Inbound supply chain of after sales parts from local suppliers to the National Parts Distribution Centre and the new Toyota warehouse Lead Times and Cross-Docking

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Executive Summary

Toyota South Africa Motors has recently opened their new National Parts Distribution Centre. A new warehouse brings with it new technology, new tools and techniques. Toyota has its own way of managing its businesses around the globe. This way is called The Toyota Way.

By applying innovative engineering techniques and also implementing Toyota standards, the goal of this project will be to eliminate unnecessary expenses and to reduce lead time from the suppliers to the warehouse and to the dealers.

This project uses BOSAL, a supplier of Toyota accessories, as an experiment to cross-dock parts that are too big to store in this new warehouse. The outcome of this experiment will determine if it is possible to do the same with the supplier of MAXE products, also a dealer of Toyota accessories. MAXE is currently delivering their products to the dealers themselves. The main problem when a supplier delivers their own parts directly to the dealers, is that Toyota has absolutely no control over the deliveries and the lead times. The main focus of this project is to determine an accurate lead time to each dealer of all parts and then to optimize the current cross-docking operation of BOSAL products. Implementing the Just in Time (JIT) supply chain method in the cross-docking operation will also form a key part of the changes.

List of Acronyms

JIT	-	Just In Time
TSAM	-	Toyota South African Motors
IMV	-	International multi-purposed Vehicle
NPDC	-	National Parts Distribution Channel
CX	-	Collaborative Exchange
TPS	-	Toyota Production System
DDD	-	Delivery Due Date
L/T	-	Lead Time
TMC	-	Toyota Motor Company
SKU	-	Stock Keeping Units
DSO	-	Direct Supply Orders
ASN	-	Advanced Shipping Notice
B/O	-	Back Order

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CHAPTER 1

1.1 Introduction and Background

Toyota South African Motors (TSAM) has invested R363-million in a new parts distribution warehouse. This 42 000 m^2 warehouse is the largest of its kind in Africa, located just off Atlas road in Gauteng and is close to major freeways, such as the R21, as well as the freight terminal at the OR Tambo International Airport. This facility is servicing more than 200 Toyota, Lexus and Hino dealerships in Southern Africa, while also exporting parts to TSAM's 56 export countries (Venter, 2011).

Along with Toyota's global strategy, Global Master Plan, Toyota's vehicle business has globalized rapidly. In such circumstances, volume of locally sourced parts has increased and exporting countries have expanded all over the world. The logistics chain has become much more complicated after the Innovative International Multi-purpose Vehicle (IMV) production launch as a trigger, and this trend will continue as more global models will be launched in the future.

Since customers expect smooth supply for all parts regardless of their supply source, each distributor must take more responsibility for parts supply not only for domestic customers but also customers overseas. **It is critical to strengthen local procurement in operation at each distributor.**

This puts pressure on Toyota to make all their systems run as smooth as possible. Moving products quickly and cost effectively provides a distinctive comparative advantage. To this effect, cross-docking operations can play an integral part of the distribution model.

The first phase of this project will focus on the cross-docking process of the supplier of BOSAL parts. It is not running at its full capacity and minor changes could speed up the process significantly.

The aim of the second phase of the project is to determine the lead times from the supplier MAXE directly to the Toyota dealers. This would indicate whether it will be more beneficial for Toyota to do the deliveries themselves rather than outsourcing the deliveries to MAXE. Since the supply chain of Toyota is much bigger than that of MAXE, the lead times will be significantly shorter for the simple reason that the deliveries done from the Toyota warehouse are much frequent than those done by MAXE. This is discussed in more detail in this report.

MAXE is the supplier of Toyota nudge bars, roll bars, side steps, rear steps and tow bars. MAXE steel is situated in Durban and they make use of a courier company – Time Freight – to do their deliveries across South Africa.

Figure 1.1: Toyota Hilux/Fortuner Nudge Bar

Figure 1.2: Toyota Hilux Roll Bar

Figure 1.3: Toyota Hilux/ Fortuner Side Bar

Figure 1.4: Toyota Hilux Tow Bar

BOSAL on the other hand manufactures exhaust systems, tow bars and cattle rails. BOSAL is situated in Pretoria. With the exception of Toyota dealers in Gauteng, BOSAL delivers their products to the NPDC.

1.2 Project Aim

A dealer orders its parts as a direct order on a system called e-Toyota. e-Toyota is then again linked with a program called Collaborative Exchange (CX). CX is a portal that is accessible by the dealer, the supplier and the Toyota warehouse. When a BOSAL truck arrives at the Toyota warehouse, with the ordered products, there is a lengthy procedure that is followed before the parts can be released again for dispatch. The warehouse only knows a few hours in advance what parts, and the quantities thereof, are expected. The aim of this project is to reduce the overall lead time on this process, develop traceability of BOSAL parts and the full control thereof. This can only be done if the parts go through a system called the Financial Management System (FMS). Should the changes of MAXE be accepted, this can

be seen as an experiment. If it works for BOSAL it can be expected to work for MAXE as well.

MAXE is currently using their own courier system to distribute their products around Southern Africa. The aim is to investigate the possibility to consolidate their products which are made for Toyota vehicles with other Toyota parts that need to be shipped from Durban to Johannesburg. It is expected that this will drastically reduce.

1.3 Project Scope

During the first part of the project, the current cross-docking process needs to be adjusted. It does work but it is far from perfect when considering external factors. The arrival time of the BOSAL truck is very important. Fluctuation in arrival times make it difficult to plan ahead. The first trucks leave the NPDC at 11:00 am sharp, thus is it important that the BOSAL truck is on time as scheduled. The blame and loss will not be placed on BOSAL but much more on Toyota as it is seen as a product of Toyota. By executing the whole process efficiently and faster saves valuable time that can be used elsewhere. Traceability of the parts from the warehouse perspective is very important in solving this issue.

MAXE steel in Durban currently supplies Toyota dealers themselves. The goal is to let Toyota themselves supply the MAXE parts to their dealers leaving them in full control of the parts. This will not affect MAXE at all, much rather their courier company, Time Freight. Instead of delivering all over the country, they only need to ship the majority to Johannesburg from where Toyota will distribute it to the designated dealers.

1.4 Document Structure

The remainder of this document consists of four chapters.

- Chapter 2 will include a study of the relevant literature available to solve the problem.
- Chapter 3 will provide a design to solve the problem and implement the solutions.
- Chapter 4 will discuss the implementation of the solution and the obtained results.
- Chapter 5 the final chapter will conclude the document with remarks and a formal conclusion.

CHAPTER 2 – Literature Study

1.1 The goal of Toyota production System (TPS)

The Toyota Production System (TPS) was adopted by many Japanese companies in the early 1970's. This system has become world renowned and is implemented in all Toyota companies around the globe.

The TPS can be described in three simple steps:

1) Social Contribution

・Provide high-quality products with a reasonable price for customers

2) Ensuring company profit

・To sustain the company and livelihood of its employees.

3) Perpetual prosperity of the company

・Keeping good balance with society

1.2 Necessity of Cost Reduction

One of the key aspects of being successful is to constantly search for ways to reduce costs. Costs in the TPS are driven by three main aspects; the circumstances of the car market, the circumstances of the service parts market and the environment of the service parts business. These aspects are explained in figure 2.

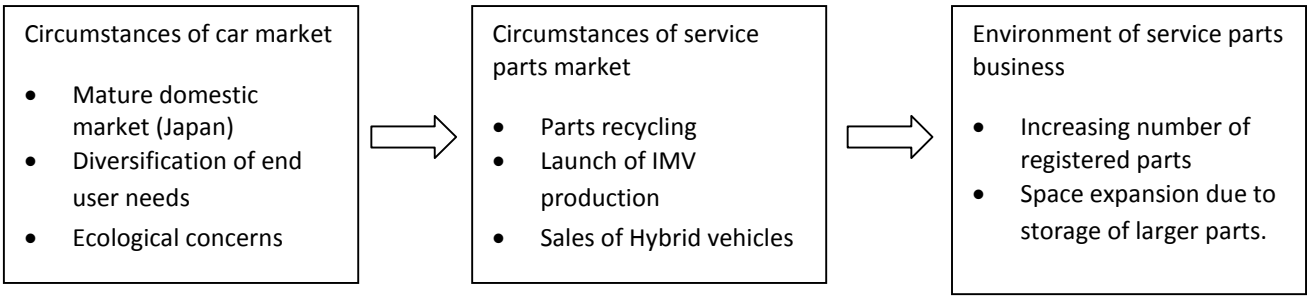


Figure 2: Necessity of Cost Reduction

1.3 Cost can be reduced by the way of producing/operating

Figure 3 typically shows the basics on where costs can be saved. The removal of Muda (redundant waste) can bring down the cost for production significantly. Selling price and the cost of stock or material are all based on the market price.

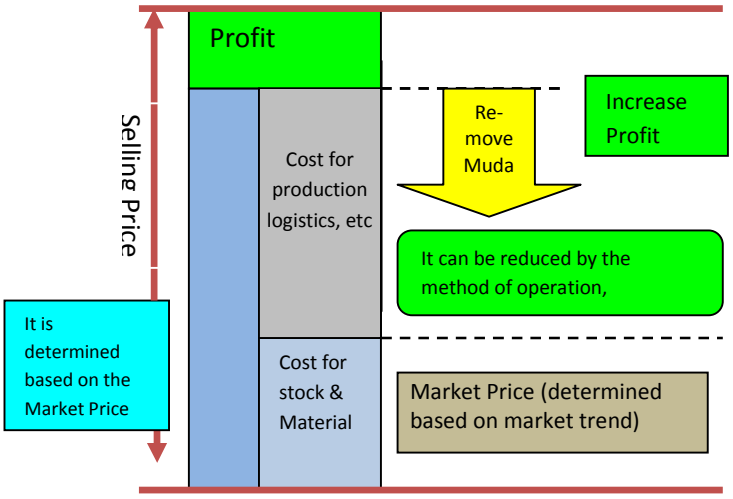


Figure 3: Reducing Cost(Terasawa, Toyota Logistical System, 2008)

2. Toyota's ideal supply chain

In order to realize an ideal supply chain, seamless flow of parts and information according to the JIT concept need to be achieved. Therefore, they need to establish **small lot and high frequent logistics** and realize **short & stable supply lead time**.

In other words, realize the Just-In-Time (JIT) concept that they can procure and deliver the parts when they are needed in the exact amount without increasing stock level. The JIT concept is realized by "Sell-One, Buy-One" operations and linking all processes seamlessly. By realizing the JIT concept, a high suppliability with an appropriate stock level can be maintained. Figure 4 is an image of an ideal service parts supply chain based on a more sophisticated Just-In-Time concept with **Delivery Due Date (DDD)** assurance and short and stable flow. Short and stable flow is established by continuous **KAIZEN** to remove MUDA or stagnation of information and material in the supply chain**,** with increasing frequency and reducing lot size (Terasawa, Toyota Logistical System, 2008).

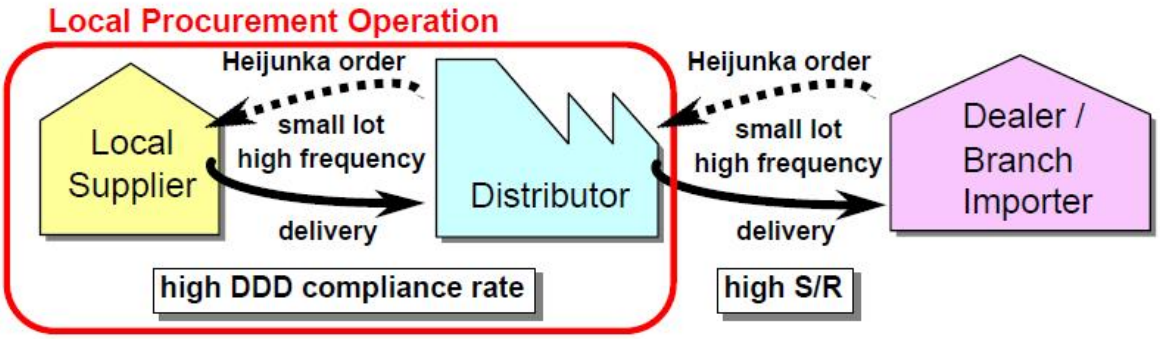


Figure 4: Local Procurement Operation (Local Parts Procurement Kaizen Series, 2006)

2.1.1 Just in Time

Just in Time is: **to deliver only what is needed, at the time it is needed, in the quantity needed.**

Just in Time Logistics is the way to achieve elimination of Muda (waste), Mura (fluctuation), Muri (overburden) that occurs in the operation flow, as well as to increase suppliability for our customers.

"Heijunka", "Pull System" and "Continuous Flow Processing "are prerequisite conditions for the JIT concept establishment. These terms are explained later in this document.

Table 1 describes the JIT concept in terms of how it influences the customer and the logistics operation.

Words	Description	
	For Customer	In Logistics Operation
What Is Needed	Items required by the customer (The quality should be assured)	What the following process needs (wrong, excess, shortage, defective items are unacceptable) The following process means) - For picking Check/sort, Loading process
At the time it is needed	On promised time with the customer	When the following process wants to perform the operation with it
In Quantity it is needed	In quantity required by the customer	In quantity required by the following process
To Deliver	Deliver to the customer	Convey to the buffer stock area

Table 1: Substance of Just In Time (Local Parts Procurement Kaizen Series, 2006)

2.1.2 Heijunka

Heijunka is to level out 'work volume' and 'type of work' per day or period of time. If operation always fluctuates widely, they have to secure the maximum level of stock,

manpower, space, containers and equipment. This causes a lot of Muda in the whole logistics flow and increase logistics costs.

Badly organized operations or disorder of the operation rhythm can also cause deterioration of the quality of work and physical fatigue of operators. Therefore, Heijunka is essential to avoid these unhealthy influences. Figure 6 illustrates the results if Heijunka is implemented. The graphs show a clear indication how this process has stabilized.

