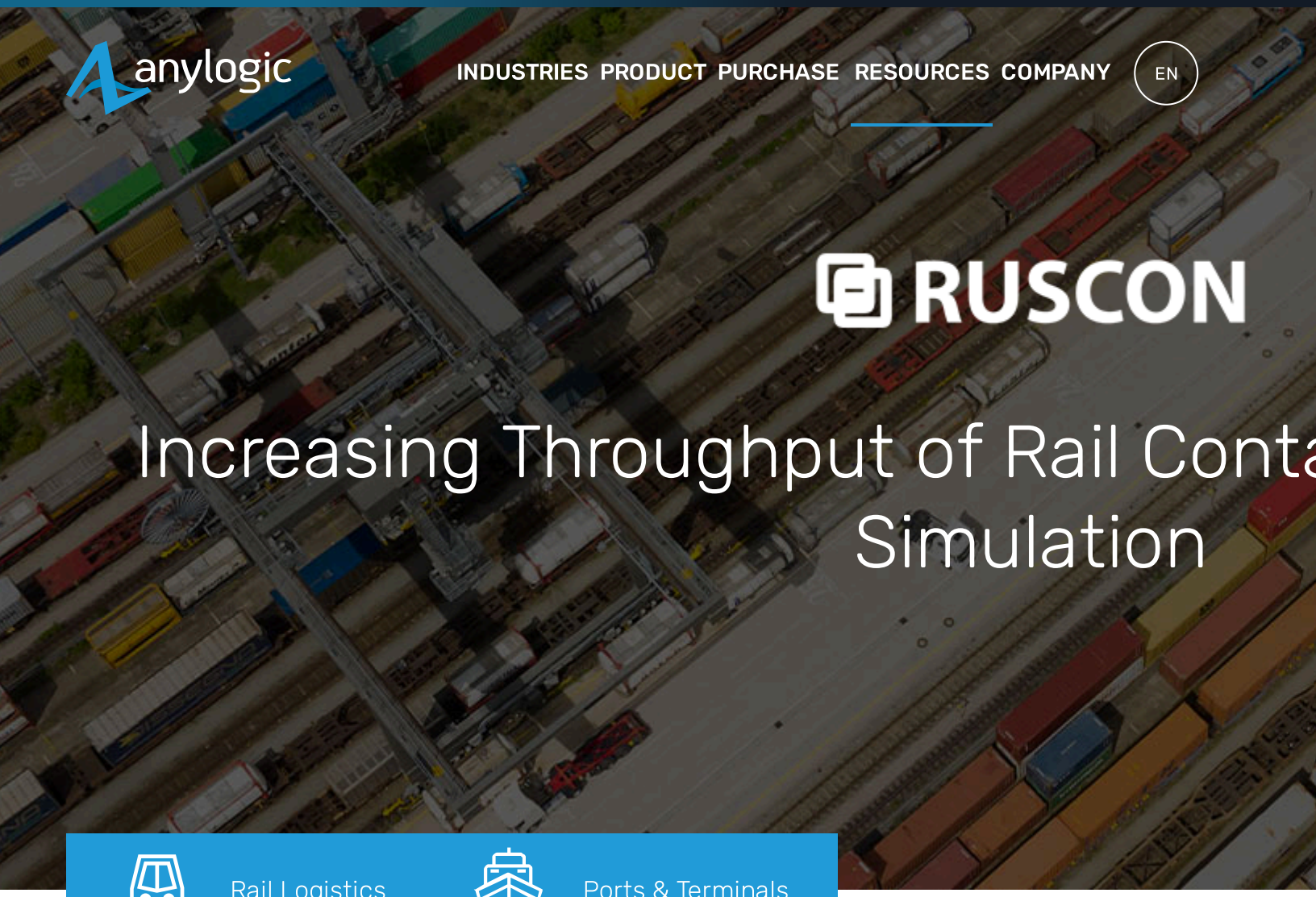


Increasing Throughput of Rail Conta Simulation

Rail Logistics

Ports & Terminals

Problem

RUSCON is one of the major container shipping companies in the CIS region. The company needed a container yard planning solution to modernize one of the rail container terminals and determine maximum capacity of the whole facility and its components. It sought the expertise of container yard simulation specialists from Dilibrium Consulting Company to

