

AUTOMATIC TRUCK IDENTIFICATION

Allan Jones, Head of Business Development, International Terminal Solutions Ltd presents a review of the changing dynamics offered by very low cost passive tags for identifying, tracking and automating job handovers for both internal prime movers and external trucks visiting container terminals.

When it comes to automatically identifying internal Prime Movers working in a container terminal, a common technology used is Radio Frequency Identification (RFID). RFID technology basically consists of small radio transponders (also known as tags,) that send their identity and other technical data to an RFID Reader. By identifying the transponder you can automatically determine such things as which part is on a production line, or which truck has arrived at a crane, or even who is operating an item of equipment. In principal, there are two varieties of this technology - Passive and Active. Active RFID will be the more expensive option because each tag carries its own power supply, but either could be cost-justified for the volume of prime movers typically used in a container terminal. But how do you create a common solution for both internal prime movers and external (road) trucks? They share common processes, typically at the Gantry Crane or the Pad for Straddle Carriers where a container handover takes place, but the investment required for a common tagging solution when the volume of external trucks can be in the 000's has historically been prohibitive. So, what if you could reduce the cost of tagging the external trucks to just a few cents?

Active or Passive RFID Tags?

There is a plethora of available tag technologies, but as mentioned they are either active or passive in their nature, so to begin with let me review the key elements of each.

☛ **Active Tags** - have their own power source, typically a battery, which gives them a longer transmission range than passive tags, but they transmit on a timed basis to preserve their internal power source. They tend to be proprietary in their nature and will work only with the manufacturer's reader/tag combination, and they will be more expensive to buy and then maintain because the battery will require servicing, or will limit the life of the tag to just a few years.

☛ **Passive Tags** - have no power source and so are lower cost. They should require no maintenance and have virtually no limitations on the length of their serviceable life. The tags are energised when in the range of a reader and typically they have a lower transmission range than active tags. They use open international standards, so any reader can read any tag, but data on the tag can be encrypted for security. Each type of tag has advantages depending on the environment and application. A container terminal is a harsh environment and at first glance Active technology may seem an appropriate choice for identifying trucks; after all, shouldn't the long range be an advantage? However if the tag is being read in an environment with a lot of truck movements, such as in the traffic lanes between the gantry cranes, there will be a lot of 'noise' from the tags of passing trucks, making an accurate read of the truck at the crane more difficult to achieve. Aside from the lower cost, this is one of the reasons we advocate the use of Passive tags for this type of application, as by using our own innovative use of the reader technology it is possible to achieve virtually 100% read accuracy. We should remember Passive RFID has been around for many years and has been adopted by many industries as the standard for identification of goods. A well-known example of this is Walmart in 2005 requiring its top 100 suppliers to apply RFID labels to all shipments and the DoD requirements for RFID tags on packages of military supplies was similarly prescribed in the Defence Federal Acquisition Regulations Supplements (DFARS) 252.211-7006. However, in the container terminal industry there has been a lag in the adoption of Passive RFID because the lack of read range has been perceived as a limitation. Whilst Passive tags are much lower cost than Active tags, as a rule of thumb the lower the cost of the Passive tag, the lower the read range. Until now this has meant the higher read range (and more expensive) tags were necessary for recognising trucks in a container terminal environment. However, technology moves on and both the readers and the read range of Passive tags continue to improve. At ITS, our aim has always been to implement the lowest cost tag that current technology will allow for truck identification. Keeping costs low means we also needed to develop innovative processes

around the reader technology to ensure read accuracy, and we have invested in many years of development to constantly refine these processes.

Crossroads of Change

We have now reached a crossroad whereby our approach means we can use Passive tags costing just a few cents and this changes the dynamics for this application, with the following possibilities:

☛ Every truck that visits the terminal can now be tagged. The tag can then be used to track the truck through portals and to automate job handover points at the Crane or Straddle Carrier Pad.

☛ Once attached the tag is permanent, which means it will be used for each repeat visit to the terminal. Any attempt to remove it will result in the tag being electronically destroyed.

