PATIENT TRANSPORTATION SYSTEM
FINAL REPORT

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TABLE OF CONTENTS

Executive summary__________________________________________1

Goals and Objectives________________________________________3

Approach and Methodology__________________________________4

Action Plan_________________________________________________6

Lessons Learned / Recommendations___________________________7

Appendix I:   How to Establish Institutional Standard Trip Times
               Headlee Systems, Inc.

Appendix II:  Patient Transportation Project  Authoritative Assumptions
EXECUTIVE SUMMARY

The previous Patient Transportation System involved telephoned dispatch and manual data collection of travel times on trip logs. The amount of time that was required for a specific transport was not a predictable standard or constant. Because of manual data collection, travel information could not be summarized or shaped in any way. Therefore, it was impossible for the Materiel Management Department to evaluate efficiency and productivity or to plan effective daily strategies.

In order to overcome these limitations, the PC based Headlee Systems software was purchased in 1990. This system uses standard transport time values to estimate travel times and summarize information. The standard transport time values are complete after standard walking, landmark travel/delay, and acceptable delay times have been determined. Our team was employed to determine the first two components of the standard transport time (standard walking times and landmark travel/delay times) for University of Michigan Hospital, Taubman Center, and Med Inn Building.

At the onset of our project, the team was provided with a Headlee Systems Inc. Patient Transportation System manual which contained a predefined methodology for determining travel standards. During the course of the project, the team interacted with a Headlee Systems' consultant in order to better understand this methodology; in working with this methodology, the team prepared for and completed extensive time studies.

Currently, the first two components, standard walking times and landmark travel/delay times, have been delivered to the client. The Headlee System can now be implemented, but on a limited basis. It is understood that the third component, acceptable delay times is still needed to complete the equation for a total standard transport time. These delay values, along with a corresponding study on the Maternal and Child Health Center, will be completed by Management Systems.
As a result of using a predefined methodology, the project team has advice and recommendations for Management Systems' study of MCHC. These recommendations are based on the lessons learned throughout the project.

INTRODUCTION

The Materiel Management Department of the University of Michigan Hospital, in an effort to provide greater efficiency in the Patient Transportation Division, has contracted our project team to perform a time study of the Medical Center. The study was to determine standard walking time values and landmark travel/delay times in order to implement the purchased Headlee System software.

Purpose

Our goal was to develop standard travel values for all possible patient transport travel combinations that exist in the University of Michigan Medical Center. These values will be the basis for the implementation of the PC based Headlee Systems Inc. Patient Transportation System software which will be used to summarize transportation data. The summarized data can then be used to determine excessive delay areas, improve transport efficiency and productivity, and provide a basis for daily planning within the Patient Transportation Division of the Materiel Management Department.

Background

Presently, patients are transported throughout the hospital in an unpredictable and inconsistent manner. The trips are manually recorded and accumulated onto Trip Log sheets which document when a department initially requests the transportation unit, when the job is completed, and by whom. This method of data collection is not sufficient. The information can not be summarized or shaped in any way; in fact, in busy times of the day, the data is the first thing to be ignored. As a result of this inefficiency, the Materiel Management Department is unable to
determine where excessive delays and backups occur or whether sufficient Full Time Equivalents (FTE's) are present. Without accurate data figures it is difficult for the Materiel Management Department to evaluate efficiency and productivity.

Our client, Mr. Greg Cox, arrived at the University of Michigan Medical Center in 1988 and immediately realized the limitations that he faced with the manual methods of patient transportation. Along with the help of a computer expert, Mr. James Kotsones, Mr. Cox defined the problem and researched possible solutions by investigating available computer software. Inspired by the success of the Cleveland Clinic, Mr. Cox and Mr. Kotsones found that Headlee Systems Inc. supplied the most efficient PC based software for accumulating transportation data and purchased the system in 1990. Before the system can be implemented, however, standard transportation values need to be developed. Our team was employed to determine these standards.

GOALS AND OBJECTIVES

The team’s overall goal was accomplished by defining objectives and using a predefined methodology.

Goal

To establish realistic standard time values for every possible patient transport travel combination within the University of Michigan Medical Center that can be used in accordance with the Headlee Systems Inc. Patient Transportation System.
Objectives

The primary objective was to define the University of Michigan Medical Center in terms of Patient Transportation Travel. This was achieved by following the methodology developed by the Headlee Systems Inc. to establish standard values for travel times.

