

# Improving the lead times at the receiving department

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Benchmark Electronics Almelo

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## **Preface**

In the context of my bachelor thesis I have performed a research about improving lead times at the receiving department for Benchmark Electronics Almelo. When I look back on my time in Almelo, I can say that I have worked in a stimulating environment and have learned a lot in a short time. I want to thank everyone that has helped me during my research. Especially Ronald Rikmanspoel and John Nijland who supervised the research. They have always made a lot of time to answer questions and talk about different perspectives on the problems. I also want to thank Erik Eilering with whom I worked on the IT aspects of the research, he invested a lot of time to help me with my work. Finally I hope that the insights and recommendations are of value to Benchmark.

## Management summary

Benchmark Almelo has some problems at the receiving department. Items that come in at the dock are not always put to stock within the norm of 24 hours that is set for the department. Even if the items are processed according to the norm there is no information available about the performance of the department. This results in a hard to control process and the purchasing department using inaccurate data to measure the performance of their suppliers. The main question this research answers is:

### ***'How should Benchmark Electronics design the incoming goods process in order to reduce lead times and prevent problems at a later point in the supply chain?'***

To answer this question the current procedures at the department have been mapped and the problems that need to be solved have been pointed out. Three different options that could possibly solve the problems were compared using the analytic hierarchic process and a sensitivity analysis has been performed to make sure the analysis was strong enough to accept the outcome.

Part of the research is Express Receiving. This is a relatively new procedure for registering items in the ERP system (putting items to stock). This method is currently not used in Almelo because operators and supervisors feel it does not improve the receiving operation. A sub goal of the research is to provide recommendations about the use of Express Receiving. This was achieved by comparing the different procedures and gathering information from Benchmark Brasov.

### ***Analytic Hierarchic Process***

Table 1 shows the scores of the alternative solutions on the criteria that were used for comparison. The alternative options that were compared are:

- a sticker that changes color when it expires, this can indicate which parcels should be processed first
- FIFO lanes, two different areas to place parcels in. One area for parcels that arrived yesterday or earlier and one for parcels that arrive on the present day. The yesterday area must always be empty before processing parcels in the today area.
- Scanning the tracking number on the outside of the parcel, which is called waybill, to be able to compare data from when a parcel arrives to when a parcel is processed. With this data we are able to show which parcels should be processed first.

The criteria that were used to compare the alternative options are: (i)how much extra work is needed (ii)to what extent are the changes in the process self-evident and understandable, (iii)costs, (iv)How visible are parcels that have priority and (v)to what extent is the option able to measure performance of the department.

## Results:

	Amount of extra work	Self-evident	Costs	Visibility	Ability to measure performance	
<b>weights</b>	0.09	0.04	0.31	0.12	0.44	<b>Score</b>
<b>Color changing sticker</b>	0.09	0.43	0.05	0.23	0.39	0.238
<b>FIFO lanes</b>	0.65	0.43	0.47	0.67	0.05	0.326
<b>Waybill scanning</b>	0.26	0.14	0.47	0.09	0.57	0.436

Table 1 – outcome of the AHP analysis

The table shows that Waybill scanning while entering component data in the ERP system is the best fit for Benchmark mainly because of the strong need for a performance indicator.

The research shows that Express Receiving should not be used and it is preferable to use one single procedure to process all items. This procedure also incorporates scanning the waybill.

With the new data we can compose the OnTime Waybill report. An example of the report can be seen in figure 1. The ‘Hurry up with waybill’ table can be used to identify parcels that need to be processed first. This will make sure the parcels are processed within 24 hours. The bar chart and the percentages on the right are good performance indicators which management can use.

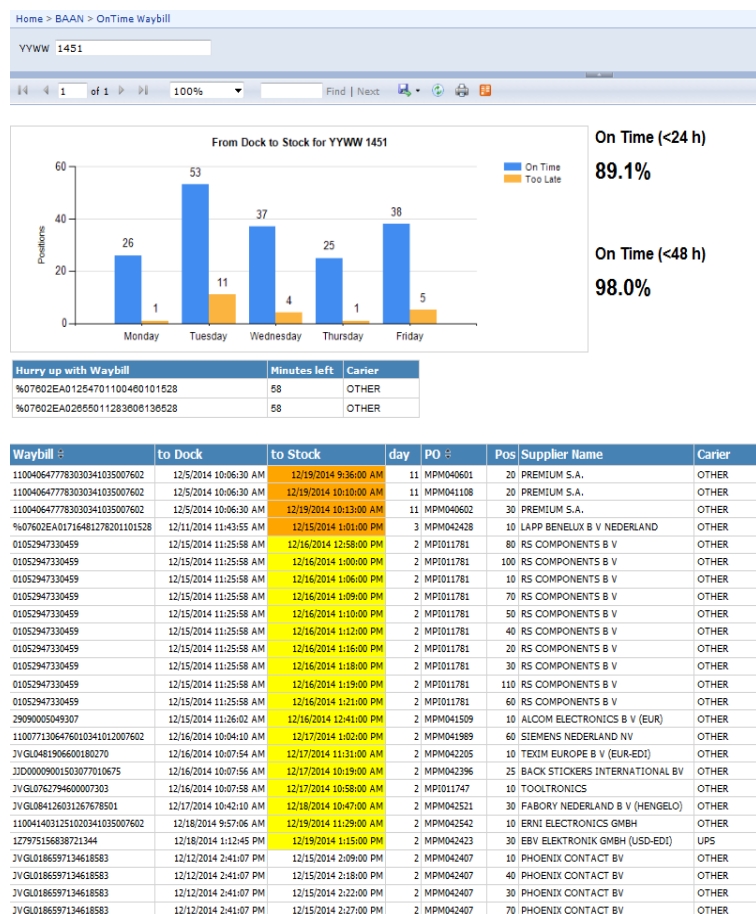


Figure 1 – OnTime Waybill report

Because the solution is already implemented, the report also provides a roadmap to improve the OnTime Waybill report. A short version of the roadmap is presented below in table 2.

<b><i>Action</i></b>	<b><i>Responsible department</i></b>
<b><i>Eliminating missing waybills</i></b> At this stage not all order lines are visible in the report. The purchasing department must make sure all suppliers provide a waybill.	<b><i>Purchasing</i></b>
<b><i>Filter unexpected receipts</i></b> Unexpected receipts are orders that sometimes stay in the receiving area for a long time. This is not the responsibility of the receiving department and this data should not influence the KPI	<b><i>Business Intelligence</i></b>
<b><i>Integrating supplier delivery dates</i></b> The on time delivery KPI at the purchasing department can be improved by integrating supplier delivery dates into the OnTime Waybill report.	<b><i>Business Intelligence</i></b>
<b><i>Barcoded waybill on packing slip</i></b> The waybill should be provided on the packing slip (a document that contains information about the contents of a parcel). This will make the work at the receiving department easier.	<b><i>Purchasing</i></b>
<b><i>Making trend information available</i></b> Adding historical information to the report can improve its value.	<b><i>Business Intelligence</i></b>

**Table 2 – Short version of the roadmap for improving the OnTime Waybill report**



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## **Chapter 1 - Introduction**

In this chapter we give an introduction to Benchmark Almelo at which the research is done and explain the grounds for the research.

### **1.1 Introduction to Benchmark Electronics**

Benchmark Electronics was founded in 1979 in Texas. Until 1988 the company operated under the name Electronics. From then on the name was changed to Benchmark Electronics. Originally Benchmark only produced complex medical equipment for intermedics. The company started growing into its current stature by acquisition of other companies. In just two years Lockheed Martin Commercial Electronics and AVEX Electronics were acquired. Today Benchmark Electronics has eighteen plants in North America, Mexico, Europe and Asia. The company is a global contract electronics manufacturer, which means they deliver parts to original equipment manufacturers all over the world. The company offers a wide range of services to their customers, these include product development engineering, new product introduction, test development, volume manufacturing, automated assembly and test, logistics management and direct order fulfillment. Benchmark Electronics strives to be the solution provider of choice for high technology original equipment manufacturers, anticipating their needs and rapidly delivering comprehensive value-creation solutions during the entire product life cycle. Currently Benchmark Electronics employs about 12000 people.

The plant in Almelo originally was a subsidiary of Phillips, specialized in designing and manufacturing test and measurement equipment. Currently the plant is expanding very fast, in the next two months it is expected that 60 new employees and a new production line are installed.

### **1.2 Background of the research**

Benchmark is using an enterprise resource planning system to manage its operations. In order to utilize the ERP system to its full potential it is extremely important that the data stored in the system is an exact representation of the actual situation at the plant. When the data and the actual situation do not correspond, huge disruptions in production can occur. This has a big impact on the company because promised delivery dates might not be met and future revenue is at risk. An important factor in the supply chain is the incoming goods department. This department makes sure that the goods that arrive at the plant match the specifications the buyer agreed on with the supplier, that the items are made available in the ERP system and the correct labels are applied in order for the items to be stored in the correct location.

The lead time for goods to be made available in the ERP system after they have been loaded off the truck is one day. This lead time is often exceeded causing problems for the production department.

In the current situation trucks deliver goods to the plant multiple times a day. When goods are delivered, the goods are docked using a scanner. After all the goods have been docked they are placed nearby a workstation in order to be received into the ERP system. The employee often chooses to receive big goods first to make some room for next shipments. The goods are now ready to be received, this is done using a pc with software that communicates with the ERP system. The content of the boxes is verified and if it checks out the items are made available in the ERP system. The software Benchmark is currently using has been replaced with new software called Express Receiving that should decrease receiving time drastically. This new software is not used because it increases receiving time instead of decreasing it.

Some of the suppliers currently deliver their goods in a container with a bundle of documents that need to be sorted prior to receiving, in some cases this can take hours of valuable time.

The purchasing department has to check the incoming goods department when the ERP system tells them a supplier has not met the promised delivery date. Most times this happens the goods are delivered on time but the goods are still waiting to be received.

In the desired situation all goods are received no later than 24 hours after the goods have been docked. There is a clear system that shows in which order goods should be received. Benchmark is standardizing processes at all sites to make sure all Benchmark sites are working in the same way. The Express Receiving software should be used in Almelo so that the methods for receiving goods are the same at all Benchmark sites. To effectively manage the operations at incoming goods, good performance indicators need to be measured and reviewed.

### **1.3 Summary**

In this chapter we have defined why the research is important for Benchmark Electronics. The time it takes to put ordered items in the ERP system after they have been delivered is often longer than it should be. It is important to investigate this problem, because a good predictable process at the entry level of the factory is essential to the performance of the factory, and in the end customer satisfaction.

## **Chapter 2 - Defining the research**

In this chapter we define the research by setting boundaries and describing the methods that we use to perform the research. We also formulate the research questions that need to be answered to reach the research goal.

### **2.1 Research goal**

The main goal of the research is to provide Benchmark Electronics with tools and recommendations to make sure goods are received in a timely manner in order to prevent problems in the supply chain. And to provide measurable performance indicators to be able to respond quickly if future problems at the incoming goods department arise.

### **2.2 Boundaries of the research**

To make sure the research can be fully done in a timeframe of ten weeks clear boundaries have to be set. We have determined that this research should consist of the following elements:

- Detailed description of the current situation
- Explanation to what extent Express Receiving is not working at Benchmark Almelo
- Recommendations regarding the use of Express Receiving
- Key performance indicators to measure performance of incoming goods department
- Solutions to reduce lead times at incoming goods department

### **2.3 Research method**

In this section the ways to achieve the desired deliverables of the research are explained.

#### ***Detailed description of the current situation***

To deliver a detailed description of the current situation I will carry out the day to day tasks of an employee working at the incoming goods department. By observing and asking the right questions I will get a good understanding of all the aspects to be considered when assessing the problems at a later point.

### ***Explanation to what extent Express Receiving is not working at Benchmark Almelo***

To get a good understanding of why Express Receiving is currently not working in Almelo, we will have to take a look at the internal procedures and get information from another Benchmark site about their procedures. I will observe employees doing Express Receiving, and review the documentation that is available about Express Receiving. I will compare the methods used with the methods for receiving directly in BaaN (ERP software used at Benchmark) as well as using the BridgeLogix software, which will be explained in section 4.2. After looking for problems internally I will contact another Benchmark site located in Brasov to obtain information on the Express Receiving process there. After gathering this information I will explain why Express Receiving is not working as it should in Almelo

### ***Recommendations regarding the use of Express Receiving***

When it is clear why Express Receiving is not working, we will determine whether or not Benchmark Almelo should use Express Receiving. Working with Express Receiving is highly preferable from a corporate point of view. If the outcome is that Benchmark Almelo should not use Express Receiving we have to justify that Express Receiving is not fit for Benchmark Almelo.

### ***Key performance indicators to measure performance of incoming goods department***

To provide performance indicators to measure the performance at the incoming goods department, we have to find out what indicators are most important and realistic to measure. By exploring the data that is already available in the form of dumps the ERP system makes to excel, we can identify what the current possibilities are. If additional data is desired we will try to find ways to collect the data.

### ***Solutions to reduce lead times at incoming goods***

We will find options to reduce the lead time at the incoming goods department by reviewing literature and applying the solutions to the situation at Benchmark Almelo.

## **2.4 Research question and sub questions**

### ***Main question***

***'How should Benchmark Electronics design the incoming goods process in order to reduce lead times and prevent problems at a later point in the supply chain?'***

### ***Sub questions***

To effectively answer the main question of the research, the problem is divided into different sections and sub questions.

