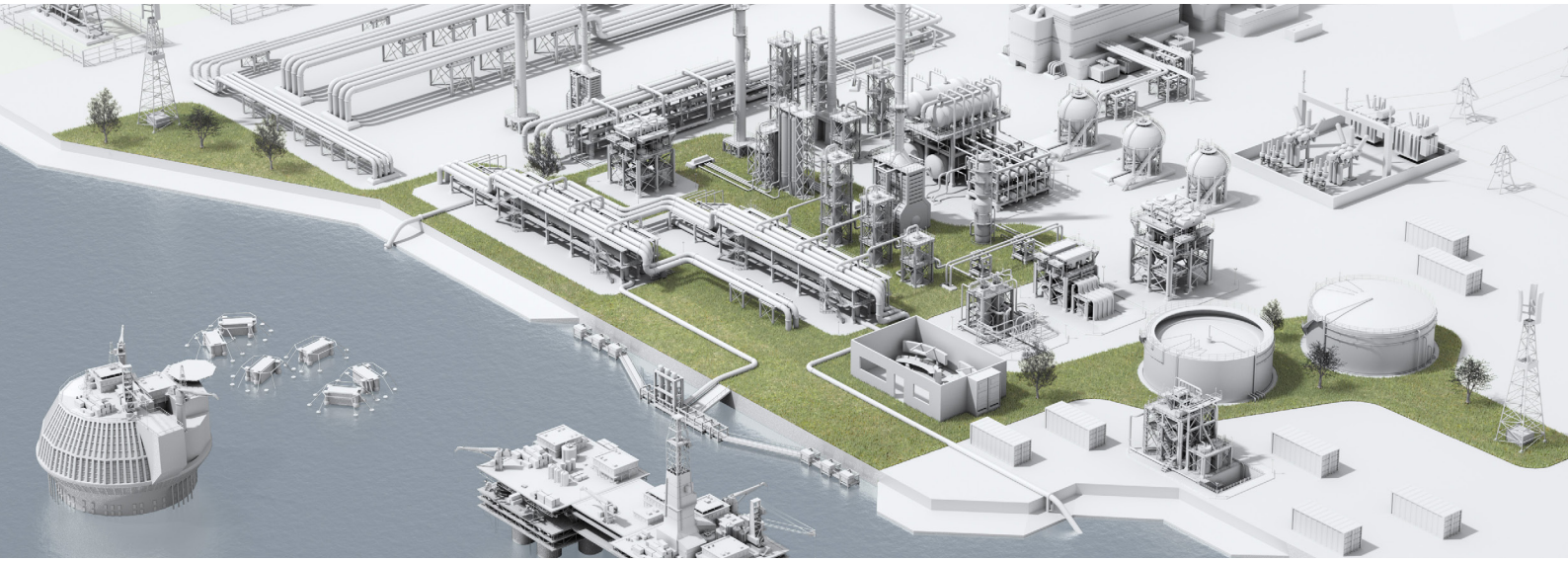
T-MAC Plus Bay Allocation

Expediting terminal operations with intelligent vehicle management



Bay allocation is used to assign all types of vehicles (trucks, railcars, ships, etc) to all types of T-MAC Plus bays (top loading bays, bottom loading bays, rail loading racks, jetties, etc).

Vehicles can be allocated to bays at different points in the business process workflow of a terminal.

- **"In advance" bay allocation** can allocate a bay well before a vehicle actually arrives at a terminal. The allocation algorithm must consider all the other allocated vehicles when selecting the most appropriate bay.
- **"Just in time" bay allocation** will wait until a vehicle has arrived at the terminal before selecting a bay. To make the most informed bay selection, the bay is often not allocated until the last possible minute.
- **"Call queue" bay allocation** will make a selection from a queue of vehicles waiting to load or unload.

T-MAC Plus allows vehicles to be allocated to multiple bays if their disposition cannot be satisfied at a single bay.

- Multiple bays can be allocated for a vehicle in advance. The sequence that the vehicle will visit the bays is maintained in the bay allocation information.
- Just in time bay allocation can be used to allocate a vehicle to another bay once it has completed its operations at the current bay.
- Equipment failures at a bay that make it impossible for a vehicle to complete its planned operations can be managed automatically by allocating to an alternate bay.

Vehicle bay allocation can be triggered in a number of different ways:

- T-MAC Plus application can perform bay allocation in response to an event at the terminal. For example, T-MAC Plus application can allocate a bay at the completion of vehicle disposition at a driver kiosk, or at the entry of a vehicle into the terminal.
- Alternatively, T-MAC Plus application can place vehicles onto calling queues where they will await bay allocation.
- External system interface protocol handlers can allocate vehicles to bays as soon as disposition information arrives from transportation logistics or ERP systems.
- Operators can manually select a bay for a vehicle using the T-MAC Plus visit editor. The visit editor will provide a list of potential bays that is ranked by recipe coverage and estimated waiting time.