This methodology follows four basic steps:

1. Determine locations and landmarks.
2. Define appropriate zones.
3. Collect travel and delay times.
4. Define realistic standard values for all travel combinations.

APPROACH AND METHODOLOGY

The predefined methodology was provided by the Headlee Systems consultant. A portion of this manual which defines the procedure is presented in Appendix I. The team followed the approach with tailored considerations due to the methods generality. The 4 basic steps of the approach include: viewing the hospital from a patient transporter perspective, preparation for time studies, execution of time studies, completion of deliverables.

Patient Transporter Perspective

In order to understand the transporters view, the team members spent many hours becoming familiar with the Medical Center by actually walking through the floorplans. This enabled the team to “get a feel” for distance verses time. Additionally, the team assumed their walking pace was equal to that of the transporters.
Preparation for Time Studies

Initially, the team obtained “Go Booklets”, employee building guides of University of Michigan Hospitals (September 1990), to establish all possible locations for transport destinations. These locations were marked on blueprints. Landmarks were also established and marked accordingly; then, the Medical Center was divided into 21 zones: University Hospital 15, Taubman Center 3, Med Inn Building 3. Concurrently, appropriate Headlee forms were completed.

Time Studies

First, travel and delay time studies were completed on all elevators and connecting tunnels. Then, centers of zones were located through sample time studies of each zone. Finally, interzonal travel times and center of zone to landmark times were established through further time studies.

Completion of Deliverables

Before the completion of the standard walking time values, the team had to make some reasonable assumptions which are found in Appendix II. These assumptions are based on authoritative knowledge, such as the “Go Booklet” reference, and helped with routing and location uncertainties. Routes were then determined for every zone to zone travel combination. Then, the appropriate Headlee forms were used to link travel and delay times while summarizing effective standard travel time values.

The team proceeded to verify a sample of the final travel times by foot-walking from specified zone to zone. In this sample, all times were within a 30 second tolerance range.
Due to the on-going construction of MCHC, the team brokered this area of the hospital to Management Systems. This external consideration staged a need to provide extra documentation and explanation to the brokered party. MCHC is, however, viewed as a separate entity and will not affect the utilization of UH, Taubman, and Med Inn deliverables.

**ACTION PLAN**

The project team has completed its goal through the previously stated objectives.

**Current Status**

Components one and two (standard walking times and delay times) of UH, Taubman, and Med Inn, as well as completed Headlee forms have been submitted to the client and consultant.

**Utilization of Deliverables**

The standard travel time values will be entered into the Headlee System software by the consultant. A one week pilot study will then be run to verify accuracy and assure labor relations. The ultimate implementation of the system will be completed upon receipt of the acceptable delay time values.

**Future Needs**

Acceptable delay times, including patient loading times and equipment retrieval, will be determined through time studies by Management Systems. Management Systems will also be responsible for the corresponding study of MCHC.
LESSONS LEARNED / RECOMMENDATIONS

Scope of the Project

To understand what time values should be collected in our studies we first had to understand that the Headlee Patient Transportation System is concerned with fractions of minutes rather than fractions of seconds. Before conducting the time studies it was necessary to have a good grasp of the “30 second slop”. The “30 second slop” was the tolerance level of the Headlee PTS. A Zone was roughly defined as having a 30 second radius and standard walking times were believed to be accurate if they were within approximately +/- 30 seconds. The greatest aid in understanding the “30 second slop” was simply walking around UMMC. Becoming familiar with the layout allowed the team to develop a perception of distance versus time; specifically distance versus 30 seconds.

What Worked

Using the predefined methodology of Headlee Systems Inc. required interaction with an external consultant from Headlee, Mr. Peter Van de Kerkhove. His knowledge and advice were very helpful in understanding the Headlee PTS. Mr. Van de Kerkhove focused the team on what was important for time studies versus what was negligible (i.e. the “30 second slop”).

The “Go Booklet”, an employee building guide to the University of Michigan Hospitals (September 1990), was a great aid for developing the project team’s patient transporter perspective. At a time when first hand information was not available, the “Go Booklet” aided the team in determining locations and landmarks and in zoning; vital steps to achieving the primary objectives.
The project team completed the time studies independent of current travel times. Industrial Engineering techniques for time studies were stressed rather than relying on transporters' travel times. As a result, the final deliverables were unbiased and provide a basis for a fresh look at patient transport travel times.

