STUDY OF GENERAL AND OFFICE SUPPLY DELIVERY BETWEEN UNIVERSITY STORES AND THE UNIVERSITY OF MICHIGAN HOSPITALS

FINAL REPORT
May 2, 1990

Project Consultants:

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Jason Hardiman
Bruce Oshaben
Rudy Redmond
Bob Russell: A
Kevin Donnarumma: A
Dale Sucks daff: B+
Joe Diederich: A to B+
Neal: B+

Koffrey Report: 95%
Good quantification
EXECUTIVE SUMMARY

The purpose of the study was to determine the staffing required to deliver general and office supplies (as defined by the University of Michigan) from University Stores (located at 3580 Varsity Drive Ann Arbor, Michigan) to user departments at the University of Michigan Hospital (UMH) buildings. This study will not only help improve the delivery system of general and office supplies but can also serve as a pilot for University Stores and University of Michigan Hospitals to adapt to other programs.

The goals of the study are:
- Determine the staffing required for timely and accurate delivery of general and office supplies to the UMH buildings specified below.
- Analyze and suggest possible improvements in the staging and sorting of general and office supplies at University Stores.
- Analyze the cost of the delivery personnel supervision.

The Delivery System (see also Appendix A) is as follows:
1. The staging of general and office supplies at University Stores.
2. The motor transportation of general and office supplies from University Stores to UMH Dock 5.
3. The sorting of general and office supplies at Dock 5 by University Stores.
4. The manual delivery of general and office supplies from Dock 5 to the specified UMH destinations by University Stores.

The methodology and approach to the study was broken down into three steps:

1) The staging of general and office supplies was analyzed by flowcharting the current system and making recommendations for improvements.
2) The number of delivery personnel was determined through the use of a daily log sheet, an end user survey, and the consultants getting first hand experience.
3) The cost of the current supervision system, which consists of delivery personnel reporting to University Stores at the beginning of the shift, was determined.
The study concluded the following findings:

- Delivery Process Time Breakdown:

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**TOTAL BILLABLE HOURS** 13 hours 37 minutes

* The above calculations are based on averages taken from the data collected which can be seen in Appendix E and F.

* These calculations do not include lunch time (30 minutes) because it is not paid time.

* It takes on an average, 1.87 full time equivalents per day to deliver the general and office supplies throughout UMH.

**CALCULATION:** 13.62 hours / 8 hours per FTE = 1.7025
then take into account sick days, holidays, and vacations:
1.7025 + (1.7025 x .10) = 1.87 FTE
This calculation is for paid FTEs. FTE is defined as a full time equivalent that works 8 hours a day, 40 hours a week, 52 weeks a year. Seasonality is not taken into account.
• The cost of the current supervision system (delivery personnel report to University Stores first and then are driven over to UMH) was found to be the expenditure of 29 unutilized minutes per FTE (waiting time for the truck).

• The staffing required should correlate with the number of delivery stops necessary for that day. Approximately, every 79 + (12) stops for the day at UMH requires reevaluation of staffing. Overtime or additional staffing could be used. This result reflects an average volume day (i.e. a variety of the available supplies were delivered: desks, small items, drums of supplies, etc... For details see data log sheets given with this report.)

In order to improve the efficiency of the delivery process, we recommend the following:

A. Eliminate Materiel Management's role in the delivery process.
B. Shipping and handling costs built into the price of goods.
C. Log sheet used by delivery personnel.
D. Delivery personnel have floor plans of UMH available.
E. Delivery personnel have their own transportation.
F. Sorting process done in one step and carts used.
G. Computer to pre-sort the orders to reflect optimum delivery route.
H. Make electronic ordering a standard procedure.

*Note: for details see part V of this report.
I. INTRODUCTION AND BACKGROUND

A. Purpose of Project

To determine the staffing required to deliver general and office supplies (as defined by the University of Michigan) from University Stores (located at 3580 Varsity Drive Ann Arbor, Michigan) to user departments at the University of Michigan Hospital (UMH) buildings.

B. Background and Environment Affecting Project

Prior to March 1989 University Stores personnel delivered general and office supplies to UMH Dock 5 and, in turn, UMH Materiel Management staff delivered these supplies to their specified destinations within the mentioned UMH buildings. In March 1989, University Stores agreed to deliver general and office supplies directly to their specified destinations.