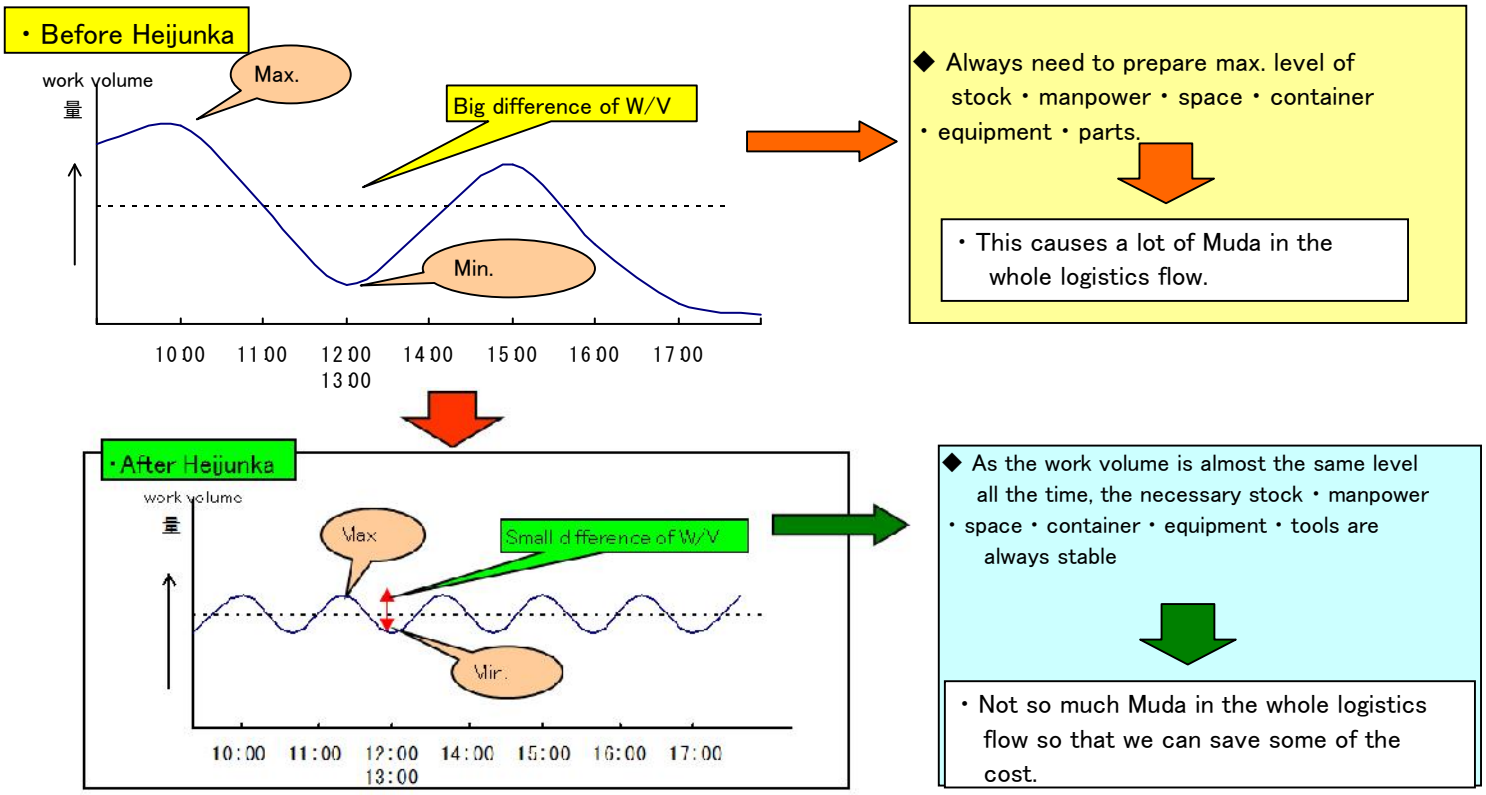


Figure 5: Heijunka(Terasawa, Toyota Logistical system, 2008)

2.1.3 Pull System

It is difficult to deliver only what is needed, at the time it is needed, in the quantity needed with the Push System. Operation contents are continuously changing from time to time during the day. When an operation is performed with the Push system, the situation of the following process is unconsciously ignored. It causes a lot of Muda between processes, such as pile of in-process stock and/or waiting time of the operators. Therefore, to achieve "Just-In-Time", the information should be provided by the process which knows what/when/how much is needed. That is why they need to apply a "Pull system".

Key Points of a Pull System

- Information requirement for the next operation to the preceding process.
- Clarify the instructions (Which tool should be used to inform or communicate)
- The operations instructions should be informed in designated timing

2.1.4 Continuous flow processing

Continuous flow processing means lean and fast flow with no stagnation of products.

The products should be forwarded to the line one by one (minimum required amount) to keep a smooth workflow without any stagnation of either products or operations.

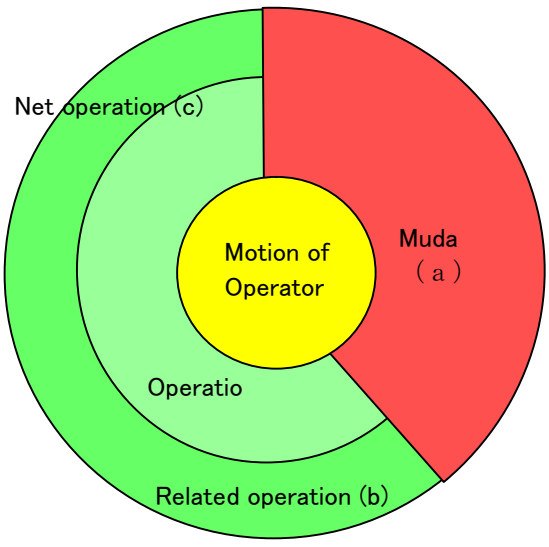
2.1.5 Kanban

Kanban is an essential tool for “Just In Time” operation.

By Kanban information about what/when/how much the following process needs, the preceding process can produce only what the follow-up process needs without any Muda and supply them Just In Time.

2.1.6 Muda

Definition of Muda = Factors which lead to cost increases without any added value. Figure 7 shows how Muda effects the operation and what big part it plays in the complete operation cycle.



a) Muda

It is something totally unnecessary in carrying out the operation. Therefore, it should be easily eliminated (e.g.) waiting, conveyance with no meaning etc.

b) Related operation

Although it doesn’t add any value, it is inevitable for the operation in the current condition.

c) Net operation

Figure 6: Muda

Types of Muda	Tips for finding Muda
Muda of over production	The condition of products flow between processes (Putting many parts into a line together at a time. Binning many pieces of parts per one P/N)
Muda of waiting	• What workers do at the buffer stock area (Waiting etc.) • Products flow (Check if the parts flow smoothly without stagnation)
Muda of conveyance	Contents and current situations of conveyance operation. (Long operation path and conveyance route, temporary staging reversing, shifting from one conveyer to the other, conveyer of nothing etc.)
Muda of processing	The way of storing & packing (Extra packaging and packing etc. for avoidance of damage)
Muda of inventory	Storage condition (Parts with dust, an old date on a TMC label, parts sticking out of the shelves, parts at the reserve area etc.)
Muda of motion	Working environment of workers (Motion which disturbs workers in continuing their assignments) (Looking for, walking, reserving, dropping something and picking it up)
Muda of correction	The result of troubles(data) (Miss-picking miss-shipping, warehouse denial, damage etc.)

Table 2: Types of Muda (Terasawa, Toyota Logistical System, 2008)

2.1.7 Mura (fluctuation)

Work volume temporarily becomes more or less in a day. These fluctuations per period of time are what is called Mura.

2.1.8 Muri (overburden)

For humans, it is regarded as mental/physical overburden imposed on workers. Also, from the mechanical perspective, it is regarded as overpressure on machines more than their capacity.

2.2 Hybrid Cross-Docking

Hybrid cross-docking is especially designed for fast moving parts. BOSAL and MAXE parts are slow moving but hybrid cross-docking will still work perfectly.

Figure 10 shows how such a hybrid cross-docking system works. In short, parts arrive, they are then checked, sorted and repacked for their final destination.

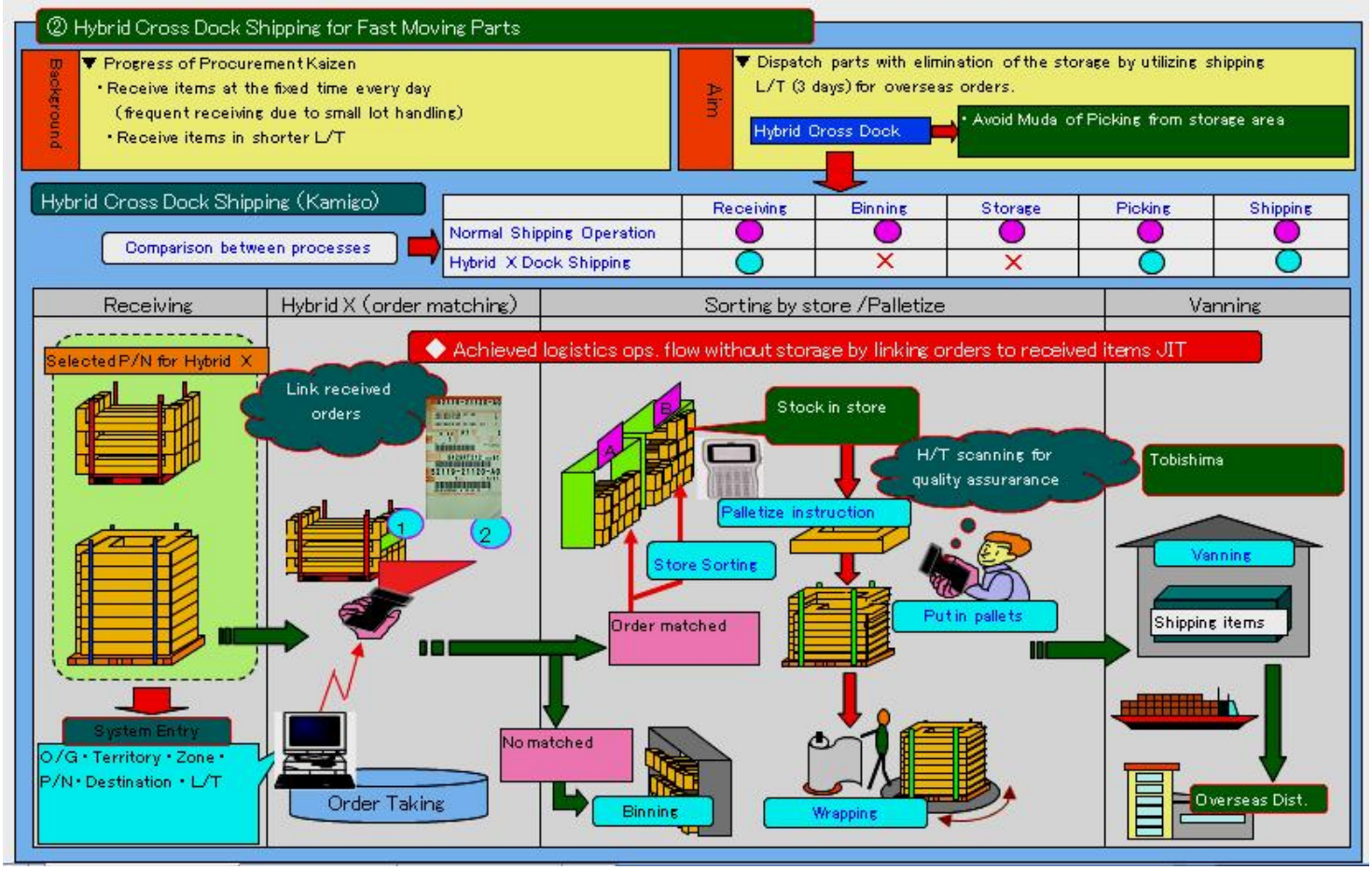


Figure 7: Hybrid Cross-Dock Shipping for Fast Moving Parts (Local Parts Procurement Kaizen Series, 2006)

2.3. Direction for local procurement Kaizen (improvement)

To realize Just In Time concept in local procurement, SHIKUMI (lean plan) must be established. This can achieve a higher Delivery Due Date (DDD), compliance rate and accommodate daily order and daily delivery synchronizing with an actual order from a customer.

To achieve JIT the following points need to be addressed:

a. Maintain high Delivery Due Date assurance

In order to ensure high suppliability to customers, it is important to maintain high DDD compliance from suppliers. Without high DDD compliance, the distributor needs to keep high stock in case of delivery delay. The DDD compliance rate is a common KPI to monitor delivery performance of suppliers.

b. Increase the frequency of the order cycle and the delivery cycle

The direction is a transition to Daily Order and Daily Delivery with minimum delivery units to develop a small lot and high frequency logistics scheme. Daily ordering enables flexibility regarding the following of demand trends. Daily delivery promotes smooth operations in the warehouse due to a constant flow of parts in small quantities.
Consequently, frequent ordering and delivery allows organizations to maintain high suppliability with minimum stock. Therefore, the need to drive for daily order expansion is to establish a fast and cyclic parts logistics flow.

c. Shorten procurement Lead Time
In order to develop short and stable logistics flow, they need to reduce procurement L/T to drive for further customer satisfaction and stock reduction.

2.4 Local Parts Procurement

In order to achieve JIT parts logistics, parts should be supplied timely with shorter lead times by implementing small lot, high frequent order and delivery.
Figure 8 illustrates how the Heijunka order or DDD impacts the flow and stock levels of parts.

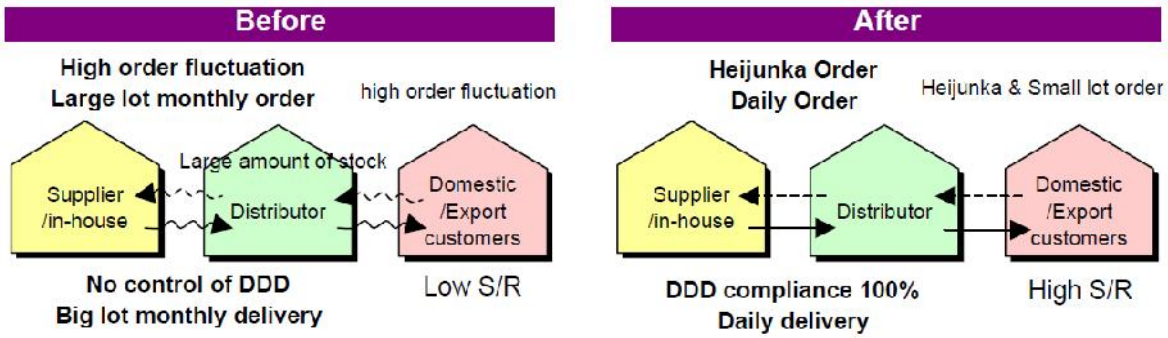


Figure 8: Delivery Due Date (Local Parts Procurement Kaizen Series, 2006)

The best way to achieve high suppliability to end customers while keeping the minimum stock is to pursue JIT logistics throughout the supply chain. It is to connect every process of the chain with small lot high frequent order and delivery. To procure parts stably within standardized and shorter L/T is the basis of JIT logistics.

Based on this concept, the following 6 basic requirements are important to set for Local Parts Procurement :

1. Stock / Non-stock Criteria
2. Procurement Lead Time
3. Order- and Delivery Cycle
4. Delivery Unit (Order Unit)
5. Order Allowance and Forecast Allowance
6. Delivery Due Date

2.4.1 Stock / Non-stock Criteria

The job of Inventory Control is to maintain an appropriate amount of inventory to achieve target levels of suppliability. The stock / non-stock criteria normally mean to define the range of parts to be stocked.

The purpose is:

1. To categorize the stock and non-stock based on the parts demand and characteristic such as space impact and critical availability of parts of parts availability.
2. To maintain high service rate with an appropriate stock level.

2.4.2 Procurement Lead Time

Procurement Lead Time is the period from placing an order to a local supplier until receiving parts at the distributor's warehouse. This is illustrated graphically in figure 9. In case the supplier does not take responsibility to deliver parts to the distributor, procurement lead time is a period from placing an order until shipment is ready to be dispatched at the supplier's warehouse.

The purpose is:

1. To determine the maximum inventory level.
2. To assign a delivery due date for a distributor’s order to a local supplier.
3. To ensure a supply lead time to the customer for back order (B/O) items.