**Difficulties**

Using the predefined Headlee methodology required the use of predefined forms. These forms and an explanation for their use were provided in the Headlee Systems Inc. PTS manual. The project team found that a great deal of time was required to decipher the instructions. The Headlee methodology was developed for general use; the user must take the time to learn how to apply the general method to their particular study. Specific problems the team had were:
1.) The forms and instruction were confusing. Each line had to be read carefully trying to focus on where the time study data fit into the methodology.
2.) Some of the forms were repetitive/redundant; requiring the same information be written in two different ways.

The best aids for using the forms were:
1.) Asking questions of the Headlee consultant
2.) Making and noting authoritative assumptions to tailor the method

**CONCLUSION**

The project team would like to thank the Materiel Management Department and the hospital staff for their time and cooperation in helping us to achieve our goal.

The team was quite pleased with the final standard walking times delivered to our client Mr. Greg Cox. We are confident of these results and look forward to their implementation into the Headlee Patient
Transportation System. It is our belief that these specific standards will aid Material Management in developing a more efficient and effective patient transportation system.
APPENDIX I: HOW TO ESTABLISH INSTITUTIONAL STANDARD TRIP TIMES

1. Obtain a general set of floor plans for the building or buildings that will contain locations to be included in the PTS dispatch control system.

2. List (on Form #1) the formal or generally accepted name of every LOCATION that patients, equipment, or other items will need to be transported to, under the control of the PTS system. Identify and place the above locations on the set of plans using the line number assigned on Form #1. Also note on the same set of plans, using alpha identifiers (A, B, etc) all elevators, major crossroads, thresholds, and exits. We refer to these as LANDMARKS. Any travel restrictions associated with a particular landmark should also be noted at this time. For example, adjacent zones which "appear" to be connected on the plans, but the connection is impassable by wheelchair and/or stretcher.

3. Establish ZONES for your institution. The purpose for creating zones was to simplify the standards development process, by associating multiple locations with one general standard, and reduce the on-going file maintenance. It is generally accepted that the value of the additional work to develop unique standards to and from every possible location would not be offset by the benefits from that additional level of accuracy.

   A zone is typically an arbitrarily determined area that can be traversed, from the center to any point on the perimeter in the same amount of time. We recommend between 15 to 30 seconds, at a normal pace, so that perimeter to perimeter travel could occur in one minute or less.

   This means, for example, that if a nursing unit desk resides in the center of a corridor, a transporter should be able to walk from that nursing station to either end of the unit within 15 to 30 seconds. It does not matter what size you make your zones, however if they are too small, all of the patient rooms on a given unit may not fit into one zone, and if you make the zones too large, your zone to zone standards could vary by more than 10% within a zone.

4. Next, identify on your list of locations (form #1) the zones in which they are located. We recommend that you number
your zoned areas (circle the zone numbers on the floor plans in order to clearly differentiate them from the locations). In addition, you must also list on Form #1 under LANDMARKS, any adjacent locations, zones, nearest travel intersections and nearest elevators (that were identified in step #2), even if they should possibly fall within that same particular zone. We recommend the use of alpha characters to denote landmarks such as elevators and any travel junctures or intersections. Once you have identified all of landmarks associated with a particular zone, this need not be repeated for other locations within that zone. The purpose again is to simplify data collection. Since many of the travel routes will have overlapping "legs", the ability to identify repetitive segments will reduce both the amount of time spent and the data to be recorded in this process. This will be further exemplified in the next step.

5. In this step you will take all of the information gathered in steps one through four on form #1 and sort it by zone. Using form #2, sort all your locations by zone, a numeric sort if you used a spreadsheet to collect your data. This will allow you (and your proof readers) to verify that all of the locations were included, since you are more likely to recognize one missing when grouped in this fashion. Also, if you have created too many or too few zones, it is easier to make your adjustments on this form.

Next, using forms #3a, list all of the paired combinations of zones and adjacent zones and/or nearest "alpha" identified landmarks. These paired combinations make up most of the sub-paths of legs that will eventually be combined to form the trip routes from one location to another. Please note that we said most of the legs that are required to complete a full trip.

6. Still missing, are the distances between landmarks where no zones happen to exist (ie from elevator to elevator, etc.) that were not identified on forms #1, 2, and 3. Using your map, identify these travel legs, and record them on form #3b, the form for summarizing all of the unique travel legs or sub-paths that are part of one or more routes. Now, in preparation for the time studies, list on form #4 all of the unique legs identified on forms #3a and 3b.