This study will not only help improve the delivery system of general and office supplies but can also serve as a pilot for University Stores and University of Michigan Hospitals to adapt to other programs.

C. Goals and Objectives of Project

• Determine the staffing required for timely and accurate delivery of general and office supplies to the UMH buildings specified below.
• Analyze and suggest possible improvements in the staging and sorting of general and office supplies at University Stores.
• Analyze the cost of the delivery personnel supervision.

D. Definitions

1) University of Michigan Hospital Buildings:

1. Adult General Hospital
2. Taubman Health Care Center
3. Mott Children's Hospital
4. Holden Hospital
5. Women's Hospital
6. Med. Inn Building
7. CFOB
8. Medical Professional Building

and including
9. Towsley Center
2) The Delivery System (see also Appendix A):

1. The staging of general and office supplies at University Stores.
2. The motor transportation of general and office supplies from University Stores to UMH Dock 5.
3. The sorting of general and office supplies at Dock 5 by University Stores.
4. The manual delivery of general and office supplies from Dock 5 to the specified UMH destinations by University Stores.

3) Full Time Equivalent (FTE):

Is defined as the equivalent of an employee working 8 hours per day, 40 hours per week, 52 weeks per year.

The delivery personnel are paid for work hours and two 15 minute breaks, they are not paid for a half hour lunch break.

E. Client Definition

This study involves two clients:

J. Joseph Diederich
Associate Hospital Director of Support Services
University of Michigan Hospitals

Eugene O. Ingram
Director of Purchasing and Stores
University Stores
II. APPROACH AND METHODOLOGY

A. Scope of Project

This project encompassed the delivery system, which is defined in section I.D.2.

The project did not include the following:
1. The use of a third party delivery service.
2. Evaluation of motor transportation of general and office supplies.
3. Evaluation of ordering, billing, returns, or refunds.

B. Approach

The staging of general and office supplies:

1. The current system, staging at University Stores and sorting at UMH Dock 5, was documented by project consultants (see Appendix A).

2. The project consultants studied the efficiency of staging and sorting the general and office supplies at University Stores using carts (see Appendix B).

The determination of the number of delivery personnel:

1. The project consultants observed the staging and delivery procedures of the University Stores delivery personnel to become familiar with the operation.

2. A University Stores delivery staff log sheet was given to the delivery personnel to use for a period of two weeks (see Appendix D).
   The delivery person recorded:
   a. The starting time
   b. Room number
   c. The time of delivery
   d. The end time
   e. Comments
3. A verbal survey was administered to selected supply recipients concerning timeliness and accuracy of delivery (see Appendix C).

4. One project consultant assumed the role of delivery person to determine the variance in time and accuracy between one delivery person and two.

Cost analysis of supervision:

The cost, in unutilized minutes, was determined for the current supervision system, which consists of delivery personnel reporting to University Stores at the beginning of the shift.
III. CURRENT SITUATION

See Appendix A for a flowchart of the current delivery process.

1) The delivery process starts at University Stores. The ordered supplies are taken off the conveyor belt and sorted by building onto pallets.

2) Supplies are placed in the staging area of University Stores dock.

3) The supplies are then loaded onto the delivery truck and transported to the University of Michigan Hospitals Dock 5. The two delivery personnel drive along with the supplies and truck driver to Dock 5.

4) The supplies are put onto Dock 5, the driver and truck leave.

5) The two delivery personnel then sort the supplies by floor on to a flat bed cart. When the cart is full, they deliver all the supplies on that cart. When they are done delivering that cart, they return to Dock 5, sort more supplies onto the cart and deliver that bunch. This cycle repeats until all the supplies are delivered to their end users.

6) When they are done delivering all the supplies for that day, they wait for the truck to come back and they return to University Stores. The delivery truck will come to pick up the delivery personnel at 3:00, however, if they are done before 1:00 they can call for the truck to come earlier.

- The delivery personnel work independently from each other unless the object to be delivered is too heavy for one person.

- Supplies, by contract, are to be delivered within 48 hours of receiving the order.