## ***1. Questions regarding the current situation***

### **1.1. What are the current procedures at the incoming goods department?**

*To be able to answer the main question we first have to know how the process is currently arranged.*

### **1.2. How does BridgeLogix work?**

*BridgeLogix is software that communicates with the ERP system. This software makes it easier to receive products that are ordered. It is an important factor at the incoming goods department because employees at the incoming goods department spend a lot of time receiving items with BridgeLogix.*

### **1.3. What performance indicators are currently in place?**

*Answering this question will tell us how management is currently assessing the performance of the incoming goods department.*

## ***2. Questions regarding Express Receiving***

### **2.1. What is the background of Express Receiving?**

*Express Receiving is a new way of receiving goods, it should be faster and more efficient. Currently it is not used at Benchmark Almelo. To get a better understanding of Express Receiving we need to have more insight on the background of Express Receiving.*

### **2.2. How does Express Receiving work?**

*In order to compare Express Receiving with the current procedures to receive an order we will give a detailed view of the procedures that are carried out to receive an order with Express Receiving.*

### **2.3. What is different at other Benchmark Electronics sites?**

*Express Receiving is used at all other Benchmark Electronics sites. Information on the receiving process at other Benchmark sites will give us a better understanding what the problems at Benchmark Almelo are.*



### **3. Questions regarding problems at the incoming goods department**

#### **3.1. What is the performance of the incoming goods department?**

*Here we will explain how the incoming goods department is currently performing according to the indicators and the norms that are set.*

#### **3.2. What problems that influence the lead time that can be identified?**

*By comparing the actual situation to the ideal situation we can determine what the problems are that need to be addressed.*

#### **3.3. Why does Express Receiving not work at Benchmark Almelo?**

*By comparing Express Receiving documents and procedures in Brasov to the situation in Almelo we will explain why Express Receiving does not work in Almelo.*

### **4. Questions regarding possible solutions**

#### **4.1. What are the expectations and constraints on the possible solutions?**

*To prevent us from coming up with solutions that are not suitable for Benchmark we need to define what Benchmark's requirements are and by what factors the solutions are bounded.*

#### **4.2. What performance indicators should be measured?**

*Here we will identify what indicators also need to be measured to adequately assess the performance of the incoming goods department.*

#### **4.3. What options are available to lower lead times at the incoming goods department?**

*Here we will present the possibilities for Benchmark to lower the lead times at the incoming goods department.*

#### **4.4. Which option is the best fit for the needs of Benchmark Electronics?**

*By means of multi criteria analysis we will determine which option is the best fitting option to reduce lead times at the incoming goods department.*

### **5. Questions regarding implementation**

#### **5.1. What are the consequences for the tasks and responsibilities of employees**

*Here we describe how the day to day activities are affected by implementing the chosen solution*

## **2.5 Summary**

In this chapter we have formulated the base of the research that we are doing. The main question we want to answer is: 'How should Benchmark Electronics design the incoming goods process in order to reduce lead times and prevent problems at a later point in the supply chain?'. We will achieve this by giving a detailed description of the current processes, identifying the ideal situation, explaining what problems cause the discrepancy between current and ideal situation, generating possible solutions to the problems, choosing the best fitting solution and eventually describing what will change if the chosen solution would be implemented.

## Chapter 3 - Theoretical framework

In this chapter we provide information about warehousing general. The four different categories of warehousing operations are explained, and insight in the contribution to total costs per operation is given. Cross docking is explained, because it has some similarities to the receiving operations that we will be looking at. Also two important developments in company data sharing are introduced, which are important for understanding Express Receiving.

### 3.1 Warehousing

In a typical warehouse, operations can be divided into receiving, storing, picking and shipping. Let us give a brief explanation of these operations.

#### *Receiving*

This operation consists of assigning trucks to one of the docks, unloading the trucks and entering information about the received goods. At some warehouses the received goods also need to be inspected to make sure there is no damage, the quantity is right and the correct documents are shipped with the goods by the supplier. According to Warehouse and Distribution science [1] this operation accounts for about 10% of the total warehousing costs.

#### *Storing*

After the receiving of goods is finished, the goods have to be stored. The most important aspects of this operation are:

- Having accurate information about the available space in the warehouse like the location, size and maximum weight that can be stored at the location.
- Determining locations for goods in order to reduce picking costs. Fast moving goods should be stored at an easy to pick location because the distance that the operator needs to travel is shorter. When items need to be picked often the location will make a great impact on total costs of picking that item
- Registering data about the assigned location of a certain item.

About 15% of the total warehousing costs are coming from storing

#### *Picking*

Picking is the most labor intensive process of the warehouse operations. The main reason for the labor intensity is that a lot of traveling is unavoidable and time critical. When an order is placed the

warehouse management system provides a list of locations and quantities that have to be picked. The operator then proceeds to visit all locations on his list and retrieve the correct amounts of the items on the list. Most items are stored in easy to ship packages, which contain a certain amount of single pieces of the item. As one can imagine, picking packages costs a lot less time than picking single items. When single items are picked, the items have to be repackaged to make them suitable for transport. When the picking is completed, the warehouse management system needs to be updated. Picking accounts for about 55% of the total warehousing costs.

### ***Shipping***

In a typical warehouse the shipping department makes sure that all shipping documentation is provided with the products and that the products are ready to be shipped. An important decision that is made at the shipping department is whether or not to stage finished product in order to ship a full pallet or truck. In some cases the shipping department sends an update to the customer about the shipment. Shipping accounts for about 20% of the total warehousing costs.

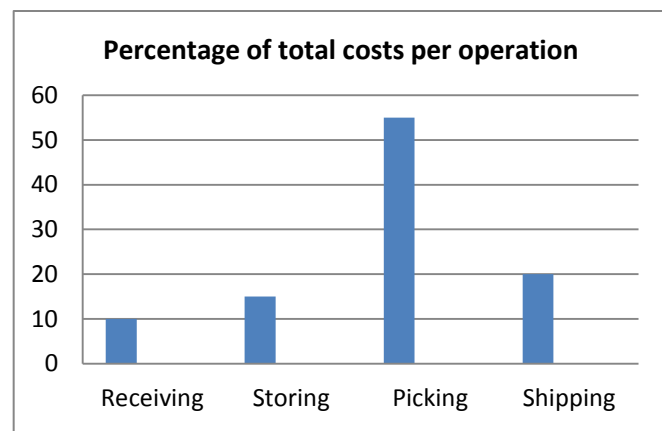


Figure 2 – deviation of costs in warehousing  
(Bartholdi, J. J., & Hackman, S. T. (2008))

## **3.2 Cross Docking**

Cross docking is eliminating stock in a warehouse. Received goods are taken to the shipping area immediately after they arrive and are shipped to retailers. The biggest benefits of cross docking are reducing costs of keeping stock and reducing costs of transportation. Transportation costs are reduced because the cross docking philosophy also includes only using fully loaded trucks. There are two forms of cross docking “pure” and “minimal time in warehouse”. At a pure cross docking warehouse all labeling and repackaging activities are completed before arrival at the dock and there are no inventory records of the product in the warehouse. The minimal time in warehouse form of cross docking, are warehouses where inventory is held for a maximum of 24 hours. To reduce costs, these warehouses can move toward a pure form of cross docking. In figure 3 we see when it would be beneficial to pursue the pure form of cross docking.

Unit stock-out costs	High	Cross docking can be implemented with proper systems and planning	Traditional warehousing/ distribution preferred
	Low	Cross docking preferred	Cross docking can be implemented with proper systems and planning
		Stable and constant	Unstable or Fluctuating
		Product demand rate	

Figure 3 – Plane to identify if cross docking should be used (Apte and Viswanathan 2000)

The receiving area at Benchmark Almelo is quite similar to a cross docking operation, because they strive to hold inventory for less than 24 hours and ship items to different internal locations. In figure 3 we can see that cross docking is preferred when unit stock out costs are low and the product demand rate is stable and constant. The receiving area at Benchmark Almelo does not meet these two conditions because a stock out would cause the production to be interrupted (high costs) and the amount of products handled by the receiving department fluctuates (unstable product demand rate). This means cross docking is not preferred and we will not apply this concept in the research.

### 3.3 Relevant developments in Warehousing

#### *Electronic Data Interchange*

Electronic Data Interchange means that no human intervention is needed before business applications can process data from outside sources. This can be data from another department within the company or data from another company. The key component in EDI is the standardization of data formats. Companies that do not use EDI often have to manually reenter data received from other companies. It often comes in the wrong format and their applications cannot process the data. When two companies in a supply chain commit to EDI they can do business without any human intervention.

#### *Advance Shipping Notice*

Like EDI the advance shipping notice is a form of data sharing between business partners in a supply chain. In this case the supplier sends an update about his outgoing shipment to the customer. The

advance shipping notice can be of great value because the company that is waiting for the shipment has the possibility of correcting possible errors before the goods arrive at the dock. An example of a common error that can cause problems at the receiving department is when a supplier decides that half of the order is shipped today and the other half tomorrow. With the advance shipping notice the receiving company can split this order in advance and make sure it does not cause problems at the receiving department.

### **3.4 Summary**

Warehousing operations can be categorized into; receiving, storing, picking and shipping respectively these operations contribute to 10, 15 55 and 20 percent of the total warehousing costs. Picking is the most labor intensive operation which explains the high percentage of total costs. Because the receiving operations are somewhat like cross docking we looked into the concept and found that it is not usable at the receiving department because stock out costs are high and the demand rate is unstable. Relatively new developments in warehousing are forms of data sharing to improve the effectiveness of supply chain partnerships. Electronic data interchange and the advance shipping notice are forms of data sharing.

## Chapter 4 - Current Situation

In this chapter we describe how the receiving department is currently designed with a floor plan. Some numbers about deliveries to Benchmark are presented and discussed. We describe how the operators at the department perform their jobs and how the software that is used works. In the last part of the chapter the methods for determining how the receiving department is performing are explained.

### 4.1 Procedures

#### *Floor plan*

The area where the receiving of shipments takes place can be divided into two sections namely inspection and receiving. Inspection happens in a closed off room with desks and equipment needed for inspection which we will not further discuss because it is outside of the scope of the research. The right side of the area is where the receiving takes place.

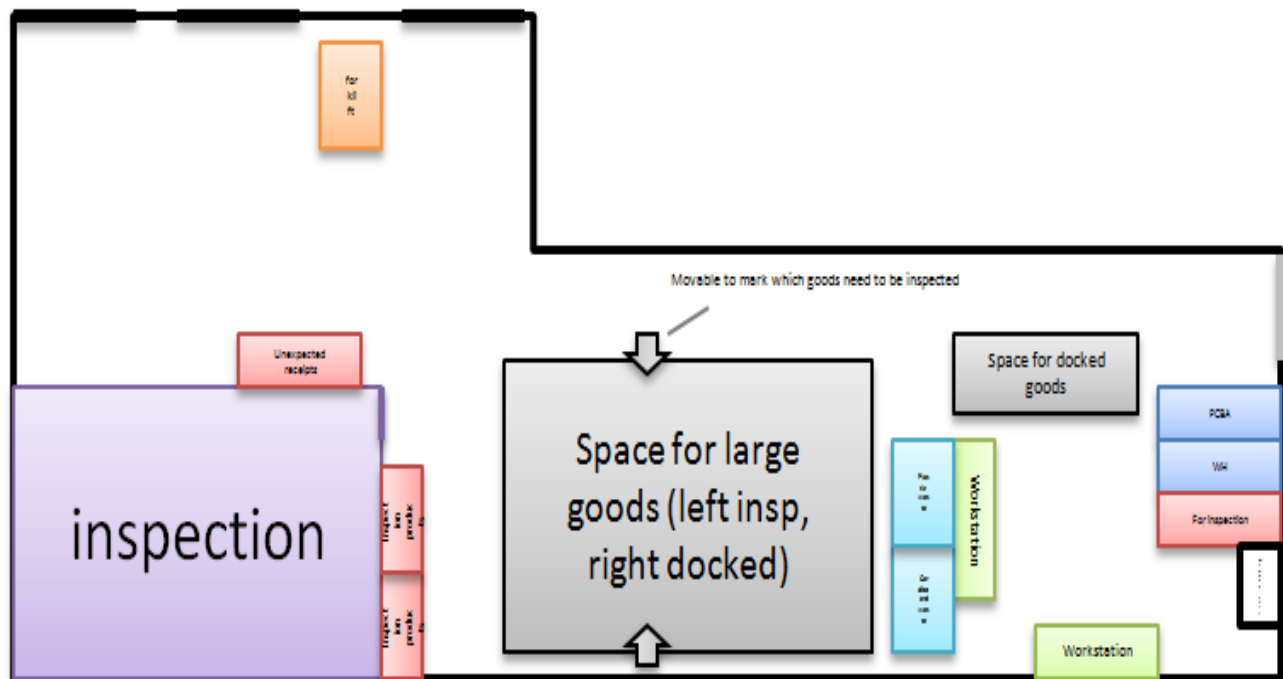


Figure 4 – Floor plan receiving area Benchmark Almelo

Purple	Inspection
Green	Workstations for receiving, these consist of a pc with receiving software, a barcode scanner and other small office equipment
Light blue	Waste bins for cardboard and plastic
Grey	Space used to temporarily store goods that are waiting to be received. The space for large goods has markers that can indicate which goods need to be inspected and which goods are waiting to be received
Blue	Carts where goods that have been received into the ERP system can be stored. There are two because some items go to the storage system at the production hall and some go to the normal warehouse
Light Red	Items for inspection
red	Unexpected deliveries are temporarily stored here
orange	Forklift used to unload trucks
White	Cabinet where documents are stored

Table 3 – explanation of floorplan items

### ***Deliveries***

The great majority of delivered goods are scanned when they arrive at the dock. These are the goods that are shipped with one of the big shipping companies like UPS. When goods are shipped like this they have a tracking number called “waybill”. This number is registered in the ERP system. The data is represented below and is extracted from 10/2013 through 9/2014.

