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Business Case : JIT - Lorry Monitoring on Large Production Sites

1. Introduction

Modern vehicle production facilities make heavy use of Just In Time (JIT) delivery strategies and it is important that supplier deliveries are well managed to ensure that component availability on the line is not compromised by poor delivery planning and inefficiency in achieving the optimum unloading turn around times. A given production site may handle as many as 1000 lorries daily, with more than 100 lorries on site at peak times, some of which may be integrated to a JIT delivery strategy managed by IT system and some of which could be considered as ordinary deliveries. Deliveries may enter the production site at one or more gates according to type of delivery (JIT deliveries or ordinary lorries).

Efficient management of transport and on-site delivery can be facilitated with radio frequency identification (RFID) technology and systems. Given that the lorries handling JIT delivers remain largely the same, then each vehicle can be assigned a transponder (RFID tag) specific to the JIT supplier(s). The JIT supplier(s) will be responsible for ensuring that every lorry is fitted with an RFID tag, as well as assuming the responsibility for any lost tags. A beacon (RFID readers) positioned at the JIT entry gate(s) will automatically read the tags on arrival, which can be used for automatic gate opening. Integration of the reader(s) and tags into a data base system would provide the production site with a solid mechanism to capture real-time traffic data and for direct summarization and evaluation.

The RFID system offers the possibility of monitoring lorries from JIT suppliers. Two configurations are possible :

Configuration A-1 :

- Fixed reader(s) are positioned at the JIT lorry entry gate(s),
- Lorries are equipped with tags by the JIT suppliers,
- The system provides :
  - accurate entrance and exit time information,
  - delivery time to the production site when referenced to the JIT time of order, and
  - the possibility for automatic gate opening.

Configuration A-2 :

- As (1a) above, but including fixed reader(s) at all on-site unloading points,
- The system provides :
  - information on entry time, unloading turnaround time, unloading dock and exit time,
  - delivery time to the production site when referenced to the JIT time of order,
  - the possibility of informing the unloading area of imminent shipment arrival,
  - the possibility for automatic gate opening.

The system can also monitor regular lorry arrivals, again in two configurations:

Configuration B-1:

- Fixed reader(s) are positioned at the lorry entry gate(s).
- Tags are provided to lorries at the entry gate and returned on exit.
- The system provides :
  - accurate entrance and exit time information,
  - the possibility for automatic gate opening on return of the tag.

Configuration B-2:

- As (2a) above, but including fixed reader(s) at all on-site unloading points,
- The system provides :
  - information on entry time, unloading turnaround time, unloading dock and exit time,
  - the possibility of informing the unloading area of imminent shipment arrival,
  - the possibility for automatic gate opening on return of the tag.

The RFID system can be integrated into the production logistics system, possibly already equipped with support for transponder and lorry control / time management. The system can assign a time window to each lorry, in which the lorry is unloaded at a specific dock. Standing fees can be saved and the forwarding agency will be allocated the appropriate time slots in advance of vehicles being dispatched.

This is of course providing that delivery uses JIT delivery management, or if not, that the supplier or forwarding agency has correctly advised the production site of their delivery plan (allowing the site to plan the unloading process more efficiently and also improve preparation for acceptance of deliveries).

Further, the RFID system should provide data allow optimisation of transport rates.

2. How the System will Work

Each JIT vehicle will be permanently fitted with a Tag, which will be fitted to the roof of the vehicle cab. Each Ordinary delivery vehicle will be allocated a tag at the entry gate and which will be magnetically attached to the driver's door.

Readers and up to four (4) Antennae will be placed at all strategic points of interest such as entry points, unloading docks and exit gates.

As tagged vehicles pass within the range of the reader, they will be interrogated and the unique serial number in the tag will be captured by the Reader. This will then be passed on to a Control PC either using a Ethernet connection.

Where the Reader is located at the JIT entry point(s), the reading of the tag by the Reader will also drive the Reader relay port which will cause the barrier to lift*

A Control PC will be located at the Ordinary Vehicle Security Gate. This will hold a simple version of the Velocity® database of the tags known to the system.

Velocity is a product developed to manage prototype vehicle assets at Ford and is a full enterprise system which can grow as more complex processing or interfacing to other systems is required. Alternatively the interface specifications to the Hardware can be provided and the production site can take responsibility for provision of the database.

The JIT Vehicle details will also be permanently known to the database and the tag for each vehicle will be assigned within the database.

Ordinary vehicles will be allocated a "temporary" tag by the guard at the Ordinary Vehicle Gatehouse(s) on arrival and the tag will be removed and returned to the gatehouse(s) who will disassociate the vehicle from the tag on exit (possibly by tag deposit system causing gate to open).

Each Reader will be associated with a "transfer point" on the database. The tracking algorithms within the application will take the sighting of a tag at a particular transfer point and determine a vehicle movement which will be recorded on the database.