- UMH pays for the cost of goods as well as the shipping and handling costs. The shipping and handling costs are currently covered through the payment of two full time equivalent's salaries.
IV. FINDINGS AND CONCLUSIONS

- Delivery Process Time Breakdown:

**FIXED BILLABLE TIME PER EMPLOYEE:**

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**FIXED TIME**

2 hours 25 minutes

**DELIVERY TIME**

8 hours 47 minutes

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**SUBTOTAL TIME**

11 hours 12 minutes

**ADDED FIXED TIME**

2 hours 25 minutes **(see note below)**

**TOTAL BILLABLE HOURS**

13 hours 37 minutes

**NOTE:** If SUBTOTAL exceeds 8 hours (one full time equivalent) then add one FIXED TIME period per each additional 8 hour period.

For example:

<table>
<thead>
<tr>
<th>SUBTOTAL</th>
<th>ADDED FIXED TIME</th>
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<tr>
<td>8.01-16 hours</td>
<td>1 x 2.42 = 2.42 hours</td>
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<tr>
<td>16.01-24 hours</td>
<td>2 x 2.42 = 4.84 hours</td>
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<tr>
<td>24.01-32 hours</td>
<td>3 x 2.42 = 7.26 hours</td>
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<tr>
<td>etc...</td>
<td>etc...</td>
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- The above calculations are based on averages taken from the data collected which can be seen in Appendix E and F.

- These calculations do not include lunch time (30 minutes) because it is not paid time.
The variables that effect the DELIVERY TIME are:
  Number of stops for that day
  Square footage covered in that day
  Number of packages per stop
  Weight of packages
  Time spent waiting for and in the elevators
  Carpet that slows down cart
  How well the delivery personnel know the hospital layout
  Time to find authorized person to sign for supplies

These variables are all built into the calculated average for DELIVERY TIME used above.

It takes on an average, 1.87 full time equivalents per day to deliver the general and office supplies throughout UMH.

CALCULATION:  

\[
\frac{13.62 \text{ hours}}{8 \text{ hours per FTE}} = 1.7025 \\
\text{then take into account sick days, holidays, and vacations:} \\
1.7025 + (1.7025 \times .10) = 1.87 \text{ FTE}
\]

This calculation is for paid FTEs. FTE is defined as a full time equivalent that works 8 hours a day, 40 hours a week, 52 weeks a year. Seasonality was not taken into account.

The data shows that Friday is consistently a day in which it takes more than 8 hours to deliver the supplies (i.e. more than one FTE needed). See Appendix G for graph showing this result.

The cost of the current supervision system (delivery personnel report to University Stores first and then are driven over to UMH) was found to be the expenditure of 29 unutilized minutes per FTE (waiting time for the truck).

The staffing required should correlate with the number of delivery stops necessary for that day. Approximately, every 79 +/- (12) stops for the day at UMH requires reevaluation of staffing. Overtime or additional staffing could be used. This result reflects an average volume day (i.e. a variety of the available supplies were delivered: desks, small items, drums of supplies, etc...). For details see data log sheets given with this report.

Survey results:
- See Appendix C for survey example.
- Overall, the end users surveyed are pleased with the service.
- On a scale of 1 (bad) to 5 (good) the average results are:
  - Timeliness of deliveries 3.7
  - Accuracy of delivery 4.9
  - Condition of packages 4.3

- About half of the end users surveyed don’t use electronic ordering, of which all are trying to or would like to get the system installed.
V. EFFICIENT DELIVERY PROCESS RECOMMENDATIONS

A. Eliminate Materiel Management's Role in the Delivery Process

University Stores should be more like a vertically integrated supplier that is the only entity involved from the ordering point to the end delivery point. UMH, specifically Materiel Management, should not be involved with the delivery process. Currently they are because Materiel Management pays for the shipping and handling costs through the payment of the two full time equivalent's salaries. While there is a unique relationship between University Stores and UMH, both being under the University of Michigan, one has to recognize that they are distinct operating entities and as such University Stores should be thought of as a vendor like UPS.

E V O L U T I O N O F D E L I V E R Y P R O C E S S S U P E R V I S I O N:

PAST:
STORES <----- MATERIEL MANAGEMENT <----- END USERS

PRESENT:

MATERIEL MANAGEMENT

STORES <--------------------------------------> END USERS

FUTURE:

STORES <--------------------------> END USERS

I M P L I C A T I O N S:

TO VENDOR (UNIVERSITY STORES): Full responsibility of delivery process including determination and payment of necessary personnel. Role of vendor in process.