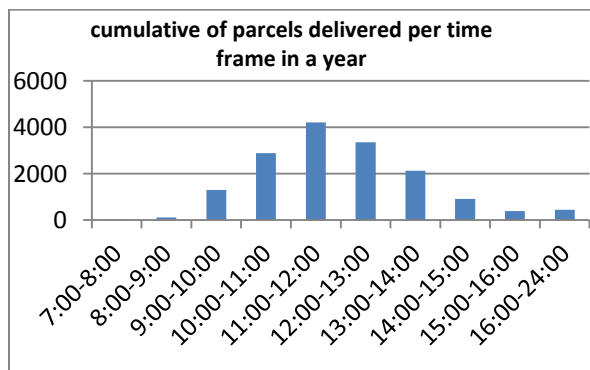


Figure 5 - Total deliveries per time frame during a year

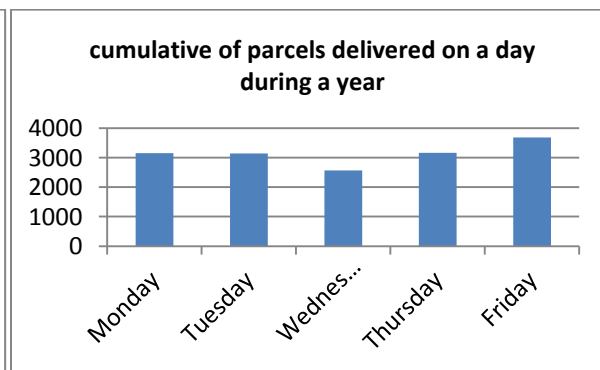
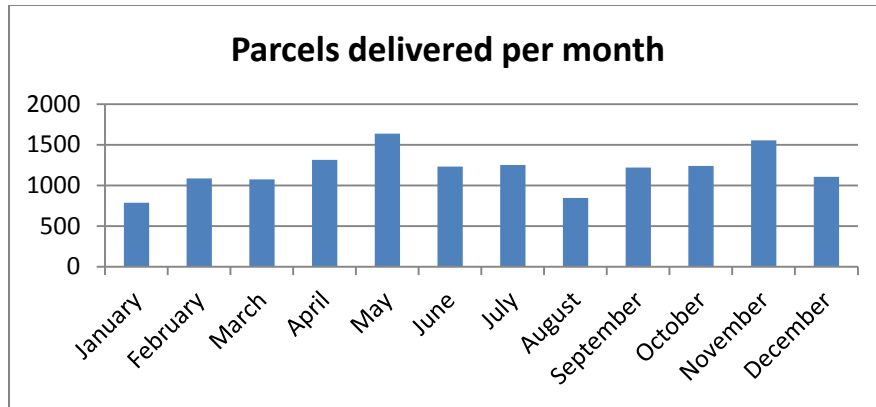


Figure 6 – Total deliveries per day during a year





**Figure 7 – Total parcels delivered per month**

This data is not a representation of workload per time frame, day or month. The real workload at the receiving department is the number of order lines they have to register in the ERP system. Since there can be multiple order lines in one parcel this is only a representation of when trucks arrive and how many parcels they deliver.

## Flowchart receiving

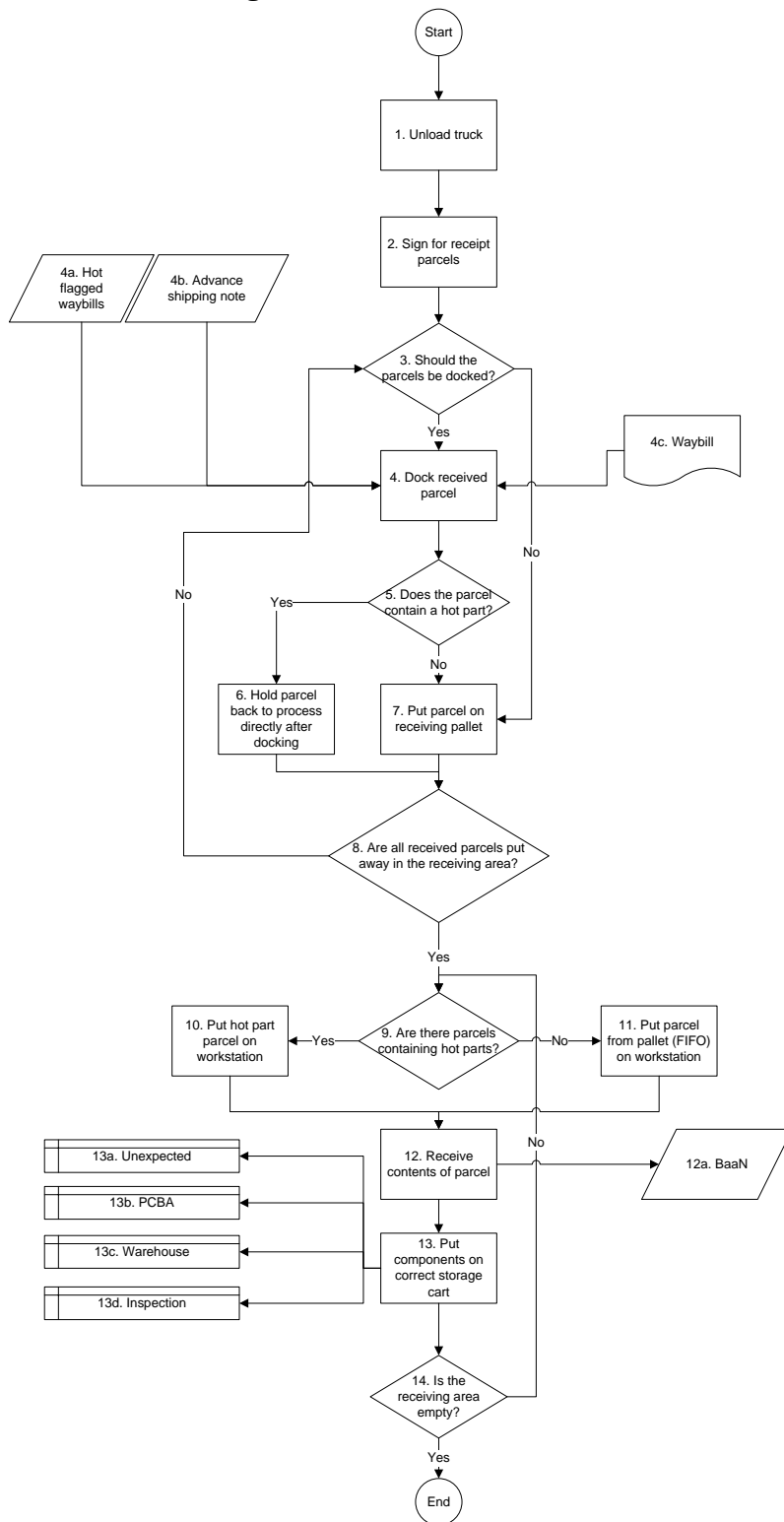


Figure 8 – Flowchart receiving

Step	Description	type
1	Truck arrives and is unloaded	process
2	Sign for receipt	manual operation
3	Should the goods be docked?	decision
4	Docking, Scan waybills of all delivered containers	manual operation
4a	Hot flagged parts	information
4b	Advance shipping note	information
4c	Waybill	document
5	Does parcel contain a hot part?	decision
6	Hold back for fast processing	manual operation
7	Put parcel on receiving pallet	manual operation
8	Are all received parcels put away?	decision
9	Check for hot part parcels	decision
10	Put hot part parcel on workstation	manual operation
11	Put parcel on workstation	manual operation
12	Receive contents of parcel using BridgeLogix	process
12a	BaaN	data
13	Put received contents on correct storage cart	manual operation
13a	Unexpected	storage
13b	PCBA	storage
13c	Warehouse	storage
13d	Inspection	storage
14	Check if all parcels are processed	decision

**Table 4 – Steps of the receiving flowchart**

### ***Detailed description receiving***

Multiple times a day trucks arrive at the dock, standard carriers are UPS and FedEx. Sometimes different carriers are used by a supplier, because they are able to choose their own carrier. The large shipments are unloaded by forklift, these can be large containers or a pallet filled with small parcels. A shipment of a few parcels is brought into the dock directly. After all goods have been delivered at the dock one of the employees has to check for damage and sign for the receipt. The supplier gets a notification that the goods have been delivered at this moment. When the goods are in the dock they need to be docked. This means notifying the ERP system that the parcels have arrived at the dock. Only parcels that have a tracking number which is also called waybill can be docked. Currently only parcels delivered by UPS, FEDEX, TNT and PostNL are docked even though some other deliveries do have a waybill. Shipments that do not have a waybill generally are shipments carried out by the supplier. This means that the supplier has its own truck and does not need to hire a shipping company like UPS. If the parcels have to be docked, the waybills are scanned and the ERP system receives a message that the parcel is at the dock.

While docking the parcels the scanner can indicate three situations that apply to the parcel:

- The parcel is designated to be received in the normal way. In this case BridgeLogix should be used to receive the contents of the parcel.
- The parcel is designated to be Express Received.
- The parcel contains a hot part and needs to be processed as soon as possible because production is waiting for this part

While docking, the hot part containing parcels are kept aside in order to be processed first and the rest of the parcels are put away on the receiving pallet. If all parcels that have arrived are docked, their contents can be registered in BaaN. Hot parts are processed first, and then the rest of the parcels are processed. Operators at the receiving area strive to process all the parcels on a FIFO basis, but when parcels are docked they are sometimes put on top of parcels that are waiting to be received for a longer time. Operators prefer to process large parcels first in order to clear space fast. After the contents of the parcels have been registered in BaaN, they can end up at three different locations. These are carts that are moved to their final destination at the end of the day. One of the carts is for components that are later stored in Kardex, a vertical lift system, at the printed circuit board assembly hall. Components stored here are delivered on SMD reels, SMD is short for surface mounted device. Other components are placed on a cart that will go to the normal warehouse, where the parts are stored on shelves. The third cart is for components that need to go through entry inspection. New parts or parts that have never been ordered before always go through entry inspection. Because of the many product development activities, a lot of new parts are handled by the operators at the receiving department. In other cases components are inspected if an engineer flags a component for inspection or as part of a random check. There still is one exception where components can also be stored, this is the location unexpected. When there is a problem with registering the components in BaaN the components go to this location. These problems can be that the quantity does not match, a wrong part number is delivered, the packing slip is incorrect, the order has not been correctly confirmed or the order has been partially delivered without notice. If one of these problems occurs, the component is placed at the unexpected location and the responsible buyer is notified through a BaaN report. When the buyer has resolved the issue the components are either registered in BaaN and put to stock or they are sent back to the supplier.

## 4.2 BridgeLogix

Let us now explain BridgeLogix. BridgeLogix is software that communicates with BaaN. Before this software was obtained by Benchmark, components had to be registered directly in BaaN (figure 9). The data entry is in both cases the same, but with BridgeLogix (figure 10) the operator does not have to go through different windows and find the fields where the data must be entered.

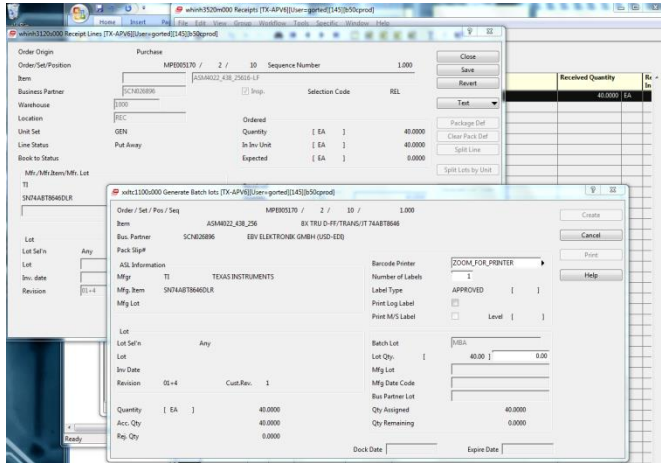


Figure 9 – BaaN receiving interface



Figure 10 – BridgeLogix interface

In the current situation BridgeLogix is used as a web application as we can see in figure 10. When BridgeLogix was first introduced, the scanner that is represented in the web application was actually used. This has caused a lot of problems because sometimes barcodes were missing or unreadable and manually entering of codes was very hard and frustrating. The solution was to develop a web application for BridgeLogix so it can be used on a computer with a keyboard and a barcode scanner.

## Flowchart

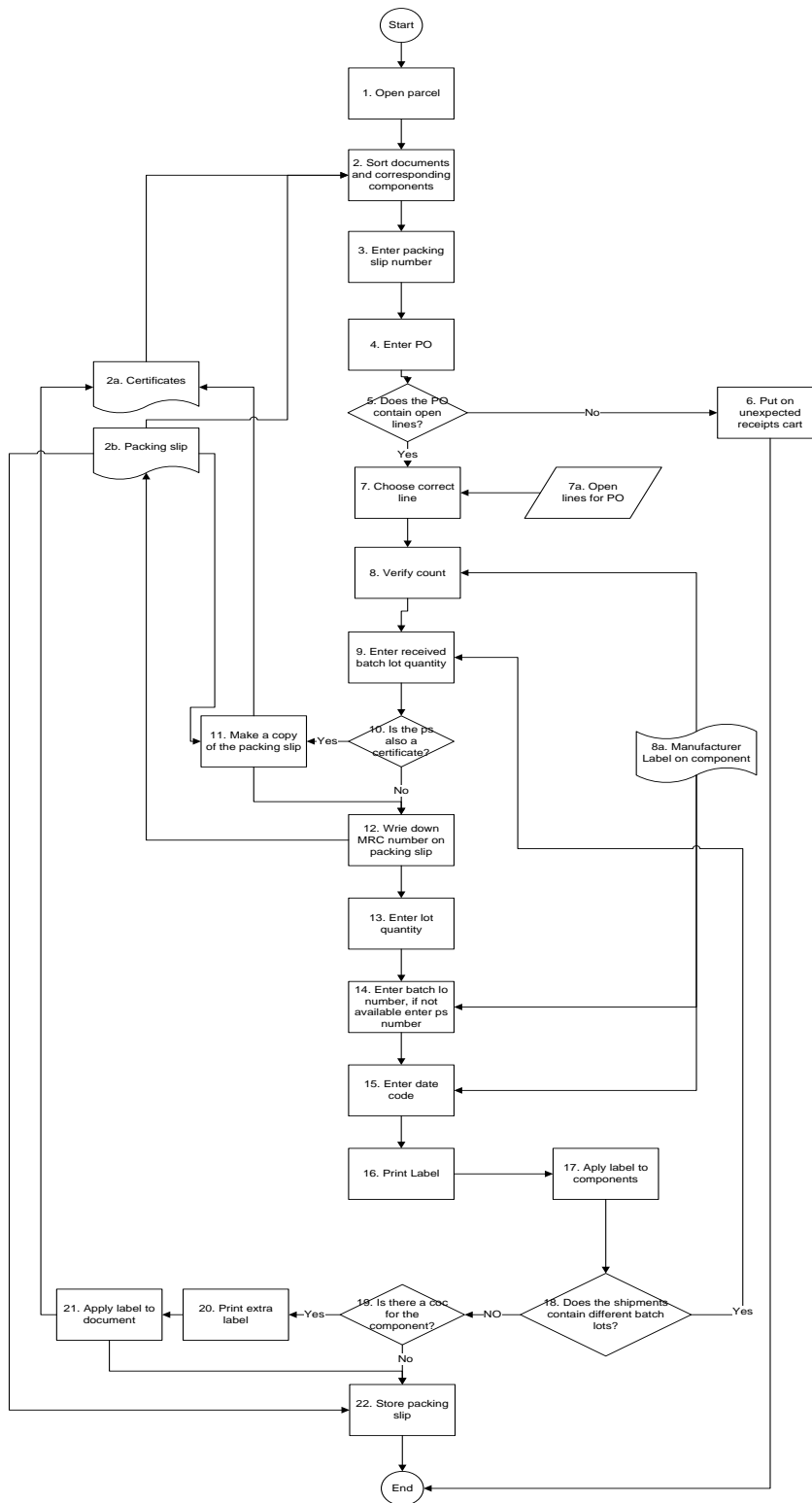


Figure 11 – Flowchart receiving with BridgeLogix interface

Step	Description	type
1	Open parcel	manual operation
2	Sort documents and corresponding components	manual operation
2a	Certificates	document
2b	Packing slip	document
3	Enter packing slip number	data entry
4	Enter Purchase Order number	data entry
5	Check for open lines	automated process
6	Put component on unexpected location	manual operation
7	If there are more lines, choose the correct one	decision
7a	Open lines for PO	data
8	Verify count	manual operation
8a	Manufacturer label	label
9	Enter received batch lot quantity	data entry
10	Check if the packing slip is also a certificate	decision
11	Make a copy of the packing slip	manual operation
12	Write down MRC number on packing slip	manual operation
13	Enter lot quantity	data entry
14	Enter batch lot number or packing slip number	data entry
15	Enter date code	data entry
16	Print label	automated process
17	Apply label to components	manual operation
18	Are there more batch lots to be processed?	decision
19	Is there a certificate belonging to the component?	decision
20	Print extra label	automated process
21	Apply label to document	manual operation
22	Store packing slip and documents	manual operation