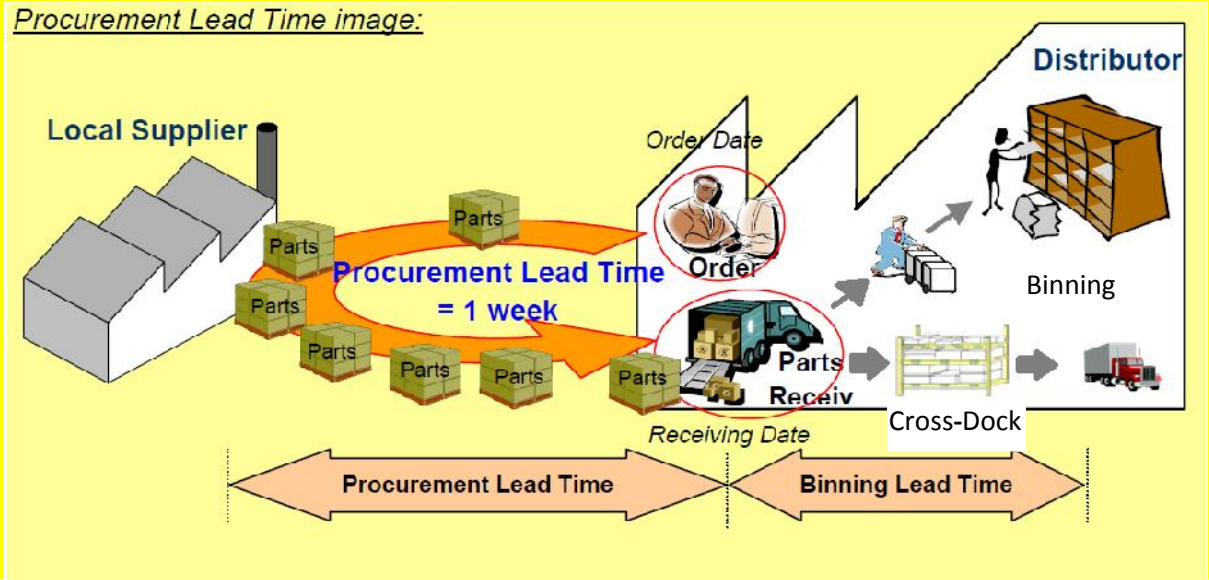


Figure 9: Procurement Lead Time (Local Parts Procurement Kaizen Series, 2006)

2.4.3 Production Lead Times

Production lead time of service parts is defined depending on whether the supplier keeps enough stock of finished parts or not.

In the case of a daily order by a distributor and daily production by a supplier Table 3 should be used to determine an accurate lead time.

Status	Procurement L/T	Note
Order qty > Production lot	Production L/T + Shipping L/T	Supplier don't keep enough stock qty
Order qty < Production lot	Shipping L/T	Supplier always keeps enough stock qty

Table 3: Production Lead Time

In case of past models, suppliers sometimes cannot produce the parts on a daily basis and procurement L/T tends to be longer. Suppliers are requested to make an arrangement to reduce procurement L/T such as to keep the component parts and to shorten the tooling change-over time.

2.4.4 Set Procurement Lead Time based on actual condition.

In order to set procurement lead time based on actual condition, distributors should check the actual process in the work site of the supplier. There are two tools that should be prepared by the supplier to check the actual procurement lead time.

a. Material and Information Flow (Chart A)

From a distributor's point of view, the purpose of this chart is to grasp the outline of the process from placing an order until receiving parts at the distributor's warehouse. The process depicted in Table 4 is how the Toyota system ultimately should function. It typically illustrates the process of the supplier before delivering parts to the NPDC.

b. Lead Time Chart (Chart B)

The flow chart shown in Table 5 shows a proposed lead time of each process from where an order is taken from the distributor to where the order is delivered to the distributor's warehouse.

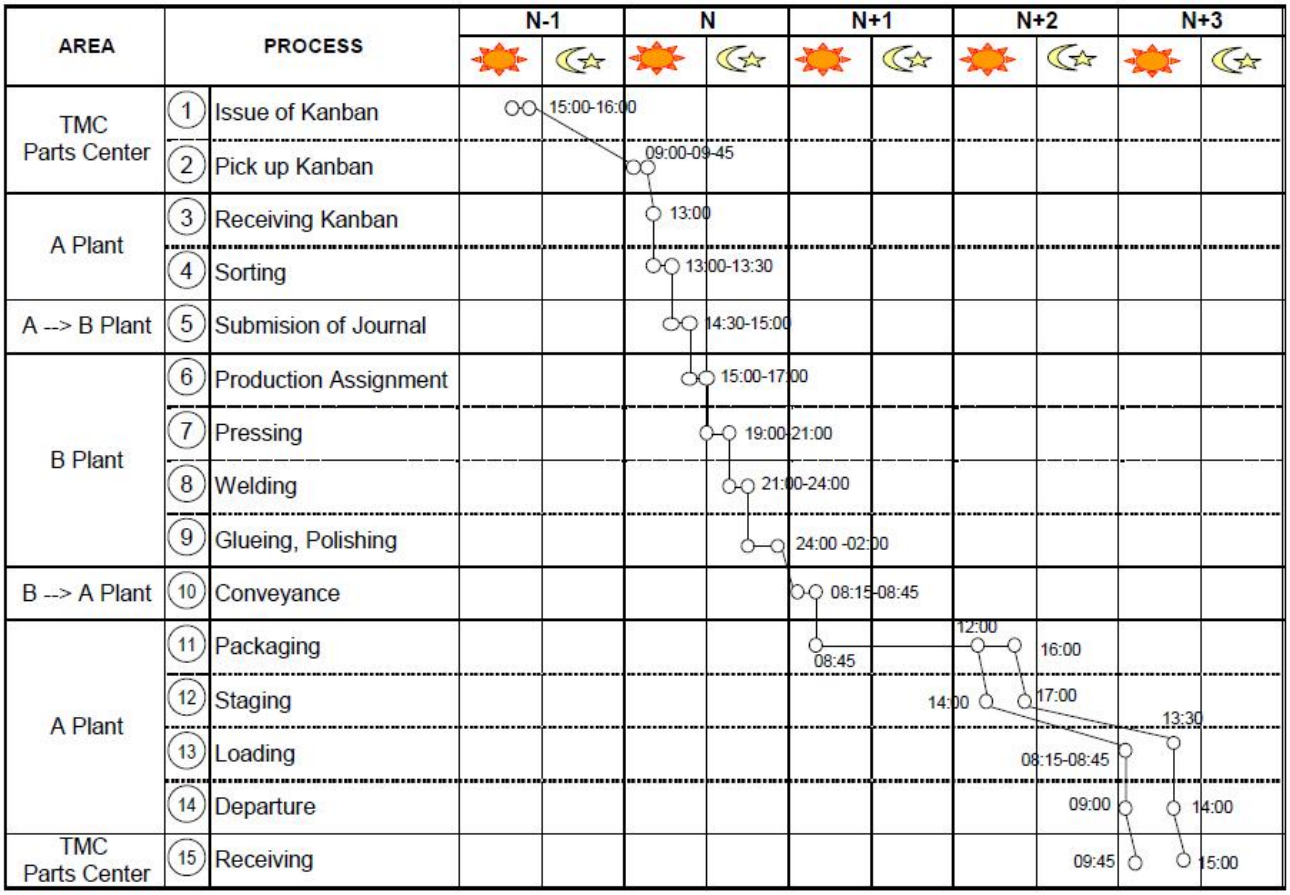


Table 4: Lead Time Chart (Chart B) (Local Parts Procurement Kaizen Series, 2006)

2.4.5 Shorten Procurement Lead Time

After checking the actual lead time in the work site, distributors and suppliers should agree on the appropriate lead time by removing stagnation of information and material in order to achieve a shorter lead time. This process is explained in Figure 11.

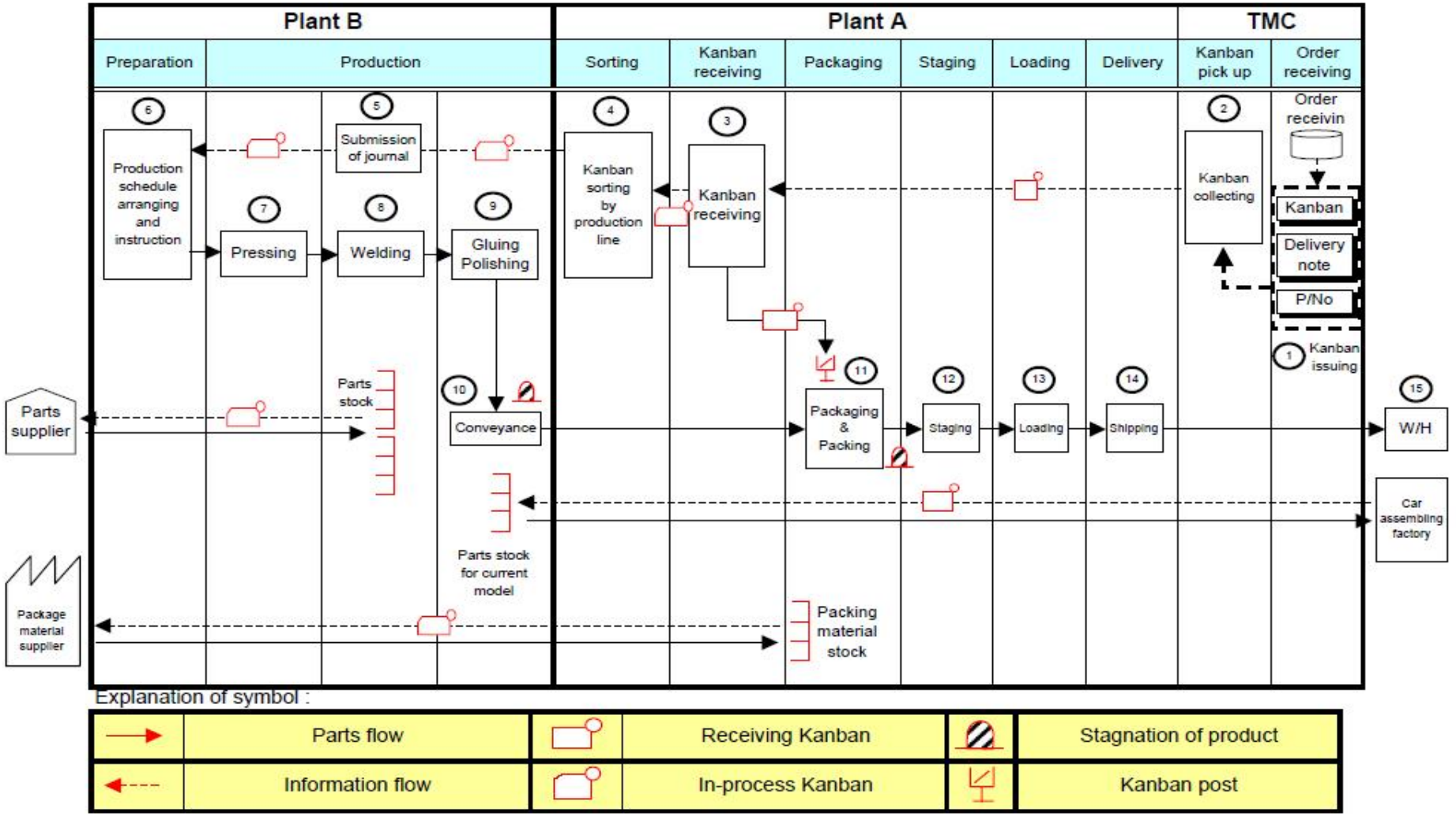


Table 5: Material and Information Flow (Chart A) (Local Parts Procurement Kaizen Series, 2006)

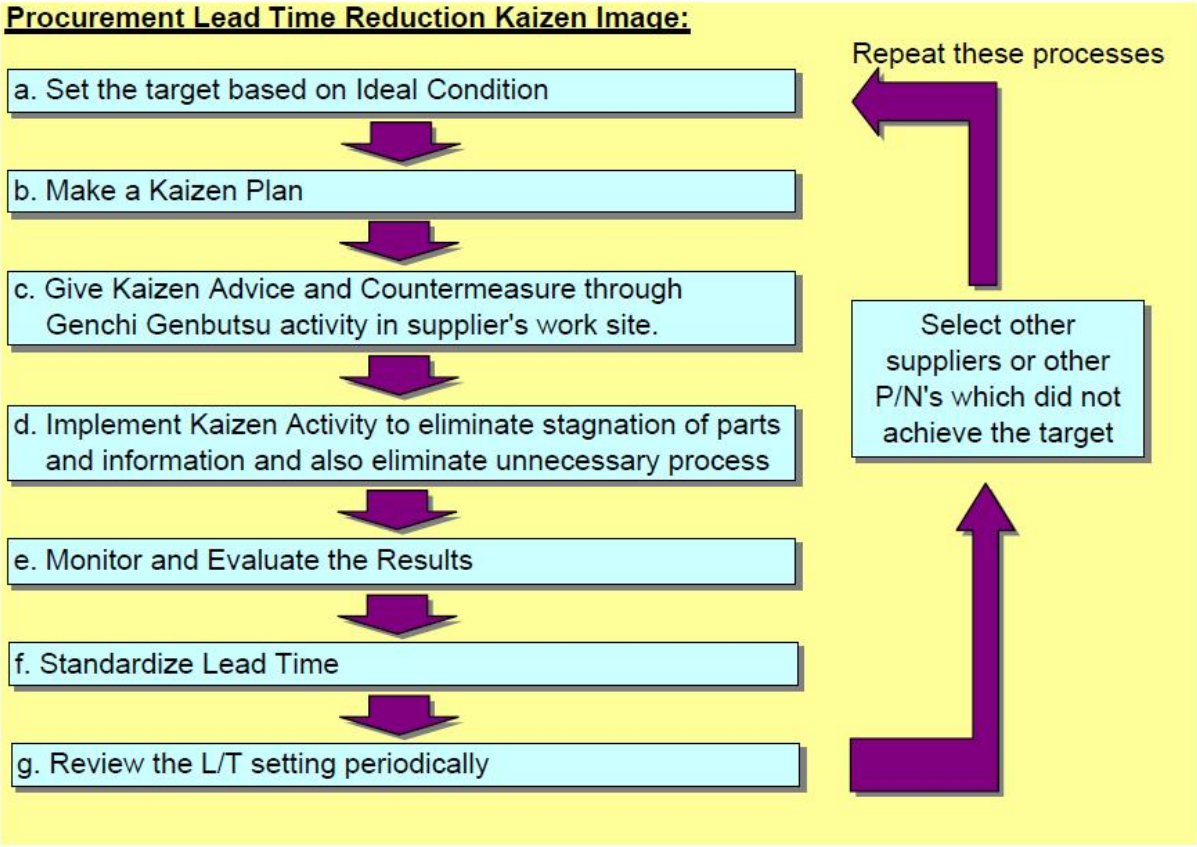


Figure 10: Procurement Lead Time Reduction (Local Parts Procurement Kaizen Series, 2006)

The points in Figure 10 are explained as follows:

a. Set target based on Ideal Condition

To describe the ideal condition, the distributor can use the best Local Supplier with the same type of production process as a reference and if their local supplier is not enough to describe the ideal condition, a distributor can refer to the best supplier in other distributors or Toyota Motor Company (TMC).

b. Make a Kaizen Plan

The distributor is requested to make a Kaizen (improvement) plan to organize procurement lead time Kaizen at the local supplier. The distributor is also requested to select a supplier and a priority number (P/No) which become the object of Kaizen based on the target and the expected impact on the distributor. A P/No which has a procurement lead time longer than the target will be the object of procurement lead time reduction Kaizen.

c. Give Kaizen Advice and Countermeasure

Based on Table 4 (Chart A) and Table 5 (Chart B), the distributor and supplier are requested to check the work site (Genchi Genbutsu) to understand the current condition. During work site check, the distributor is requested to try and find Muda in the process and give advice to reduce Muda and procurement L/T.