TO UMH: Elimination of direct payment of FTE's salaries as method of delivery service charge (see next recommendation for other method of delivery service charge). No Materiel Management responsibility over delivery process.

TO UNIVERSITY OF MICHIGAN OVERALL: Defines the roles of the two operating entities.
B. **Shipping and Handling Costs Built into Price of Goods**

Incorporating the shipping and handling costs directly into the price of the goods would take out Materiel Management's involvement and allow for the expansion of the delivery process to the rest of the University of Michigan. These shipping and handling costs should be based on the cost of delivering the applicable class of supplies.

**IMPLICATIONS:**

**TO VENDOR (UNIVERSITY STORES):** Full responsibility of delivery process including determination and payment of necessary personnel. Role of vendor in process. Use optimum number of FTE to deliver the supplies (currently 2 FTEs are used everyday).

**TO UMH:** Elimination of direct payment of FTE's salaries as method of delivery service charge. Payment of delivery service more in line with services rendered. This is consistent with UMH's program of Enhanced Customer Service (see article given with this report titled *Off-site storage- Move it!* by Ralph Sommers, William Chapelle, and Juliana Wooster).

**TO UNIVERSITY OF MICHIGAN OVERALL:** More cost efficient procedure.

C. **Log Sheet Used by Delivery Personnel**

Having the delivery personnel keep a log would allow data to be collected on the delivery process to determine workload patterns and document deliveries. The log could either be manual like the one shown in Appendix D or (preferably) a computerized bar code scanner.
D. **Delivery Personnel Have Floor Plans of UMH Available**

Floor plans of the buildings involved in the delivery process should be available to all delivery personnel so that time will not be wasted in trying to find an end user. Part of their initial training should be to learn the layout of UMH, but these floor plans would be used as a quick reference.

E. **Delivery Personnel Have Their Own Transportation**

If the delivery personnel had their own transportation to return to University Stores when they were done for the day, there would not be unutilized waiting time. The average waiting time per day is 29 minutes (see Appendix F). If the delivery personnel had their own transportation they should be able to park it at or near the Dock 5 like a vendor would.

**IMPLICATIONS:**

**TO VENDOR (UNIVERSITY STORES):** The delivery personnel could return to University Stores right after they were done with their deliveries so they could be used to do other work back at University Stores.

**TO UNIVERSITY OF MICHIGAN OVERALL:** More cost efficient procedure because it optimizes the delivery personnel's time.
F. Sorting Process Done in One Step and Carts Used

Combining the two sorting processes (sorting by building and floor) into one and doing it when the supplies come off the conveyor would save overall delivery time (see Appendix B). Special carts would be needed to allow this new sorting process to work. These carts should be satisfactory to the delivery personnel in order for them to do their job. The carts should be lightweight, strong, stable when packages are stacked in them, and able to withstand truck transport.

IMPLICATIONS:

TO VENDOR (UNIVERSITY STORES): New carts would allow sorting to be done in one step and therefore reduce the time delivery personnel must spend sorting the supplies.

TO UNIVERSITY OF MICHIGAN OVERALL: More cost efficient procedure because it optimizes the delivery personnel's time.

G. Computer to Pre-Sort the Orders to Reflect Optimum Delivery Route

The order forms should be put in a picking sequence that optimizes the delivery time, then the supplies could be pulled and put onto the conveyor in that order. The picking sequence could be based on floor plans of the delivery route and input from delivery personnel. This would allow the supplies to be pre-sorted before they are put onto the delivery carts.

IMPLICATIONS:

TO VENDOR (UNIVERSITY STORES): The delivery personnel will be able to sort the supplies onto the carts much faster because the supplies will be in a pre-sorted sequence so that all items that go to one floor will come off the conveyor together in a row.

TO UNIVERSITY OF MICHIGAN OVERALL: More cost efficient procedure because it optimizes the delivery personnel's time.
H. Make Electronic Ordering a Standard Procedure

The survey taken showed that electronic ordering is not used by every end user at this time (see Appendix C). It is our recommendation that electronic ordering become a standard procedure.