Table 5 – Steps corresponding to the receiving with BridgeLogix flowchart

### ***Receiving in BridgeLogix***

The first step is to open the parcel and put the contents on the workspace. Orders can arrive one per parcel or with multiple order lines inside. When there is more than one order line inside, the operator has to find the document for the corresponding component. This process is highly variable because it depends on how well the contents are packed and how many order lines are in the parcel. The time to sort documents increases drastically when there are more order lines because the chance of finding the right documents and components decreases. If all documents and components are sorted the operator can start registering the components in BaaN. The first thing to scan or key in, depending on what the operator prefers, is the packing slip number and the order number. After pressing 'enter' the application will present a screen with all open lines for that order number. Open lines are order lines which are expected by the ERP system, only these lines can be processed by the operators. If there are no open lines the component and documents go to the unexpected receipts cart and wait for the buyer to

resolve the situation. When nothing is wrong with the order number the operator has to choose the correct line for the component he is registering. This is checked on matching part number and quantity. In the case there is only one line open for the purchase order, the screen where the correct line has to be chosen is skipped automatically. At this point the components have to be counted to verify if the count matches the amount ordered. Some components are weighed using a scale, but most are counted by hand. If the component is sealed to prevent electro static discharge damage, the components will not be counted. In this case the quantity on the manufacturer label will be used to verify the count. The next step is for the operator to check if the components are produced in different batches, if this is the case the order will be registered in BaaN per batch. To do this the batch quantity is entered as the total received quantity and when the batch is processed, the other batches will be booked under the same order line as if it were partial deliveries. Before the operator can go to the next screen the application displays the MRC number, which is an internal traceability number that is unique for every entry in BaaN. This number has to be written down on the packing slip. If for some reason the packing slip is needed at a later point, it is possible to trace it with this number. When writing down this number the operator has to make sure that the packing slip is not also some sort of certificate that has to be saved. If this is the case, a copy has to be made of the packing slip for use as a certificate. After writing the MRC number down, the batch lot quantity, batch lot number and date code have to be entered. The purpose of this last data entry step is that it is required that all components of a finished product can be traced back to their origin. This makes it possible to trace all products that contain a part produced in a certain batch. If this part is causing defective products, all products containing the same component can be replaced. The last part of the process is labeling the components correctly. Every box/package of components gets a label with the partial quantity and one label for the total quantity is printed. If there is a certificate present a label has to be applied to it also. When the components are labeled for inspection one label for the total amount and one for the certificate is enough because the components will receive a new label after they have been inspected. The final step is storing the documents in the right place.

### **4.3 What KPIs are currently in place?**

At this moment there are no specific indicators that are used to be able to quickly see how the incoming goods department is performing. The most common way for supervisors to see whether the department is performing good, is to go to the receiving area and see how many containers are left for the next day. When all goods have been received and put away to storage the department has done a good job. If



there are containers left at the end of the day it is a sign that performance might be under the norm, but it can also mean that a shipment came in just before 4 PM when the shifts end and there simply was no time to process the shipment. Another indicator of performance currently used is the on time delivery statistics for suppliers at the purchasing department. When the purchasing department receives a notification that one of their suppliers has delivered an order too late, they will investigate this shipment. If they find out through tracing the shipment that the supplier was on time but the time it took to register the order in the ERP system has caused the hit, it means bad performance at the receiving department. The purchasing department is currently using a margin of two days before an on time delivery hit can occur. Assuming the supplier delivers on time, the receiving department must process deliveries within 48 hours before getting an indication of bad performance.

#### **4.4 Summary**

The operators at the receiving department perform two kinds of operations, these are docking and receiving. The first operation is docking, this is the unloading of the truck and scanning the parcels to register in the ERP system which parcels have arrived. These parcels are then put on a pallet and received one by one. This receiving operation is registering the items that are inside the parcels in the ERP system using BridgeLogix software. Currently there are no explicit performance indicators to measure the performance of the department. Gut feelings and estimates based on performance indicators from the purchasing department are used to measure performance.

## Chapter 5 - Express Receiving

In this chapter we explain what Express Receiving is, why it was introduced and how it works. With a flowchart we describe the procedures step by step. We also compare the Express Receiving procedures in Almelo to the procedures in Brasov.

### 5.1 The background of Express Receiving

Express Receiving was introduced by corporate headquarters as the first part of their warehouse reengineering project. This project is called the Slipstream project and it was introduced in 2010. The goal of the project is to achieve a threefold reduction in time it takes to receive an order into the ERP system. In the Express Receiving documentation the new way of receiving orders is said to take three to four minutes instead of the old receiving which takes about twelve minutes. Express Receiving is dependent on the possibility for suppliers to cooperate in data sharing. In this case the most important factor is the advance shipping notice. This notice is sent to Benchmark at the moment the supplier ships an order. With the information in the advance shipping note, buyers can correct errors that cause problems with receiving before the order arrives at the dock. After implementation at Benchmark Almelo, eventually the project was stopped and all receipts again received with BridgeLogix. The reason the project was stopped is that operators and supervisors felt the new way of receiving was taking a lot more time than receiving in BridgeLogix. This is backed by tests supervisors have done where the outcome was that receiving with Express Receiving takes more than twice as long as receiving with BridgeLogix. Another reason for corporate headquarters to introduce Express Receiving was that, when entering lots of data using a keyboard mistakes are easily made. With Express Receiving all data is barcode scanned, and there is no room for human error. In figure 12 we see the scanner used for Express Receiving



Figure 12 – Express Receiving scanner

### 5.2 Express Receiving procedures

At the time Express Receiving was used, the parcels that were designated to be express received were separated from the parcels that would be normally received. When the parcels are docked the scanner can indicate that a parcel is eligible to be Express Received, as was described in chapter 4. At this point

the parcels are separated. The rest of the process before the actual receiving into Baan takes place is the same as we described earlier.

The volume of parcels that can be Express Received is roughly twenty percent of the total volume that is processed at the incoming goods department. The reason for this low percentage is that suppliers need to do extra work for Benchmark at their shipping departments, not all suppliers are cooperating on this matter. The main reason for this is that the supplier ships low volume to Benchmark and therefore does not want to put effort in changing their shipping procedure for a very small customer.

## Flowchart Express Receiving

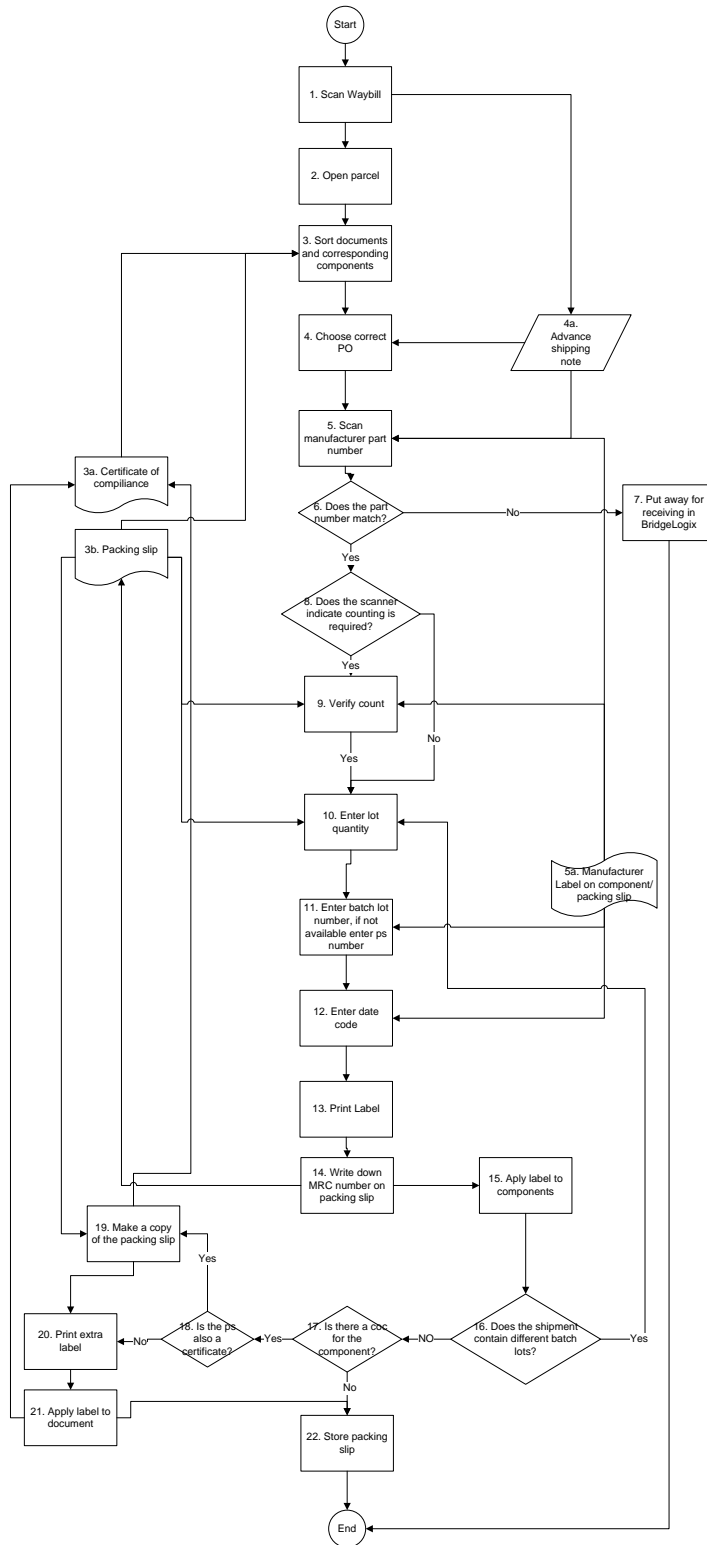


Figure 13 – Flowchart Express Receiving

Step	Description	type
1	Scan Waybill	manual operation
2	Open Parcel	manual operation
3	Sort documents	manual operation
3a	Certificate	document
3b	Packing slip	document
4	Choose Po from list	decision
4a	Advance shipping note	data
5	Scan Manufacturer part number	manual operation
5a	Manufacturer label on packing slip/component	document
6	Does the part number match?	automated process
7	Put away for receiving in BridgeLogix	manual operation
8	Does the scanner indicate that counting is required?	decision
9	Verify count	manual operation
10	Enter lot quantity	data entry
11	Enter batch lot number or packing slip number	data entry
12	Enter Date code	data entry
13	Print label	automated process
14	Write down MRC number on packing slip	manual operation
15	Apply label to components	manual operation
16	Does the shipment contain different batch lots?	decision
17	Are there certificate's for the components?	decision
18	Check if the packing slip is also a certificate	decision
19	Make a copy of the packing slip	manual operation
20	Print extra label	automated process
21	Apply label to document	manual operation
22	Store packing slip and documents	manual operation

Table 6 – Steps corresponding to the Express Receiving flowchart

At the first step the operator must scan the waybill on the outside of the parcel. This will bring up a screen on the scanner with all open order lines associated with the scanned waybill. This information is available because of the EDI (electronic data interchange) and the ASN (advance shipping notice). EDI and ASN make sure that all information about the shipment is available before the shipment actually arrives. Before choosing an order line to receive the documents have to be sorted to match the components. As with receiving in BridgeLogix this can take a lot of time depending on how well the supplier has packaged its goods. When the order line is chosen the operator has to scan the manufacturer part number. The software will check if the part number that was scanned matches the number from the advance shipping notice. When the numbers do not match, the component will be put away for receiving the normal way, in BridgeLogix. If the numbers do match the operator can proceed to the next step; counting the components. The Express Receiving software has an algorithm, which we will explain later on, that determines if the components should be counted. New components should always

be counted, but for known components an occasional check is enough. The algorithm works as follows: Each known component has a certain threshold, if this threshold is exceeded the component must be counted. When a component is always delivered in the correct amount, the threshold will become greater and the chance that this component has to be counted becomes smaller. To get a better understanding of how such an algorithm works, imagine that a component has got 100 points. Every time the same component is handled by the operator we subtract 10 points. When the component does not have any points left, a thorough physical counting is required. If the component is shipped in the correct amount, the next time the same component will start with a higher amount of points. This will result in less counting of products from reliable suppliers.

The scanner will indicate if counting of the components is required and the operator will act accordingly. In the case that there are more batch lots, the lot quantity will be entered now. The next steps until the label is printed will be for the batch lot with the previously entered quantity, after that the next batch lot quantity will be processed until the total received amount is processed. If there is one batch lot, then the total amount will be entered.

per batch lot:

- Enter batch lot number and date code.
- Print label and apply to corresponding components.