☛ In addition to being used to recognise the truck at the Crane or Straddle Carrier Pad, the tag can also be used for a fast gate authorisation. This can be used stand-alone or in addition to gate automation systems, which typically use OCR to read the truck registration as well as the container number. In addition to truck recognition at the gate, the tag will offer an increased level of security - it is possible for drivers to switch registration plates, but not the tag.

☛ Because the tag can be read by any reader, it can be used by multiple terminals and also maybe by the Port Authority, to track movements around the port. Security is maintained because data contained on the tag can be encrypted to ensure it will be recognised only by authorised read points (both the tag and the information on the tag is protected from fraudulent activity).

The capability to deploy low cost tags to all trucks visiting the terminal offers greater security and higher levels of automation to container terminal operations. These systems are typically justified by automating operations of internal trucks, but with few cents for each external truck, the benefits of including these in the terminal's automated operations is potentially huge for very little add-on cost.

Passive RFID Tags for Prime Movers and External Road Trucks

Tagging External Trucks

The external trucks have a low cost passive tag attached to the Windscreen. This is normally attached during the pre-gate operation for the truck's first visit and thereafter a fast-gate can be used, if this is available. Once inside the terminal the tag will be used to identify and track the truck through portals and to identify the truck under the Crane or



Figure 1: Low cost tag used for external trucks

Straddle Carrier Pad. A tag is usually attached to both sides of the windscreen to ensure it can be easily read whatever the direction of travel of the truck.

Tagging Prime Movers

The same tag could be used for Prime Movers, but because these trucks are constantly working in a harsh environment we would usually recommend an industrialised tag. These are more costly, but because the number of prime movers used in the terminal is much lower compared to the number of external trucks visiting the terminal, the more expensive tag does not represent a significant add-on cost. As can be seen in Figure 2, two tags are mounted as with external trucks to ensure the trucks can be read in any direction of travel. Let's now look at some of the automated processes the terminal can implement using these tags.

Terminal Processes Using Low-Cost RFID Fast Gate

Portals positioned at the gate will automatically read the tag on the windscreen and then this will be used to authorise entry of the truck, and to then plot the progress of the truck through further portals at key stages in the container terminal processes. The RFID system will need to be integrated with the Terminal Operation System (TOS) to update the system in order to complete the truck authorisation, after which a gate barrier is typically lifted.

Lane Portals and Processes at the Crane or Straddle Carrier Pad

Depending on the individual requirements of the terminal, further portals can be positioned at key points in the terminal. These can be at the entrance of the crane stack, so that sequence at which trucks present to the crane can be identified. Identifying this sequence can be particularly important for Automatic Stacking Crane Operations (ASC) or automated RTGs. As each truck passes through the lane portal, the TOS is advised to enable it to update the crane's work order list to the sequence

of the trucks in the stack lane, an important step to the Crane's automation processes. There are typically a number of road lanes parallel to the stack resulting in a lot of 'noise' or false reads for passing trucks, so the reader system needs to be capable of differentiating each of those reads. Furthermore, the reader system at the crane needs to be able to cope with trucks that over and undershoot the crane position and will therefore shuffle backwards and forwards, whilst detecting positions for 40' and front and rear 20' containers. Similar challenges occur at the Straddle Carrier Pad, where there are a number of trucks passing and also those parked at the Pad will be in close vicinity to each other. Knowing which truck is positioned at the Pad or under the Crane would seem a simple requirement, but as described above, the reader system will need to employ complex processes to differentiate and identify the actual truck in position, and the

system must also be able to continually confirm the truck is remaining in position, until it moves on.

Summary

The ability to accurately read low cost windscreen tags suddenly changes the dynamics of automated identification and tracking applications, as it is now possible to tag 000's of trucks and other assets for a very small investment. Whilst continual improvements to the tag technology makes this possible, equally important and key to these systems is using innovative processes around the reader to ensure accurate identification of these tags. Converging innovation in both the tag and reader processing is now dramatically changing the cost equation for using this technology to make mass tracking applications possible, whilst also strengthening the container terminal's potential to increase the security of the terminal and improve productivity. 