- Temporary storage area is more than 22,000 m2.
- There is an open storage yard (2,500 TEU) for containers allowing to stow 20 ft. and 40 ft. containers in the customs inspection zone and temporary storage area.
- The terminal provides for handling (receipt\departure, loading\unloading) of container flatcars, universal flatcars, covered rail cars, gondolas, etc.
- Two frame cranes, a number of fork lifters, an in-house tractor trucks fleet, and other ancillary equipment are available in the terminal.

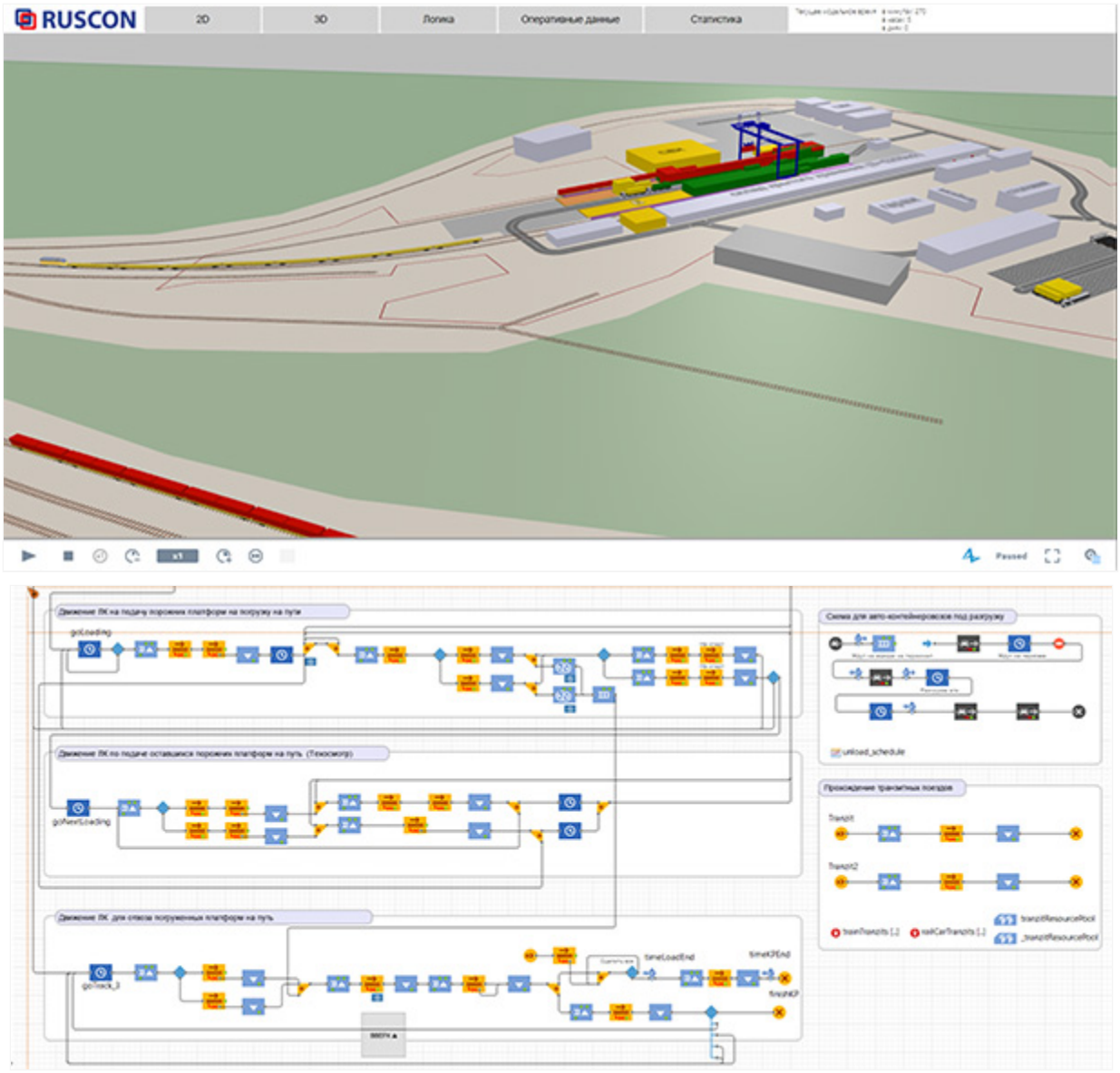
The consultants decided to simulate several different scenarios of terminal development to find the best alternative.