**IMPLICATIONS:**

**TO CUSTOMER (END USERS):** Electronic ordering has many benefits which include: decrease in the time needed between ordering and delivery, end users would become more confident in the delivery time and therefore see no need to over stock, immediate checking of accuracy within an order (many errors occur on manual forms), and end users could check the availability of items, the unit of issue, and prices.

**TO VENDOR (UNIVERSITY STORES):** There would be one standard procedure by which the supplies would be ordered. Less errors in order forms would occur. Reduction in time between ordering and delivery.

**TO UNIVERSITY OF MICHIGAN OVERALL:** Standard procedures used. Reduction in time between ordering and delivery.
VI. SUMMARY OF REPORT RESULTS

- Delivery Process Time Breakdown:

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**FIXED TIME**
2 hours 25 minutes

**DELIVERY TIME**
8 hours 47 minutes

**SUBTOTAL TIME**
11 hours 12 minutes

**ADDED CONSTANT TIME**
2 hours 25 minutes *(see pg. 10*)

**TOTAL BILLABLE HOURS**
13 hours 37 minutes

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Efficient Delivery Process Recommendations:
A. Eliminate Materiel Management's role in the delivery process.
B. Shipping and handling costs built into the price of goods.
C. Log sheet used by delivery personnel.
D. Delivery personnel have floor plans of UMH available.
E. Delivery personnel have their own transportation.
F. Sorting process done in one step and carts used.
G. Computer to pre-sort the orders to reflect optimum delivery route.
H. Make electronic ordering a standard procedure.
APPENDIX

A. Flowchart of present delivery process
B. Flowchart of recommended delivery process
C. Survey results
D. Log sheet example
E. Log sheet tallied results
F. Waiting time tallied results
G. Graph of Working Time vs. Date
H. Other useful graphs
APPENDIX B

RECOMMENDED DELIVERY PROCESS

CONVEYOR

SORT BY BUILDING & FLOOR

CARTS

TRANSPORTATION

DOCK 5

DELIVERY

END USERS
APPENDIX C
VERBAL SURVEY TO END USERS
EXAMPLE AND RESULTS FOR 25 HEAVIEST PURCHASERS OF GOODS

Date: ___________________
Name: ___________________
Phone #: ___________________

Hi, my name is _____________ and I am taking a survey for the University Hospitals Management Systems on the delivery of general and office supplies. I would appreciate it if you would answer 5 quick questions about the delivery system.

(1) On a scale of 1 to 5 with 1 being dissatisfied 5 being satisfied
   How would you rate your satisfaction with the timeliness of deliveries?
   1 2 3 4 5  
   AVG = 3.7

(2) On a scale of 1 to 5 with 1 being you never get what you want 5 being you always get what you want
   How often do you get what you ordered?
   1 2 3 4 5  
   AVG = 4.9

(3) On a scale of 1 to 5 with 1 being always damaged 5 being never damaged
   How often are your packages damaged?
   1 2 3 4 5  
   AVG = 4.3

(4) Do you know of electronic ordering?  
   YES NO
   Do you use it?  
   YES NO
   if not, why?

12 OUT OF 25 DON'T USE ELECTRONIC ORDERING, ALL OF WHICH WOULD LIKE TO.

(5) Do you have any suggestions or comments about the delivery system?

PLEAS'D WITH THE PRESENT SERVICE.
APPENDIX D
LOG SHEET EXAMPLE

UNIVERSITY OF MICHIGAN STORES
DAILY DELIVERY LOG

<table>
<thead>
<tr>
<th>#</th>
<th>TIME</th>
<th>LOCATION</th>
<th>NUMBER OF PACKAGES</th>
<th>EST. WEIGHT</th>
<th>SIGN FOR</th>
<th>COMMENTS</th>
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### APPENDIX E - LOG SHEET RESULTS

<table>
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<tr>
<th>DATE</th>
<th>DAY</th>
<th>TIME - FTE 2</th>
<th>TIME - FTE 1</th>
<th>SAMPLE TIME</th>
<th>SAMP. STOPS</th>
<th>FTE 1 - STOPS</th>
<th>FTE 2 - STOPS</th>
<th>TOTAL STOPS</th>
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<table>
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<tr>
<th>AVG. STOPS</th>
<th>TOTAL TIME</th>
<th>AVG. TIME</th>
<th>#PACK.-FTE 1</th>
<th>#PACK.-FTE 2</th>
<th>TOTAL PACK.</th>
<th>AVG. PACK.</th>
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<tbody>
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APPENDIX E
DETERMINATION OF FULL-TIME EQUIVALENTS