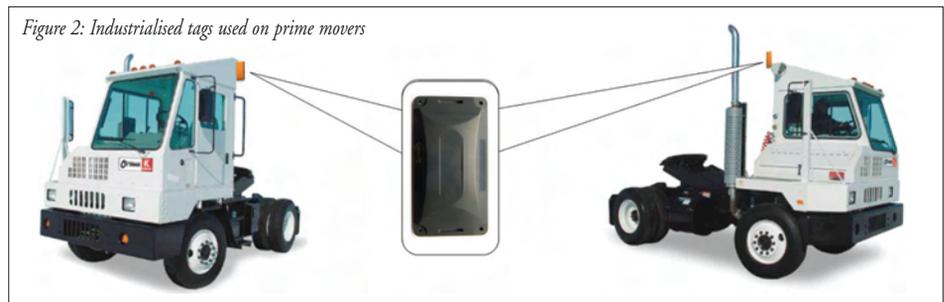


Figure 2: Industrialised tags used on prime movers

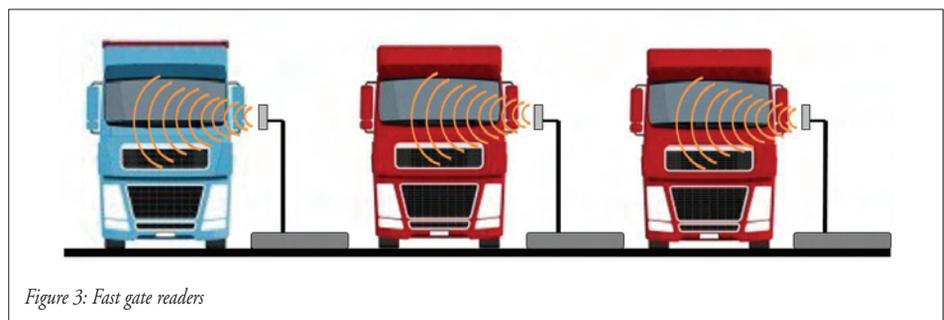


Figure 3: Fast gate readers

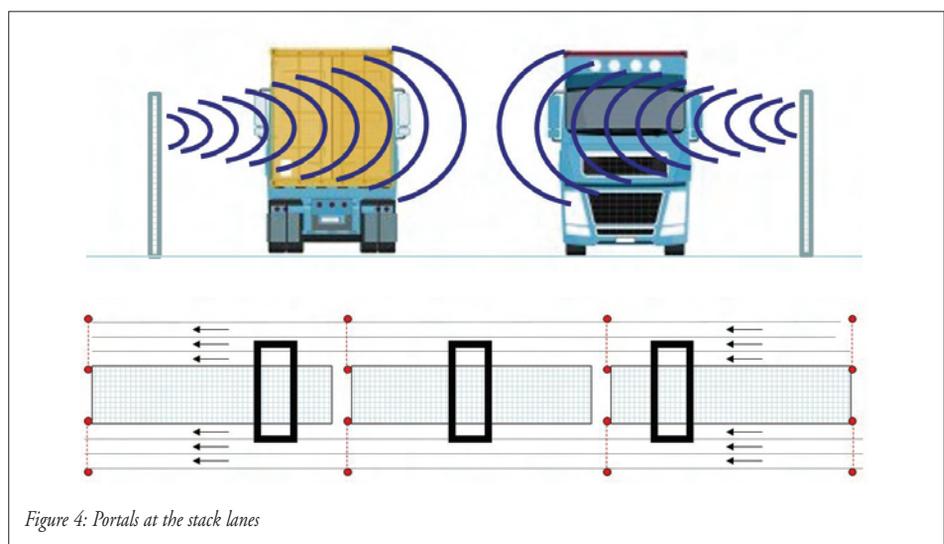


Figure 4: Portals at the stack lanes