When the label(s) are printed, we can see the MRC number that is used for internal traceability and it is written down on the packing slip. In the case that the packing slip is also a certificate, a copy has to be made which will be used as the certificate. If there is a certificate present an extra label will be printed to put on the certificate. The last step before the components are put away is storing the packing slip.

### **5.3 Express Receiving in Brasov**

An attempt at internal benchmarking has been made, but sadly it was difficult to obtain good information about the receiving process at Brasov. The information I did obtain is from mail contact with a receiving department supervisor at Brasov. At the Benchmark site in Brasov, Express Receiving is still being used, unlike in Almelo where they have decided not to use Express Receiving because they feel it does more harm than good to the process. In Brasov the receiving area has two different places to put parcels after they come off the truck and are docked. One place for Express Receiving and another one for normal receiving. The procedures for both receiving in BridgeLogix and receiving with Express Receiving are the same at Almelo and Brasov. The main reason for not using Express Receiving in Almelo

was, that it takes a lot more time. In the table on the next page we see a comparison of the average time it takes to receive an order line with the different methods at both sites:

	Almelo	Brasov
<b>Express Receiving</b>	About 5 or 7 minutes	About 1 or 2 minutes
<b>BridgeLogix</b>	1.5 minutes	About 1 or 2 minutes

**Table 7 – Receiving times at Almelo and Brasov**

The difference in Express Receiving time that we see in the table is possibly influenced a lot by experience. In Brasov the procedures are being used for almost four years now and the operators can easily switch between normal receiving and Express Receiving.

## **5.4 Summary**

The most important factors for introducing Express Receiving are reducing the time it takes to put an order line in the ERP system and eliminating human errors. The physical procedures and the data entry in BaaN that are carried out with Express Receiving are explained and insight in the Express Receiving procedures at the Benchmark site in Brasov is provided.

## Chapter 6 - Problems at the incoming goods department

In chapter six we first describe how the receiving department is currently performing in order to discuss the problems that we found. We also compare the procedures of Express Receiving to the procedures of receiving with BridgeLogix.

### 6.1 performance of the incoming goods department

Because there are no specific performance indicators we will describe the performance, using the indicators described in chapter four. First we will look at the on time delivery statistic from the purchasing department. The figure below is obtained from an excel file which contains data about all ordered lines.



Figure 14 – On time delivery performance of suppliers (KPI at the purchasing dept.)

As described before there is a difference in the moment goods are docked and the moment that order lines inside the parcels are received and booked in BaaN. OTDC stands for 'on time delivery confirmed'. For the scores in percentages, the date of booking in BaaN is compared with the date the supplier confirmed to deliver the order. In the past year 85.1% of all order lines were registered in BaaN within 48 hours of the date the supplier committed to. In November this was 89.2%, the reason that these fields are red is because the goal at the purchasing department is to achieve a score of 95%. We can see here that during the past year almost 15% of all order lines were late. A small part of these OTD hits are caused by bad performance at the receiving department, in these cases parcels have waited more than 48 hours before they were processed. In the past month the performance of the suppliers and probably also the receiving department was better than the average during the past year. During the first weeks of my time at benchmark, I have been at the receiving department on different occasions and observed the procedures and also how much was left at the end of the day which also is used to see how the department is performing. Most of the days there were only a few parcels left that were waiting to be received. According to this observation the performance of the department seems to be good, but



because we do not know how much time these parcels are waiting in the receiving area, this observation does not have much meaning.

We know with certainty, by tracking the shipment, that sometimes even when the supplier meets his OTD promise, the buyer gets an OTD hit. This means that the receiving department needed more than 48 hours to process the order. The actual norm for the department is to process all orders within 24 hours after they have arrived at the dock. We can safely assume that the number of parcels waiting more than 24 hours is greater than parcels waiting more than 48 hours before being processed. About the performance of the receiving department we can say that the norm of receiving within 24 hours is not always met and the department is not performing optimal.

## **6.2 Problems**

### ***FIFO***

One of the problems is that the parcels are not always processed on a first in first out base. This seems to be a small problem, but in reality it can cause big problems. When it becomes busier at the department it also becomes more important to process the parcels that are waiting the longest first. On a busy day trucks will bring in shipments throughout the day. When the batches of parcels are not separated and processed first in first out, a possible scenario is that a parcel that is delivered at the beginning of the day when the receiving area is empty stays on the bottom of the pile the entire day and even the next or more days if the workload does not become smaller. This can have great impact because eventually if an order stays at the dock long enough one of the production lines has to be stopped because it is missing parts to complete the production run.

### ***Unnecessary work due to poor supplier performance***

One of the most variable procedures is sorting documents and looking for the right codes to enter. Because there are a lot of different suppliers there is also a lot of difference in packaging and packing slips. Although Benchmark has a document with supplier requirements which the supplier should sign, a lot of suppliers do not meet the requirements. This problem ranges from a missing barcode till a box with lots of order lines and unsorted documents. The first causes a few extra seconds in process time because the operator cannot scan the barcode but has to type it manually. The last can cause hours of extra time added to the process and cause disruptions for other goods that are waiting to be received.

### ***No KPI in place***

At the moment it is not easy to tell how the receiving department is performing. In paragraph 4.3 we described how the performance is currently measured. The problem behind the absence of this performance indicator is that there is no link between the data about delivered order lines and processed order lines. This data is only available for EDI suppliers, in this case we know which order lines were in which parcel. To be able to assess the performance, we also need docking data from non EDI suppliers.

### ***On Time Delivery measurement purchasing department***

In the past, buyers have had a lot of problems with supplier performance. It often happened that buyers had to call their suppliers to demand an explanation for the bad on time delivery. After the phone calls or meetings with suppliers, the buyers often got factual evidence of good performance from the supplier. This was of course not good for the buyers' reputation and they wanted to know what was happening. They found out that the problem was that the ordered items waited too long at the dock. In their data they could only see the moment that the items were booked in BaaN, not the moment the items came off the truck. To make sure these incorrect OTD hits are prevented, the department has chosen a margin of 48 hours before an order becomes a hit. Even with this margin that is currently in place buyers often assume that a hit is caused by bad performance at the receiving department instead of confronting the supplier, this causes a lot of friction and frustration between the departments.

## **6.3 Express Receiving**

### ***Expectations***

When Express Receiving was first introduced the expectations were too high. The supervisors and employees at the receiving department in Almelo were told that a parcel containing multiple order lines could be processed at once. This would drastically cut the process time. When we take a look at the documentation of Express Receiving we find that there is no possibility for processing multiple order lines at once. Corporate and Brasov both confirmed that this possibility does not exist. There must have been a miscommunication at the implementation phase that has led to these high expectations which have caused a lot of frustration.

### ***Process Time***

The documentation about the Express Receiving procedures emphasizes that parcels eligible for Express Receiving take the *fast* path to stock and the normal receipts take the *slower* path. When we compare

the flowcharts of BridgeLogix receiving and Express Receiving (figure 11 & 13), we see that the flowcharts look almost the same and consist of the same amount of elements. These elements are all on the same scale of time intensity, this means that even if Express Receiving is faster, it cannot be absolutely much faster. To prove this assumption we have tried both receiving methods with the same amount of order lines. With BridgeLogix it took 28 minutes to process 6 order lines and with Express Receiving it took 32 minutes to process the same amount of order lines. To make sure experience of the operators with BridgeLogix could not influence the results, the test was carried out by a person that was inexperienced with both receiving methods. If we also take the information from Brasov into account, where both Express Receiving and BridgeLogix take about one or two minutes, we can conclude that Express Receiving is not faster than receiving with BridgeLogix.

### ***Elimination of human errors***

With BridgeLogix receiving, a keyboard is used to enter data and the part number on the screen has to be compared with the part number on the label. This leaves some room for error which Express Receiving eliminates. In paragraph 5.2 we described the ASL verification. This is the automated checking of the part number by scanning the number on the label and letting the software check if the number matches the number in the ERP system.

The problem with the elimination of human errors by means of Express Receiving is that these errors are almost nonexistent in Almelo. In the past four years production has only had problems that could have been prevented by Express Receiving three times. Wrong parts can only be mounted on a circuit board when they have the exact same dimension, otherwise the machine would not accept the parts because they do not fit. Using Express Receiving would eliminate only twenty percent of the possible human errors because twenty percent of the volume received is eligible for Express Receiving.

## **6.4 Summary**

The main problems that need to be addressed are that parcels are not always processed on a first in first out base, that supplier documentation is not always according to Benchmark standards, that the performance of the receiving department currently cannot be measured and that the purchasing department uses wrong data to measure supplier performance. Apart from the problems with the current procedures we also compared the procedures of Express Receiving and BridgeLogix. We can conclude from this comparison that the expectations of Express Receiving were too high. These

expectations have caused a lot of frustration. The procedures for Express Receiving are not faster and the human errors that it prevents are almost nonexistent.

## Chapter 7 – Additional literature

In this chapter we review literature which helps us choose the best solution in chapter eight and we look at an extensive framework of performance indicators.

### 7.1 AHP

In the next chapter we will discuss options that solve the problems that we described in the previous chapter. In order to choose the best solution we will compare the options using the Analytic Hierarchic Process. In this section we will describe the process of finding the best solution with the AHP.

To start with the AHP we first need to identify, based on which criteria the options should be evaluated. When we have established the criteria the next step is to find the hierarchy of the problem. There are three levels; the goal, the criteria and the options. In figure 15 we see a visual representation of the hierarchy.

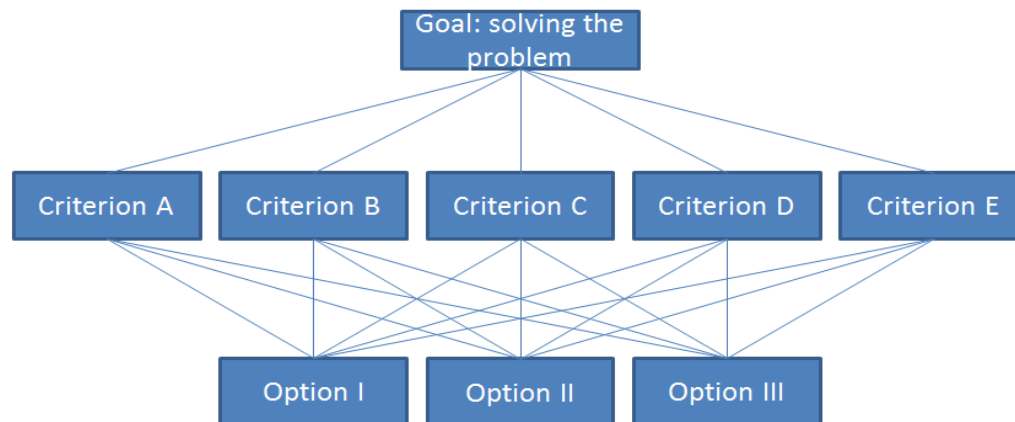


Figure 15 – AHP hierarchy

The next step is finding out the weights of the criteria by comparing every possible combination of a pair of criteria. We achieve this by asking, which of the two criteria is more important with respect to the goal and putting the answers in a matrix. The answers to the questions can range from one until nine, which is represented in the table below.

Absolute value	Meaning
1	The two criteria are of equal importance
3	The criterion is moderately more important than the other
5	The criterion is strongly more important than the other
7	The criterion has Very strong importance with respect to the other

<b>9</b>	The criterion is absolutely much more important than the other
<b>2,4,6,8</b>	Values used when compromise between two is needed
<b>Fractals</b>	When the opposite is true, 1/3 is used when the criterion is less important

Table 8 – Possible answers to pairwise comparison questions

When all comparisons are made we can calculate the eigenvector of the matrix which gives us the weights of the criteria. Now we need to find the scores of each option on each criterion. These scores are obtained in the same way as we obtained the weights of the criteria. This will result in a comparison matrix for every criterion we want to use for our selection of the best option. In these matrices we compare the options in pairs with respect to the criterion. The eigenvectors of these matrices are the scores per option on the criteria. After all these comparisons and calculations we can come up with the following table.

	<b>Criterion A</b> <b>(0.35)</b>	<b>Criterion B</b> <b>(0.15)</b>	<b>Criterion C</b> <b>(0.05)</b>	<b>Criterion D</b> <b>(0.25)</b>	<b>Criterion E</b> <b>(0.20)</b>	<b>Score</b>
<b>Option I</b>	X	X	X	X	X	0.42
<b>Option II</b>	X	X	X	X	X	0.33
<b>Option III</b>	X	X	X	X	X	0.25

Table 9 – Example of AHP outcome

In this example we would go with option one, because it has the highest weighted score on the criteria. We can also see here that criterion A was found the most important of all criteria.

One of the advantages of the AHP is that we can perform a consistency check to determine whether the scores are or are not usable. We are able to do this test because when we are comparing the pairs, we make more comparisons than needed. The outcome of this test will tell us how consistent the scores are. When the consistency is low we can choose to improve it or to start over with the AHP.

## 7.2 Performance indicators in logistics

The work of Krauth, Moonen, Popova & Schut (2005) provides a framework of performance indicators based on an extensive literature review. They have divided the performance indicators into the different points of view on a logistical process. For the management point of view the indicators are further categorized into *effectiveness*, *efficiency*, *satisfaction* and *IT and innovation*. These indicators provide management with information on the performance of the company. They are used to make

adequate decisions and improve the overall performance of the company.