Lead time chart before Kaizen

The stagnation of information and material becomes clear by developing Chart B (Figure 10) for "Drum Brake Shoe" Order**.**

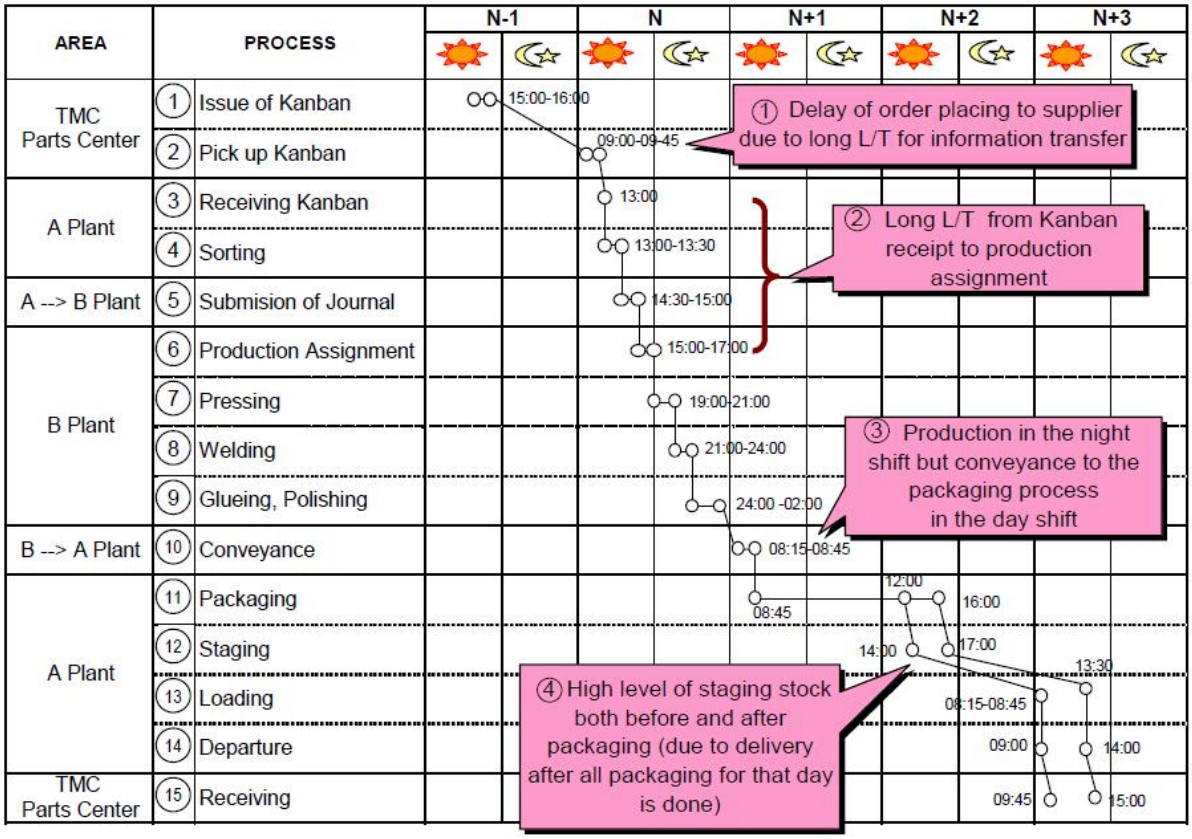


Figure 11: Lead time chart befor Kaizen

d. Kaizen Activity

Both sides (distributor and supplier) are responsible to reduce lead time in each operation in order to reduce procurement lead time. The supplier is required to do Kaizen and the distributor can give support with Kaizen advice and improving the ordering manner to the supplier.

e. Monitor and evaluate the results

Kaizen activity should be implemented within a certain period and the distributor needs to monitor the results with the supplier during that period. Then, the Kaizen result will have to be evaluated.

Lead time chart after Kaizen

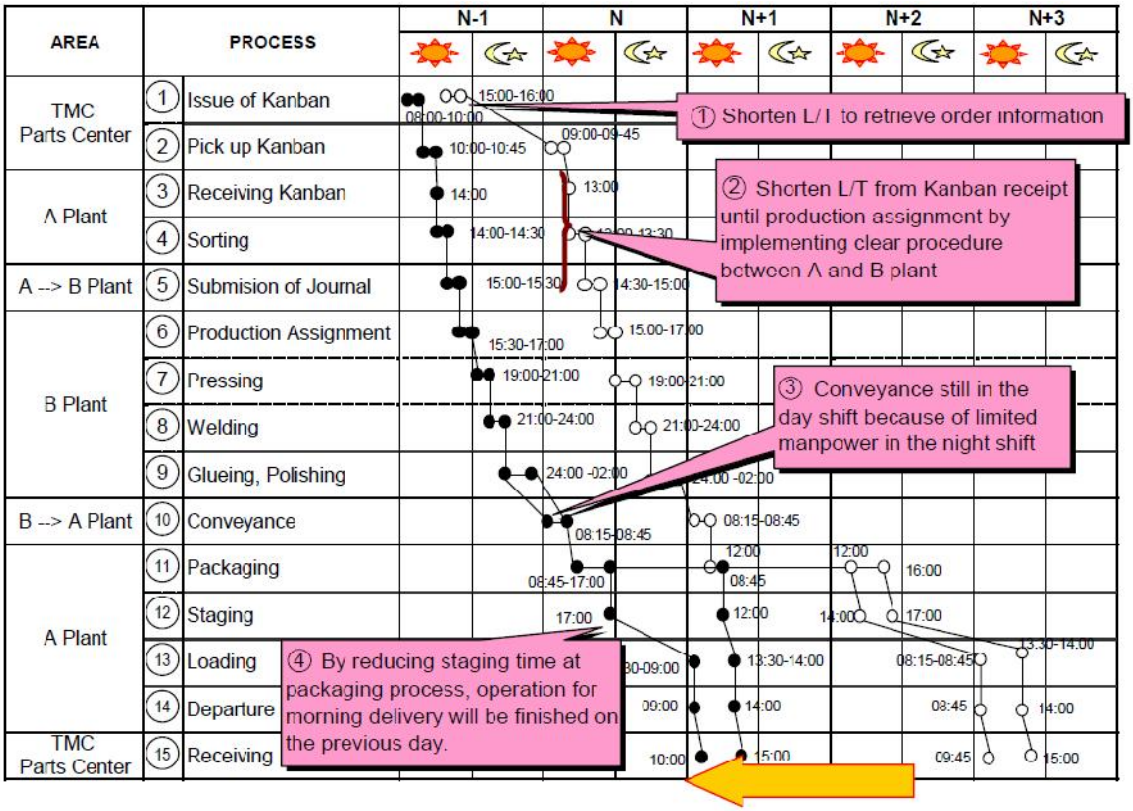


Figure 12: Lead Time Chart after KAIZEN

f. Standardize Lead Time

Based on the evaluation results, the distributor standardizes procurement lead time with the suppliers.

When setting the standard L/T, it is effective to classify the P/Nos by the factor impacting production condition such as 1) commodity, 2) production line, 3) current model or old model, 4) in-house parts or suppliers, 5) the location of factory etc.

2.5 Order Cycle and Delivery Cycle Setting

2.5.1 Order Cycle

Order Cycle is an interval from one order to the next. Delivery Cycle is a period from one delivery to the next.

The purpose is:

1. To place an order in a timely manner and get the parts delivered in an appropriate cycle.
2. To reduce stock while maintaining high suppliability.

It is preferable to have daily or more frequent order cycles and delivery cycles to realize JIT and Heijunka logistics.

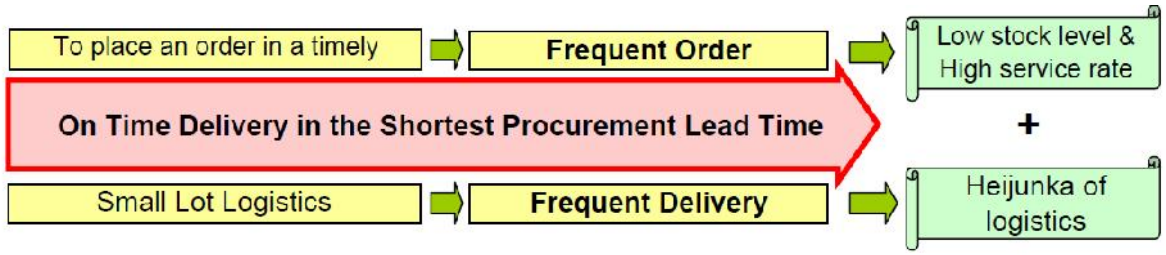


Figure 13: Heijunka Logistics

To realize "Just in Time", that is to place an order for just the right quantity in a timely manner, the purchase order quantity should be minimized and small lot logistics should be implemented in the service parts operation. Frequent Order and Frequent Delivery are important in order to realize these conditions.

2.5.2 Delivery

Frequent delivery helps to handle smaller stock in the warehouse. In local parts procurement, it's ideal to implement daily order and daily delivery. However, the increase of delivery frequency will cause an increase of transportation cost. This is because the number of delivery increases and subsequently the truck fill rate decreases. In order to improve transportation efficiency, combined delivery can be utilized in the case of loading volumes lower than the limit.

Figures 14, 15 and 16 show three types of combined delivery:

a. Consolidation of OE and service part

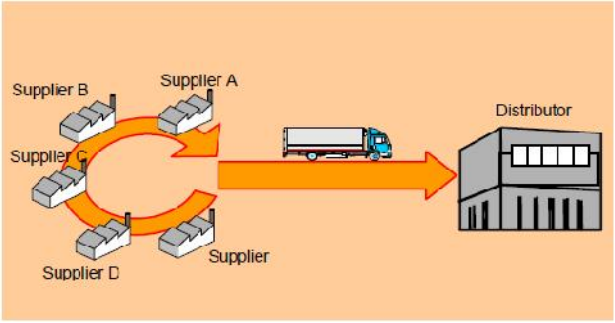


Figure 14: Consolidation of OE and Service Parts

b. Consolidation of OE and service parts

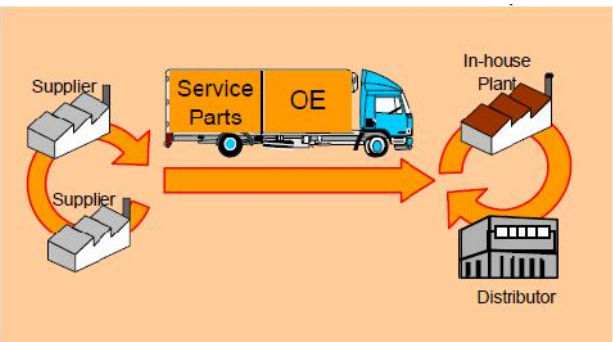


Figure 15: Consolidation of OE and Service Parts

c. Consolidation in transit

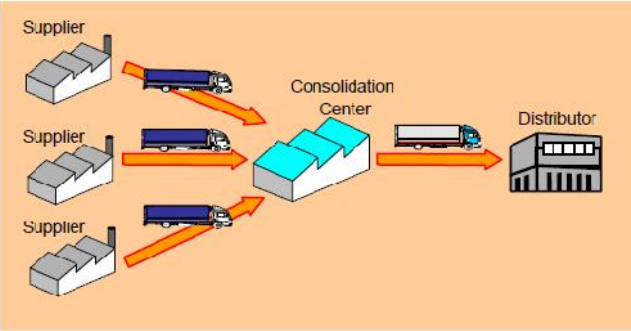


Figure 16: Consolidation in Transit (Local Parts Procurement Kaizen Series, 2006)

2.5.3 Summary

The Toyota Way is a set of principles and behaviors that underlie the Toyota Motor Corporation's managerial approach and production system.

- The Toyota way is trying to eliminate unnecessary stagnation of information and products. Shikumi (lean plan) of smooth workflow is established by realizing Just In Time. As for Jidoka (intelligent automation), Shikumi of operation control is incorporated into machines. These operational Shikumi are all based on the Toyota way.

  However, people manage all operation in warehouse logistics. It is required for all workers to completely understand Just In Time and Jidoka so as to incorporate Toyota way into logistics operation. This Shikumi (Toyota Logistics System) enables them to clarify problems/irregularities hidden in daily operations, that is, they can implement Kaizen more effectively.
- In order to realize this ideal situation, it is important to incorporate rules and standards into Shikumi so that workers can detect what is normal versus irregular or abnormal. Even in perfect logistics Shikumi, Muda (waste), Mura (fluctuation) and

Muri (overburden) momentarily occur almost every day because the work volume normally fluctuates.

2.6.1 Cross-Docking – Overview

In today's high velocity supply chain world, the focus on distribution methods that will drive efficiency and increase customer satisfaction is very important. Customers expect products when they are ordered on-demand, with a reasonable level of compliance. With the main focus placed on customer service, companies have moved away from a supply driven business towards a demand driven business. Ways in which inventory and holding cost can be reduced lies high in most companies' priorities. This high velocity has forced companies to search for ways to move their products faster and more cost effective and also to reduce the cycle time.

The number of Stock Keeping Units (SKU) has increased dramatically over the years. This increase has added complexity to the business environment and has also increased the cost and time needed to manage these situations. The pressure runs high on the heads of departments since they are required to stock shelves with the right product and ensure that the customer demand is met all the time. To achieve all the goals that the industry throws at one, cross-docking has become important and is seen as a core aspect in the distribution strategy (Nieuwoudt, 2010).

Figure 17 is a graphical representation of how cross-docking works.

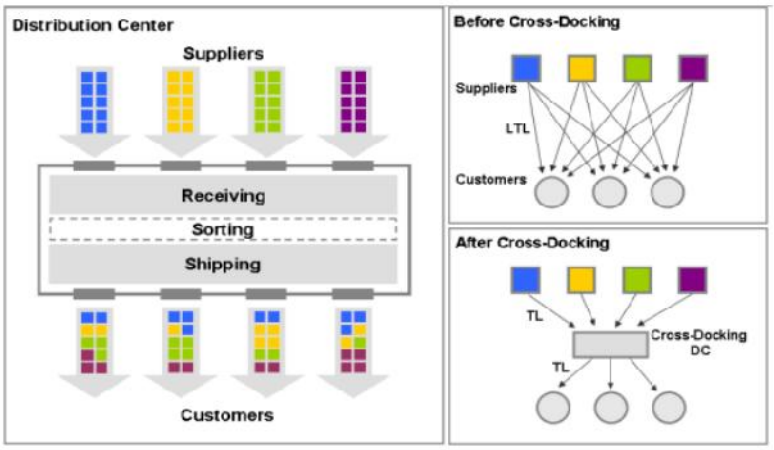


Figure 17: Cross-docking Operation Process (Ji, 2010)

2.6.2 What is cross-docking?

As per definition cross docking is the practice of receiving products and immediately shipping it out without putting it in a warehouse (Fulcher, 2011). In other words cross-docking is a system that relies on speed and agility and is normally used in hub-and-spoke operations as can be seen in Figure 1. When the need for a storage facility can be eliminated, inventory can move quickly from one end of the supply chain to the other. It is a fairly simple way of handling inventory that involves loading and unloading inventory from an incoming truck onto an outboard truck (Nieuwoudt, 2010).

Given that demand is increasingly volatile, it comes as no surprise that cross-docking continues to gain favor. Indeed, companies increasingly implement cross-docking as a means to reduce costs, manage inventory levels, increase efficiencies and accommodate unpredictable customer demand (The Benefits of Cross-Docking, 2011).

Cross-docking is very simple, but requires detailed planning and collaboration with partners. Companies need to know all about the shipment and the final destination of the goods or parts. It is expensive and time consuming to set up the required infrastructure. It is vital that the success is not dependant on technology; however the right system can smooth out problems and increase visibility in the chain (Nieuwoudt, 2010).

2.6.3 Planning for Cross-docking

There are numerous methods of cross-docking:

1. **One touch:** this is considered as the method with the highest productivity since products are not loaded on the dock, but from one truck onto another.
2. **Two-touch**: the focus is on load optimization and driving efficiency. Inventory is received and staged on the dock, without making use of a storage facility.
3. **Multiple-touch**: products are received and staged for reconfiguration and customization

Cross-docking can be split into two further sections:

- **Pre-Packed Cross-Docking**: The supplier decides on the packaging. The parcels are then received and carried to the outbound docks so that products from other suppliers that are packed in the same sort of packaging are combined and loaded into a delivery vehicle. These vehicles then drive directly to the dealer whose order it is. This eliminates extra handling on the parts. This process is also called Pre-Distribution and can be described as the customer or dealer in this case, being

assigned before the shipment leaves the supplier (Cross-Docking Distribution Center).