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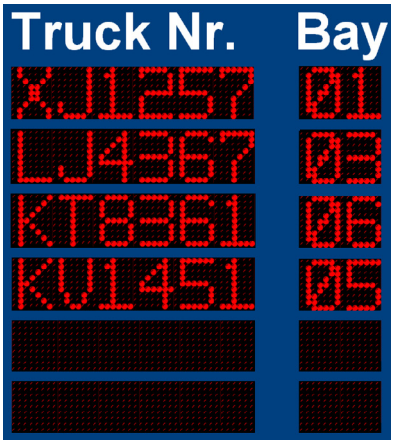
Outdoor call queue display where trucks are assigned to bays



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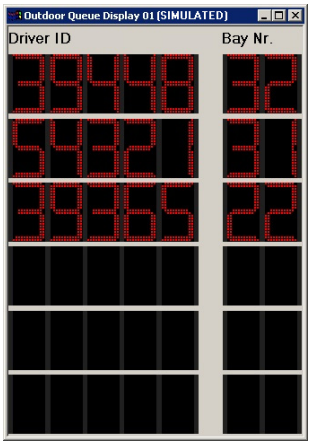
Outdoor call queue display where drivers are assigned to bays



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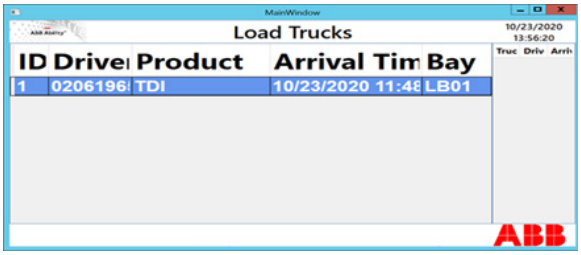
Indoor call queue display where drivers are assigned to bays



Bay allocation can extend down to the loading spot level if required.

- Algorithms configured to allocate both bays and loading spots will assign a loading arm to each of the available compartments in a vehicle.
- Bay allocation algorithms will select an optimal loading pattern for the vehicle compartments to ensure that bay occupancy time is minimized.
- Compartments that are not disposed, or are already loaded will not be assigned an arm.
- Workflows running at the bay and loading spot will ensure that the allocated arm is used.

T-MAC Plus allows vehicles to queue up behind bays ready to enter the bay the moment it becomes available.

- The maximum number of vehicles allowed to queue behind each bay is configurable. Different bays can support different queue lengths if required.
- Queue jumping can be prevented by configuring T-MAC Plus application to check the bay queue during identification to ensure that the queue order is respected.
- Tardiness in arriving at the bay can be discouraged as each vehicle in a bay queue is assigned a timer. Vehicles that fail to arrive and identify at the bay within a configurable time can be denied access to the bay and forced to start again; given lower priority in future bay allocations; etc.

Calling queues are used by the bay allocation subsystem when vehicles are expected to remain in a waiting area prior to a bay becoming available.

- Multiple waiting areas can be present within a single terminal. For example, truck parking areas, and offshore ship mooring anchorages.
- Vehicle arrival times can be respected using call queues. Vehicles arriving first can generally be the first allocated to bays, depending on availability of the necessary products on the arms at the bay.
- Queue priority is also supported. Vehicles with higher priority can jump ahead in the queue.

Bay allocation algorithms are T-MAC Plus application extensions. Custom bay allocation algorithms that are specific to a particular terminal can be quickly developed and plugged into a T-MAC Plus system to deliver optimizations according to the precise requirements of the terminal.

The T-MAC Plus product comes with a number of standard bay allocation algorithms that provide sophisticated bay optimization.

Estimated bay occupation times are calculated for both the vehicle to be allocated and any vehicles at the bay or already queued for the bay.

- The estimated time for vehicles to enter and prepare for operations is taken into account. The estimated time to vacate the bay is also used.
- The estimated time for vehicles to connect and disconnect loading / unloading arms or hoses is taken into account.
- The ramp up and ramp down times for the loading controllers and pumps is taken into account, along with the normal flow rate expected for the remainder of the operation.

The standard bay allocation algorithms assign a “score” to each bay (or waiting vehicle) based on a set of factors. The bay (or vehicle) with the best score is allocated.

- The recipe coverage score is a percentage of the number of compartments that can have their planned operations fulfilled at a particular bay out of all the planned operations for the vehicle.

- The resource maximization score is a percentage of the number of loading spots (arms) at the bay that can be used by a vehicle out of all the loading spots actually available at the bay.
- The position of a vehicle in waiting area queues is scored on a first in first out (FIFO) basis.
- The visit type priority configured on the bay is used to score the vehicles waiting for a bay based on the type of visit type have.

Vehicle to bay affinity is determined.
- Top loading vehicles are only allocated to bays that support top loading.
- Bottom loading vehicles are only allocated to bays that support bottom loading.
- Vehicles that support both top and bottom loading can be prioritized for either type of bay – normally bottom loading.
- The “handedness” of bottom loading bays is taken into account. Vehicles that load on the left hand side are only allocated to left hand side loading bays, with the mirror approach for right hand side bays.

The status of bays and loading spots are automatically taken into account by bay allocation algorithms. Bays that are set out of service are not considered as allocation targets. Out of service loading spots reduce recipe coverage scores, and increase resource maximum scores.

Call displays are configurable, and can show various attributes including driver names, driver identification numbers, bay numbers, vehicle registration numbers, visit numbers, status in the queue, etc.
- The position in the queue can be sent to the driver via a notification in the Terminal Insight App (developed by ABB as part of the digitalization concept of terminals).
- Outdoor LED displays are supported.
- Displays for control room operators to manage call queues and bay queues are available.

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