<b>Internal perspective - Management point of view</b>		
<i>Effectiveness</i>		
Revenue ↑ Profit margins ↑ Capacity utilization ↑ Km per day ↑ Labour productivity ↑ Price ↑ Turnover per km ↑ Number of deliveries ↑ Benefit per delivery ↑ Trips per period ↑ Perfect order fulfilment ↑ *Storage surface ↑ *Storage volume ↑ *Storage racks ↑ *Number and characteristics of docks ↑	Total number of orders ↑ Number of customers ↑ Number of new customers ↑ Number of regular customers ↑ Number of profitable customers ↑ Continuous improvement, rate ↑ Product range ↑ Plan fulfilment ↑ Total loading capacity (for trucks) ↑ On-time delivery performance ↑ *Product variety ↑ *Amount of products* ↑ *Seperation of storage areas ↑ *Handling equipment (electric, gas and diesel/petrol forklifts) ↑ *Ventilation control ↑	Long term plans availability / development ↑ Market share width ↑ Number of markets that have been penetrated ↑ Successful contacts – % of successful deals out of the initial offers ↑ Effectiveness of distribution planning schedule ↑ % of orders scheduled to customer request ↑ % of supplier contracts negotiated meeting target terms and conditions for quality, delivery, flexibility and cost ↑ Competitive advantage ↑ Certification (ISO 9001/9002, SQAS, HACCP) ↑ *Dangerous item storage possibilities ↑ *Temperature control ↑ *Distance to highway ↓ *Distance to train ↓ *Distance to waterway connection ↓
<i>Efficiency</i>		
Total distribution cost ↓ Labour utilization ↑ Overhead percentage ↓ Overtime hours ↓ % Absent employees ↓ Salaries and benefits ↓ Controllable expenses ↓ Non-controllable expenses ↓ Customer service costs ↓ Order management costs ↓ Inventories ↓ Number of trucks in use ↑ Total delivery costs ↓ *Pallets per hour ↓	Average fuel use per km ↓ Average delivery re-planning time ↓ Marketing costs ↓ Failure costs ↓ Prevention costs ↓ Appraisal/Inspection costs ↓ % of failed orders ↓ % of realized km out of planned km ↑ Performance measurements costs ↓ Human resource costs ↓ Variable asset costs ↓ Fixed asset costs ↓ Information system costs ↓	Overhead/management/administrative costs ↓ Quality of delivery documentation per truck/driver ↑ Effectiveness of delivery invoice methods ↑ % orders / lines received with correct shipping documents ↑ % product transferred without transaction errors ↑ Item/Product/Grade changeover time ↓ Order management costs ↓ Supply chain finance costs ↓ Total supply chain costs ↓ Total time in repair (for trucks) ↓ Ratio of realized orders vs. requested orders ↑ Average delivery planning time ↓ *Pallets/ m <sup>2</sup> ↑
<i>Satisfaction</i>		
Attrition of drivers ↓ Morale, motivation of personnel ↑	On-time delivery performance ↑ Number of customer complains ↓ Overall customer satisfaction ↑	% of orders scheduled to customer request ↑ Overall employees satisfaction ↑ Overall society satisfaction ↑
<i>IT and innovation</i>		
Information system costs ↓ Up-to-date performance information availability ↑ Utilization of IT equipment ↑ IT training costs ↓	Number of new products in the range ↑ % of information exchange through IT ↑ % of employees with IT training ↑ Availability of IT equipment ↑ Use of RFID/Barcoding ↑	% of information management assets used / production assets ↑ % of invoice receipts and payments generated via EDI ↑ Average time for new products development ↓ Average costs for new product development ↓
<b>Internal perspective – Employee's point of view</b>		
Km per trip ↓ Working conditions ↑	Weight to (un)load per labour hour ↓	Salaries and benefits ↑
<b>External perspective – Customer's point of view</b>		
Transportation price ↓ Insurance price ↓ Primary services price ↓ Goods safety ↑ Product variety ↑ Response time ↓ *Opening hours ↑ *On site offices ↑	Transparency for a customer ↑ Possible types of communication ↑ Available types of goods insurance ↑ Order size flexibility ↑ Timeliness of goods delivery ↓ *Duration pickup until information is updated inventory information is available to shipper ↓	Services variety ↑ Order configuration flexibility ↑ Possibility to change order details ↑ Additional services price (priority transportation) ↓ Contact points (number of people to contact) ↓ *Assistance with customs ↑
<b>External perspective – Society's point of view:</b>		
Level of CO2 emission ↓ Society satisfaction ↑ Wasting resources ↓ Recycling level ↓ Employees satisfaction ↑ Disaster risk ↓	Solid particles emission ↓ Taxes to the national treasury ↑ Participation in charitable actions ↑ Reputation of a company ↑ Road maintenance costs ↓ Number of available work places ↑	Competition level among similar companies ↑ Care for animals/children around ↑ Use of innovation technologies ↑ Development of innovation technologies ↑ Cooperation with other companies ↑

Table 10 - framework of performance indicators formulated by Krauth, Moonen, Popova & Schut (2005)

## Chapter 8 – Solutions

To provide a fitting solution for Benchmark Almelo, first we describe the expectations and wishes, and define the performance indicators that should be used. The different options are then described and evaluated using the analytic hierarchic process.

### 8.1 Expectations and wishes

When we try to find different solutions to the problems, we have to take the expectations en wishes from Benchmark into account. These expectations and wishes are listed below.

- ***Make sure all orders are processed within 24 hours***

In the current situation not all receipts are processed within the norm of 24 hours. The solution must provide Benchmark with tools to make sure the norm is met.

- ***KPI receiving***

The research must provide Benchmark with a way to adequately measure performance of the receiving department. This can also help prevent the discussion between the purchasing department and the receiving department.

- ***Visibility***

It is desired that the parcels that are in the dock for more than 24 hours are easily identified. This will make it easy to see which parcels should have high priority

### 8.2 Performance indicators needed

In the framework developed by Krauth et al (2005) that was introduced in the previous chapter we find two interesting performance indicators that can help us. From the effectiveness category the on-time delivery performance indicator is needed and from the efficiency category the percentage of order/lines received with the correct shipping documents is a useful performance indicator

#### ***Percentage of orders/lines received with correct shipping documents***

One of the problems is that finding the information that is needed to register an order line in the ERP system can cost a lot of time. In order to have a better idea of how often there are problems with the shipping documents, the percentage of correct shipped documentation should be measured. The requirements for documentation are in document BE-43002 and AN-46003 (appendix I), when a received order does not meet these requirements a registration should be made.



### ***On-time delivery performance***

The receiving department has to process the contents of the parcels they receive within 24 hours of arrival at the dock. We want to know how much of the items are delivered to the storage department within 24 hours. The percentage of order lines that are delivered on time should be measured. This will give a good representation of the performance of the receiving department.

## **8.3 Possible solutions**

In order to find ways to solve the problems at the receiving department we have been searching in literature, talking with stakeholders and also looking for ideas on the internet. Before we discuss the alternatives that we compare with the AHP, we give a short overview off the alternatives that did not make the initial selection.

One of the options that are left out is making spaces for every day of the week to place parcels that have come in. This results in five spaces to place parcels in and processing parcels from the area farthest away from the today area first. This option was left out of the AHP because of the space it would take up at the receiving department. Also parcels being booked into the ERP system more than three days after being received at the dock are rare, so two of the five spaces would almost always be empty.

Another option that did not make the first selection was putting stickers on the parcels with a different color for every day. These stickers would be placed on the parcels on the moment they arrive at the dock. This option was not taken into account because it is too similar to the color changing sticker option, discussed further on in this section, which is preferable.

### ***Color changing sticker***

The color changing sticker or badge is used for a lot of different applications. For example, they can be used to give visitors temporary access to a building or as a temporary parking permit. These stickers have to be activated by applying two components of the sticker together. The composition of the chemicals inside the sticker determine the time it takes for the sticker to change color or for a certain pattern to become visible. The stickers are widely available on the internet and are easy to use.



Figure 16 – Example of a color changing sticker

The solution would be to use stickers that expire after 24 hours. If these are applied to the parcels on the moment they arrive at the dock, they will expire 24 hours later. This will make it easy for operators

to see which parcels have high priority. The stickers need to be placed in such a way that they are always visible. This solution will make sure that parcels that exceed the norm of 24 hours are easily identified and then quickly processed in order to minimize the extent to which the norm is exceeded. As a performance indicator the number of parcels with an unexpired sticker can be measured, these can be presented as a percentage of the total processed parcels. This shows how much of the parcels are processed on time.

### ***FIFO lanes***

The area where the docked parcels are waiting to be processed can be divided into two sections. One section for parcels that came in yesterday or before yesterday and a section for parcels delivered on the present day. At the end of each day the last thing the operators should do is move any parcel that is left to receive and is in the “today” area to the “yesterday” area. With this system parcels that are in the yesterday area have priority over parcels that are in the today area, only when a shipment contains a hot part the priority is higher than the yesterday area. As a performance indicator for this solution, the number of parcels processed from the yesterday area can be measured. This will give information on the percentage of parcels that are processed on the day that they have arrived.

### ***Waybill scanning in BridgeLogix***

By scanning the tracking number that is on the parcel, called the waybill, while registering an order in the ERP system, data becomes available that can be compared with the data from the waybills that are scanned when the parcels arrive at the dock. The software that is currently used by the operators at the receiving department is BridgeLogix, it already has the option of entering the waybill number that is associated with an order line. When we compare this data we can show which waybills have not yet been registered in the ERP system, and how long they are waiting to be processed. The operators can then start their day by identifying which parcels from the previous day should be processed first. This solution also has the capability of reporting how much time there was between the moment of docking and the moment of entering in BaaN, for every order line. We can use this data to establish performance indicators.

## **8.4 Finding the best solution**

Now that we have three possible solutions we want to find a good fitting solution for Benchmark. In the previous chapter we explained the analytic hierarchic process which we will use to find a good solution.

Before we start with the process we need to establish what the criteria will be on which we base our analysis. The following criteria were obtained with advice of the senior supply chain analyst.

### ***Criteria***

- Amount of extra work added to the process (less is better)
- Self-evident, to what extent are the changes that need to be made understandable (more is better)
- Costs (less is better)
- Visibility (higher is better)
- ability to measure performance (more is better)

The criteria have been discussed in open interviews with the employees involved with the problems, these were operators, supervisors and a senior supply chain analyst. This has provided sufficient information to generate the weights of the criteria. By performing pairwise comparisons of the criteria we find the weight of each criterion and a consistency index. These are shown in table 11.

<b>Criterion</b>	<b>Weight</b>
<b>Amount of extra work</b>	0.09
<b>Self-evident</b>	0.04
<b>Costs</b>	0.31
<b>Visibility</b>	0.12
<b>Ability to measure performance</b>	0.44
<b>Consistency Index</b>	16.97

**Table 11 – Weights of the criteria and consistency index**

When the consistency index approaches zero the consistency of the scores in the AHP comparison matrix is better. A score of 16.97 is in the range of reasonably consistent. Scores ranging from 10 until 33 are in this range. Because we are satisfied with the level of consistency we will continue the analysis. The next step is to perform the same sort of comparisons for the alternatives with respect to the criteria. In this case we need five matrices to find the scores for each alternative on the criteria. When we sum the weighted scores on the criteria, we find the scores for each alternative shown in table 12.

	Amount of extra work	Self- evident	Costs	Visibility	Ability to measure performance	
<b>weights</b>	0.09	0.04	0.31	0.12	0.44	Score
Color changing sticker	0.09	0.43	0.05	0.23	0.39	0.238
FIFO lanes	0.65	0.43	0.47	0.67	0.05	0.326
Waybill scanning	0.26	0.14	0.47	0.09	0.57	0.436

Table 12 – AHP outcome

According to the results of the analysis in table 12 Waybill scanning in BridgeLogix is the best fitting solution for Benchmark.

### *Sensitivity analysis*

To find out how vulnerable the AHP is to minor misjudgments in the pairwise comparisons we perform a sensitivity analysis. We will do this for the weights of the criteria as well as the scores of the alternatives on the criteria. What we want to know is how much a weight or score can deviate from the initial value before the outcome of the AHP is changed. When we change the weights of the criteria, we have to make sure the sum of the weights is still one. This means that the weights of other criteria will become lower when we increase the weight of a criterion.

	initial weight	low	high	best scoring alternative
<b>Amount of extra work</b>	0.09	N/A	0.27	FIFO lanes
<b>self-evident</b>	0.04	N/A	0.36	FIFO lanes
<b>costs</b>	0.31	0.02	N/A	FIFO lanes
<b>visibility</b>	0.12	N/A	0.29	FIFO lanes
<b>ability to measure performance</b>	0.44	0.27	N/A	FIFO lanes

Table 13 – Sensitivity in criteria weights

In table 13 we can see that the weights have to be changed significantly before the result of the AHP will be different. We can also see that the FIFO lanes option would have been the best alternative if one of the criteria was given the wrong weight. Because we can justify that the ability to measure performance is the most important aspect and it is unlikely that the other criteria should be higher rated at the cost of the most important criteria the AHP is strong enough.

Now we will check the sensitivity in scores on the criteria. This is performed in the same way as the sensitivity of the weights from table 13. The only two criteria that are relevant for analyzing are costs

and ability to measure performance. The reason for this is that changing the scores on these criteria result in a different outcome of the AHP. When we change scores on the other criteria the outcome of the AHP will stay the same.

<b>Costs</b>	<b>Initial score</b>	<b>low</b>	<b>high</b>	<b>Best scoring alternative</b>
<b>Color changing sticker</b>	0.05	N/A	0.5	Color Changing sticker
<b>FIFO lanes</b>	0.47	N/A	N/A	N/A
<b>Waybill scanning</b>	0.47	N/A	N/A	N/A

Table 14 – sensitivity in criterion costs

Regarding the costs criterion, the outcome of the AHP would only be different when the color changing sticker scores 0.5 or higher. We can be absolutely sure that the other two alternatives will cost less, therefore the possibility that the color changing sticker will score higher on this criterion than the other two alternatives does not exist.

<b>Ability to measure performance</b>	<b>Initial score</b>	<b>low</b>	<b>high</b>	<b>Best scoring alternative</b>
<b>Color changing sticker</b>	0.39	N/A	0.63	Color changing sticker
<b>FIFO lanes</b>	0.05	N/A	0.5	FIFO lanes
<b>Waybill scanning</b>	0.57	0.29	N/A	Color changing sticker

Table 15 – sensitivity in criterion ability to measure performance

In table 15 we can see that the criterion ability to measure performance is not very sensitive to minor misjudgments because the scores would have to deviate a lot from the initial scores before another alternative would get the highest score on the AHP.

## 8.6 Summary

In this chapter three possible options that contribute to solving the problems at the receiving department are compared using the analytic hierarchic process. The options were compared on five criteria; Amount of extra work, to what extent is the option Self-evident for operators, costs, visibility and ability to measure performance. The highest scoring alternative is waybill scanning in BridgeLogix. The sensitivity analysis points out that the results are strong enough for further use.

## **Chapter 9 – Consequences and utilization of the solution**

In this chapter we will describe what changes need to be made in order to implement the solution provided by the previous chapter and how Express Receiving should be approached. The reporting tool and its applications will be explained and a roadmap to improve the reporting tool will be provided.