- **Intermediate Handling Cross-Docking:** When a package is received from a supplier, it is unpacked, sorted and then re-packed. The new package receives a new label which indicates the new destination and part number. The new package is then sent to the outbound dock to be combined with a similar package from another supplier. This is then packed in the delivery vehicle destined for the dealer. This is also called Post-Distribution Cross-Docking. Which means the cross-dock itself allocates the parts to the dealers (Cross-Docking Distribution Center).

Pre-distribution is definitely more difficult to implement because the suppliers of the cross-dock must know which customers of the cross-dock need what before they send the shipment. This involves quite a bit of information transfer, system integration, and coordination. But it is a much faster process and less labor intensive at the cross-dock itself.

When looking at Toyota as a whole, the increased reliance on Just-in-Time (JIT), leads to result in parts being shipped much faster and more regularly but in smaller quantities. By making use of cross-docking, Toyota has reduced distribution cost by consolidating smaller part supplies into consolidated loads. Cross-docking has allowed companies to increase JIT and remove good-for-nothing operations in the organization.

The cross-docking facility that Toyota currently uses has allowed them to increase delivery frequency and in some cases even double delivery cycle time. But some of these systems are not as optimal as they can be and there is still much room for improvement.

2.6.4 Common Types of Cross-Docking

Several types of cross-docking can be practiced, namely:

Full pallet load operation: This is the simplest and usually the least costly version, which involves receiving an incoming load that is marked and separated by outgoing orders. The pallet loads are simply sorted and re-routed into outgoing trucks destined for different destinations.

Case-load order makeup: In this version merchandise arrives at the dock sorted and marked by SKU. However, the goods must be segregated by customer order, generally requiring that pallet loads be broken down. Cases may then be re-palletized and the new loads delivered to appropriate outbound vehicles.

Hybrid cross-docking: In some cases materials in storage at the warehouse are blended in with incoming materials, and these newly completed palletized orders are then routed to outbound trucks. Likewise, some of the incoming goods may be routed to temporary storage in the warehouse instead of all being cross-docked.

Opportunistic cross-docking: "Hot" items, such as late-arriving products on back order, are often cross-docked rather than being placed in inventory and order picked. Such goods may be cross-docked directly upon receipt, or combined with items from storage. The operation can be vital in enhancing customer service.

Truck/rail consolidation: Products may sometimes come in by both truck and rail, and need to be consolidated in order to complete customer orders. Here the goods are combined and sorted for shipment within 24 hours to 48 hours. A related tactic is pool-car forwarding. Here the goods are picked up by truck and transferred to a rail boxcar at the shipping origin point. Then, at the rail destination, the goods are unloaded and transferred back into trucks for final delivery.

Short – term storage: Promotional or seasonable merchandise, or awkward, bulky items, may be stored temporarily off-site, or in a yard trailer, until just before shipment, when they are moved to the cross-docking area. This approach works well for a space-limited warehouse, or where warehouse handling may be extremely tedious and time consuming.

2.6.5 Planning and Designing the Operation

At the Efficient Consumer Response – Russia (ECR-RUS) third annual conference, the following principles have been highlighted when planning and designing a cross-docking operation (ECR-RUS third Annual Conference, 2007).

2.6.5.1 Dock-area layout and capacity

Most cross-docking operations are concentrated at receiving and loading docks. It is therefore important to have:

- The right number of dock doors
- As much dock space as possible, by eliminating shelves
- Visible floor layouts, processes and systems
- Well laid-out visible floor areas to enable management by sight
- Clear floor policy at the end of shift periods

2.6.5.2 Yard Management

Cross-docking has a rigid schedule. To keep to the schedule there needs to be a yard manager on hand to ensure that trucks are spotted at the right doors at the right times, resolve equipment issues, and coordinate incoming and outgoing trucks so that delays can be avoided.

2.6.5.3 Material Handling Equipment

Because it is important to move large volumes of parts in a short time, the right material handling equipment is needed. A forklift may be used for parts that are stacked on pallets. Even a conveyer system can be put in place to speed up the process.

2.6.5.4 Personnel

Cross-docking cannot fully achieve its objective without a good core of receiving/shipping supervisors and logistical planners. Supervisors must be able to recognize opportunities for pre-receiving or pre-allocating receipts before the actual product arrives.

2.6.5.5 Communication and information systems

Information an all inbound parts should be in place before the shipment arrives. With the knowledge of what parts to expect, all outbound information flows of what, where and when goods need to be shipped**,** must be clear. Labeling should be printed with the necessary part numbers and routing information on it.

Cross-docking relies on continuous communication between the suppliers, distribution centers, and all the dealers**.**

2.6.6 Operational and Planning Problems at a Cross-docking facility

According to the operational process of cross-docking, there are several operational and planning problems to be solved with a cross-docking facility. It is important to decide the shape and the layout of the cross-dock first, where the inbound doors and the outbound doors should be located. Next**,** it must be determined which policies will be assigned to the inbound and outbound trucks; for example first-come-first-serve. Once the trucks are assigned to doors, machines and/or workers need to be assigned to the trucks. All these problems are related to the operational cost of a cross-docking facility (Ji, 2010).

The reasons that some cross-docking operations fail is because there is a lack of understanding of the system requirements. There are five categories for cross-docking requirements:

- The partnering with other distribution chain members;

- The need to be absolute confident in the product quality and availability;
- Communication between supply chain members;
- Adequate Personnel, equipment and facilities; and
- Tactical management

The technical management is probably the most important aspect within the system (ECR-RUS third Annual Conference, 2007).

2.6.7 Implementation and Maintenance

It is always good to start with a pilot program. It will allow you to experiment with various methods on small scale and should any weaknesses occur, they can be resolved before it is implemented on an entire line or network of facilities.

There should always be a plan for any contingencies that might occur. This may include keeping a small inventory of cross-docked product in your facility.

There should also be standard operating procedures in place so that orders are not delayed and products can still be cross-docked even when fewer units than expected are received.

Once the cross-docking operation is functional and running smoothly, it does not mean there is no room left for improvement. Supply and demand conditions change constantly, so constantly monitor cross-docked products to determine their sustainability in the current program (ECR-RUS third Annual Conference, 2007).

2.6.8 Conclusion

It can be clearly seen that such a system can only run smoothly with full cooperation with all departments concerning this process. Material handling equipment need to be up to standard and communication between the suppliers and the facility is vital to have a successful cross-docking process.

CHAPTER 3 – Current Operations

3.1 The current cross-docking operation

3.1.1 Placing an Order

Toyota uses a system called e-Toyota. It is on this system that a Toyota dealer places his order. Parts are divided into different categories. BOSAL and MAXE part orders are called Direct Supply Orders (DSO). A DSO is where the supplier delivers straight to the dealer. When a Toyota dealer places his order on the e-Toyota system, the Toyota administrators place the order with the supplier. There is a system called collaborative exchange (CX). Each supplier and each dealer can access this system and track the progress of the order. This is illustrated in much more detail in Figure 14 on the next page.

3.1.2 Delivery of BOSAL parts

BOSAL is located in the eastern parts of Pretoria. BOSAL makes use of their own trucks to do their deliveries on a daily basis (depending on the orders). BOSAL delivers directly to all the dealers in the Pretoria, Centurion, Midrand and Johannesburg areas. All other dealer deliveries are done by Toyota. The BOSAL truck can be expected almost on a daily basis between 9:00am and 11:00am.

The main problem with the current situation is the difference in expected arrival times from BOSAL. It makes it very difficult to plan ahead when one does not know the exact time the truck will arrive. Although the orders from the dealers to the suppliers can be traced by Toyota, it is still impossible to know the exact quantity that will be delivered each day.

The Advanced Shipping Notice (ASN) is already checked and signed off at the entry gate to ensure that the quantities on the truck match those on the paper. The truck content is off-loaded immediately upon arrival. Outer case labels are printed as soon as the list is checked and signed. The parts are then sorted according to their dedicated routes.

Figure 19 is a picture illustration where the BOSAL parts (in the stack left in the picture) need to be sorted according to their routes in the Blue and Yellow bins. An example of an Advanced Shipping Notice (ASN) is shown in Figure 20. Outer case labels are stuck on each part to indicate their delivery address as well as the designated route. An example is shown in Figure 21. A picture of parts that are sorted according to their specific route can be seen in Figure 22

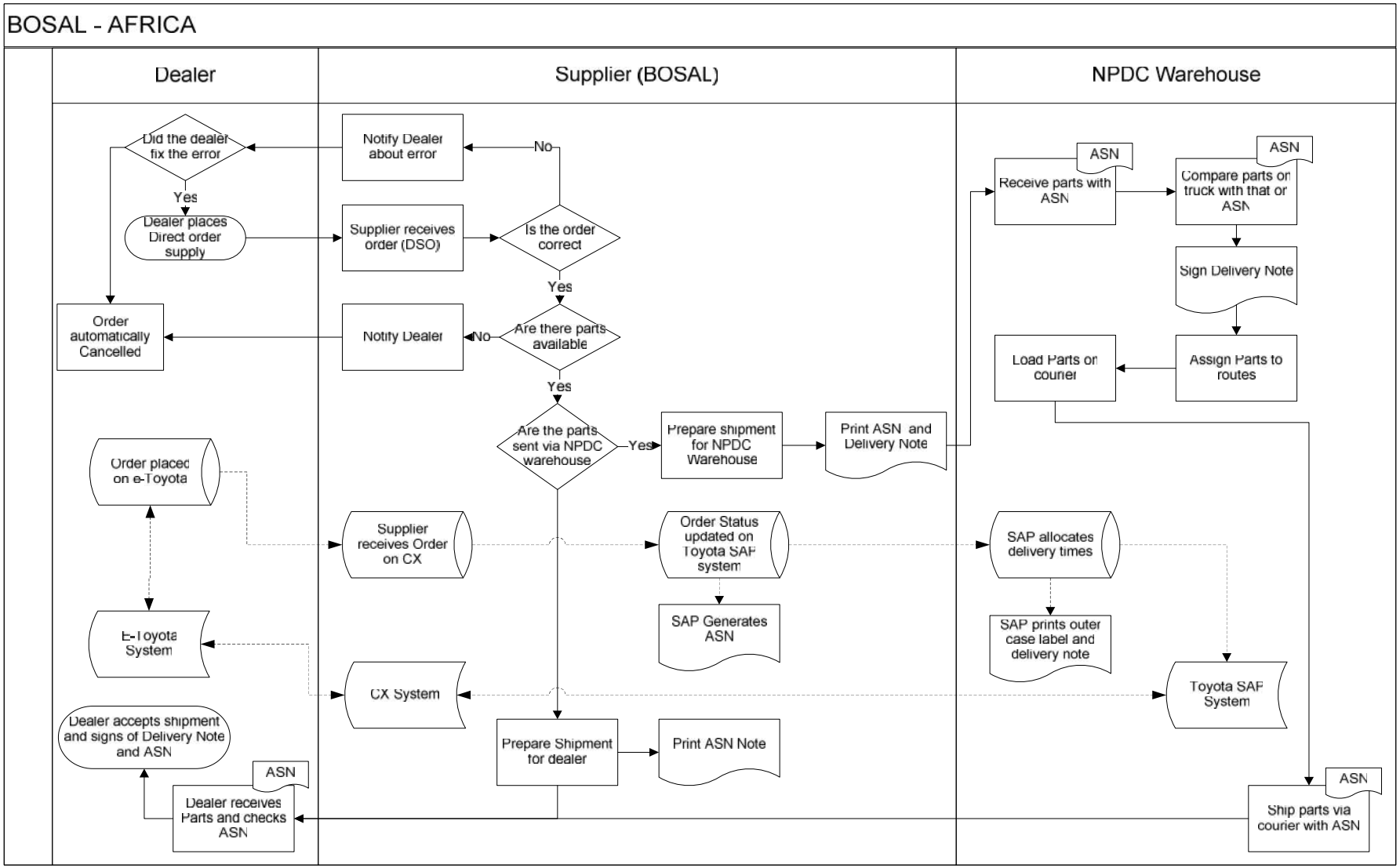


Figure 18: Work Flow diagram of BOSAL

Figure 19: BOSAL parts ready to be sorted

Figure 20: Advance Shipping Notice

Figure 21: Outer Case Label

Figure 22: Parts sorted according to route

3.1.3 Time study of truck arrival

The times in Table 6 are a clear indication of how the current system behaves. There is only one BOSAL truck per day. The time it takes for the parts to be ready for dispatch is directly influenced by the size of the delivery. The dispatch area opens at 11:00 am each day and the first trucks already depart at 12:00 sharp. This means that the BOSAL parts, on the date of the 31 July, missed the first round of couriers, resulting in an unnecessary increase in the lead time of up to a day for some of these parts. One more major concern with this is, that complaints do not go to BOSAL but to Toyota instead, leaving Toyota with unhappy customers. This situation is shown in Figure 23.

Date	Truck Arrival Time	Parts Ready for Dispatch	Shipment Size	Dispatch opens for first couriers to be loaded
31/07/2012	10:40 AM	12:00 PM	Large	11:00 AM
02/08/2012	10:00 AM	10:30 AM	Small	11:00 AM
06/08/2012	09:00 AM	10:00 AM	Medium	11:00 AM
08//08/2012	10:20 AM	11:10 AM	Medium	11:00 AM
13/08/2012	10:00 AM	10:50 AM	Large	11:00 AM
16/08/2012	09:30 AM	10:10 AM	Small	11:00 AM
21/08/2012	10:30 AM	11:30 AM	Large	11:00 AM

Table 6: BOSAL Truck Arrival Times

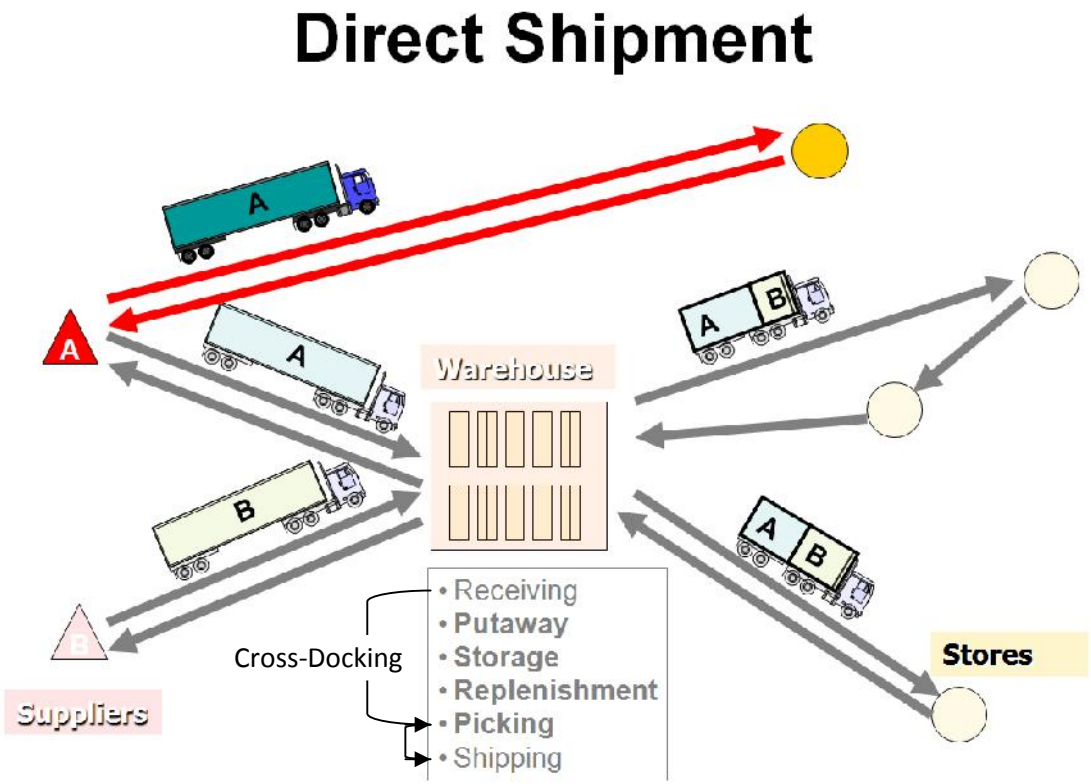


Figure 23: A graphical representation of the current scenario

3.1.4 Conclusion

Time is a critical factor in a cross-docking facility. The system as it is in its current state does work, but there is a need for consistency. BOSAL trucks need to be scheduled in a time slot and they should keep to that time slot. Accidents do happen, e.g. because of a flat wheel or traffic congestion, but these situations need to be taken into account when the truck is allocated a time. A late truck can result in an extension in the lead time of specific parts and these delays can be up to a day. Customer satisfaction is extremely important and should not be ignored.

