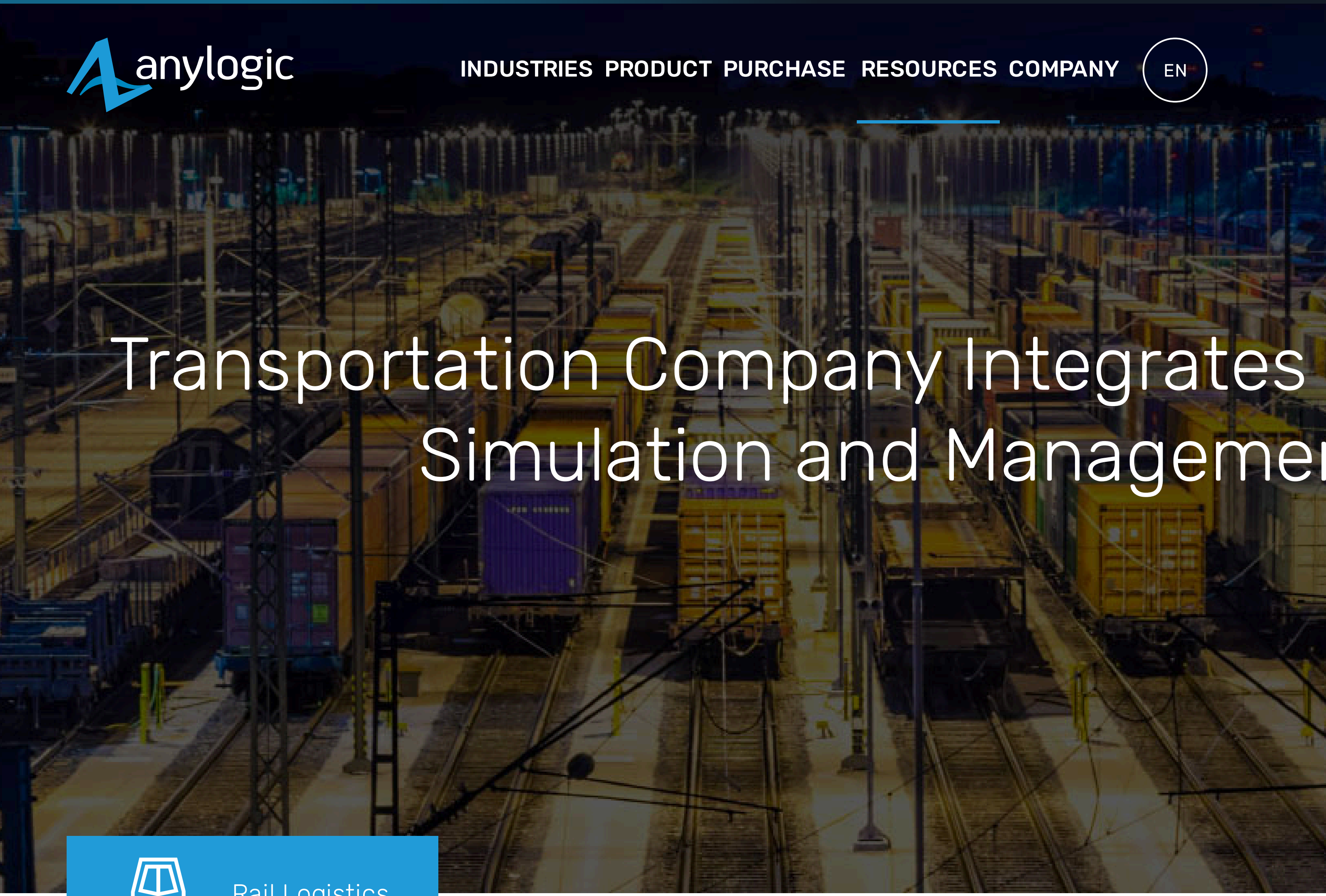

Transportation Company Integrates Simulation and Manageme

Rail Logistics

Problem

In 2012, a railway operator decided to create a strategic railway network to embrace the need to increase the scale and volume of cargo traffic. This network was comprised of three railway ports and six transport and logistics terminals (TLTs). The network was aimed at enhancing the efficiency of cargo transportation. The first stage of launch would increase cargo traffic by consolidation, transit, storage, distribution, customs clearance, and temporary storage of containers and cargo.

TLT Bely Rast

The TLT included container and liner train terminals, customs facilities, terminals for processing large and heavy cargoes, building materials, vehicles, a system of warehouses, and a business center. So, the TLT was both a multifunctional system and one of the elements of the modernized railway network. This meant that Bely Rast was a complex facility with a great number of internal and external functional links.

The success of the project depended greatly on the local logistics efficiency and the proper operation of every TLT element. Basically, there are no universal railway yard models for TLT design and analysis. That is why when creating a TLT, engineers applied the experience of already existing terminals.

The railway operator entrusted the examination and testing of the proposed solutions to the engineers of SPC Infotrans. This is an enterprise engaged in the full cycle of creating technical facilities to diagnose the railway infrastructure. Infotrans experts suggested applying the AnyLogic railway simulation software. Simulation modeling allowed them to track many parameters, both at the design stage and at the operational stage.

The TLT functional model was implemented to enhance internal relations at TLT Bely Rast. This was micro level of train performance. The AnyLogic railway simulation software also provided options for modifying and expanding the models with the help of Java programming language, allowing them to adjust the TLT model for the specific project tasks and setting.

Solution

The railway simulation was applied to enhance the efficiency of the continuous cargo traffic inside the TLT and to find the best logistics solutions. This determined the choice of discrete-event modeling.

The TLT model included the following basic facilities:

1. Intermodal terminal
2. Inert cargo terminal
3. Loading/unloading vehicles terminal
4. Specialized warehouses (cross-docking facility included), providing for adjacent checkpoints and their entry points
5. Local road infrastructure, providing for the checkpoints and parking places

Railway simulation model logic and animation (click to enlarge)

It was possible to set parameters at different logical levels of the railway simulation model and conduct experiments. With the model, the experts were able to manage train arrival schedules, as well as change:

- The number of

- Parameters for separa
(storage capacity, nur
loading/unloading, etc
- The structure and pu

Railway simulation tool interface with parameters for railway optimization (click to enlarge)

The additional option of entering source data into the model using third-party resources, for example, databases and Excel data sheets, enabled users to consider not only simple numerical parameters (the density of daily train flow), but also complex structural data (train schedule).

The dynamic modeling made it possible to track changes in local indicators for terminal transport (number of tractor units, maximum queue size, delay time at the checkpoint, etc.), warehouse and terminal capacities load, and the number of operations performed with containers by type of operation.

Random events algorithms (equipment breakdowns, queues, weather conditions) and 'what-if' options helped predict the consequences of unforeseen situations and evaluate the interrelated dynamics of the TLT indicators.

Result

As a result of the railway simulation and management

- Create a system for planning and dispatching traffic flows.
- Create a tool for choosing optimal solutions for further operation.

Model implementation also disclosed critical limitations of the infrastructure. The insufficient traffic capacity of the checkpoints, transport cross flows, and the points of the adjacent road network junctions were identified and corrected. Such restrictions potentially could lead to queuing and overload in particular TLT zones, which would significantly reduce the efficiency of the entire TLT as a whole.

Apart from that, experts came to the conclusion that the railway planning model should be used for further needs:

1. To integrate the TLT Bely Rast in the system of external logistics links.
2. To optimize the adjacent transport infrastructure.
3. To create a macro-model for monitoring and optimizing the interaction between all TLTs of the planned network, as well as railyard management.

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