For example, if a JIT vehicle drives up to a JIT entry gate, the tag will be read by the Reader and the tag id together with a date and timestamp will be sent to the database. The database will know which supplier vehicle this tag is associated with and record that the vehicle entered the site at a certain date and time. The database will also instruct the Reader to open the barrier and let the vehicle in. (Unauthorised or non-JIT vehicles will not be allowed in a JIT entry gate). When the vehicle arrives at an unloading dock (options A-2 and B-2) the Reader at that bay will read the vehicle tag and send this together with the date and timestamp to the database. The application tracking algorithm will deduce

that the vehicle has moved from "on-site" to "Being Unloaded on unloading dock X" and record this on its database. Once the vehicle is unloaded and pulls away from the unloading dock, the system could determine the time spent at the unloading dock and record this to its database to manage turn around times. Finally, when the vehicle arrives at the exit gate, a Reader will read the tag and send this together with the date and time stamp to the database where the tracking algorithm determines that the vehicle has left the site and updates the database accordingly.

Reports by supplier or by vehicle can be run to determine the amount of time spent by each vehicle on each visit at each stage of the process. If required, Velocity can make this report data available over a network to all users in html format.

3. System Options

3.1 Traceability of re-usable pallets :

In the same manner that the JIT lorries are identified above, it possible to identify specific re-usable pallets or specific specialised re-usable containers (stillages) adapted to the delivery of components. Cedar Ridge has tested the simultaneous reading of 60 metal stillages arriving simultaneously on a lorry.

Please refer to the Re-Usable Pallet Business Case.

3.2 Integration of RFID tags into component boxes or Kan Ban quantities :

The RFID tag can be integrated into supplier shipments and automatically signal movement of Kan Ban quantities of components through the Kan-Ban loop :

- arrival in warehouse,
- exit from warehouse to production
- arrival at specific locations, etc

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Business Case : Re-usable Pallet Control Requirements

1. Warehouse Control

Suppliers to OEMs working in JIT environments (Automotive, Appliances, …) often deliver components in purpose designed metal Re-usable Pallets each having a significant cost. These are shipped between Manufacturing Facilities, Distribution Facilities (logistics platforms run by the Company or its sub-contractors) and Customer Locations.

Management of stocks through the supply chain is complex and could benefit from real time collection of pallet and contents data. In addition, stock auditing and rotation is heavily reliant on staff manually following procedures to ensure correct reporting. Finally, picking of the correct Re-usable Pallets for FIFO and KAN Ban is difficult to control in the current environment.

This Business Case recommends the introduction of UHF omni-directional RFID (Radio Frequency Identification) technology on each Re-usable Pallet and a hand-held reader capability with tunable read range up to 30m which would facilitate the ability to automate the tracking of Re-usable Pallets within each facility, as well as speeding the picking task by allowing specific Re-usable Pallets to be identified giving confirmation to a Fork Lift Truck Driver which Re-usable Pallets to pick. Perhaps the single most important enhancement would be the ability to automate the stock checking process by obtaining the ID of each Re-usable Pallets in the warehouse simply by walking around each stack of Re-usable Pallets and reading the tag with a hand-held device at a range of up to 30m.

2 Re-usable Pallets Tracking

In order to ensure that JIT deliveries are maintained, ample stocks of Re-usable Pallets must be available to guarantee that enough empties are available to meet production demands and prevent line stoppages. Indeed a large part of the set up costs for each new product is the investment in purpose design Re-usable Pallets.

The control process is exacerbated by the difficulty in monitoring how many Re-usable Pallets are located at each part of the supply chain, and in particular, ensuring that all empty Re-usable Pallets are collected back from the various sites, logistics platforms or Customer sites in a timely fashion.

The inventory of Re-usable Pallets can represent a significant investment and this is increased when Re-usable Pallets remain on the various sites long after they have been emptied.

Accurate information on turn around time of bottles would allow :

- better internal supply chain control on the Company site and logistics platforms,
- determination of precise Re-usable Pallet inventory costs for application of :
  - penalty to customers/suppliers making late returns, or
  - bonus to be given to those making rapid return.

Clearly, it would be preferable for customers not to incur rental charges on empty Re-usable Pallets, but neither is it fair for the Company to incur production stoppage costs because of insufficient Re-usable Pallet stocks to meet demand.

Cedar Ridge would propose to implement an RFID (Radio Frequency Identification) Solution based on its broadcast tag hardware and software to allow the Company to exert substantive control improvements on the Re-usable Pallets Inventory such that the total numbers and location in the supply chain is known in real time.

Re-usable Pallets utilisation can then be accurately measured and managed and the logistics improved between sites. The system would have the facilities to issue warnings or if required, issue rental invoices, where empty units are not returned from suppliers and customers in a timely fashion.

In our experiences elsewhere, it is not unreasonable to expect that the implementation of a control system such as that Cedar Ridge propose will realistically allow the inventory to be reduced by 10%.

Re-usable Pallets removed can be modified to support new projects and remove the need to produce new Re-usable Pallets. Therefore say 80% of the inventory saving is also a cost saving in terms of new Re-usable Pallets purchases for new products.

In addition to improved utilisation Cedar Ridge would expect to gain improvements in product traceability by programming the database with data relating to the Product and Batch located on each Re-usable Pallets against the serial number of its transponder as it is loaded at the end of the production line. This could facilitate the automatic capture of product and batch data at each stage of the supply chain, allowing :

- improved productivity where faulty units are quickly traced and withdrawn,
- better quality management.

Cedar Ridge can provide expertise for integration of the RFID system into the existing IT system.