3.2 Lead time

3.2.1 MAXE Lead Times

The ordering process of MAXE works exactly the same as with that of BOSAL. It is also classified as a DSO. The only difference is that MAXE does not deliver any of their products at the Toyota warehouse. MAXE makes use of Time Fright who distributes their products to all their customers. The main problem with this is that Toyota has absolutely no control over the parts. Because Toyota dealers place their orders on the e-Toyota system, it is expected from Toyota to deliver a quality product on time over which they have no control.

To solve this problem, the whole distribution system of MAXE needs to be compared with that of Toyota. Toyota has a massive distribution channel where they can deliver parts to each dealer in South Africa on a daily basis. One does not want to take away business from Time Fright, but instead of delivering to the entire SA, they can deliver to Johannesburg from where it will be re-distributed to all the dealers, including those in Botswana and Namibia.

3.2.2 Conclusion

Toyota is the leading auto manufacturer in South Africa. This also means that they have by far the most dealers and service centers around the country. To serve each dealer on a daily basis requires a huge distribution channel. Toyota makes use of six different courier companies in South Africa. MAXE on the other hand only uses Time Fright as their primary courier for Toyota products. Therefore it is logical that the lead times for these six different couriers will be shorter than that of one, namely Time Fright. Hereby one can conclude that by consolidating MAXE products into the Toyota distribution channel will lead to a reduction in lead time of MAXE products in all provinces with the exception of Kwa-Zulu Natal.

The administration of these distribution channels is done by the courier companies. The amount of parts that are supplied by MAXE in comparison to the total amount of all to be transported is significantly small and will not have a major impact on the current operation.
A further advantage is that this proposed change is much greener, as loads are consolidated, resulting in less trucks on the road that equals less carbon emissions.

CHAPTER 4 Proposed Solutions

4.1 BOSAL Cross-Docking

One of the major concerns of the cross-docking operation was time. To solve this issue it is important to be able to schedule incoming BOSAL trucks at least a day in advance. This will ensure that operations are ready upon arrival of the truck. BOSAL delivers once almost every day. The expected overall time is around 10:00 am but nobody is ever sure when the truck arrives exactly. To schedule a BOSAL truck on any specific day, BOSAL needs to inform Toyota of the time they will be expected to deliver and also the size of load that can be expected. The BOSAL truck needs to be at the warehouse any time before 10:00am. The earlier the better, so that the parts can be sorted and be ready to depart with the first trucks at 11:00am.

To help speed up this process BOSAL now sends a list of the parts and their destination by e-mail the day before the truck arrives. This helps, so that the warehouse is prepared for the incoming parts. Invoices and outer case labels can be prepared in advance. In Figure 24 a basic flowchart illustrates how the new process is working.

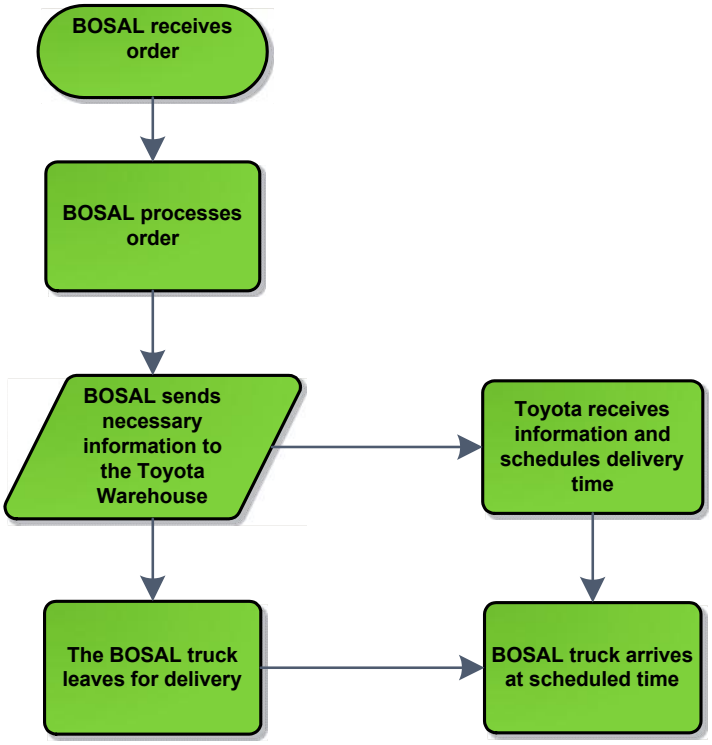


Figure 24: Flow chart of the new process

Table 7 depicts a typical list that is sent from BOSAL to Toyota in advance. The list shows the part number, as well as the quantities of each part. These parts are linked to an invoice which number is also provided for clarity. Each batch is linked to a destination. Figure 25 shows-what a typical outer case label looks like. This label is based on the list as illustrated in Table 7. This particular batch is to be delivered to Vereeniging. The courier that will deliver these parts, is Namlog. The time and date when this label is created, is also indicated.

Figure 25: Outer case label

TOYOTA NPDC - 31/07/2012				
PART NUMBER	**QTY**	**REFERENCE**	**INVOICE**	**DESTINATION**
F.141.202.CPA	10	135512	177410	WINDHOEK-PUPKEWITZ TOYOTA
TAC274	1	135422	177316	POLOKWANE
1-890-040	1	13548	177362	OUDTSHOORN
1-277-040	1	135448	177362	OUDTSHOORN
15TT40CPA	1	135386	177286	WESTONARIA
14TT81CPA	1	430254	177306	NEWCASTLE
14TT81CPA	3	135430	177304	NYLSTROOM
14TT74CPA	1	135499	177402	CERES
14TT81CPA	2	135501	177396	PAROW
F.141.202.CPA	3	135400	177296	TZANEEN
14TT84CPA	1	135507	177398	PONGOLA

F.141.202.CPA	1	135457	177349	OTTERY
F.141.202.CPA	1	135425	177300	HARRISMITH
F.141.202.CPA	1	135424	177332	PUTSOE MOTORS TOYOTA-MAPUTU
F.141.202.CPA	3	135426	177299	GROBLERSDAL
F.141.202.CPA	10	135421	177309	POLOKWANE
14TT80CPA	1	135455	177348	DURBAN
14TT80CPA	2	135427	177302	RIVERSDAL
F.141.136.CPA	1	135479	177375	GROBLERSDAL
F.141.136.CPA	1	135399	177297	FRANCISTOWN
F.141.136.CPA	2	135492	177391	LENASIA
F.141.136.CPA	3	135509	177388	NYLSTROOM
F.141.136.CPA	4	135503	177389	POTGIETERSRUS
15TT39CPA	1	135440	177386	VREDENBURG
15TT39CPA	11	135443	177385	PARK RYNIE
F.141.136.CPA	2	135429	177429	VEREENIGING
14TT81CPA	5	135429	177429	VEREENIGING
15TT46CPA	2	135429	177429	VEREENIGING
14TT81CPA	1	135517	177409	LOUIS TRICHARDT

Table 7: List of parts and their destinations

An ASN, as depicted in Figure 26, is dedicated per dealer. This ASN is checked at dispatch at the BOSAL plant to make sure that all the parts are on the truck. The note is then again checked at the gate before entering the Toyota premises. Once the truck contents are off-loaded, the note is checked and signed before it is dispatched. Figures 25 and 26 explain how the paperwork corresponds with the list in Table 7.

Figure 26: Advanced Shipping Notice

4.2 MAXE Lead Time Analysis Results

The given lead times are average times. Delivery times of both Time Fright (Courier used by MAXE) and delivery times done by Toyota's own couriers are plotted against each other to determine if there is actually a difference in the lead times of various destinations as depicted in Figure 29. The data received from Time Fright and Toyota is attached in Appendix A.

Lead time is an important aspect of a supply chain. By reducing the lead time, customer satisfaction increases. This is the primary reason why this project is done. The other aspect is that Toyota will have more control over their parts if they do the deliveries themselves.

NPDC is the lead time from where the courier picks up the part till it reaches its destination. The blue and green bars indicate the lead time of parts from the MAXE supplier to the NPDC warehouse and from the NPDC warehouse to the dealers respectively. The overall lead time difference for Gauteng is small, but because Gauteng is the biggest consumer of MAXE products it might be better if Gauteng products remain outsourced to Time Fright. This suggestion is purely based upon the large quantities and limited space requirement at the NPDC warehouse. For provinces like North West, Mpumalanga, Limpopo, Northern Cape and Western Cape, this proposal should be highly considered as the lead times done by MAXE are much longer than those done via the NPDC warehouse.