A full-time equivalent (FTE) is ideally defined as person(s) working 8 hours per day, 40 hours per week, 52 weeks a year. Calculations used to determine the ideal number of FTEs are as follows:

**IDEAL FTE REQUIREMENTS**

Value A) AVERAGE WORK TIME PER DAY - 13.62 hours

Value B) WORK TIME PER DAY PER FTE - 8.0 hours

\[
A/B = 13.62 / 8.0
\]
\[
= 1.7025 \text{ FTEs}
\]

Value C) NUMBER OF FTEs PER DAY - 1.7025 FTEs

The above numbers are idealizations. A factor of 1.1 must be inserted into the above equations to compensate for real world occurrences such as sick days, holidays, and vacations. Over a year's time, this factor adds approximately 5 weeks worth of cost to the FTEs. Calculations used to determine the actual number of FTEs are as follows:

**ACTUAL FTE REQUIREMENTS**

Value D) COMPENSATION FACTOR - 1.1

\[
C*D = 13.62 * 1.1
\]
\[
= 1.87 \text{ FTEs}
\]

Value FTE) ACTUAL NUMBER OF FTEs PER DAY

1.87 FTEs
APPENDIX F
WAITING TIME CALCULATIONS

The waiting time is defined as the amount of time the delivery personnel spent between finishing the delivery process at University Hospitals and being picked up by a truck for their return trip to University Stores. The data was taken from both delivery personnel over a nine working day period from March 20 to April 2, 1990. Daily and ten day averages are shown on the following table and graph.

<table>
<thead>
<tr>
<th>DATE (1990)</th>
<th>AVERAGE WAIT TIME (minutes)</th>
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<tbody>
<tr>
<td>Tues. 3/20</td>
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<tr>
<td>Wed. 3/21</td>
<td>17.5</td>
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<tr>
<td>Thurs. 3/22</td>
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<tr>
<td>Fri. 3/23</td>
<td>45.0</td>
</tr>
<tr>
<td>Mon. 3/26</td>
<td>7.5</td>
</tr>
<tr>
<td>Tues. 3/27</td>
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</tr>
<tr>
<td>Wed. 3/28</td>
<td>No data available</td>
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<tr>
<td>Thurs. 3/29</td>
<td>47.0</td>
</tr>
<tr>
<td>Fri. 3/30</td>
<td>30.0</td>
</tr>
<tr>
<td>Mon. 4/2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

AVERAGE WAIT TIME FOR THE PERIOD - 29.4 MINUTES
APPENDIX F - WAITING TIME
UStores to UMH Delivery Study - 3 & 4/90

DATE - MARCH & APRIL 1990

\[ X = 29.4 \text{ MINUTES} \]
APPENDIX G - DAILY DELIVERY TIME

USTores to UMH Delivery Study - 3 & 4/90


DATE - MARCH & APRIL 1990

\( \bar{X} = 8.78 \text{ HOURS} \)

SAMPLE = 5.60 HOURS

\( \bar{X} = 8.78 \text{ HOURS} \)

SAMPLE = 5.60 HOURS
APPENDIX H - PACKAGES PER STOP
UStores to UMH Delivery Study - 3 & 4/90

AVERAGE # OF PACKAGES PER STOP = 2.73
APPENDIX H

TIME BETWEEN CHECK-IN & FIRST DELIVERY

U Stores to UMH Delivery Study - 3 & 4/90

\[ \bar{X} = 56.82 \text{ MINUTES} \]

DATE - MARCH & APRIL 1990
APPENDIX H - DAILY DELIVERY STOPS

UStores to UMH Delivery Study - 3 & 4/90

SAMPLE = 64.0 STOPS

\bar{X} = 86.2

DATE - MARCH & APRIL 1990
APPENDIX H - NUMBER OF STOPS PER HOUR

UStores to UMH Delivery Study - 3 & 4/90

8.62 STOPSPER HOUR AVERAGE

NUMBER OF DELIVERY STOPS

DELIVERY TIME - HOURS

SAMPLE DATA