### **9.1 Changes that need to be made**

#### ***Express Receiving***

Before explaining what changes need to be made at the receiving department, we want to make clear that Express Receiving should not be used. Along with the issues described in paragraph 6.3 which made clear that Express Receiving is not faster and is not necessary to eliminate human errors, we also feel that one single procedure to enter orders in the ERP system is much better than two different ways to achieve the same. Express receiving also adds unnecessary complexity to the receiving operation because the procedures are very similar, but slightly different. This means mistakes can easily be made. Another reason for not using Express Receiving is the scanner and the software. The scanner for Express Receiving has very small buttons which are very hard to use when manual input is needed. This can happen when a barcode is unable to be scanned. The software on the scanner is not working flawlessly, while doing different tests and using Express Receiving the scanner needed to reboot multiple times without any reason. BridgeLogix does not have these problems.

Only when all orders can be Express Received and the software works flawlessly, the use of Express Receiving should be reconsidered.

#### ***BridgeLogix***

The procedures as described in paragraph 4.2 do not need to be changed rigorously. The most important thing is to hold on to the parcel along with the items that are inside. The waybill is always on the outside of the parcel therefore the parcel should not be thrown away immediately after opening it. The waybill should be scanned when the BridgeLogix software indicates that it can be entered, this happens after entering the order number, or choosing the order line when there are more lines to be received. The ERP system will now contain data from the moment a parcel arrived at the dock and the moment the content from that parcel is processed and put to stock. The ERP system 'BaaN' currently makes a data dump of the waybills that are scanned every week. This data dump of the waybills that are scanned at dock and to stock must be made after every working day. These excel files can then be used

to compare the data and make a report with on time delivery performance and make a list of parcels that should be processed first because they are close to overriding the norm of 24 hours.

## 9.2 OnTime Waybill report, how does it work?

When goods arrive at the dock they are scanned to register that they have arrived. Let us recall that the barcode that the operators at the receiving department scan is referred to as “waybill”. This procedure is called docking. When all parcels are scanned the information is stored in BaaN. Every night the docking data is dumped from corporate servers into an excel file “Waybill scan at dock last 13 months.xls”. This file contains the date and time on which a waybill has arrived at the dock. Inside the parcels are the order lines that need to be booked into the ERP system. This booking procedure is carried out with the BridgeLogix software. During this procedure the waybill will be scanned again and stored in BaaN along with the order line information. This data is also dumped into an excel file called “Waybill scan to stock last 13 months.xls”.

These two excel files contain data about the moments when the waybill arrived at the dock and when the waybill was booked into BaaN. If we compare these times, we find the time that an order line has been waiting in the dock before being processed.

### late waybills

The order lines that were registered in BaaN within 24 hours are the lines in the table that are not marked yellow or orange. For every day these lines are counted and they are represented as the blue bars in the bar chart above. Order lines that have waited longer than 24 hours are either marked yellow or orange. Yellow lines have waited between 24 and 48 hours and orange

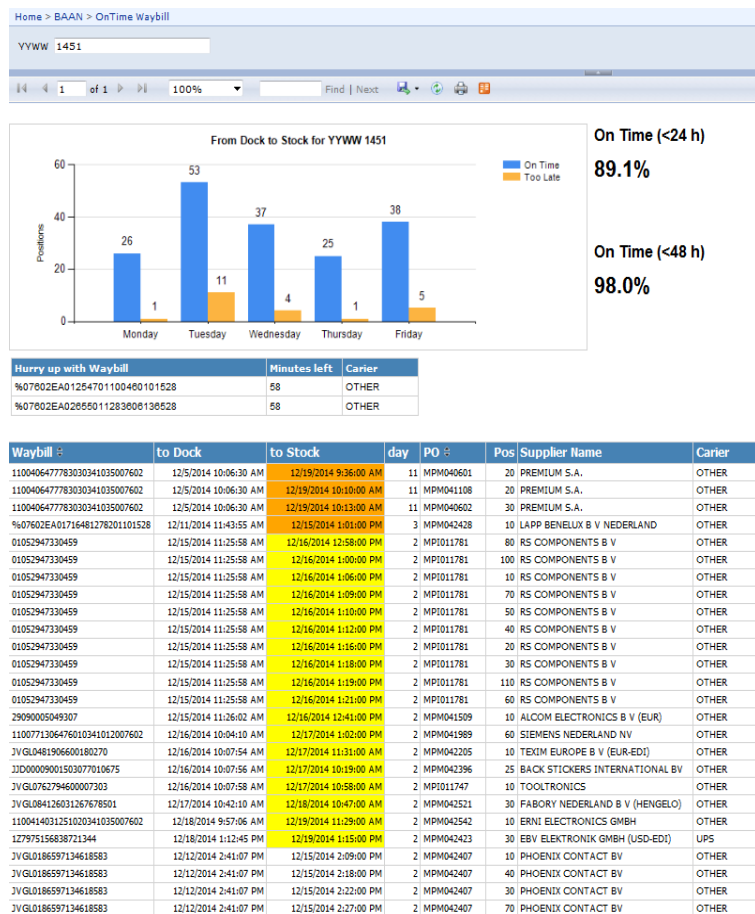


Figure 17 – OnTime Waybill report

lines have waited more than 48 hours. Yellow and orange lines are also counted per day these are both represented in the orange bars in the bar chart above the tables.

### ***Hurry up***

The table *hurry up with waybill* consists of waybills that are in the excel file with Docking information, but are missing in the excel file with to stock information. This means that they have arrived at the dock but have not yet been registered into BaaN. Only the urgent waybills are in this table, these are waybills that have four or less hours until they become late. During the day these waybills will be different, because waybills that are too late will not be represented and other waybills may become urgent. The data is dumped only once a day, right before the operators start their shifts. This means that the report will not update right away when an operator has processed an urgent waybill.

## **9.3 Using the OnTime Waybill report**

The reporting tool has different applications which will be discussed in this section.

### ***Reducing lead times***

Operators at the receiving department want to make sure all orders are processed within 24 hours. The “Hurry up with waybill” table will help them identify parcels that should be processed first. When the operators start their day, they must check the table and take a few minutes to identify parcels that are in the table. In the example from figure 17 there are two waybills that need to be processed within 58 minutes. When these two parcels are processed first they are within the norm of 24 hours. The report works with data that is dumped overnight so the hurry up table will only be up to date in the morning when the operators start their shifts.

### ***Performance indicator***

The bar chart in the report provides information about the day to day performance of the receiving department. It visually represents the amount of order lines processed within 24 hours and the amount of order lines processed later than 24 hours after being docked. The report should be printed weekly and put up on the performance score board of the warehouse department. This should be discussed weekly with the operators.

### ***On time delivery discussion with purchasing department***

The report can be used to eliminate speculation in the discussion about whether an on time delivery hit regarding a supplier is due to poor performance of the receiving department or due to poor



performance of the supplier. The report provides accurate information about when an order arrived at the dock and how long it has taken before that order was put to stock.

## 9.4 Roadmap for improving the OnTime Waybill report

The report as described in the previous paragraphs is functional, but there still are some improvements that need to be made. This section provides a roadmap with actions that need to be taken to improve the OnTime Waybill report, ranked in order of importance.

<b>Action</b>	<b>Responsible department</b>
<b><i>Eliminating missing waybills</i></b> At this stage not all order lines are visible in the report. The problem is that some suppliers deliver their shipments without tracking numbers on the parcels. Therefore the parcels cannot be scanned on the moment they arrive at the dock. The purchasing department must make sure these suppliers (ES ELEKTRO and DUTRON) deliver their shipments with waybills. This will make sure all order lines are represented in the report.	<b><i>Purchasing</i></b>
<b><i>Filter unexpected receipts</i></b> The primary use of this report is to provide insight in the performance of the receiving department. Items that have been staged unexpected for some time, and then booked into BaaN after a lot of days, are not bad performance of the receiving department and should not be taken into account when calculating the performance of the receiving department. In the current version of the report this does happen as we can see in the example of the report (figure 17). These occasions need to be filtered out of the performance calculation and transformed into a performance indicator for the purchasing department. The goal should be to minimize the time that items stay on the unexpected location. An option to achieve this could be to make a barcode that can be scanned with all items that are booked after coming from the unexpected location. Another option would be adding numbers to end of the barcode that the report can recognize and filter. The difficulty here is that the barcode that is scanned as a waybill when booking the unexpected item, still needs to be compared to the waybill associated with docking.	<b><i>Business Intelligence</i></b>
<b><i>Integrating supplier delivery dates</i></b> The report provides the exact moment that a parcel and the order line(s) it contains arrive at the dock. This data should be used to measure the on time delivery performance of the suppliers. Currently the purchasing department measures the OTD performance based on data from booking the order lines in BaaN. This leaves a lot of room for error as it is sometimes very busy at the receiving department, which means order lines are in some cases booked a lot later than they have arrived at the dock. The spreadsheet that is used for measuring OTD performance accounts for these errors by only marking order	<b><i>Business Intelligence</i></b>

lines that are more than two days late as an OTD hit. When the confirmed delivery dates in BaaN are linked to the docking data from the report, the purchasing department will have accurate information about the on time delivery performance of their suppliers.

**Barcoded waybill on packing slip** **Purchasing**  
To make the scanning of waybills in BridgeLogix easier for the operators, the purchasing department must arrange with the suppliers that they provide the waybill with a barcode on the packing slip. In the supplier requirements documentation from benchmark (appendix I) a tracking number is already required on the packing slip but few suppliers provide it. The purchasing department must add “barcoded waybill” to the supplier requirements. And make sure all suppliers comply.

**Making trend information available** **Business Intelligence**  
The percentages that are shown in the report can be used to plot a trend line. This information can be helpful with predicting when it will be hard to process al order lines on time. Buyers could also try to avoid ordering non-essential items to come in when the receiving department cannot handle the workload. These items could be requested a week earlier or later.

Table 16 – Roadmap to improve the OnTime Waybill report

9.5 Summary

In order to implement the solution presented in the previous chapter, Benchmark should not engage further in Express Receiving and only use BridgeLogix software to register orders in the ERP system. While registering these orders the operators need to scan the waybill that is present on the outside of the parcel. This extra procedure provides the data needed to measure the performance of the receiving department and also improve the amount of parcels that are processed within the norm of 24 hours. For the purchasing department accurate information about when an order arrived at the dock is also available. This data should be used to measure on time delivery performance of their suppliers. The roadmap to improve the report explains how that can be accomplished and what other improvements need to be made to the report.

## **Chapter 10 - Conclusions and recommendations**

### **10.1 Conclusions**

The goal of this research was to provide Benchmark with tools to improve the lead times at the receiving department and ways to measure the performance of the department. According to this research the best way to achieve both goals is to make more information available about the moment an order is registered in the ERP system. This is achieved by scanning the waybill in BridgeLogix, this same waybill is also scanned on the moment the order arrives at the dock. This provides Benchmark with a performance indicator and a tool to lower the lead time at the receiving department. Operators at the receiving department should start their shifts with the identification of parcels that should be processed first, this will make sure that the norm of processing parcels within 24 hours will be met. In the rest of their activities they should try to work according to the FIFO principle as accurate as possible. The use of the tool prevents parcels from getting lost on the bottom of the pile.

Express Receiving which was introduced in 2010 was presented as a revolution in receiving and with very high expectations. It would be much faster, easier to perform and human errors would be eliminated. In the research we show that Express Receiving does not live up to these expectations and that it causes more frustration than benefits. The receiving department is better off working with only one procedure to register items in the ERP system, because they do not have to switch methods which makes operators faster and more experienced with the procedure.

### **10.2 Recommendations**

It is recommended that the OnTime Waybill report is improved by taking the actions described in the roadmap from paragraph 9.4. When these actions have been completed Benchmark achieves improved on-time delivery measurement at the purchasing department and is able to see trends in the workload at the receiving department, this will help with planning the need for extra operators at the receiving department.

In section 8.2 useful performance indicators are described. The internal on time delivery performance indicator is provided in the solution, but the other performance indicator 'percentage of order/lines received with correct shipping documents' is not. Further research is needed to make this indicator measurable and useable as a performance indicator of the purchasing department. The goal of this recommendation is that the variety in which suppliers deliver goods should be reduced to a minimum.

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### Color changing sticker

<http://www.labelvalue.com/more-for-the-office/name-badge-labels-and-clips/dymo-30367-self-expiring-stickers-p-381.html>

# Appendix I – Supplier requirements

## AN-46003



Almelo Policy and Procedure  
Logistic Supplier Requirements  
Document Number: AN46003  
Revision Level: 001 Date: 27-11-12

### 1 Purpose and Scope

#### 1.1 Purpose

This procedure describes the requirements towards the supplier regarding logistic subjects.

#### 1.2 Scope

This procedure is valid for supply chain management and development.

### 2 References

- Approval form Logistic Supplier Agreement ANF46003
- Amendment to Logistic Supplier Requirements ANF46004

### 3 Definitions

- SCM = Supply chain management
- RoHS = Restriction of Hazardous Substances

### 4 Responsibility

The supply chain architect is responsible for the qualification process concerning defined projects and products (specials) for development starting from phase one up to including phase 5 of the 7 steps model. The initial purchaser is responsible for the qualification process of SCM from phase one up to including phase 5 for the other parts and for the running projects from phase 6 and 7.

Filename: AN46003  
Approved by: SC Manager

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Template:



Almelo Policy and Procedure  
Logistic Supplier Requirements  
Document Number: AN46003  
Revision Level: 001 Date: 27-11-12

### 5 Concept Procedure

#### Supplier product identification:

Deliveries from suppliers to Benchmark b.v. should be clearly identified according to our packaging and identification standards.

#### Order confirmation:

Purchase orders need to be confirmed within 5 working days.