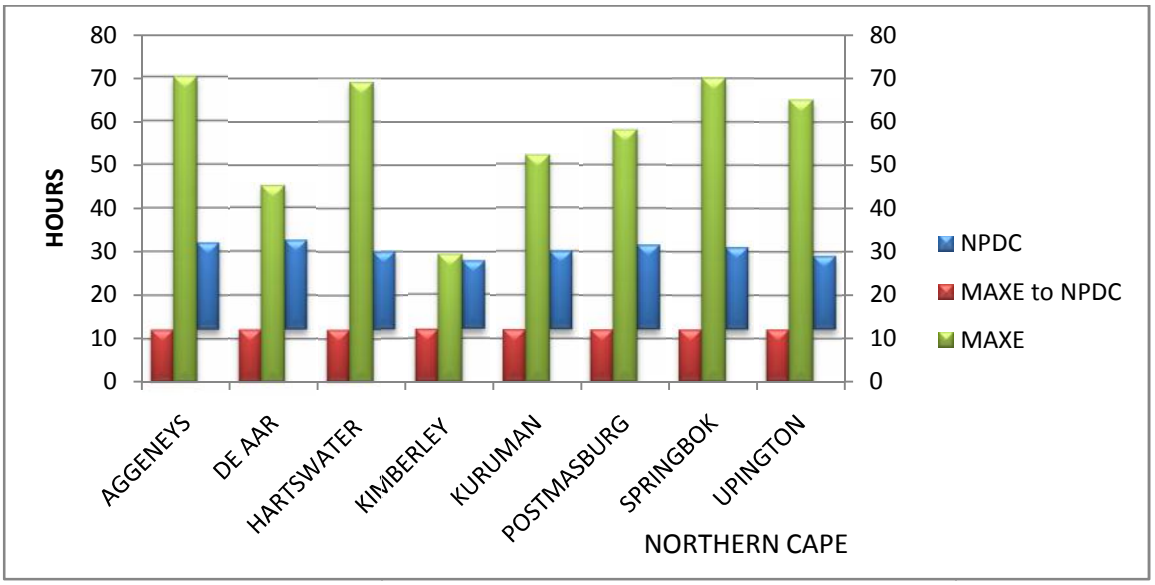


Figure 27: MAXE lead times vs NPDC lead times - Northern Cape

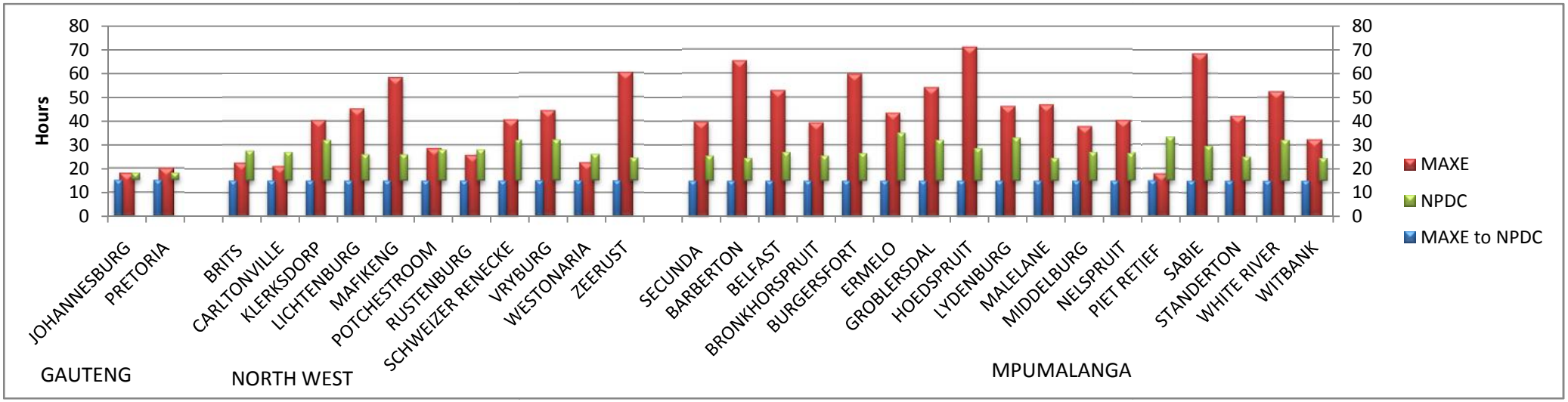


Figure 28: MAXE lead times vs NPDC lead times

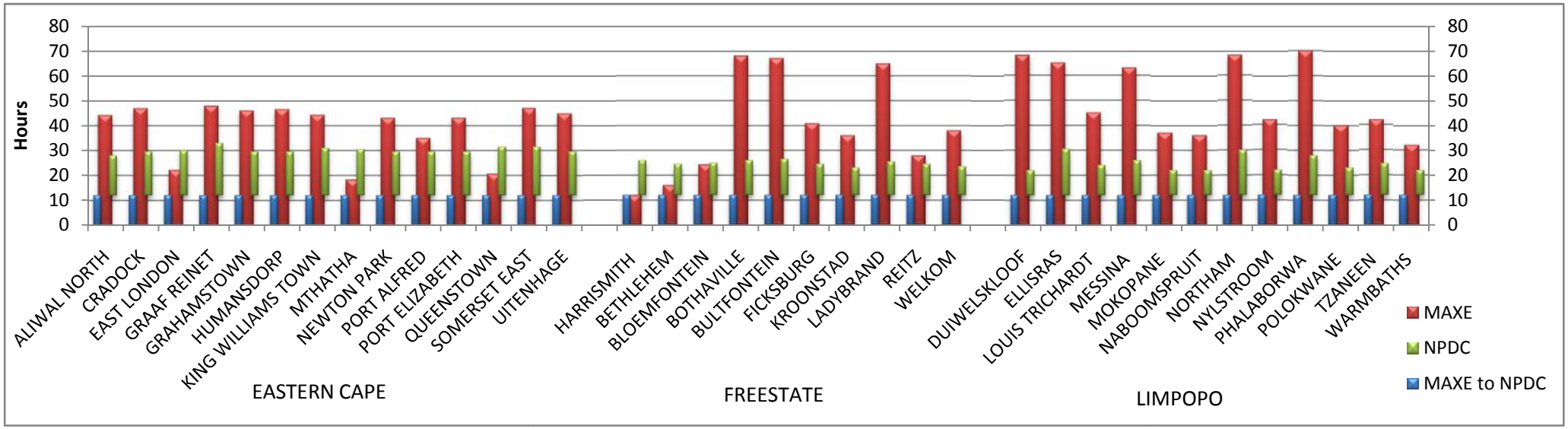


Figure 29: MAXE lead times vs NPDC Lead times

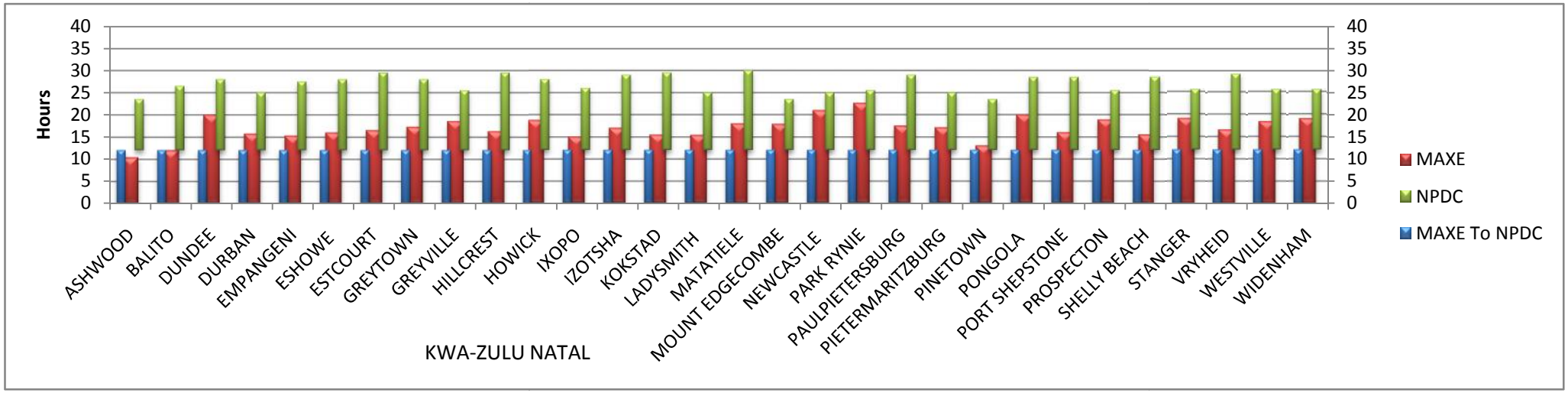


Figure 31: MAXE lead time vs NPDC lead time

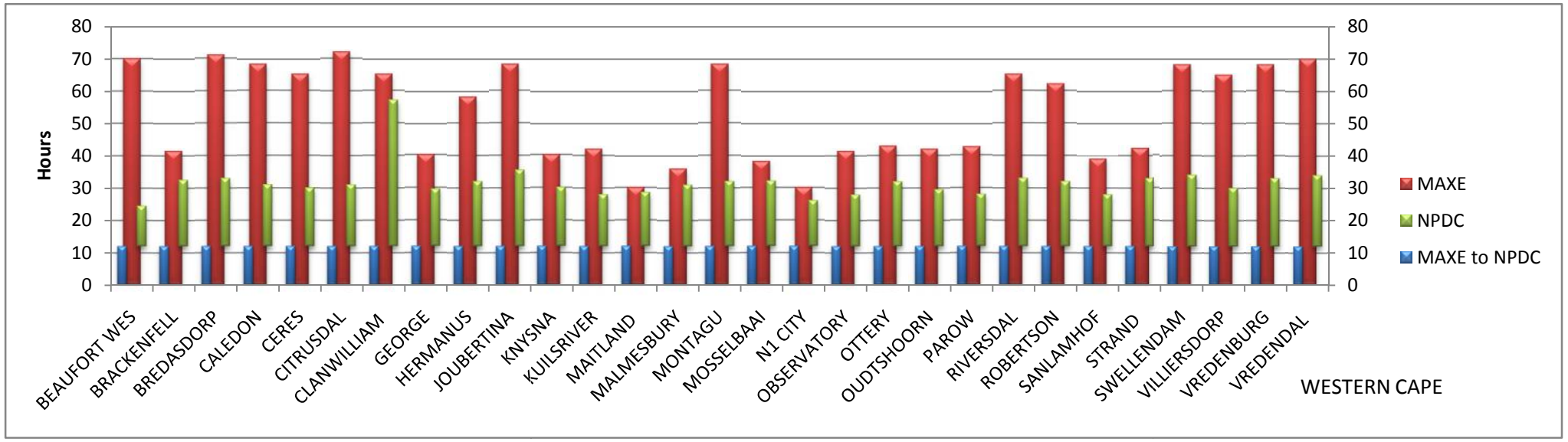


Figure 30: MAXE lead time vs NPDC lead time

4.3 Conclusion

By studying these graphs it is safe to say that the lead time can be reduced in the majority of the provinces. KZN however, will stay the same as it is logic that those lead times are the fastest with the exception of one or two in Mpumalanga and in the Eastern Cape. When Toyota takes over these deliveries, they will not only reduce the lead time of these products, but they will also gain complete control over these products and therefore ensure that customer satisfaction is maintained.

CHAPTER 5

5.1 Conclusion

Redesigning the current cross-docking has already lead to visible changes. These changes include shorter lead times, more control and order once the truck has arrived. The first courier trucks depart from the warehouse at 11:00 am each morning. It is important that these times are met to ensure the shortest lead time possible. By being prepared when a truck arrives is an advantage in time consumption. Marked allocated areas and pre-received lists can and will ensure that parts do not miss their designated courier truck.

The MAXE supplier analysis showed a clear indication on the possible lowering in lead times and also the gaining of control over these parts. This alone should be a good motivation for the go-ahead of this project as these aspects have a direct influence on customer satisfaction.

5.2 Recommendations

The entire lead time database at Toyota is not up to date nor is it accurate. To have an accurate database these figures need to be correct. It is extremely difficult to work with data that is neither up to date nor accurate. This is purely a recommendation to the Toyota Company to update their databases and to log this kind of information. A map of Southern Africa with actual accurate lead times should be in every supply chain office of any distribution company as this helps to visualize the current and also the probable situations. There is an employee at Toyota who performs this important task amongst other tasks. This will help him to map the lead times from the MAXE supplier against that of the NPDC and in future this can be expanded to many more suppliers.

CHAPTER 6

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Appendix A

MAXE ACTUAL CALCULATED LEAD TIMES (Sections of spread sheets)

Waybill No.	Receiver	Destination	Coll. Date	Del. Date	Del. Time	average	max	min	days
			Start date	End Date					
			2012/06/26	2012/07/27					
E932552	MIDWAY TOYOTA	ALBERTON	2012/07/09	2012/07/10	09:08				
E942651	MIDWAY TOYOTA	ALBERTON	2012/07/23	2012/07/24	11:30	10:19	11:30	09:08	1
E925896	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/06/28	2012/06/29	13:00				1
E925899	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/06/28	2012/06/29	13:00				1
E925914	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/06/28	2012/06/29	13:00				1
E925925	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/06/28	2012/06/29	13:00				1
E926583	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/06/29	2012/07/02	12:35				2
E930813	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/05	2012/07/06	11:47				1
E931351	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/06	2012/07/09	12:42				3
E933623	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/10	2012/07/11	12:50				1
E933626	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/10	2012/07/11	12:50				1
E934659	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/11	2012/07/12	12:00				1
E935697	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/12	2012/07/13	13:50				1
E937518	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/16	2012/07/17	11:43				1
E938803	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/17	2012/07/18	12:00				1
E939614	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/18	2012/07/19	11:52				1
E941331	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/20	2012/07/23	11:56				3
E943814	MCCARTHY TOYOTA ARCADIA	ARCADIA PRETORIA	2012/07/24	2012/07/25	14:25				1
E944848	MCCARTHY TOYOTA	ARCADIA PRETORIA	2012/07/25	2012/07/26	12:00				1
E944852	MCCARTHY TOYOTA	ARCADIA PRETORIA	2012/07/25	2012/07/26	12:00	12:35	14:25	11:43	1
E923325	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/06/26	2012/06/27	12:28				1
E923365	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/06/26	2012/06/27	12:28				1
E924692	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/06/27	2012/06/28	11:37				1
E924724	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/06/27	2012/06/28	11:37				1
E925775	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/06/28	2012/06/29	12:28				1
E930754	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/05	2012/07/06	11:44				1
E931314	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/06	2012/07/07	12:00				1

E933558	MCCARTHY TOYOTA BRUM	BEDFORDVIEW	2012/07/10	2012/07/11	11:07				1
E933564	MCCARTHY TOYOTA BRUM	BEDFORDVIEW	2012/07/10	2012/07/11	11:07				1
E934612	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/11	2012/07/12	10:55				1
E935632	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/12	2012/07/13	11:31				1
E936435	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/13	2012/07/14	10:41				1
E937490	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/16	2012/07/17	10:40				1
E939558	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/18	2012/07/19	10:43				1
E939578	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/18	2012/07/19	10:43				1
E941285	MCCARTHY TOYOTA BRUMA	BEDFORDVIEW	2012/07/20	2012/07/21	10:30	11:23	12:28	10:40	1
E938817	PROTEA TOYOTA BELLVILLE	BELLVILLE	2012/07/17	2012/07/19	11:15	11:15	11:15	11:15	2
E924787	ORANJE TOYOTA BLOEM	BLOEMFONTEIN	2012/06/27	2012/06/29	09:54				2
E924790	ORANJE TOYOTA BLOEM	BLOEMFONTEIN	2012/06/27	2012/06/29	09:55				2
E944765	ORANJE TOYOTA	BLOEMFONTEIN	2012/07/25	2012/07/26	13:35	11:20	13:35	08:46	1
E939551	EAST RAND TOYOTA BOKSBURG	BOKSBURG	2012/07/18	2012/07/20	11:00	11:06	11:45	09:50	2
E939619	IMPERIAL TOYOTA CAPEGATE	BRACKENFELL	2012/07/18	2012/07/20	10:39	10:34	10:45	10:26	2
E943765	BARLOWORLD TOYOTA CENT	CENTURIAN	2012/07/24	2012/07/25	12:34	12:08	14:00	09:55	1
E929748	MARKET TOYOTA CAVENDISH	CLAREMONT	2012/07/04	2012/07/06	10:46	10:46	10:46	10:46	2
E940667	MONUMENT TOYOTA CONSTANTI	CONSTANTIA KLOOF JHB	2012/07/19	2012/07/20	10:21	10:24	11:55	09:43	1
E939606	PAT HINDE BOKSBURG	DUNSWART	2012/07/18	2012/07/19	11:27	11:54	12:30	10:50	1
E944898	THEKWINI TOYOTA DURB	DURBAN	2012/07/25	2012/07/26	10:30	09:24	10:30	08:40	1
E940729	BUFFALO TOYOTA	EAST LONDON	2012/07/19	2012/07/20	13:47	14:07	16:00	09:56	1
E939562	MCCARTHY TOYOTA EDENVALE	EDENVALE	2012/07/18	2012/07/19	09:24	10:16	11:30	09:24	1
E942670	FOSTERS TOYOTA ELDORADO P	ELDORADO PARK	2012/07/23	2012/07/24	11:40	11:07	11:40	10:35	1
E938839	MCCARTHY TOYOTA EMPANGEN	EMPANGENI	2012/07/17	2012/07/18	08:06	08:18	08:30	08:06	1
E944784	IMPERIAL PARKTOWN	FORSDSBURG	2012/07/25	2012/07/26	10:18	11:24	13:11	10:00	1
E942683	HALFWAY TOYIOTA FOURWAYS	FOURWAYS	2012/07/23	2012/07/24	10:28	11:06	14:55	08:51	1

E940611	MCCARTHY GERMISTON	GERMISTON	2012/07/19	2012/07/20	11:50	11:50	11:50	11:50	1
E943839	SETTLER CITY TOYOTA	GRAHAMSTOWN	2012/07/24	2012/07/26	15:00	15:00	15:00	15:00	2
E942785	MCCARTHY PARTS WAREHOUSE	GREYVILLE	2012/07/23	2012/07/24	11:00	11:33	13:13	08:45	1
E940703	MCCARTHY TOYOTA HATFIELD	HATFIELD	2012/07/19	2012/07/20	15:09	14:12	15:26	12:47	1
E944818	AUTO - REN HEIDELBER	HEIDELBERG GAUTENG	2012/07/25	2012/07/26	09:00	12:10	13:30	09:00	1
E935776	HILLCREST TOYOTA	HILLCREST PTN	2012/07/12	2012/07/12	09:24	09:16	09:57	08:50	0
E944888	HALFWAY TOYOTA HOWIC	HOWICK	2012/07/25	2012/07/26	11:34	11:48	12:20	11:00	1
E943718	IMPERIAL TOYOTA CITY	JEPPESTOWN	2012/07/24	2012/07/25	11:01	10:24	11:01	09:58	1
E944839	PUPKEWITZ TOYOTA	JET PARK	2012/07/25	2012/07/26	11:15	10:59	12:15	09:48	1
E941320	RAND STADIUM TOYOTA	JOHANNESBURG	2012/07/20	2012/07/21	11:49	10:39	12:00	09:32	1
E944809	IMPERIAL TOYOTA KEMP	KEMPTON PARK	2012/07/25	2012/07/26	10:00	10:18	11:00	09:40	1
E938830	THE MOTIQUE TOYOTA	KOKSTAD	2012/07/17	2012/07/18	08:13	08:27	09:00	08:13	1
E938810	BARLOWORLD TOYOTA KUILSRI	KUILSRIVIER	2012/07/17	2012/07/19	13:25	11:25	13:25	10:15	2
E943872	KILLARNEY TOYOTA STANGER	KWADUKUZA	2012/07/24	2012/07/25	12:48	12:05	12:48	11:00	1
E944886	MORTIMER TOYOTA LADY	LADYSMITH KZN	2012/07/25	2012/07/26	07:35	08:21	09:50	07:35	1
E924700	SOUTHERN TOYOTA	LENASIA	2012/06/27	2012/06/28	13:00	13:00	13:00	13:00	1
E943734	FURY TOYOTA LINDEN	LINDEN	2012/07/24	2012/07/25	11:18	11:14	11:18	11:10	1
E940700	MCCARTHY TOYOTA LYNNWOOD	LYNNWOOD	2012/07/19	2012/07/20	10:25	10:25	10:25	10:25	1
E938776	CMH TOYOTA MELROSE	MELROSE	2012/07/17	2012/07/18	11:19	11:49	12:20	11:19	1
E944846	BARLOWORLD TOYOTA ME	MENLO PARK EXT. 1	2012/07/25	2012/07/26	11:05	11:09	11:51	10:30	1
E929652	MCCARTHY MENLYN	MENLYN	2012/07/04	2012/07/05	09:46	09:46	09:46	09:46	1