7. Next, on form #4, eliminate the easy ones. The standards for travel time between adjacent zones, or to landmarks that are within the zone, will be your established perimeter to perimeter intra-zone travel time. In addition, all legs which are identical in length (ie sub-paths from zones to elevators that are on different floors), can be marked in

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the second column of form #4 as multiples of a previous leg and will only have to be timed once.

8. Collect the remaining sub-path travel times using an abbreviated industrial engineering approach. Gather three or four time samples for each leg, only take additional samples if any of your individual samples vary more than plus or minus 10% of any other sample within that set. If you need to do more, add two more samples to the set, then throw out the high and the low of the new set and re-test your set. If your set of samples are "reasonable", as defined above, take the average of that set to be your standard for that individual leg of a trip. Repeat the process for each leg listed on form #4.

9. The remaining time standards required to complete an entire trip are the travel and wait standards associated with each landmark. This portion of the standards development process needs to be approached from the "big picture" perspective.

We suggest that you do not take the excessive amount of time that it would take to consider all of the variances that might occur at a given landmark throughout an entire day. Using Form #5a, simply take four or five elevator rides throughout the day and take the average and then divide that by the number of floors that it stops on. This will provide you with an average elevator ride time per floor traveled. With regard to the delay-time associated with the elevator landmarks, proceed to step ten.

10. Each set of elevators could have a unique set of delay-time standards. Each intersection may or may not have a delay-time associated with it. Use Form #5b to collect the "delay-time" random samples for each landmark.

11. Now that you have all of the component time standards associated with zone to zone travel, excluding special delay factors that are addressed in step C of Chapter 1 - "Setting Up the PTS System", you are ready to build the complete route time standards with the assistance of form #6.

To complete form #6, please take the following steps:

a. List each unique Zone to Zone combination as identified in our sample matrix, based upon the actual number of zones at your institution.

b. Fill in each travel leg included in each zone to zone route.
c. Fill in each time standard associated with each travel leg and each delay associated with each landmark, in the corresponding boxes. Note that for an elevator; multiply the "per floor" standard times the number of floors traveled and add in the corresponding standard "delay-time" for waiting for the elevator.

d. Add each of the component standards together and write it in the "Total Trip Standard" box.

12. You have now completed the trip time standards development process. Please summarize them on Form #7 (for ease of data entry) and enter them into the PTS system as described in Section B of Chapter 1.
APPENDIX II: PATIENT TRANSPORTATION PROJECT
AUTHORITATIVE ASSUMPTIONS

These assumptions were broadly used to:
1.) Tailor the generalized Headlee Methodology to the specific needs of UMMC
2.) Overcome the difficulty of not always having first hand information
3.) Keep the project on time

PACE

1.) Transporter's pace = Project Team's pace (brisk walking)
   (all of the travel walking times are consistent and unbiased to present travel times; if necessary a ratio between the project team's walking values and average transporter travel walking time could be found to adjust the standard values)

FACILITY

1.) Patient Transporter Perspective
   - required to know what time values to collect
   - obtained through the use of the "Go Booklet" employee building guide
   - obtain time vs. distance relationship for the layout by actually walking the main areas

2.) Taubman Center
   - time studies were established from the North elevator on every floor
     (timing began at the North elevator assuming that most transport occurs to/from University Hospital)

3.) University Hospital
   - elevator travel times were calculated by the Headlee method dividing the average travel time by the number of floors stopped at the number of floors used for the east elevators was 8 (B1, 1, 2, 4, 5, 6, 7 & 8) and for the west elevators 9 (B1, 1, 2, 4, 5, 6, 7, 8 & 9)
1.) Transporters always take the shortest travel route

2.) The shortest travel route from zone 'A' to zone 'B' is the same for zone 'B' to zone 'A' (the shortest travel times are the same there and back)

3.) Elevator travel always occurs with the nearest staff elevator

4.) ZONE 1
   - from zone 1 to any patient floor (zones 6 -15) transporters cross on zone 1 to the staff elevator nearest to the final destination
   - travelling from zone 1 to zones 16, 17 or 18 cross on zone 1 to landmark F then take elevator to appropriate floor
   - travelling from zone 1 to zones 19, 20 or 21 take staff elevator A to floor 2 then walk to Med Inn Building
   - to establish the travel time from zone 1 to zone 5 an average of travelling in either staff elevator A or B was used

5.) ZONE 5
   - the center of the zone 5 is symmetric to both sides of the floor
   - travel time for landmark G to zone 5 is the same as A to zone 5
   - travel time for landmark H to zone 5 is the same as B to zone 5