullest. Adopt and internalise their use in your organisation.
- Plan for the widest range of futures you can imagine, not just one scenario.
- Trust the partners that have done it before. Remember that your suppliers also want your project to become a successful, world-class reference.
- Focus on the whole lifecycle of the system, not just on the go-live date.

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Timo is the head of the Terminal Design Services team in Kalmar's Automation and Projects Division, part of Cargotec, a global leader in cargo handling solutions. Timo has worked at Cargotec close to 18 years, first in automation R&D, where his key project was the development of the AutoStrad solution. During the past eight years, he has held various positions in terminal automation business from product management to the head of the cranes business line. He has been involved in all terminal automation projects by Kalmar. Timo has studied automation engineering (M.Sc., Automation Technology) at the Tampere University of Technology.

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Jarno Kuipers is working as a Sr. Manager in the Terminal Design Services team. Jarno is a container terminal automation professional with more than 14 years' experience in port automation. His background is in IT consultancy and in terminal operations management of a fully automated terminal, where he was involved heavily in the implementation of new technology. In the time working for Kalmar, before joining the Terminal Design Services team, Jarno has held several positions in sales and execution of terminal automation projects. Jarno has degrees in mechanical engineering and business administration with a master in strategic management.

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Tom obtained his major in strategy and managerial economics and holds a PhD in Applied Economics (Business Engineering). For more than 23 years, he has been active as a senior management consultant in the port industry. Tom has been working with terminal operators, port authorities and investors assisting them with the project appraisal of port/terminal set-up and expansion. He has been involved as well in the business planning of port community systems and enhanced ICT port solutions.

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Wim is port expert at Rebel. He has over 18 years international experience in the planning and design of ports and harbours overall. He has been responsible for managing numerous multi-disciplinary port development projects around the world as a Maritime Consultant with RoyalHaskoningDHV and Program Manager Terminal Infrastructure with Terminal Investment Limited (TIL), the 6th largest private global container terminal operator. Since joining Rebel in late 2016, he has been involved in various operational and financial assessments of container terminal projects. Wim brings to the team a unique experience in the optimisation of terminal and operational design, and combined with his experience in infrastructure and civil engineering, he offers a unique blend of expertise.

DRIES VAN DEN BROECK
Director RebelGroup Advisory Belgium
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Dries is Director of RebelGroup Advisory Belgium and Financial Modelling Expert, who has worked at Rebel for over 10 years. In his first years at Rebel, Dries developed his profound financing skills in the project finance team of Rebel. Later his interest in ports and logistics grew, resulting in an internal transfer to the Ports and Logistics team, where his financial modelling and business case structuring skills are considered as an added value for the team. Dries has vast experience in drafting and elaborating financial models, with a special interest in decision tools. These tools enable decision makers to take informed courses of action by clearly displaying the impact over time of certain decisions. The core of this is in structuring the large amount of available data and visualizing the results so that this information is converted into useful information on which to make informed decisions.

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