Solution

It was decided to build a digital twin of the terminal in the AnyLogic container yard planning environment. This dynamic simulation model, unlike traditional analytical ones, would reflect the facility with high accuracy – the variance between real data and virtual operations results was estimated to be within 5%. Digital twin technology provides detailed modeling and allows for considering various parameters, as well as non-linear, nontrivial, and unknown dependencies and cause-effect relationships.

The starting point of the container yard simulation is the arrival of trains with loaded containers to the railway sorting yard. Then, the rail cars are switched to

- Processing at customs checkpoints

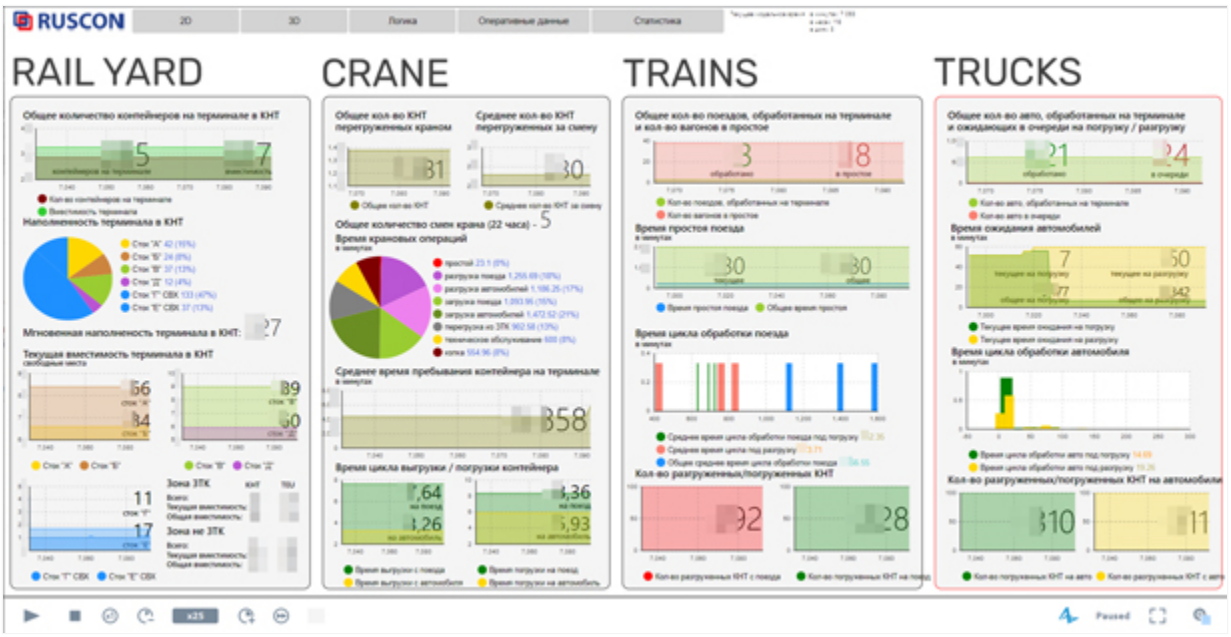


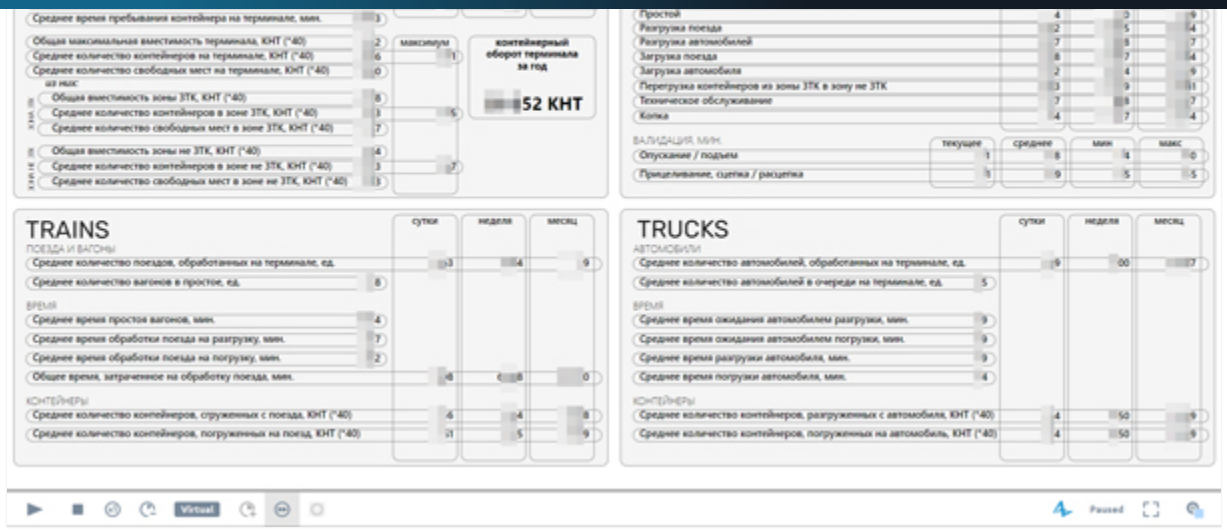
Container yard planning model

The capabilities of the AnyLogic container terminal simulation environment enabled engineers to create 2D and 3D model animation. The animation allowed

- Red containers were not cleared through customs yet.
- Green containers were customs-cleared and ready for unloading.
- Empty containers were colored yellow.

The engineers introduced in the container yard planning model “virtual sensors” which were gathering information from the digital twin and transferring operational data while the model was running. This facilitated tracking simulated facility performance and model calibration. Such a thorough approach in data gathering allowed for close matching of the digital twin with the operations of the real-life container yard.





Rail yard simulation optimization model

After the container terminal simulation model was built and calibrated, the engineers managed to determine the terminal capacity and verify the analytical model data. When comparing the performance indicators of the terminal models with the "as is" scenario, the accuracy of the analytical model was 72%, whereas the simulation model showed 96% accuracy.

The model also facilitated in testing the operations of the frame crane, the terminal's loading machine, in a virtual risk-free environment. The model reflected three-axis movements of the crane's trolley and spreader. Moreover, the different time duration of each crane operation was considered. As a result, crane operation bottlenecks were detected, and optimization measures were suggested and supported by experimental data.

In AnyLogic, industry-specific Material Handling Library simplifies the simulation of complex material handling

This work resulted in simulation-based recommendations on how to upgrade infrastructure and reorganize terminal business processes.

Outcome

After the experiments were held and the output data was obtained, the engineers were able to define facility bottlenecks and possible optimization scenarios. They discovered that further optimization measures could enhance terminal capacity by 57%.

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