The order confirmation should contain the following information:

- Benchmark-order nr + linenr.
- Benchmark part number
- Confirm quantity
- Unit of measure
- Requested Delivery date
- Confirmed Delivery date
- Price + currency
- Supplier part-identification
- Supplier order reference
- Name/address supplier
- Contact Benchmark b.v.
- Contact Supplier
- Additional costs
- Terms of payment
- Terms of delivery
- RoHS compliant status (if applicable)

#### Package information:

Each separate package should be identified. The packaging should contain the following information:

- Benchmark article numbers
- Package quantity
- Benchmark-order number + borderline number
- Benchmark-address
- Shipping date
- RoHS compliant status (if applicable)

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Template:

**Packing list:**

Each shipment must contain a packing-list with detail information of each package.  
The packing-list should contain the following information:

- Benchmark-ordernr + linenr.
- Benchmark part number
- Supplier part-identification
- Delivered quantity
- Unit of measure
- Name/address supplier
- Contact Benchmark b.v.
- Contact Supplier for deliveries
- Tracking and tracing information on shipments (Waybill, Airway bill or Bill of Lading)
- RoHS compliant status (if applicable)

**Invoice:**

After delivery, the goods should be invoiced from the supplier to Benchmark b.v.

- The invoice should contain the following information
- Benchmark-ordernr + linenr.
- Benchmark part number
- Supplier part-identification
- Delivered quantity
- Unit of measure
- Name/address supplier
- Contact Benchmark b.v.
- Contact Supplier for payments
- Price + currency
- Additional costs
- Terms of payment
- Terms of delivery
- Tracking and tracing information on shipments (Waybill, Airway bill or Bill of Lading)
- Origin statement
- Harmonized code
- Banking information
- VAT-number

Package, packing list or invoices that don't meet above mentioned requirements can only be accepted after written approval from Benchmark-purchasing.

## 1 Scope and Purpose

This document establishes requirements for package labeling and date or lot code segregation for suppliers providing material to Benchmark Electronics (BEI).

This document is specific to all commodity types directly related to the manufacture of BEI products.

## 2 References

None

## 3 Definitions

Lot: a group of product that is unique to time, date and location of manufacture.

## 4 Requirements

### 4.1 Purchases from non-standard suppliers

From time to time, due to availability, BEI Purchasing is required to buy material from a supplier who is unaware of this requirement and does not have sufficient time to incorporate the necessary equipment to comply. This material will receive a Benchmark Electronics barcode label upon receipt.

### 4.2 Supplier

#### 4.2.1 Overview

In order to provide an increased level of efficiency, inventory accuracy and product traceability, Benchmark Electronics requires that all material shipped be labeled with a combination of human readable and bar code. In addition, material must be segregated and identifiable by date code or lot code in the supplier packaging for all part numbers. This means each lot of a unique date code, or date code and lot code combination, must be separated, packaged appropriately and marked as defined in this procedure. The unique date or lot code groups can then be packaged and shipped together as long as the final shipping container is marked as defined in the following paragraphs.

#### 4.2.2 Labeling requirements

##### 4.2.2.1 All material

Suppliers must not cover any manufacturer labels with the supplier labels. If the manufacturer label includes bar-coded information that meets Benchmark's specifications, then the supplier may eliminate those fields from the supplier label.

#### 4.2.2.2 Additional label requirements include:

- Code 128 bar code is preferred but Code 39 is acceptable.
- Bar codes should be at least 0.2" [5 mm] in height.
- Bar codes should use a minimum 3:1 ratio with a 6.6 mil [0.17 mm] minimum bar width.
- Text on the label should be a minimum of 0.12" [3.0 mm] in height.
- Fields shown on the label are in the order desired by Benchmark. It is preferred that the vendor supplies the fields in the same order for consistency.
- (HR/BC) indicates that both human readable text and bar code are required.
- (HR) indicates that only human readable text is required.
- (HR/BC desired) indicates that human readable text is required and a bar code is desired if there is space available on the label.

Labels must be on the outside of the shipping container, each bag of product contained within the shipping container, and the packing list (see figure 1). If material is received in tape and reel format then this label must also be on the outside of each reel.

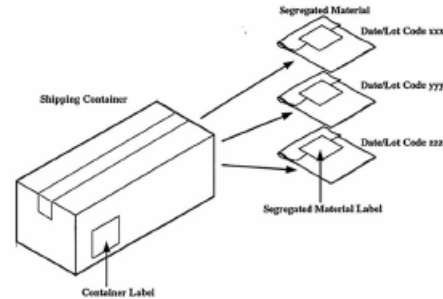


Figure 1 – Drawing showing approximate location of bar code labels for the shipping container and the segregated material.

#### 4.2.2.3 Outer container label

The outer container label is typically 4" x 6" [100 mm x 150 mm]. The following information is required (see figure 2):

- From address (HR). May be provided on a separate shipping label if desired.
- To address (HR). May be provided on a separate shipping label if desired.
- Date shipped (HR).
- Box 1 of X (HR). Where X is the number of boxes used to pack a single pack slip line number. May be provided on a separate shipping label if desired.
- Vendor pack slip number (HR/BC). Must be referenced on vendor's invoices.
- Purchase order number (HR/BC).
- Benchmark pin (HR/BC).
- Total quantity of part number referenced on this label (HR/BC).
- Manufacturer name (HR/BC).
- Manufacturer part number(s) (HR/BC).
- Manufacturer lot code (if applicable) (HR/BC).
- Manufacturer date code (if applicable) (HR/BC).
- Revision (if applicable) (HR/BC).

Figure 2: Example of an outer container label

#### 4.2.2.4 Inner packaging label and packing slip label

Figure 3 shows our ideal label to be placed on each inner package, with a copy of each label placed on the pack slip. This label is typically 4" x 2.5" [100 mm x 62 mm]. If space is limited on the label or pack slip, it is acceptable to bar code the pack slip number and purchase order number on the pack slip and create the inner packaging label as described below with the pack slip and purchase order in text only. The following information is required:

- Vendor pack slip number (HR/BC). Must be referenced on vendor's invoices.
- Purchase order number (HR/BC).
- Benchmark part number (HR/BC).



- Total quantity in package (HR/BC).
- Manufacturer name. (HR/BC desired).
- Manufacturer part number(s) (HR/BC).
- Manufacturer lot code (if applicable) (HR/BC).
- Manufacturer date code (if applicable) (HR/BC).
- Revision (if applicable) (HR/BC desired).

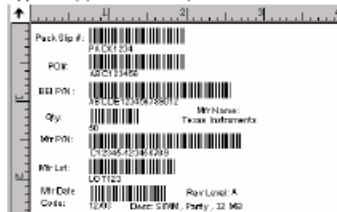


Figure 3: Example of inner package label

If no manufacturers label exists or it is lacking required information, suppliers are then required to provide requested information.

Additional information may be added as required by the needs of the supplier.

#### 4.3 Nonconformance

Suppliers who do not meet this requirement may have their material rejected at the Benchmark Electronics receiving level. A supplier corrective action request may be issued, requesting an explanation for nonconformance and a target date for compliance.

## Appendix II – OnTime Waybill report, how does it work?

This explanation of the OnTime Waybill report was provided to Benchmark at the last day of my internship, it is almost similar to the information provided in chapter 9.

### SharePoint/reporting/On Time to Stock

#### **Gathering the data**

When goods arrive at the dock they are scanned to register that they have arrived. The barcode that the operators at the receiving department scan is referred to as “waybill”. This procedure is called docking. When all parcels are scanned the information is stored in BaaN. Every night the docking data is dumped from corporate servers into an excel file “Waybill scan at dock last 13 months.xls”. This file contains the date and time on which a waybill has arrived at the dock. Inside the parcels are the order lines that need to be booked into the ERP system. This booking procedure is carried out with the BridgeLogix software. During this procedure the waybill will be scanned again and stored in BaaN along with the order line information. This data is also dumped into an excel file called “Waybill scan to stock last 13 months.xls”.

These two excel files contain data about the moments when the waybill arrived at the dock and when the waybill was booked into BaaN. If we compare these times, we find the time that an order line has been waiting in the dock before being processed.

#### **late waybills**

The order lines that were registered in BaaN within 24 hours are the lines in the table that are not marked yellow or orange. For every day these lines are counted and they are represented as the blue bars in the chart. Order lines that have waited longer than 24 hours are either marked yellow or orange.

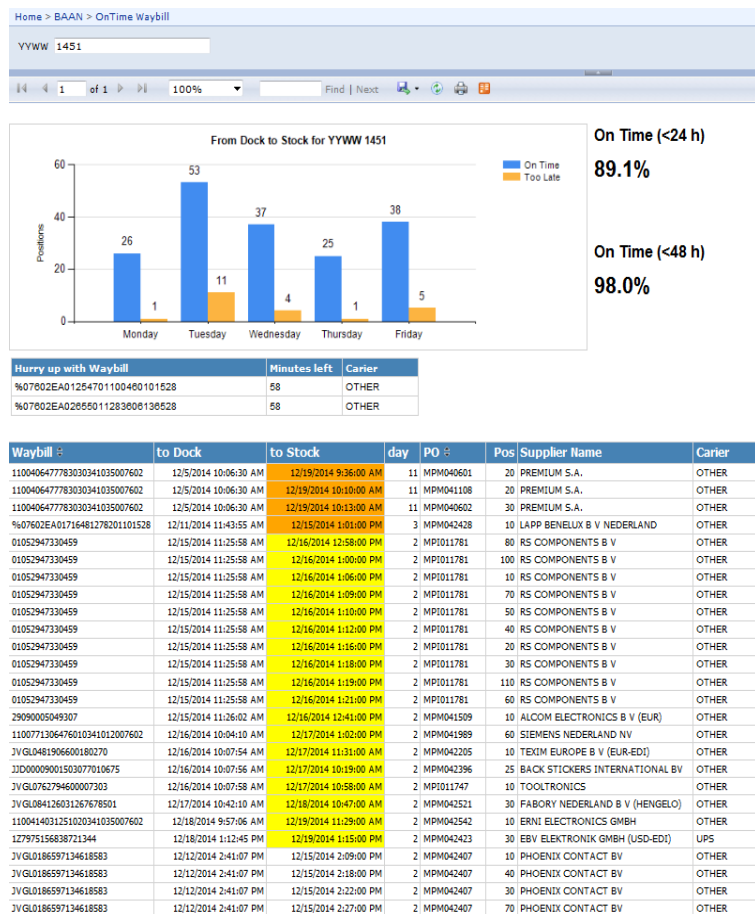


Figure 18 – OnTime Waybill report

Yellow lines have waited between 24 and 48 hours and orange lines have waited more than 48 hours. Yellow and orange lines are also counted per day these are both represented in the orange bars in the bar chart above the tables.

### ***Hurry up***

The table *hurry up with waybill* consists of waybills that are in the excel file with Docking information, but are missing in the excel file with to stock information. This means that they have arrived at the dock but have not yet been registered into BaaN. Only the urgent waybills are in this table, these are waybills that have four or less hours until they become late. During the day these waybills will be different, because waybills that are too late will not be represented and other waybills may become urgent. The data is dumped only once a day, right before the operators start their shifts. This means that the report will not update right away when an operator has processed an urgent waybill.

### ***Applications of the report***

- The report should be put on the BAM board once a week preferably on Monday because that is the first moment the data of an entire week is available.
- Every morning the hurry up waybill table should be used to identify parcels that need to be processed first. The operators at the receiving department must reserve a few minutes at the beginning of their shift to find these parcels. If they cannot find a waybill from the table or the table is empty, they should still try to achieve as much FIFO as possible.
- The purchasing department can check the report to see when an order arrived at the dock

### ***Further actions to improve the report***

#### ***Missing waybills***

At this stage not all order lines are visible in the report. The problem is that some suppliers deliver their shipments without tracking numbers on the parcels. Therefore the parcels cannot be scanned on the moment they arrive at the dock. The purchasing department must make sure these suppliers (ES ELEKTRO and DUTRON) deliver their shipments with waybills. Most ideal for the operators at the receiving department would be a barcoded waybill on the packing slip from every supplier.

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OE#: 20653822  
SHIP TO: 221166-477321  
A. Vermeij  
Benchmark Electronics BV  
Lelyweg 10  
7602 EA Almelo  
Netherlands

Delivery Name: 6134707  
Ship Date: 11-DEC-14  
MAWB:  
Customer PO#: MPI011748

Waybill: 1ZA0748A6801754462  
Ship Method: NIE-UPS-TL-Standard  
Collect Acct:

Figure 19 - packing slip

In the figure on the right there is a waybill provided on a packing slip from December, this shows that it is possible for suppliers to provide the waybill on the packing slip. In this example the waybill is not barcoded but that should also be possible.

### ***OTD purchasing department***

The report provides the exact moment that a parcel and the order line(s) it contains arrive at the dock. This data should be used to measure the on time delivery performance of the suppliers. Currently the purchasing department measures the OTD performance based on data from booking the order lines in BaaN. This leaves a lot of room for error as it is sometimes very busy at the receiving department, which means order lines are in some cases booked a lot later than they have arrived at the dock. The spreadsheet that is used for measuring OTD performance accounts for these errors by only marking order lines that are more than two days late as an OTD hit. When the confirmed delivery dates in BaaN are linked to the docking data from the report, the purchasing department will have accurate information about the on time delivery performance of their suppliers.

### ***Unexpected***

The primary use of this report is to provide insight in the performance of the receiving department. Items that have been staged unexpected for some time, and then booked into BaaN after a lot of days, are not bad performance of the receiving department and should not be taken into account when calculating the performance of the receiving department. In the current version of the report this does happen as we can see in the example of the report (figure 18). These occasions need to be filtered out of the performance calculation and transformed into a performance indicator for the purchasing department. The goal should be to minimize the time that items stay on the unexpected location. An option to achieve this could be to make a barcode that can be scanned with all items that are booked after coming from the unexpected location. Another option would be adding numbers to end of the barcode that the report can recognize and filter. The difficulty here is that the barcode that is scanned as a waybill when booking the unexpected item, still needs to be compared to the waybill associated with docking.

### ***Trend***

The percentages that are shown in the report can be used to plot a trend line. This information can be helpful with predicting when it will be hard to process all order lines on time. Buyers could also try to

avoid ordering non-essential items to come in when the receiving department cannot handle the workload. These items could be requested a week earlier or later.

### ***Risks***

The risk of this report is losing time when searching for waybills that are already processed. When the occasions on which this can happen are kept in mind, time will not be lost.

- When the hurry up with waybill table is used during the day, the waybills in the table might already have been processed. The report is not updated real time so it is only accurate on the beginning of the day.
- It can happen that the waybill is not scanned when the order line is being registered in BaaN, the barcode might be missing or unreadable. This can cause waybills to be presented in the hurry up table when they have already been processed.