E944797	MCCARTHY TOYOTA MIDR	MIDRAND	2012/07/25	2012/07/26	13:03	11:58	13:03	10:50	1
E943745	IMPERIAL NELSPRUIT	NELSPRUIT	2012/07/24	2012/07/26	09:10	09:07	11:10	07:12	2
E939505	HONEYDEW TOYOTA	NORTH RIDING	2012/07/18	2012/07/19	12:00	10:44	12:00	09:45	1
E940732	MARKET TOYOTA CULEMBORG	OBSERVATORY CT	2012/07/19	2012/07/23	10:55	11:01	11:30	10:35	4
E938677	FREEWAY TOYOTA	ORMONDE	2012/07/17	2012/07/18	09:35	10:55	11:57	09:35	1
E937542	OTTERY TOYOTA	OTTERY	2012/07/16	2012/07/18	10:50	11:04	11:30	10:50	2
E943866	HALFWAY TOYOTA SCOTTBURGH	PARK RYNIE	2012/07/24	2012/07/25	16:59	15:41	16:59	14:23	1
E941357	MCCARTHY TOYOTA N1 CITY P	PAROW	2012/07/20	2012/07/23	12:30	11:32	12:30	09:00	3
E942756	MCCARTHY TOYOTA (PMB)	PIETERMARITZBURG	2012/07/23	2012/07/24	11:02	10:07	11:10	09:17	1
E943744	LIMPOPO TOYOTA	PIETERSBURG (POLOKWA	2012/07/24	2012/07/26	09:43	09:04	09:43	08:35	2
E942754	ALGOA TOYOTA	PORT ELIZABETH	2012/07/23	2012/07/25	09:07	12:03	14:57	09:04	2
E942733	PRETORIA NOORD TOYOTA	PRETORIA NORTH	2012/07/23	2012/07/24	13:30	13:30	14:35	12:26	1
E942773	DURBAN SOUTH TOYOTA	PROSPECTON	2012/07/23	2012/07/24	11:34	11:56	13:04	11:00	1
E942697	IMPERIAL TOYOTA RANDBURG	RANDBURG	2012/07/23	2012/07/24	12:54	11:13	12:54	09:22	1
E933569	MONUMENT TOYOYA RANDFONTE	RANDFONTEIN	2012/07/10	2012/07/11	10:35	10:35	10:35	10:35	1
E939662	PROVINCIAL MOTORS R/BAY	RICHARDS BAY	2012/07/18	2012/07/19	08:18	08:18	08:18	08:18	1
E927585	FOSTERS TOYOTA	ROBERTVILLE	2012/07/22	2012/07/24	10:30	11:04	12:05	10:25	2
E944776	MONUMENT TOYOTA WEST	ROODEPOORT	2012/07/25	2012/07/26	10:30	11:06	12:00	10:26	1
E936521	MARKET TOYOTA ATHLONE	RYLANDS	2012/07/13	2012/07/16	11:45	11:28	11:55	10:45	3
E944738	TOYOTA S.A CONVENSIO	SANDTON	2012/07/25	2012/07/27	10:04	10:29	11:14	09:25	2
E939571	HINO SELBY	SELBY	2012/07/18	2012/07/19	12:00	12:00	12:00	12:00	1
E943858	HALFWAY TOYOTA SHELLY BEA	SHELLEY BEACH	2012/07/24	2012/07/25	08:10	08:32	09:25	08:02	1

E925887	MCCARTHY TOYOTA SINOVILLE	SINOVILLE	2012/06/28	2012/06/29	14:17	14:17	14:17	14:17	1
E944781	PAT HINDE SPRINGS	SPRINGS	2012/07/25	2012/07/26	13:00	12:30	13:05	11:51	1
E943831	HEIDERBERG TOYOTA	STRAND	2012/07/24	2012/07/26	11:30	11:18	11:30	11:07	2
E942747	MARKET TOYOTA TOKAI	TOKAI	2012/07/23	2012/07/25	11:00	10:52	11:26	10:00	2
E939627	BARLOWORLD TYGERVALLEY	TYGER VALLEY	2012/07/18	2012/07/20	13:50	13:50	13:50	13:50	2
E943868	CMH TOYOTA UMHLANGA	UMHLANGA ROCKS	2012/07/24	2012/07/25	10:19	10:54	20:00	08:38	1
E942708	VAAL TOYOTA SASOLBURG	VAAL PARK	2012/07/23	2012/07/24	12:01	12:18	14:03	11:32	1
E944766	VAAL TOYOTA VEREENIG	VEREENIGING	2012/07/25	2012/07/26	11:30	10:47	11:39	09:48	1
E944890	NTT TOYOTA-VRYHEID	VRYHEID	2012/07/25	2012/07/26	09:12	09:23	12:10	07:35	1
E938851	THEKWINI TOYOTA WESTVILL	WESTVILLE	2012/07/17	2012/07/18	10:25	09:57	12:00	08:30	1
E941377	HALFWAY MALANDA TOYOTA	WINDHAM	2012/07/20	2012/07/21	12:00	12:00	12:00	12:00	1
E938762	MCCARTHY TOYOTA WOODMEAD	WOODMEAD	2012/07/17	2012/07/18	10:21	10:40	11:24	09:03	1

MAXE NATIONAL LEAD TIMES

To Code	Route	DESTINATION	RATE CODE	DELIVERY TIMES
851	1851	Aberdeen Area	BL	48 HOURS
659	1659	Aggeneys	BJ	72 HOURS
608	1608	Albertina	BJ	72 HOURS
656	1656	Alexanderbaai	BJ	72 HOURS
609	1609	Ashton Area	BJ	72 HOURS
606	1606	Atlantis Area	BJ	72 HOURS
53	1053	Barberton	BJ	72 HOURS
622	1622	Beaufort West Area	BJ	72 HOURS
120	1120	Bela-bela (warmbaths)	I	48 HOURS
33	1033	Bethal Area	I	48 HOURS

45	1045	Bethal Outlying	BJ	72 HOURS
29	1029	Bethlehem Area	H	OVERNIGHT
650	1650	Bitterfontein Area	BJ	72 HOURS
72	1072	Bloem Outlying	BJ	72 HOURS
70	1070	Bloemfontein	I	48 HOURS
612	1612	Bonnievale Area	BJ	72 HOURS
664	1664	Brandvlei	BJ	72 HOURS
602	1602	Bredasdorp Area	BJ	72 HOURS
108	1108	Brits Area	I	48 HOURS
603	1603	Caledon Area	BJ	72 HOURS
661	1661	Calvinia	BJ	72 HOURS
600	1600	Cape Town	BL	48 HOURS
51	1051	Carolina	BJ	72 HOURS
640	1640	Ceres Area	BJ	72 HOURS
630	1630	Citrusdal	BJ	72 HOURS
631	1631	Clanwilliam	BJ	72 HOURS
601	1601	Ctown-paarl	BL	48 HOURS
52	1052	Delmas Area	I	48 HOURS
8	1008	Dundee	B	OVERNIGHT
1	1001	Durban	A	SAME DAY/OVERNIGHT
212	1212	E.I. Outlying	BL	48 HOURS
850	1850	East London	I	OVERNIGHT
632	1632	Eendekuil	BJ	72 HOURS
17	1017	Empangeni	F	SAME DAY/OVERNIGHT
30	1030	Ermelo	I	48 HOURS
38	1038	Ermelo Mines	BJ	72 HOURS
40	1040	Ermelo Outlying	BJ	72 HOURS
5	1005	Estcourt	B	SAME DAY/OVERNIGHT
651	1651	Garies	BJ	72 HOURS
620	1620	George	I	48 HOURS

641	1641	Gouda	BJ	72 HOURS
643	1643	Graafwater Area	BJ	72 HOURS
675	1675	Grabouw Area	BJ	72 HOURS
28	1028	Greytown	VE	OVERNIGHT
20	1020	Harrismith	B	OVERNIGHT
610	1610	Heidelberg Cape	BJ	72 HOURS
50	1050	Hendrina	BJ	72 HOURS
604	1604	Hermanus	BJ	72 HOURS
626	1626	Hermon Area	BJ	72 HOURS
10	1010	Ixopo	C	OVERNIGHT
37	1037	Jhb Outlying	M	OVERNIGHT
21	1021	Johannesburg	I	OVERNIGHT
652	1652	Kammieskroon	BJ	72 HOURS
665	1665	Keimoes Area	BJ	72 HOURS
666	1666	Kenhardt	BJ	72 HOURS
76	1076	Kimberley	I	48 HOURS
77	1077	Kimberley Outlying	BJ	72 HOURS
633	1633	Klawer	BJ	72 HOURS
676	1676	Kleinmond	BJ	72 HOURS
657	1657	Kleinzee	BJ	72 HOURS
104	1104	Klerksdorp	I	48 HOURS
130	1130	Klerksdorp Outlying	BJ	72 HOURS
621	1621	Knysna	BJ	48 HOURS
658	1658	Koinas Area	BJ	72 HOURS
11	1011	Kokstad	B	OVERNIGHT
49	1049	Komatiepoort	BJ	48 HOURS
74	1074	Kroonstad	I	48 HOURS
6	1006	Ladysmith	B	SAME DAY/OVERNIGHT
627	1627	Lagulhas Area	BJ	72 HOURS
105	1105	Lichtenburg	I	48 HOURS

103	1103	Lichtenburg Outlying	BJ	72 HOURS
667	1667	Loeriesfontein	BJ	72 HOURS
124	1124	Louis Trichardt	I	48 HOURS
123	1123	Louis Trichardt-outlying	BJ	72 HOURS
54	1054	Louwsburg	X	48 HOURS
644	1644	Lutzville Area	BJ	72 HOURS
128	1128	Lydenburg	BJ	48 HOURS
48	1048	Malelane	BJ	48 HOURS
634	1634	Malmesbury	BJ	72 HOURS
12	1012	Matatiele Area	B	NEXT DAY AFTER 12 VIA KOKSTAD
32	1032	Middelburg Area	I	48 HOURS
41	1041	Middelburg Outlying	BJ	72 HOURS
41	1041	Middleburg Outlying	BJ	72 HOURS
116	1116	Modimolle (nylstroom)	I	48 HOURS
122	1122	Mokopane (potgietersrus)	I	48 HOURS
611	1611	Montagu Area	BJ	72 HOURS
635	1635	Moorreesburg	BJ	72 HOURS
618	1618	Mossel Bay Area	I	48 HOURS
118	1118	Naboomspruit (mokgopong)	I	48 HOURS
680	1680	Napier	BJ	72 HOURS
4	1004	Natal Midlands	B	OVERNIGHT
31	1031	Nelspruit Area	I	48 HOURS
39	1039	Nelspruit Outlying	BJ	72 HOURS
7	1007	Newcastle Area	B	OVERNIGHT
662	1662	Nieuwoudtville Area	BJ	72 HOURS
16	1016	North Coast	A	OVERNIGHT
655	1655	Okiep Area	BJ	72 HOURS
619	1619	P.e. Outlying	BL	48 HOURS
55	1055	Paulpietersburg	X	OVERNIGHT

35	1035	Piet Retief	AV	OVERNIGHT
3	1003	Pietermaritzburg	A	SAME DAY/OVERNIGHT
636	1636	Piketberg	BJ	72 HOURS
2	1002	Pinetown	A	SAME DAY/OVERNIGHT
660	1660	Pofadder Area	BJ	72 HOURS
112	1112	Polokwane (pietersburg)	I	48 HOURS
125	1125	Polokwane Outlying	BJ	72 HOURS
56	1056	Pongola	AI	OVERNIGHT
628	1628	Port Alfred	BJ	48 HOURS
800	1800	Port Elizabeth	I	DEPOT O/N PM/ DEL 48 HOURS
673	1673	Port Nolloth	BJ	72 HOURS
15	1015	Port Shepstone	D	SAME DAY/OVERNIGHT
642	1642	Porterville	BJ	72 HOURS
106	1106	Potchefstroom	I	48 HOURS
107	1107	Potchefstroom Outlying	I	72 HOURS
23	1023	Pretoria	I	OVERNIGHT
126	1126	Pretoria Outlying	BJ	48 HOURS
625	1625	Queenstown	I	OVERNIGHT
645	1645	Queenstown-outlying	BL	48 HOURS
24	1024	Qwa Qwa	H	OVERNIGHT
27	1027	Richards Bay	G	SAME DAY/OVERNIGHT
613	1613	Riversdal	BJ	72 HOURS
678	1678	Riviersonderend	BJ	72 HOURS
615	1615	Robertson Area	BJ	72 HOURS
102	1102	Rustenburg Area	I	48 HOURS
132	1132	Rustenburg Outlying	BJ	72 HOURS
129	1129	Sabie	BJ	72 HOURS
34	1034	Secunda	AF	48 HOURS
46	1046	Secunda Outlying	BJ	72 HOURS
25	1025	South Broom/munster	G	OVERNIGHT

14	1014	South Coast	A	OVERNIGHT
653	1653	Springbok	BJ	72 HOURS
677	1677	Stamford	BJ	72 HOURS
19	1019	Standerton	J	48 HOURS
654	1654	Steinkopf	BJ	72 HOURS
614	1614	Stilbaai	BJ	72 HOURS
629	1629	Sutherland	BJ	72 HOURS ONLY THURSDAY
616	1616	Swellendam Area	BJ	72 HOURS
637	1637	Trawal Cape	BJ	72 HOURS
674	1674	Tulbagh	BJ	72 HOURS AGENT DEPOT
114	1114	Tzaneen Area	I	48 HOURS
13	1013	Underberg Area	BC	NEXT DAY
668	1668	Upington Area	BL	72 HOURS
638	1638	Van Rhynsdorp	BJ	72 HOURS
607	1607	Villiersdorp Area	BJ	72 HOURS AGENT DEPOT
18	1018	Volksrust	J	48 HOURS
42	1042	Volksrust Outlying	AF	72 HOURS
670	1670	Vredenburg Area	BJ	72 HOURS
639	1639	Vredendal	BJ	72 HOURS
109	1109	Vryburg	I	48 HOURS
111	1111	Vryburg-outlying	BJ	72 HOURS
9	1009	Vryheid Area	B	OVERNIGHT
211	1211	Vryheid Outlying	AI	NEXT DAY AFTER 2PM
73	1073	Welkom	I	48 HOURS
75	1075	Welkom Outlying	BJ	72 HOURS
26	1026	Winterton/bergville	H	OVERNIGHT
36	1036	Witbank	I	48 HOURS
47	1047	Witbank Outlying	BJ	72 HOURS
679	1679	Wolseley	BJ	72 HOURS
617	1617	Worcester Area	BJ	72 HOURS

EXAMPLE OF CALCULATION OF TOYOTA LEAD TIMES

Dealer Code	Dealer Name	City	Province	Route	Dispatch time	day	Exp time	MAXE Lead Times
D11281	IMPERIAL TOYOTA STRYDOMPARK	RANDBURG	Gauteng	ROUTE..01A	5:00/12:00	0	12:00/17:00	18.22
D17047	HONEYDEW TOYOTA	RANDBURG	Gauteng	ROUTE..01A		0		17.73
D50802	HINO HONEYDEW	HONEYDEW	Gauteng	ROUTE..01A		0		
D11054	MONUMENT TOYOTA CONSTANTIA	WELTEVREDEN PARK	Gauteng	ROUTE..01A		0		17.4
D50402	HINO WESTRAND	WELTEVREDEN PARK	Gauteng	ROUTE..01A		0		
D11500	MONUMENT TOYOTA WEST RAND	ROODEPOORT	Gauteng	ROUTE..01A		0		18.1
D11052	MONUMENT TOYOTA RANDFONTEIN	RANDFONTEIN	Gauteng	ROUTE..01A		0		17.58
D14760	FOSTER`S TOYOTA	ROBERTVILLE	Gauteng	ROUTE..01A		0		41.5
D71757	ROLA TOYOTA	STRAND	Cape Town	ROUTE..05B	23:59	1	14:00	42.3
D36015	OTTERY TOYOTA	OTTERY	Cape Town	ROUTE..05B	19:30	1	13:00	42.07
D63624	MARKET TOYOTA TOKAI	OBSERVATORY	Cape Town	ROUTE..05B		1		41.87
D63595	IMPERIAL TOYOTA BRACKENFELL	BRACKENFELL	Cape Town	ROUTE..05B	23:59	1	13:30	41.57
D23140	PROTEA TOYOTA	SANLAMHOF	Cape Town	ROUTE..05B	14:45/18:30	1	12:00/15:00	
D50202	HINO PAROW	PAROW	Cape Town	ROUTE..05B		1		